Inc42

KERALA

Driving India's Hardware Startup Revolution

2021

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Maker Village
THE ELECTRONICS INCUBATOR IN KERALA

Foreword

Dr. A.P. James
Professor-in-Charge,
Maker Village

Among incubators in India, Maker Village, Kochi, is the leading electronics hardware incubator hosting over 80 startups. The focus of the incubator has always been on indigenisation of products to build self-reliance in electronic product design and manufacturing.

Maker Village was established by the Indian Institute of Information Technology, Kerala, as a joint effort with Kerala Startup Mission (KSUM) and funded by the Government of Kerala and Ministry of Information, Electronics and Technology (MeitY). Reflecting on the success of Kerala's startup ecosystem in the last decade, the incubator is home to several innovative hardware products, including indigenously developed 3D printers, drones, robots, health monitoring devices, marine electronics, wearables, and more.

The benefits of building a world-class hardware startup ecosystem is multifold. Take for instance, the skilled human resources in the country. There are more than a million engineering students who get graduated each year in India. A large proportion of these graduates are trained in electronics or computer systems-related disciplines. Unfortunately, this talent is underutilised, with only a tiny proportion of these graduates of all age groups pursuing careers in core electronics disciplines.

Adding to that is the fact that today almost all domestic electronic product markets are dominated by foreign players with less than a desirable number of home-grown hardware product innovations. This is responsible for not only the underutilisation of talent but also a significant loss of revenue. There, thus, is a dire need to cut imports and improve reliance on locally made electronic products.

While nearly all major semiconductor companies in the world have offices in India — making use of the local talent — only a tiny proportion of them have manufacturing units here, and thus, the intellectual property ownerships reside outside the country as well.

It was the global pandemic that put a spotlight on the limitations in the India's electronics market. It brought to the forefront the vacuum to be filled in electronics product manufacturing and the need for the rapid growth of hi-tech semiconductor components such as chips, sensors and more.

There is no denying that the lack of semiconductor manufacturing facilities is a significant bottleneck for Indian electronic design companies to flourish and lead the market. The renewed efforts to establish semiconductor fabrication plants in the country is one step in the right direction.

In Kerala, the centers for end-to-end PCB manufacturing, 5G testing facilities, and sensor manufacturing are all in the list of ongoing activities for the growth of the electronic hardware startup ecosystem. Building on all these initiatives, Maker Village is poised to lead the revolution in electronic hardware systems innovation, design, and manufacturing in the country.

Preface

Nizamuddin Mohammed
CEO, Maker Village

The Only Constant Is Change.

It has been a year since Covid-19 and the new normal made their way into India, forever changing the way we innovate, conduct business, and interact socially. At Maker Village as well, the solutions we are witnessing have not been the usual, but with innovation that adapts, and creativity that transcends limits.

Maker Village has always been at the forefront of electronic hardware innovation in India, with best-in-class fabrication, measuring, and testing facilities for electronic hardware systems. Creating a robust ecosystem for the support of innovative products, Maker Village has helped some of the country's most creative hardware startups to build, grow, evolve and scale.

With the advent of the pandemic, several of these startups pivoted their business lines to create socially beneficial products. Among them are examples such as humanoid robots that provided sanitation and security services, low-cost ventilators, ultraviolet based decontamination devices, unmanned aerial vehicles and drones for covid surveillance and temperature mapping and more. Such metamorphosis could only be the result of the resilience of the startups aided by the strong support structure at Maker Village.

With government initiatives such as 'Atmanirbhar Bharat' or 'self-reliant India', Hardware startups in the country have gained immense prospects to innovate . These drives for indigenisation and creating 'Made in India' solutions, have opened up India's defense sector and sizable public corporation to the budding startup community.

Leveraging this, Maker Village — as a partner of the Defence Ministry's Innovation for Defence Excellence scheme and a strategic associate of few Public Sector Undertakings in the country — is gearing up to be at the vanguard to support the next generation of innovators and entrepreneurs through advanced infrastructure, systems, and procedures.

The opportunities in the hardware startup ecosystem are immense, and with the support of incubators like Maker Village, we are positive that hardware startups from the country will be able to tap into these opportunities and scale to a global level.

Editor's Note

Pooja Sareen
EIC, Inc42

"Let's go invent tomorrow instead of worrying about what happened yesterday." - Steve Jobs

The growth of the Indian startup ecosystem through the years and its efforts against the pandemic resonate with the idea behind Job's quote. Especially in 2020, we witnessed the entire ecosystem come together to help each other through these trying times. From the startup hubs of the country, many innovative solutions came forth to provide some relief to the ecosystem. Amongst them the state that captured the most attention — through its drones, robots and more — is Kerala.

In the last two years, we have had the opportunity to work with the Kerala startup ecosystem very extensively on various areas, subjects and fields. Through these two years, we got to experience what we only had a glimpse of before — the progress of the state in terms of its startup revolution.

What benefits the state's ecosystem the most, is the proactive nature of its government to support the entrepreneurial culture for the innovative minds. From formulating policies to setting up a nodal agency, KSUM, to leveraging its networks across the globe and focussing on entrepreneurship in schools and colleges, and much more, the role of the state government in the growth of its ecosystem is undeniable and commendable.

In our last report on Kerala's vibrant ecosystem, we noted that the state housed over 2,200 startups with dozens of startups recognised globally. These startups have time and again come forward to the rescue and relief of the state in the times of crisis such as the floods and the Nipah virus outbreak in 2018, the floods in 2019 and finally the current pandemic.

During my last visit to Maker Village, I was amazed at the level of innovations housed by the incubator as well as the world-class infrastructure it provides the startups with. Kerala has been the hardware innovation house in the country since long. The journey of the state towards hardware dates back to 1973 with Keltron — manufacturer of various electronic products. And today, companies such as Sastra Robotics, VST Mobility, Asimov Robotics and more lead the torch of the state not only in domestic markets but also the international ones.

In this report, our team has worked with KSUM, Maker Village and the other stakeholders to understand and showcase the hardware landscape of Kerala.

With this report, we give you a glimpse of Kerala's more than 80 hardware startups and the role of various initiatives — such as Maker Village, Fablabs and more — in helping the state in becoming the largest hardware hub of India.

I congratulate Tapan Rayaguru, Mohammed Nizamuddin, Dr Saji Gopinath, Prasad Balakrishnan Nair and the teams of both KSUM and Maker Village for the feat Kerala has achieved, building such a robust and supportive ecosystem for not just startups but entrepreneurship as a whole.

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The Indian Hardware Startup Ecosystem

History is fundamentally a narrative of innovation, be it the invention of the wheel or the creation of computers. Innovation is the lifeforce of the neverending technological revolution around the globe. It drives economic growth and progress.

India is one of the hottest startup hubs in the world today. Many startups across the country have successfully gained both size and prominence over the years. Of late, India's startup ecosystem has improved significantly. The primary drivers of this unprecedented growth are improved and easy access to capital, the presence of a massive domestic market, and an increase in the number of mentors and incubators.

Surviving a slew of challenges in the past decade, the country's startup ecosystem has managed to achieve and hold its position as the second-largest startup hub in the world. The launch of more than 49K startups took the total value creation in the market to $130 Bn in 2018.

However, this ecosystem is dominated by software startups with hardware and Internet of Things-focussed startups accounting for a mere 8% of the total market, according to The State Of Indian Startup Ecosystem 2018 report by Inc42 DataLabs. Also, India's contribution to global hardware electronics production stands at 3.4%.

In 2017-18, the country's electronics hardware production grew from 26.7% to around $ 59 Bn. The segment's share in the country's gross domestic product (GDP) was 2.3% at the time.

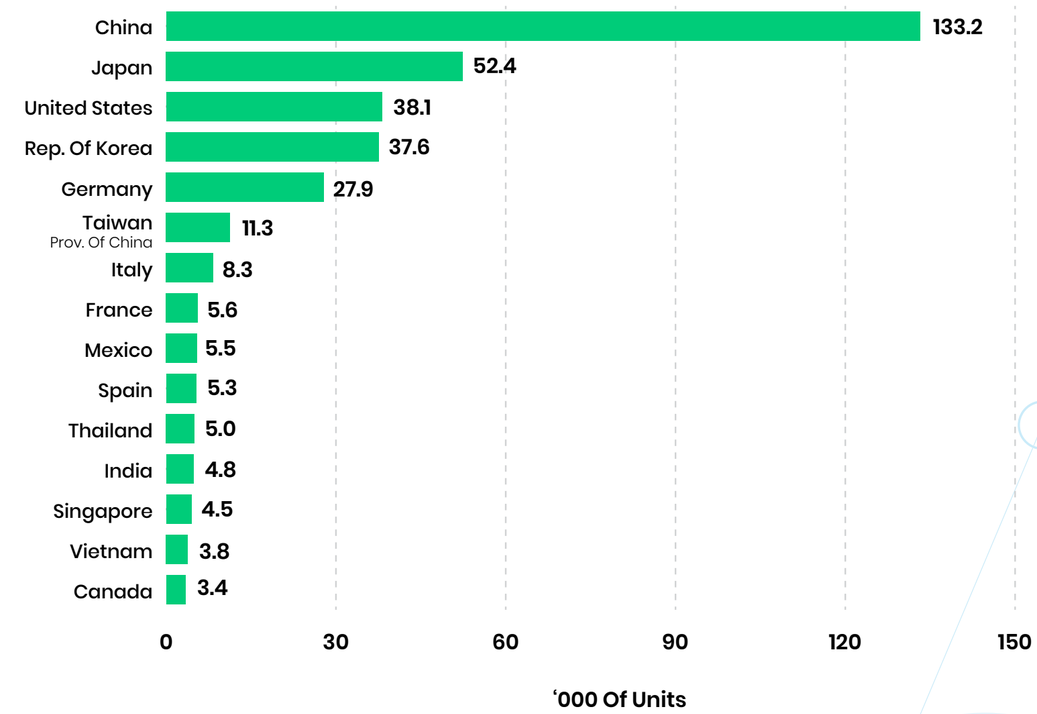
Hardware products are gradually gaining popularity in the country thanks to recent developments in the electronics systems design and manufacturing (ESDM) segment — such as the production of mobile handsets and LCD/LED televisions. The Ministry of Electronics and Information Technology's Phased Manufacturing Programme (PMP) for mobile handsets and related subassemblies components is a step towards strengthening the country's manufacturing ecosystem. India's hardware startup ecosystem is classified into four main categories: industrial automation, 3D printing, drones and Internet of Things (IoT). Out of the four, the most promising in terms of business application are industrial automation and IoT.

Industrial Automation

Industrial automation involves the use of semiconductor-powered devices to control various operations of an industry without significant human intervention to enable automated control performance. The applied control strategies are based on a set of technologies that are implemented to get the desired performance or output, providing a strong automation system for industries.

Grey Orange, SwitchOn, S-Cube Futuretech, Unbox Robotics and Tranzmeo are some of the top industrial automation startups in India. Secondary research by Inc42 DataLabs shows that Bengaluru and Mumbai are the top startup hubs for this segment, which has more than 101 startups, having raised more than $174 Mn in more than 50 rounds of funding. Brinc and Xseed Capital are the top investors for startups in this area.

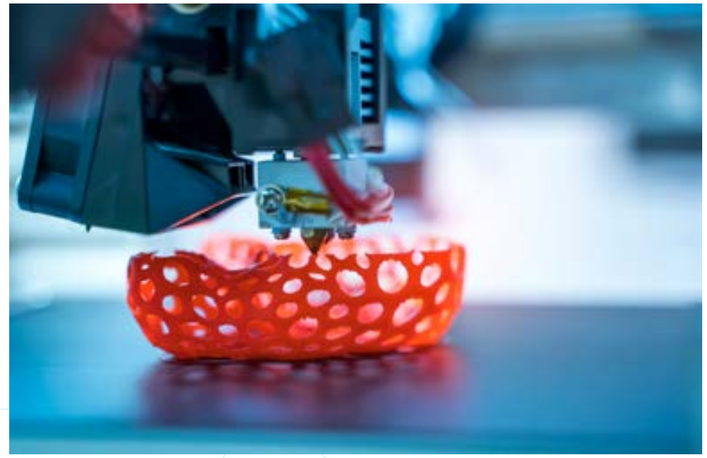
Estimated Worldwide Annual Supply Of Industrial Robots At Year-end 15 Main Markets 2018*



*Preliminary Data
Source: IFR Statistical Department

3D Printing

Projected to touch a record $79 Mn by 2021, the country's 3D printing market is expected to gain momentum, thanks to rising domestic production, low cost of manufacturing and increasing penetration across applications, and the government's Make in India initiative.



While the automotive and electronics segments hold the highest share in the country's 3D printing market, areas such as healthcare, aerospace and defence are expanding. Enabling designing without constraints, 3D printing technology promotes both creativity and innovation.

Fracktal works, Prynto, 3Dexter, MyObjectify and Chizel are among the prominent top 3D printing startups in the country. Secondary research by Inc42 Plus reveals that New Delhi and Mumbai are the top startup hubs, and Y Combinator and Spark10 Accelerator the top investors for this segment. Additionally, there are more than 56 3D printing startups in the country, having raised over $4 Mn in more than 15 rounds of funding.

India's 3D printing market is relatively younger globally. However, the 3D printing segment has registered significant growth in the country due to the launch of more startups and the emergence of global company operations.

Drones

Today, unmanned aerial vehicles - or simply, drones - are utilised in a range of applications effectively, be it for recreational or commercial purposes. While action camera-fitted drones are deployed in surveillance and security-related applications, UAVs are also used to make commercial deliveries and to provide essential services in war-torn countries as well as natural calamity-struck regions.

Between 2010 and 2014, India was the second-largest importer of drones, and accounted for 13.2% of global demand, according to a report by the Stockholm International Peace Research Institute. Despite the growing demand for drones in the country, homegrown drone startups still have a long way to go in terms of market penetration.

Currently, only six of the 50 drone startups in the country are funded. These startups attracted $16.56 Mn worth of funding between 2014 and 2018, which was a mere 2.26% of the total funding of $733 Mn in the deep tech sector.

Internet Of Things

India is poised to be a front-runner in the adoption of Internet of Things (IoT) adoption in the Asia Pacific (APAC), according to a report by IT industry body

NASSCOM. The IoT market in India is expected to grow at a CAGR of 62% to touch $9 Bn by 2020, with the number of IoT connections estimated to grow 137% to $1.9 Bn, from $60 Mn in 2016.

Zypp, Fasal, Shipsy and Stellapps are some of the top IoT-focused startups in the country. There are more than 520 Internet of Things startups, with Bengaluru and Mumbai having emerged as the top hubs in the field. These startups have raised more than $110 Mn in more than 198 deals. Brinc and Blume Ventures are the top investors in the segment.

The deployment in digital utilities and areas such as smart cities, besides in the sectors of manufacturing, transportation and automotives, may boost the demand for IoT solutions in industrial applications going forward.

Kerala's Transformation Into Hotbed For Hardware Innovations

Kerala has time and again emerged one of the best states for the startups in the country. Holding a leadership position in the Human Development Index, the state has a literacy rate as high as 94% (2011) and offers a strong social as well as intellectual infrastructure for innovation. And hardware is one segment where Kerala has excelled and proven its leadership.

The tale of Kerala's hardware ecosystem started in 1973 with Keltron, the producer of a wide range of products from electronic components to sophisticated equipment. In a span of mere five years, the company engaged with more than 5K people in the state for manufacturing electronic goods. Keltron, which has today grown to six production centres and two subsidiaries in different parts of the state, is known for building the country's first indigenous television.

Many segments of the electronic industry followed in Keltron's footsteps in the 70s and early 80s, and the increased activity in these areas enabled the state government to recognise the potential in hardware and electronics.

Over the years, such companies helped Kerala develop a huge pool of tech talent. These individuals, well-versed with the applied technology, its components and its various use cases, went on to become the biggest asset of the state in building hardware. Despite a lag in industrial activity after Keltron, the Kerala government gradually started to nurture an ecosystem for the newly-discovered talent.

The first major move in that direction was the setup of Technopark Technology Business Incubator in 2006 which was approved by the Department of Science and Technology and the incubator Startup Village in 2012. The state government's initiatives to build the robust startup ecosystem was done by the introduction of Technology Startup policy in 2015 and the state government designated Technopark Technology Business Incubator

which is rebranded as Kerala Startup Mission (KSUM) as the state nodal agency to frame startup policies,schemes and to implement the same in 2015. It is KSUM, the nodal agency for startups in Kerala, which has helped the state in putting together a strong ecosystem for budding entrepreneurs and skilled professionals.

With the state government's growing interest in the hardware market, the Union Ministry of Electronics and Information Technology (MeitY) set up incubator Maker Village in 2015 through its ESDM policy. Today, Maker Village has become the most proactive hardware incubator in the country.

Till 2017, Kerala catered to more than 5% of the total demand for electronics in the country with estimated consumption at $2.8 Bn, according to an interim report on the state's hardware ecosystem. Today, Kerala houses a huge market for automobile and healthcare electronics, presenting an attractive opportunity for investors.

The Kerala government took the ground-up approach to develop its hardware ecosystem. Kerala first built an ecosystem - which is typically erected around the needs of the existing startups in a place - and then attracted startups to it. The state authorities kept on adding more facilities to the existing infrastructure based on further requirements of the startups.

"Industry will always gravitate towards the land where this an innovative culture" - Prasad Balakrishnan Nair, ex-CEO, Maker Village

Soon, the state's ecosystem grabbed the attention of giants and startups from across the globe by adopting innovative technology and vast infrastructural facilities. That led to many of the state's talented individuals having migrated abroad to return to their hometowns.

With the return of experienced individuals, the talent pool in the state expanded.

In the hardware sector, an entrepreneur requires everything under the sun, be it the right infrastructure, ample space, engineering or design validation. And the experience that an entrepreneur has makes a big difference.

"Everyone knows the destination they want to reach but it is the journey that requires a lot of vigour. And experience always helps in these scenarios" - Maker Village's Nair

So, the revolution pioneered by Keltron has today helped the state become a hotbed for hardware activities, harbouring the biggest hardware ecosystem in the country. Today, the state is home to Kerala Technology Innovation Zone, the biggest startup incubator in the country which houses Maker Village, the country's first hardware accelerator, Brinc and more.

According to The State Of Kerala Startup Ecosystem report by Inc42 DataLabs, in 2019, the state was home to more than 230 technical colleges, where it runs its Innovation and Entrepreneurship Development Centres (IEDCs), nurturing more than 10K aspiring entrepreneurs. During the same year, the state housed more than 2,200 startups and the number is still growing.

Even though Kerala's startup ecosystem has grown tremendously over the years, the state is nowhere near done with its efforts in adopting an innovative and entrepreneurial culture.

Hardware Startups In Kerala: An Overview

80+

Hardware Startups Incubated At Maker Village

85%

Startups Are DIPP Registered

52%

Startups Are Revenue Making

2018

Year With The Highest Number Of Incubations

1 In Every 5

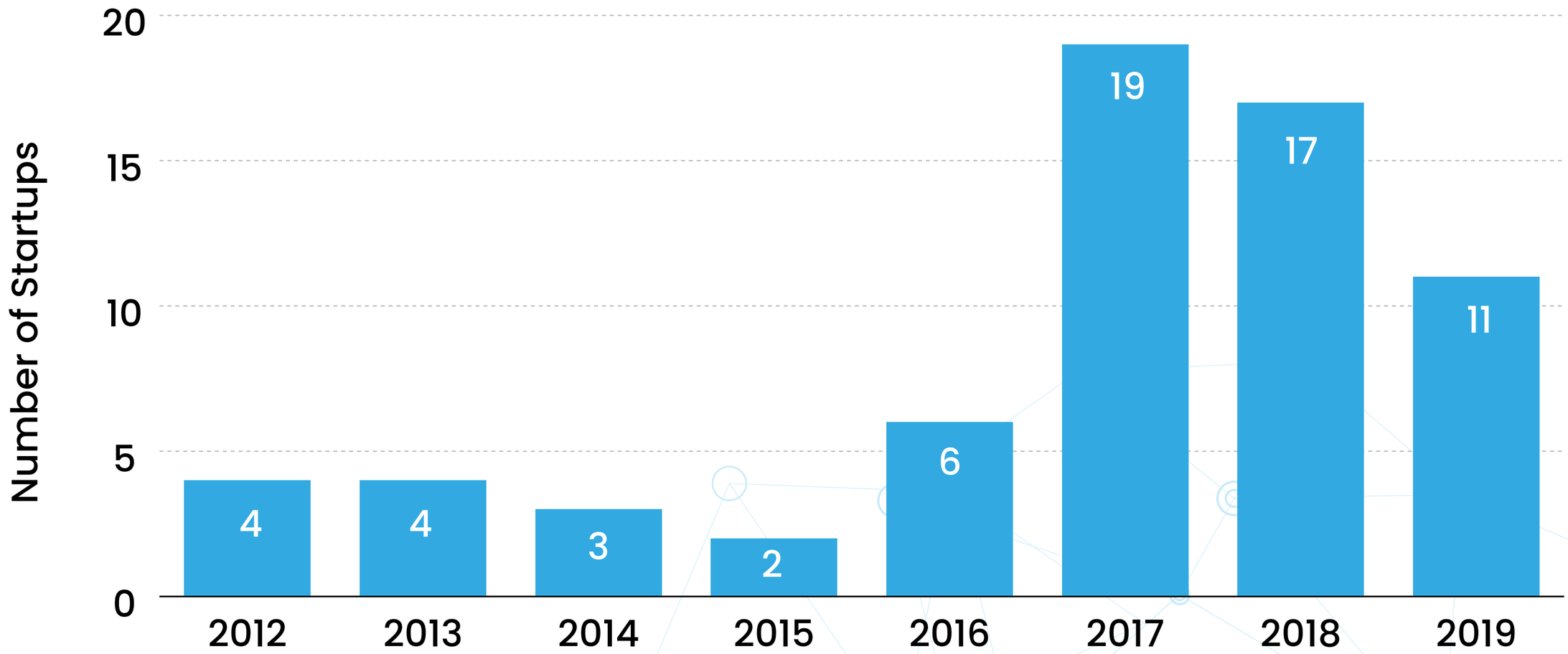
Startups Have At Least One Female Founder

INR 20 Cr+

Financial Support Provided To Startups

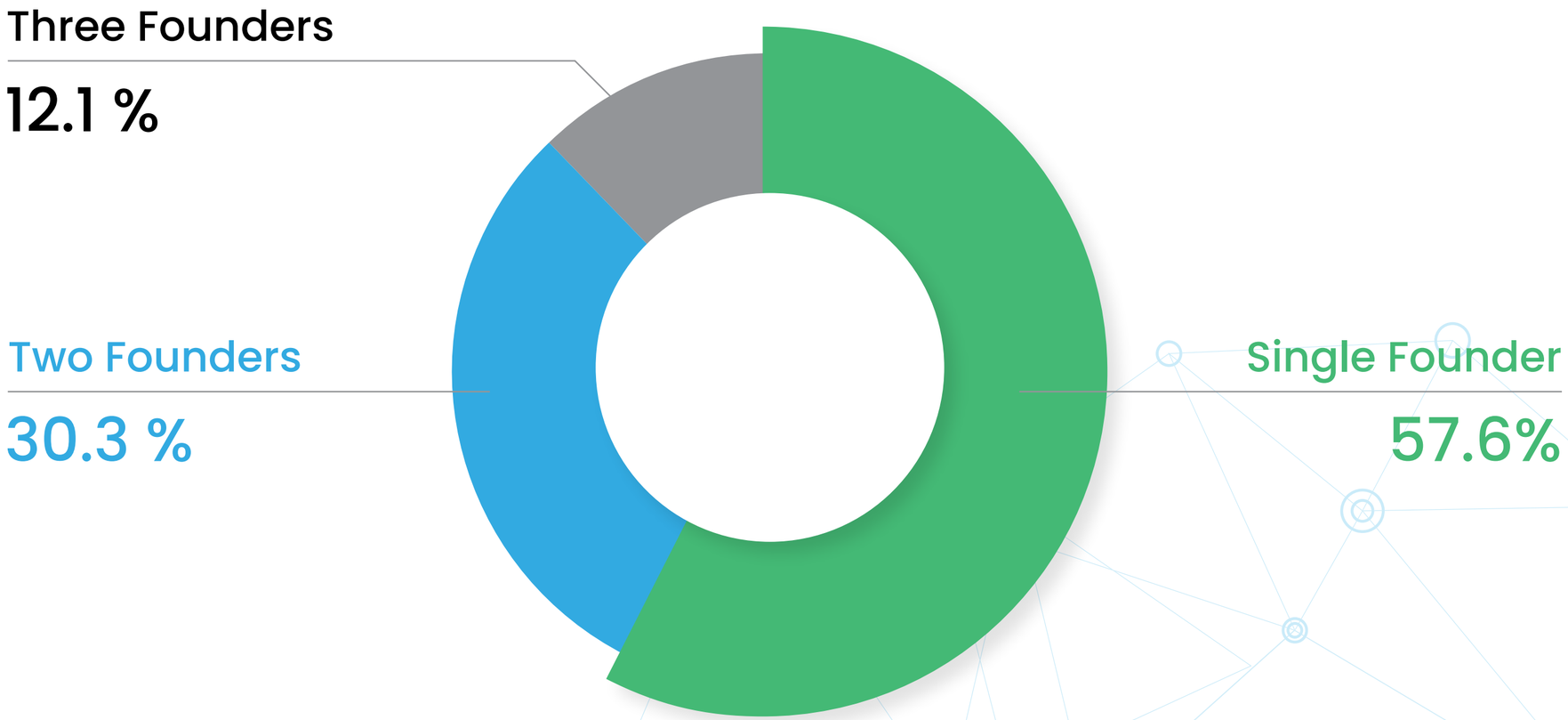
Note: The analysis is based on hardware startups incubated at Maker Village, Kerala Financial support refers to debt/equity funding, grant etc.

Hardware Startup Launches In Kerala



Note: We have considered hardware startups incubated at Maker Village, Kerala for this analysis

57% Of The Startups Are Founded By Single Founders



Note: We have considered hardware startups incubated at Maker Village, Kerala for this analysis

Maker Village: The Propeller Of Kerala's Hardware Ecosystem

"Maker Village is currently the largest electronic technology incubator in the country. It has since its inception, vastly exceeded the number that we had planned earlier. The government had asked us to help around 40 companies and we have already helped more than 80. Many of these have already graduated, moved out and are now scaling on a large scale." - Saji Gopinath, ex-CEO, KSUM

Making Of The Maker Village

The Kerala government has time and again proven its commitment to the state's startup ecosystem. With a range of measures in place, the authorities have aided the growth and development of the ecosystem.

The Kerala government started working towards the development of synergy among all components of the ecosystem. It has established an entrepreneurial culture right at the grassroot level to help the aspiring minds nurture their ambitions, through its Innovation and Entrepreneurship Development Centres (IEDCs).

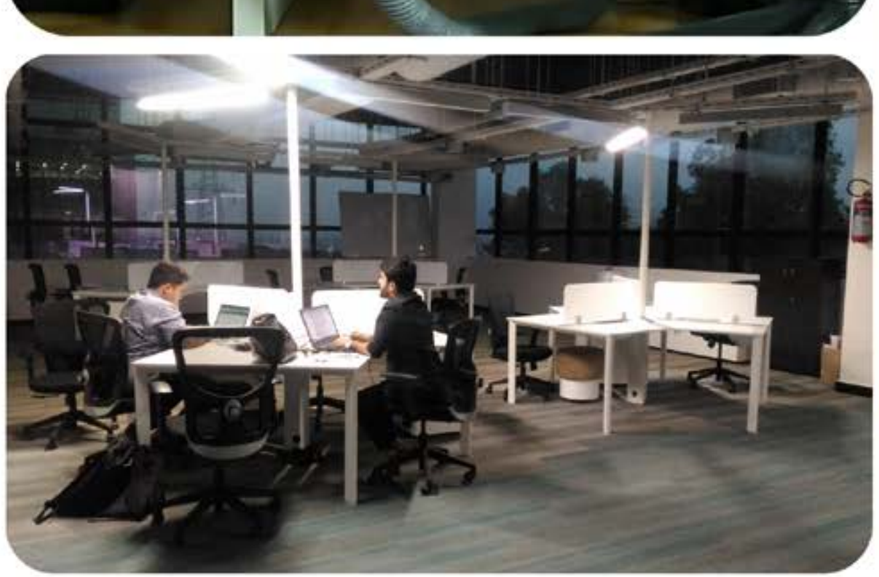
Startup Village initiated a slew of activities in colleges whereas the state government hosted competitions, together with enabling a conducive environment for budding entrepreneurs. That led to the much-needed interest in startups, however, the need of the hour was proper infrastructure to not only provide incubation but also necessary support.

That push enabled startups such as Fin Robotics, which became the first Indian hardware solutions provider to raise Series A funding. Although Fin Robotics rose to both growth and fame rapidly through its product line, the startup had to shut shop in 2017 for several reasons.

Maker Village So Far

- **45,000 sqft** Incubation Space
- **15,000 sqft** Labs and Equipment
- **82** Incubated Startups
- **80 Seater** Amphitheatre
- **150 Seater** Mini Auditorium
- **48** Patents Filed
- **INR 29 Cr** Overall Funding
- **29** Purchase Order Received


UPSCALED FACILITY



Maker Village began its journey in 2015 with an aim to meet the infrastructure and incubation needs of the startup ideas in the state.

Its a joint initiative of the Ministry of Electronics and Information Technology (MeitY), the Government of India and the Government of Kerala, with the Kerala Startup Mission as a leading partner and the Indian Institute of Information Technology and Management-Kerala (IIITM-K) in Thiruvananthapuram Trivandrum as the implementation agency. Residing in what's famed as South Asia's largest innovation hub, the Integrated Startup Complex in Kochi, Maker Village today has more than 82 Kerala-based hardware startups thriving in its incubation facilities.

"Maker Village leveraged the electronic heritage of Kerala and started helping the startups looking at and developing the products for the next stage. While the first wave was primarily driven by the government, the next wave in the sector is driven by the entrepreneurs in the incubator," KSUM's Gopinath

Lack of consumer demand, a high burn rate, lack of interest following crowdfunding and product strategy mistakes appear to be the key reasons behind the failure of hardware startups, data from CB Insights reveals.

With support from KSUM and its various connections in the industry, Maker Village ensures the startups in its portfolio do not meet with such challenges. Maker Village guides them through its workshops and keeps them updated with the latest market trends. The Kochi-based incubator also provides financial support to startups through loans, industrial partnerships and other schemes, and connects them with experts to help them stay relevant and cost-efficient, as well as ensure quality and productivity.

Maker Village's Portfolio Startups

Categorisation

- **Automobile:** 6
- **Healthcare:** 10
- **Social Relevance:** 9
- **Robotics:** 12
- **IoT & Wearable:** 19
- **Automation:** 19

Startup Stage

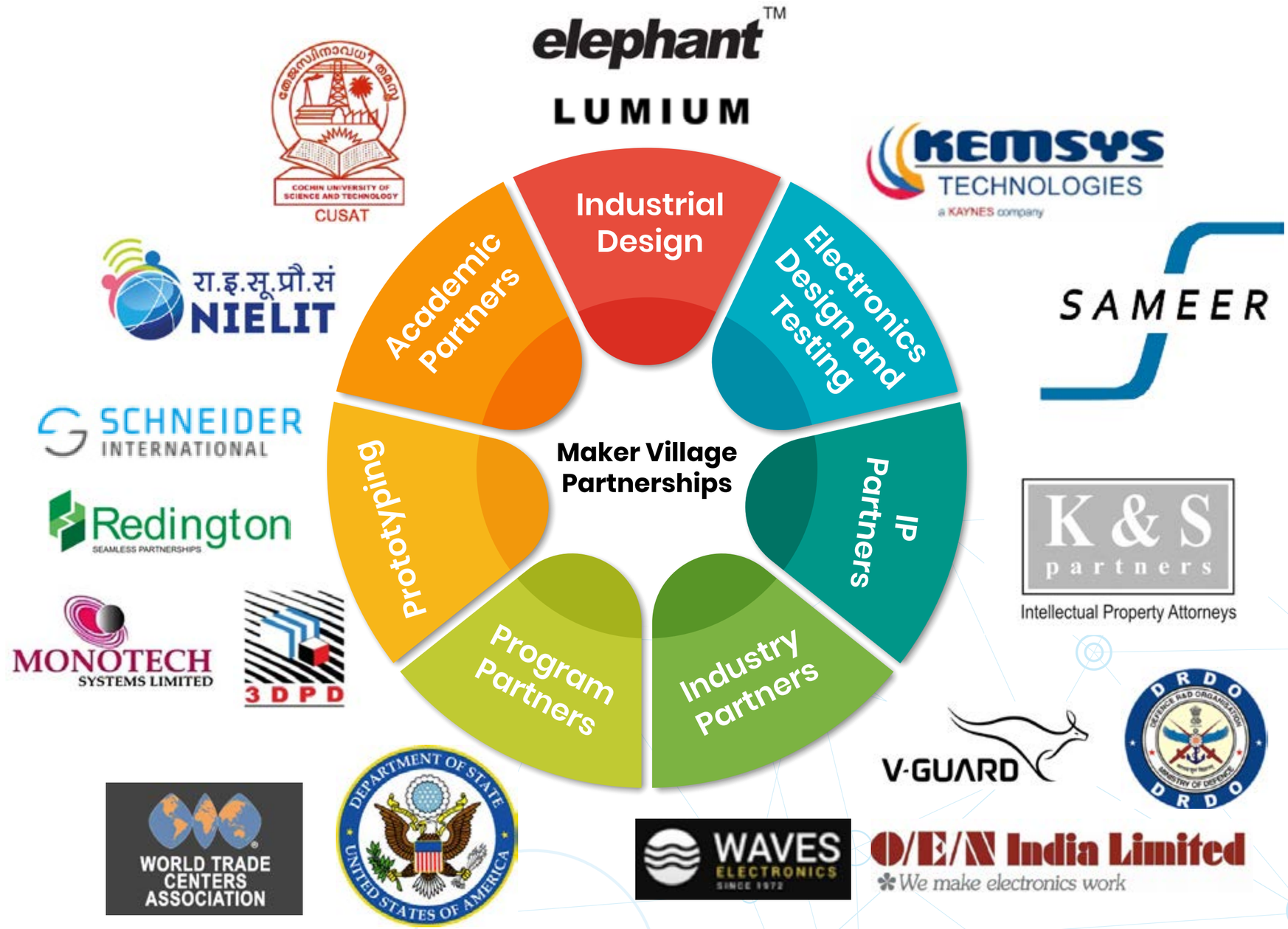
- **Proof Of Concept:** 17
- **Prototype Development:** 25
- **Product Development:** 33

"What majorly categorises Maker Village is the variety of products that have come from it. Ranging from IoT to robotics to drones, the varieties, and thus the opportunities, are many. And now scaling to international markets is also a possibility with the many partnerships we have, such as with the international hardware accelerator, Brinc and many more," Gopinath

Building A Support System Through Its Connections

Since its inception, Maker Village has worked on a variety of initiatives to boost participation by startups as well as skilled individuals active in the state's hardware startup ecosystem.

In 2018, Maker Village helped four startups receive support through state-run Bharat Petroleum Corporation's Project Ankur scheme, and in 2019, it was chosen by the Union government for its Innovations for Defence Excellence (iDex) programme, which aims to bring innovation into the country's defence forces. Besides iDex, the incubator has rolled out a range of programmes in partnership with leading homegrown entities.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Redington
SEAMLESS PARTNERSHIPS
MONOTECH SYSTEMS LIMITED
3DPD
K&S partners
Intellectual Property Attorneys
Academic Partners
Industrial Design
Electronics Design and Testing
Prototyping
Maker Village Partnerships
IP Partners
Program Partners
Industry Partners
V-GUARD
DRDO
WORLD TRADE CENTERS ASSOCIATION
DEPARTMENT OF STATE UNITED STATES OF AMERICA
WAVES ELECTRONICS SINCE 1972
O/E/N India Limited
We make electronics work

NIDHI PRAYAS

The central government's NIDHI-PRAYAS - or the National Initiative for Developing and Harnessing Innovation's Promoting and Accelerating Young and Aspiring Technology Entrepreneurs - programme is aimed at nurturing knowledge-based and technology-driven ideas into successful startups. In early 2019, the Union government joined hands with Maker Village to boost Kerala's startup ecosystem. Under the programme, Kerala's early-stage hardware startups get up to INR 10 lakhs in grants along with lab equipment.

Bharat Petroleum Corporation's Project Ankur Scheme

Through Project Ankur, Bharat Petroleum Corporate provides the startups associated with Maker Village with support, in areas such as funding, product development, testing, procurement and business development.

Defence Forces India (iDex programme)

The central government's Innovations For Defence Excellence (iDEX) programme selects startups from Maker Village in a bid to bring innovation into the country's defence forces and reduce the dependence on defence-related imports. The programme has so far chosen more than nine startups to work with for its projects.

Aram Holdings

Maker Village helps startups focused on domestic as well as international markets based on its partnership with ARM Holdings, which enables the Kochi-based incubator to help the startups under its watch connect with the global market. The Cambridge, United Kingdom-headquartered ARM offers special training and guidance programmes to Maker Village startups.

All India Council For Technical Education (AICTE)

Maker Village's partnership with the All India Council for Technical Education (AICTE) under the Union Ministry of Human Resource Development is aimed at enabling the incubator to pilot innovative projects. Its programmes with AICTE are designed to promote entrepreneurship and innovation focusing on deep tech hardware solutions.

Providing Financial Aid Through Partnerships

- **GAIL:** FeatherDyn, CEAD, EyeROV
- **IIGP2.0 (Lockheed Martin, TATA Trusts):** Sastra Robotics, EyeROV, CEAD
- **BPCL:** Resnova Technologies, Nava Innovations, EyeROV, Waferchips, Sastra Robotics, GenRobotics
- **IDEX:** HW Design Labs, EyeROV, Nyokas Technologies

Fab Labs For Efficient Product Prototyping

The developments in computer-aided design (CAD) and fabrication have created a deep interdependence among technology, hardware and software. Kerala set up its first digital fabrication centres called Fab Labs each in Kochi and Thiruvananthapuram in collaboration with the Center for Bits and Atoms (CBA) under the Massachusetts Institute of Technology (MIT).

Companies formed out of MIT, ranked among the top four universities in the world, are known to produce annual revenues to the tune of $1.9 Tn. The CBA, in particular, specialises in interdisciplinary initiatives exploring the fields of computer science and physical science and studies how to turn data into things, and things back into data. The fabrication facilities and programmes available in the CBA are considered one of the most technologically advanced in the world, providing startups with the right tools to attract the cream of researchers around the globe.

Comprising industrial-grade fabrication and electronics tools, Fab Lab has developed into a hardware innovation centre, and common platform for students, faculty and entrepreneurs in the state to learn about digital fabrication. Currently, as a standard community, Fab Lab includes a laser cutter, a sign cutter, a high-resolution numerical control (NC) milling machine, a large wood router, and a suite of electronic components and programming tools for low-cost, high-speed microcontrollers enabling on-site rapid circuit prototyping.

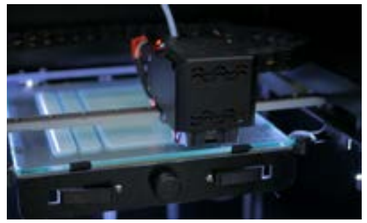
These labs provide startup teams with the capability to prototype their ideas rapidly. GenRobotics and EyeRov are the most notable startups to have made use of the Fab Lab facilities. GenRobotics created a sewage cleaning robot, named Bandicoot, whereas EyeRov developed EyeRov Tuna, the country's first underwater robotic drone.

Encouraged by initial results, the state government set up a network of 20 mini-Fab Labs to allow more students to learn and experiment with digital fabrication. Currently, Kerala has incubated about 80 hardware startups, and its designing and prototyping facilities are attracting more startups from across the country.

Machines At Fab Labs

3D PRINTING

- Ultimaker 2: For prototyping small 3D objects
- Dimension 1200ss: For prototyping production grade 3D objects
- Aeqon 400 V2: For prototyping small 3D objects

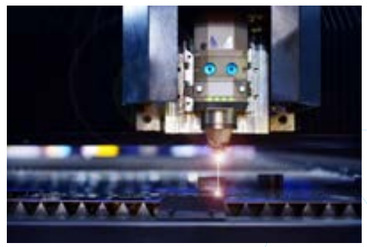


CNC MILLING

- Shopbot CNC Router: For milling of 3D models, full scale furniture parts, molding and casting, architectural elements and more
- Roland MDX -20: For milling wax molds, copper circuits printing, scanning 3D objects and more

VINYL AND LASER CUTTING

- Roland GX-24: For signage, cutting flexible electronic circuits, cutting patterns and more
- Trotec Speedy 100: For signs, cutting pieces of models, raster engr, cut patterns and more



ELECTRONICS AND PCB FABRICATION

- Weller Soldering Station: For soldering electronic components
- DSO, Function Generator, variable Power Supply: For electronics testing

MANUAL MACHINES

- Vulcan Furnace: For foundry operations, Mounding and Casting
- Scroll Saw: For precision cutting of small objects
- Kinect Sensor: For 3D scanning, motion sensing
- Band Saw: For wood cutting

Startups Leveraging The Fab Labs Benefit

FeatherDyn
- Shopbot CNC Router
- Trotec Laser Cutter
- 3D Printers

EyeRov
- Shopbot CNC Router

Robo Inventions
- Shopbot CNC Router

Gen Robotics
- Shopbot CNC Router
- Trotec Laser Cutter

Asimov Robotics
- Shopbot CNC Router
- 3D Printers

Resnova
- Trotec Laser cutter
- Roland MDX 20 milling machine

Super Fab Labs: A Step Further From Fab Labs

In the bid to enhance the state's hardware capabilities, the authorities worked with the Center for Bits and Atoms through the Kerala Startup Mission initiative to create Super Fab Lab, a prototyping facility equipped with the technology available for researchers in the Massachusetts Institute of Technology (MIT).

Kerala now has the first Super Fab Lab facility outside of the United States. The Super Fab Lab workshops add a set of highly-specialised machines supporting small- to mid-volume manufacturing. These laboratories can also be used for prototyping with a variety of material, including metals, composites and carbon. Besides, the Super Fab Lab facility houses machines for testing, designing and fabrication using materials of a wide range of sizes from to meters.

"The creation of a Super Fab Lab in Kerala will enable the state to take a lead in advanced manufacturing capabilities, and support the development of new technology-based SMEs, while also bolstering the existing engineering educational pipeline," said Prasad Balakrishnan Nair, ex-CEO, Maker Village.

These labs aim at creating the technology base for an advanced manufacturing ecosystem, with a view to positioning Kerala as a pioneer of disruptive technology trends in the global market. "The Super Fab Lab will allow researchers, innovators and developers to do things beyond what can be done in the existing fab labs," said Nair.

This new facility is located in the Integrated Startup Complex (ISC), Kochi, inaugurated in 2019 by Kerala Chief Minister Pinarayi Vijayan. The Kerala Technology Innovation Zone (KTIZ) comprises the Integrated Startup Complex for startups, hardware and biotech incubators Maker Village and BioNest respectively, and a Super Fab Lab facility for hardware startups and enthusiasts.

"Number of Fab Labs around the world is doubling every year and the collaboration with MIT will also allow hardware startups in Kerala to use the Super Fab Lab. It will also give the startups an opportunity to work with researchers of the MIT's CBA on the Machine That Make (MTM) project—exploring the possibility of using machines in a Fab Lab to create machines for the Fab Lab—creating a pathway to desktop manufacturing," explained Nair.

The first experiment in this regard was conducted in the Thiruvananthapuram Fab Lab facility with the creation of a three-axis CNC machine. The Kerala Startup Mission is set to lead the transition of the Machine That Make project from laboratories research to field applications.

Brinc Sets Up Operations In Kerala To Accelerate Hardware Innovations

With the aim of helping the startups penetrate not only domestic markets but also global ones, Kerala Startup Mission approached a Hong-kong-based hardware accelerator, Brinc, to be a part of the state's ecosystem in 2019.

KSUM initiated talks with the CEO of Brinc, Manav Gupta almost three years back when it was trying to find the right accelerator for its hardware ecosystem. And in the summer of 2019, the partnership agreement, taken care of by Heriberto Saldivar Massimi, managing director, Brinc Accelerator, was signed.

"We formalised our strategy and were more focussed on emerging markets rather than just going to any country. Emerging markets — as the operations are scaling, investments are happening and with the government supporting them — are a really good platform to start," - Mikhail Zenchenkov, head of programme, Brinc

Brinc helps startups not only counter the challenges in the domestic market but also understand the requirements of the global one further easing their penetration in both.

Working alongside Maker Village and KSUM, Brinc operates out of Kerala Technology Innovation Zone, where it is working with four hardware and IoT startups helping them advance their design for manufacturing (DFM) phase. Additionally, the accelerator also helps aspiring entrepreneurs acting as an education platform, product development studio and distribution platform.

"Maker village is helping startups develop their initial product or a working prototype. They were looking at accelerators which could add value to them, by taking that working prototype and bringing it up to the manufacturing and commercial level and this is where we come in. We have really good value in terms of ecosystem chain for hardware development," added Zenchenkov on the partnership.

BRINC TODAY

$35Mn

funds under management and available for early and late stage startups

300+

entrepreneurs across more than 100 companies

3.3%

acceptance rate from the thousands of entrepreneurs that apply to programs

$250Mn+

market value of compainies in aggregate

9

live accelerator programs helping entrepreneurs scale their businesses

75K

mentors and investors in our community across more than 32 countries

10+

innovation engagements with compainies and governments

$800K

average raise amount after startup completes program

7

offices located across Asia, Europe and the Middle East with 56 employees

Brinc India's Hardware And IoT Programme

Along the same lines, it hosts an India Hardware & IoT programme, to support hardware startups from across sectors such as IoT, robotics, consumer electronics and more in Kochi twice a year. The goal of the programme is to help Kerala become the preferred destination for all startups who want to develop IoT and connected hardware businesses in India. It provides comprehensive support to mid-stage startups, with a working prototype, progressing towards the DFM phase.

"We had an agreement with the government that we will be taking teams per cohorts in a year. Initially, when we started last year in June 2019, we were planning to close five teams but we could only close four. So from India programme, we currently have four teams in our portfolio." said Raj Jagan, programme manager, Brinc.

Focussing on startups from India, the programme requires at least one member from the startup's team to be in Kochi for the entire duration of the same.

Brinc Benefits For Hardware Startups

- **Funding:** Investment Capital To Help Launch The Startup
- **Mentorship:** To Help In Both The Early Stages As Well As Growth Stage Of A Business
- **Network:** Help Get Connected To Brinc's Global Network Of Investors And Partners
- **Curriculum:** Customised To A Startup's Needs
- **Perks:** Get Tools And Services From Brinc's Partners At A Discounted Rate
- **Ongoing Support:** The Accelerator Supports A Startup Even Post The Completion Of The Programme

The selected startups, who progress through the programme levels can receive up to $250K in investment in exchange for 12.25% to 22.42% equity and additional support services to develop their DFM and bring their businesses to the market.

The funding amount is paid to the startups via a three gate payment tranche. As the startup progresses through the programme, it unlocks more cash as a support right from product development to its first sale.

- **Gate 1 Tranche: $40K**
- **Gate 2 Tranche: $80K**
- **Gate 3 Tranche: $130K**

Investment Verticals Focussed On By Brinc

With a strict focus on hardware products providing efficient solutions for better output, Brinc provides investments to startups from various verticals such as:

- **Agritech**
- **Consumer Electronics**
- **IoT**
- **Drones**
- **Healthtech**
- **Logistics**
- **Manufacturing**
- **Robotics**
- **Smart City**

Additional Support Offered By Brinc

Adding to its funding support and market validation of the product, Brinc provides mentorship, investor networking, customised curriculum and more to promote efficiency and better implementation of solutions in the early stages of a startup's journey.

Mentorship: In-house experts and mentor network guiding the startup through all the essentials of its early stages such as the branding, legal work, fundraising, manufacturing, marketing, production, and sales

Network: As the startup begins to scale, Brinc introduces them to its international network of startups, investors, and partners to further accelerate their growth

Customised Curriculum: It has devised a curriculum catering to the specific needs of a startup and claims to provide guidance to any startup wherever they may need any support.

Technical Onsite Training: As a part of the programme, Brinc also takes the startups for a one month of onsite training, where international experts from its network are also present to guide the startups on how to go to the market.

Startup Perks Package: In this package, startups from Brinc's portfolio get a discount on the tools and services from its global partners.

On-Going Support: Even on the completion of the programme, Brinc strives to support the business development and growth of the startups

It is undeniable that India houses a lot of talented individuals working on developing products on various technologies and entities such as Maker Village and Brinc are providing a helping hand to them. "The only place where they are lacking is the focus on business. And we aim to bring greater value here because we have access to global markets, global technologies and global know-how. So, we try to leverage all this information and experience we have from across the global markets to bring to the startups here," added Zenchenkov.

Brinc: Application Process

Accelerator team reviews & votes on applications

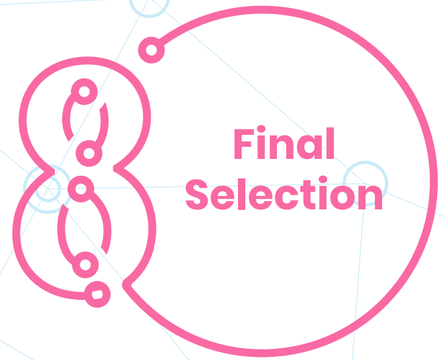
Follow up due diligence questions and internal scoring

Review and select teams for extended due diligence

Term sheet signed with unilateral option to void in extended due diligence

Work hands-on with teams to conduct deep dive due diligence and internal scoring

Investment Committee performs a 360° interview



Investment Committee performs analysis and votes for final selection

As part of the Brinc's on-going support, it also gives its portfolio startups access to perks from various service providers that are critical to a startup's success such as Alibaba Cloud, HSBC, IBM, Microsoft Ventures and more, even after they have graduated. Termed as 'Perks Package', the accelerator claims it to be worth more than $100K.

Additionally, Brinc participates in many events in the Kerala ecosystem such as the Huddle Kerala to help the startups with tips and tricks of how to penetrate and scale to different markets in the world. Zenchenkov further elaborated that through these events, Brinc gave startups presentations — on how to negotiate with the investors, how to present their business ideas, how to improve their pitch decks and more — to help them be more prepared for initiating talks with investors.

Future Plans To Build The Ecosystem

Recently, the accelerator got in touch with BioNEST — launched by BIRAC to foster a biotech innovation ecosystem in the country — for a partnership. "I met with Dr Saji and Dr Uma (Uma Subramanian Unni, programme scientist at Kribs-BioNEST) and we looked at their facilities and agreed that we will participate in a series of events. Through them, we will introduce our programme, and help the researchers in understanding what a business is like, not just the research but how to convert it into business," Zenchenkov explained.

Considering the fact that it receives over 200 applications for the programme where it is to select only 10, Brinc is aware of the demand there is in the ecosystem for the services it provides. Looking at the amount and talent of the startups here, Brinc wanted to further add to these services. For this, the accelerator has talked to its team in China — which has a dedicated branch of services in the country to help startups connect to manufacturers, vendors, suppliers, companies and more — to formulate a proposal and see what more services it can add to its offerings in India.

"Our director of sales is looking after the proposal and, just recently, we have already circulated the announcement for those startups which are not under the programme but are looking for similar manufacturing and production services in China," added Zenchenkov.

The accelerator is also trying to counter the lack of activity of the investor groups in Kochi by looking for partners in Bengaluru and bringing them to the city and, in turn, promoting the corporate and investor engagement in the entire state.

While currently Brinc is in a partnership with KSUM for funds, going forward the accelerator will have its own funds and investors for the startup, told Jagan.

Makerspaces: Boosting Entrepreneurship And Hardware Ecosystem In Kerala

Name of the entity	Launched In	Point Of Contact	Equipments Available	Brief Overview	Complete Address
Foxlab Makerspace	2016	Name: Muhammed Jaseel Email Id: hello@foxlabmakerspace.org Contact No.: 8129155621	Electronics workbench & Testing equipments, PCB Milling Machine, 3D printers, Tiny assembled laser engravers, Power tools etc.	Foxlab Makerspace is a non-profit community-based collaborative work space, in which people with shared interests, can gather to work on projects while sharing ideas, equipment, and knowledge.	2nd Floor, TBS Tower Perinthalmanna, near Govt. Polytechnic College, Malappuram, Kerala 679321
STEAG centre for smart city technologies	2020	Name: Daniel Jeevan Email Id: Contact No.: 9747572989		Set up in Rajagiri School of Engineering and Technology, Kochi, India (RSET), Steag Centre for Smart City Technologies aims to help develop the innovative capacity of students by learning by doing. Covering an area of over 4000 sq feet, the centre has machines such as 3D printers, CNC routers, laser cutters and more. It also has electronics and software facilities to enable the students in converting their ideas to prototypes. Students are also provided with mentors from the faculty as well as domain experts from the ecosystem.	KE Block Extension RSET, Rajagiri Valley, Kakkanad, Kochi, Kerala 682039

Fablab Trivandrum	2015	Name: Vinod Kumar Email Id: vinod@startupmission.in Contact No.: 9809494669	PCB Milling, 3D printer farm (FDM, SLA, MJF technologies), CNC Router, Moulding & Casting, Vinyl cutter, Electronics workbech with testing equiments, Laser Cutter.	A Fabrication Laboratory (FabLab) — established in the Indian Institute of Technology and Management-Kerala (IIITM-K) — is a technical prototyping platform for innovation and invention, aiming at promoting local entrepreneurship. It works as a small scale workshop offering digital fabrication and connecting a global community of learners, educators, technologists, researchers and innovators. It has a number of high-end machinery to expedite the prototyping process for those with innovative ideas.	IIITM-K Building , Technopark Campus, Thiruvananthapuram, Kerala 695581
Super Fablab Kochi	2015	Name: Nadeem Ahmed Email Id: nadeem@startupmission.in Contact No.: 8089902399	PCB Milling, 3D printer farm (FDM, SLA, MJF technologies), CNC Router, Moulding & Casting, Vinyl cutter, Electronics workbech with testing equiments, Laser Cutter, Fiber laser cutter, water jet, ZUND- swiss made format cutter, CNC Lathe, Semi automated CNC, Wood working tools & Power tools, SHAPER- Portable CNC, Pick & Place machine, High end testing equipments etc.		Kinfra Hi-Tech Park Main Rd, HMT Colony, North Kalamassery, HMT Kalamassery, Kochi, Kerala 683503
Palakkad polytechnic Fablab	2020			The Palakkad incubation center and mini-fab lab has been setup in the Government polytechnic college in 5K square feet of space. The incubation center has reserved 20% of the space for students and the FabLab comprises of machines such as Laser cutter, vinyl plotter, mini CNC milling machine, 3D printer, safety tools and more	Palakkad
CUSAT Fablab	2020				Ernamkulam

Mini Fablabs					
GEC Trissur	2017	Name: Ajay James Email Id: gectfablab@gectcr.ac.in Contact No.:	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Government Engineering College, Thrissur, Ramavarmapuram, Thrissur, Kerala, 680009, India
JECC	2017	Name: Jinesh KJ Email Id: jineshkj@jecc.ac.in Contact No.: 9400086378	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Jyothi Engineering College Work Shop Lab, Cheruthuruthy, 679531, India
MESCE	2017	Name: Shine K Email Id: shinekunnath@gmail.com Contact No.: 9446344648	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc	FabLab - MESCE, combines 2D and 3D design with the latest fabrication technology. The lab has various machinery in its facility, ranging from CNC machining to 3D printing, and even PCB Milling. It aims to help students produce their unique products from a digital design quickly and at a very low cost in comparison to traditional methods. Additionally, the lab boosts manufacturing capability with equipments such as precision laser, cutters for moulding, milling equipment, electronic components and circuit boards.	Kuttippuram, Thrikkanapuram P.O., Kuttippuram, Kerala, 679573, India
SSET	2017	Name: Venu P Email Id: fabsset@scmsgroup.org Contact No.: 0484-2450330	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		SCMS School of Engineering and Technology, Vidya Nagar Palissery Karukutty Ernakulam, Ernakulam, Kerala, 683576, India

FISAT	2017	Name: Renjith R Email Id: fablab@fisat.ac.in Contact No.: 0484 2725051	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc	Federal Institute of Science and Technology (FISAT) started a mini FabLab with the support of A P J Abdul Kalam Technological University and KSUM in the college campus. It functions as an auxiliary body of FISAT Science and Technology Park and Research Centre and is a technical prototyping platform for innovation and invention. Hosting machinery such as 3D printer, laser cutter, Electronics workbench and more, it aims to empower students and other users to create smart devices for themselves which can be tailored to local or personal needs.	Mookkannoor P.O., Angamaly, Ernakulam, Kerala, 683577, India
Adishankara	2017	Name: Goutham S Email Id: fablab@adishankara.ac.in Contact No.: 0484-2463825 , 0484-2461933	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Adi Shankara Institute of science and technology, Near Shankara arts college, Mattor,Kalady, Ernakulam, Kerala, 683574, India
SNGCE	2017	Name: Aby Mathew Email Id: abysngce@gmail.com Contact No.: 9847883774	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Sree Narayana Gurukulam College of Engineering, Kadayiruppu, Kolencherry, ERNAKULAM, KERALA, 682311, India
Rajagiri Sunya	2017	Name: Shubha Sree AV Email Id: fablab@rajagiritech.edu.in Contact No.: 0484 2660999, 8089185526	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Rajagiri School of Engineering & Technology, Rajagiri Valley PO, Kochi, Ernakulam, Kerala, 682039, India
MEC	2017	Name: Pradeep M Email Id: principal@mec.ac.in Contact No.: 0484-257739	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Model engineering College, Kochi, Kerala, 682021, India

LBS	2017	Name: Prasoon Kannan Email Id: lbsfablab@gmail.com Contact No.: 0499-4250290, 9895745012	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc	The LBS Mini FabLab at LBS College of Engineering offers a blend of technology solutions. It not only provides, open access to design software, laser cutters, 3D printers, vinyl cutters, CNC router and hand tools but also, access to information, tools, software and space for anyone who has an interest to learn and create,	Povval, Muliyar P.O, Cherkala, Kasaragod, kerala, 671542, India
GCEK	2017	Name: V Vinod Kumar Email Id: fablab@gcek.ac.in Contact No.: 0497-2780226	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Govt College of Engg. Kannur, Kannur, Kerala, 670563, India
Saintgits	2017	Name: Arun K Vargheese Email Id: arun.k@saintgits.org Contact No.: 9744254337	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Pathamuttam, Pathamuttam, Kerala, 686001, India
RIT	2017	Name: Vikas VK Email Id: vikas.vk@rit.ac.in Contact No.: 9446001296	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc	An on-campus model fabrication resource that utilizes various professional 3D printers, laser cutters, and CNC routing devices to support curricular needs of RIT students, faculty, and staff.	Pampady, kottayam, kerala, 686501, India
CEC	2017	Name: Liju Philip Email Id: fablabcec@ceconline.edu Contact No.: 0479-2456046	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Chengannur P.O, Chengannur, Kerala, 689121, India
TKMCE	2017	Name: Rahul Nath Email Id: apjdreamlabtkmce@gmail.com Contact No.: 8281583996	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		TKM College of Engineering, Karicode, Kollam, Kerala, 691005, India

Heera CE	2017	Name: Anand Michael Email Id: anandmichael007@gmail.com Contact No.: 9496973797	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Heera College of Engineering and Technology, Panavoor,Aanad, Nedumangadu, Thiruvananthapuram, Kerala, 695568, India
SCTCE	2017	Name: Shajan S Email Id: shajansct@gmail.com Contact No.: 9447389404, 9895631048	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc	Mini FabLab Kerala SCTCE was setup at SCTCE with support from APJ Abdul Kalam Technological University and KSUM. The lab is equipped with latest machines, tools and technologies required to facilitate research and prototyping activities. Some of the facilities available are such as laser cutting and engraving machine, 3D printers, vinyl cutter and plotter, electronic components and tools, electronic test equipments, computers and more.	SCT College of Engineering, Pappanamcode, Thiruvananthapuram, Kerala, 695018, India
VJCET	2017	Name: Anishin Raj Email Id: anishinraj@vjcet.org Contact No.: 0485-2262211	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Vazhakulam, Vazhakulam, kerala, 686670, India
MACE	2017	Name: Aji Joy Email Id: fablab@mace.ac.in Contact No.: 0485-2822363	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Mar Athanasius College of Engineering, Kothamangalam, Kerala, India, Kothamangalam, Kerala, 686666, India
CET	2017	Name: Binu LS Email Id: cetvm@cet.ac.in Contact No.: 0471-2515556	3D printer, Laser Cutter, Mini-Shopbot (CNC), Electronics workbench, Vinyl Cutter,etc		Ambadi Nagar,Trivandrum,Kerala, Thiruvananthapuram, Kerala, 695016, India

For any hardware startup to grow and scale, infrastructure plays the biggest role. Easy access to machines and tools help these startups in efficiently building prototypes and models to scale, grow and attract the attention of the right people. To achieve this requirement of the startups as well as promote the culture of entrepreneurship across the state, Kerala took to the concept of Makerspaces.

For the uninitiated, Makerspaces are collaborative workspaces with adequate tools and equipment to enable building new products and creating new things. Usually situated inside a school, library or any other public/private facility, Makerspaces are open to kids, students, adults and entrepreneurs. These places include equipment such as 3D printers, laser cutters, CNC machines, soldering irons and even sewing machines, however, it isn't necessary that it includes all or any of these to be considered a Makerspace.

Evolved long before Hackerspaces, intended to help collaborate and work on software-related projects, Makerspace is a physical space where anyone who is keen to know, make or research hardware technology and processes can do their job.

Following this concept is Fab Labs — a concept of Massachusetts Institute of Technology (MIT) — providing young startups and aspiring entrepreneurs with the right tools and equipment to build their products. Fablabs is an organised and structured Makerspace, governed by a global non-profit entity called Fab Foundation from MIT, USA. The core ethos of the Fablab and Makerspace remain the same — "making local solutions to local problems".

While the concept of Makerspaces has been popular and widely accepted in the West, it took some time for India to pick up the trend — considering the fact, the first maker space was set up in 2002, following which there was no activity for quite some years!

To help its startup ecosystem, with the help of the concept, the Kerala government announced that it would set up 21 Fab Labs, with specifications and directions of MIT in 2013. Making it the first state in India to analyse and implement the concept of Fablabs to the hardware ecosystem.

Makerspaces and Fablabs expose one to global standard machinery and processes and help to resonate with the worldwide trend in making things. In Kerala, it started with two labs and eventually evolved into 20 mini Fablabs. These spaces have opened the state up to distributed manufacturing capabilities. Adding to the already achieved milestone by the state in the same field is the recently inaugurated Super Fablab — the first of its kind facility available outside MIT, USA — which is capable of making machines needed for making other labs.

Among the most prominent Makerspaces in the state apart from FabLabs are Foxlab Makerspace, STEAG centre and more.

Government As An Enabler For The Indian Hardware Startups

The Government of India has, without doubt, put in a lot of efforts with the aim of establishing the country as a global electronics manufacturing hub. These efforts to boost the hardware ecosystem can be broadly categorised into four segments, namely, policy initiatives, fiscal initiatives, innovation and R&D and skill development.

Policies such as Make In India, Digital India and National Policy on Electronics (NPE) have played the biggest role in the growth of this sector.

According to NPE draft electronics hardware demand is set to rise rapidly to over $400 Bn by 2023-24. Considering that, India cannot afford a big import bill in electronics — which stood at $ 53 Bn in 2017-18. Realising this, it became all the more important for the government to promote domestic electronics hardware manufacturing.

Under Digital India and Make In India, the government placed ‘net zero imports by 2020’ through electronic manufacturing as one of the key pillars. Even amidst the coronavirus outbreak, it has not lost sight of this goal, providing INR 42K Cr to boost domestic manufacturing of mobile phones and boost production. With this, the aim is to not only integrate India into the global supply chain but also remove the Indian manufacturers’ dependence on China.

Thus, the initiatives aim at helping the country in establishing leadership in Electronics System Design and Manufacturing—by enabling a healthy environment for the industry to compete globally.

Launched in 2012, the goals of the NPE include:

- **To attract an investment of $100 Bn**
- **To reach a turnover of $400 Bn by 2025**
- **To create employment for 28 Mn people**
- **To increase exports from $8 Bn to $80 Bn**
- **To produce 1 Bn mobile handsets by 2025**

Furthermore, with the aim of offsetting disability and attracting investments in electronic manufacturing, the government launched the Modified Special Incentive Package Scheme (M-SIPS) in 2012.

Available for both new and expansion projects, the scheme provides capital subsidy of 20% in special economic zones (SEZ) and 25% in non-SEZ for businesses working in electronics manufacturing. It also provides for reimbursements of excise for capital equipment for the non-SEZ businesses and more.

Till January 2020, the scheme was reported to have led to job creation of over 1.2 Lakh and capital expenditure of over INR 17 Cr since its inception. Additionally, it received over 397 proposals out of which 252 proposals worth over INR 72 Cr received approval.

The Relief In Import And Export

Scheme	Products Covered	Benefits Offered
Electronics hardware Technology Park (EHTP)	The electronics products manufactured in these parks	• Duly free import of raw materials required • Reimbursement of Central Sales Tax (CST) • Excise duty exemption on procurement of indigenously available materials
Focus product Scheme (Under Foreign Trade Policy)	Domestically manufactured set top boxes and other electronic products	• 2-5% incentives
Scheme for MSME (Under National Policy on Electronics)	800 electronic models (maximum)	• Reimbursement of expenses for testing and certification required for export. • The total Grant in Advance (GIA) for one model is INR 125,000
Merchandise Export from India Scheme (MEIS) (Under the Foreign Trade Policy 2015-2020)	Specific electronic products (includes AC parts and compressors, refrigerating equipment compressors, fully automatic washing machines, color TV and STB for accessing internet)	• Offered export subsidy starting at 2% and higher for items that have high domestic content and value addition (when exported to specific countries)

To promote innovation in the electronics sector, the government has taken initiatives such as Electronic Development Fund, Center of Excellence — National Centre for Flexible Electronics, National Centre of Excellence in Technology for Internal Security, Incubators and more.

Furthermore, focussing on strengthening the availability of talented and skilled manpower in the sector, there are initiatives such as skills councils, financial assistance for electronics & ICT academies, Schemes for Skill Development in the ESDM Sector and more.

Kerala's Support To Startups

Known for its proactive approach in helping startups, Kerala has, for long, been ahead of the curve to support its startups. The state government has an active mission to support the electronics system design and manufacturing (ESDM), and hardware industry that maps all the players in the ecosystem and monitors their capabilities closely.

The state's distinctive socio-economic factors such as a high literacy rate and per capita income enable it to nurture the country's biggest hardware ecosystem. A history spanning more than five decades has helped Kerala's electronics industry to expand to a leading position, through Keltron as well as organisations such as software and hardware manufacturer SFO Technologies and the country's largest blood bag producer Terumo Penpol.

Kerala's focus on startups is not only through its incubator and accelerator programmes but also its mentorship initiatives has helped nurture many business ideas, along with steps driving seed-level funding and grants for research and development.

KSUM Fund Of Fund Scheme

State-run incubator KSUM invited proposals from alternative investment funds (AIF) recognised by market regulator Sebi under its Fund of Fund scheme. Through this scheme, startups gained access to a large corpus of funds through selected AIFs, which received funds from the Kerala government, in partnership with leading venture capital firms in the country.

Unicorn India Ventures, Indian Angel Network Fund I (IAN Fund I), Speciale Invest Fund I and SEA Fund are some of the VC funds participating in the Fund of Fund scheme. While three of these funds have a sector-agnostic approach for investment, Speciale Invest Fund focuses on deep tech startups. Startups can meet these VCs through the KSUM-organised Investor Cafe programme.

The KSUM Fund of Fund portfolio includes hardware startups, including GenRobotics, SectorQube and Perfect Fit. One such embedded systems industry startup is Inntot, which provides Digital Radio Mondiale (DRM) software-based digital ratio solutions. One of the partnering funds is in the final stages of its new investment in a startup which develops integrated hardware and software solutions for medical diagnostics.

Investor Cafe

The KSUM-organised Investor Cafe programme, held on the last Wednesday of every month at the Integrated Startup Complex (ISC) in Kochi, Kerala, connects select startups looking for funds with marquee angel investors and leading VCs in the ecosystem. The meetings are conducted on a one-to-one basis - one investor and one founder at a time.

Startup founders are required to register one month prior to the programme. The profiles of shortlisted startups are shared with the investors scheduled to attend the upcoming Investor Cafe session, which enables them to prioritise their meetings based on their investment philosophy and preference. Once a match is made, the selected startup founders are invited to attend the Investor Cafe session.

Seeding Kerala

Also organised by KSUM, Seeding Kerala is a summit of angel investors held in February every year. The programme is aimed at:

- **Promoting seed investments into startups**
- **Educating high-net-worth individuals (HNIs) active in Kerala's startup ecosystem on the seed investment culture**
- **Attracting angel investors, HNIs and VCs to Kerala**

KSUM organises a startup challenge under this summit to discover the top startups from the country. This sector-agnostic challenge handpicks three startups to present their pitches in the summit, while other promising startups are given the opportunity to meet investors for a one-on-one closed room pitch. A majority of investors in the programme work on a sector-agnostic strategy.

Innovation Grants

- **Up to INR 30 Lakh R&D Grants:** This particular grant is provided to the startups for the purpose of conducting R&D and prototyping of technologies having the potential to create value for an industry or society as a whole.

- **Up to INR 2 Lakh Idea Grant:** Meant for enabling startups with innovative ideas to build their prototypes, the Idea Grant provides businesses with initial-stage funds to help them purchase essential equipment, such as testing machinery, as well as raw material to get them started.
- **Up to INR 5 Lakh Productisation Grant:** This grant is to help startups develop a product, make critical product improvements, higher versions for market adoption and more
- **Up to INR 5 Lakh Scale-Up Grant:** This grant is to help startups scale up their business and customer acquisitions

A startup can avail up to INR 12 lakhs from the Innovation Grant Scheme. Successful startups can repay the grants as goodwill to KSUM.

Seed Support Scheme

The state government's Seed Support scheme provides loans of up to INR 15 lakhs to hardware startups. Loans granted under this scheme can be used towards product development and certifications, operational expenses, purchase of software licences and tools, product building distribution channels, and customer acquisitions. The loan comes with a moratorium of 12 months, which enables startups to start the repayments in 12 months over 36 Instalments at a flat interest of 6%.

Patent Support

Through another scheme, KSUM provides reimbursement support of up to INR 2 lakhs and INR 10 lakhs for domestic and international patents respectively. The reimbursement covers expenses such as government fees and consulting charges.

Marketing Supports

The state government also provides marketing and promotional support to startups, in the form of free-of-cost public relations activities. The authorities also reimburse charges towards exhibitions and conferences of national as well as international recognition.

International Travels

The state provides support for international travel and exposure to startups, enabling them to explore globally-recognised market opportunities such as the UAE's GITEX Dubai trade show, and the Bahrain and Singapore legs of innovation platform UNBOUND. The support provided to startups covers 50% costs of travel and accommodation. Besides, expenses related to participation in international conclaves and exhibitions such as the California, US-based TiEcon Silicon Valley event as well as the MWC in Barcelona, Spain, and the SLUSH in Helsinki, Finland are also covered.

Rent Subsidy

Many hardware startups require more operational support compared to others even after graduating from an incubator. This is primarily because in many cases hardware startups take about 4-5 years to start generating revenues. Also, these startups require more space than IT solution providers to accommodate manpower, machinery, inventories, and testing and assembling units. Through its Rent Subsidy scheme, KSUM provides reimbursement of rental charges up to either 50% or INR 20 per square foot (whichever is lowest) to well-performing startups operating from IT parks.

The Most Promising Hardware Startups From Kerala

Sastra Robotics: A Bot's Leap Of Faith To Go Global ... Takes 3 Years

Among the very few startups in India delivering innovative robotic solutions, Sastra Robotics aims to ease the physical work done by human workers. Innovative solutions by Sastra Robotics, which was founded in 2013, help original equipment manufacturers (OEMs) and other service providers expedite their testing phases, which would otherwise be an extremely lengthy and tedious task if left to human capacity and capabilities. With a core team comprising those passionate about robotics since college days, Sastra has developed a robotic system which acts like a human arm.

In 2016, the works of cofounders Akhil A, Achu Wilson and Aronin P drew interest from a global automobile giant in Bengaluru. This helped the startup receive an order for building robots that could touch a screen 1K times per minute. The robot was able to garner impressive results for the company, which won the startup order of INR 10 Lakh.

"We are catering to the B2B sector with our product, which is a replication of the human hand. It comes with functionalities of the human finger such as touch and feels and on top of that, it can produce controllable pressure on the surface as well as sense the vibration and temperature from the surface," explained Aronin. He also elaborated that the startup's B2B clients are currently using it as a platform to evaluate the testing of human-machine systems, involving a range of touch screens and gesture feedback technologies.

Sastra Robotics enables companies to determine the kind of latency, which is the time taken for a stimulus to trigger a response, impossible for the naked eye to detect. For example, a user might be able to feel the vibration but for practical reasons not able to estimate its frequency or amplitude, or even gauge the force deployed to operate the device. All such information is important for businesses and OEMs to evaluate, and effectively quantify, in order to make decisive calls.

"They need to summarise all this data and make a decision and the results to be shared with the stakeholders inside and outside the company," stressed Aronin.

The robotic arm of Sastra enables businesses to do all this and much more. Its most prominent features include:

- Cloud-based infrastructure
- Evaluation, research, data collation and analysis
- Sharing of data across networks
- Touch and feel ability
- Ease of manual workload
- Faster and more efficient than humans

The startup is building products to cater to the needs of several segments, including smart home appliances such as kitchen equipment where it uses an interface based on any touch, voice or gestures. Sastra Robotics aims to enable contactless interaction with these technologies.

Sastra is working to build a prosthetic arm with a five-finger gripper which enables a touch-and-feel ability to the user.

Electronic hardware incubator Maker Village helped Sastra expedite the process of building its prototypes through access to its Fab Labs workshops, and by providing the necessary tools in the form of grants, funds and industry connections to scale up operations, and emerge a success story of the state. Besides, a grant of INR 12 Lakh from the Kerala Startup Mission provided Sastra with the freedom to focus more on building products, not sourcing funds.

Kochi-headquartered Sastra Robotics has earned many titles; it was ranked among the top 50 startups in the world by TiE Silicon Valley in 2017. The startup has developed scalable automated robotic solutions, and even signed a memorandum of understanding (MoU) with US-based Lockheed Martin, which helped it tap the global market, and set it on course to contribute to both domestic as well as global aerospace and defence industries.

"At Sastra, we believe that the coexistence of humans and intelligent machines is the next step of evolution and we are confident that we will be able to drive this revolution," added Aronin.

Factsheet

• **Founded In:**	2013
• **Founders:**	Akhil A, Achu Wilson, Aronin P
• **Website Link:**	https://sastrarobotics.com/
• **Mission Statement:**	Replication of human hand to ease human workload and intervention
• **Product Offering**:	Ability to replicate human finger with force control, vision-based intelligence and touch and feel ability
• **Target Market Size:**	$51 Bn
• **Key Accomplishments:**	MoU with Lockheed Martin, Among the Top 50 Startups by TiE Silicon Valley in 2017 and more
• **Team Size:**	15
• **Benefits From KSUM:**	Direct Contact with Industrial Stalwarts, On-Request Guidance
• **Funding:**	Grants & Loans

Are We There Yet? EyeROV, The Team Behind India's First Underwater Drone

Passionate about building hardware and robotics products since college days, Johns T Mathai and Kannappa Palaniappan P have to their credit more than four years of experience in the segment. In 2015, Mathai, who worked in technology firm GreyOrange, and his partner Palaniappan, a project scientist in the National Institute of Ocean Technology (NIOT) at the time, decided to begin their startup journey.

Palaniappa travelled on ships a lot as part of his job. On one such journey, his team was required to inspect the hull or the bottom section of the ship, which underlined the challenge of getting a diver on such short notice.

The duo realised that miniaturised versions of the big machines going in oil rigs could be used for fast and efficient inspection underwater, and started working on an underwater drone model that worked as a remote-operated vehicle.

Incorporated in 2016, EyeROV pitched its idea to electronic hardware incubator Maker Village the same year and got selected. Soon after, EyeROV started working on its initial proof of concept and a prototype thanks to infrastructural support from Maker Village.

Soon, the startup was able to build India's first underwater robotic drone, Tuna, with features such as:

- **Navigation up to a depth of 50 metres**
- **Real-time HD video images**
- **Removes the need for costlier and riskier manual inspection**
- **Weighs less than 10 kgs**
- **Easily accessible and controllable**
- **Can be connected to laptops, joysticks and more**

It took EyeROV almost two years to build Tuna, which the startup rolled out in September 2018. The first order of the product came from the Defence Research and Development Organisation (DRDO)'s Naval Physical and Oceanographic Laboratory (NPOL) for a solution to be deployed in R&D activities.


EyeROV TUNA
India's First Commercial ROV
APPLICATIONS
BENEFITS
FEATURES

Providing a strong manoeuvring capability at low cost, EyeROV was tested on India's first solar ferry, the Aditya, in Vaikom, Kerala. Its use cases include:

- **Inspections of ship hulls, ports, dams and nuclear power plants**
- **Search and rescue**
- **Naval mine detection**
- **Ocean studies**

Electronic hardware incubator Maker Village connected EyeROV with a team of reputed mentors and advisors that included ex-DRDO and ex-Navy officials as well as Marine industry experts. The Kerala Startup Mission and Maker Village supported EyeROV throughout its early journey.

Initial funding through a Bharat Petroleum Corporation project, the Ankur Startup Scheme which works on a partnership with Maker Village, and grants worth INR 15 Lakhs from KSUM, gave wings to the startup's ambition.

"The major support, I would say, is the mentoring. They have helped us when we needed to connect with the right people to help us deploy the product. Furthermore, Maker Village's facilities allowed us to easily and efficiently test our equipment. Some of the equipment in the Maker Village facilities cost around INR 25 to 30 Lakhs, which is not affordable for a startup," said Mathai.

EyeROV's first order was based on its second prototype, whose predecessor did not meet client requirements. The startup was given the task of building a drone capable of carrying a 2-Kg payload, which later helped it in attracting the interest of Bharat Petroleum, the Mumbai Port Trust, the coastal police as well as dam operators the same year.

Factsheet

• **Founded In:**	2016
• **Founders:**	Johns T Mathai and Kannappa Palaniappan P
• **Website Link:**	https://www.eyerov.com/
• **Mission Statement:**	Underwater robotic drone
• **Product Offering:**	Real-time HD video images, lightweight, easily accessible and controlled and more
• **Total Market Size In India:**	INR 500 Cr
• **Key Accomplishments:**	Counts names such as BPCL, Mumbai Port Trust, NPOL of DRDO and more as clients
• **Team Size:**	
• **Benefits From KSUM:**	Infrastructure Support, Grants, Market access, Industry Connect

It’s Time! From Vehicle Tracking To Infotainment, VST Mobility Turns To IoT

An aggregator of transport solutions, VST Mobility develops secure mobile- and web-based applications along with hardware devices using technologies such as Internet of Things (IoT). Its solutions deal with areas spanning from real-time vehicle tracking to monitoring of fuel and driver behaviour. Its web solutions ensure effective facility management by providing surveillance solutions for administrators. Its mobile applications provide passengers with different modes of connected transport solutions using a single travel card.

In Budapest, Alvin George had an experience that made him recognise the importance of safety devices and location-based tracking for passengers, especially while using public transport networks. He figured that public transport systems lacked intelligent solutions capable of not only helping in bringing down the cost of operations but also in connecting travellers.

Since its launch in 2015, it took VST Mobility three years to build and deploy its products. It was near the end of 2019 that the startup rolled out two products at an event: the Smart Eclipse and the VDASH VST-0507. During the event, which had Department of Transport principal secretary KR Jyothilal and Kerala State IT Mission director S Chithra in attendance, Kerala Startup Mission (KSUM) ex-CEO Saji Gopinath granted Central Eye Track the distribution rights of Smart Eclipse for all of the state’s 14 districts of Kerala.

What Are VST Mobility’s Products All About?

Smart Eclipse: A vehicle tracking unit, Smart Eclipse is embedded with an eSIM (embedded SIM card) and an Indian Regional Navigation Satellite System (IRNSS) module, which together make it an effective fleet management device.

VDASH VST-0507: A smart infotainment system, VDASH is a complete dashboard for a vehicle fitted with a tracking device along with gauges such as a speedometer and an odometer.

Features Of The VST Solutions:

- Touch screen
- HDMI connectivity with Bluetooth and wifi
- Dual-zone display
- On-board diagnostics (OBD)
- Destination alerts

Driver assisting tools such as reverse camera, 360-degree camera and more
Passenger information system

The startup's product portfolio also includes the Electronic Ticketing Machine (ETM), which is a handheld data terminal capable of real-time collection, processing and transmission of information to host servers. It has a user-friendly interface which is integrated with a QR code reader, supporting near-field communication (NFC) to enhance flexibility in operations. The device comes with an in-built thermal printer which enables the printing of transaction receipts instantly. It even supports uploading of collected data to the host control room through a 4G/WiFi-enabled interface.

VST Mobility faced many challenges initially in order to make it to the market. While developing the product cost the startup a lot of time and effort, its major challenge was the lack of interest in its devices in the market, funds and even infrastructure.

Discussions with companies such as Quectel helped the startup overcome such challenges. "We also did free distribution of the device to understand the use of the device for vehicle owners and soon received an initial investment of INR 1.8 Cr from an investor to develop from 10 to 1K devices," recalled George.

VST Mobility received support from not only the Kerala Startup Mission (KSUM) but also Maker Village, which helped the startup penetrate the market and deploy its products on a large scale. This support, in the form of grants, infrastructure and testing labs, eased the process of manufacturing electronic boards for VST Mobility.

Through the support of KSUM, VST Mobility signed a memorandum of understanding (MoU) with Finland-based Here Technologies to distribute its products in the global market. The startup has already received orders from more than 100 countries and has an investment offer of INR 140 Cr from a foreign investor.

With more than 117 employees, the startup today has a presence in locations including Lucknow, Patiala, Pune, Kolkata, Bhopal, Hyderabad and Bengaluru.

Factsheet

• **Founded In:**	2015
• **Founders:**	Alvin George
• **Website Link:**	https://vstmobility.com/
• **Mission Statement:**	Smart and secure mobility solutions
• **Product Offering:**	Infotainment systems, electronic ticketing machine, GPS tracker
• **Target Market Size:**	$200 Mn+
• **Total Market Size In India:**	$1.2 Bn+
• **Key Accomplishments:**	Distribution of products in all 14 districts of Kerala, Global market penetration through an MoU with Here Technologies, Certifications AIS140, CIRT approvals
• **Team Size:**	117
• **Benefits From KSUM:**	Seed loan, Infrastructure Support, Grants, Market access

The Story Of GenRobotics: From An IronMan-Inspired Semi-Robotic Device To 30 Bots In 10 States

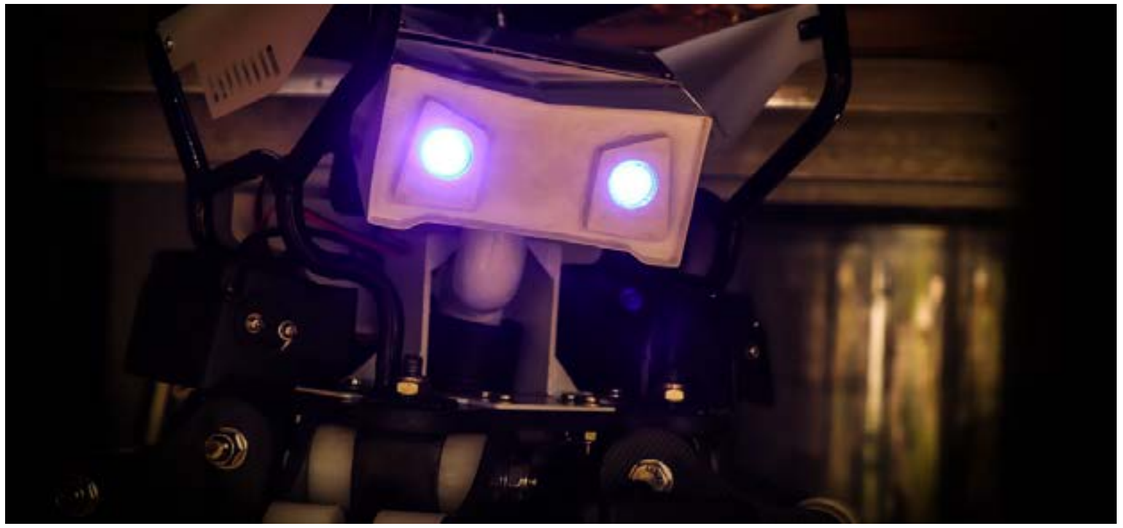
Four young minds from the MES College of Engineering built their first semi-robotic device: a 14-foot robot suit with arms and legs similar to humans and operated by a person within, all inspired by American science fiction film Iron Man. The successful development of this Generation 1 G-Robotic Suit helped the startup earn appreciation and recognition from far and wide.

Set up in 2015 by the team of four students, GenRobotics was registered in 2017 with a renewed focus on providing a solution aimed at manual scavenging in India. Since its incorporation, all the founders have been extensively researching the potential of technology in addressing and solving a variety of social issues.

With support from the Kerala Startup Mission (KSUM) and the Kerala Water Authority, the startup developed a prototype of their flagship product, the Bandicoot.

The first manhole-cleaning robot to eradicate the age-old practice of manual scavenging, the Bandicoot enters a manhole by converging its diameter through manholes; it is capable of decreasing the width of the robot to a suitable size based on the shape of the manhole. It then pulls out solid

waste with its robotic arm-and-bucket system, to help the seamless flow of waste through sewer lines.



Some Features Of The Bandicoot:

- **Compact size**, which makes it easy to use even in narrow lanes
- **Easily portable** without any tampering with the traffic or disturbance to the public
- **CFRP body**, which is anti-corrosive and ensures high durability
- **The robotic arm**, designed to eliminate human intervention, providing functionalities such as robotic silt shovelling, plastic waste pulling, grabbing and picking the solid wastes from corners of manholes
- **Robotic legs** make it flexible to move around the manhole and enable a strong positioning inside the manhole
- **Enhanced user experience**, with the help of tech such as AI and ML
- **Machine vision**, which gives a live camera vision even from deepest and darkest manholes
- **Gas sensors**, to know and track the presence of deadly gases
- **Pneumatic system** to avoid fire accidents due to gas present in the manholes
- **Bucket unit** which has the capacity of carrying the waste of up to 16 Lts and 125 Kg
- **Inbuild Tutorial app**, to enable easy self-training existing workers

"We also train the manhole cleaning workers to operate the Bandicoot robot to improve their quality of life. By bringing this robot tech as a solution we are also aiming to create job opportunities in manual scavenging, rehabilitating them other than losing their job," said Vimal Govind MK, cofounder and CEO, GenRobotics.

Other Products:

Manhole Monitoring System (MMS)

GenRobotics' product portfolio includes the Manhole Monitoring System (MMS), which is a complete sanitation solution that monitors manhole networks. It not only collects crucial data but also processes it using Machine Learning (ML) and Artificial Intelligence (AI) technologies. It provides a detailed report on the overall health of a manhole as well as alerts on the possibility of clogging and overflow.

G-Robotic Suite

- **Generation 1:** A 10 ft. high robot suit, which is a prototype of the tech that can be used for defence, space application, weight lifting and more that requires some extra power and protection
- **Generation 2:** This next version of generation one robotic suit uses a pneumatic feedback system in machine tool control, automobile steering and breaking, medical field and more

While in the company's portfolio, these products have not been commercialised yet.

Based on a B2G model, the startup credits the Kerala Startup Mission (KSUM) and electronic hardware incubator Maker Village for enabling the development and deployment of its Bandicoot project. Access to Maker Village's Fab Labs workshops and related infrastructure helped GenRobotics minimise both the time and the cost to develop its prototypes.

GenRobotics has deployed more than 30 Bandicoot units in as many as 10 states thanks to the support from KSUM and Maker Village. It has signed a memorandum of understanding (MoU) with the Dubai Municipality and joined hands with Tata Brabo Robotics for mass production.

Factsheet

• **Founded In:**	2017
• **Founders:**	Vimal Govind MK, Rashid K, Nikhil NP, Arun George
• **Website Link:**	https://www.genrobotics.org/
• **Mission Statement:**	Ending manual scavenging by removing human intervention completely using The Bandicoot robot
• **Product Offering:**	A robot that not only helps clean the manholes but also helps avoid any accidents related to fire or poisonous gases
• **Target Market Size:**	Tier 1 cities (50K - 1 Lakh manholes)
• **Key Accomplishments:**	Deployed the robots in ten states in India, Mou signed with Dubai municipality and tied up with Tata Brabo robotics for mass manufacturing
• **Team Size:**	65+
• **Benefits From KSUM:**	Supported for the initial R&D and product development, mentoring and Space for office and prototyping lab

Wireless Critical Connect Via Digital Mobile Radio? Yes, Says Triaxon Tech

With more than 20 years in the wireless critical communications field, Mahesh Bala, Padmakumar P, Wins Thomas and Hyungki Min's first startup stint was with an R&D firm by the name of Sigtech. Having created mission-critical products for 11-12 years under Sigtech, the team of four later set up Triaxon technologies, as a manufacturing arm of their R&D company.

Incorporated in 2019, Triaxon Technologies manufactures customisable Digital Mobile Radios (DMRs) and hand-held devices making use of indigenous resources. The startup creates devices which are built in India from scratch. Claiming to be the first company to have developed indigenously customisable DMR technology in India, the startup offers a variety of products in the category, which includes:

- **DMR Tier II & III Solutions**
- **DMR Repeaters**
- **DMR Modem**

Besides DMR solutions, the startup also provides end-to-end communication layouts and designs of critical requirements. "We aim to be a leading manufacturer in the wireless communications area. In that too, we are working on fail-safe mission-critical communication gadgets," said Mahesh Bala, cofounder, Triaxon.

Features supported in the products are:

- **Dual Capacity Direct Mode**
- **DMR Group Call**
- **Caller ID Display**
- **DMR Remote Monitor**
- **DMR Call Alert**
- **DMR Radio Check**
- **Man-down feature**

Additionally, the products of Triaxon come with the following benefits:

- **Analogue to digital migration**
- **Tier 2 to Tier 3 upgradation with a software**
- **Easily customisable and configurable with the existing network (in case of an emergency)**
- **Public security forces can use the devices with the latest encryption techniques**


TARAXON
AT TIMES,
A FAIL-SAFE
COMMUNICATION
SYSTEM
COULD SAVE
PRECIOUS LIVES
AND HOURS
Experts in fail-safe mission critical
communication technology.

Registered with the Kerala Startup Mission (KSUM), Triaxon Tech has received support from the state government agency to build indigenous products, and also joined hands with electronic hardware incubator Maker Village. “While we have received a lot of support from KSUM as well as the incubator, we still need a lot of certifications for our products,” elaborated Bala.

Not only has the incubator helped Triaxon in hardware research and mentorship, but also in showcasing its products to industry stalwarts, who can be the startup’s potential customers. Among the bigger players interested in Triaxon’s solutions is state-run Bharat Electronics, which has evaluated the startup’s technology. Bharat Electronics and Triaxon are currently in talks for signing a memorandum of understanding (MoU) for collaboration.

Working on B2G and B2B models, the startup is currently conducting research to bring in more technologies to its products. Most industry players are researching on introducing 5G and LTE technologies to their products, Bala mentions.

“For critical communications and RF (radio frequency) solutions, 5G and integrating 5G with LTE are very different protocols, they are two different architectures in themselves. Even Motorola, who is our primary competitor, has not yet come out with a 5G critical communication solution yet,” added Bala. The startup’s goal going further is to build an indigenous solution, combining these two things, “Which will be a great achievement from both the Indian and the global perspective”.

Factsheet

• **Founded In:**	June 2019
• **Founders:**	Mahesh Bala, Padmakumar P, Wins Thomas, Hyungki Min
• **Website Link:**	http://www.triaxontech.com/
• **Mission Statement:**	Providing solutions for wireless critical communication and public safety
• **Product Offering:**	DMR TII and T III
• **Target Market Size:**	$43 Mn as of 2020
• **Market Size:**	$12 K Mn as of 2020
• **Key Accomplishments:**	BEl’s interest to manufacture our technology to supply defence
• **Team Size:**	5
• **Benefits From KSUM: and Maker Village**	Reaching the market, Industry Connect and more

Delgado's Answer To Cost-Effective Spray Coating

Having more than 13 years of research experience in the field of spray coating technology, R Sreekumar was aware the industry has challenges such as reproducibility and repeatability. In 2017, he incorporated Delgado Coating Technology Solutions. "With our startup, we are now able to manufacture spray coating machines that can deposit thin films of compound semiconductor, transparent conductive oxides, nanoparticles with high rates of repeatability," said Sreekumar.

The startup claims that the use of its solution can result in the manufacturing of products such as cost-effective solar cells, electro-chromatic smart windows and touchscreen devices. For Sreekumar, the idea behind the product is to make solar-powered and large-area advanced transparent electronics devices cheaper for the common man.

"For example, the cost of transparent electrode material used in solar cells electro-chromatic windows is about INR 400 to INR 600 per square inch. And by using our machines, this can be achieved at a rate of INR 1 per square inch. I am determined to take this technology to the highest level possible through my venture," he added.

The startup is using PLC- or Programmable Logic Controller-based electronics and servo motor-controlled automation for high precision and repeatability. Delgado's technology could be incorporated with the current glass manufacturing process to ease the manufacturing of conductive glass.

Currently, these types of precision-controlled machines are being imported to fulfil the requirement of R&D institutes and universities. To counter this, Delgado is providing machines with better specifications at a much lower price compared to imports.

Among the universities and institutions that are leveraging its machines are names such as:

- **The Defence Bioengineering and Electromedical Laboratory (DEBEL), Bangalore:** R&D project for coating nanomaterials on wearables
- **International and Inter-University Centre for Nanoscience and Nanotechnology (IIUCNN), Kerala:** R&D project for coating organic coating on fruits to enhance shelf life
- **Cochin University of Science and Technology, Kerala:** R&D project for developing thin-film solar cells
- **Higher education Dept. Govt College for Women, Thiruvananthapuram:** R&D project for developing Transparent Conductive oxides and compound semiconductors


Delgado

Currently, the startup is trying to help the state with the coronavirus situation with three new products:

- **N95 respirators/mask** with advanced nano-coatings (antibacterial and antiviral)
- **Sanitiser machine**, for sanitising home, offices and industrial areas
- **Automated Pharma testing device**

While still in an initial stage, Delgado was granted a soft loan at 6% interest without any collateral. Mentorship and guidance from the Maker Village team kept the startup motivated and confident.

"Fundraising for startups is a big issue and the financial support offered by Maker Village and KSUM is of a high prospect. And Maker Village is also providing a world-class ecosystem and facility, which helped us build our business with a minimum rent for space," Sreekumar elaborated on the challenges faced by the startup.

The funding support received by the startup from the enabling entities from the state are:

- **Maker Village:** INR 5 Lakhs (Soft loan with 6% interest rate)
- **KSUM:** INR 12 Lakhs (Soft loan with 6% interest rate)
- **Nidhi Prayas Grant:** INR 6 Lakhs (no repayment required)
- **Idea Grant:** INR 2 Lakhs (no repayment required)

Delgado also benefited from free-of-cost access to Maker Villages' Fab Labs workshops equipped with machines such as 3D printers—for fabricating a part of their machine, source measuring units.

Factsheet:

Founded In:	2017
Founders:	R Sreekumar, A K Sukumaran
Website Link:	https://www.delgadocoatingsolutions.com/
Mission Statement:	Towards cost effective coatings
Product Offering:	Various models of customised spray coating machines of any size, Fruit coating machines, UV-exposure systems / photo-reactors, Electrospinning machines
Target Market Size:	INR 200 Lakhs
Market Size:	INR 500 Lakhs
Key Accomplishments:	Supplied first Machine to DRDO, Working prototype machine installed at Maker Village for R&D
Team Size:	4
Benefits From KSUM: and Maker Village	Seed loan of INR 12 Lakhs

Innovation Enters Kitchen Appliances Via SectorQube

Formed in 2011 as a college startup, SectorQube is the result of two flatmates without much cooking skills. The challenge faced by the two friends led them to research innovative automated cooking solutions. Soon, they realised that India's kitchen appliances sector had seen least innovation.

The duo realised that most of the products in the market were based on 20-year-old technology. With an aim to tap this opportunity, they decided to conduct R&D on smart appliances for the industry.

After two years of research, ideation and manufacturing, SectorQube launched its first product, MAID, a smart microwave that can download recipes and make suggestions using the internet. The smart oven can be controlled with a mobile app, through voice and even gestures.

The launch of MAID opened a lot of opportunities for SectorQube and soon, the startup started operating as an independent innovation wing for multiple home appliance manufacturers in the country.

The company primarily leverages the power of the Internet of Things (IoT) and machine learning (ML) in making kitchen appliances smarter. It starts with the automation of mundane tasks and extends to intelligently figuring out user preferences to deliver personalised experiences.

Features and specifications of SectorQube:

- Internet-connected products
- Personalized suggestion engine
- Automation of tasks
- Allows for user customisations
- Clean cooking

"SectorQube's smart appliances will reduce the time you spend in the kitchen doing mundane tasks, thereby allowing more time for your creative side," said Nibu Alias, cofounder and CEO, SectorQube.

SectorQube Products And Use Cases

MAID: The product takes cooking to the next level by providing users with the access to internet recipes that are custom-built for microwaves. Using MAID, a user can prepare ingredients with image and video prompts. It also makes suggestions based on a user's preferred calorie intake.

Rotibo: An automatic roti maker, allows ease in the process of making chapatis

Currently working with a number of prominent entities including the Government of Dubai, IFB Appliances and Godrej Appliances, the startup credits its success and growth to the support it received from the Kerala Startup Mission (KSUM) and electronic hardware incubator Maker Village. KSUM helped it with grants to build its products, Maker Village provided it with much more than just financial support.

Not only did it get infrastructural support from the incubator but also funding as well as access to tools to expedite the process of building its prototypes. If it weren't for Maker Village, the journey would have been much longer, admit the founders.

Maker Village helped the startup raise funding from Unicorn Ventures, and gave it access to its Fab Labs workshops.

Factsheet

• **Founded In:**	2011
• **Founders:**	Nibu Alias, Ani Abraham Joy, Midhun Skaria, Arjun Sarath, Biniyas VL and Sabarish Prakash
• **Website Link:**	http://www.sectorqube.com/
• **Mission Statement:**	Creating smart appliances to build a smarter world
• **Product Offering:**	Smart appliances to ease the workload
• **Target Market Size:**	$ 2.3 Bn
• **Market Size:**	INR 1K Crore
• **Key Accomplishments:**	Launched India's first Android oven, worked with major appliance manufacturers to launch India's first Wi-Fi washing machine
• **Team Size:**	25
• **Benefits From KSUM: and Maker Village**	Raising funds, Grants & loans, Equipments, Expert advisors

Vacus Tech Claims 99% Accuracy In Real-Time Micro-Location Tracking

Two persons got introduced to each other through a common friend, and that led to the birth of Vacus Tech. A conversation between Venugopal Kapre and Pratik Magar instantly made them realise their shared interest in a sector. The curiosity was around the GPS system, and how effective and yet vulnerable it can be in different circumstances.

The duo went on to examine the existing micro-location systems such as Active RFID and beacons, which helped them point out few fundamental technical errors in the contemporary processes. And that eventually led to the incorporation of Vacus Tech, which develops wireless radio products and hardware modules to enable real-time, accurate, low power and local area micro-location services.

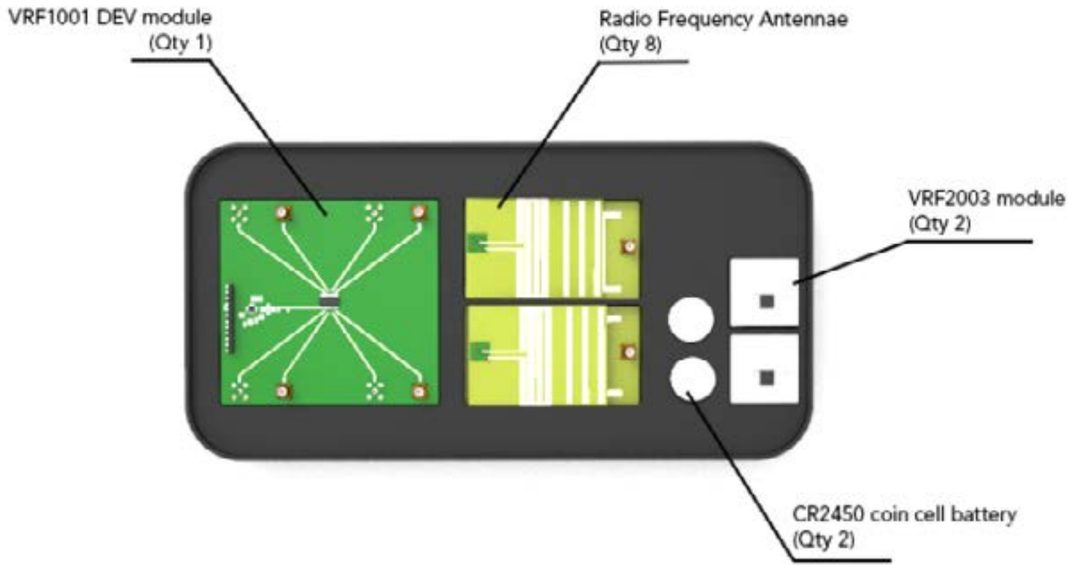
"We built our core team and set our milestone to develop a new technology which would give precise micro-location. The accuracy we get for our proprietary indoor positioning technology is 30 cm," Magar explained.

The indoor positioning technology developed by the startup, built around a virtual radio fencing technology, helps in ensuring system reliability for indoor navigation. The new configurable technology developed by Vacus Tech is based on a pair of antennas: one transmitter and receiver each. The antennas do the majority of processing, making the system power-efficient and cost-effective, elaborated Magar.

"Adding to that is our star network architecture, on which our technology is built, this enables us to cover large indoor environments and the open embedded network stack helps developers to package the solution with scalability," he added.

Vacus Tech boasts of fog-enabled Internet of Things (IoT)-based products with 99% accuracy in real-time indoor navigation and tracking. The cell-based system makes it consistent, reliable, accurate and highly immune to interference.

The primary use cases of Vacus Tech's products lie in the domain of productivity and safety. With two broad categories in its portfolio, the CRF EVK series (an evaluation kit for configurable radio fencing applications) and the CRF Product series (for indoor tracking of assets/people). Its most widely-commercialised product, Smart People Tracking, part of the CRF Product category, enables indoor tracking of a person.



Built with a US patented technology, the product has the following features, setting it apart from the competition:

- 30 cms indoor location accuracy
- Asset and people tag
- Panic button
- Battery life of 3 years
- Enables tracking with warehouses, manufacturing facilities and more

The product that took the startup two years to build came with its own set of challenges. A major challenge for the startup was lack of access to testing facilities, one that it was able to overcome with incubator Maker Village's electronics labs. Vacus Tech utilised Maker Village's assembly, injection moulding and packaging machines at almost 10% of the cost outside, which helped the startup expedite the process of developing its prototypes.

Factsheet

- **Founded In:** 2017
- **Founders:** Venugopal Kapre, Pratik Magar
- **Website Link:** https://www.vacustech.com/
- **Mission Statement:** Vacus makes fog enabled IoT product for indoor positioning and tracking
- **Product Offering:** Asset and people tracking of up to 30 cms
- **Target Market Size:** $500 Mn
- **Market Size:** $56 Bn
- **Key Accomplishments:** US Patent granted
- **Team Size:** 15
- **Benefits From KSUM: and Maker Village** Testing lab facility, funding and mentors

India’s Infusion Gets A Shot Of Innovative Tech, Evelabs Is Here!

Intravenous infusion through gravity drip struck Sanjai Rajendran as a potential area that required innovation, having explored the functional issues in hospitals as part of a student project back in 2015. The two main factors that drew Rajendran’s attention to the segment were the existence of several serious but undermined issues and wide demand for infusion therapy in hospitals.

After several attempts and iterations, Rajendran and his friends came up with the concept of a simple portable connected infusion monitor—christened Dripo—in 2016. The device helps a health practitioner set infusion rates accurately and monitor them from anywhere.

Some Features Of Dripo

- Helps set infusion rates accurately
- Enables monitoring from anywhere
- Counts the drops and calculates real-time drop rate
- Data sent to a central software at the nursing station
- Enables doctors to view patient history and treatment status
- Affordable pricing
- Reduce administration errors in IV effectively.

"An average nurse spends 30% of the time on administering medicines and Dripo can help in reducing the time taken by 50% on IV therapy administrations. One of the major reasons for IV errors is lack of training and all the devices available in the market are very complex to use. Dripo can be used by any practitioner without training," asserted Rajendran. The probability of making at least one error in administering a dose of intravenous medication is 0.73, and Dripo can help in bringing it down effectively, he explained.

With support from Trivandrum-based Sree Chitra Tirunal Institute for Medical Sciences and Technology's incubator, SCTIMST-TIMed, which focusses exclusively on the medical devices and bio-materials sector, and its biomedical technology wing, Evelabs gained an understanding of the regulatory aspects in the area.

Since its inception, the startup has been leveraging electronic hardware incubator Maker Village's facilities, which helped it reduce the lead time in prototyping by providing it access to 3D printers, laser cutters and electronics workbenches.

"We were charged merely INR 30 per hour for 3D printing, it was very less compared to any other vendors outside," added Rajendran. The startup also received an idea grant of INR 10 Lakh from the Kerala Startup Mission (KSUM) and a Biotechnology Ignition Grant (BIG) from the Biotechnology Industry Research Assistance Council (BIRAC). Additionally, KSUM also enabled the startup to be a part of its delegation to the startup and tech event SLUSH in Helsinki, Finland in 2017.

With 50 units sold and 70 units in the pipeline, Evelabs is currently working on more products in the infusion space.

Factsheet

• **Founded In:**	2016 August
• **Founders:**	Vishnu MS, Sanjai Rajendran, Sruthy Gopal
• **Website Link:**	https://www.evelabs.co/
• **Mission Statement:**	Safe and Efficient IV therapy for hospitals
• **Product Offering:**	Dripo Smart Infusion Monitor
• **Target Market Size:**	$2.5 Bn
• **Key Accomplishments:**	Completed Product design and moving on to manufacturing
• **Team Size:**	8
• **Benefits From KSUM: and Maker Village**	Grants, Support in terms of manufacturing, Public Relations

NAVA Design & Innovation, Tech To Unleash The True Potential Of Coconuts

Charles Vijay Varghese had a yard full of coconut trees in his hometown in Colonypady, near Aluva, used exclusively for harvesting and tapping toddy. Varghese recollects that in his childhood, a tapper would come to this field every day to collect toddy and give him some neera, which is unfermented toddy.

While working abroad years later, an article on the struggle of toddy and neera industries in Kerala grabbed his attention. It made Varghese realise the challenges that the industry faced. “A neera tapper can usually tap around 15-20 coconut palms per day, but that is the most ideal-case scenario and not to forget that the job is very dangerous,” said Varghese.

He found that almost all neera-producing companies in Kerala were shut down and the coconut farmers faced losses due to low income from coconut sales. It was then that Varghese decided to work on a solution for these industries.

“It was then I started my small research over there to understand how the tapping is done and what all processes are necessary to tap toddy from the coconut tree,” elaborated Varghese.

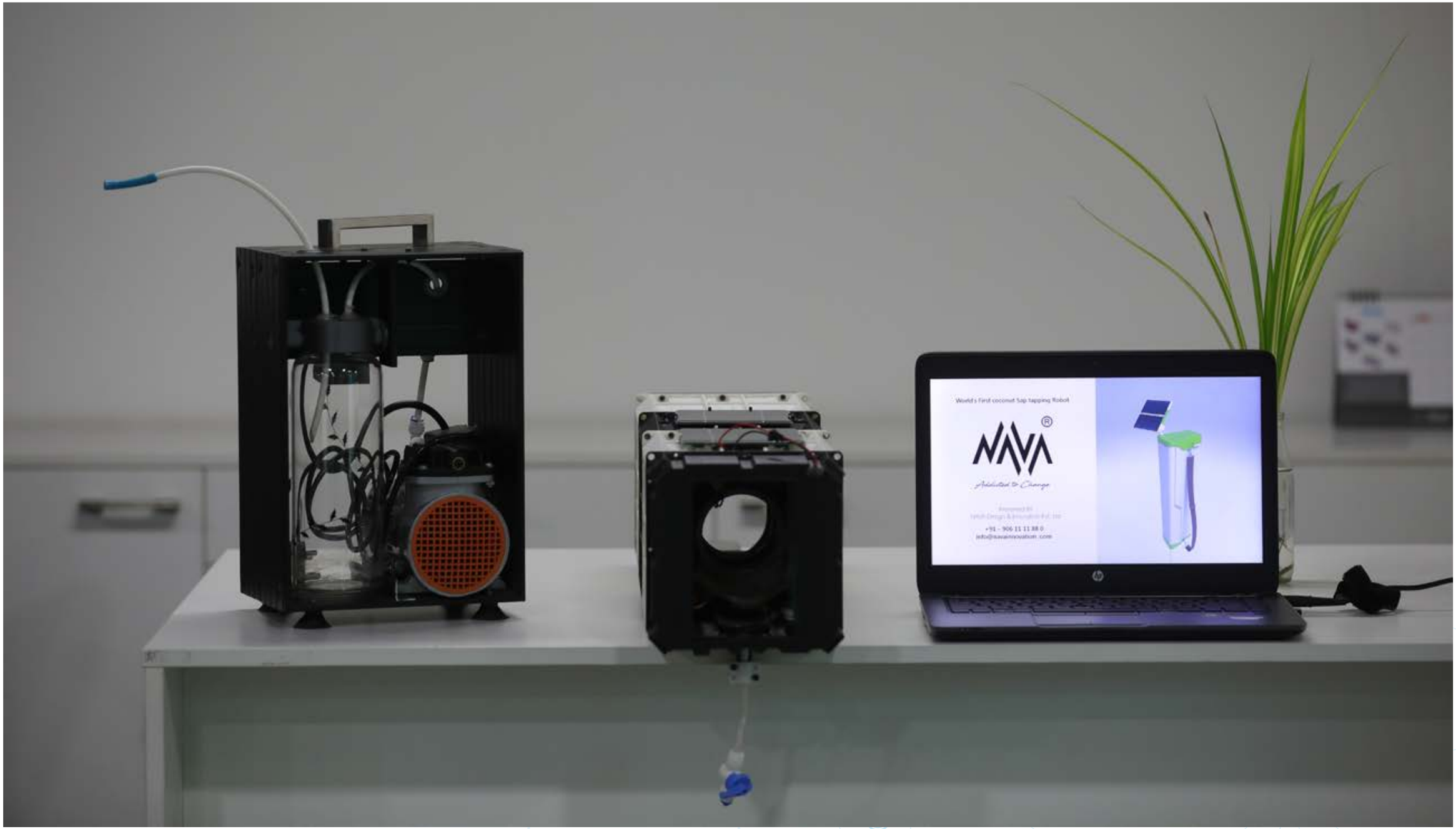
He further went on to add, “From that research, I realised that mechanising the tapping process can solve the problems related to the tapping and the difficulties faced by the farmers. I started developing sketches for a robotic device which helps to tap toddy automatically.”

Varghese filed for a patent after completing his sketches. Soon after receiving the patent, he quit his job and returned to Kerala to develop the solution. With some initial support from friends and family, he started to work full time on the product. To understand the intricacies of the process better, he held discussions with tappers and visited locations where the activity took place prominently. He spent most of his time, effort and money into the process of building a working prototype of his product.

Varghese presented his idea to the Kerala Startup Mission (KSUM) and electronic hardware incubator Maker Village, which offered him a seat in its workshop for designing and developing the product. He was able to develop a prototype with the help of both the organisations.

Some features Of NAVA’s robotic device:

- Increase in the yield
- 5 years guarantee
- Integrated battery and solar panel
- Zero contamination of the collected neera or toddy
- Real-time data monitoring
- Easy to install design
- Centralised vacuum suction for the sap


World's First coconut Sap tapping Robot
NAVA
Addicted to Change

After its development, the prototype of the product went through a range of in-house tests. “The prototype has been tested on a tree near to the office. This helps our engineers get a closer look in the device installed and make necessary changes if required,” explained Varghese.

With support from Maker Village, Varghese met industrial designers to get more clarity in the area.

“Maker Village and KSUM together provide a substantial platform for the development of autonomous and robotic devices. The startups can easily access all the machinery and technologies provided by Fab Labs, Super Fab Labs or the Electronics Lab. Almost all the high-tech instruments are installed in these labs for the startups. Anyone can make use of it at any time,” said Varghese, on the benefits received from Maker Village.

Making use of the tools available in Maker Village’s workshops, mainly a 3D printer, a band-saw, a jigsaw and a laser cutter, NAVA Design & Innovation tested its products and achieved growth.

Factsheet

• **Founded In:**	2016
• **Founders:**	Charles Vijay Varghese
• **Website Link:**	https://navainnovation.com/
• **Mission Statement:**	A solar-powered robotic device developed to mount over every coconut flower to tap and collect the sap at a central storage
• **Product Offering:**	Centralised collection system, vacuum suction, an app for monitoring, neera preservation, theft control, mesh networking and more
• **Target Market Size:**	$ 1Bn
• **Total Addressable: Market**	$ 106Bn
• **Key Accomplishments:**	Won Kerala Startup Mission Idea Grant, Top 25 Startups by SingularityU USA
• **Team Size:**	8
• **Benefits From KSUM: and Maker Village**	Productisation Grant, Patent Reimbursement, Seed Loan, Industrial connect, Investor connect, Ministerial connect, Showcasing events

Back To The Basics: HW Design Labs' Solutions For Internet Lags With Radio Frequency

Starting his career in 1999, Jayakrishnan AL worked with a range of organisations including Qualcomm, Tata Elxsi and ISRO Satellite Centre, before starting his own venture, HW Design Labs, in 2015. He felt the need to build a socially-relevant solution in the hardware technology space, and that led him to leave his job at Qualcomm.

Even having achieved high internet penetration, with more than 600 Mn users, India still lags many countries in areas such as dealing with emergencies and natural calamities. That is one area where terrestrial radio broadcast proves to be one of the most effective options even today.

To counter this challenge, HW Design Labs has developed a novel solution, FM Radio Data System (RDS) Utility, which combines the advantages of radio broadcasting and smartphones. The startup claims that this utility provides geolocation services and a secure mode of communication to FM RDS Utility users.

A combination of hardware and software applications which does not depend on internet speed or network coverage, FM RDS Utility enables sharing of useful real-time information, in the form of text notifications, audio alerts and geographic location indications, to unlimited users.

"FM RDS Utility works based on the FM Radio principle and can address more than six problem areas such as disasters or any emergency and is capable of instantly notifying the public with text messages, audible alerts, animated warnings and also live geographic indications on an offline map," explained Jayakrishnan.

Using an in-built FM receiver capable of collecting live feeds even in a flight mode, FM RDS Utility provides extended standby time to survivors of a natural disaster, added Jayakrishnan.

FM RDS Utility comprises hardware as well as mobile applications. While the hardware part - the FM RDS Broadcaster - is a multifunction device which includes a global navigation satellite system (GNSS) receiver and a radio broadcaster along with required sensors to assess a situation and switch to an appropriate mode automatically. The device is portable and is powered by a vehicle battery. HW Design Labs believes it can help in improving public life as well as provide support during emergencies that cause disruption to mobile networks and power.

Using the in-built FM receiver available in a smartphone, the FM RDS Utility mobile app is capable of working offline. It also has an offline map to indicate geographic locations.

Use Cases For HW Design Labs:

- **eeZeeBUS** – For Smart cities
- **DWBS** – For Disaster Management
- **Boat/Ferry Tracking**
- **Garbage Truck Locator** – Swachh Bharat
- **e-Gov** – Public Notice & Govt notifications
- **Wildlife Alert** – For Rural population when wild animals enter the village
- **Wildfire Alert** – For Rural population in the case when a wildfire breaks out

Its association with experts, thanks to electronic hardware incubator Maker Village, helped HW Design Labs cross the main hurdles in the form of starting off, funding and skilled resources. “Kerala ecosystem has been very beneficial for us, not only did it help in overcoming the initial challenges but we also get the industrial connect, mentorship and networking opportunities from this ecosystem,” said Jayakrishnan.

A regular user of Maker Village’s Fab Labs workshops, the startup received access to a range of assembly, fabrication and testing equipment. It gained access to these tools, which otherwise involve significant costs.

The startup was selected for incubation and seed funding by Maker Village, which helped it improve its products through a slew of development and testing processes. During the course of development, HW Design Labs received both mentorship and industry connections, which it utilised to explore avenues for next levels of funding.

The startup has so far received a seed loan worth INR 5 Lakh from the Kerala Startup Mission (KSUM), and a grant worth INR 2 Lakh under the Centre’s NIDHI-PRAYAS programme.

Factsheet

Founded In:	2015
Founders:	Jayakrishnan A L, Divya Govind, Arun Kumar
Website Link:	http://www.hwdesignlabs.com/
Mission Statement:	To grow and expand as a reliable source for high-performance radio systems as well as RF and Wireless Connectivity Turnkey Solutions for Industrial Applications
Product Offering:	Advanced Tracking & Navigation Systems and Wireless Connectivity Solutions
Target Market Size:	$10 Mn
Market Size:	Expected to reach $7500 Mn by 2022
Key Accomplishments:	Patent filed on FM RDS Utility
Team Size:	6
Benefits From KSUM: and Maker Village	Facilities, Mentorship, Workspace, Seed loan, Industry networks

CEAD's Pollution Free Rickshaws Roll On The Road To The Future

In 2016, a Japanese semiconductor manufacturer approached the founders of Neona Embedded Labz to develop a platform for electric vehicle motor control using their semiconductor components. While working on this project, the duo realised the gap between India's tech advancement with its global peers in the area of motor drive in-light electric vehicle applications.

India is amongst the fastest consumers of fossil fuels in the world, primarily because of the number of two- and three-wheelers it houses. This has, in turn, led to a rise in demand for environment-friendly and renewable models of transportation, the establishment of a strong and unique ecosystem for which is still due in the country.

"Low voltage motor controllers were seldom manufactured in India so the process knowledge of the same is limited. We, through CEAD, are giving a lot of focus on the process of innovation for achieving high current operating low voltage drives with high reliability and competing prices," said Ratheesh K, CTO, C Electric Automotive Drives (CEAD).

With the belief that their expertise can help fill that gap, C Electric Automotive Drives aims to enable pollution-free transportation in the country. The startup has worked for two and a half years for the prototyping and development of technology in the electric vehicle (EV) domain.

"Once our technology matured and we were ready to do production, we started approaching vehicle manufactures. This was in November 2018, now we have started supplying E-rickshaw motor controllers to different OEMs and with plans to roll out E-scooter controllers soon," Ratheesh said explaining CEAD's journey and current reach.

Building customised connected electric powertrains for light EV, its features include:

- Extended mileage by recuperation
- Inbuilt vehicle control application
- High flexibility in selecting motors
- Vehicles performance tuning software
- Field upgradable software through CAN/ UART
- Speed diagnostics with real-time data logging
- Overvoltage cut-off
- Under voltage cut-off
- Rated Power: 1000 W
- Rated Current: 25A
- Maximum current: 50A
- Phase Current: 200A

C Electric Automotive Drives has received an initial order for 500 e-rickshaw units from auto component maker SEG Automotive and another 200 units from e-rickshaw manufacturer VVA Auto Industries. The startup has sent samples for field trials to e-rickshaw manufacturers such as Altius and Pi Beam, and e-cycle manufacturer Infidreams.

Currently, the startup is building e-auto and e-scooter products. “As we go further, we want to implement connected features of controllers for a real-time performance optimisation based on live driving conditions,” explained Ratheesh.

C Electric Automotive Drives regards electronic hardware incubator Maker Village’s electronics lab as a major support to its development cycle. The line of equipment the lab provides enabled the startup to easily develop power electronics.

“We use the electronics lab almost daily. It has all major equipment such as multiple system operators (MSO), digital storage oscilloscope (DSO), DC power supply and more which we regularly use. These are all very relevant for us in the development phase of power electronics,” elaborated Ratheesh.

Factsheet

• **Founded In:**	2018
• **Founders:**	Bavil Varghese and Ratheesh K
• **Website Link:**	http://c-electricdrives.com/
• **Mission Statement:**	Building customised connected electric powertrains to help light EV manufacturers shorten their time to enter the market
• **Product Offering:**	Customised connected electric powertrains for two/three-wheeler EVs
• **Market Size:**	$200 Mn electric two-wheeler by 2023 and $1Bn electric three-wheeler by 2025
• **Key Accomplishments:**	Selected in GAIL’s startup initiative “Pankh”, NIDHI PRYAS GRANT from MeitY, amongst the top 40 startups for Start-O-Sphere 2019
• **Team Size:**	18
• **Benefits From KSUM: and Maker Village**	Productisation grant, Investor connects, Startup schemes, Connect with government officials

AI Aerial Dynamics' Drone Tech Vs The Rapid Spread Of Covid-19

Kerala-based AI Aerial Dynamics started as an academic project from the college days of Vishnu V Nath. Having worked on a project to build an unmanned aerial vehicle (UAV), Nath soon realised the potential in the segment and worked on related optimisation features till the completion of his PhD. He incorporated AI Aerial Dynamics in 2019 after working in the area for more than 18 months along with his cofounders.

Based on a custom-built UAV design and a hybrid propulsion system, the AI-enabled drones manufactured by the startup have two versions: based on payloads of 25 kilograms and 120 kilograms. "We focus on customising UAV design as per our client requirements, such as integration of multiple payloads, remote operation design and more," said Nath.

The drones of the startup have been used for many reasons across the state, such as:

- Surveillance and security
- Wildlife monitoring
- Smart agriculture
- Payload deployment
- 3D mapping

AI Aerial Dynamics recently signed a memorandum of understanding (MoU) with Kerala Police to counter the fallout from the Covid-19 pandemic. The company started by helping in providing surveillance in the regions locked down due to the coronavirus outbreak using thermal imaging cameras, and detecting any violations in crowd-control regulations, and expanded its operations subsequently. It has developed newer versions of its solutions with features such as thermal scanning, which help in collating and processing data to enable officials to detect potential coronavirus positive cases from a distance.

Not only the Kerala state government but also the startup's products attracted the attention of the Defence Research and Development Organisation (DRDO), which is working on a research project and has deployed applicable sensors in collaboration with the Navy.

The startup is testing its drones with added features in the facilities of electronic hardware incubator Maker Village. Adding features and sensors to a drone whose core programme is built becomes easier as required by the client, enabling faster testing, according to AI Aerial Dynamics.

The startup came across a number of challenges in the early part of its journey the startup came across a number of challenges in the early part of its journey, which involved difficulties related to the procurement of items and

finding effective guidance on business planning. It was able to cross these hurdles, thanks to support from Maker Village.

“Currently, the commercialisation of drones is not done quite well, due to licensing issues. The regulation and the framework is not yet completed and everybody is in the research phase right now. We can’t fly UAVs for commercial applications because licensing is a challenge,” said Nath, speaking about his current challenges.

The startup is still focused on research because it wants to be absolutely ready to enter the market once its framework is complete. It is in the process of testing the autopilot and apparatus possibilities in this regard, and is studying the feasibility of adopting a 120-Kg payload capable of carrying humans.

AI Aerial Dynamics received access to electronic hardware incubator Maker Village’s Fab Labs facilities, equipped with machines such as CNC as well as calibration and test equipment including digital storage oscilloscopes (DSO) and logic analyzer. “The provision to schedule and book the required machines on-line is very useful. Some of them are free to use and other’s usage charges depend on machining time,” added Nath.

The startup utilised Maker Village’s infrastructure facilities for its manufacturing and testing processes, as well as its mentorship and industry connections to scale up its solutions.

Factsheet

• **Founded In:**	2019
• **Founders:**	Vishnu V Nath, Denny P, Rubin Ray, Sujai K J
• **Website Link:**	http://aiaerialdynamics.com/
• **Mission Statement:**	Customised long endurance and heavy payload UAV
• **Product Offering:**	Configure-to-order
• **Target Market Size:**	INR 500 Cr
• **Total Market Size: (India)**	INR 50K Cr
• **Key Accomplishments:**	Successfully tested prototype with NPOL
• **Team Size:**	6
• **Benefits From KSUM: and Maker Village**	Lab facility, Guidance on business planning, infrastructure and test facility

Are Startups Ready To Fulfil India's Drone Needs? Featherdyn Is

Founded by a team of experienced aerospace engineers, Featherdyn is tapping the vast potential in India's unmanned aerial vehicle (UAV) market. Realising the opportunity in long-distance UAVs, in areas such as oil and gas pipeline monitoring, marine logistics, border patrol and disaster relief, Rajeev Chandrasekharan, Akhil Gopalan and Navaneetha Krishnan incorporated Featherdyn in 2018. The startup aims to provide safe and cost-effective alternatives to carry out a wide range of tasks in these segments.

With the country's UAV market estimated to reach $885.7 Mn by 2021, the development of policy to promote commercial use of drones gives confidence to the startup's founders for manufacturing a UAV.

Featherdyn's drone sets itself apart with features such as vertical take-off and landing (VTOL), and fixed-wing hybrid configuration, which help it seamlessly transition between vertical and horizontal movements during flights. The drone is designed with a focus on autonomous collision avoidance technology and is fitted with necessary technology that allows it to fly in difficult weather conditions and lift heavy equipment, which is in turn used in monitoring cargo ships and oil and gas pipelines. These capabilities make the drone an ideal choice for performing a wide range of commercial and military aerial tasks.

Having participated in the Innovations for Defence Excellence (iDEX)'s Defence India Startup Challenge, Featherdyn drew the interest of defence officials through its solutions. A winner in the contest, the startup is all set to work in the country's navy sector to build indigenous solutions.

With a problem statement in hand, the startup is awaiting final details and stands ready to develop solutions. Its partner in the programme, electronic hardware incubator Maker Village aims to help Featherdyn in completing its project successfully.

The unique features of Featherdyn include:

- Electric propulsion system tailor-made for long-range and difficult weather scenarios
- Safe beyond visual line of sight operation with innovative collision avoidance system
- Real-time monitoring with live long-distance data transfer
- Post-processing of the sensor data to extract critical information
- Long-range flight with heavy equipment (up to 100 km with a payload of 1kg)


FEATHERDYN PVT LTD

Funded by state-run GAIL's startup initiative, Pankh, the startup attracted the interest of industry stalwarts by demonstrating its capabilities in events such as the iDEX's Defence India Startup Challenge and FORGE Accelerator's STARTegies camp.

Currently, in a testing phase of its prototype, which took a year to build, Featherdyn received initial financial support from the Kerala Startup Mission (KSUM) in the form of Idea Grant, and a seed loan from Maker village, apart from benefits such as the incubator's working space and necessary tools enabling efficient product development.

With access to Maker Village's Fab Labs and Super Fab Labs workshops, the startup utilised tools such as a 3D printer, a CNC machine and a laser cutter at a minimal fee along with free-of-cost computer-aided design and analysis software to develop its prototypes. These in-house facilities enabled the startup to accelerate and simplify its fabrication process.

Apart from providing financial and machinery support, Maker Village helped Featherdyn connect with experts in the startup ecosystem to consult on a range of financial, regulatory and technical aspects of the business. Thanks to its interactions with business experts, the startup today claims to have explored various international markets.

Factsheet

• **Founded In:**	March 2018
• **Founders:**	Rajeev Chandrasekharan, Akhil Gopalan, Navaneetha Krishnan
• **Website Link:**	http://featherdyn.com/
• **Mission Statement:**	Semi-autonomous eVTOL UAV for long-range asset monitoring and logistics support
• **Product Offering:**	eVTOL UAV for aerial monitoring of assets spread over long distances
• **Market Size:**	$885.7 Mn (India) and $21.47 Bn (Global)
• **Key Accomplishments:**	Recognised at various forums such as IDEX DISC3, Startup Initiative of GAIL India Limited and Pitchfest at Forge Accelerator
• **Team Size:**	7
• **Benefits From KSUM: and Maker Village**	Idea & Productisation Grant, Access to FabLab, Mentoring support, Interactions with external experts

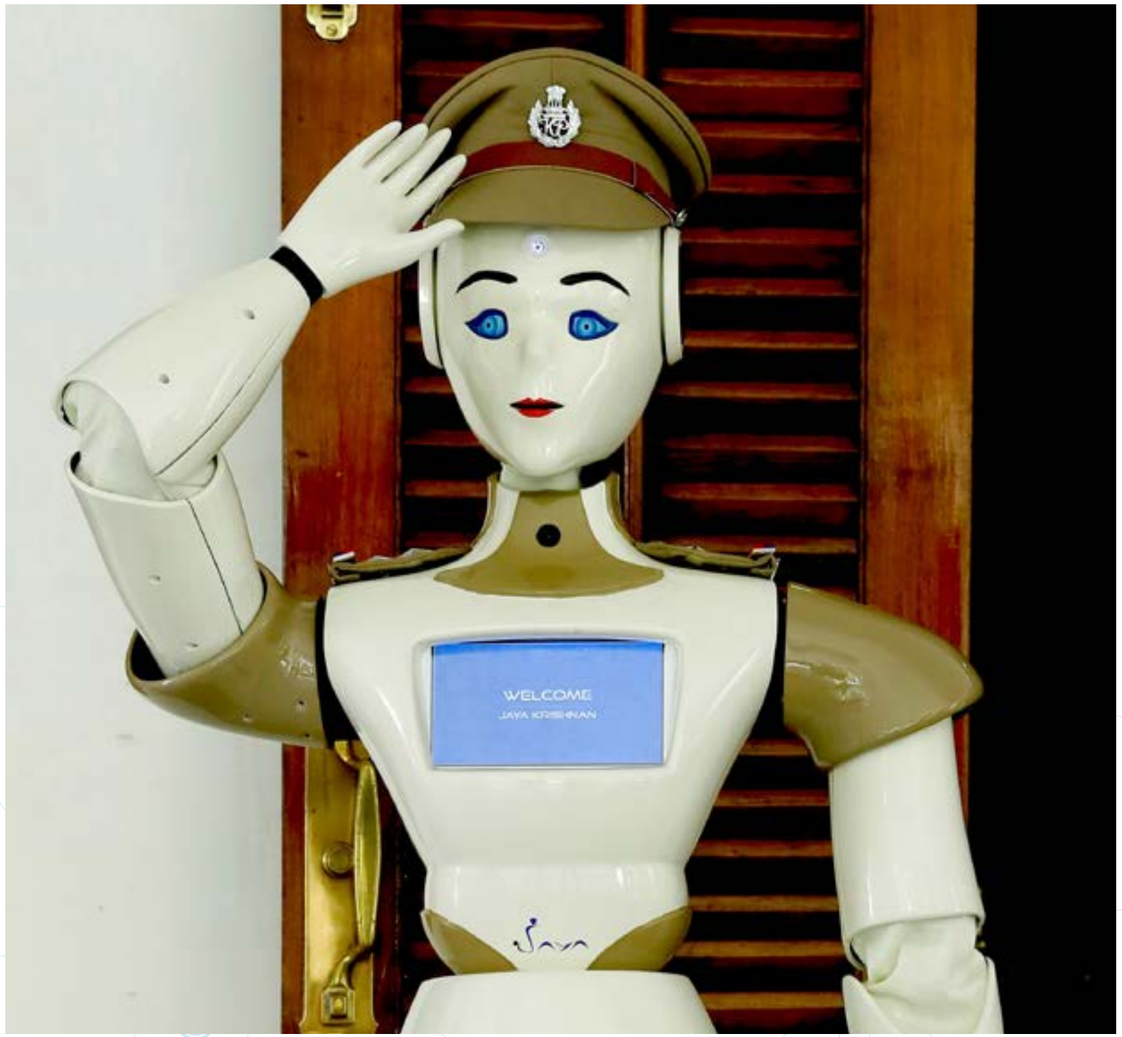
ASIMoV Robotics' Humanoid Solutions To Human Healthcare Needs

Among the first names to have developed a humanoid in India, ASIMoV Robotics was founded in 2012 by Jayakrishnan T, a robotics enthusiast. ASIMoV Robotics commercialised its humanoid, ISRA (Intelligent Service Robot Assistant)—also known as IRA (Intelligent Robotic Assistant)—in 2017 and in the same year, sold its first unit to HDFC Bank to greet customers and perform tasks such as guiding them to the relevant counter. Later, the startup went on to create more humanoids for other banks and even Kerala Police.

ASIMoV recognised the demand for such technology in the healthcare sector in May 2018 during the Nipah virus (NiV) outbreak in Kerala. The startup then decided to modify its flagship product to roll out SAYABOT—also known as SAYA—to support healthcare workers.

By the end of 2019, ASIMoV entered into a joint research partnership with Narayana Health, Bengaluru to develop robots supporting indoor mobility and logistics in hospitals. This partnership enabled ASIMoV to come up with a robot called KARMIbot, which is currently being used by many healthcare facilities to fight the coronavirus (Covid-19) pandemic.

Though the startup boasts of having many robotic products in its portfolio, it is more focussed towards commercialising KARMIbot. In order to aid the fight against the deadly Covid-19 disease, the bot enables the distribution of masks, medicines and hand sanitisers in isolation wards, protecting healthcare workers against the virus.



Features Of KARMIbot:

- Cost-effective
- Lightweight
- Easy to handle
- Heavy payload up to 25 Kgs
- Quick transportation
- Autonomous
- Video streaming and conferencing
- Detachable container with a self-disinfection facility
- Self-Charging

Humanoids As A Social-Impact Solution

At the time ASIMoV started operations, India's robotics segment was still in a preliminary stage. Support from the Kerala Startup Mission (KSUM) and Maker Village helped ASIMoV in an early stage of its challenging journey.

The startup received a loan of INR 15 Lakh and a scale-up grant of INR 12 Lakh from KSUM, and not only financial support of INR 5 Lakh but also access to infrastructure from Maker Village, whose Fab Labs workshops' machines such as laser cutters and 3D printers were instrumental in enabling ASIMoV to build the prototype.

Factsheet

- **Founded In:** 2012
- **Founders:** Jayakrishnan T
- **Website Link:** https://www.asimovrobotics.com/
- **Mission Statement:** Help healthcare providers by transporting and dispensing food and medical supplies to the patients amidst Covid-19 pandemic
- **Product Offering:** Robot that autonomously dispenses food and medical supplies inside an isolation ward
- **Target Market Size:** $2 Bn
- **Total Market Size:** $20 Bn by 2022
- **Key Accomplishments:** Amongst the top 10 startups in Startup Village, selected by NASSCOM for #InnoTrek2018
- **Team Size:** 10
- **Benefits From KSUM:** Loans, Grant, Infrastructure and Prototyping facilities

Ecodew: When Technology Takes Herbal Road To Treat Water

Working in a water treatment company in Kerala, Muhammed Nujoom realised the need for Indian businesses to adopt modern technologies to treat water to switch from a decades-old system. With the financial support and mentorship of Yunus Muhammed, Nujoom and his friend Akhil Johnny started Ecodew, with a small lab at a rented house in Kochi.

It focusses on providing solutions for the following five segments:

- Sewage Treatment
- Effluent Treatment
- Drinking-Water
- Industrial Water
- Cooling Water
- Agricultural & Environmental Products

Ecodew's most commercialised product, Ecospede, is a compact wastewater recycling system which uses herbal extracts to treat water. A fully automated system, Ecospede comes with features such as one-touch operation and helps in recycling wastewater to make it potable. Besides, what distinguishes Ecospede from other solutions in the market is the ease of use, as the product can be used to treat water in homes or villas (with up to five bedrooms), small restaurants, small scale industries and vehicle wash stations.

Besides that, its features include:

- **Natural and Eco friendly:** The system uses herbal extracts rather than harsh chemicals used in the conventional process
- **Less Costly:** The plant costs only 50% of the cost and requires only 30% footprint as compared to a conventional plant
- **Capacity:** 5K Ltrs in 10 hours
- **Power Consumption:** 7.5 units for full-day operation
- **Footprint area:** 90 sq ft

"During our initial years of marketing, we realised that people were not ready to adopt the technology even though it cost them only 50% compared to the conventional systems," explained Nujoom. "The challenge was to convince the authorities about our solution as it was very different from their pre-concepts about water treatment. It took us almost a year to get our first client."

Helping Ecodewin sailing through this early phase was Maker Village, which granted the startup a seed loan of INR 5 Lakh, enabling it to develop the prototype. Maker Village also helped the startup with technical and financial support to bring its ideas to life.

Factsheet

- **Founded In:** 2017
- **Founders:** Muhammed Nujoom, Akhil Johny, Yunus PM
- **Website Link:** https://www.ecodew.solutions/
- **Mission Statement:** Driving sustainability worldwide
- **Product Offering:** Ecospede: A 5K litre capacity compact wastewater recycling plant
- **Target Market Size:** $1 Bn
- **Market Size:** $100 Bn
- **Key Accomplishments:** Innovation Partner of Dubai Electricity and Water Authority, Acceleratee of Toilet Board Coalition India Cohort 2020 and more
- **Team Size:** 9
- **Benefits From KSUM:** Funded events at a global stage, technical and financial support

Perfit Fashion Has A 3D Scanning-Backed Answer To Boost Product Cataloging

Founded in 2016, Perfit Fashion started by developing 3D body-scanning technologies. The startup began by building a small room to take the measurements of a person's body through 3D scans. Soon, it extended its operations to provide small scanners for ecommerce service providers to scan and take measurements of products at a faster rate. With a vision of digitising the hardware and software for ecommerce inventory cataloguing, Perfit Fashion aims to provide a complete workflow from digitisation to production to multiple web stores, and marketplaces.

Currently, it offers:

- Smart garment manufacturing solutions
- Smart body measurement solutions for custom garment manufacturing
- Augmented reality large format displays
- Smart workout solutions using 3D scanning

Perfit's solutions—which enable sellers and businesses to set up online stores and commercialise their products—are being used by companies including Adobe, Swiggy, Zomato, Bigbasket and Namdhari's Fresh.

The startup has participated in contests such as Zone Startups' Next BIG Idea and Startup Oasis's The Craft Catapult. It was one of the finalists of the Bosch Hardware challenge and the winner of the Kerala Startup Mission (KSUM)'s Best Product Startup in Retail 2019.
Maker Village and KSUM supported Perfit Fashion to build prototypes for its scanning devices. The startup utilised the CNC, vinyl cutter and MISC machines in Maker

Village's Fab Labs workshops to achieve a faster process of prototyping and marketing its products to a wider audience.

Factsheet

- **Founded In:** 2016
- **Founders:** Eobin Alex George
- **Website Link:** https://perfit.fashion/
- **Mission Statement:** Perfit is a faster, cheaper and better solution for sellers to digitize, process and publish products data to web stores and online marketplaces
- **Product Offering:** A smart box which captures photos and videos of seller inventory and directly publishes them online
- **Target Market Size:** $8 Tn+
- **Key Accomplishments:** Rated as the best product in the state and the top 13 in the country multiple times, filed over 6 patents
- **Team Size:** 12
- **Benefits From KSUM:** Funding, mentorship, infrastructure and more

De’sintox: When Tech Adds Quality To A Differently-Abled Journey

While still in college, two friends developed a walking aid for children fighting cerebral palsy disorders and donated it. After graduating, the duo set out on different paths until one of their friends met with an accident, which made them realise the lack of assistive equipment in India. They founded De’sintox to develop devices aimed at easing the journey of the differently-abled in the country.

De’sintox’s product portfolio includes:

- **Patient Transfer Hoist:** This product uses an electric model to transfer a patient from the bed, wheelchair or even the floor
- **A Standing/Reclining Wheelchair:** It helps patients develop muscle strength and provides ease of access to things at home
- **Electric Wheelchair:** This wheelchair comes with a joystick attached to it, which enables the patient to move around

“We are not commercialising all our products right now. We are currently focussing on electric standing and reclining wheelchair which provides easy movement, posture change and more, with the help of switches,” explained Don Paul, cofounder of De’sintox.

Additionally, the device helps in progressive physiotherapy. For instance, a user might have been on a wheelchair or a bed for years and may not have the strength to stand, but with the device aids the development of muscle strength, gradually. “To make it easier, we are also trying to include control via phone in the device,” added Paul.

The device can help people through a number of functionalities, such as mobility, easy standing and easy reclining. The chair can be set in sitting, lying and standing positions, and is also fitted with a suspension and lights for outdoor use.

“We have got feedback from users all over India regarding this product and modified it to make it suited for maximum patients,” explained Paul.

Most important support has been through Maker Village and the Kerala Startup Mission (KSUM), the startup’s management told Inc42, explaining the journey to achieving both growth and scale for its prototype. Helping De’sintox with mentorship and the right industry connections, both the entities enabled it to realise how it should go about its journey.

De’sintox received a grant of INR 10 Lakh from KSUM. “We are now looking for patent reimbursement from KSUM. Both the entities (KSUM and Maker Village) have also given us many referrals for sales and been proof of our genuinity for the sales outside Kerala,” said Paul.

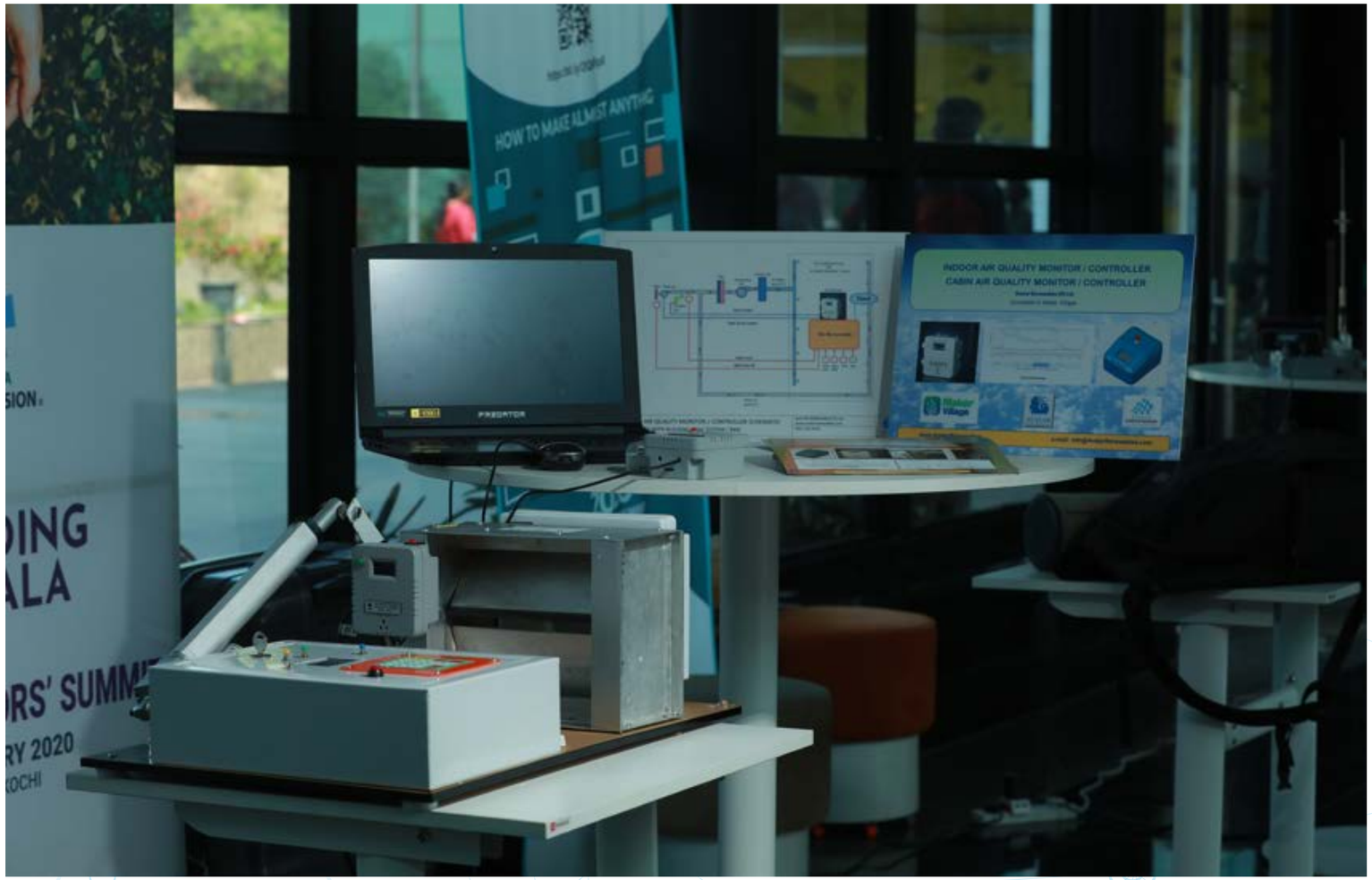
Factsheet

- **Founded In:** 2017
- **Founders:** Don Paul, Sooraj C
- **Website Link:** https://desintox.business.site/
- **Mission Statement:** Enabling people through technology
- **Product Offering:** Standing wheelchair, a Patient transfer device, Cerebral Palsy walker
- **Target Market Size:** 1 Lakh users by 2023
- **Market Size:** 70 Lakh+ (suffering from movement disability)
- **Key Accomplishments:** Represented KSIDC at International Trade Fair 2017, Top ten startups at AICTE Startup Summit 2017, the founder was invited to meet the French President Emmanuel Macron during his India visit in 2018
- **Team Size:** 8
- **Benefits From KSUM:** IdeaGrant, Mentoring, Connections

Avatar Renewables: Smart Solutions That Bring A Breath Of Fresh Air

Avatar Renewables was incorporated by a group of engineers passionate about the use of renewable energy alternatives to promote energy conservation. The startup is currently focussed on solutions to monitor and regulate indoor air quality, through its flagship product, Air Quality Monitor/Controller (IAQ).

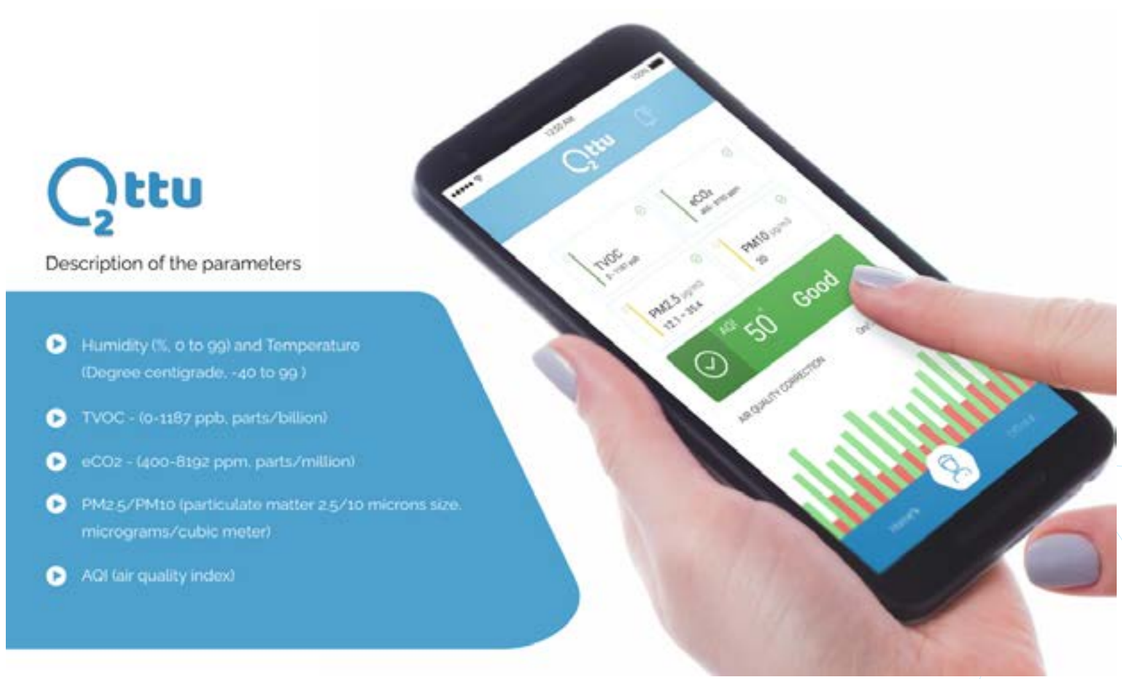
"Our product IAQ is a total solution for good indoor air quality. It can monitor, log locally (in SD card) and remotely over IoT (Internet of Things) and control the air quality. It monitors TVOC, e-CO2, temperature, humidity and particulate matter," said Krishnan Thampi, managing director at Avatar Renewables. "A smaller, basic version for automobiles has also been developed."



Avatar Renewables has a range of products in its portfolio, including:

- **Avatar Water Wheel:** It is based on a fully submerged, vertical axis water wheel that can harness power from low-to-medium velocity uni or bi-directional flow of water

- **Indoor Air Quality Monitor (IoT-WiFi):** Powered by 230-volt AC, the Internet of Things-enabled innovative solution provides efficient air quality management for office spaces and commercial setups such as gyms; it intakes fresh air supply automatically when required, displays the information on a 1.3-inch OLED screen, and sends this data over Wi-Fi to cloud to enable remote-monitoring
- **Flow Probe:** A portable microprocessor-based standalone water-velocity measuring instrument, this water-current meter product is powered by two standard AA-size alkaline batteries; the Flow Probe can be used in locations such as a hydropower station or an irrigation canal.



With access to Maker Village's electronics laboratory, Avatar Renewables has conducted research and development (R&D) for a range of environment-friendly solutions. With both financial support and exposure and connections with the industry leaders and experts, the startup has expanded its horizon to practice its ambition of promoting green solutions. It has received recognition from the India Navy Southern Command, which helped it enter the India Navy Vendor list.

Factsheet

• **Founded In:**	2013
• **Founders:**	Krishnan Thampi, Ramesh Thampi, Rajeevan Keeran, John Paul, John Peter
• **Website Link:**	http://avatarrenewables.com/
• **Mission Statement:**	Indoor Air Quality Monitor and Control as a total solution for wellness.
• **Product Offering:**	A stand-alone monitor and controller or in conjunction with third-party HVAC / BMS systems communicating through MODBUS. CAQ (for automobile cabin air quality) can be an integrated part of India Automobiles
• **Key Accomplishments:**	Got into India Navy Vendor list
• **Team Size:**	7
• **Benefits From KSUM:**	KSUM grant, Maker Village facilities, PR, Showcasing, Networking

PlacerBots Adds New Perspective To India's Electronics Story

While working on a custom audio board, Ajith N, Sagar Pai and Unnikrishnan KC realised the challenges in prototyping electronic products in India. They found that lack of equipment and knowhow for precise placement and reliable assembly of printed circuit boards was the biggest barrier in the country's electronics sector. The trio decided to tap into the potential opportunity, and then developed the concept of desktop-sized safe-mount technology (SMT) assembly bots.

With the belief that reliable assembly of SMT devices is an essential capability to monetise on the developments

in the electronics industry, the team incorporated Zoid Labs and developed the PlacerBots robotic systems. Zoid Labs realised that the contemporary systems were often big and expensive for businesses. Using proprietary algorithms, Artificial Intelligence (AI) and vision systems to solve the challenges in electronics prototyping, Zoid Labs' robotic systems allow easy setup and specialised features to cater to the businesses' prototyping needs.

"We believe our products will empower the potential innovators by reducing the debug cycles, time and labour involved in the assembly and inspection of the printed circuit board (PCB). The solutions also eliminate the IP theft risk as the entire development process could be conducted in-house in a cost-effective manner," added Unnikrishnan.

Some Features Of PlacerBot:

- Optimised for prototyping
- Flexible feed volume
- Fits on your desktop
- Automatic Tool Changer
- QR codes for component identification

The biggest challenges faced by Zoid Labs in its early years were related to the costs of product development and capital needs.

But soon, Kerala Startup Mission (KSUM) introduced it to hardware incubator, Maker Village, which not only helped the startup financially (Nidhi Prayas Grant) but also helped it get in touch with relevant market stalwarts. Maker Village's initiatives such as exhibitions and open houses acted as a great platform for the startup to showcase its products. Regular workshops and mentoring sessions conducted by Maker Village helped in streamlining the product development process for the startup.

Factsheet

• **Founded In:**	2018
• **Founders:**	Ajith N, Sagar Pai and Unnikrishnan KC
• **Website Link:**	https://zoidlabs.com/
• **Mission Statement:**	Develop robotic systems and solutions to empower innovators and developers
• **Product Offering:**	PlacerBot consists of a desktop-sized pick-and-place robot, solder paste dispensing solution and reflow ovens
• **Target Market Size:**	$15 Mn
• **Market Size:**	$2 Bn
• **Key Accomplishments:**	Acquired a few initial customers and started Field Trials under a Beta Programme, Trademark granted, Patent filed
• **Team Size:**	4
• **Benefits From KSUM:**	Idea grant, Support for exhibitions

Cavli Wireless: When A Device Meets The Soul Of IoT

Cavli Wireless provides a range of industrial-grade cellular Internet of Things (IoT) modules with connectivity and edge computing capabilities, to cater to the needs of developers and enterprises looking to deploy cellular-based solutions. These modules are not only integrated with e-Sim- or embedded-SIM-based designs but also promise to support global connectivity.

"We are among the first players in the industry to launch connectivity modules integrated with e-SIM, pre-loaded with global IoT data, which can be managed by our platform— Cavli Hubble," said Ajith Thomas, cofounder and CMO, Cavli Wireless.

Cavli Wireless' modules enable IoT product developers to minimise the time it takes to elevate a solution from the prototype stage to mass production, and global deployment. The modules operate on a network of more than 60 telecom operators across the globe to provide IoT connectivity to developers.

Features Of The Cavli Wireless Modules:

- **Hardware IoT connectivity smart compute modules:** C-series and P-Series
- **Hubble SIM/eSIM solutions:** Powers connectivity for your device
- **Cavli Hubble:** Device and connectivity management platform

P-Series:

- Durable use
- Minimal field support requirement
- Connected computing modules
- Large scale deployment
- Carry out product development to global scale-up
- Power EDGE computing capability
- Espressif ESP32 chipset and a dual-core processor
- Flexible programming consoles

C-Series:

- Durable use
- eSIM preloaded with global LTE connectivity subscriptions
- Wide range of options (footprint, power consumption and network capabilities)

- Available in both module and plug and play
- Minimal field support requirement

“Our SIM solutions are available in both traditional Nano-SIM and eSIM form factors. We directly work with telecom operators around the world facilitating local data connectivity. Thus, we ensure IoT developers from across industries, be it logistics, smart agriculture, industrial IoT and more can easily build, connect and scale their IoT solutions to any geography in the world,” added Thomas.

The startup has recently also launched Hubble99, as an attempt to organise and bring together the Indian IoT ecosystem. It bundles together the basic building blocks of IoT required by an IoT product company at $0.99 per device in a month with a lifetime warranty on the connectivity hardware. With this, it aims to help the IoT product companies achieve 50% savings on their IoT connectivity costs in the first year and around 30% overall over three years.

“This is the first time any player in the global IoT enablement space is introducing such a plan. We are the only player in this segment with an R&D base in India. As part of the plan - IoT product makers will get the connectivity hardware, IoT network data and the device management cloud platform all bundled together for 99 cents per month, hence the name, Hubble99,” added Thomas.

The startup has tied up with Orange, Telenor, Vodafone and other major global telecom operators to introduce this plan.

Though Cavli’s niche sampling requirements are met by its partners in Taiwan, China and Vietnam, the startup has also been utilising Maker Village’s workshops for part of its capacity.

Cavli has benefitted from an initial productisation loan of $7K, networking opportunities and important introductions that have resulted in downstream partnerships by both KSUM and Maker Village.

“The ecosystem also conducts workshops and meetups regularly and we try to be part of it whenever we can manage/whenever it is of relevance to our line of activities,” added Thomas.

Factsheet

Founded In:	2017
Founders:	John Mathew, Ajit Thomas, Tarun George, Akhil A Zeeb
Website Link:	https://www.cavliwireless.com/
Mission Statement:	To break the barriers of connectivity across geographies, enabling every object and things in the physical world to be turned on and managed from anywhere.
Product Offering:	Cellular IoT enablement Software - Hardware Product suite
Market Size:	$3 Bn (Serviceable market)
Key Accomplishments:	Among the world’s first commercially available full suite cellular IoT enablement solutions
Team Size:	35+

WaferChips Doesn’t Just Monitor, It Takes Care Of Your Heart

Techie Sonia Mohandas decided to put her knowledge towards strengthening the country’s healthcare sector, after an immediate relative of her husband, Archu S Vijay, an assistant professor in an engineering college, had to endure lags in the system as a cardiac patient, majorly due to weak tech support. The result of the whole ordeal was WaferChips, set up by the husband-wife duo who quit their jobs to achieve their common goal.

Soon, WaferChips developed Biocalculus, a product that ensures effective care for cardiac patients at an affordable cost. The product is easy to use: all one has to do is stick the Biocalculus to the patient’s chest using an adhesive patch and get started by installing an application on a smartphone. Not only does the app enable the collection and analysis of the data from the device, but it also generates reliable reports of the patient using that data, which in turn helps in better treatment.

Some features of Biocalculus

- Tracks daily activity
- AI and Cloud-enabled
- Lightweight
- Wireless
- Ease in monitoring health
- Long-distance connectivity with the app
- Affordable

With a focus on early detection of symptoms in cardiac patients and monitoring of the health of post-operative patients as well as for cardiac rehabilitation purposes, the duo took almost two years to build the product. The startup was able to score an initial grant from the Kerala Startup Mission (KSUM) followed by another one from Bharat Petroleum Corporation and with the support of Maker Village, gained the right mentorship and guidance to pursue its goal.

WaferChips utilised the access to Fab Labs and Super Fab Labs to both design and bulk-produce their flagship product. That along with two months of marketing efforts has taken Biocalculus to more than 10 hospitals in the country.

Factsheet

Founded In:	2016
Founders:	Sonia Mohandas and Archu S Vijay
Website:	http://waferchips.co.in/
Mission Statement:	To procure and analyse cardiac rhythm abnormalities outside the clinical environment and enhancing patient care to masses
Product Offering:	Biocalculus is a remote cardiac monitoring ecosystem which includes a single-lead ECG device, smartphone app and AI-based cloud platform
Target Market Size:	$ 72Mn in India
Market Size:	$ 4.3Bn
Key Accomplishments:	Formed a good and reputed advisory board with well-known cardiologists
Team Size:	20
Benefits From KSUM:	Funding, Mentoring, Investor connects

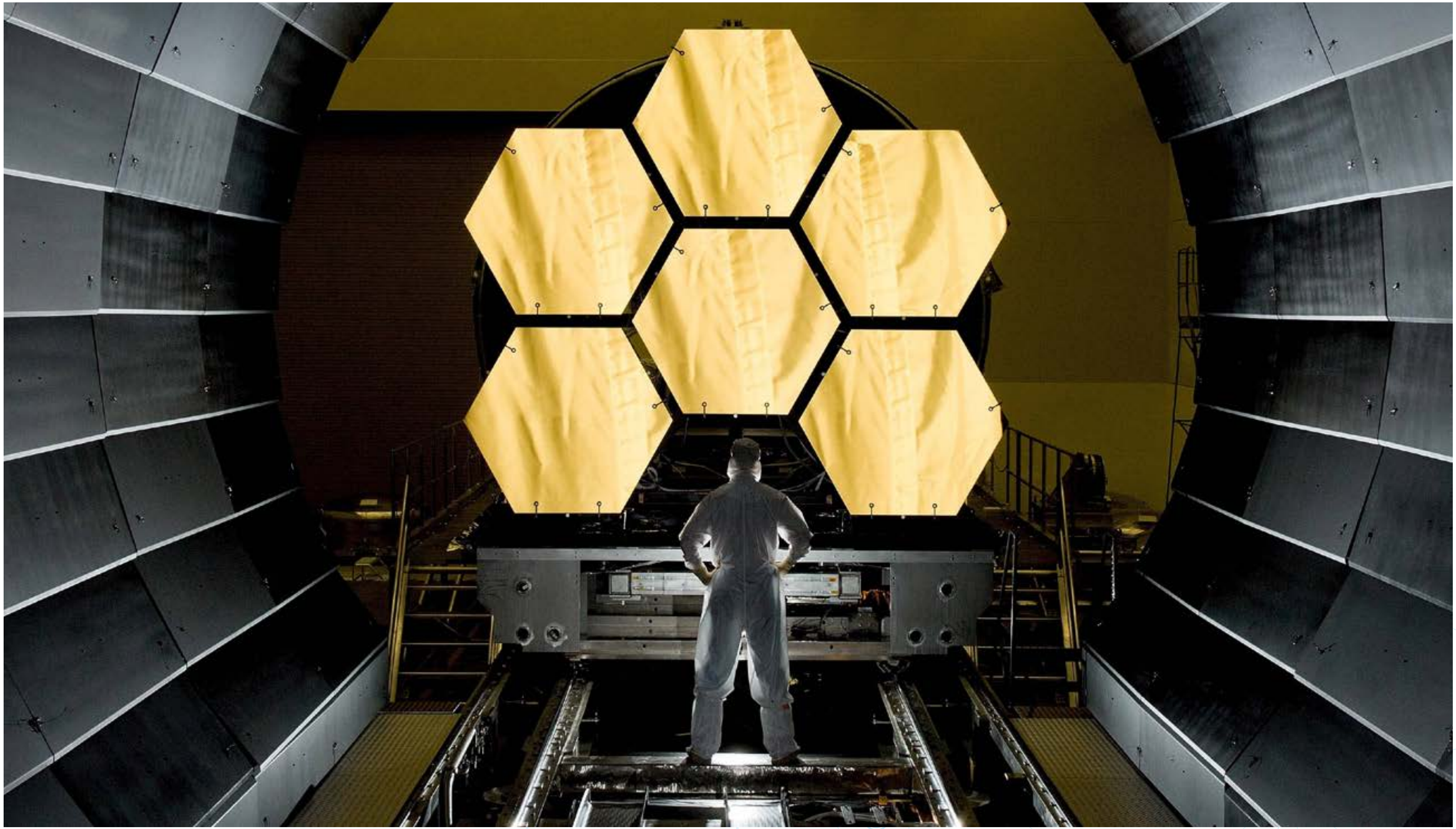
Verdatum: When Artificial Intelligence Meets Security

Verdatum AI is an Artificial Intelligence-focused startup working on computer vision, Internet of Things (IoT) and automation. It delivers effective sensors as well as hardware for data generation, the IoT backbone of data collection, and AI systems for data modelling.

Claiming to provide its services at a cost dramatically lower compared to industry peers, the startup boasts of a specific focus on security. “Security is particularly important for IoT, but is often treated as an afterthought but we at Verdatum AI keep this at our core focus,” said Joseph Monis, CTO, Verdatum AI.

Athul Ram and Joseph Monis were still in college and working on their idea, a road monitoring product, for a potential startup. The duo received a grant from the Kerala Startup Mission (KSUM) and even before completing college began working with the government to develop their project, which went on to serve as an effective solution against delay in road maintenance works.

Soon after that, Ram and Monis realised the demand for their services in other sectors as well. Businesses and startups across sectors required both data and a platform to generate, collect and monitor those data to execute their ideas, which led to the creation of Verdatum AI.



The offerings of Verdatum AI include:

- HiveSight: A centralised IoT platform that's designed by the startup from the ground up with hardware-level security and a multitude of peripherals, capable of several connectivity options (WiFi, GSM, LoRa, etc), running on solar, secure over-the-air updation and more
- AutoSurvey: An automated survey system that uses light detection and ranging (LIDAR) for topographical road-mapping
- Low-cost LIDAR: High-performance LIDAR systems at a significantly lower cost

Working in a relatively new and fairly complex segment in India introduced Verdatum with challenges such as procurement of components - from microcontrollers and processors to sensors - and timely delivery of high-performance computing capabilities. A development grant awarded by KSUM along with cloud computing credits, the startup was able to overcome these hurdles.

Verdatum gained access to 3D printers, oscilloscopes and spectroscopes at Maker Village's Fab Labs and Electronics Lab free of cost, which helped the startup develop its flagship prototype.

Factsheet:

- **Founded In:** 2017
- **Founders:** Athul Ram, Joseph Monis
- **Website Link:** https://www.verdatum-ai.com/
- **Mission Statement:** Democratisation of advanced technologies
- **Product Offering:** AI, IoT, and advanced sensing solutions
- **Target Market Size:** $2.3 Bn by 2024
- **Team Size:** 6
- **Benefits From KSUM:** Two grants, incubation at Maker Village and use of its facilities, exposure via events, and lead generation

Devaditek, The Maker Of India's Own Autonomous Unmanned Ships

Working in the smart autonomous unmanned ships and vessels space, Devaditek Innovations aims to disrupt the traditional systems by introducing innovative, smart solutions. With a belief that the future of the maritime industry lies in unmanned ships, the startup uses Internet of Technology (IoT), blockchain and Artificial Intelligence (AI), and claims to be the producer of "India's first-ever completely indigenous smart autonomous unmanned ships and vehicles".

"We are doing research and development (R&D) on smart system integration for autonomous unmanned ships and vessels (AUS/V)," said Sumith C Mohan, director, Devaditek Innovations.

Mohan, along with his cofounders have developed technologies such as:

- Smart ballasting system with auto & semi controls
- Smart navigation system
- Smart propulsion system
- Smart diving system

Going further it plans to include tech and innovation such as solar scanners, hydrophones and visual payloads to its vessels and ships.

Among the various use cases of its products, it claims there are sectors and verticals such as:

- Underwater archaeology
- Search & recovery
- Route surveys
- Geological/geophysical surveys
- Environmental data collection
- Lead detection
- Water level monitoring

Maker Village helped the startup in developing the prototypes of its product line as well as marketing. It also enabled the startup to establish industry connections with entities including the Indian Navy, the Indian Army and Cochin Shipyard.

“Maker Village keeps on exploring opportunities in the market for the benefit of every startup. They even introduced us to an Engineering Manager of Cochin shipyard to help us forge collaboration with them and develop our product with their help,” added Mohan.

With the use of the fused deposition modelling-enabled 3D printers - such as Acrylonitrile Butadiene Styrene (ABS) and Polylactic Acid (PLA) printers, the startup was able to rapidly print the prototypes of its products. A slew of training programmes in Maker Village equips startups such as Devaditek with the relevant machines and tools for setting up their foundations through the development of their dream projects.

Factsheet

- **Founded In:** 2019
- **Founders:** Sumith C Mohan & Manoj Menon
- **Website Link:** https://devaditek.wixsite.com/home
- **Mission Statement:** To disrupt the maritime industry and provide solutions to the lower segment in the industry which is usually neglected
- **Product Offering:** Autonomous Unmanned/Underwater Vehicles/Vessels (AUV)
- **Target Market Size:** $ 50K
- **Market Size:** $ 25Mn
- **Key Accomplishments:** Nominated for a technical collaboration meeting with CTO, HITACHI at KTIZ, nominated for defence product development and more
- **Team Size:** 8
- **Benefits From KSUM:** Infrastructure and incubation at Maker Village, awaiting Nidhi-Prayas and IIMTK live grants

Envitus Knows Your Environment Better Than You

The growing need to address environmental degradation has opened up a whole new market for businesses providing green solutions. Kochi-based Envitus has developed the Internet of Things (IoT)-based portable devices that provide block by block environmental data. Integrated with cloud services, these solutions are capable of handling, storing and analysing data to make environmental projections.

Envitus has already rolled out two products: the Ambient Air and the Household Air. While the former focuses on providing real-time and hyperlocal air quality data to communities, the latter provides collected information on the health-damaging factors existing indoors.

Ambient Air Features

- IoT enabled
- Custom reports and analysis
- Real-time hyperlocal air data measurements
- Web dashboard and mobile app to view and analyze data from multiple sensors and locations

Household Air Features

- Advanced sensors
- Provides actionable insights
- Personalised tips
- Portable
- Analyse and monitor air quality anywhere at home

Through its products, the startup aims to provide information on not only air but also soil, water and weather, to cater to areas such as disaster forecasting and the emergency needs of citizens. While its air quality-oriented products are out, Envirus is working on solutions for the other areas.

Other Products In Envitus Pipeline:

- Envitus H2O
- Envitus Soil

Factsheet

- **Founded In:** 2013
- **Founders:** Arjun Varma, Abdulkhadar K A, Anees A M
- **Website Link:** http://envitus.co/
- **Mission Statement:** Acquire, Analyse, Aware, Act
- **Product Offering:** Environmental Monitoring Solutions, IoT solutions
- **Target Market Size:** $1 Bn
- **Market Size:** $8 Bn
- **Key Accomplishments:** Project implementation in Delhi, Raipur, Aurangabad, Nagpur, Bhavnagar and in Malaysia
- **Team Size:** 30
- **Benefits From KSUM:** Market Access, Access to funds

Bagmo: What Makes A Blood Bank Smarter!

Bagmo is addressing the needs of the healthcare sector through its engineering innovations and operation management techniques. An extension of BIRAC's Social Innovation Immersion Programme, under the theme 'Maternal and Child Health', the startup has a focus on issues related to blood bag monitoring and blood bank inventory management systems.

Haemorrhaging is one of the major causes of maternal death, according to the National Centre For Biotechnology Information (NCBI). The availability of blood at blood banks is a precursor to better management of haemorrhage cases. The startup's product, the Bagmo Device, ensures adequate supply of blood in blood banks, as it monitors the blood bags right from the donor's end to the patient's, eliminating manual checklists and follow-ups required otherwise.

With the Bagmo Device, the startup aims to improve the efficiency of blood banks, through factors such as a faster response time. But that is not all. The device helps in avoiding Hemolysis — the rupture or destruction of red blood cells — by tracking the expiry of the bag and any fluctuations in its temperature.

Features Of The Bagmo Device

- Simple IoT-based device
- Cost-effective with zero recurring cost
- Stock management
- Analytics and reporting
- Expiry tracker and temperature fluctuation graph
- Real-time alerts
- Blood bag traceability
- Unlimited data storage

With the incubation space and financial support from Maker Village, Bagmo expanded its operations to conduct a pilot study in the government sector. Bagmo also made use of a range of opportunities to showcase its products to the stalwarts in the startup ecosystem, including mentorship through workshops, discussions and one-on-one sessions.

Factsheet

- **Founded In:** March 2017
- **Founders:** Ashfaq Asharaf C, Anas D and Dhanya Davis
- **Website Link:** http://www.bagmo.in/
- **Mission Statement:** Counter the issues pertaining to the lack of availability of blood and Hemolysis
- **Product Offering:** IoT based blood bag tracker
- **Key Accomplishments:** Received a biotechnology grant award from BIRAC, one of the best 3 solutions in the healthtech for good awards by NASSCOM
- **Team Size:** 8
- **Benefits From KSUM:** Incubation and Infrastructure support, Mentorship, Grants

How Hungry Your Electricals? Greenturn Idea Factory's Greenie Knows

Greenturn Idea Factory's flagship product, Greenie, promotes the adoption of environmental management systems (EMS) among businesses. As an energy monitoring system, Greenie uses Internet of Technology (IoT), cloud services and non-intrusive load monitoring (NILM), powered by its own patent-pending algorithm, to address the lack of information on energy usage among businesses and achieve its ultimate goal of promoting green energy solutions. Greenturn Idea Factory has realised that while many businesses do have a rough estimate of their load pattern, the idea is based on unreliable indicators without any supporting data.

With the underlying principle that each piece of electronic equipment has a unique power signature or waveform, Greenie measures aggregate power at the distribution panel on a very high frequency. Once collected, the raw data is then uploaded to Greenturn's cloud where the unique power signatures are scanned by algorithms to identify each piece of equipment.

Features

- Single hardware to track overall consumption and each individual equipment
- Non-intrusive and quick installation with no downtime or disturbance to existing infrastructure
- Supports predictive maintenance by identifying deviations in the consumption of any particular equipment
- Provides real-time alerts, periodic reports and recommendations to enable efficient energy consumption
- Data available on the go, over the web interface and mobile app to any number of users

Financial support from the Kerala State Electricity Board (innovation grant of INR 15 Lakh) and the Kerala Startup Mission (scale-up grant of INR 12 Lakh), along with incubation and product development support from Maker Village have enabled Greenturn to achieve successful penetration of its target audience.

Factsheet

- **Founded In:** July 2017
- **Founders:** Sajil Peethambaran, Manoj Krishnan, Dr Jim Joseph John, Dr Vivek Kuthanazhi
- **Website Link:** https://greeniee.com/
- **Mission Statement:** Helping enterprises optimize their energy spends through data-driven insights
- **Product Offering:** IoT based energy management solution
- **Target Market Size:** $ 120 Mn
- **Market Size:** $ 6.6 Bn (India & ME)
- **Key Accomplishments:** Part of Startup Bootcamp Smart City Dubai Accelerator, Part of Facebook India Innovation Accelerator for Social AI, Awarded by Society of Energy Engineers & Managers (SEEM) India
- **Team Size:** 15
- **Benefits From KSUM:** Innovation grant from KSEB, Scale-up Grant from KSUM in addition to industry customer and investor connects

Aqoza: Fighting Air Pollution In A Unique Way

Incorporated in 2019, Aqoza fights air pollution by controlling the odour-related problems that exist in the country. Its solution, the Odour Control Units (OCU), are aimed at reducing the emissions of odorous gases to a permissible limit.

These units are powered by solar energy and additionally, the startup is using cloud services to monitor the work of the units. The integration of Internet of Things (IoT)-integrated air quality monitors enables the startup to not only monitor the work of the unit but also inform the client of the servicing and suggest any improvement that it would require.

Through these units, it is aiming to eliminate the toxic gases and odours produced from manholes, remote lifting stations, small sewage treatment plants (STPs) at the commercial complex, smart cities, hospitals, hotels and restaurants.

Features Of The Units Include

- IoT integrated air quality monitoring system
- UV protected vessel
- Fire retardant material
- Improved air distribution
- Corrosion-free valves
- Energy efficient

Soon after the incorporation of the startup, the founders went to the Kerala Startup Mission (KSUM) and Maker Village for incubation and support. Aqoza got access to 3D printers for prototyping and model printing of its product through the Fab Labs workshops.

“When we make prototypes, it is difficult to design with standard available parts and getting those parts are very difficult. In our case, we just need to focus on 3D design and print on the next day and do trials. It was a dream for us. We also made many smaller models for introductions to PCBs and potential clients,” explained Zahid Muhammed, founder of Aqoza.

Today, the Fab Lab team has helped Aqoza minimise the cost and the time for printing, by simplifying most of the startup’s work. It was able to rent the 3D printers from the lab at the mere cost of INR 35 per hour.

Factsheet

- **Founded In:** May 2019
- **Founders:** Zahid Muhammed, Razin Rahman
- **Website Link:** https://www.aqoza.com/
- **Mission Statement:** Counter air pollution by reducing the emission of toxic and odorous gases
- **Product Offering:** Solar-powered Odour Control Units to control the emission of toxic and odorous gases and improve the quality of air
- **Key Accomplishments:** Partnership with Surcash Filters Pvt Ltd, working closely with few startups from Europe, signed an NDA on developing few products for Indian markets
- **Team Size:** 5
- **Benefits From KSUM:** Mentoring, Industry Connect, Product Prototyping And Models, Infrastructure and Talent Recruitment and more

Countering Neuro-Developmental Disorders Through VR

With a focus on healthcare and well-being using assistive technology products, Embright Infotech develops virtual-reality therapy modules for patients with autism and related disabilities. “Using our immersive experience, the patients can undergo training and therapy sessions that help in improving their social, self-care and motor skills. Also, our AI-XR platform provides prediction and diagnosis reports,” said founder Sathyanarayanan AR.

The startup has developed a therapy toolkit by the name Auticare, for the skill development and training of children with high-functioning autism (HFA) - or autism without intellectual disability - and other neurodevelopmental disorders. The toolkit is designed to guide therapists and physicians in diagnosis and interventions while providing them with relevant information about the patient’s progress. Built around an interactive VR environment, Auticare stimulates and assesses the performance and progress of autistic children, especially in cognitive, social and self-care skills.

“The response-based model of Auticare generates feedback based on the patient’s interactions and records progress within the simulated environments. These data get stored in the cloud for further effective reference and diagnosis that would aid doctors,” said Sathyanarayanan.

Auticare Features

- The module can provide affordable therapy to a large number of people with data backup.
- A single Doctor can monitor multiple patients even from a remote location.
- Integrated sensors give valuable data about the patient's behaviour.

Embright is part of accelerator programme XR, run by Unity CoE and the Kerala Startup Mission (KSUM) for the augmented reality (AR), virtual reality (VR), mixed reality (MR) and gaming sector, which allows the startup access to product development free of cost.

Government support through KSUM, and Maker Village helped the startup in showcasing its products not only in the domestic but also in the international markets. Additionally, it has already signed a memorandum of understanding (MoU) with Reva University Bangalore, St Gits College of Engineering and Technology, and Trinity College of Engineering.

The startup is currently working on the successor to its product Auticare, which is already out.

Factsheet:

• **Founded In:**	May 2017
• **Founders:**	Sathyanaryanan A R, Bobin Chandra
• **Website Link:**	https://embrightinfotech.com/
• **Mission Statement:**	Change the lives of patients who suffer from neurodevelopmental disorders
• **Product Offering:**	An affordable home therapy kit for skill training and development therapy executed for highly functional patients suffering from autism, cerebral palsy and other learning disabilities
• **Key Accomplishments:**	BIRAC BIG15 (Biotechnology Ignition Grant) grant, KSIDC's Entrepreneurial Development fund and NIDHI PRAYAS grant and more
• **Team Size:**	18
• **Benefits From KSUM:**	Funding Support, Mentoring, Investor Connect, Industry connect, PR support

Startups Under Maker Village's Portfolio

S. No.	Startup	Founder Name	Contact Name	Founded In	Total Funding	Description
1	AgLam Technologies Private Limited	Sameer Hassan Anoop Adhur Kutty	Sameer Hassan	2018		Aglam Technologies is developing technology platforms that can do on the spot, instant, quality grading of Spices, at the fraction of a cost and time of the usual conventional methods.Minaturized spectrometric sensors are used to achieve this.
2	AI R and D		Vishnu V nath			Custom designed UAV system for land surveying, precision agriculture, reconnaissance, disaster management including nuclear accident inspection.
3	Alcodex Technologies Private Limited	Abdulkhadar K A Anees A M Arjun Varma	Arjun Varma	41547	4.9 Lakh	Portable device to measure block by block realtime, hyperlocal environmental data with AI powered IoT suit for live, historic and forecasted environmental information
4	Asimov Robotics	Jayakrishnan T	Jayakrishnan T	2012	21 Lakh	Customized AI-Powered Humanoid Robot for front desk and customer support In offices which can be customised for various applications
5	Astrek Innovations Private Limited	Robin K Thomas, Jithin Vidya Ajith	Jithin Vidya Ajith	2018	2 Lakh	Astrek Innovations develops robotic support suit for the lower limb for handicaped/ aged persons. It is derived from inspration to help India realize its untapped potential in the form of disabled people using technology.
6	Autogrid Mobility Private Limited	Himanshu Karia	Himanshu Karia	2017	5 Lakh	Autogrid Mobility Platform aims to deliver mobile SDKs, scalable cloud infrastructure & modular hardware for developing Connected Mobility Products & Solutions. This helps in analyzing the driving patterns, road conditions etc.
7	Avatar Renewables Private Limited	Krishnan Thampi, Ramesh Thampi, John Paul	Ramesh Thambi	2013	7 Lakh	Avatar Renewables is working on the design and development of Renewable Energy Generators (Kinetic Energy Turbines), Water Wheel clean Energy monitoring and control equipments (like Indoor Air Quality Monitor/Controller) Power Monitors (for energy monitoring / auditing and saving) water Current Meters.
8	Bagmo Private Limited	Ashfaq Ashraf C	Ashfaq Asharaf C	2017	47 Lakh	Smart blood bag monitoring device which monitors the transfer of blood from centralized storage to hospitals and vice versa.This ensures temperature logging of every blood bag unit issued to blood storage centers so that reliability of blood collected can be assured.
9	BBHUD Technologies LLP	Albin George	Albin George	2017	7 Lakh	Smart plug and play solution to protect elctronic devices from high voltage, low voltage, leakage problems etc. This circuit breaker provides protection to individual loads connected to the distribution.
10	Cavalier Wireless Private Limited	John Mathew	John Mathew	2017	7 Lakh	Cellular IoT Modules and solutions for industry-leading companies. They focus on manufacturing LTE modules for IoT in CAT M1/NB and with eSIM for global data connectivity through its platform HubbleThings.

11	CEAD		Bavil Varghese			CEAD is engaged in the development and manufacturing of two & three Wheeler Electric Vehicle power train. The drive has been developed in house and is currently being tested by different OEMs
12	Delgado Coating and Technology Solutions Private Limited	R Sreekumar	R Sreekumar	2017		Delgado Coating & Technology Solutions Pvt Ltd focous on promoting and popularizing versatile Spray Pyrolysis /Ultrasonic Spray coating method, potentially capable of coating Compound Semiconductors, TCO's, Quantum dots and Nanostructure's.
13	Design Testing Lab Private Limited		Dr Jolly Chirayil			Indigenous development of core machine for Precission Non Destructive Testing using Holographic method
14	Desintox Technologies Private Limited	Don Paul, Sooraj C	Don Paul	2017	10 Lakh	Advanced Automated Standing Wheelchair which allows the disabled patients to stand on their own using switch control. This type of wheelchair helps in improving the mobolity of the patients and strengthening the muscles of the patient
15	Ecodew Pure Water Solutions Private Limited	MUHAMMED NUJOOM A A	Yunus Mohammed	2017	2 Lakh	Water treatment and quality Monitoring system using IoT
16	Embright Infotech Private Limited	Sathyanarayanan A R, Bobin Chandra	Sathyanarayanan AR	2017	Grant	Auticare-Virtual reality based autism therapy kit for training the autism children
17	Enspark Systems Private Limited	K K Vijayan	K K Vijayan	2016	2 Lakh	IoT based intelligent home automation system with built in internal home environment monitoring. The built in AI engines keep learning the user behaviour and makes the system intelligent over time.
18	Evelabs Technologies Private Limited	Vishnu MS	Vishnu M S	2016	1.07 Crore	Developed a connected infusion monitor, which can count the drops, calculate real-time drop rate and adjust the fluid flow for administering IV medications. The device will send data to a central hub installed at the nursing station, where rate changes and completion of every source will be alerted. The hub also has a smart infusion chart, where the status of every ongoing and upcoming infusion and the patient histories will be shown for easy monitoring.
19	FAYETTE INNOVATIONS Private Limited	SACHIN S JOSEPH, RAHUL G	Rahul G	2018		Fayette Innovations provides a low cost, wearable, continuous blood pressure measurement device that can be used by pregnant women all over the world who are at risk of pre-eclampsia. The detection system is a watch-shaped device which uses an optical sensor for tracking volumetric changes in blood flow. The system continuously monitors blood pressure of the mother and produces alerts much before it becomes dangerously high. The system uses a proprietary algorithm to calculate the blood pressure efficiently.
20	Featherdyn Private Limited	Rajeev Chandrasekharan, Akhil Gopalan, Navaneetha Krishnan	Rajeev Chandrasekharan	2018	75 Lakh	FeatherDyn is developing autonomous unmanned medium range aerial vehicles to enhance maritime logistic service, surveillance, and surveying among other applications.

21	GDRIS Innovations Private Limited	Vishnu Prasad	Vishnu Prasad	2018	2 Lakh	Digital Emergency Assistent (DEA), response system contained in a fixed type tablet alert system. To notify, in case of emergency,to near by numbers or designated numbers.
22	Greenturn Idea Factory Private Limited	Sajil Peethamparan	Sajil Peethamparan	2017	1.03 Crore	Smart Energy Meter providing mointoring capabilities of Individual Equipment along With Overall Consumption using a single device equipped with intelligent cloud-based algorithm
23	HW Design Labs OPC Private Limtied	Jayakrishnan A L	Jayakrishnan A L	2015	11 Lakh	Turnkey solutions in Indoor positioning tracking and maping solutions. This finds variety of applications in malls, halls, factories and other gatherings where there is need for continuous monitoring of movement of public.
24	Ignitarium Technology Solutions Private Limited	Sanjay Jayakumar, Ramesh Shanmugham, Sujith Mathew Iype	Pradeep Sukumaran	2012		Ignitorium Technology is an R&D focussed company with expertise in IoT and Machine Learning technologies creating solutions such as Real Time Location System (ATL-i) and Vision Intelligence for Industry 4.0 (TYQ-i). ALT-i is their high precision asset tracking solution that is optimized for sub-50cm accurate positioning of objects moving in harsh indoor environments. And TYQ-i is a deep neural network based visual AI platform custom built for defect detection and quality assurance in industrial use cases.
25	Inspirein Technologies Private Limited	Praveen Mathew	Praveen Mathew	2015	3 Lakh	Inspirein Technologies is an IOT solution providing company, making an ingenious and eco-friendly solution for helping tourists to explore the touristspots through a user friendly bicycle sharing scheme. To enable this an advanced embedded system based Ride assist system can be operated through their App
26	Irov Technologies Private Limited	Johns T Mathai Kannappa Palaniappan P	Johns	42954	1.75 Crore	Compact underwater drone to perform inspection and survey of submerged structures using video , ultrasound etc and perform realtime analysis of the data for ship hulls, fish farm inspection, dam inspection, port structure inspection, bridge foundation inspection etc.
27	JPNME Private Limited	PINKY JAYAPRAKASH, PUSHPAVALLY M R	Pinky Jayaprakash	2018		AI based intelligent system that forms the basis of scalable and sustainable asset tracking solution. Track the devices from the video/image files from the camera feed and also automatically tag the devices in the images and videos.
28	Maklab Innovations	santhosh v	Santhosh V	2017	5 Lakh	Plug and play electronics building blocks based on raspberrypi for educational purposes. This is intended to minimize the difficulties in HW interfacing and provide hazzle free learning enviornment for students in an effective manner.
29	Natureka Green Technologies Private Limited	Vedant	Vedant	2018	3 Lakh	Natureka develops natural mosquito repellent dispersion device using organic solutions. This is an alternative to the currently available inorganic solutions which adversely affects the health of the end user.
30	NAVA Design & Innovation Private Limited	Charles Vijay Varghese	Charles Vijay Varghese	2016	6.8 Lakh	An automatic electro-mechanical system to tap and harvest neera (inflorescense sap) from coconut trees. This solution could revolutionise the coconut sector by opening up unexplored opportunities of efficient and productive harvesting of neera.

31	Nayasale Retail Private Limited	Subhash S	Richu Jose	2018		AI based cashier less autonomous micro Store. Solving the pain points in shopping for daily food essentials.
32	Nimo Technologies Private Limited	Rohildev Nattukallingal	Rohil Dev	2016	43 Lakh	Nimo is a daily wear smart eyeglasses that can connect with your smartphones to deliver large private screen experience and augmented reality experience. This will allow users to manage multiple applications or informations without reducing the portability.
33	Nyokas technologies Private Limited	Ajay Sangwan, Rohith, Vivek	Ajay Sangavan	2017	12 Lakh	An E-Textile solutions company focusing on developing Standardised Intelligent Textile (SIT) for sensing, analysis of data and application of IoT smoothly into contemporary fashion . Applications ranging from Women Safety-Sensor- Alert Safety Smart Apparels, Defence -Monitoring Activity, Health and Communication and Industrial - Work-force Safety and Interaction Design.
34	NyQuest Innovation Labs Private Limited	Harsh Mohan	Harsh Mohan	2017	18.93 Lakhs (Funding), 11 Lakh (Grant)	An intelligent device to efficiently harvest solar energy and store it using the existing UPS systems. This converts the normal UPS to a hybrid one adding more value to the existing system with lesser cost and greater efficacy through machine learning algorithms based on usage pattern of the consumer.
35	OTOME INNOVATTIVE SOLUTIONS Private Limited	RAJAGOPAL V, VIBIN M VENUGOPAL	Rajagopal V	2017	3 Lakh	Otome focus on automating factories and homes using Wi-Fi or LAN. The ability to form mesh networks among the devices differentiates Otome with the similar solutions available in the market and this helps to provide a highly configurable solution to the end user.
36	Pasbion Healthcare Private Limited	Abin Simon K	Abin Simon K	2014		Pasbion Healthcare Private limited focus to provide people the opportunity to live better and healthier lives through the use of technology , especially IoT. Pasbion is developing solutions that will result in lower cost, real time health management and better user experience for day to day activities.
37	poboT Labs		Jithu A Prasad			Irona is an AI powered Cleaning robot Wet Cleaning with the unique features such as room Localization & real time 3D Mapping , automated navigation, automated refilling and disposal , disinfection of microbes, non destrictive cleaning , intelligent object identification all together providing an Intelligent cleaning process.
38	Pradjna Intellisys Private Limited	Sunil Haridas	Sunil Haridas	2017	NIL	Pradjna provides innovative data driven, objective, scalable, secure and always available platform based on Artificial General Framework to assess motor skills like driving, welding, machining etc without the need for subjective and expensive subject matter experts.
39	Proraptor Technologies Private Limited	Rajeev S.K	RAJEEV S K	2019	NIL	Mobile Pollution Tester - Mobile Pollution Tester is a handheld device used for testing vehicle pollution. can be used for testing pollution of both petrol and diesel vehicle. This device is integrated with a rechargeable battery. The output from the device is processed using android application, this device consists of wifi microchip for communication with the Android device. As a digital India initiative work, pollution testing result is obtained through mail and Whatsapp.

40	Resnova Technologies Private Limited	Jijo Paul, Ajith Asok	Jijo Paul	2014	10 Lakh	Dairy management system (DMS) is a product designed to solve the issues faced by farmers with the aid of technology. With the help of advanced MEMS technology, It enables early detection of diseases, manage resources and improve productivity in dairy farms.
41	Rmmedi Innovations Private Limited	Dr Joseph Thomas, Stephen George, Digo Joseph Sebastian	Digo Joseph Sebastian	2018	1.16 Crore	Device heals the wound by applying controlled negative pressure upon wounds. It is a highly effective and popular modality of wound therapy.
42	Sastra Robotics India Private Limited	Aronin P	Aronin P	2013	3.12 Crore	Customized SCARA Robot Arm For Human Machine Interface Testing. This helps to automate the testing process eliminating the need for human intervention and reduce the testing cycle time
43	Scavenger WasteTech Private Limited	Jeffrey George, Joseph E Palathingal	Jeffrey George	2018	3 Lakh	Scavenger WasteTech provide decentralized home waste management solutions. Using their product ,household waste would be converted to Refuse Derived Fuel (RDF) to be used in industries for power and heat generation.
44	SectorQube Technolabs	Nibu Alias	Nibu Alias	2012	2.28 Crore	Automatic Roti making machine with IoT enabled user interface exclusively for home use. The device will minimize the user efforts and provide healthy and fresh rotis with the press of a button.
45	Selektra Innovations Private Limited	Praji Kolayithody	Praji Kolayithody	2018	NIL	Reasearch and Development of electric vehicle and heavy duty thermally stable Battery pack with 200 Km / charging cycle. They are in the development of electric auto rickshaw.
46	Technorip Innovations Private Limited	Arun P M, Tom Victor	Arun P M	2016	2 Lakh	IOT based standalone, location-based telemetry system with the help of data analytics for tracking, law & enforcement, NBFC's, logistics etc
47	TechSynergie Technologies		Basil K Poulose			Synergie connects existing systems and equipment based on Industry 4.0 standards to help in realizing optimum process managment solutions.
48	Vaugn Frayr Luminaires		Niyas N			Vaugn Frayer presents a programmable LED lighting solution for filim shooting. This novel idea is supposd to replace the traditoinal solution with repeatable light settings combined with intensity and colour control. This also will help to save considerable amount of power as LEDs are used for lighting.
49	Verdatum A.I. Private Limited	Athul Ram, Joseph Monis, Renu Cherian	Athul Ram	2017	2 Lakh	AI based self powered IOT platform with hardware level security and encryption
50	Vi Innovations Private Limited	Vimal Kumar CR, CV Rajan	Vimal Kumar	2017	5 Lakh	IoT based Cost effective system to automate functions in low-end/pre-owned vehicles and provide premium user experience.
51	Volobot Advanced Systems Private Limited	1. Davis Devasia 2. Gurjap Singh	Davis Davasia	2018		Volobot focous in developing 2 in 1 Radio Control with in-built telemetry systems for making drones that can meet the international standards. They are also in the process of developing real-time/post processing softwares for drones.

52	Waferchips Techno Solutions Private Limited	Sonia Mohandas & Archu S vijay	Sonia Mohandas	2016	1 Crore	AI-powered wearable ECG device for a 24*7 monitoring of persons with critical heart conditions. The system allows the doctor to remotely monitor and respond to a critical medical situation of the patient.
53	Wahoo technologies Private Limited	Anoop AB	Anoop A B	2019	5 Lakh	A BUOY- The product is a smart buoy that can rescue a person drowning in water with a remote controlled floating platform.
54	Westghats Technologies Private Limited	Jyothis Indirabhai	Jyothis Indirabhai	2012		VPU (vision processor) that delivers high-performance machine vision and Artificial Intelligence for power-constrained environments. The VPU processor core has a unique heterogeneous parallel processing architecture suitable for low-power applications and can be easily integrated in to SoCs and FPGAs.
55	wioo pikings Private Limited	Pramod S	Pramod S	2018		Plug IN hardware IoT module for various industries
56	Zoid Labs (India) Private Limited	Unnikrishnan KC	Unnikrishnan K C	2018		Zoid Labs focus on creating technologies and solutions to make electronics prototyping and assembly fast, reliable and affordable. They are developing an automatic Pick and Place machine for startups, hobbyists, makers and R&D labs where small-scale PCB assembly is required. A unique product of its kind to address the smaller machines market segment in assembly and automation.
57	Triaxon Technologies Private Limited	1. Padmakumar P 2. Wins Thomas 3. Mahesh Bala	Mahesh Bala Padmakumar, Thomas	43640		Digital Mobile Radios and MCPTT-LTE for fail free communication
58	Finahub Technology Solutions Private Limited	Rajesh Sukumaran, Ajith K George	Rajesh Sukumaran and Ajith k George	2014		Gold Loan Machine (GLM) is a computerised ATM like machine that completely automates the process of issuing gold loans
59	Tenova Systems P Ltd	Anoop j, Sasikumar M R	Anoop J and Sasikumar	2019		Device improve bottom line and product quality by reducing the cold line spoilage with IoT enabled remote monitoring and data analytics. Block chain integrated cloud based system avoids manual intervention and improves transparancy and trust
60	New Electric Mobility Private Limited		Shabeer A J			A smart bicycle for the daily commute and fitness featuring Anti-theft tracking, Tamper alert, Jot.life App, portable battery pack, bionic assist, keyless unlock and safety lights.
61	Tranzmeo IT Solutions Private Limited	Safil Sunny	Safil Sunny	2017		Device to detect anomaly & intrusion detection in pipelines with the help of AI, ML and smart IIoT Devices
62	Calpine Labs Private Limited	JIJO G JOHN	Jijo G John	2018		Non invasive device to electrically stimulates right median nerve for neuro-resuscitation of disabled patients.
63	Rotoye LLC		Eohan George			Battery Monitoring system for Drones
64	In-Sync Tech Pto Private Limited		Atul Warrier			Edu-tech product focussing on Aero-modelling, Rocketry & Robotics

65	IONIC3DP VENTURES PRIVATE LIMITED	Francis Reagan	Francis Regan	2019		Next Generation metal 3D printer
66	Futurefarm Private Limited	KPS Nair	KPS Nair	2019		Portable Agriculture System to protect banana plants from wind related calamities
67	Devaditek Innovations Private Limited	SUGATHA MOHAN & SUMITH C MOHAN	Sumith C Mohan, Manoj Kumar	2019	1.4 Lakh	Unmanned ships / vessels with auto ballasting and smart logistics system using technologies of IOT and Block Chain
68	Infitore Engineering Solutions	AKHIL	Akhil and Ajith	2019		Automated system for cleaning PV Modules
69	iSenses		Karan Bahar			Friend or Foe Identification using AI
70	Lekha Wireless		Ramu Srinivasaiah			4G Tactical LAN
71	AIConstellation		Biswajith Pal			Combined Sensor platform to Generate real time battlefield imaging and mapping
72	WellGreen Technologies Private Limited		Sijo K. Joseph			Developing biodegradable films from tapioca
73	Ajith (No company registration)		AJITH MATHEW			Automatic Cocoa bean separating machine
74	MARITRONICS INDIA PRIVATE LIMITED		ANEES PRABHU			Wireless Antipiracy FMCW Radar for detection and short range tracking of every boat (typically wooden boats) undetectable by conventional radar
75	Aqoza Technologies Private Limited	Razin Rahman & Muhammed Zahid	Zahid	2019		industrial Odour / toxic gas removal systems for commercial and industrial applications to control the air pollution from the source itself
76	NT Labs Private Limited	Nitin Vasanth	Nitin Vasanth	2018		Brain Wave Mapping Wearable Earphones
77	Transight Systems Private Limited		Feroz Rehman			Vehicle tracking and IoT solutions for automobiles
78	Fermidicious Labs Private Limited		Subhajith Biswas, Nitheesh Kumar			Providing vending machine and related solution to offices and commercial space
79	Vacus Tech Private Limited		Pratik Shatrughna Magar			Wireless indoor positioning with patented technology (resolution 30cm) for automated configurable fencing, precise positioning and accountingof assets and people
80	Lamaara		Anto P Biju			Smart ioT based water purifiers for domestic and industrial purposes
81	Hymotiv		Jeffin			Mileage Enhancer & Pollution Reducer for Vehicles
82	Infinicomm		Jay Kulangara			IoT based asset tracking and infrastructure monitoring
83	NavAlt		Arjun Bhaskar			RoRo electric Boat

Maker Village's Corporate Connect

There is no doubting the efforts of Maker Village in building Kerala's image as the hardware hub in the country. The efforts of the incubator has earned it a lot of appreciation from stalwarts across the country.

During a visit to Maker Village in November 2019, Union Minister Sanjay Dhotre called the hardware incubator a role model fit for application in a wide range of fields including deeptech, healthtech and more. Additionally, he also stated that it is the only successful hardware startup venture by the Union Government in association with a state.

Apart from providing infrastructure and R&D facilities that cater to all the needs of a hardware startup, it also provides contacts and connections in the industry to help in the successful penetration of domestic and international markets.

Leveraging Corporate Connect To Support Startup Growth

Altair

In 2018 Maker Village Collaborated with Altair, a multinational IT company from America. Altair India is providing the incubator with support in the field of mentorship and creating awareness in technology. With Altair, Maker Village launched a Centers of Excellence with key focus on engineering design through simulation-driven innovation.

Qualcomm

With the partnership with Qualcomm, Maker Village is helping startups reach international standards by charting out a four-phase project to be completed in six months. The collaboration is essentially between the semiconductor and telecommunications equipment company, Qualcomm and MietY which gives startups access to peers working on similar challenges across the world.

With the same, Qualcomm India aims to support startups from three categories — startups by college students, incubated by Maker Village, and groups functioning as industrial units — in a wide range of subjects such as ideation, model, product, intellectual property rights, marketing and more. Experts in different fields guide the startups through the projects.

Bosch

With the aim of testing the innovative skills and technical knowledge of the growing electronics startups from its portfolio, Maker Village teamed up with Bosch, a global giant with a presence in 150 countries, to host "Bosch DNA Grand Challenge". This challenge enables young entrepreneurs to come up with innovations in electronics product design and development.
The winning teams in the challenge get to avail incubation services of Maker Village for 12 months along with a cash prize.

The partnership has been put in place to counter the challenges that early-age startups face in turning their prototypes into desired products. The

participants all get a set of five challenges based on product requirements and are expected to come up with solutions falling in the categories of smart city solutions, IoT, wearables, robotics and more.

ARM Holdings

To help its startups successfully dominate the international markets, Maker Village tied up with the multinational UK-headquartered giant, ARM Holdings. This has enabled the incubator to hold special training and guidance programmes under the giant, such as workshops on 'Secure Device Management at Scale', networking with international leaders and more.

Dassault Systemes

Leveraging Dassault Systemes' focus on the startup community in India and worldwide, Maker Village partnered with the giant. With the partnership, it is providing its portfolio startups access to Dassault Systemes' 3D Experience platform along with the necessary design and simulation tools. Additionally, Dassault has committed to providing full time technical support to the budding entrepreneurs to speed up the process of innovation and designing of virtual products.

Hardware Startups To The Rescue

If there is anything that the current pandemic has shown us, it is that the Indian startup ecosystem is well connected and united. From various parts of the country, startups from across sectors have come up with solutions to provide relief from Covid-19, in some or the other way. While some biotech startups are focussing on solutions to help support the country's healthcare infrastructure, some deeptech startups are leveraging new-age tech to fight Covid-19.

From low-cost ventilators to augmented reality (AR) based solutions, these startups are exceeding and surpassing the existing innovation bar in the country. A testament to that is the increased development of robots and drones.

While robotic solutions are supporting the public healthcare infrastructure of the country — sharing the workload of the frontline staff, disinfecting zones, dispensing hand sanitisers, serving meals and medicines and more — drones are acting as an effective solution to monitor and control crowd — sanitisation, deliveries of payloads and goods, thermal imaging cameras, spreading awareness and more.

This is where it becomes imperative to mention Kerala. From floods, torrential rains, landslides to registering the first case of coronavirus in January 2020, Kerala has seen its fair share of calamities and troubles in the past decade.

Though Kerala was the first state in India to register a positive Covid-19 patient and the initial graph of the pandemic in the state was alarming, it has today handled the situation better than most states through some tough measures. However, it is not only these measures that have helped the state. Time and again, it is the startup ecosystem of the state that has helped it in countering the hardships.

The state's realisation of the role tech-enabled solutions can play in managing the crisis situations came in 2018 with the first outbreak of Nipah Virus. And today, tethered and supported by the nodal agency of the startups, Kerala Startup Mission, the startup community is well equipped with fighting any challenges that the state encounters.

Strava Technologies

Based out of Trivandrum, Strava Technologies works with geospatial technologies. During the floods in 2016, the startup developed a product, Cyber Monkey to help rescue agencies identify points of distress. A cloud-based geospatial intelligence system, Cyber Monkey transforms real-time data into a meaningful location. The startup provided its product as a service to support the state government rescue people stuck in the affected areas.

Apart from its drone-mapping and GIS technology helping the rescue forces, the startup also helped with managing various distress calls and messages to offer useful data for efficient and faster rescue operations.

Mentored by KSUM, the solution developed by the firm put together crucial intelligence data which was then shared to the Army, Navy, Air Force, National Disaster Response Force and Coast Guard aided in the rescue operations in the major flood-hit areas in the state.

- **Founded:** 2016
- **Founders:**

GenRobotics

Based out of Trivandrum, the product of GenRobotics, Bandicoot shot to fame due to its solution to manual manhole and sewer cleaning. Back in 2018, the startup had gone over to Andhra Pradesh when the state was hit by the floods. It was able to coordinate and work with the government of AP for flood relief support to Kerala.

Additionally, the startup has also taken an active role in helping the state fight against covid-19. In the latter half of May, health experts realised that Covid-19 tests on sewage samples could reveal the extent of community spread in a particular locality. GenRobotics helped the state with its robot, Bandicoot that removed the need for any human intervention.

- **Founded:** 2017
- **Founders:** Vimal Govind MK, Rashid K, Nikhil NP, Arun George

ASIMoV Robotics

Hailing from the startup hub city of Kerala, Kochi, ASIMoV has been a part of the state healthcare sector's support since May 2018 during the Nipah virus

(NiV) outbreak. With the advent of coronavirus in the state and the resultant pandemic, the startup decided to modify its flagship product to roll out SAYABOT — also known as SAYA — to support healthcare workers.

The company has deployed two robots in Kochi, while one robot provides information related to coronavirus, the other one offers hand sanitiser to 600 employees of 40 companies. The startup aims to spread awareness about coronavirus and, in turn, help people adopt healthy practices to stay safe amid the outbreak.

The founder of the startup, Jayakrishnan T is looking to help hospitals and other medical facilities to enable the medical staff to prevent themselves from getting infected. Additionally, robots also have a digital screen which people can use to interact with family members in quarantine.

The startup claims to be prepared to take on any surge in the number of cases, having been in the field of robotics since 2012. It has provided over 250 robots to clients in the US, UK, and India as well, this is due to the capacity of the startup to build robots in a short time.

With a joint research partnership with Narayana Health, ASIMoV also developed robots to support indoor mobility and logistics in hospitals, KARMIbot, which is currently being used by many healthcare facilities to fight the coronavirus (COVID-19) pandemic. The bot enables the distribution of masks, medicines and hand sanitisers in isolation wards, protecting healthcare workers against the virus.

- **Founded In:** 2012
- **Founders:** Jayakrishnan T

Aqoza Technologies

Launching its water-based sanitisers back in 2018 during Nipah, chemtech company Aqoza Technologies is another startup in the list of names that are solving issues for the state. The company is providing disinfectant products to airlines, IT parks, commercial buildings and more. But instead of alcohol-based disinfectants, the company is offering a hypochlorous acid-based solution, claiming that its product can disinfect most viruses including the novel coronavirus and Nipah virus.

Considering that the product is water-based, the startup says that it takes just 15 minutes to disinfect any area, whereas alcohol-based disinfectants take around four to five hours for the same task. Additionally, while alcohol-based disinfectants are toxic, water-based ones are safe even for children. Its products are being used by DRDO for the Indian Army to sanitise hospitals.

Aqoza is currently selling its product exclusively at airports in Chennai, Kochi, Trivandrapuran, and Calicut under the brand name Voyager. But with the current situation, the company has ramped up its operations and has secured additional licenses to ensure that its products are available locally and for industrial and hospital use.

- **Founded In:** May 2019
- **Founders:** Zahid Muhammed, Razin Rahman

AI Aerial Dynamics

Incorporated in 2019, AI Aerial Dynamics builds unmanned aerial vehicles (UAVs), incorporated in 2019. Recently, the startup signed a memorandum of understanding (MoU) with Kerala Police and started helping it by providing surveillance in the locked-down regions of the state. Using thermal imaging cameras, it helped in detecting any violations in crowd-control regulations. The startup has now developed newer versions of its solutions with features such as thermal scanning, which help in collating and processing data to enable officials to detect potential coronavirus cases from a distance.

The startup's products attracted the attention of the Defence Research and Development Organisation (DRDO), which is working on a research project and has deployed applicable sensors in collaboration with the Navy.

Currently, it is testing its drones with added features in the facilities of electronic hardware incubator Maker Village. Adding features and sensors to a drone whose core programme is built, becomes easier as required by the client, enabling faster testing, according to AI Aerial Dynamics.

- **Founded:** 2019
- **Founders:** Vishnu V Nath, Denny P, Rubin Ray, Sujai K J

VST Mobility Solutions

An aggregator of transport solutions, VST Mobility develops secure mobile- and web-based applications along with hardware devices dealing with areas spanning from real-time vehicle tracking to monitoring of fuel and driver behaviour.

UVSPOT

BIN-19

However, with Covid-19 making its presence known in most parts of Kerala, the startup teamed up with Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum to launch — an automated mask disposal machine — BIN-19 and — UV light based multipurpose disinfector — UVSPOT.

Both the products are first of their kind in Kerala and are not only aiming at fighting Covid-19 but also prevent environmental challenges.

The used masks dropped inside BIN-19 are first disinfected by a process, then these disinfected masks are transferred to another container inside the Bin. Additionally, the person dropping the mask can also sanitise his/her hands with the help of the automatic sanitiser dispenser attached to the product. All functions are automated and thus one does not need to manually do anything.

Some features of BIN-19 are

- Auto Sanitiser Dispenser (remotely alerts if it's empty)
- Mobile Application to find Bin-19
- Web Portal for status alerts
- Power ON/OFF alerts
- Box open alerts

The other product, UVSPOT is a multipurpose disinfectant device with ultraviolet disinfection lamps. The startup says that the reflective surfaces and UVC Lamp inside the product, disinfect a board range of microorganisms.

Both the devices by VST have been tested under various microbiological tests conducted by Sree Chitra Lab.

- **Founded:** 2015
- **Founder:** Alvin George

The Humble Shit

While the pandemic has forced the people to stay indoors some citizens have no option but to step outside. And these citizens find it difficult to find hygienic public toilets. A solution to this is being provided by The Humble Shit, which is developing a toilet monitoring system to measure the cleanliness of a toilet.

The platform collects data from public washrooms such as the number of people who have used the washroom, total time spent by these people, the number of people inside the toilet and more. These numbers help the authorities to clean and maintain the toilets appropriately.

- **Founders:** Samir Dayal, Ujjawal Dayal
- **Founded:** 2017

Fighting Challenges, Eyeing Next Level Of Growth

"When we were starting up, most of India barring a few states, was not very entrepreneurial. And so bringing people to the entrepreneurial facility was our first biggest challenge," - Saji Gopinath, ex-CEO, KSUM.

The task of building an ecosystem and then scaling it to become one of the most robust hardware ecosystems in the country is not an easy task and it comes with its own set of challenges. At a time when KSUM started working towards building this ecosystem, existing frameworks or playbooks, on how to go about it was a distant dream. The state started with its initiatives, improvised and scaled eventually. This is probably one of the major reasons Kerala was termed as one of the "top-performing states" in India according to DPIIT's Ranking Framework 2018 for having the most progressive startup culture in the country.

While initially, the biggest challenge for the state was to build the ecosystem with all the right ingredients from scratch, it then shifted to focussing on how to convince the innovative minds to work on their own startups and come together to be a part of the ecosystem. The authorities at Maker Village and KSUM realised that the basic problem was that all the talented students and individuals in the state were hesitant to work on their own ideas.

"Main challenge was to deliver these stories to the innovators and startups. It was important that they buy, believe and trust the story. They should see the value they would get from this ecosystem and that was our first big challenge,"
- Prasad Balakrishnan Nair, ex-CEO, Maker Village.

This was dealt with by the contribution and help of Startup Village, which started doing a lot of activities in colleges along with the government of Kerala. These activities helped in creating momentum, interest and buzz around starting up. And to provide a platform for these ideas that were starting to take form in the state, there was the infrastructure and incubation by Maker Village.

Once the ecosystem started coming together, the next challenge was to convince the ecosystem enablers to come on board.

"Not only startups but also investors and other enablers were unsure. The funding activity was also slow in the state and of course, if we want to build a robust ecosystem, investors would play a major role.", said Nair.

Considering the fact that the state had not seen any major activity in the hardware sector for a long time, the investors were a little sceptical of the progress the ecosystem would make. There was a hesitation in them about the kind of solutions a tier 2 city would yield. To remove this reluctance, the authorities realised that it was important to show them the kind of innovations and solutions they will be supporting, so started focussing on bringing startups on board. Soon enough, the investors and the VCs started showing interest themselves.

"I think today, the entire VC fraternity in the country has made at least one visit to the facilities we have made that much progress in the years gone by," added Nair, when asked of the current state of the participation from the enabler community.

Not only this but forging the right partnerships, bringing the right enablers onboard all were challenging for an ecosystem that was still at a nascent stage. Over the years, Maker Village was able to onboard many leading names as partners such as collaborating with international events, bringing Brinc — a hardware accelerator from Hong Kong — to Kerala and more.

He further explained that while not all discussions resulted into something fruitful instantly, the mere conversations and connections helped the startups gain more confidence. Today, the incubator sees a lot of engagements happening between the startups and the stalwarts from around the world.

With the right startups onboard and the enablers also in place, the ecosystem grew bigger and started supporting more and more ideas and in turn, garnered a lot of attention from the global ecosystem. The challenge then became to screen out startups.

Elaborating on this challenge Nair said, "We started with trying to screen-in more and more startups but now the challenge has become to screen out startups. We see a lot of innovative ideas and startups come to us and we have to choose just a few from them and that has become quite hard."

Needless to say, the hardware ecosystem in Kerala has overcome a lot of these hurdles but one challenge that continues to exist — though a lot of progress is still being made in the same — is the lack of sufficient leading industries in the ecosystem.

"Kerala does not have a very strong industrial ecosystem. By that what I mean is those companies who are growing in a nonlinear manner. Naturally, the kind of support a company can gain in Bangalore, it's not very easy to gain that in Kochi," added Gopinath.

For any hardware startup, it is imperative that it get a lot of guidance, mentorship and support from the industry. While for some it may be good if the engagement starts in the initial stages, for others they might need it more in the middle stages and others might need it in the scaling-up stages but some guidance or mentorship goes a long way. So do the engagements, the right connections and the right partnerships are vital for the growth and success of a hardware startup. And the state lacks in the number of industries it can bank upon for this support for its startups.

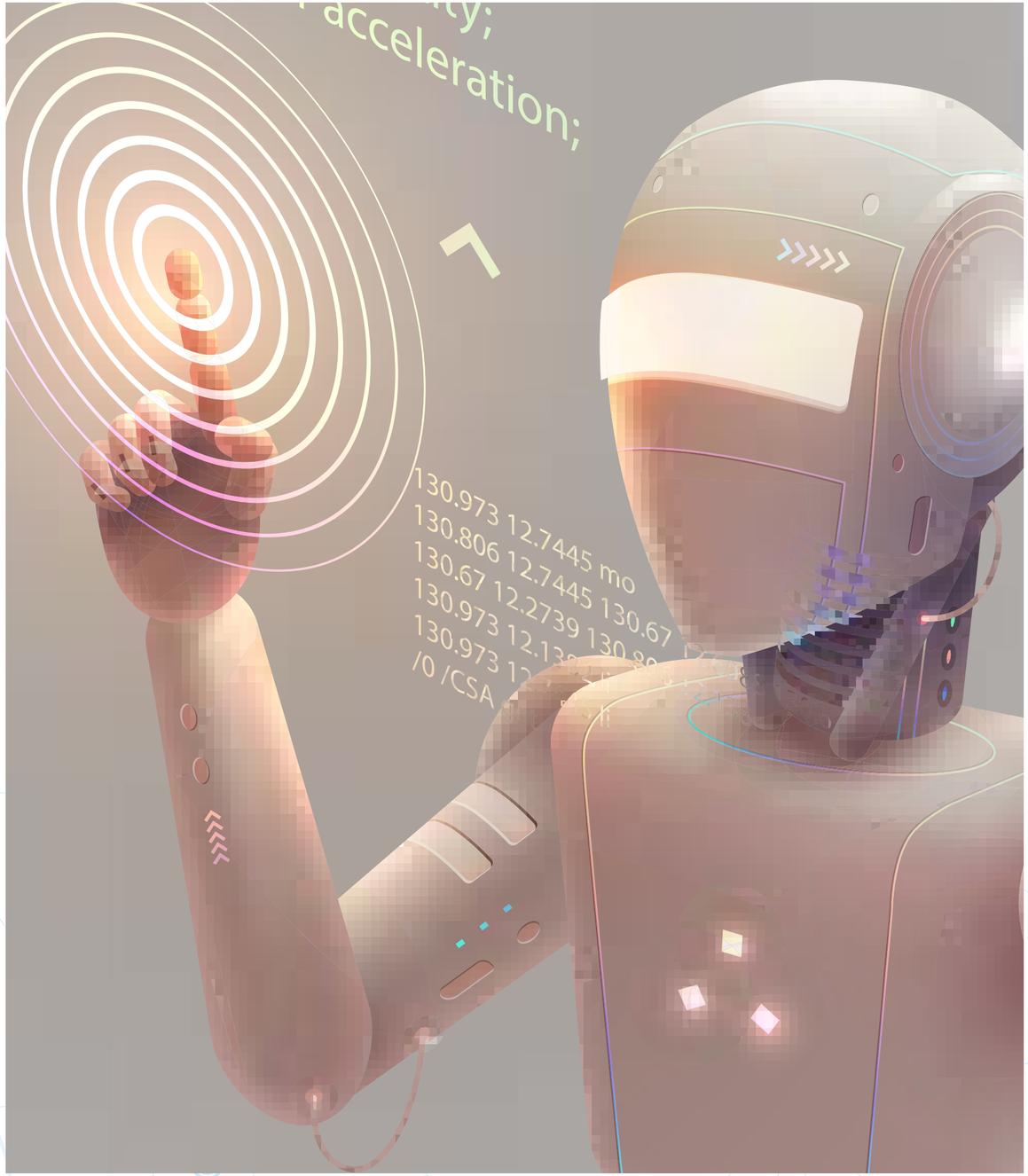
"We are not very robust when it comes to top-class industries in the ecosystem. The industries are not really located in the state, they are located

in other parts of the country. While we do want to have industrial support, like that of Chennai, Bengaluru and more, getting that kind of an industrial connect while being situated at the far end of the country is definitely a big challenge," explained Nair speaking of the biggest hurdle for the hardware ecosystem of Kerala.

However, the state is making a lot of progress in that as well. The govt, both state and central are working very thoroughly to change the same. Nair further added that while it is a very complicated process to bring the industrial support that they want, they have started witnessing some activity in the same already. The biggest example of this is the involvement of the defence industry, which has started taking the help of the startups from the state to build innovative indigenous solutions through the iDex platform.

"We actually created a model in which we meet all the top companies, we continuously made them come and meet our startups. Some of these companies are for helping them (the startups) in design, some are helping them in simulation and more. So, once all of these things are there, the typical handicaps of Kerala will be addressed to some extent," added Gopinath.

Additionally, even MeiTy has put in some broader schemes to enable and encourage the participation of the industries and it has also signed MoU with some leading names in the sector to help the state counter this issue. "It is still not up to the desired level but we are getting there, we are gaining momentum," said Nair.



What's Next For The Hardware Hotbed Of India?

"I believe that we were able to break the myth that hardware companies have a larger failure rate, that it takes a lot of time for the hardware community to become successful. Take the case of GenRobotics, it took merely two years for the startup to become profitable. The notion that hardware will fail in India is wrong, all you need is the right ambience and support," - Saji Gopinath, ex- CEO, KSUM.

In India, Kerala is the one state which has worked extensively in offering support to hardware innovations. Understanding the importance of infrastructure, machinery, mentoring, guidance and more, the state has put together an ecosystem that helps the startups grow and scale in a very cost-efficient way.

Working on the vision to provide a robust support system for hardware startups, the most prominent enabler from the state has a couple of things in the pipeline. "We have some discussion under work but I don't want to name them currently. By next year we should be able to formalise something to increase the supporting factor," added Prasad Balakrishnan Nair, ex-CEO, Maker Village. Focussing different sectors such as engineering, electronics manufacturing and more, it is in discussion with some of the top-notch giants from both the global and local giants.

A Support System To Indian Hardware Manufacturing

"While we plan to become a Center of Excellence for hardware manufacturing, we want to make these facilities accessible to the startups and incubators from across the country, enabling them to come and utilise the facility as per their requirements," said Nair talking about how the state wants to extend its support beyond its boundaries.

The idea is to become a National Center of Excellence for hardware startups for product development. The state is working towards packaging and presenting its facilities as comprehensive support for the product development to the entire hardware startup ecosystem across India.

In Focus: Deeptech Startups

As it progresses, the hardware ecosystem in the state — while supporting startups from across sectors and industries — it aims to increase its focus towards deeptech startups. To achieve this, the state is working towards building a centre exclusively for deeptech manufacturing, "We want to build an Advanced Center Of Manufacturing for deeptech startups," explained Nair.

The ecosystem already enjoys the benefits from the support of existing facilities such as Super FabLabs, FabLabs and more in Maker Village. This centre will further help with the facilities specifically required for deeptech manufacturing such as for robotics, drones and more.

While the idea is still in the formulation stage, it is already seeing some positive response from the stakeholders from different departments of the central government and other industries.

Relief From The Fundraising Chase

"Maker Village has not taken any equity in a company so far, we have not come up with that model but going forward, Maker Village will start investing in some of these companies," - Saji Gopinath.

While providing infrastructure and prototyping facilities, the idea is to also invest in these startups and help them in scaling up. Parallelly, it is also opening its doors to allow established companies to use the infrastructure of Maker Village. So, while some time will be devoted to startups, the hardware companies can also leverage the facilities of the enabler. This move not only helps the hardware ecosystem but also helps in getting more cash flow into Maker Village.

Focus On Future With 4G

With the belief that the evolution of 4G will change the Indian startup scenario, the state is taking steps towards building ***Usecase Lab For Startups***. With the advent of 4G in the startup ecosystem, the state believes that there will be an accelerated movement towards deeptech manufacturing.

"The evolution of deeptech startups and the deeptech innovation ecosystem is going to witness a giant leap with the emergence of 4G. So, we want to be a pioneer in that by setting up a Usecase Lab for startups," explained Nair.

Also, in the formulation stage, the lab will allow the startups to test their solutions. These labs will not be limited to the startup ecosystem in the country but will be open to international startups as well.

Needless to say, the ecosystem that the state has built for its hardware startups has given birth to some amazing stories and solutions that not only act as a testament to its efforts but are also helping the country through its solutions. And the efforts to build this ecosystem further and taking it to the next level are still underway.

"If we keep up our current pace, I am definite that we will be the centre of excellence for hardware startups by the end of 2020. We will become the numero uno or the best hardware startup ecosystem in the country with international quality standards and a specific focus on deeptech startups," - Prasad Balakrishnan Nair, ex-CEO, Maker Village

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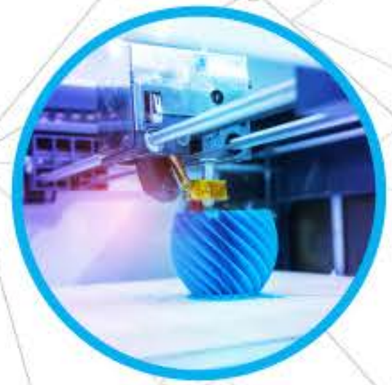

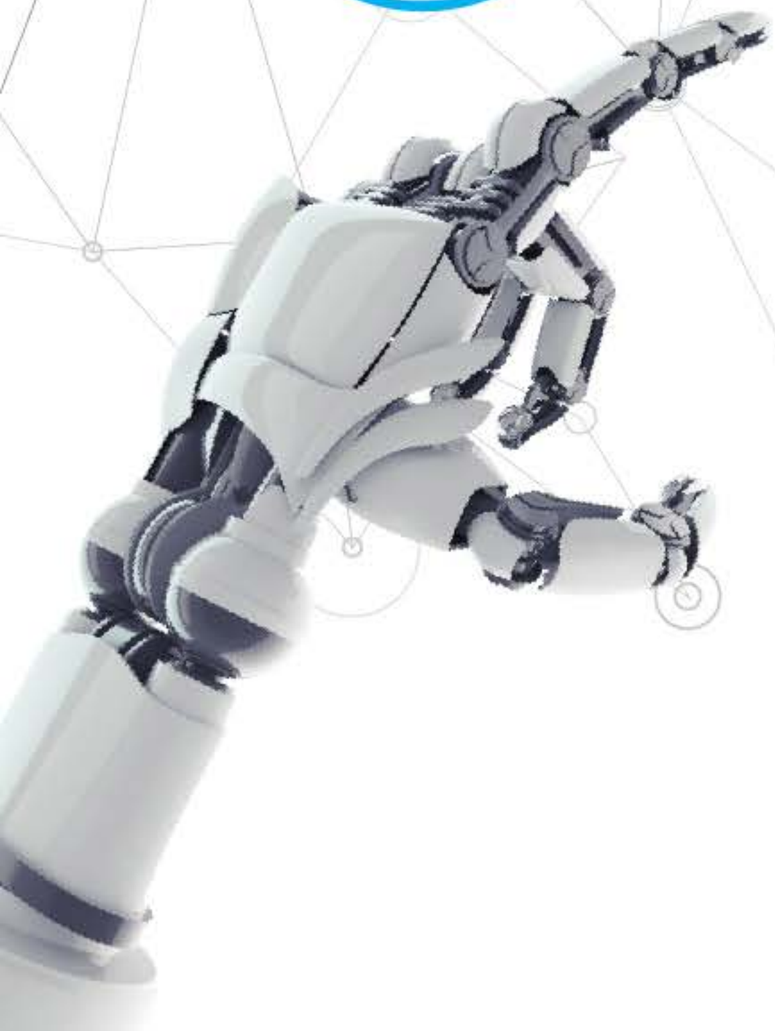

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