

Do Something Wonderful

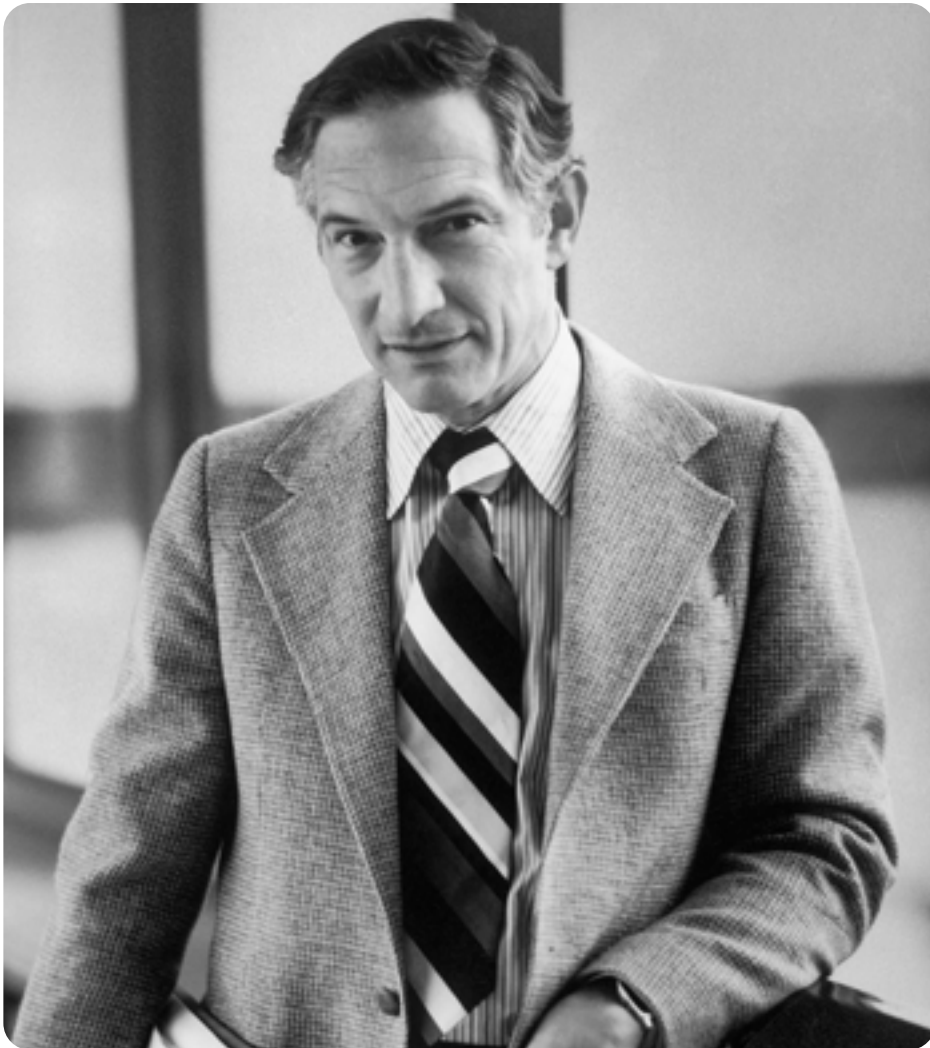
2021 edition



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Foreward



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**Don't be encumbered by the past.
Go off and do something wonderful.**

- Robert Noyce



Today, we have magic at our fingertips. You can instantly connect visually with your loved ones halfway across the globe; a mother-to-be can see the child inside her, and hear its heartbeat, sitting in Bengaluru you can fix a code in Seattle, and a farmer in Barmer gets the latest weather update to help him plan his crop. We live in a world where technology is taken for granted, enabling, protecting, and empowering us in ways which we can't even begin to understand. And all this is because a few people decided to do amazing things.

Over 50 years ago, Robert Noyce, one of the co-founders of Intel, did something amazing when he invented the monolithic integrated circuit – that enabled multiple technological breakthroughs that followed and brought us to where we are today.

The fire he started is still burning strong. Standing on the shoulders of such giants, innovators today are pushing the boundaries of what humanity can achieve. In this book, you will see some of these inspirational stories. We only hope that by reading these stories, you will, in the words of Robert Noyce himself, "Don't be encumbered by the past. Go off and do something wonderful."

Intel and The Better India welcome you to join us on this journey, where technology enables business transformation to do something wonderful and better human lives. Now is the time to take this mantra out into the world and celebrate it – celebrate you and all the things your work inspires others to do.

After all, with Intel Inside, you cannot but succeed.

Introducing the Wonderful Innovators



HaystackAnalytics

In India, Genomics can be used to precisely predict, diagnose and treat diseases efficiently.







Discovering the Blueprint of India's Healthcare Revolution

When buying a house, would you just look at the front door and make an instant decision to purchase it?

Or would you learn more about its history, current status, overall layout and foundation?

The healthcare industry in India seems to be operating like the former method according to Dr Anirvan Chatterjee.

He has dedicated to more than a decade researching evolutionary biology and Genomics with a focus on infectious diseases, virology and disease epidemiology. He says,

"In the healthcare sector today, we are focused on looking at the isolated symptoms and not just the larger picture. In other words, everytime you visit the doctor your condition is judged on the basis of your current status, not your entire healthcare history or your biological blueprint. This lack of perspective is making most healthcare providers increasingly dependent on diagnostics and less self-reliant. Which means that the patient has to undergo a longer journey for the doctors to figure out the ailment and then proceed with the treatment".

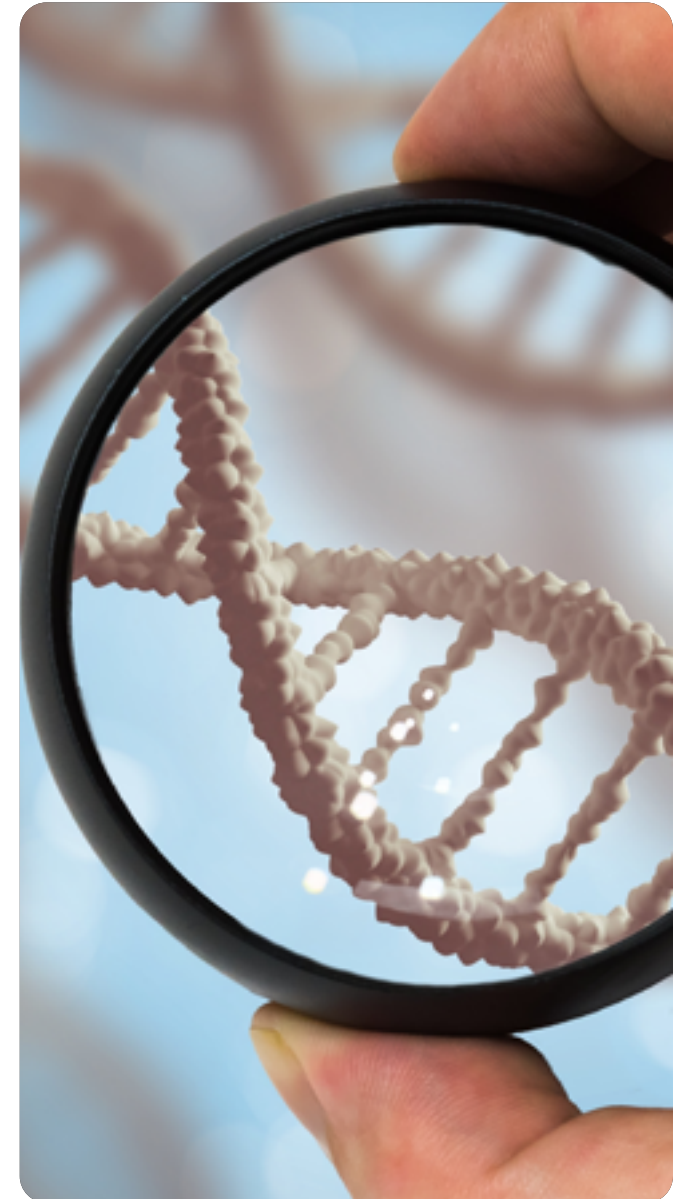
"In biology, our DNA is the blueprint, and studying and recognising the patterns created by multiple DNAs through Genomics can provide a holistic perspective. Access to this data can not only enable quicker diagnosis and treatment but also make healthcare more accessible and affordable," explains Anirvan, who is on a mission to revolutionise the sector through his start-up, HaystackAnalytics, that he co-founded with Gaurav Srivastava and Dr Kiran Kondabagil.

Discovering the Big 'Why'

In the initial years of starting a company, most entrepreneurs delve into defining 'who they are' and 'what solutions they should provide'. But, for HaystackAnalytics, the question of 'Why' triumphed over it all. A man who had spent more than 15 years working in laboratories, making exceptional contributions to the scientific community, Anirvan's eureka moment was when he discovered the purpose behind all his work.



A major part of his career was dedicated to research on Tuberculosis (TB) and he was a prominent part of the research team behind the discovery of the biomarker for multidrug-resistant TB (MDR TB), which is caused by an organism that is resistant to at least two of the most potent TB drugs - rifampin and isoniazid, that are used to treat TB patients. This discovery using next-generation sequencing, qRT-PCR and other molecular biology techniques, has been a gamechanger in the TB elimination mission, and hence secured funding from The Bill and Melinda Gates Foundation and The Department of Science and Technology, India between 2013 and 2014.



Yet despite all this impactful work, Anirvan shares that he was still looking at this more from a science perspective rather than a social impact approach. He wanted to change that and evolve first.

Having worked under prominent microbiologist and immunologist Dr Nerges Mistry, who is known for her unique biosocial approach focused on creating impact through science, Anirvan wanted to create grassroots impact through his research. While his work on TB was impressive, on a personal level he found himself amiss.

“I remember driving with Prof Peter Small, one of the senior researchers from Stanford University, when I popped the question — ‘Why am I doing this?’ After working for several years on TB I had reached a point where I was confused about the impact. In response, he said that though there might not be much on-ground impact, if I didn’t do this, it would not have any impact whatsoever,” adds Anirvan, who spent another year working on the TB research before making a switch to Genomics.



Transforming Healthcare with Genomics

According to Anirvan, the healthcare sector in India is in urgent need of a transformation. Comparing its complexity with that of a black box, he says that the sector needs to be more patient-friendly with an enhanced level of transparency and accountability.

“In most cases, the patient does not have enough information about their condition. The maximum they can do is either seek a second opinion or try to sift through the jargon. The lack of transparency limits them from making an informed decision, thus elongating the entire process of accessing treatment and making it much more expensive. But a way to come out of this complexity is by leveraging the information that Genomics offers,” he says.

An interdisciplinary field of Biology, Genomics is a study of the genome which is an organism’s complete set of DNA. Employing DNA sequencing methods and bioinformatics among many others, Genomics can be used to precisely predict, diagnose and treat diseases efficiently. A human genome contains three billion base pairs of DNA that are uniquely arranged to create the fundamental anatomy of a person and their individual physical characteristics.



DID YOU KNOW ?

Human DNA sequences (that is, our genomes) are more than 99.9% identical among people. The 0.1% genomic differences come from variations among the nearly 3 billion bases (or “letters”) in our DNA; sometimes these variations can influence our chances of developing a disease.



Driven by his experience in TB, molecular biology, infectious diseases and epidemiology in addition to Genomics, Anirvan's vision was to make this genomic data accessible for people. His work has been focused on reducing the cost of sequencing and democratising clinical Genomics by leveraging technology. Anirvan's vision was to usher in a new era of personalised healthcare, which would empower an individual to sequence their own genome and analyze it for early detection of any diseases.

However, this vision of automation in healthcare that is accessible to all, irrespective of their socio-economic status, was limited to his laboratory until he met his childhood friend, Gaurav, in 2016. This chance encounter in Mumbai then paved the way for HaystackAnalytics, a Bioinformatics startup that was recently launched in 2021.

"The science that Anirvan has been working on for years has evolved beyond the laboratories and has huge commercial value. When I met him, I communicated just that and that this was the right time to take the plunge," says Gaurav, who is the COO of the company and focuses on implementa-

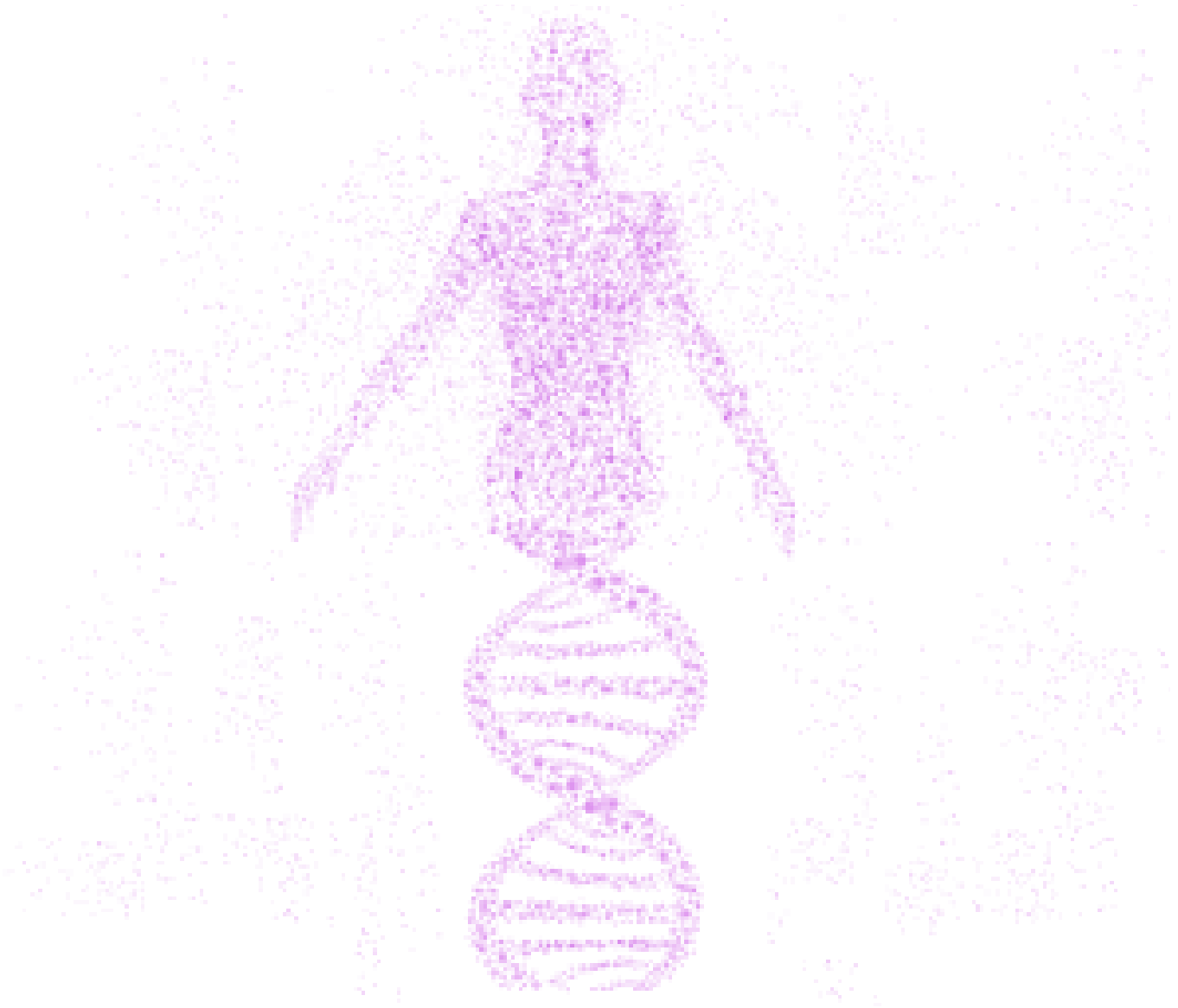


tion of the technology.

“Gaurav inspired me to start this venture by showing the business viability of my research and how proper implementation can make it immensely impactful. Combined with the efforts of Prof Kiran, we are creating innovation in Genomics that provides one-click solutions to analyze complex genomic data within just a couple of days or hours,” says Anirvan.

In other words, the platform created by HaystackAnalytics provides clinically relevant interpretations of complex genomic data that enables better decision-making in healthcare.

Talking about the potential of HaystackAnalytics, Gaurav adds, “A lot of information in the healthcare paradigm is in silos and not comprehensive. There is a lot of experimentation and back and forth. But, through this technology, we are able to provide the blueprint to command certainty in decision-making based on genomic data. We are shifting the paradigm for good.”



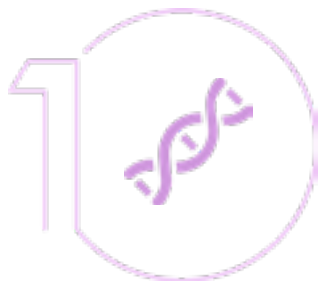
An Asset to Battle the Pandemic

With the scope for understanding infectious diseases and virus transmission, one of the biggest challenges and feats for HaystackAnalytics was to create solutions for tackling the COVID-19 pandemic. This was an opportunity to prove how genomic analysis is relevant in the mainstream healthcare system, especially one that was grappling with the raging coronavirus.

This led to the development of a unique genome sequencing dashboard, which was then incubated by the Indian Institute of Technology (IIT), Bombay and deployed for Brihanmumbai Municipal Corporation (BMC) in June 2021.

Incubated under the Society for Innovation and Entrepreneurship (SINE) at IIT-B, Haystack created an analytical tool that aids public health officials and epidemiologists to better understand data that is retrieved from genome sequencing of ribonucleic acid (RNA) samples collected from COVID-19 patients.

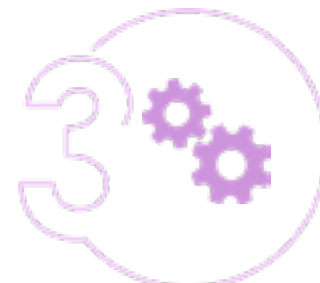
They are able to do so in four major steps — sample processing, creation of a DNA library, sequencing the data from the genomes, and analysing data.



Sample processing



DNA library



Data sequencing



Data analysis

However, conventionally, the process of genome sequencing is long and tedious, and can go from 72 hours to as long as 30 days. But this limitation was skillfully overcome. Co-developed with Intel, their unique computing hardware has brought the processing time down to less than 36 hours and has made the Genomics data directly available and consumable to the users. “With Intel’s assistance, we were able to reduce the turnaround time considerably. Initially, when we started, our analysis would take around an hour, but when we finished the programme, we were able to bring it down to 15 minutes. Essentially,

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through this technology, we are reducing a patient’s diagnostic journey and the cost. For instance, to identify a condition, instead of having to do multiple tests and therapies, the patient is now able to find the most likely cause and solution in a matter of just a few hours,

”

explains Anirvan.

Today, HaystackAnalytics is creating the future of medicine with a dream team of individuals from different backgrounds. If Anirvan is the brain behind the venture, Gaurav, an engineer-turned-finance professional, is the soul, while Kiran, an IIT-B faculty, serves as the backbone of HaystackAnalytics. It is this diversity, interdisciplinarity and unique individual voice they bring to the table, the founders claim, that forms the foundation of the company. “Whenever you are starting something challenging, risky and disruptive, many intelligent people will tell you about all the ways it is not going to work out, and that happened with me. But, very few people will stand by you and inspire you to take the plunge. In a moment like this, my co-founders told me, ‘let’s give it a try’ and here we are changing the world!” concludes Anirvan.

At a glance

Genomics is a study of the genome which is an organism’s complete set of DNA. Our DNA is the blueprint, and studying and recognizing the patterns created by multiple DNAs through Genomics can provide a holistic perspective. The platform created by HaystackAnalytics provides clinically relevant interpretations of complex genomic data that enable better decision-making in healthcare.

“With Intel’s assistance, we were able to reduce the turnaround time considerably. Initially, when we started, our analysis time would take around an hour, but when we finished the programme, we were able to bring it down to 15 minutes,” explains Anirvan Chatterjee, who has dedicated more than a decade to researching evolutionary biology and Genomics.

EnglishHelper

Tackling India's low literacy rate and bringing a technological revolution in government schools via an app.







A Word, Sentence or Paragraph: Tap to Experience Reading

“The entire class was staring as she stood mum with a book in her hand. It seemed like she was being punished but all she had to do was read a sentence aloud. The storyteller in her, too, wanted to be set free but a familiar fear gripped her voice. She mumbled an attempt but the words that formed in her head quickly dissipated with the thought of being wrong. She was stuck, embarrassed and scared to even read aloud the word, ‘The’.”

Gurugram-based “Impact First” social enterprise entrepreneur Sanjay Gupta points this out as a classic example of the language literacy crisis faced by India’s education sector. In a country with over a million government schools, the problem is not just access to books but also quality of education. A study by the Annual Status of Education Report (ASER) reports that about 50 per cent of students from Class 5 government schools in India cannot read a simple text — be it letters, words or a simple paragraph. They cannot read a story with the difficulty level of Class 2.

However, Sanjay, previously Chairman of American Express India, and Venkat Srinivasan, a Boston-based social entrepreneur and cognitive scientist of Indian origin, have devised a solution that is scalable and has the potential to transform the entire sector for good. Named English Helper, their company employs technology to provide multisensory learning solutions for students in government schools. What started with a few hundred schools has now expanded its impact to helping millions of students learn and use English to further their academic and professional careers.

The Journey Begins

Sanjay spent over 30 years in the corporate world driving impact in scale and numbers. A 48-year-old then, he was at the peak of his career in 2007 working with American Express. However, it was the same time when something began to change inside of him.

“A few years before moving to Singapore in 2007 I was running several business initiatives in New York. I was always travelling and was practically living on a plane. But around the same time, in 2004, my father passed away in India. It left a very large hole in my heart that I wasn’t by his side and forced me to introspect,” shares the 62-year-old entrepreneur.

Three years later, his employer fulfilled his request to move to Singapore, where he handled business operations while consulting with a life coach, Rajiv Vij. He helped Sanjay figure out the course of his career and open his eyes to the changes he wanted to translate in his life. “After a lot of time working with the life coach, the penny finally dropped and I realised that I wanted to work in an area where I had a



social purpose. I wanted to be close to my country and be there with my family, while also driving grassroots impact,” he says.

The next challenge then was to figure out which sector to work in. Healthcare and education are the two sectors that require transformation on scale, an expertise he had carefully crafted over decades. Now, he was planning to leverage it for social good.

“My mother was a teacher in a girls’ school in Howrah, West Bengal. For her, education was always the most important. She enrolled us in a good school despite it being quite far from our home. My brother and I would cross a river and then board the suburban train to reach school after a two-hour-long journey. But despite all the struggles, she decided to invest in our education that shaped our futures and I am forever grateful to her for that,” he shares.

He adds, “I would not have been where I am today if not for my education and so I decided that the education sector would be the area of my focus for the social enterprise.”

However, before he took the leap, his mentor and Boston-based renowned business strategist Dr Saj-nicole Joni had a valuable piece of advice for him.

“She told me not to start a school or college as I had no idea about running one. Instead, she advised me to use my strengths to create impact. I have immense experience in scale and building big things and she advised me to leverage that to create grassroots impact. It made sense because



In India the literacy problem, especially concerning language, is massive and cannot be handled just through a human resource perspective. It needs to incorporate technology in a big way,”



says Sanjay.

Hence, a year after quitting his job at AMEX in 2010, he met Dr Venkat Srinivasan, a former professor at Northeastern University, Boston, who was an expert in cognitive, language-based artificial intelligence. At the time, he was working on a technology to solve the problem of English literacy from a multisensory point of view. After months of discussion, the duo finally zeroed in on the plan and their goal to transform the public education system through a solution that was boundaryless.

Thus began their journey with EnglishHelper in 2011.

EnglishHelper - Redesigning Public Education

Words like 'examination', 'revolution' or 'celebration' were too difficult to understand and pronounce for students in her class, says Andhra Pradesh-based government school teacher Radhika Dharavat. She has been teaching English for the past 15 years, having taught in engineering colleges as well as having first-hand experience about the challenges faced by students in rural areas trying to grasp a complicated language like English.

"Most even pronounce the word 'pronunciation' wrong. English is a complex language to read because of phonetics. But today every profession requires a basic knowledge of English. So, as teachers, it is our responsibility to help students overcome their fear or difficulty



with this language,” she says.

However, this is not an easy feat, especially with students from rural backgrounds who have little to no access to the language outside the school gates. A first-generation English learner, Pooja Banothu shares how challenging it has been for her.

“My father is a poor farmer and the opportunity to go to a school itself is big for us. Now I study in a Telugu medium school and outside the English class, there is no scope to learn this language. At first, I always got nervous when asked to read a sentence. I never understood what they meant or how to pronounce them. But now things have begun to change,” she says.

This change has been made possible through the technology deployed by EnglishHelper. EnglishHelper is bringing a technological revolution in government school classrooms via an app called ReadToMe.

Launched in 2013, as part of the eponymous initiative, RightToRead, this introduced a multisensory reading and comprehension software, which helped read out English textbooks using Artificial Intelligence.

“Even before we start to speak, we begin to associate and relate everyday objects and situations with words, through sound and sight. It is through this visual and aural exposure that language learning develops into the spoken and written form — making the multisensory approach the ideal



DID YOU KNOW ?

India is the second largest English speaking country in the world. With around 125 million speakers (about 10% of the population), it is second only to the USA, which currently has more than 300 million English speakers.



one,” explains Vineet Mehra, Vice President and Chief Operating Officer (K12) of EnglishHelper.

Over time, the team at EnglishHelper curated a wholesome approach to help learners listen, read, write, comprehend and speak the language simultaneously. Their technology does not provide alternative content to the preexisting one, rather it integrates itself with the curriculum helping the class be more engaging and interactive. This not only results in a better understanding of the information, but also helps students improve their retention rate.

Sanjay explains this with an example: “Imagine a small school built amidst the sugarcane farms of Beed district, Maharashtra. An impoverished village where Class 6 students are sitting on the floor, barefoot, bent over reading a thick book by Arthur Conan Doyle. Do you think they will be able to truly read or understand if books are just handed over to them? Not really. Our technology works to empower them to read it, understand it and remember it. With our multi-sensory exposure, each sentence of the book is highlighted by the teacher on their screen, be it a smartboard, TV or an android phone. And students are constantly helped in reading the

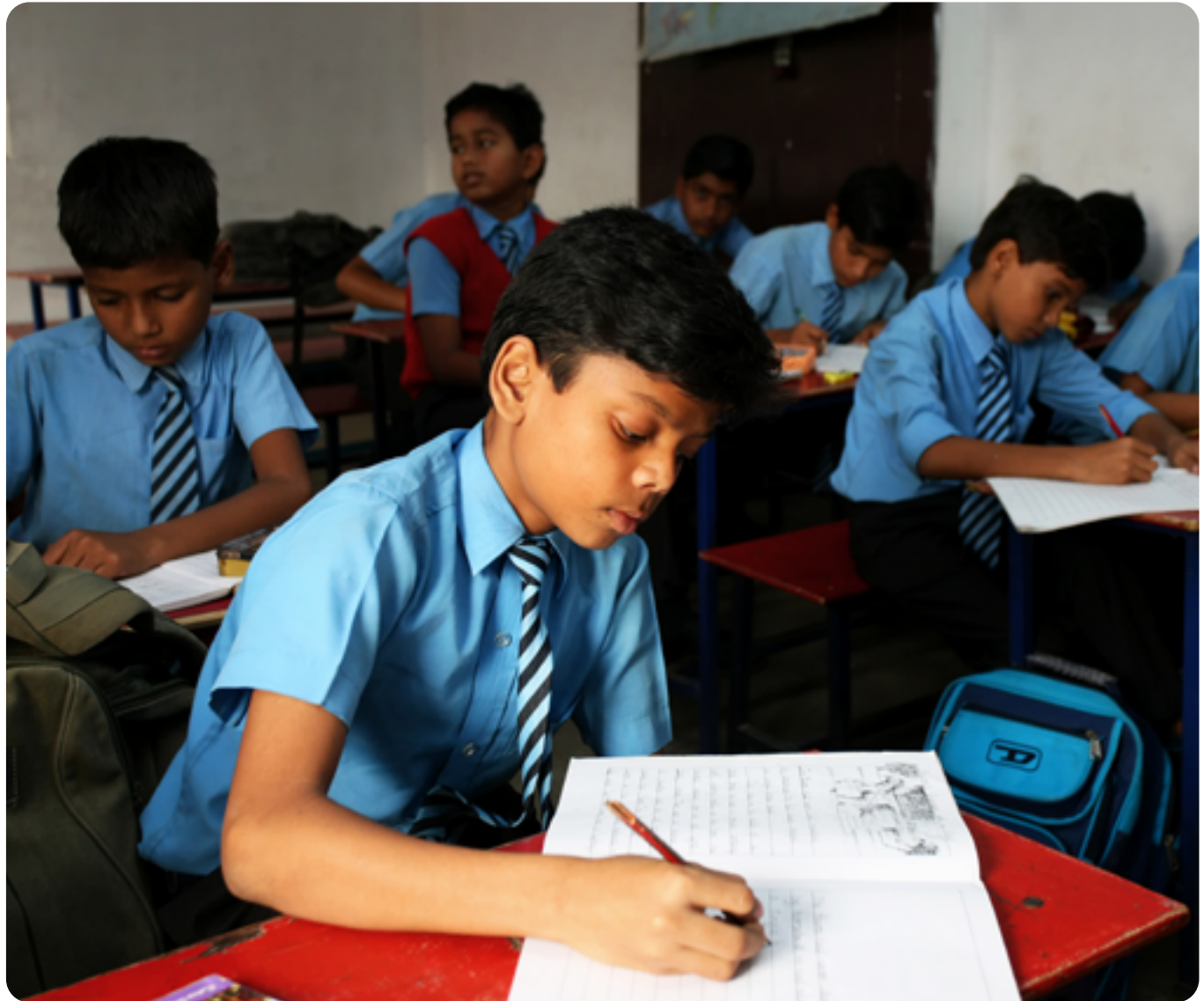


sentence through audiovisual assistance.” He continues, “At any point, a student can pause, click on a word to listen to its pronunciation, see the picture depiction from the picture dictionary or even understand its meaning in their local vernacular language. On top of that, students can also use the ReadToMe student edition to practice all of it at home.”

Available in various forms e.g. ReadToMe School Edition and ReadToMe Student Edition software—they have created a massive impact bridging the education gap, even during the pandemic.

“Earlier, during class readings, I was scared to ask the teacher to repeat a sentence or pronounce a word. I would be embarrassed. But now that is not a worry at all as I can practice the words and sentences at home through ReadToMe, at my own pace. I can adjust the speed of reading and take help from the picture dictionary or translation feature to understand every sentence. That has made me more confident now,” adds 14-year-old Pooja.

In collaboration with Intel and Amazon



Web Services (AWS), EnglishHelper in partnership with Schoolnet India Limited have been able to scale and provide the software to thousands of government schools across India. Utilizing key capabilities of AWS instances powered by Intel(R) Xeon(R) Processors, they have been able to seamlessly deploy the RightToRead program in more than 100,000 schools across urban and rural parts of India, as well as many foreign countries including in Africa and Latin America.

Thanks to EnglishHelper, more than 10 million students and 1.2 lakh teachers today are empowered with the knowledge and confidence to speak the global language, paving the way for a brighter future.

At a glance

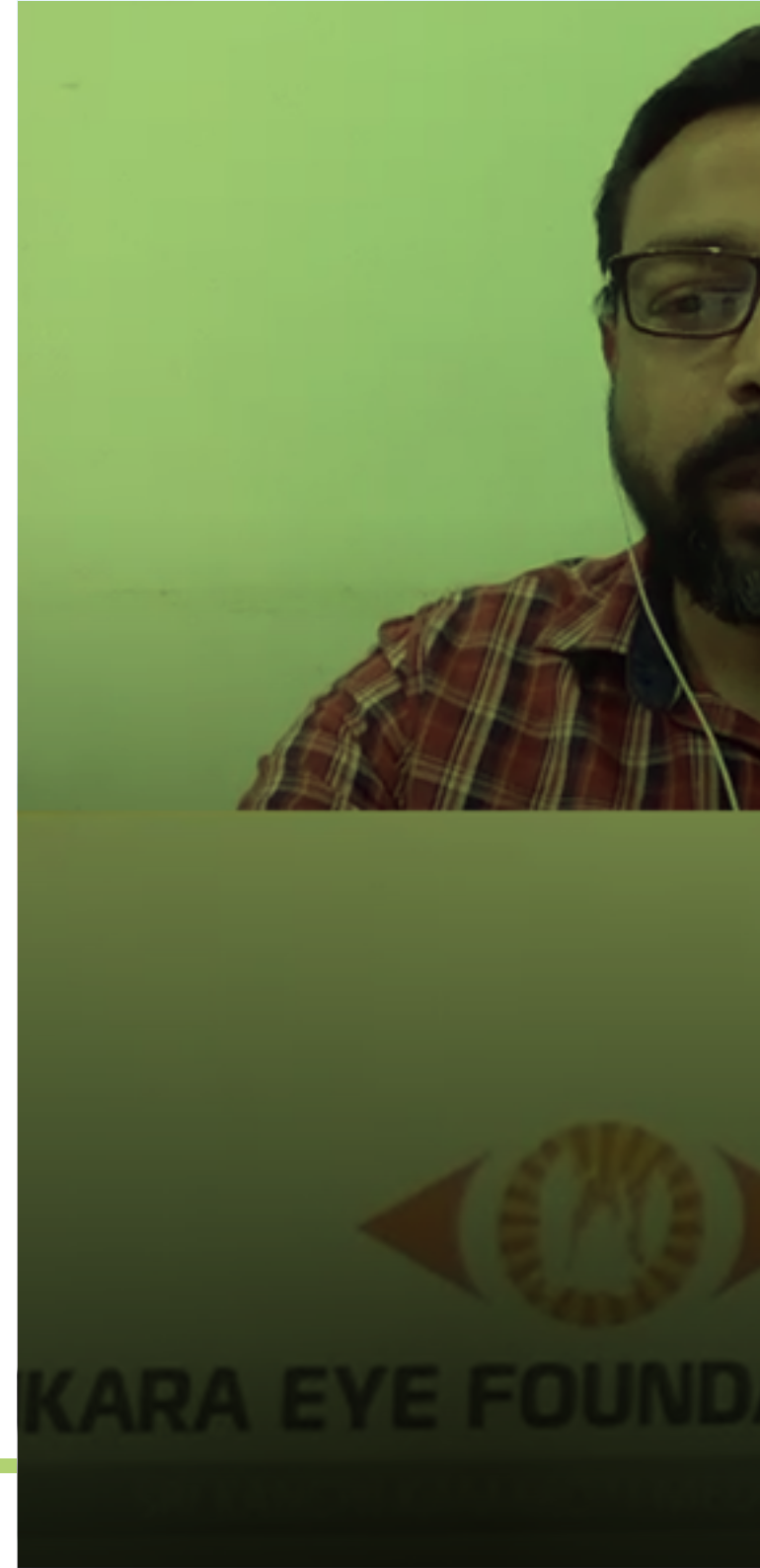
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Netra.AI

**Comprehensive, affordable,
accurate and accessible AI
solutions for retinal illnesses
being brought to the masses.**







A Vision for the Future: Timely Intervention With AI

One out of six diabetic adults in the world are from India, a study suggests.

The second-largest population of diabetic patients in the world, India has around 77 million people living with diabetes. It was 72.3 million in 2017 and is estimated to rise to almost 98 million by 2030. These numbers are a clear indication that we as a country need to take a step back, introspect and re-evaluate our strategy to combat this condition. Because, among the many consequences of diabetes, exists a severely impairing condition called DR - Diabetic Retinopathy (DR).

A leading cause of blindness and loss of vision in adults, its prevalence in India makes it a critical condition in urgent need of mainstream attention. However, as serious and irreversible this might be, early diagnosis and timely treatment can successfully prevent loss of vision.

To fill this gap of access to a reliable solution, Sankara Eye Foundation, Leben Care and Intel technologies came together to develop a powerful innovative device called Netra.AI. Powered by advanced technology, this device uses deep learning technology to efficiently diagnose retinal conditions, in less than a minute.

Vision for the Future

A diabetes complication that affects the eyes, Diabetic Retinopathy (DR) is caused by damage to the blood vessels in the tissue situated at the back of the eye. Early symptoms of this condition include blurriness, dark areas in vision, floaters and difficulty in seeing colours. In some cases, delayed diagnosis and treatment can even cause blindness.

Dr Payal Shah, the consultant research coordinator at the Department of Vitreoretinal and Ocular Oncology, Sankara Eye Hospital, explains,



The human eye is like a window to the world. In diabetes, there is reduced oxygen that is supplied to the retina. This results in microvascular changes that are called macular oedema. The damage done is irreversible and over some time can cause blindness. But early treatment can prevent this.



According to the National Diabetes and Diabetic Retinopathy Survey conducted by the Union Health Ministry, in India, the prevalence of Diabetic Retinopathy is 16.9 per cent with a sight-threatening possibility of 3.6 per cent. This suggests the emergence of DR as a critical and notable non-communicable disease that can lead to ocular morbidity.



But there exists a gap between the onset of DR and it has reached a stage where it is irreversible. “If (by using AI), we can diagnose diabetic retinopathy early, we can intervene at that stage and try to either modify the disease so that the retinopathy itself doesn’t progress or can preserve the limited vision for the patient. We tried to mimic what we were doing as clinicians and be able to look at AI algorithms. That enabled us to get a very high sensitivity (99.7 per cent) and specificity (98.5 per cent) - similar to how ophthalmologists would diagnose diabetic retinopathy,” says Kaushik Murali, President Medical Administration, Quality & Education, Sankara Eye Foundation to a publication.

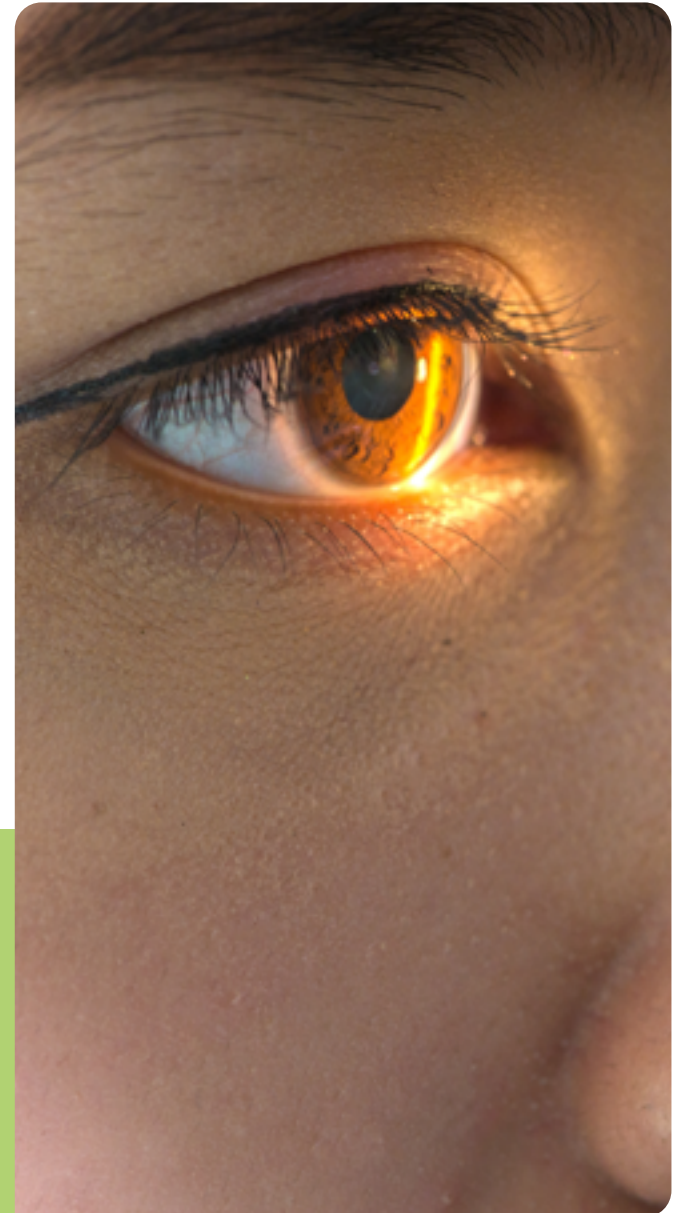
To provide more accurate and efficient diagnosis and treatment of DR, Singapore-based Leben Care and Sankara Eye Foundation used Artificial Intelligence to create an inclusive retina risk assessment software called Netra.AI.

Built on Amazon EC2 C5 and M5 instances and powered by Intel(R) Xeon(R) Scalable processor, this software aims to provide comprehensive, affordable, accurate and accessible AI solutions of



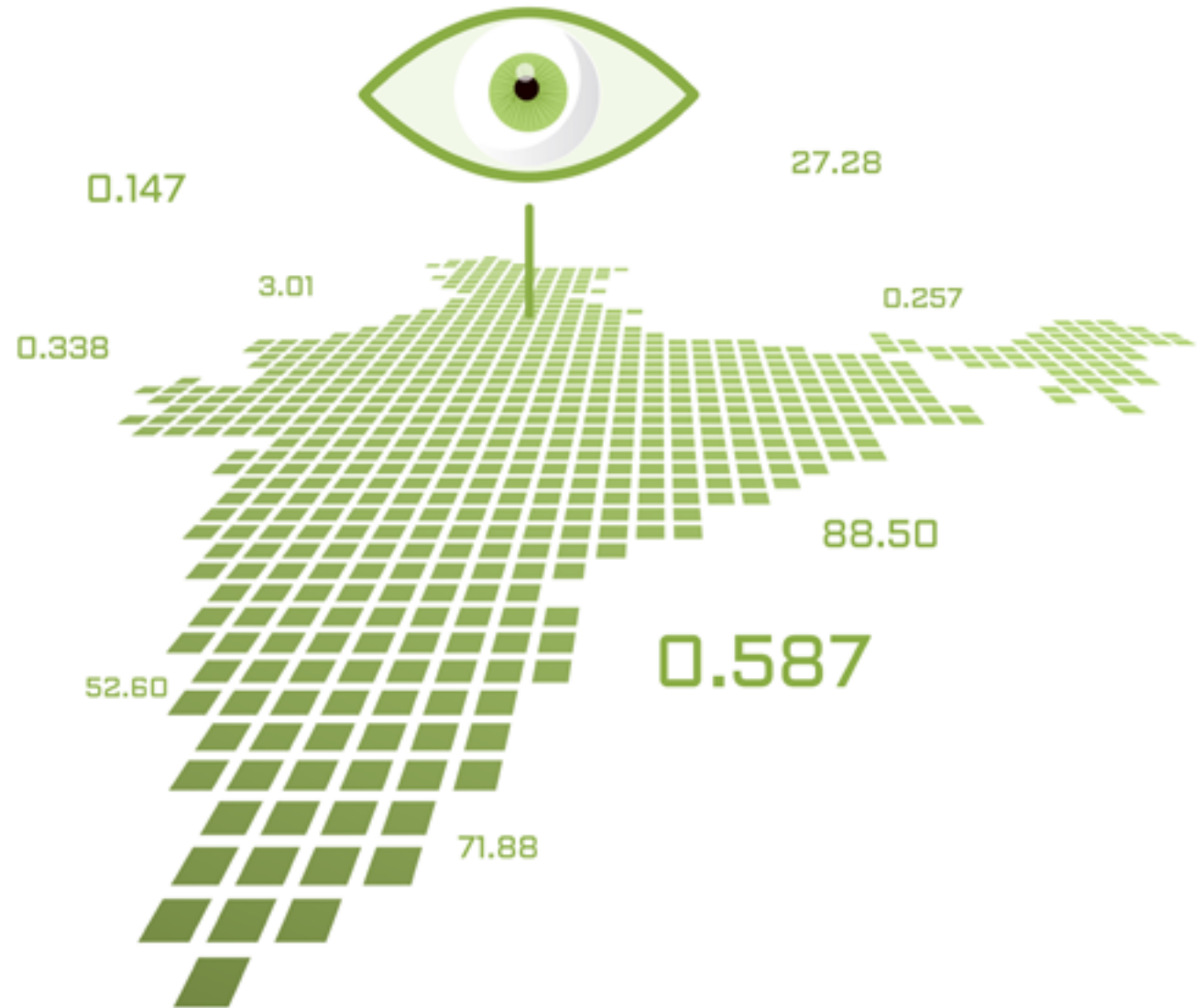
DID YOU KNOW ?

The amount of insulin needed to effectively treat type 2 diabetes will rise by more than 20 per cent worldwide over the next 12 years.



retinal illnesses to the masses in a short period. A big step towards reforming the overburdened healthcare system and implementing a sustainable solution, Netra.AI manages to provide the best results, leveraging Intel's AI, DL Boost and Vector Neural Network, even amid limited infrastructure.

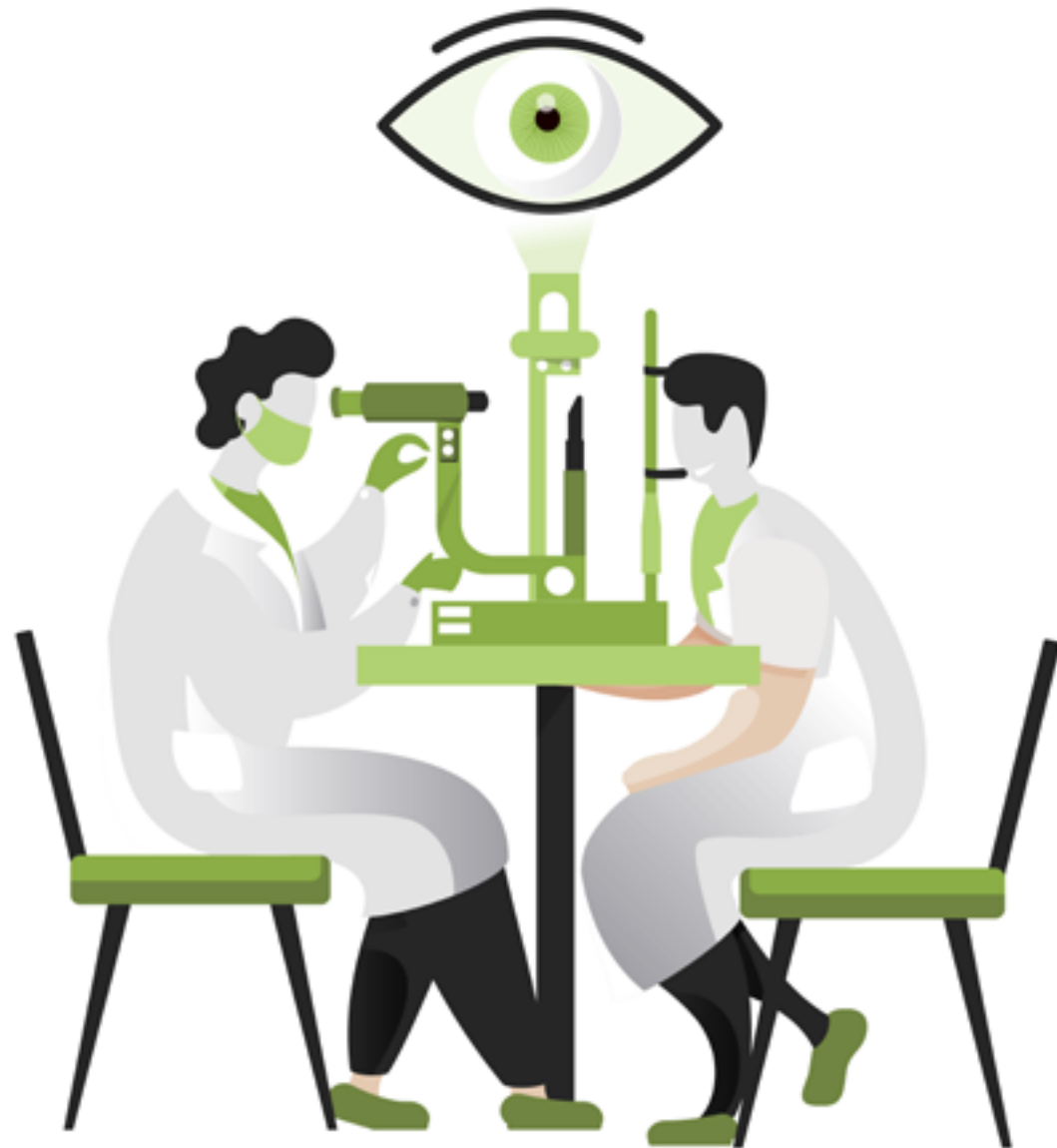
The cloud-based sustainable solution boasts the level of accuracy comparable with human doctors, but with deliverance in half the time. A possible game-changer in the sector, this technology is being harnessed in a socially positive way enabling Netra.AI to make a substantial grassroots impact.



“This AI solution can have a sensitivity of about 98.9 per cent which is a very high sensitivity for any screening tool,” adds Dr Shah.

The device analyzes images from portable fundus cameras which assist in obtaining a DR grading via a cloud-based web portal instantly. So far, the device has accurately screened a total of 3,293 patients and identified a total of 812 high-risk patients. Created in partnership with prominent retina professionals, through a four-step deep convolutional neural network (DCNN), this device enables the detection of the stage of the disease and annotates lesions based on the pixel density of the photographs generated.

Netra.AI can also diagnose many other retinal conditions like glaucoma, retinal pathologies and macular degeneration, which in the longer run, thus reducing the screening burden of healthcare providers.



Talking about future plans, Dr Murali says, “We have established several vision centres that offer a point of contact for our patients. We conduct outreach eye-care programs, we have set up mobile vision care vans, and we also conduct targeted screening programs. Together we want to create a platform that makes access to top healthcare facilities truly inclusive and holistic, for all.”



At a glance

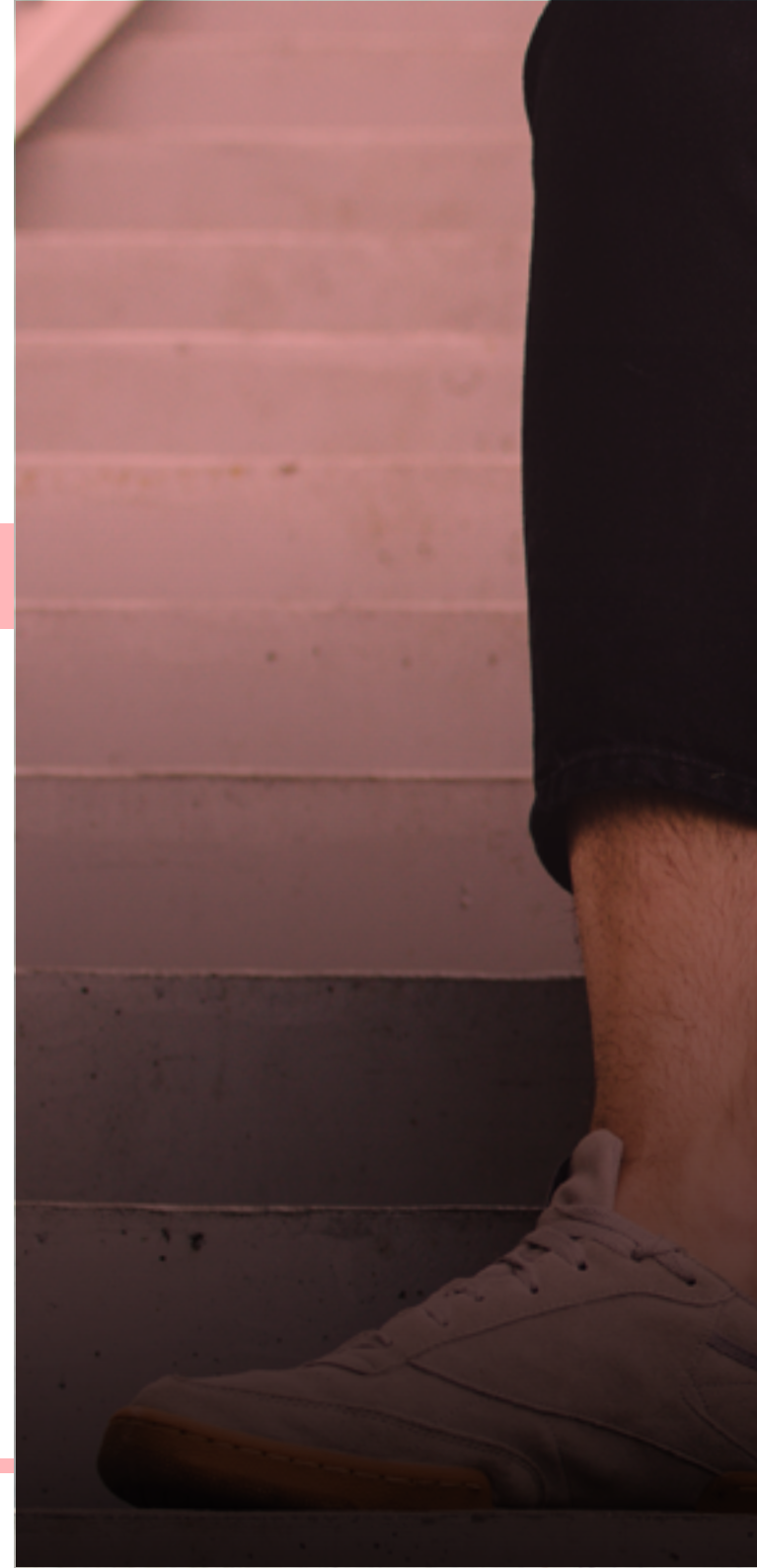
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Ximira

An AI-powered, voice-activated backpack that can help the visually impaired navigate and perceive the world around them unobtrusively.







A-Eye: A 'Visionary' Backpack That Helps the Visually-impaired Navigate Daily Life

Bengaluru-born Jagadish Mahendran had always dreamt of being a doctor, but an inadequate rank in the exam eventually led him towards engineering. However, his drive to help those in need has remained and culminated in a unique technology that can assist the blind in their daily lives.

The AI (Artificial Intelligence) developer has innovated an AI-powered, voice-activated backpack that can help the visually-impaired navigate and perceive the world around them. This assistive device helps the user detect common obstacles like traffic signs, hanging objects, crosswalks, moving objects, elevations, and more, all while running on a low-power and interactive device.

Jagadish says this project is an open-source and free device that he and his non-profit, Ximira, plan to make available to anyone in the world. "Our team is focused on providing choice and freedom for the visually-impaired, as well as a way to make their daily lives easier," he tells The Better India.

The assistive system is placed in a backpack that the user wears. The bag contains a host unit, such as a laptop, and a vest jacket worn by the user conceals a camera. A fanny pack holds a small battery that can last up to eight hours. The camera connects to the computing unit in the backpack, and a Bluetooth earphone lets the user interact with this system via voice commands. So as the user moves through their environment or walks forward, this system audibly conveys what obstacles they might find on their way, and helps them navigate and maneuver accordingly.

How Did it All Begin?

Jagadish, who came to the US around 2013 for his master's degree, worked with a few startups as an AI and perception engineer. His previous projects include developing systems for various kinds of robots including inventory management, cooking, and more. He says his interest in robotics came during his college days, when he had the chance to develop a micromouse robot, which was his first brush with AI. "New developments and research in AI have always piqued my interest. In a way, I'm glad I didn't become a doctor," he laughs.

The idea of creating an assistive device for the blind came to him during his master's degree. "I wanted to do something for the community using AI. I wanted to make a system that makes the visually-impaired person completely unnoticeable," he says, adding that the members of the community may otherwise find it difficult to navigate the world without attracting too much attention to themselves.



"I proposed the idea to my professor, but back then, the AI and sensor space was completely different. I was just a student without much experience. Machine learning and deep learning were not as common," he explains. "So the project never really took off."

A few years later, Jagadish became friends with someone who was visually-impaired. "One day, she was explaining the usual challenges she faces in her daily life. She had a black eye because she'd bumped into a tree branch," he recalls.

"I was struck by this irony, that I teach robots to see things, but at the same time, there are human beings who need help in doing exactly that. My conversation with my friend piqued my interest even further, and I started looking more deeply into a solution," he adds. "By now, I'd gained a lot of experience over the years, and the sensors and AI space had progressed multifold as well."

"A few months later, OpenCV announced a worldwide competition in collaboration with Luxonis and sponsored by Intel. I submitted my idea of an AI-based visual assistive device, which was



accepted, and I won the first prize. Because of this, we were able to develop a prototype that could solve this problem. It also gave me some exposure and ability to reach out to users, and a lot of volunteers came in to help develop the device.”

These people came to form Ximira, a group of volunteers who were collaborating on this project. The group launched a GoFundMe campaign for their project and was able to raise around \$50,000. “We’ve recently developed our prototype that our team members are using to assess its practicality. It’s all open-source, so anyone from anywhere in the world can adopt this solution in a system assembled by themselves. A major focus has been to keep this system simple and low-cost,” he says.

This, Jagadish says, is because, in a survey they conducted, they found that many blind people were uncomfortable with the amount of attention they received from the public on their daily commute. “We wanted to keep the system simple so that it’s unobtrusive. Another factor was that the unemployment rate among the visually impaired community is very high, so they cannot afford a system that’s too expensive. We’re still trying to reduce the cost as much as possible.”

Explaining the advantages of the device, Jagadish says that it’s a cutting edge-AI device, so it is real-time and doesn’t exist on the cloud. “Also, the form factor of Intel’s Movidius chip is extremely



I was struck by this irony, that I teach robots to see things, but at the same time, there are human beings who need help in doing exactly that.



small, it looks like a small pen drive. So you can plug it into any device, and that device becomes AI-enabled. We also used Intel's OpenVINO(TM) Toolkit to optimize our AI models. When we train the model for the first time, there are millions of parameters. These parameters can slow down the device when we use it in real-time. So Intel's Toolkit helped us make the model faster, affordable and more efficient," he explains.

An Impactful Solution Grounded in Simplicity

The device uses depth information to detect obstacles, and also assess traffic conditions, such as lights, signs, crosswalk signs, and more. "It can detect people, cars, animals, fire hydrants, and many other objects and obstacles in real-time," Jagadish says. "In our survey, we'd found that it was extremely difficult for the visually-impaired to detect elevation changes and move from the road to the sidewalk, or climb up and down the stairs. So this model works to improve on that."

He adds that the system also comes with a GPS device, so if the user ever feels like they are lost, they can find out where they are. The device also allows users to save frequented locations, say a grocery store. The system will share snapshots and coordinates of the user to save contacts, who can then help the user know their exact location.



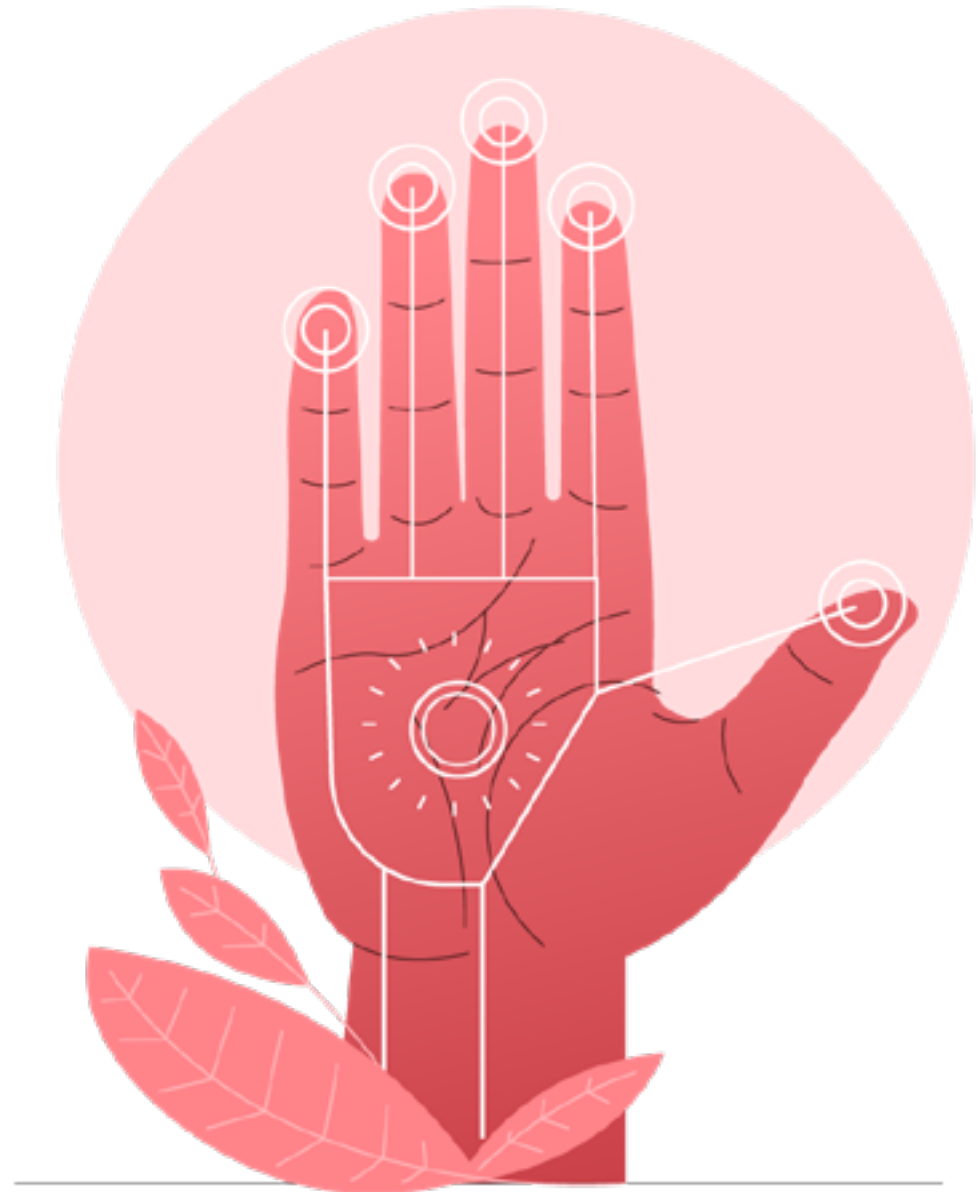
DID YOU KNOW ?

As per the World Health Organization, globally, at least 2.2 billion people have some form of visual impairment. In at least half of these cases, the impairment could have been prevented, or is yet to be addressed.



In addition to this, the backpack is hands-free, lightweight and small, and wireless, which further increases its ease of use.

Jagadish adds, “With our prototype, since the user interface was audio-based, it blocked out surrounding audio cues to a certain extent. The visually impaired rely heavily on these audio cues in their daily lives. So one of our researchers has come up with a wireless replacement in the form of a glove, which communicates these cues via vibrations rather than audio. This interface can be used alongside the audio one, or as a standalone, depending on the user’s preference.”



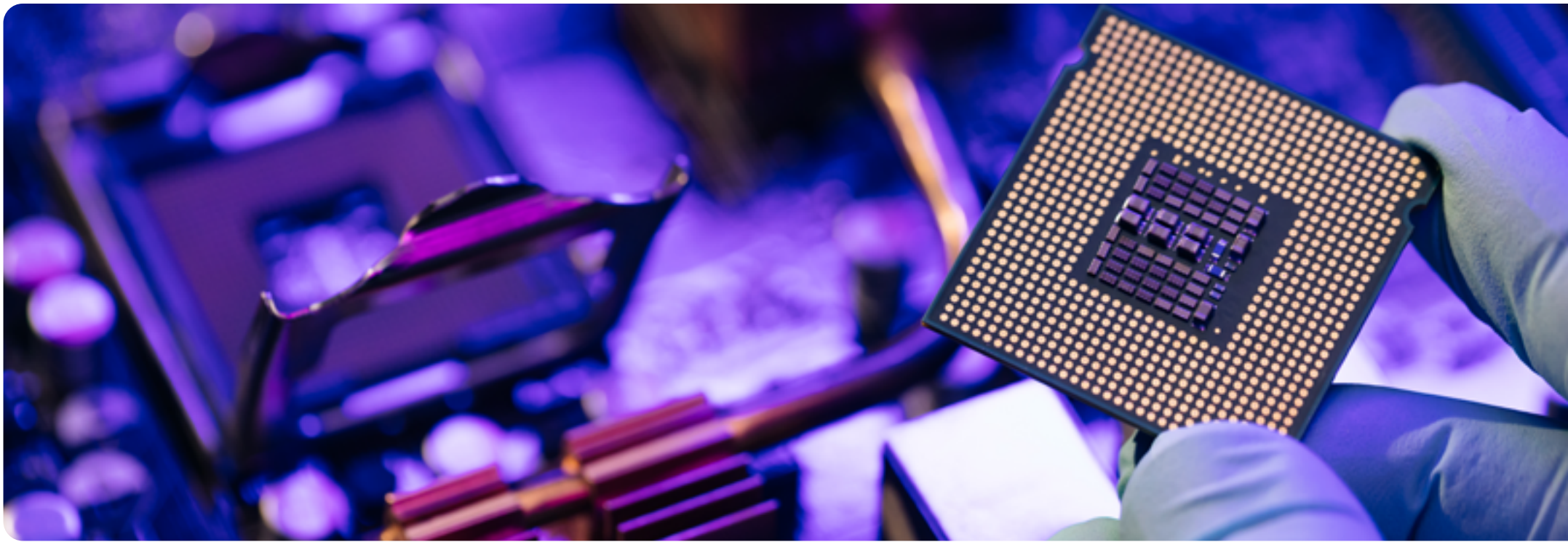
How is this device different from existing solutions for assistance to the visually impaired?
“We try to incorporate user requirements regularly, as part of the development cycle.

Our team has visually-impaired people, so there’s intense scrutiny in terms of how useful our device is. Moreover, unlike existing systems that overburden the user with information, we aim to provide only critical information to keep things simple. The user can request more information if they need it,” he explains.



At a glance

With Intel's OpenVINO(TM) Toolkit and movidius chip, Jagadish Mahendran has developed an AI-powered, portable and free device that can help persons with visual impairments navigate their daily lives. The device helps the user detect common obstacles like traffic signs, hanging objects, crosswalks, moving objects, elevations, and more, while remaining unnoticeable as an assistive device.



Vacus Tech

A technology that enables comprehensive monitoring of public places, with the singular aim of ensuring safety through accurate indoor contact tracing and auditing amid the pandemic.







Inspiration Hidden Behind an Everyday Problem

“No idea is big or small. It is what you do with it that makes all the difference,” two engineering students were once told by their faculty.

Venugopal Kapre and Pratik Magar, studying at the Maharashtra Institute Of Technology (MIT), Pune, had just approached their professors with an innovative indoor positioning solution for a long-time problem – lab equipment that would disappear and be misplaced after every use.

Their professors saw merit in this innovation beyond its apparent use, and inspired the duo to work harder on it. What started off as a creative solution to an everyday problem has ended up becoming a life-saving innovation that has impacted thousands of people during the pandemic.

Explaining how the need for this technology arose, Venugopal says, “We used to spend multiple nights working in the labs. But in the process, which was always very hectic, we would lose assets all the time. Equipment would either get misplaced during work, or someone would take it for their own project. At the end of the day, when we would come back to the lab to complete our work, we’d have to bear the added load of finding these assets. It was becoming a daily and futile exercise.”

Motivated to find a solution, the duo’s first approach was to employ existing tools and technologies to track the assets. This involved tagging them as well as using beeping technology. However these options were difficult to set up, and never truly solved their problem.

“We needed to make something more efficient and began formulating ideas to build a solution instead. We were final year engineering students for whom unsolved problems like these were extremely enticing. With time, we innovated an indoor positioning and tracking technology leading to the foundation of Vacus Tech in 2017,” he shares.

This technology has developed an entire system of comprehensive monitoring of public places like hospitals, schools, colleges, offices, and other commercial spaces. Termed Di-Fence, the singular aim of this innovation, the duo says, is to ensure safety through accurate indoor contact tracing and auditing.

“With the guidance of our faculty, we developed the confidence to solve that technical problem and built a scalable solution that could have a larger impact than what we had previously anticipated. We realised that this technology of foolproof indoor positioning solution in place could benefit more than 35 industry segments including data centres, enterprises, manufacturing, warehousing, etc,” adds Pratik.



An Innovation That Saves Lives

When Venugopal and Pratik – who spent two long years formulating and perfecting their technology to achieve accuracy – started Vacus Tech, none of them had truly realised the impact this technology could have on society and the healthcare sector. It was COVID-19 that helped put it all in perspective.

“Prior to the pandemic, our focus was to create smart buildings and workplaces that ensured safety and security of the employees working inside. But when the pandemic struck, a lot of automobile companies reached out to help track factory workers with respect to following the COVID protocols,” says Pratik.

After the lockdown was lifted, and as offices and commercial enterprises began reopening, the biggest challenge was to get back in business while following all safety protocols. While surveillance was one solution for it, the lack of accuracy would often breed the possibility of loopholes. This, in turn, created a risk of exposure to infection, which had to be avoided at all costs. It was at this juncture that Vacus Tech’s innovation turned out to be life-saving by assisting large corporations and hospitals to monitor and manage social distancing and contact tracing norms.



DID YOU KNOW ?

Researchers estimate that contact tracing in England missed out on more than half of the close contacts of COVID-positive people. No data exists as to how many of the contacts that were traced were actually isolated and quarantined.



How Does It Work?

Imagine putting a location on Google Maps to a specific hospital. The map will definitely show the direction and a bird's eye view of the said location, but not what's inside of it. Vacus Tech's technology provides access to the indoor location as well as through indoor tracking.

This is based on two basic principles – the transmitter and the receiver. The transmitter is essentially a tag which is attached to an object to be tracked - like expensive assets in a hospital or individuals entering a space required to be surveilled. The receiver on the other hand is like a WiFi device that receives the signal from the tag, processes it and sends the data to the Cloud.

Installed in employee ID cards, Di-Fence has not only encouraged employees to follow the COVID-19 guidelines at all times, but also simplified contact tracing in case of any infection.



“Usually in any office, an employee is required to provide identification before entering the premises. We introduced special tags that could be installed in these ID cards. Once inside the building, each employee could be easily tracked and monitored through these user tags,” Pratik explains further.

Using a zone monitor, the tags enable collection of all information, including the data about their movement around the premises. Once collected, this data is then segregated through an Intel gateway and sent to the Cloud, from where it is displayed on Vacus’ software platform called the ‘Digital Blanket’.

Equipped with a buzzer system and a panic button, with each of these tags, users can easily alert authorities in case of any safety threat. Also, in case of any breach or violation of COVID-19 safety guidelines, that tag would detect and send out an alert to the authorities. This technology can also be used to restrict movement of employees through virtual fencing and avoid crowding. So far, through their B2B model, Vacus has deployed more than 12,000 tags, and they credit their growth to the support received from Intel’s Plugin Alliance.

“We participated in this startup accelerator programme before COVID. The platform helped us finalise our architecture and scale up the company. At the time we were able to produce only 3,000 to 4,000 tags and to scale beyond 10,000 tags we needed an efficient gateway that could handle such a big load. That’s when Intel helped us further with the AAEON UP Squared developer board. One of the fastest, this also comes with several security options that allow us to encrypt the data received,” adds Pratik.

With Intel’s help, they managed to source the gateway UP Squared board in record time, despite challenges posed by the COVID-19 lockdown.



At a glance

A small scale solution to fix an everyday problem in a college laboratory has turned into a key solution in contact tracing and following of protocols, key components in the world's fight against the COVID-19 pandemic.

Through indoor positioning and tracking, this technology can track both people as well as assets inside a building, without disrupting day-to-day operations.



Videonetics

**A homegrown platform
changing the surveillance game
while providing invaluable aid
in securing public health and
safety.**







“Cursing the Dark Doesn’t Help, If You Don’t Light a Candle”

Renowned Indian technologist Tinku Acharya remembers spending his 41st birthday in 2004 talking to himself in the mirror.

Tracing every step that had led him to his present reality living in a beautiful home with all the comforts at his disposal, it was only a few decades ago that this had been a mere dream. “I know what true hunger feels like. I know how it feels when you have not eaten a single morsel of food for over a day,” he said.

But today, facing his reflection, he stood as a self-made man who had triumphed over every obstacle and made the best out of the opportunities he created for himself.

A millionaire entrepreneur and award-winning inventor, among many other things, at that moment, he shares how disillusionment had gripped him, his conscience making him question the purpose of his life.

“I had not forgotten my past, but what have I done for my country or the people who were going through the same struggles I had once endured and overcame? ‘Nothing,’ was the answer I got but I was not ready to accept it. I spent the next 24 hours deliberating on this and realised that cursing the dark doesn’t help until you light a candle,” he says. The next day he decided to leave everything

behind in the US and start life with a fresh perspective.

He knew that solving world hunger might not be his expertise but what he knew best was technology and the wonders an innovative mind can create. In the next few weeks, he changed his life, left the US and came back to India to build a self-sustaining Indian tech company that was bound for game-changing innovations. His only goal was to reduce India's dependency on foreign technology, generate Indian intellectual properties and empower India's raw talent for greatness with home-grown innovative products.

Starting in 2008, his company Videonetics has developed a state-of-the-art AI & Deep Learning powered Unified Video Computing platform. But even more importantly, after a decade, since its inception, this technology has provided invaluable aid in securing public health and safety in public places, during the COVID-19 pandemic.

In Dr Acharya's words, Videonetics is the number 1 video management system provider in India and among the top five in Asia as per the ranking by IHS/Informa Tech Research, headquartered in London.



A scientist, teacher, author, inventor and entrepreneur, this Kolkata-based technologist has donned several hats throughout his three-decade-long career.

Dr. Acharya became the first innovator to receive the prestigious 'NASI- Reliance Platinum Jubilee Award for Innovation in Physical Sciences from the National Academy of Science in India (2009) and he was awarded with 'Fellow of IEEE' in 2010. Dr Acharya was the recipient of the first 'Acharya PC Ray Memorial Award' for distinguished achievements in science and entrepreneurship from the Institute of Pulmocare and Research. An author of over 200 published research papers, he is what one may call an icon of India's IT industry.

However, when asked to close his eyes and share a moment from his life where he found himself to be the most fortunate, he said, "Sitting under the streetlight and studying. It was my golden opportunity to be more and dream big."

"I started by working in stores and factories as a child labourer. I did it all to survive. But I was the luckiest in the family because I was the first to go to school. I knew education was my best chance to do well in life and I gave it my heart and soul. The first time I ever studied under an electric light was when I was pursuing MTech. Every struggle was a learning opportunity and a motivation boost for



DID YOU KNOW ?

We are living in a data-driven world. The amount of data generated globally in the last two years has been greater than in the entire human history before that.



me,” adds Dr Acharya, who received his B.Sc. (Honors in Physics), B.Tech and M.Tech in Computer Science from the University of Calcutta, and PhD in Computer Science from the University of Central Florida, USA.

In 1996, he joined Intel Corporation as the Principal Engineer where he led several R&D teams to develop electronic imaging systems, reprographic architecture for colour photocopiers and scanners, digital cameras and multimedia computing algorithms, among others.

He was also the person responsible for developing the ‘image processing chain’ and mapped it into small foot-print silicon for the first dual-mode digital camera (the first ‘Webcam’ from Intel Corporation) in the 1990s. Dr Acharya’s work had a significant influence on the design of digital cameras when the technology was in its nascent stage, and also paved the way for the successful transition of analogue to digital photography.

His research also led to the foundation for the MXP 5800/5400 processor from Intel, which is capable of processing 10 billion operations per second. This technology enabled a set of Internet-capable photocopiers for Xerox and Fuji-Xerox. Following this, he even collaborated with Xerox PARC and Kodak.

While at Intel Corporation, until 2002, Dr Acharya had managed to create almost 160 patented inventions.

A prominent name in the industry, he comments that engineering is indeed an ‘attitude’. It is not just about knowing JAVA or Python.



It is about being excited to innovate and solve problems. For an engineer or a scientist, a challenge is a catalyst for brilliance. And India is a country with an abundance of fantastic challenges and hurdles that require brilliant ideas and solutions. If your innovation manages to work in India, it will work anywhere in the world,



he shares.

His current work at Videonetics has been implemented in more than 140 cities in India, making 80+ Indian airports safe. "Some might say I have come a long way, but I feel that I am only getting started," he adds.

Making India sustainable and SAJAG

"Back when I co-architected the first webcam for Intel, I realised that video computing was indeed the future and hence a few years down the line, I created a company leveraging video computing technology to the best of possibilities," says Dr Tinku. From using CCTV cameras to ensure road safety and traffic compliance to saving lives during the pandemic, Videonetics' world-class technology has proved to be a game-changer.

According to Dr Tinku, theirs is the only platform in the world that is agnostic to the operating system, camera, database, networking and browser. In other words, Videonetics runs equally well on any platform whatsoever and can make use of any network, browser, camera or database to run its operations. One of a kind,



this homogenous platform hence gives the democratic choice to the users.

Talking about the impact generated in terms of road safety, he adds how its implementation in Indore helped reduce traffic violations by 90 per cent. Their technology has so far been implemented in 140 cities, exclusive of its impact abroad, in Middle Eastern countries, and Thailand as well.

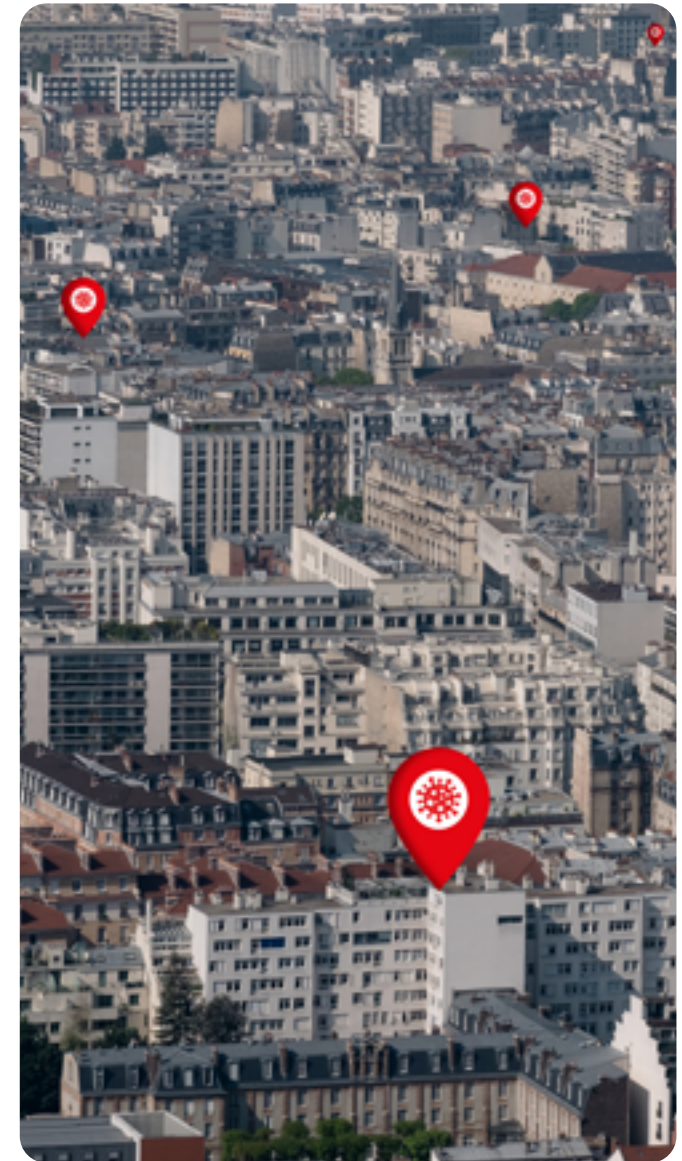
But the impact during the pandemic has been most noteworthy, he adds.

“As scientists, we cannot just sit back at home during the lockdown when our innovations can potentially save lives. Hence, we started SAJAG,” says Dr Tinku.

Built to endure and operate under extreme conditions, SAJAG offers real-time alerts and data to ensure compliance with all precautionary guidelines — both during and post-lockdown. Used by facility managers and district administration of several smart cities as well as Tier II and III cities, its technology enables video evidence-based contact tracing that has proven to be invaluable amidst the pandemic.

“SAJAG, a word that describes an agile surveillance system, is a platform that has helped several private and public stakeholders to handle the COVID-19 situation efficiently. From ensuring compliance with all the government lockdown guidelines, monitoring social distancing to maintaining law, and order it has played a pivotal role in helping authorities tackle the pandemic with efficiency,” says Avinash Trivedi, vice president of Videonetics.

As an ISV (independent software vendor) partner of Intel since its inception, Videonetics has been leveraging the technical insights and computing infrastructure powered by Intel(R) Xeon(R) Scalable processors and Intel(R) Core(TM) i7 processors to create a benchmark for their technologies and scale up its potential impact.



"Intel and Videonetics are technology collaborators, operating in tandem. It is a match made in heaven. We contribute to each other to enable the creation of innovations that can benefit thousands of people and society at large. And SAJAG is the recent example of this collaboration," adds Avinash.

Another one of its collaborators, Ravindra Singh, founder of a technology company, called Delcom, says that Videonetics' sustainable approach to technology is what inspired their partnership. "Working with multinational companies can be a challenge sometimes as they are not always tailored to your specific needs and are sometimes not able to solve specific problems. But that is not the case with Videonetics."

Taking surveillance to yet another level, Dr Tinku shares about his new research concept called Sixel. A US patented innovation, Sixel will employ not just visual but also other sensory communication and tools in their technology products. A cloud-agnostic software, this independent project is slated to launch in 2022 and is Dr Tinku's big step towards making Indian technology entirely self-reliant.



At a glance

Since 2008, Videonetics has created a homegrown Unified Video Computing platform that has revolutionised security and surveillance across several countries today.

From using CCTV cameras to ensure road safety and traffic compliance to saving lives during the pandemic, Videonetics' world-class technology has proved to be a game-changer. Tinku Acharya's research also led to the foundation for the MXP 5800/5400 processor from Intel, which is capable of processing 10 billion operations per second.

Another innovation, SAJAG offers real-time alerts and data to ensure compliance with all precautionary guidelines — both during and post-lockdown.

Videonetics has been leveraging the technical insights and computing infrastructure powered by Intel(R) Xeon(R) Scalable Processors and Intel(R) Core(TM) i7 processors to create a benchmark for their technologies and scale up its potential impact.



Do something small that leads to something big

Writer: Ananya Barua
Editors: Divya Sethu & Yoshita Rao

