SPARKS OF
INNOVATION

Stories from the STEM Spark, Innovation @ Schools program

2019 - 2023

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MESSAGES

Message from Mission Director,
Atal Innovation Mission

It gives me great pleasure to introduce this book, Sparks of Innovation. Readers of these stories will get an interesting glimpse into the STEM Spark, Innovation @ Schools program through the experiences of some of its key stakeholders. This book reveals the creativity, imagination and technical aptitude of young India, showcasing the essential spirit of the Atal Innovation Mission.

The flourishing Indian economy is an unprecedented opportunity for innovation and enterprise, with the nation's young population as its powerhouse. The launch of Atal Innovation Mission (AIM), under NITI Aayog, has been occasioned by the need to sustain this impetus. Through the synchronization of innovation policies at central, state and sectoral levels, AIM seeks to generate a favourable climate for innovation and entrepreneurship in the country.

The Atal Tinkering Laboratories (ATL) program is a vital segment of AIM, focusing on high school students. It encourages the development of skills such as problem-solving, critical thinking, creativity and collaboration among them. The labs provide an environment where students are at liberty to explore and initiate experiments on their own, as well as to experience cutting-edge technology. AIM also addresses the professional development needs of teachers through training sessions, contributing to the overall enhancement of the school innovation ecosystem.

End-to-end innovation, which translates ideas into impact, involves several crucial steps, from the understanding of the problem to the designing of the solution and its eventual adoption. As the stories in Sparks of Innovation prove, our young students are remarkably adept at learning these processes. It reassures us that the culture of renewal we aim to promote has found fertile ground. As we continue our efforts to enthuse budding young innovators and entrepreneurs, who can lead India ahead, we may seek inspiration from such success stories. May these sparks grow into a blaze of glory and illuminate our future.

Happy Tinkering!

Dr. Chintan Vaishnav
Mission Director, Atal Innovation Mission,
NITI Aayog, Government of India

Message from President,
Asia Pacific Global Delivery Centers of Excellence

Building a more sustainable and inclusive world for all

At CGI, we recognise the accelerated pace of the Industrial Revolution 4.0 in India and the need to champion education and digital inclusion for all. As a technology organisation, we are committed to improving access to equitable STEM education for young children and adults to thrive in a globalised digital society.

In this pursuit, we are proud of CGI's continued association and commitment to NITI Aayog's Atal Innovation Mission (AIM), the flagship program of the Government of India that promotes a culture of innovation and entrepreneurship through the Atal Tinkering Laboratories (ATLs). These labs provide students a unique opportunity to explore their creativity and develop innovative solutions to real-world problems through hands-on experience using STEM tools. With the support of our implementing partner, Learning Links Foundation, we are enabling schools and teachers with the resources, environment and mentoring and coaching forums, to improve accessibility to technology, especially to those who are underrepresented.

Through this Sparks of Innovation Coffee Table Book, we share transformative stories of our ATLs on how hands-on experiences and discovery-led learning strategies are helping young children and adults develop critical thinking skills and technical expertise and proficiency for the future.

We hope these 'Sparks of Innovation' ignite a passion for creativity and innovation in all who read them.
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Mr. George Matackal
President,
Asia Pacific Global Delivery Centers of Excellence

Message from Director CSR,
CGI Asia Pacific SBU

CGI's association with NITI Aayog to nurture innovation through Atal Tinkering Laboratories is closely aligned with its ethos of corporate citizenship. Fostering a diverse talent pool for the future is a core strategy of the CGI Group to contribute towards a more inclusive and sustainable world. STEM Spark, Innovation @ Schools has provided a favourable avenue to pursue this goal. As the stories in this book show, the program has given a head-start to the careers of many budding young innovators at the school level. It has enabled them to discover emerging technologies and fresh approaches for addressing real-life challenges. The students have imbibed many of the essential skills to thrive in today's world, where everyone must keep learning to match pace with the lightning speed of change.

Even more significantly, it has helped to level the playing field for students from varied social, economic and cultural backgrounds. Girls have also shown a tremendous aptitude for technology and innovation, defying myths that identify STEM careers as a male preserve. This spells good news for the future of our nation and the world as a whole. The most pressing problems we face today, across sectors ranging from public health and education to infrastructure and environment, call for the inclusion of diverse perspectives and skill sets. This can accelerate progress towards a sustainable future for all.

Collaboration is often described as an important 21st-century skill, a keyword we emphasize while mentoring young students in such initiatives. Our experience with this program has reinforced our belief in the power of collaboration, not just for students but for all stakeholders in the innovation ecosystem. Our collaborations with the government, educational institutions, communities, and our implementing partner Learning Links Foundation, have generated many enriching opportunities to pursue common goals and interests. We all have a lot to learn from each other, and such partnerships will continue to be the bedrock of future efforts towards fulfilling our social responsibilities.

Nirbhay Lumde
Director- Corporate Social Responsibility
Asia Pacific SBU, CGI

STEM Spark
Innovation Fest
2021

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Message from Chairperson,
Learning Links Foundation

With the rapid change around us, we need to urgently re-examine our beliefs about the essential goals of education. What we need today is not another generation that excels in taking tests but one that views life's complexities as challenges to be tackled with curiosity, creativity and persistence. Young people naturally possess these qualities but need encouragement and support to blossom to their full potential.

It is, therefore, very satisfying to be associated with initiatives such as Atal Tinkering Laboratories and STEM Spark, Innovation @ Schools. The introduction of tinkering, STEM, design thinking and inquiry-based learning in Indian school education is a welcome and much-needed measure. It helps to inculcate a culture of open-ended exploration and 'learning by doing'. Students work with tools and materials, build new things, and test these against ground realities. Young learners are very perceptive about their surroundings. Given a chance, they can find the most innovative solutions for challenges affecting them or their communities.

I recall the words of the legendary psychologist, Carl Jung: "The creation of something new is not accomplished by the intellect, but by the play instinct arising from inner necessity. The creative mind plays with the object it loves." When we set young minds free to play with knowledge, their inherent creativity and love of learning can transcend the limits of abstract theories and codified precepts.

Their sparks of innovation can set the whole world alight.

Such programs also have a crucial role in fulfilling the vision of education as a social leveller. As seen through the stories in this book, disadvantages of social background, economic status and gender become insignificant when transformative learning opportunities are made available. This augurs well for the future of society as a whole. Learning Links Foundation reiterates its firm commitment to all such initiatives that bridge gaps in access and equity to learning, across varied stages and circumstances of life.

Dr. Anjlee Prakash
Chairperson, Learning Links Foundation

INTRODUCTION TO THE PROGRAM

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Just as energy is the basis of life itself, and ideas the source of innovation, so is innovation the vital spark of all human change, improvement and progress.
Theodore Levitt
"

The journey of innovation documented in this book began when the Atal Tinkering Laboratories program was introduced for schools as part of the Atal Innovation Mission (AIM), a flagship initiative of NITI Aayog, Government of India. The focus was on creating a vibrant ecosystem for innovation, which could transform the nation's creative potential into viable enterprises. With the eventual target of creating one million young innovators in India, AIM began to establish Atal Tinkering Laboratories (ATLs) in schools across the country. The labs were envisaged as dedicated workspaces, where students from grades 6 to 12 could engage in 'do-it-yourself', hands-on experiments. To make them future-ready, the ATLs created access to tinkering, computational and design-thinking skills, along with cutting-edge technologies and tools for STEM (science, technology, engineering and mathematics) learning.

For keeping the innovative spark high within young minds, numerous activities were planned: bootcamps, lectures, designing and fabrication of products, regional and national contests, exhibitions, and more. School heads were brought on board to oversee the implementation of the ATL activities within their institutions. Training workshops, manuals, instructional toolkits and other measures were incorporated for enhancing teachers' professional capacities. The program also created opportunities for collaboration with businesses and nonprofit organizations, engendering a dynamic environment where students could benefit from the best possible guidance.

CGI India, an arm of the global CGI Group, came forward to support the ATL initiative as part of its corporate social responsibility. Known for its Information Technology and business consultancy services worldwide, the CGI Group also had a long history of engaging with initiatives for a more inclusive and sustainable world. It had frequently partnered with schools, governmental bodies, non-profit and community organizations to conduct awareness and training programs on STEM. The corporate group maintained a special focus on students from under-represented communities, as part of a strategy for nurturing a robust and diverse future talent pool. There was, thus, a close match between CGI's social impact objectives and the transformational agenda underlying the ATL initiative. This resulted in the sponsorship of the STEM Spark, Innovation @ Schools program for Atal Tinkering Laboratories in 100 schools across 4 Indian states (Maharashtra, Telangana, Karnataka and Tamil Nadu).

CGI India's implementing partner in this initiative was Learning Links Foundation (LLF), a non-profit organization recognized for its educational, training, skilling and self-enhancement solutions impacting all stages of life. The non-profit already had significant experience in operationalizing holistic interventions for enriching lives with learning. It was working along four core pathways: Educational Solutions for Lifelong Learning, Technology and Innovation, Research and Advocacy, and Skill-Building and Entrepreneurship. To support CGI in executing the program, Learning Links Foundation recruited dedicated Innovation Coaches. Their key responsibilities included training the students; hosting workshops for teachers; and conducting "train the trainer" sessions for CGI volunteers so that they could contribute in mentoring the students and teachers.

The outcome of this synergistic multi-stakeholder collaboration can be glimpsed through the stories that form the rest of this book. The response from school heads, teachers, students, mentors, volunteers and the larger community has been heartwarming and overwhelming, to say the least. The collective enthusiasm has continued unabated through the COVID-19 pandemic, in spite of the closure of schools. With online training and mentoring sessions, virtual innovation festivals and hackathons, and a plethora of awards and recognitions for the students' creative projects, the momentum has remained high. If anything, the recent uncertainties have reaffirmed the fundamental vision behind this program. It is a timely reminder that progress means closing gaps in knowledge, not just in resources. In a world of fast-paced changes and inevitable disruptions, it is continuous learning and innovation, above everything else, that can help the human race to deal with challenges and turn them into opportunities. Reassuringly, the young generation of learners associated with this program has picked up the gauntlet of change and swung into action.

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SCHOOL LEADERS AND EDUCATORS

Stories from the STEM Spark, Innovation @ Schools program
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Enabler of Change

Stories from the STEM Spark, Innovation @ Schools program 2019 - 2023

It was the 28th of February, 2020, and India was celebrating National Science Day. There was a festive air inside the exhibition hall at Government High School, Vijayanagar Colony, Hyderabad. Visitors milled around, now pausing to stare curiously at the STEM projects on display, then putting questions to the student teams standing beside the exhibits. Teachers looked on proudly, often remarking to each other that the first Innovation Festival in their school's history was turning out to be a crowd-puller. Listening to the hum of conversation, Principal P. Suresh Kumar was smiling with quiet satisfaction.

Flashback to the time when the Atal Tinkering Laboratory and CGI STEM Spark, Innovation @ Schools had been newly introduced in the school. Principal Kumar had been among its earliest supporters; extending all possible help to the Innovation Coaches from Learning Links Foundation, and encouraging students' engagement in tinkering activities. Every such initiative to enhance students' learning prospects found an ally in Mr. Suresh Kumar - an eclectic scholar, textbook author and winner of multiple awards for excellence in teaching.

However, the one thing about which Mr. Kumar was sceptical was the students' capacity to build complex, challenging STEM projects on their own. He assumed that the mentors and experts would do most of the work, while students would assist or simply replicate their efforts. With over two decades of experience in school administration, the principal had ample reasons to justify his doubts.

Government High School, Vijayanagar Colony, Hyderabad, caters to a large student population from low-income communities. These children struggle against heavy odds to complete their schooling. Their families are not able to support their learning with additional resources, be they home computers, private tuition classes or personal libraries. Students from Mr. Kumar's school have had very limited exposure to educational and technological innovations, such as STEM, project-based learning, design thinking, or programming -- until now!

One fine day, he paid a surprise visit to the tinkering laboratory. He found students absorbed in coding and project-designing, while their mentors stood by, watching but rarely interrupting. The principal was reassured that the program was not spoon-feeding the youngsters, but actually nurturing their critical thinking and problem-solving skills. It was helping his pupils to grow into active learners and creative, independent innovators. In that moment, the sceptic gave way to the whole-hearted believer. To everyone's surprise, Mr. Kumar exclaimed, "I have never felt happier than today, because I have been proved wrong!"

Promising Futures

Stories from the STEM Spark, Innovation @ Schools program
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Increasingly, teachers and school heads are realizing the significance of a STEM program for improving their students' learning outcomes as well as quenching their thirst for growth and development. One school leader who strongly endorses this educational innovation is Ms. Bhuvaneshwari, headmistress at the BBMP School in Chamarajpet, Bengaluru.

The students attending Ms. Bhuvaneshwari's school all belong to the lower socio-economic strata of society, and education is their only ticket out of the lives they have been living thus far. The establishment of the Atal Tinkering Laboratory and the introduction of the CGI STEM Spark, Innovation @ Schools program has had a palpable impact on these youngsters. Ms. Bhuvaneshwari observes that her students have opened up more – not only are they thinking critically and constructively, but also demonstrating augmented reasoning skills.

The Teacher Training sessions organized as a part of the program have also benefited the faculty members at the school. According to Ms. Bhuvaneshwari, her teachers diligently look forward to each training session, so they may better identify ways to help their students.

Within the vast network of schools run by Bengaluru Municipal Corporation, the BBMP School at Chamarajpet has proven to be a model institution, boasting of one of the best-maintained tinkering laboratories. Ms. Bhuvaneshwari is very proud of this, stating that students and teachers from other schools in the vicinity never miss a chance to visit her school, and actively take part in innovation fairs and events hosted here.

Ms. Bhuvaneshwari strongly believes that the use of technology in education is of vital importance, and that adequate infrastructure is crucial to maintain and boost her students' progress. She also emphasizes the critical role that parents play in their children's education. She would like to see more active engagement from their side, believing that parents and society must join hands with the school system to help fill the gaps that exist in the education domain.

Ms. Bhuvaneshwari warmly acknowledges the contributions of the Innovation Coaches from Learning Links Foundation, who have diligently supported her students and staff. She looks forward to a long and fulfilling continuance of the school's association with the program, for the betterment of her students' futures.

Torchbearer of Progress

Stories from the STEM Spark, Innovation @ Schools program
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"A society that is progressive has schools with progressive leaders". Mr. Maheshwar Rao, a postgraduate and Ph. D. in Biology, exemplifies this thought. After years of experience as a teacher at various private schools, he was drawn towards making a difference in society; and so, in 2015, he accepted a position as the principal of Telangana Model School, Shankarpally, a state-run school that he inaugurated and established from scratch.

From infrastructure to the selection of the best teachers, Mr. Rao has done a commendable job at providing quality education to his students, who belong to poor and educationally backward communities. Hence, when he was approached with an offer to associate his school with the STEM Spark Innovation @ Schools initiative, he readily accepted! "No school in the district or state had such state-of-the-art STEM Laboratory facilities. It was the first time we had heard about it and I am honoured that our school was chosen for it", says the principal with happiness and pride.

In spite of a busy schedule and numerous responsibilities as the principal, he has shown active involvement and cooperation in setting up and running the Atal Tinkering Laboratory. He visits the laboratory regularly and is highly impressed by its style and design, the educational resources, activities and workstations.

Thus, Telangana Model School has been a STEM innovation centre since 2019. It has shown exemplary performance by its students in the field of STEM. "Our students are enthusiastic about making projects in the laboratory. With the guidance and mentorship of Raj Kishore and Sameer (Innovation Coaches from Learning Links Foundation), the children are creating models that break new ground and solve social problems, making us proud. Wherever they go to showcase their projects, they bag the top prizes!", says Principal Rao with joy.

Mr. Rao generously gives credit to the program in helping to make the Telangana Model School one among the best in Telangana. He singles out the Innovation Coaches for special praise for their constant support, enthusiasm and zeal, before and during the COVID-19 pandemic. The program has given students a platform of exposure where they don't just learn but explore and create.

"I wish our school continues to get the support from the program, as I am immensely happy to see my students grow and my school advance", says Mr. Rao.

Quest for a Meaningful Education

As the headmistress of Perunthalaivar Kamarajar Government Girls Higher Secondary School (PKGGHSS), Ambattur, Chennai, Ms. S. Vanitha Rani has around 3000 students under her care. She has served for over sixteen years as a physics teacher, and seven years as a school leader. The veteran educator still remembers a time when simple experiments and projects were the only means for her pupils to get a practical understanding of the concepts described in books. Today, she feels gratified to see students working with robots, sensors and 3D printers in her school's state-of-the-art Atal Tinkering Laboratory (ATL).

Ms. Vanitha Rani is full of praise for the ATL and the CGI STEM Spark, Innovation @ Schools program. She credits these initiatives with catalyzing the right ambience for innovation and technical education in her school. Under the guidance of the Innovation Coaches from Learning Links Foundation, girls have not only taken to tinkering and project-designing with great enthusiasm, but are also winning laurels at prestigious competitions and events. A student was recently selected for the World Mathletics Program, while three others were shortlisted for the Aroma Innovators Award. In the pan-India ATL Marathon 2021, a project from this school was among the top winners.

Realizing the importance of technology and innovation, the dedicated school leader does her best to encourage students' engagement with the program. She has appointed two teachers to facilitate the tinkering activities in the school. Currently, the Innovation Coach from Learning Links Foundation visits the school on two days every week. Given the large number of students, Ms. Vanitha Rani is keen to have a full-time Innovation Coach, who can support the school throughout the week.

The innovation events organized in the school have witnessed a massive turnout of students. The young learners' families have also responded positively. Even during the COVID-19 pandemic, parents have permitted their wards to visit the school for special tinkering sessions, while adhering to health and safety protocols. In the near future, Ms. Vanitha Rani plans to organize 'community tinkering days', where children from nearby schools and localities can also participate.

When asked about her message for the larger academic community, she replies, "Foster innovation and creative thinking among students. This is the only way for education to result in any practical benefits for students and society". Because of the STEM program, as she has observed, pupils have become more attentive to community issues, and are 'thinking outside the box' to find solutions. She feels positive that these young people will not only have successful careers but also contribute meaningfully to the world around them in future.

Educate to Empower

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023
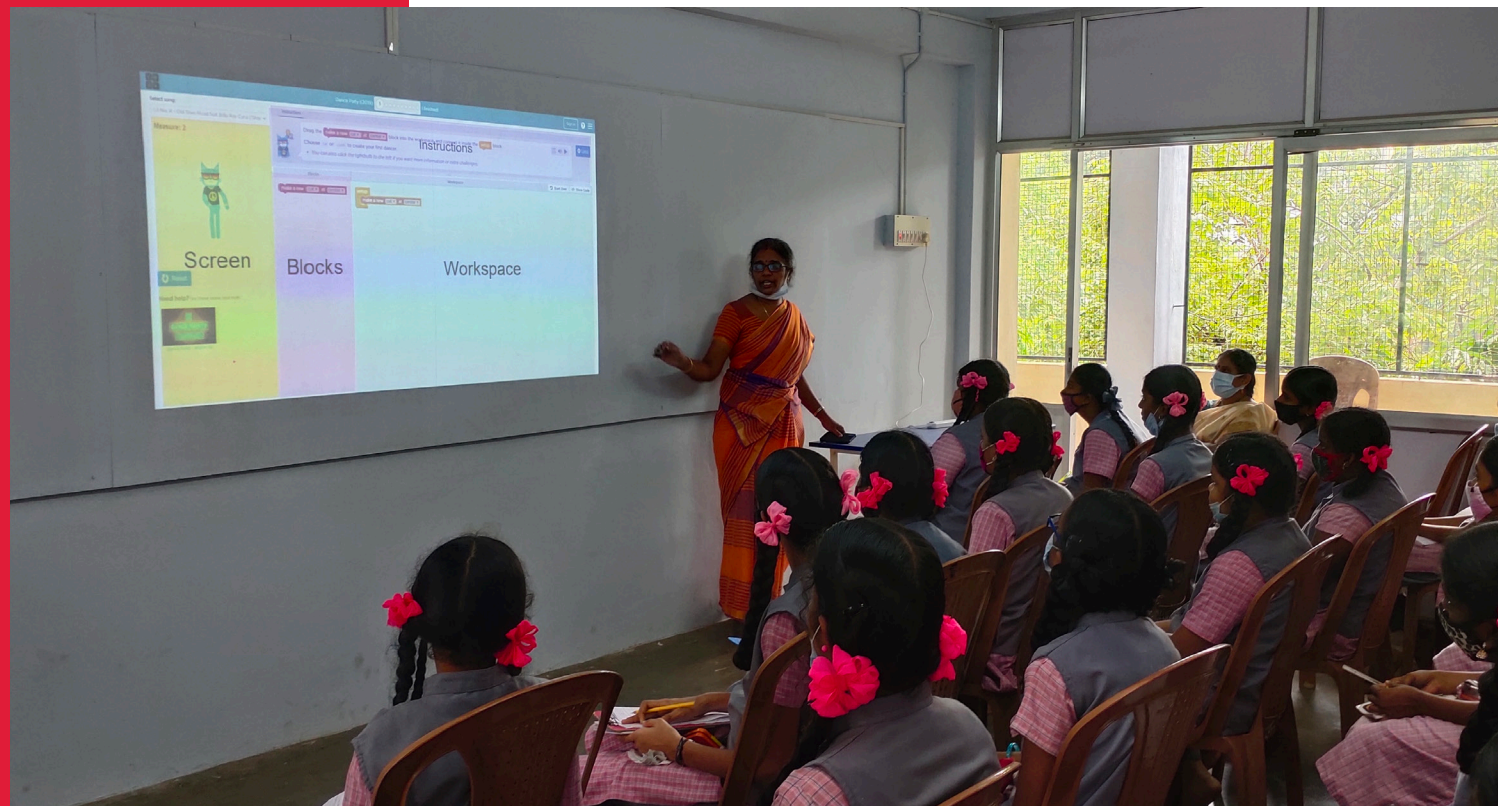
Meet Ms. Sujatha and Ms. Selva Kumari, teachers at Perunthalaivar Kamarajar Government Girls Higher Secondary School (PKGGHSS), Ambattur, Chennai. Their pupils at PKGGHSS belong to underprivileged backgrounds. Many of them work part-time at convenience stores and the local vegetable market. Along with the pursuit of jobs and studies, the burden of household work also falls on these young shoulders.

Understandably, educating these girls is no mean feat, particularly when classes have to be conducted online because of extended school closures during the COVID-19 pandemic. "We face a lot of challenges in teaching these students. They do not have mobile phones and are forced to use their fathers' devices for online classes. We can only teach and interact with them before 7:30 AM and after 9 PM. In some of the households, if the father is an alcoholic, the evening classes have to be cancelled," says Ms. Selva Kumari. "Many students have limited data on their phones. How can we insist on data plans, when we know that they can't afford it?" adds Ms. Sujatha rhetorically.

These economic and social dynamics, being a part of the students' upbringing and environment, had deeply affected them. The girls were diffident and lacking confidence. This, further, manifested as a hesitance to speak up, an apprehension of the outside world and a complete refusal to dream big.

However, the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program have brought a turning point in the lives of these students and their teachers. "Our students thoroughly enjoy the different activities in the tinkering laboratory. They have learnt so much about the latest technology," shares Ms. Sujatha. "We have also undergone trainings in STEM activities. It has been a fantastic experience," Ms. Selva Kumari says with childlike excitement.

With the help of Mr. Veerapathiran-- the Innovation Coach from Learning Links Foundation-- the teachers have engaged students in exploring different tech tools, participating in competitions and quizzes, and showcasing their innovations at different forums. Furthermore, they have helped the girls become aware of diverse career opportunities associated with the STEM fields, and pushed them to discuss these with their families.

Ms. Sujatha and Ms. Selva Kumari have witnessed a great transformation in their students' personalities. From operating smart classrooms and laptops, to taking up leadership roles in the class, the girls at PKGGHSS now show confidence like never before. Modest and unassuming as these teachers are, they do not realize how much their own zeal and motivation have contributed to this change-- along with the consistent support from the program.

A truly empowered student is one who is motivated and equipped to question the dynamics of reality around them, in order to effect change and improve society. In this process of creating empowered students, teachers have very significant roles to play. Ms. Sujatha and Ms. Selva Kumari are fine examples of this. Wouldn't you agree?

STUDENTS

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New Horizons

Stories from the STEM Spark, Innovation @ Schools program
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Opportunities seldom come knocking, but when they do, the ones who make the most of them truly succeed in life. One such example can be seen in the case of Sahil and Jitu, recent grade 10 pass-outs from Navi Mumbai Municipal Corporation School, Rabale.

Both Sahil and Jitu had always harbored a strong interest in science, technology and innovation-- looking up to role models like Elon Musk, Bill Gates, and Steve Jobs. However, until their introduction to the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program, these bright young boys were only exposed to theoretical knowledge in their favorite subjects. Thus, while they had ideas galore, they lacked adequate practical know-how to convert these into reality.

Sahil and Jitu made good use of the new opportunities offered by the program, attending the tinkering sessions two to three times a week. Here, they learnt more about subjects like Robotics, Artificial Intelligence, and Coding – in addition to tinkering with toolkits and the 3D printer. Putting this experience to good use, they came up with an innovation to aid the elderly and disabled members of society. This was part of their Smart City project, with features that make everyday life accessible. With tremendous support and guidance from the Innovation Coaches of Learning Links Foundation, these young students continuously fine-tuned their model. Even during the lockdown necessitated by the COVID-19 pandemic, the two students—with support from their school principal—carried on with their project-building in the ATL. Sahil and Jitu participated in numerous school competitions and external innovation events, receiving accolades and recognition along the way.
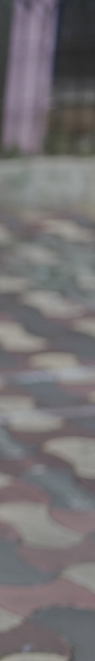
Reflecting on this period, both students feel that the program has given them a new lease of life – allowing them to finally get hands-on practical experience and apply their theoretical knowledge to solve problems around them. The exposure received has made them both more confident as individuals, and there is a vast improvement even in their communication and presentation skills. In fact, seeing them, many of their peers in school now also take a greater interest in the tinkering program, and are inventing creative solutions of their own.

Sahil and Jitu receive immense support from their respective families – with both sets of parents being very proud of their children's accomplishments. Their school principal and teachers, who appreciate and recognize the boys' passion and thirst for learning, also encourage and help them.

Now in Junior College, both Sahil and Jitu have chosen science as their subject for graduation, and with all the learning from the school STEM program, they are a step closer to emulating their idols.

"I Want to be a Computer Scientist!"

What are the typical answers that you get when you ask a 14-year-old girl what she aspires to be when she grows up? In all likelihood, she would say that she either wants to be a teacher or a doctor. Growing up, children have maximum interactions with professionals from the teaching community or the field of medicine. Consequently, their world is limited to the school and the neighborhood dispensary. Two sprightly girls, Farah and Namira, have proven to be exceptions to this rule. They have been inspired by a school laboratory to use some tools, their creativity and courage to challenge the conventions.

Farah and Namira are among the keenest learners in the Atal Tinkering Laboratory and CGI STEM Spark, Innovation @ Schools program. Studying at Anjuman-Islam School, Mumbai, they dream of becoming computer scientists. Inventive, interested and inquisitive is how Ms. Chhaya Marbate, the Innovation Coach from Learning Links Foundation, describes the two grade 9 students. Both girls joined the program when they were in grade 8. "We didn't know anything about technology then. But now we know how to code, develop phone applications and connect circuits," says Farah enthusiastically. "It is too much fun! Even in our free time, we engage in tinkering", adds Namira, with a sparkle in her eyes. They strongly believe that each school should have a tinkering laboratory like theirs. Needless to say, they can't stop talking about their love of the laboratory, with all its interesting components, and more importantly, the physical and mental space it gives them to innovate.

Thanks to the diverse STEM activities they have participated in, Farah and Namira have now become junior tech experts. The two girls together have developed a 'Drink and Fitness' app to help users practice a healthy lifestyle by providing steps of conducting fitness activities and helping users track their water consumption. They participated in the STEM Girls competition held in their school, where they made an earthquake sensor alarm and designed automatic streetlights. Using the MIT App Inventor web application, they have also developed a zoo-visiting app to give a virtual zoo tour to school students.

Farah and Namira wish to simplify modern living by generating solutions to societal problems, from inequity in education and waste management to road traffic and easing daily chores. Armed with all their STEM knowledge, these are two budding scientists who are out to change the world! Here's wishing them a bright future full of new achievements in technology and innovation.

Charged-up with Energy

Mayank Rajguru, a class 11 student of Shri Chhatrapati Shivaji Vidyalaya in Gavhan, Ahmednagar, is an astute and perceptive boy. His father, who himself studied only till the 12th grade, runs his own business now, and aims to provide his son with the education he never received. With the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools initiative arriving at Mayank's school, the young boy's learning journey has been greatly accelerated. Making the most of this opportunity, he has honed his knowledge on a range of subjects, and now looks at life through a very keen, inquisitive lens.

Trying to relate what he has learnt from the program to solve real-world problems, Mayank has taken cognizance of how most people tend to charge their mobile phones while they are asleep at night. They often let the charger run till they wake up the next morning. This practice results in tremendous electricity consumption, and also negatively affects the battery health of the device.

This led Mayank to invent the Energy Saving System – by making use of a relay in an electric circuit – specifically, using the relay to break the circuit at a certain time once the phone is charged.

After studying the theoretical as well as practical dimensions of a relay, and related concepts, Mayank proceeded to create a model of the same, placed inside a switch board. He made use of another model (to be operated using a mobile phone via Bluetooth) so as to convey the signal. To create the same, he consulted with his Innovation Coach, and made use of the MIT App Inventor to create the application which would help tie his project together cohesively.

All this was challenging work – Mayank spent months on end working diligently on this project. His efforts culminated in a final test run of the device, which went off just as planned. Being a perfectionist, Mayank also upgraded the setup to switch off lights automatically, so that users would not need to wake up just to do so after going to bed. This was an idea he executed keeping his grandparents in mind.

With such dedication and diligence as he has exhibited, we are sure Mayank will come up with a slew of useful innovations in the near future. We are glad our program has helped him see the world in a new light.

Turning Theory into Practice

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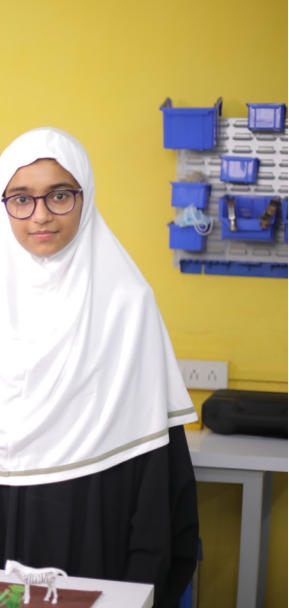
Ayesha, Huda, and Saniya are three young, promising 10th graders studying in Anjuman I' Islam Saif Tyabji Girls High School, located in Mumbai Central. The launch of the Atal Tinkering Laboratory and CGI STEM Spark, Innovation @ Schools has proven to be a boon for them and their schoolmates. All the students participating in the initiative have demonstrated increased understanding of theoretical concepts, as well as commendable progress in practical knowledge.

Ayesha, Huda, and Saniya had previously studied about crop production and management as a part of their science syllabus. While doing so, their attention had been drawn to the fact that, more often than not, crops are damaged by the animals and birds who come to feed on them. This results in a reduction in farmers' production capacities, often leading to severe financial losses.

Using the theoretical knowledge acquired from studying the subject at school, and the practical experience gained from the STEM program, these three students have come up with an invention of their own – the Crop Protection System. To help farmers protect their crops from wild animals and birds, the girls came up with the idea of placing a laser beam at one corner of the farm, with corresponding mirrors at the other three corners.

The laser beam is then reflected from one mirror to the others and eventually detected by the LDR sensor. Once this process occurs, it automatically triggers the buzzer, which alerts the farmer of the presence of wild animals in the farm.

Initially, when in the R & D stage of the project, the three friends had played with the idea of creating a circuit design, making use of ultrasonic sensors. However, after multiple rounds of iterations, they realized that this technique would not help them accurately detect the presence of wild animals from all sides of the farm - eventually leading the three innovators to make use of laser beams and an LDR sensor.

This innovation is a very significant one, given how it has far-reaching applicability – with farmers around the country facing the very same problem that the Crop Protection System aims to deter. We eagerly look forward to more practical, hands-on solutions from these students in future, and are thrilled that the program is encouraging young minds to translate their learning into out-of-the-box inventions.

Learning with Fun and Creativity

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Adarsh Sonkamble and Swadeep Bansode, grade 9 students at Navi Mumbai Municipal Corporation School No. 104, Rabale, were in class one day, when their teacher decided to quiz the students on the history of the different states of India. To their utter dismay, the boys noticed that their classmates were unable to answer most of the questions, with some even struggling to names of the capital cities of different states of India. In fact, the entire class was feeling a sense of remorse for not knowing these basic but vital answers.

Adarsh and Swadeep decided to do something about it, so that everyone could be well-versed with information about the country they all grew up in. With their prior exposure to the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program, the minds of the duo were already buzzing with ideas for applying technology to solve everyday challenges.

As luck would have it, at around the same time, the Atmanirbhar Bharat Abhiyan – a flagship program of the Government of India-declared they were organizing a competition titled 'Toycathon'. They encouraged students, teachers, start-ups, toy experts and professionals to ideate on the conceptualization and execution of toys or games, with a focus on subjects related to Indian civilization, heritage, culture, mythology, history, ethos, technology, national heroes, and important events.

Keenly motivated by the impetus to impress at such a stage, Adarsh and Swadeep came up with what they named the 'Indian Aurora' - a remote Doll, operated through a mobile app. When prompted, it would respond with pertinent information about a particular state in India. Our students made good use of what they had learnt from the STEM program. They started by designing a 3D Doll using the Grab CAD Community, eventually printing the design onto the 3D Printer using PLA filaments. After multiple rounds of iteration, the Doll was fully ready. The students then worked to create the mobile application for the same, adding pertinent information and facts for all the states in India, after which this toy underwent a final round of testing.

Adarsh and Swadeep's deep-seated passion to help their classmates, and those around them, is commendable; and in the times to come, we hope to see many more such thoughtful contributions from these bright students.

Chalking Up a
New Achievement

Stories from the STEM Spark, Innovation@Schools program
2019 - 2023

Yashraj Balasaheb Survase, a class 10 student at Prithviraj Kapoor Memorial High School, Loni Kalbhor, Pune, has been described by his teachers and peers as not only very meticulous and sincere in his studies, but also extremely observant of his surroundings. When the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program were introduced in his school, Yashraj showed tremendous interest. He often spent hours on end at the Laboratory, and paid close attention to every word uttered by the Innovation Coaches from Learning Links Foundation.

Yashraj had noticed how, during classroom sessions, all his teachers faced the same problem – while cleaning the blackboard, the dust that arose from it made them cough and wheeze. After doing some research by himself, Yashraj realized that this chalk dust contains large amount of toxins. When inhaled, these cause instant irritation to one's respiratory system, and repeated exposure to the same can even result in life-long respiratory illness.

Realizing the sheer magnitude of the problem, Yashraj utilized his learning from the program to create the Automatic Blackboard Cleaner - a mechanism by which the duster will automatically clean up the board, using mechanical linear and circular motion systems. He also made provisions for the chalk dust particles to be collected in a compartment placed just below - to be later extracted with a vacuum cleaner, thus avoiding their circulation in the air.

The process of designing the Automatic Blackboard Cleaner was a long, time-consuming one. Yashraj spent months on end clarifying the concept, ideating with his mentors and tinkering in the Laboratory. After multiple rounds of iterations and testing, his determination and perseverance to succeed bore fruit, and his innovation is now already being utilized in his school.

This particular invention is one of high utility, addressing a widespread problem that teachers around the country have been grappling with for years. With his first major innovation now out of the way, Yashraj is now eager to move onto another project, and we cannot wait to see what he comes up with, next!

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Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

The Grassroots Innovators

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Mauli Patil, Adarsh Suryawanshi and Shivam Ranbavle are the best of friends. The three 9th graders of Navi Mumbai Municipal Corporation School No. 104, Rabale, all hail from Latur and Shengaon (agricultural regions in the state of Maharashtra). Coming from families that often struggle to make ends meet, they have always been keenly engaged in their studies. The introduction of the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program has significantly broadened their horizons.

Enthusiastically participating in every STEM session, tinkering in the laboratory, and hanging on to every last word of their trainers, these students have shown remarkable development. They have translated their learning from the program into their very own invention – the Mini Agrobot. Mauli, Adarsh and Shivam all belong to families that have been traditionally engaged in agriculture. As we are all aware, an average day in the life of a farmer is tedious, exhausting, and strenuous, to say the least. This is the main source of inspiration behind the boys' innovation.

In the hope of leaving such a life behind, the parents of all three students had migrated to the city years ago, leaving the farming lands in the hands of their elders (the children's grandparents). During the extended school closures caused by the COVID-19 pandemic, Mauli, Adarsh and Shivam got the opportunity to return to their native villages. They stayed at their grandparents' houses, often accompanying them to the fields – and this opened their eyes to the struggle and hard work undertaken by farmers daily.

Deeply moved by what they had seen, the three students came up with the idea of designing a robot that can be operated using an electronic device (such as a mobile phone), capable of undertaking the three toughest tasks in agriculture - ploughing, seed sowing and levelling the ground. After extensive research and learning sessions with their trainers on the topic of robotics, over a period of ten months, the trio successfully created the Mini Agrobot. The robot was tested in their school's garden, and proved to be a resounding success.

This is a grassroots-level innovation that stands out for its sheer practicality, and wide-spread scope of usage. Once successfully tested further, it can play a pivotal role in easing the lives of countless farmers across the country.
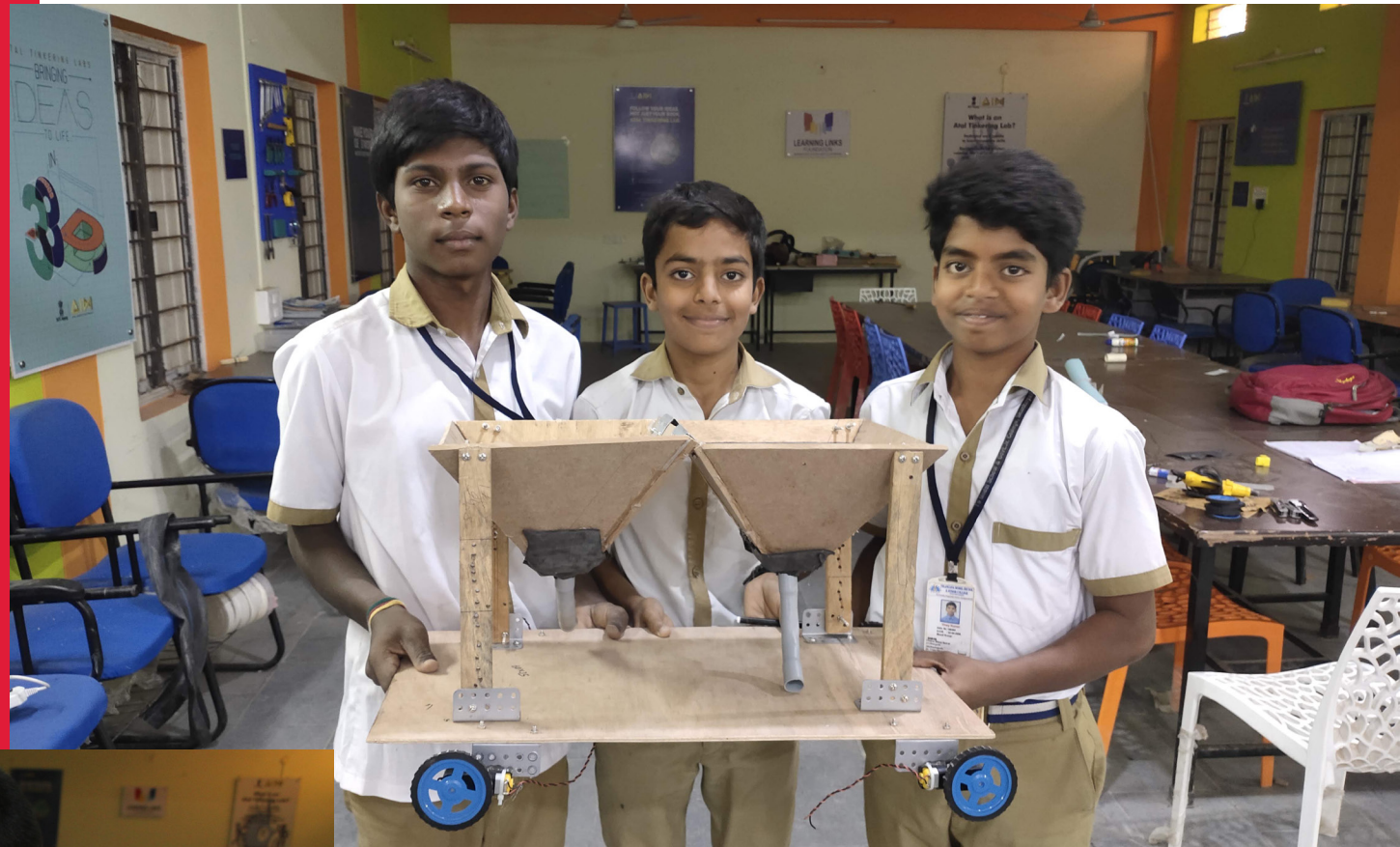
Solving Real-World Problems

Stories from the STEM Spark_Innovation @ Schools program
2019 - 2

'Amer' and 'Nandeesh' are two names that have become synonymous with innovative projects at Telangana Model School, Shankarpally. The two best friends, hailing from farming backgrounds, recall the time when they were just like other children of their age. Studying in grade 8, they used to attend school, play with friends, and help their parents. In their free time, they enjoyed working on simple motor-operated machines used in farming. However, they had no proper guidance or facilities at school to turn this hobby into a passion.

One day, they witnessed a STEM showcase boot-camp, which quickly captured their attention. The Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program had just been introduced, and the boys became fascinated with the possibilities opening up before them. The Innovation Coaches from Learning Links Foundation were quick to spot the hidden potential in Amer and Nandeesh. Under the mentors' guidance, with just one hour a day at the ATL, the boys began to make projects, using technologies that they had barely heard before. Now, the two were more excited to attend the tinkering sessions than any other class at school!

Amer and Nandeesh had often noticed their fathers face difficulties in the manual dispensing of fertilizers on their fields. To tackle this problem, the boys created an automatic fertilizer dispenser. This was presented at the CGI STEM showcase in Bangalore, and

bagged the first prize at the science festival held in IIIT Basara. Amer and Nandeesh had now become the famous young project techies, for whom nothing seemed impossible.

With ample support from their mentors and families, the boys have built various other projects. Notable amongst these is a non-human intervention temperature scanner with hand sanitiser, which has been installed at their school to protect security guards from the COVID-19 infection. At a young age, these boys have channelled their curiosity into solving problems around them for their families, school and community. Wider recognition continues to pour in. Both the fertilizer dispenser and the temperature scanner have succeeded at the district level of the Government of India's INSPIRE Awards-MANAK, and have made it to the state-level shortlist. Plans are also underway for patenting the fertiliser dispenser innovation.

"Before, we did as we were told by our teachers. We did not think for ourselves. But now, we observe curiously and try to find out how things work and how to develop them. We think, discuss and find solutions," says Amer with a wide smile. "The mentors are like our friends. We feel like going to the tinkering laboratory and making new projects every day. The STEM program has given us the support to turn our hobby into a passion and the confidence to showcase our innovations," chimes in Nandeesh, his eyes twinkling in excitement.

The Inspired Inventor

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023
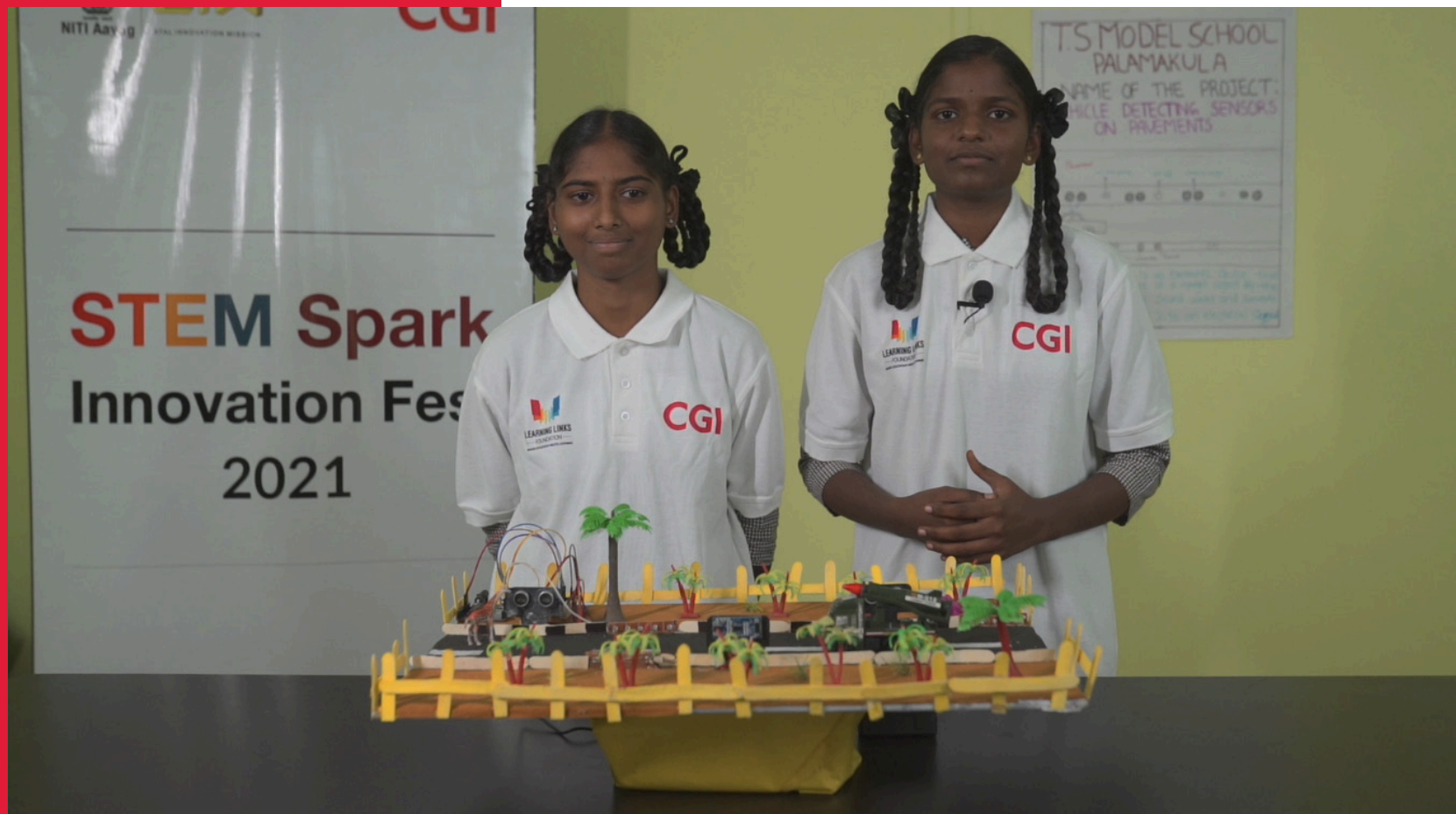
Born to a family of modest means, Lalugani Srija, from Shamshabad, Rangareddy district, always harboured a strong liking for the social sciences. However, for the class 10 student at Telangana Model School, Palamakula, life took an unexpected, yet positive, spin three years ago, when she was first exposed to the Atal Tinkering Laboratory and CGI STEM Spark, Innovation @ Schools program.

Srija has, over the last three years, been consistently attending the tinkering sessions two to three times a week. Even during the lockdown caused by the COVID-19 pandemic, she attended the online classes and sessions, connecting through an Android phone. At times, she encountered problems because of poor network connectivity in her village – but that did not stop someone like her with a steely resolve to learn. She would call her classmates who had attended those sessions and note down all that she had missed. Before her involvement in the STEM program, she used to spend her free time playing with friends - now, she prefers to use it to observe, reflect, and innovate. She is still passionate about volleyball, however, and continues playing the sport, routinely.

Utilizing her learning from the program, Srija has created two projects. The first is an Obstacle Avoidance Robot, which can identify hurdles using ultrasonic sensors and then modify its path accordingly. Her second innovation is a Vehicle Detection and Lighting System. Observing the lack of streetlights in her village, she has up with this novel solution to avert crimes as well as accidents. Working on sensors, lights on the pavement are activated whenever they detect movement on the road. This novel project was submitted for the Government of India's INSPIRE Awards - MANAK, and was shortlisted at the district level.

Srija believes the tinkering program has made learning more hands-on – enabling application of theoretical knowledge to innovate and solve real-world problems. Mentorship from Learning Links Foundation's Innovation Coaches-- and her participation in STEM activities, events and competitions-- have made her more confident as a person, as well as a better communicator. She firmly believes that every school should have a tinkering laboratory, as students otherwise miss out on these vital opportunities for experiential learning.

Srija has blossomed as a student innovator, with everyone in her family – her mother, as well as her two older sisters-- supporting her ambitions. She also receives unconditional support from her principal and teachers, who are proud of her accomplishments.
Srija aspires to become a police officer, and wishes to implement her knowledge of technology in her future career. She believes everyone should have practical knowledge of technology, no matter which walk of life they are in.

Stories from the STEM Spark, Innovation @ Schools program

Electrifying Success

Stories from the STEM Spark, Innovation @ Schools program 2019 - 2023

Meet Sahitya and Vandana, batchmates in grade 10 at Government High School, Vijayanagar Colony, Hyderabad. Sahitya's family has migrated all the way from Paralakhemundi in Odisha to Hyderabad in Telangana. They get by on her father's wages from his labouring job, and dream of a more prosperous future. Vandana's father, also a manual worker with basic education, looks forward to the day when his daughter will get a degree and embark on a rewarding career.

Fortunately, Sahitya and Vandana have access to a well-equipped Atal Tinkering Laboratory at school, and are part of the CGI STEM Spark, Innovation @ Schools initiative. They are enjoying the opportunity for experimenting with the latest STEM tools, seeking out-of-the-box solutions for everyday situations, and benefiting through the guidance of the experienced Innovation Coaches from Learning Links Foundation.

A commonplace incident, during a long school break, caught the two girls' attention. On the last working day, students had forgotten to turn off the lights, fans and other electrical equipment in the tinkering laboratory. When the school reopened, everyone was conscience-stricken on realizing how much energy had been wasted.

"Electricity saved is electricity generated": the slogan, promoted by their state power distribution company, was echoing in the thoughts of Sahitya and Vandana alike. They went to their mentors to discuss how such episodes could be prevented. Then, a brainwave struck them. What if the electrical fixtures could be connected to the internet? Then, even if the Laboratory was closed, anyone in a remote location would be able to turn the switches on or off.

The girls gave their project a catchy title, 'Hi-Wi-Fi'. It involved connecting an ESP 32 microcontroller, with inbuilt Wi-Fi, to a set of relays for switching the electric gadgets on or off. The ESP 32 was linked to Sinric Pro, whose API key would be used for communication between the devices and the Alexa mobile app. The ESP 32 was programmed by using Arduino IDE. The ESP 32, relays, transistors, resistors, diodes and capacitors were soldered onto a general-purpose PCB. It took multiple iterations before the prototype was perfected. Yet, the cost for assembling it was surprisingly modest – between Rs. 1500 to 2000.

Looking back, Sahitya and Vandana realized how much they had learnt. The whole experience had pushed their boundaries. However, the best was yet to come! The local media noticed and reported the achievement by the two school girls, filling their parents' hearts with pride and joy.

Vision into Reality
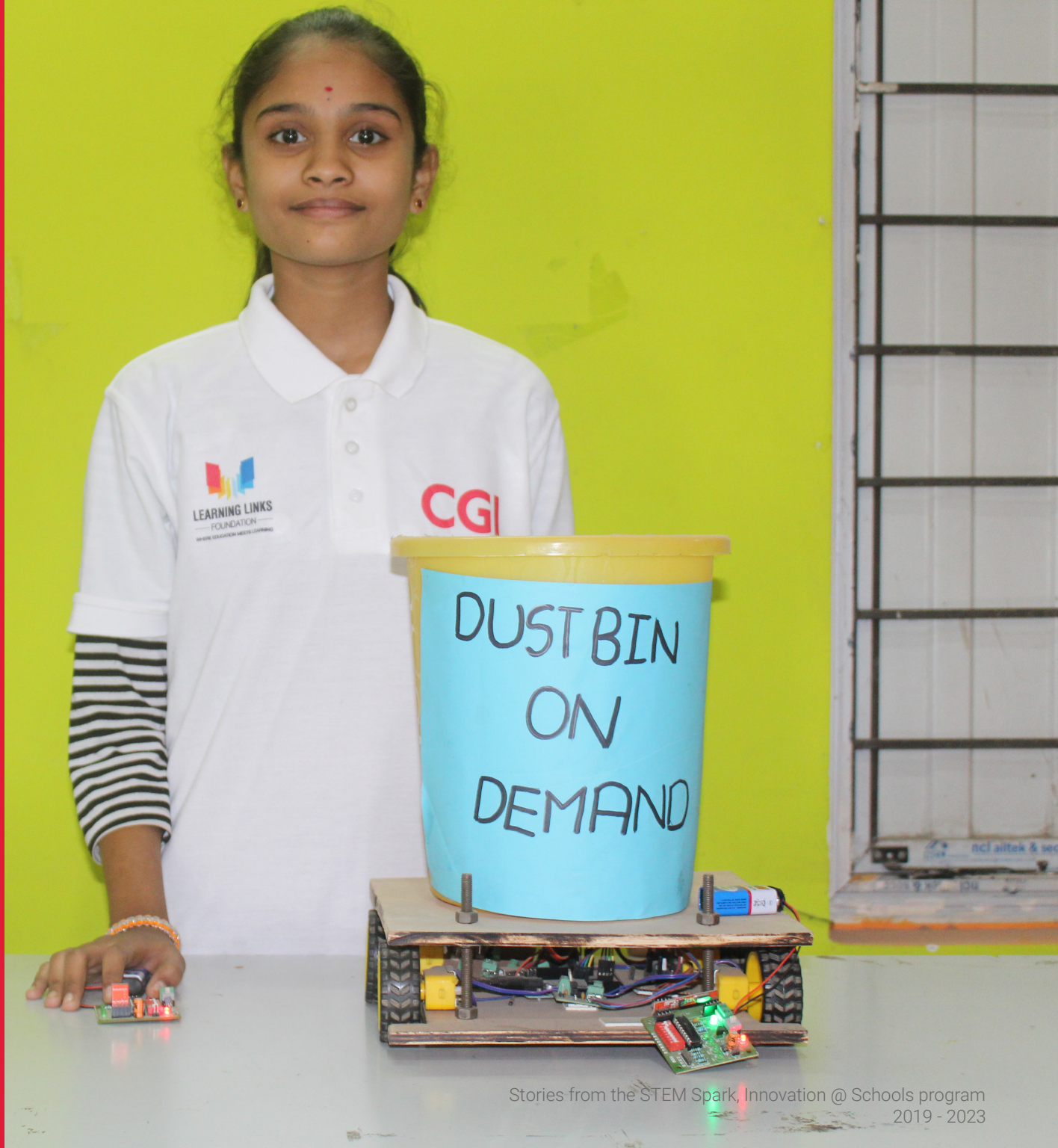
Sparkling eyes and a winning smile make Sloka stand out in a crowd. This young resident of Donthanpally village studies in grade 8 at the Telangana Model School in Shankarpally. Sloka's lively mind is often exercised by the 'why's and 'how's of the day-to-day occurrences in her surroundings. Access to her school's Atal Tinkering Laboratory and involvement in the CGI STEM Spark Innovation@ Schools program are two factors that have further whetted her appetite for investigating challenges.

One day, she was seized by the idea of creating an efficient system to maintain spotless cleanliness at all times in her school's ATL. She knew it was easier said than done! Students, by and large, were habituated to littering their surroundings. Moreover, with the prevailing hot and dry climate, it took next to no time, after a clean-up, for dust to accumulate again on various surfaces.

Musing over these circumstances, Sloka suddenly recalled what she and her classmates had learnt about line follower robots during STEM sessions. What if the same principle was employed to automate the process of collecting dust and garbage? It would create a 'Dustbin on Demand', responding to the pressing of a button, and navigating to the points from where trash needed to be collected. After waiting for a few seconds at each point, allowing the trash to be poured into its receptacle, the dustbin-robot would return to its original position.

Sloka tried out the concept in her school tinkering laboratory. While it sounded beautifully simple in theory, building and repeatedly testing the prototype took all the patience she could muster. At times, the mechanism would fail to respond in the ways she expected. Luckily, her mentors were by her side to encourage and support her. Thus, the bright young girl was able to give a concrete shape to her vision of keeping the Laboratory immaculately tidy.

Needless to say, the 'Dustbin on Demand' is adaptable to a large variety of places and situations. The use of Artificial Intelligence for waste management has great scope in India, and innovations like this can effectively support the ongoing nationwide programs such as Swachh Bharat Mission and Smart Cities Mission, which emphasize environmental cleanliness. It is heartening to see young students like Sloka using their creativity to apply contemporary technology for tackling some of the most basic social issues of our times.

Solving Community Challenges

Stories from the STEM Spark Innovation @Schools program
2019 - 2022

Tania and Ayesha are 8th graders attending the Singareni Collieries Aided High School in Yellandu, Telangana. Coming from similar backgrounds, they are aware of the sacrifices made by their working-class parents to raise and educate them. The Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program have provided these students with much-needed opportunities for exploring technology and the latest tools of science, engineering and mathematics. Under the watchful eyes of the Innovation Coaches from Learning Links Foundation, both girls have become confident in applying their new-found knowledge to solve the common challenges they notice every day.

Living in a region with a large agrarian population, Tania and Ayesha have often observed, and heard about, the toil and struggles of farmers. Multiple farming operations, such as ploughing, levelling, sowing seeds, spraying fertilizers, and weeding, require the use of different types of machines. Not only does this call for a heavy investment of time and effort, but the resulting expenses can also be prohibitive, for small and impoverished cultivators, in particular. The girls wondered: How could they make this process more cost-effective, and also reduce the burden of tedious physical labour for the farmer? They engaged in intensive brainstorming and research, till the answer came to them one day: a versatile mechanism to support multifarious operations on the farm.

Nicknamed the 'Multi Agri Device', Tania and Ayesha's solution is actually a vehicle to which various implements can be attached as needed. To begin with, the farmer connects a plough for tilling the field; then, replaces it with the leveller that evens out the upturned soil. Next comes the seed-sower, which embeds seeds at precise and equidistant intervals on the field. Whenever needed, the weeder or the fertilizer sprayer can be attached to the same contraption, to get rid of weeds or to spray the crops.

Testing this all-purpose apparatus meant frequent trips to outlying farms, for which the students usually needed the assistance of their mentors. However, this did not dampen their enthusiasm; and, to their joy, they found their mechanism working perfectly well on the fields. The project was showcased during the 2021 STEM Spark Innovation Fest, bringing widespread appreciation for Tania and Ayesha.

Winning
Laurels

The effective results being yielded by the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program become palpable upon interacting with students of PKGGHS School, Ambattur, Chennai.

Parvin Banu, a grade 9 student, has transferred to PKGGHSS from another school, primarily to have access to the STEM program. Parvin is a diligent student and an English language enthusiast, who loves drawing in her spare time, while also enjoying badminton and tennis matches with her friends. Parvin loves every moment of the STEM program, having attended over 60 tinkering sessions held specifically during the lockdown, to ensure continued learning. With the guidance and encouragement of her mentors, she has gained immense knowledge of subjects such as App Development, Game Development, 3D Design and Circuit Boards.

Parvin Banu has worked on a range of projects, and has showcased them at events such as the ATL Marathon, besides participating in the International Mathletics event. When school is open, she makes it a point to regularly attend the tinkering sessions, held twice a week. She is excited about her latest project, a "School Girl's Safety Bag", that has a circuit and panic button attached, to alert authorities when the user is in danger. She also dreams of venturing further into Robotics, having simultaneously started work on a Talking Robot.

Muthulakshmi, another 9th grade student, has always been interested in science, and the STEM program has proved to be a catalyst in her life. The demure young student, who spends her free time reading literature, has been attending the tinkering sessions for 2 years now, and has taken a keen liking to Robotics in particular. Muthulakshmi has participated in a number of events thus far; but the shining jewel in her repertoire is the fact that she took part in the International Mathletics, and secured the 1st rank in Tamil Nadu, even getting featured in the local media and newspapers. She looks forward to absorbing more about STEM subjects, with a special focus on Artificial Intelligence.

PKGGHS has seen a tremendous response to the STEM program, with students showing high levels of engagement, and even winning laurels for the school. With each passing day, we hope the spark of change and creativity the program has ignited in every learner's mind continues to grow and shine brighter.

STEM for Agricultural Research

Food is a necessity for life. But how often do we remember our farmers, who go through countless hardships to provide us with the meals on our plates? Today, the Indian agricultural sector is plagued by problems such as insufficient water supply, soil erosion and climate change, which affect the lives of our farmers. One substantial issue is the growing demand for crops due to the ever-increasing population, and corresponding decrease in fertile agricultural land. We need to find solutions to this problem to ensure food security in the country.

Afreen, Harshini and Hemavathi, students of class 11 at PKGGHSS, Ambattur, Chennai, belong to socio-economically deprived communities. They have observed at close quarters the conditions of Indian farmers. The girls are inherently inspired to make a difference in farmers' lives. They had been actively involved in the projects created through the CGI STEM Spark, Innovation @ Schools program in their school. The Atal Tinkering Laboratory has provided them with opportunities to develop problem-solving skills and design thinking processes, equipping them to give shape to their ideas. With the research guidance and the resources available at the Laboratory, the three girls have come up with the idea of making 'Colour Photonics', which can measure the growth of crops under different coloured lighting conditions.

They hypothesised that the rate of growth of plants is affected by different lighting conditions. During their research, they kept the plants under study in a dark room, with exposure to artificial light LEDs in a continuous spectrum range, and observed them for a particular duration. The technique was not only energy-efficient but also gave the best possible growth performance. The results showed that the rate of plant growth indeed varies with different light conditions. Unlike generally assumed, the growth of plants under green light was retarded, whereas plants under red light seemed to grow faster, and plants under yellow light showed almost similar growth to plants under red light. Their hypothesis was thus proved right.

The team concluded that a controlled light quality in the cultivation environment can speed up the plant growth process and significantly increase the end-product's market value. This project model can be used for grafting of vegetable seedlings, seed production, vertical farming. and production of aromatic and medicinal plants. "We are keen on finding innovative agricultural techniques. Our main aim is to increase the agricultural produce to feed to the growing Indian population," says the excited Afreen.

STEM as Life-Saver

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023
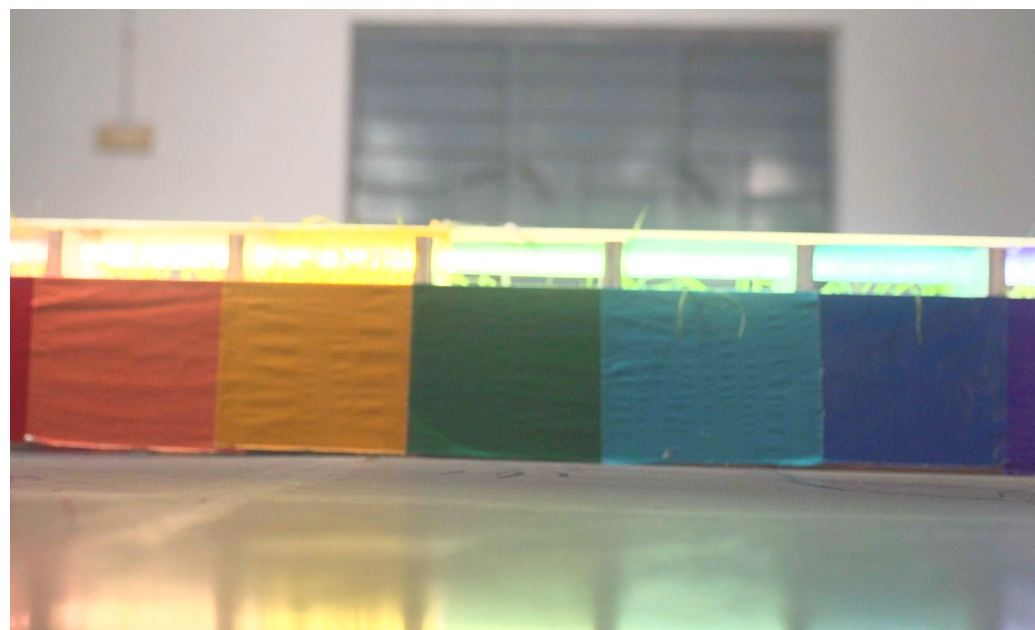
Carelessness is a common human trait, and no matter how vigilant we are towards our own and our loved ones' safety, sometimes simple mistakes lead to disasters. The skills of disaster management and safety, although extremely important, are still not emphasised at schools, colleges or even at our homes as we grow up. One of the most dreaded mishaps is cooking gas (Liquefied Petroleum Gas) cylinder leakage during domestic usage, which, in case of a running electric supply being present, may produce a spark, causing a blast with a loud explosion. Hence, the presence of a cooking gas cylinder poses serious life risks in domestic situations.

This problem was the focus of research for Anupriya and Krishika, students of class 10, Government Girls Higher Secondary School, Ashok Nagar, Chennai. The Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program infused them with research skills that helped them solve real-life problems. Before, they had never imagined the plethora of innovations possible with curiosity and technology. Skills like problem-solving and critical thinking, which remained overlooked in regular textual studies, were now being developed among the students.

With the training they received from making STEM projects, they were able to think independently; and took upon themselves a challenge to create a project to help the community they live in. Using the tools available at the tinkering laboratory, the girls built a system called 'LPG Gas Suction and Alert System', which could detect cooking gas leakage and turn off electric power automatically. In technical terms, they used a lighter which, when exposed to the gas, gets detected by an MQ2 sensor. This then rings an alarm for a few seconds, after which the power supply of the whole circuit turns off automatically.

Anupriya and Krishika are confident that this system will help reduce accidents due to the flow of electricity during the leakage of LPG in domestic households. Moreover, this project can save people with disabilities; people who are visually-impaired can be alerted by the automatic alarm, and the hearing-impaired can be alerted with an LED feature. This automated system can ensure the safety of our households like never before. The duo is elated by the achievement, and Anupriya speaks for both when she says, "Flow of electricity during gas leakage may cause accidents, with people losing their valuables and loved ones. We were very happy to develop a system to reduce such accidents and also alert the hearing- and sight-impaired people. We hope that this system will be useful to society."

Have a Safe Journey!

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

The introduction of tinkering and STEM education at Government Higher Secondary School, Avadi, Chennai, has been working wonders in the lives of the girl students. Otherwise, they might have remained aloof from technological advances in the world, getting too little exposure to research and design to be able to pursue careers in related fields. With the establishment of an Atal Tinkering Laboratory and the inception of the CGI STEM Spark, Innovation @ Schools program, these students are learning to think, design and test hypotheses, and seeing the world with countless innovative possibilities. They have also started discovering many ways to use technology responsibly for the needs of people in their community and society at large.

Meena and Rajeswari, studying in class 10, were only speculating about their interests and career options when STEM and tinkering were brought into their school. Having a keen interest to learn new things, they decided to explore what the program had to offer. The hands-on training and experiment-based teaching methods helped them gain the confidence and skills to use STEM tools in creating simple machines. In less than six months, they began thinking critically and creatively about solving the technical problems around them!

Being highly motivated, the girls decided to build a machine to reduce road accidents in the country. They learned from their research that, in India, 74% of vehicles use high beam lights that lead to tragic accidents. The bright beam from the headlights, while driving at night, causes a discomforting glare to the driver travelling from the opposite direction. It may even cause temporary blindness, leading to a collision. Although the intensity of the beam can be adjusted manually, most often the drivers forget or find it difficult while driving.

Hence, Meena and Rajeswari worked on automating the process. Using STEM tools, and the constant support from their trainer, they designed an 'Automatic Dim and Dip Headlight System'. This system can automatically control the headlight glare according to the intensity of light from the opposite vehicle. The light sensor in the system senses the bright light from the approaching vehicle, and automatically switches from high beam to medium or low beam mode, reducing the glare and risk of accidents.

With this success, the girls are now thinking of pursuing careers in the fields of research, engineering or even programming. All of these may have never been possible had there been no exposure to STEM at their school. The program has helped girls in this school to dream beyond their circumstances and aspire to shape India's future in technology.

LDR SENSOR

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023
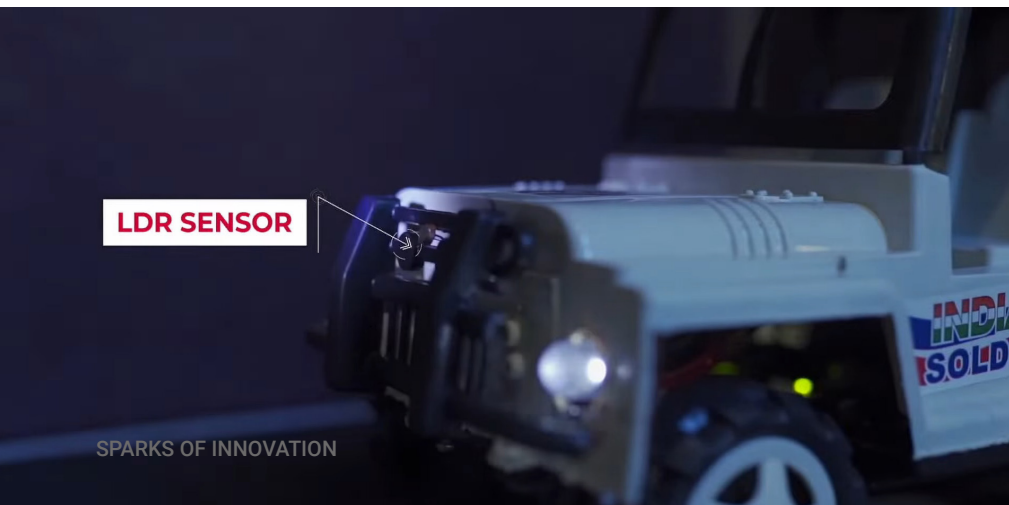
A Clean Sweep!

Cities in India have seen exponential growth in the last decade, not just in technology and infrastructure, but in terms of a population surge. As a result, these cities face a massive garbage disposal problem, which is a by-product of an exploding population, poor urban planning and systemic dysfunction. This scenario disturbed Monisha and Mahalakshmi, class 9 girls living in a low-income locality in Chennai. While going to school, they crossed railway stations and bus terminals and observed people throwing trash wherever they wished, due to sheer apathy or inability to find a dustbin.

The girls resolved to take the matter into their own hands. They explored their locality, talking to people and understanding the reasons for the negligence towards proper garbage disposal. Something had to be done to stop people from littering the surroundings. Monisha and Mahalakshmi had been regularly attending the Atal Tinkering Laboratory and participating in the CGI STEM Spark, Innovation @ Schools program at their school. Here, they had been trained to solve everyday problems by combining curiosity with technology. They put their knowledge of STEM towards finding an innovative solution for the problem they had observed in their city. After much thought, they came up with the novel idea of an 'Automated Moving Trash Bin', which would move on the backline around the railway platform. Now, instead of people moving to the dustbin, the dustbin would come to them!

With the help of robotics, to which they had been introduced in the ATL, the girls successfully built a trash bin that was capable of moving around the platform. It would allow people to throw the trash in it at their convenience. The bin has other special features such as giving an alarm once full, LED lighting, an automatic opening and closing lid, and an automatic hand-sanitiser dispenser. In spite of many awareness drives and vigorous efforts undertaken by the government, garbage disposal still stands as a major problem across the country. The automatic bin can solve this and encourage people to keep their surroundings clean. Monisha and Mahalakshmi strongly recommend that this trash bin should be widely used across railway stations, bus terminals, theatres, schools, hospitals, shopping malls, airports, roadsides, beaches and other public places; and indeed, it is of grave necessity in highly populated cities. In Monisha's words, "Today, we made a small innovation to dispose the trash in, but in future, this will be a great help to our lives and our society. With this small change now, we can have a great life in future."

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Innovation in the Face of Crimes against Women

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Crimes against women represent a serious concern around the globe. This is certainly the case in India, where, even in the 21st century, girls and women feel trepidation while stepping out of their houses, not just in small towns and villages but in metropolitan cities, too. Parveen Banu and Kalaivani belong to Chennai, a city where the crime rate against women is lower than many other cities in the country, yet it's far from being a crime-free and safe haven for women.

Parveen and Kalaivani live in an economically backward community, where most people are illiterate and helpless in the face of crimes. Girls feel insecure staying out of their homes alone and till late hours. The incident that jostled Parveen was when a 16-year-old girl was kidnapped while she was returning from school. Something as simple as going to school became a life-threatening experience. Following this, people became fearful of sending their daughters to school, and the attendance of girls saw a decline.

With a lack of safety, how would women live their lives freely? Inflamed by this question, the girls decided to find a solution. They had been attending the tinkering sessions at their school, which had not only given them an opportunity to learn innovative techniques and skills, but also ignited their curiosity and creativity. With their knowledge of STEM, and the will to eradicate crimes against women, these students took upon themselves a project that would ensure that all women and girls could travel safely.

Upon evaluating the situation, by talking to school-going girls and working women in their locality, they discovered an interesting fact that most women carry bags when they go out. This inspired Parveen and Kalaivani with the idea of creating a "Safety Bag with Emergency Alert and Tracking System". Using the tools available in the tinkering laboratory, they built a device that can be conveniently placed in the secret compartment of the bag. In case of a crime, this device is capable of generating an emergency alert message and also sending an SMS with location details to the registered mobile number of the emergency contact person.

The project did not just prepare the girls with research skills, but also gave them an opportunity to connect with their community, with a vision of adding value to the lives of people around them. "Girls' and women's safety is a burning issue, due to the increasing crime rates against women these days. I'm very happy that our safety bag project tackles this issue, and hope that it will be beneficial to society at large", says Parveen Banu.

Out of
Harm's Way

Road accidents remain a cause of concern in the country, due to unsafe roadways, poor traffic management, rash driving, and violation of traffic rules. Sangeetha, Moghana, and Monisha, students of class 11 at the Government Girls Higher Secondary School, Avadi, Chennai, have chosen road safety as the topic for research and innovation. The three girls are keen participants in the Atal Tinkering Laboratory activities and the CGI STEM Spark, Innovation @ Schools program.

Sangeetha, Moghana, and Monisha found that one of the most common types of road accidents are mishaps with trucks and lorries on national highways. Over-speeding, driver fatigue and sleepiness are reported to be the most common reasons for road accidents among truck drivers. Falling asleep on the wheel can have serious consequences, as there may be major accidents and people may even lose their lives. Looking closely at the issue, the girls saw that a shortage of drivers available to truck fleet owners often leads to overburdening of work on truck drivers, with long working hours, thereby reducing their resting time and causing fatigue while driving.

Sangeetha, Moghana and Monisha put their STEM caps on to find a solution to this grave problem. Crossing many hurdles and challenges in their way, they finally developed a device called a 'Sensitive Smart Glass' for drivers. The idea was that, while driving, the device will alert the user if he/she falls asleep, avoiding accidents and saving lives. The device is in the form of wearable glasses with an eye blink sensor that can detect the eye movement of the driver wearing the glasses. While driving, if the driver falls asleep, the sensor can detect the stoppage of eye movement. A buzzer will then ring, to alarm the driver, and the vehicle engine will turn off automatically. This system will be especially useful for people who travel long distances and to those who drive late at night.

"We are happy that the sensitive smart glasses will provide the safety precaution that is needed for drivers and for the protection of lives of innocent people on the roads. We hope that this device will stop the accidents on road occurring from a small mistake of falling asleep", says Sangeetha, echoing the thoughts of her teammates Moghana and Monisha.

SENSITIVE SMART GLASSES

EYE BLINK SENSOR
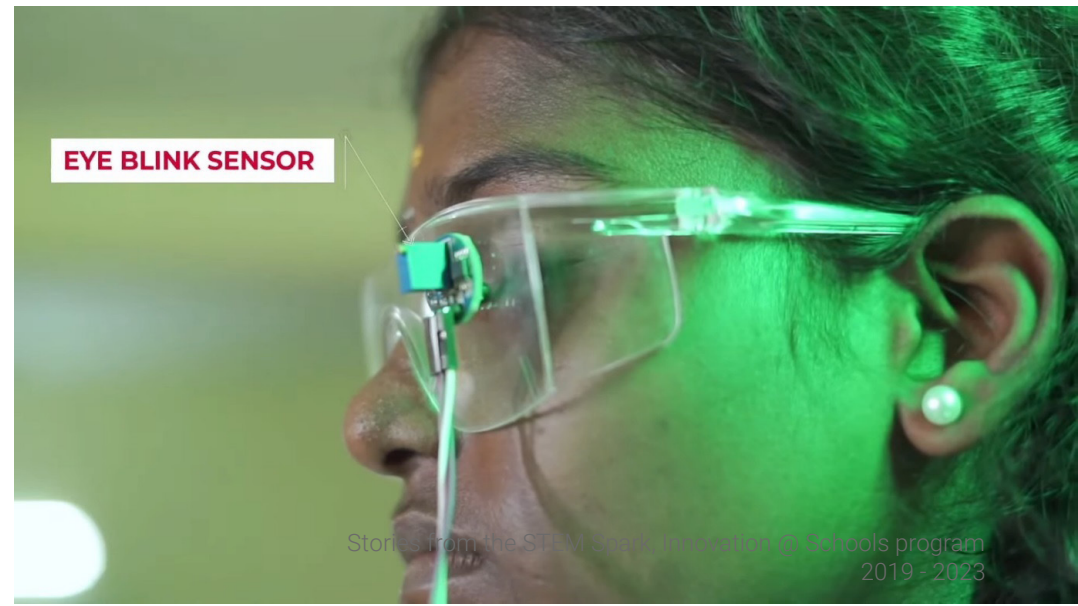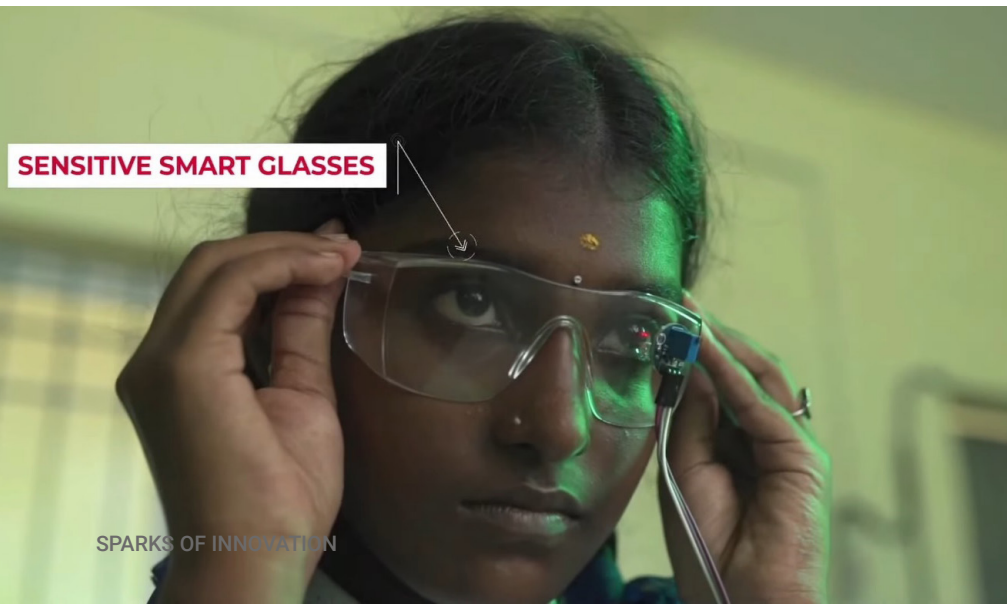
A Device to Detect and Dispense the Indispensable

Pavithra and Sangeetha, studying in class 9 of Government Girls Higher Secondary School, Avadi, Chennai, were among the most enthusiastic attendees at their school's Atal Tinkering Laboratory and keen participants in the CGI STEM Spark, Innovation @ Schools program. Belonging to an economically deprived community with low literacy levels, they had no prior exposure to the concepts of STEM that were included in the curriculum of most private and international schools. The girls had, therefore, been fascinated with the wonders of technology that the program showcased.

It is a general misconception that, as compared to girls, boys are better at subjects like robotics and mechanics. Pavithra and Sangeetha, always interested in the working of machines, now had an opportunity to break the stereotype. Under the guidance of their STEM trainer, they discovered their interests and honed their skills. But, COVID-19 struck the world in 2020, unfortunately shutting down the schools. In spite of the ensuing challenges, STEM training continued via online sessions, ensuring no lockdown on learning and curiosity for the students from intervention schools. With over 20 million people affected and over 50 lakh deaths having already occurred globally, the students of the STEM program brainstormed ways to fight the pandemic and help their communities, in whichever way possible. With this determination, Pavithra and Sangeetha pondered over the means to break the chain of infection using technology. They observed that the negligence of people in using face masks posed a serious threat. and was a leading factor in community transmission. The girls came up with an innovative solution by developing an 'Automatic Face Mask Detector with Mask Dispenser', which could be deployed at doors and entrances. The PIR sensor in the device detects people coming through the door, the in-built application checks whether the person is wearing a mask or not, ringing an alarm in case of no masking. The device can also dispense a mask.

Masks, being indispensable in the pandemic, are sometimes unavailable or unaffordable in poorer communities, and are more often neglected, even if accessible. Hence, this system will be a gentle reminder to people for the safety of all humankind. In the words of Pavithra, "For prevention of COVID-19, wearing a face mask is essential while going outside or meeting others. We were very happy to develop a device to detect and dispense the face mask. With this device installed in every house, office and public place, we hope to reduce the spread of COVID-19 in our community and country."

SPARKS OF INNOVATION

Glimpses from the STEM Spark, Innovation @ Schools program 2019 - 2023

Connecting the Dots

SPARKS OF INNOVATION

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

When nurtured with the right inputs, students can do wonders – and that is exactly the case with Mohammad Siddique, Sandeep Kumar and Soundararajan, students of BBMP High School, Chamarajpet, Bengaluru. These promising young pupils have been in the good books of their teachers for years, and have showcased tremendous progress since being exposed to the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program.

With a keen passion for science, Siddique and Soundararajan were naturally attracted to the components of the STEM program. Sandeep, who has always nurtured a love for history, was also, inevitably, drawn to it, by the sheer desire to learn more about the workings of the world around him.

Before exposure to the program, all three students used to pay attention to their education – but often wasted their free time. There has been a sea-change in their thought processes ever since. Now, they often use their free periods in school, and any spare time available, to tinker and innovate, for a minimum of three hours, daily.

The program has helped develop a keen sense of innovation in these students, and has enabled them to create tailor-made solutions for problems plaguing society around them. In the last two years alone, these students have created a multiplicity of projects, including a Home Automation system (to assist the elderly and disabled alike live with ease), an application to avoid and monitor Food Wastage, a Rainwater Harvesting system (to help farmers), and Automatic Street Lights (running on sensors).

Spotting the brilliant innovations being churned out by these students, the principal and teachers of BBMP High School have shown immense support and encouragement to the boys. Under the guidance of the Innovation Coaches from Learning Links Foundation, the three students have also participated in a number of competitions. They even got the opportunity to meet and interact with the CGI President at Bengaluru, on his visit from Canada. During this memorable event, the boys also learnt more about drones – technology that absolutely had them in raptures.

The program has exposed them to a host of new subjects such as Robotics, Artificial Intelligence, and Programming. It has helped them connect the dots between problems and possible solutions. In future, Siddique wishes to become a scientist, Sandeep an entrepreneur and Soundararajan a Civil Services officer. With the immense potential being currently shown by them, we eagerly look forward to them achieving all their dreams, and hope for many more handy innovations along the way.

Innovating for Efficiency

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Haripriya, a class 9 student of Government High School, Abbigere, Bengaluru, is a sharp, diligent young girl, who sees education as a solution to provide a better standard of living for her family. Her parents, deprived of comparable educational opportunities in their younger days, somehow manage to scrape through a living. This is a situation she wishes to rectify.
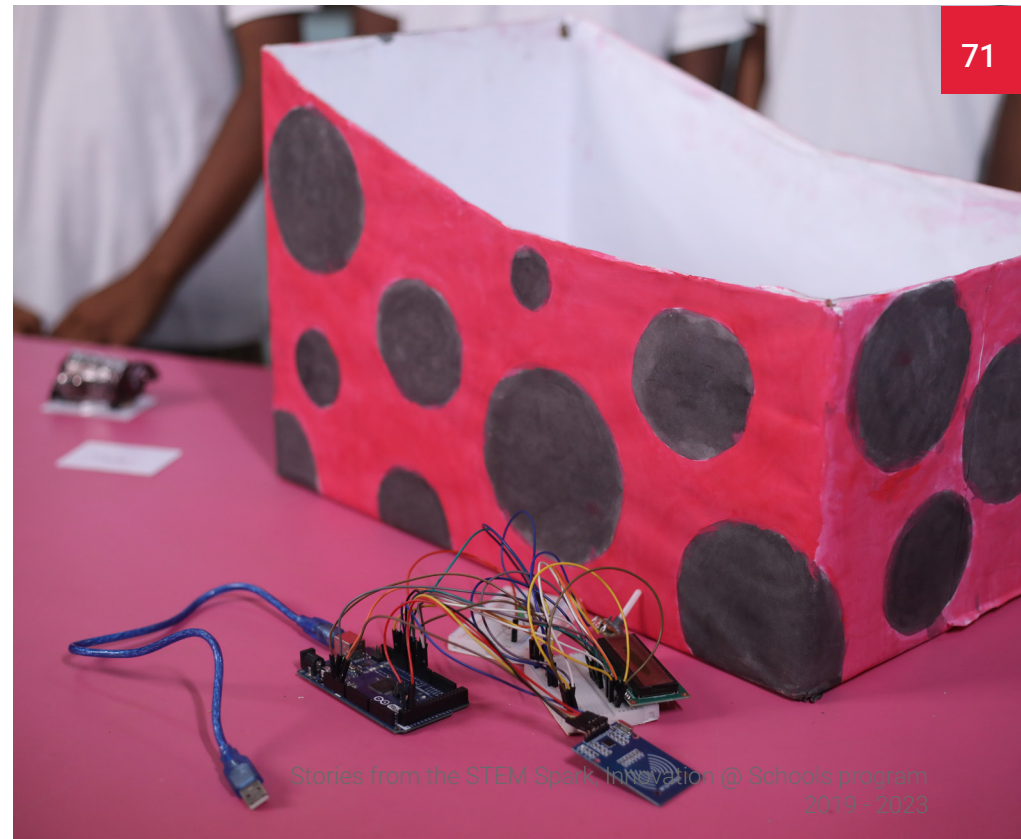
The introduction of Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools initiative brought about a sea-change in the thought process of her peers, and Haripriya was no different. The lessons (both theoretical and practical) greatly helped to hone her skills, while also pushing her to think of how her innovations could impact the world around her.

Having had the opportunity to visit certain shopping malls in her vicinity, Haripriya has frequently witnessed that customers have to drag around their trolleys, all over shopping floor, adding products along the way as per their needs. By the time the shoppers reach the billing counters, they are usually greeted by long queues for checkouts and payment, which prove to be extremely time-consuming. To abate this problem, Haripriya has come up with the idea of a 'Smart Trolley' – operating on the concept of an RFID.

With these Smart Trolleys, customers can undertake the billing themselves, as the process is fully automated. This innovation incorporates the use of RFID tags instead of barcodes. The RFID tags are pasted on every product. Each trolley is specifically designed to have an RFID Reader on it, for the purpose of scanning the product. Arduino is used to store the data, safely and securely. To aid the entire process, Haripriya has also incorporated the use of 16x2 LCD display screens to show product names, costs and expiry dates. Once a product is removed from this smart trolley, the customer has to press the deduct switch, after which the requisite

amount for that item is automatically added to the total bill.

When asked why she specifically chose this topic to address through her project, Haripriya stated that, on every visit to the malls, this had been a consistent observation of hers. Hence, she decided to come up with an innovation that would not only save the customers' time, but also enable an efficient and quick form of business for store owners, ensuring uniformity, accountability and transparency.

Shaping Futures

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023
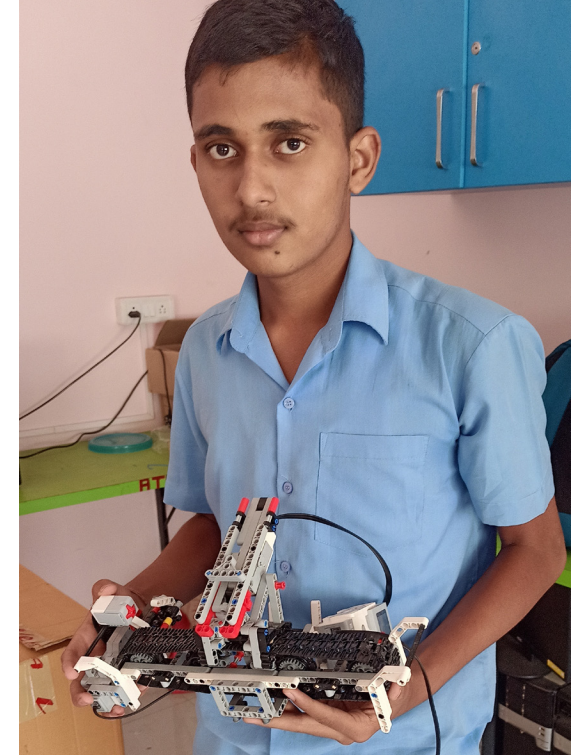
Young minds are attracted in the direction of subjects that are made simple, interesting and fun, not just to study, but also pursue as careers. Students involved with the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program at Government High School, Peenya, Bengaluru, are perfect examples of this.

Prajwal, Dhanush, Manoj and Raghavendra study in this school -- from the 8th to 10th grades. The four friends have been attending tinkering and STEM sessions under the guidance of Mr. Karthik, the Innovation Coach from Learning Links Foundation. Together, they have worked on various projects to solve social problems. Some of the innovations they are currently creating include: a mechanical hand, a brain control wheelchair to help the disabled, an automatic garbage disposal and segregator truck to help the garbage collectors, hydroponic farming for agriculture, and an automatic billing trolley for shopping at malls and other pick-and-pay centres.

Such technological creations have been made possible by the students' exposure to motors, sensors, robotics, 3 D printers and other tools and items at the tinkering laboratory. Even during the difficult times of lockdown, their learning continued via online sessions where they learnt programming, coding and application

development, which are now their favourite subjects! "In a regular class, we study lessons and appear for exams. But in the ATL, we learn to create, understand new concepts and know the working of different machinery. We find it much more interesting than our regular classes", says Manoj, while his friends smile broadly in agreement.

An interesting by-product seen in tinkering laboratories across many schools is that the students are now not just more aware of the latest technology but have become better at communication skills. They feel more confident explaining their projects and having discussions in spite of the barriers of their native languages. With their experience at the ATL and the support from their coach, these students are now determined to pursue careers in fields such as mechanical engineering, science and research, machinery manufacture and business. The laboratory has not just provided them a platform to explore STEM, but given them a purpose for life.

"The students are very enthusiastic. Initially, I used to guide them in making projects, but now, they come up with their own ideas and work on projects by themselves", says Mr. Karthik with pride.
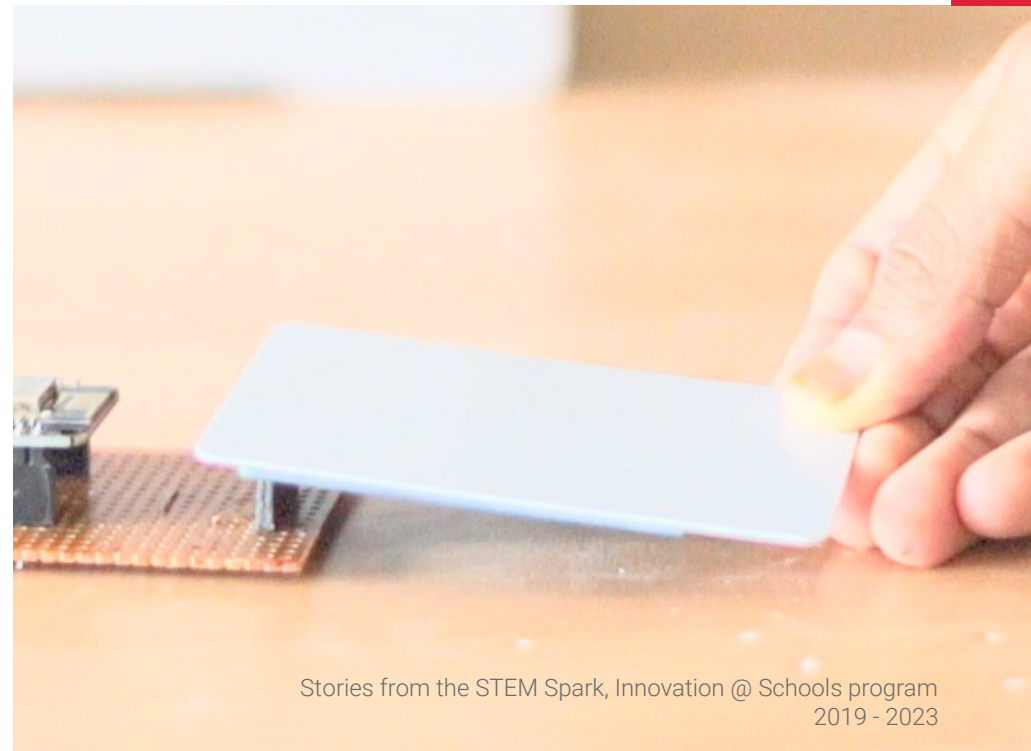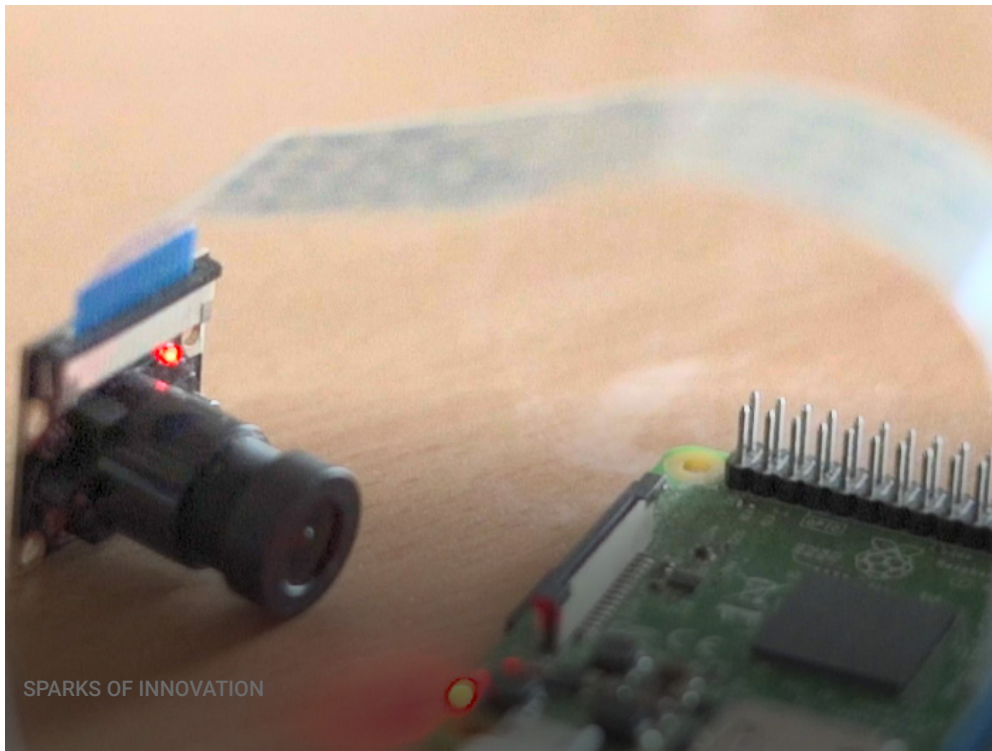
Optimizing Teaching-Learning Time

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

The introduction of the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program has proved to be boon for Keerthana, a bright grade 9 student of Government High School, Peenya, Bengaluru. Coming from a family with modest levels of schooling and income, the young girl is keenly aware of the vitality and significance of a sound education. With the tinkering and STEM activities in school, she now has access to a wider range of subjects, along with constant handholding and mentorship from the Innovation Coaches of Learning Links Foundation.
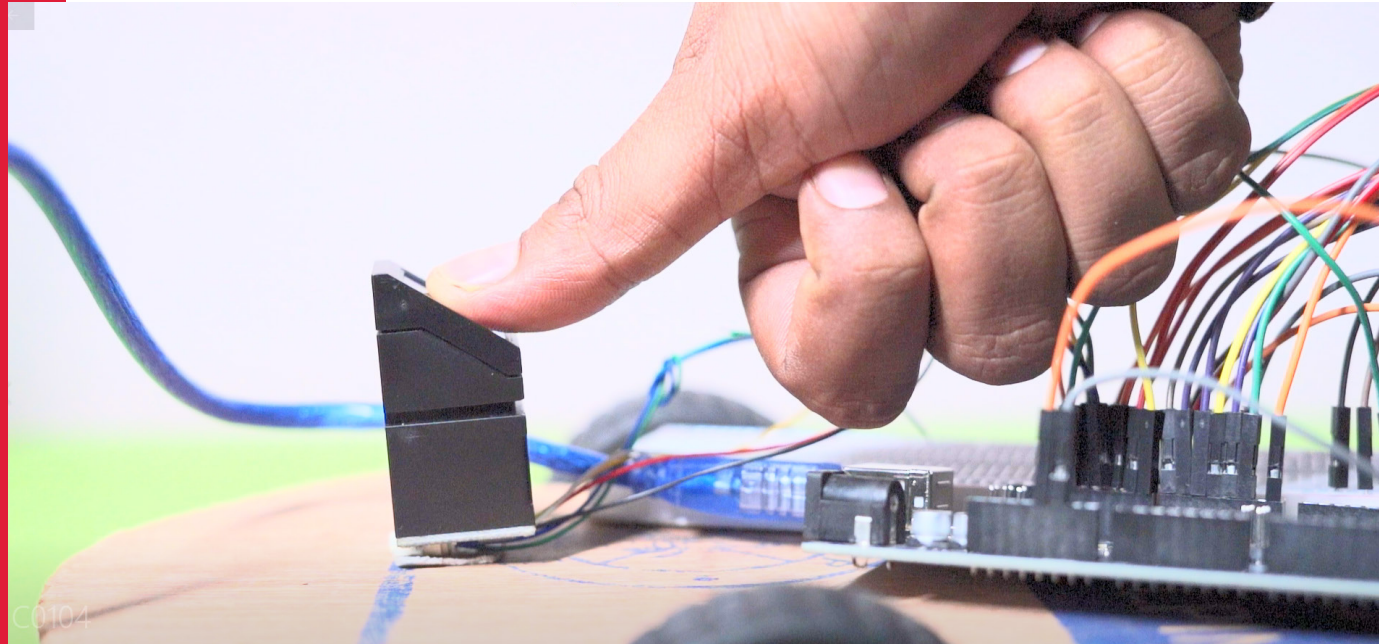
Making use of what she learnt from the program, Keerthana decided to come up with the Smart Attendance System, to be used initially in her school, with other schools hopefully following suit soon. Keerthana, being highly observant, had noticed that, in any school, the process of taking attendance is a long and tedious task for teachers, cutting into the valuable time that should be utilized for teaching and learning.

To accelerate this routine task, Keerthana's system makes use of a RFID Card reader as a Student ID card, ensuring that whenever a student enters or leaves the class, the RFID card reader automatically takes cognizance of the same, with real-time attendance data being then logged onto the central database. The database is shared with the teachers and school staff on a regular basis, with provisions even being made to utilize a facial recognition system to mark attendance. Keerthana has utilized a range of components for this project such as RFID cards, Raspberry Pi Camera, and Arduino Nano, all of which she has learnt about through the STEM program in her school.

The Smart Attendance System, designed by Keerthana, will prove to be very helpful to teachers, ensuring they spend less time on attendance, and more time teaching. Her project has a wide range of applications, and can be scaled significantly to cover schools and colleges across the country.
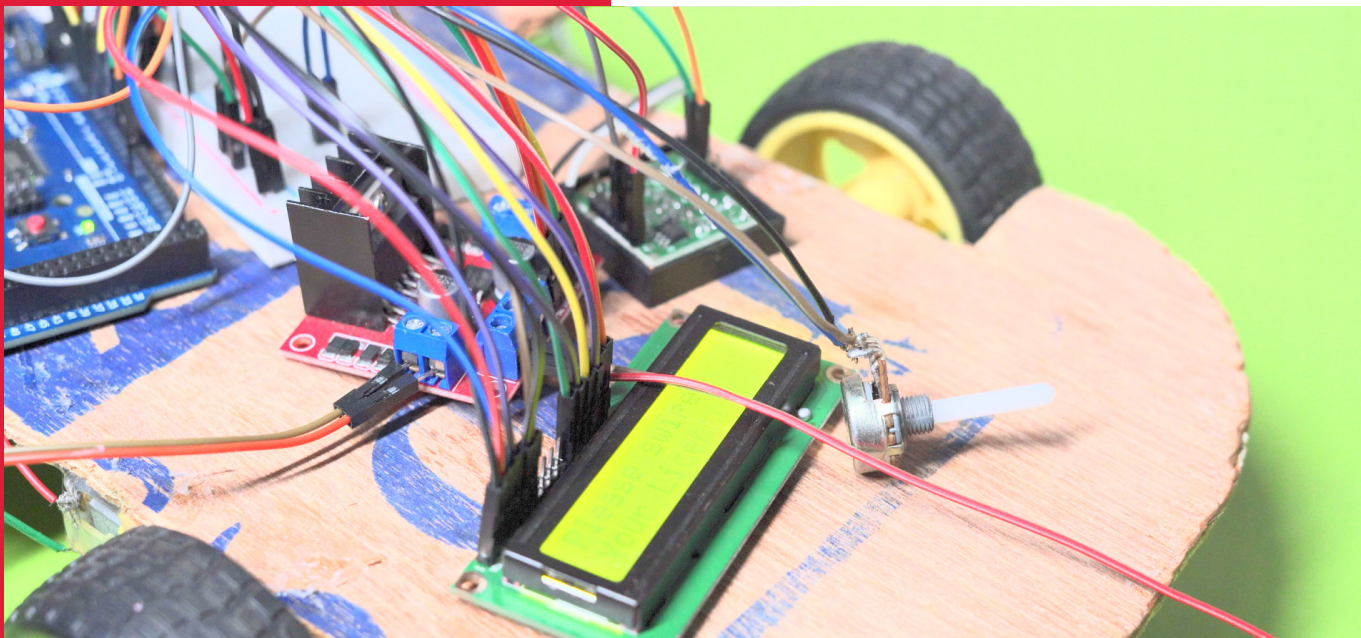
Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

A Vehicle for Safety

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Manjunath, an inquisitive, bright young boy, all of 14 years, is currently pursuing his education in Government High School, Peenya, Bengaluru. The 9th grade student has always shown a keen interest in grasping new concepts. Hence, after the introduction of the Atal Tinkering Laboratory and CGI STEM Spark, Innovation @ Schools initiative in his school, he has made a priority to devote equal amount of time to his regular classes and the program activities.

Being highly observant, Manjunath approached his trainers with a unique idea for a project – an innovation that would help protect vehicles from unauthorized use. The intention was to not only safeguard vehicles from theft, but also avoid mishaps, in case children or other unsupervised minors accessed their parents' vehicles without permission. After discussing the idea with his trainers, followed by multiple rounds of iterations, Manjunath perfected his concept – a RFID-based Vehicle Ignition System.

Given that it is very common to witness youngsters take their parents vehicle without permission (inadvertently causing accidents), Manjunath's innovation makes use of a host of added security systems. These include a feature to first scan the license necessary for verification, followed by a fingerprint sensor – only after this 2-stage verification will the driver have the option to start the vehicle.

When asked what motivated him to pursue an innovation along such lines, Manjunath stated that he was witness to one such incident in his neighbourhood. One of his friends took his parent's vehicle without permission, and as luck would have it, ended up meeting with a severe accident – an incident that shook Manjunath to his core. This led him to realize the magnitude of the problem, and with an iron resolve to mitigate such accidents, he came up with the idea of adding sensors to each vehicle.

With this innovation of his having far-reaching practical implications, Manjunath now wishes to scale up his project, and aims to make it a necessary addition to every vehicle in the country – with the objective of making India free from vehicle thefts and accidents alike.
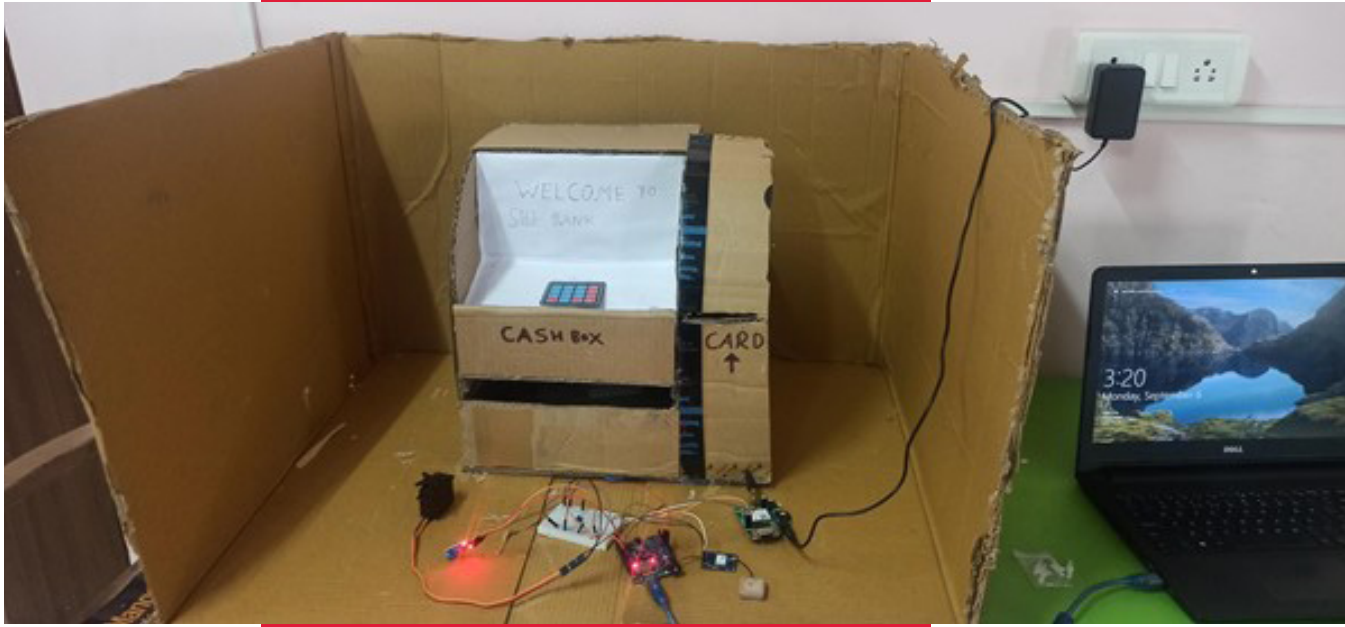
Crime-Fighting with STEM
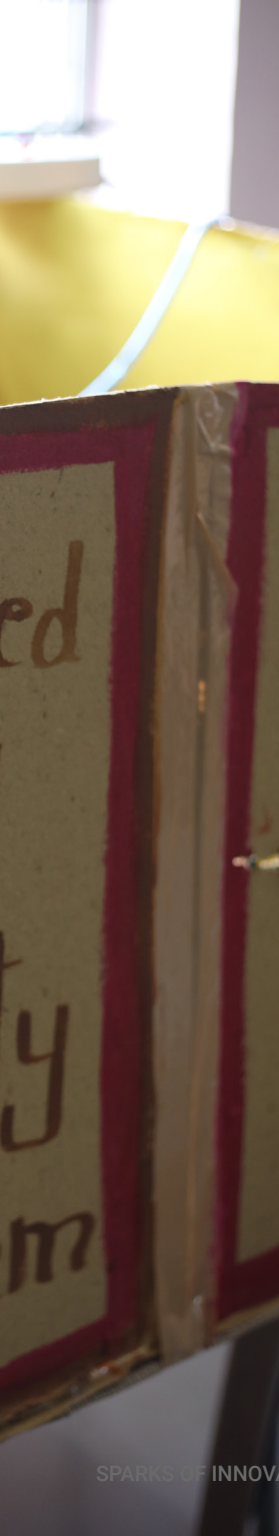
Manoj Patil, a class 10 student at Government High School, Peenya, Bengaluru, has always been very cognizant of his surroundings. Born with an inquisitive nature, he lives with the aim of one day being able to solve the multitude of issues we face in society. His parents, having remained deprived of educational opportunities in their youth, encourage him to develop his potential to the fullest. Manoj has had his worldview greatly amplified by the introduction of the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program. This has given him the chance to explore a range of interesting, cutting-edge topics.

Manoj has recently come up with an Advanced ATM Security System. The aim is to battle the increasing cases of ATM (Automated Teller Machine) robberies taking place across the country. His security system is based on the idea of detecting and reporting thefts in real-time – something the current manually supervised system fails to do. He has designed his mechanism to include vibration sensors, which set off an immediate alarm when an ATM break-in occurs. GPS sensors are also used to detect the exact location of the crime, and an instant SMS is sent to Bank officials and the local police stations, to notify them of the crime.

Manoj spent a lot of time with the Innovation Coaches from Learning Links Foundation, understanding the features and uses of each component deployed in this project. Eventually, on his own, he came up with the concept of the vibration sensor (attached to the machine) sending a signal to the ARDUINO microcontroller. Upon the signal being received by this controller, it would lock the door of the ATM room by sending an indication to the DC motor. The buzzer would be activated at the same time, to alert authorities nearby. Simultaneously, the controller would send a message to an authorized bank staff through the GSM modem.

This elaborate security system designed by Manoj is bound to be very useful for facilities across the length and breadth of the country. We cannot wait to see what this bright young student, just stepping out into the world, shall create in the times to come.

Bridging Gaps for Inclusive Infrastructure

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Prajwal R., a class 9 student of Government High School, Peenya, Bengaluru, dreams of completing his education and securing a better life for his parents, who come from the lower economic stratum of society. Prajwal is a very bright pupil, and despite the limitations of his background, has always striven to be a high-ranking student, impressing his teachers and principal alike.

With the introduction of the Atal Tinkering Laboratory and the CGI STEM Spark, Innovation @ Schools program in his school, Prajwal was provided with a gateway to dabble more in technology. Over the course of time spent in the Laboratory, he came up with his own unique invention, titled 'Railway Pedestrian Crossing' – a project designed with the purpose of helping the elderly and people with disabilities cross from one platform to another in railway stations. This was an issue he had been meaning to address for years.

In his project, Prajwal has proposed the addition of a movable bridge to the existing infrastructure. In the instance when there are no trains passing by, the bridge shall automatically be lowered (with the help of ultrasonic sensors placed at either end of the platform). This enables the elderly and people with disabilities to cross the platform easily. The project has been highly lauded by everyone at his school, and by students and staff from nearby schools, as well.

When asked to ideate for his project, Prajwal took it up as a challenge – wishing to do something for the society he lives in. In his own words: "Whenever I visit a railway station, I see many elderly people and people with disabilities struggle to climb the stairs to reach their respective platforms, which is when I decided to come up with the idea of an automated bridge setup. Realizing the significance of such a project, I started working on it. Despite some initial setbacks during the ideation and creation stage, I am thrilled with my innovation, and really wish to see it being implemented in railway stations across the country."

The Rescue Rangers

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

The Indian innovation landscape has seen young innovators blossom, finding simple solutions to problems that often baffled adults, and M. Archana and S. Sadhana are among them. These young minds are studying in Grade 9 at Government Girls Model Higher Secondary School, Avadi in Chennai.

Both girls are first-generation learners, but this never stopped them from exploring their ideas. Their keen observation, combined with a deep sense of empathy and spark for action, has enabled them to design the 'Elderly Fall Detection' device.

Falling is a common cause of disability and morbidity among the elderly, especially for a bedridden person. Sometimes, there wouldn't be anyone around to take them to the hospital after their fall. . Archana and Sadhana would notice in their homes and society that often, the aged injure themselves resulting from falls. They took it as a problem statement and brainstormed to design a device that safeguarded senior citizens and patients.

The girls started working on a prototype and designed an IoT-

based fall detector device that can save a life in an emergency. The system consists of NodeMCU and MPU6050 sensors. The MPU6050 sensor module has a built-in gyroscope and an accelerometer sensor. If the fall is detected, the device will send an SMS to the concerned person. NodeMCU ESP8266 is used here as a microcontroller and Wi-Fi module to connect with IFTTT to send SMS. They call this device; the 'Elderly Fall Detection' system.

Their parents and the entire school are proud of Archana and Sadhana for their innovative project. They were among the top 350 and 10 winners of the National and State-level Atal Tinkering Lab Marathon 2021-22, respectively. Hats off to these young budding innovators for the life-saving project and their problem-solving and critical thinking skills.

The Wind-powered EV
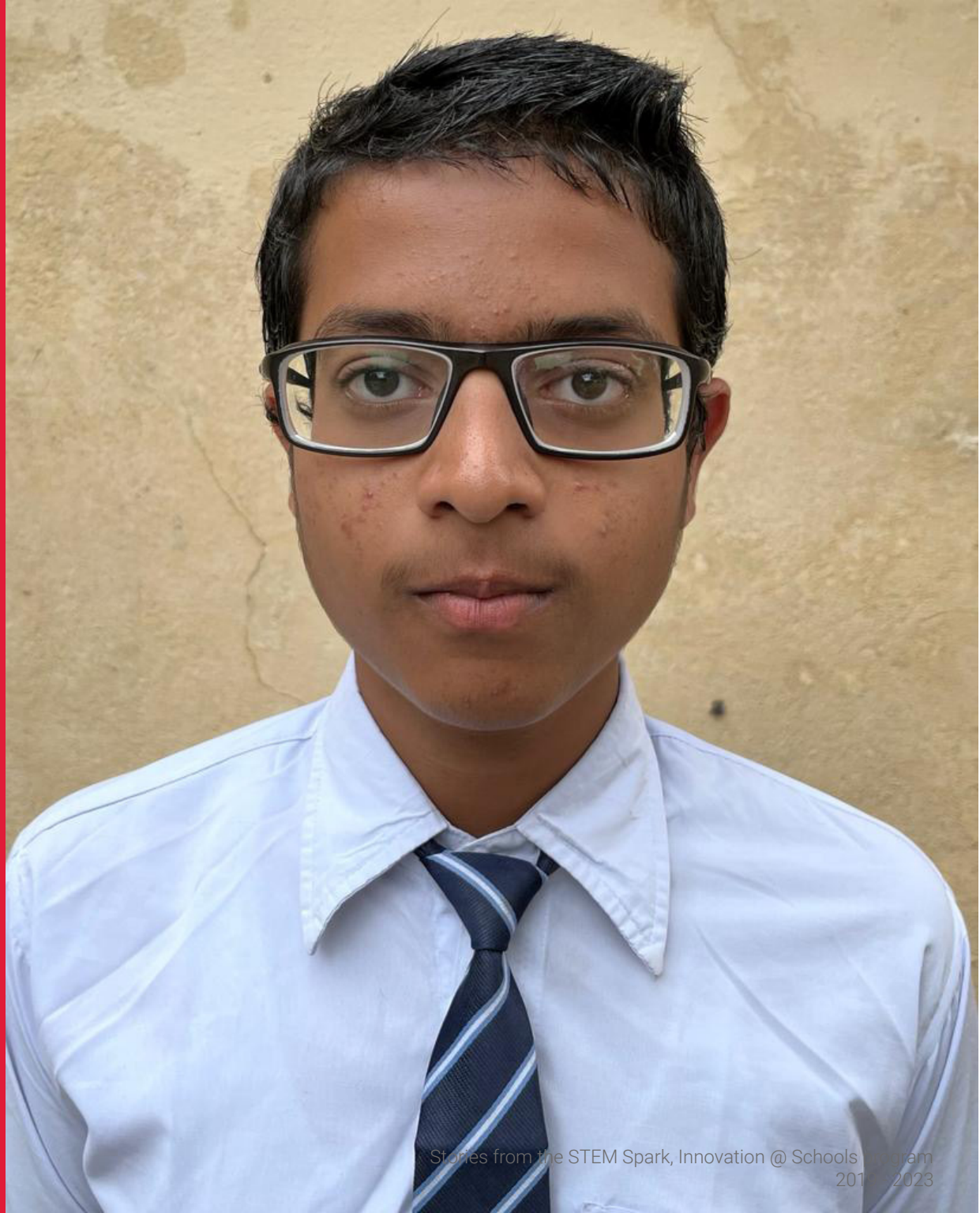
Purshotham Reddy M N, a student of Grade 9, Jawahar Navodaya Vidyalaya, Yenigadele, Chickaballapur, comes from an agrarian family in Bagepalli village. He dreams of becoming an Automobile Engineer and reads about Electric Vehicles (EVs) during his free time. EVs electrified his curiosity to know more about these eco-friendly vehicles and how they run without fossil fuels like petrol and diesel.

We are certain that EVs will change the trajectory of transportation. Purushotham looked at real-world issues regarding vehicles to improve them. It is hard to find charging stations for EVs. Moreover, their batteries take a very long time to be fully recharged. After some research on windmills, Purshotham came up with the idea to integrate the windmill principle into these vehicles. He further researched charging EV batteries using integrated safe, environmentally sustainable wind energy. As per his innovative prototype, the batteries would automatically charge up on the vehicle's movement, leaving very little need to charge the battery at EV charging stations.

Although Purshotham's project seemed antithetical to innovation, he shared his idea with his friends - Gaurav and Revanth Kumar. All three worked on the prototype and bagged a position among the top 350 ATL Marathon winners of 2022 under the theme - Energy and Transportation.

We can't deny the fact that transport is a fundamental requirement of modern life, however, the traditional combustion engine is quickly phasing out. The Electric Vehicle revolution is here, and these students can be a part of it through their eco-friendly innovation. Hats off to Purshotham and the gang for their initiative to build an ecosystem that can support a new clean vehicles revolution.

The Vivid Learner

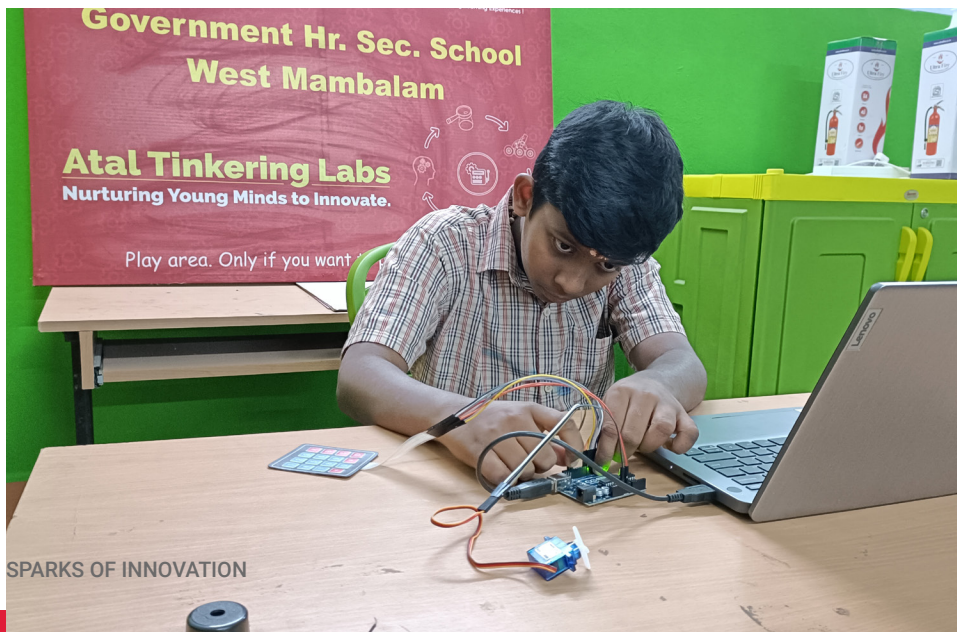Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Thirteen-year-old Parthiban is a first-generation learner in his family and is a promising student. His mother is the sole breadwinner, and life was never easy for his family. Earlier, he was studying at a private school, but due to financial restrictions, he joined Government High School, West Mambalam in Chennai, in Grade 8. Despite the odds, Parthiban always gave his best at school and was the class topper. His teachers always admired and described him as a good student. He was always eager to learn about the latest technologies and enthusiastic to join numerous science projects. However, he used to struggle due to the lack of equipment and guidance.

Parthiban was on cloud nine when he became a part of the STEM Spark, Innovation @ Schools. This was a golden opportunity to utilize the lab equipment and work on his science projects. The lab allowed him to play and learn through the lens of science. He never missed an opportunity to visit the lab and frequently volunteered to do group activities for the Tinkering sessions in school. This was an excellent chance for this budding scientist to innovate and implement his ideas using the STEM Spark program benefits.

One of his favourite engagements in the lab was to assemble and design electronic circuits. When we asked about his aims and ambitions, he replied - "I want to become an Electrical and Electronics Engineer in future." He admitted that earlier he was worried about his future and ambition to become an engineer, but the CGI STEM Spark, Innovation @ School program, has given him confidence for a brighter tomorrow. He expressed his gratitude towards the program and the trainers who motivated him to chase his goals and aspirations.

It is natural to admire students with good grades and conduct in schools, but the happiness is incomparable when we see students like Parthiban being benefitted from the STEM Spark program. Parthiban has come a long way, and we wish him great learning in years to come.

Smart Shelters for Travellers

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Johanna and Chandana are best friends studying in Grade 9 at Govt. High School, Peenya, Bangalore. They took the same bus to school and would wait together at the bus shelter. However, they would avoid sitting on the chairs in the bus shelter as they were unclean and could ruin their school uniform. During the rainy season, the shelter's roof leaked, which made it difficult for the passengers even to wait inside.

Although the problem seemed small, the girls had to deal with it daily. Johanna and Chandana also noticed that apart from them, others were facing the same issue. So, they decided to come up with a plan to tackle the problem.

In school, they got exposure to the Design Thinking sessions, one of the best tools to address community challenges. At one of the sessions, the girls raised this challenge, shared it with their classmates, and decided to find a solution. It was also an opportunity for Johanna and Chandana to showcase their first real innovation with the help of Atal Tinkering Labs, which are well equipped to design the prototypes for these challenges. Here, they came up with the 'Smart Bus Shelter' concept to protect travellers from the rain and sun.

In their prototype, they used ultrasonic sensors and servo gears to automatically open the gate when passengers enter the shelter and close it when it is empty. Apart from better seating facilities and automated features, the best part about the bus shelter was the reserved space for People with Disabilities.

Their prototype - Smart Bus Shelter, was exhibited at the STEM Showcase event held at the Bangalore office. The girls demonstrated the project and explained the working principles in front of CGI leaders from various countries. The leaders appreciated their ability for innovative thinking and commended their efforts. One of them also suggested giving this project prototype to the Govt. of Karnataka and implementing it across the state.

Although the product is still in prototype mode, it has already earned a lot of praise. Johanna and Chandana's simple innovation will help hundreds and thousands of commuters waiting at bus shelters. We wish both these innovators the best for their future endeavours and innovations.

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Waste Warriors

Stories from the IIT of Tamil; innovation @ Schools program
2019 - 2023
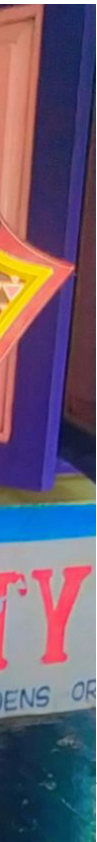
M. Sangeetha, V. Ponmalar, and S. Monisha are three incredible and budding environmentalists leading the way in waste management, one of the major environmental issues we face today. All three of them are studying in Grade 12 at the Government Girls Model Hr. Sec. School, Avadi, Chennai. At a very young age, these girls understood how our surroundings are indispensable to our survival, thus, increasing the priority for environmental conservation.

While commuting to their school, they would notice the waste dumped on the streets. It made the girls worry about the toxic discharge in the air from the trash. It also exposed the improper collection of waste that leads to hazards like environmental degradation, as well as water, soil, and air pollution.

Since this was the daily commute route for Sangeetha, Ponmalar, and Monisha to school, they wanted to solve this problem. They realized the seriousness of the threat of waste to the environment, health, and safety, which inspired them to build a Smart Dustbin, a unique solution to the environmental challenges associated with waste generation and inadequate waste collection. They built a prototype with dry and wet waste separation technology. When asked about the importance of separation of waste, one of

them replied - "We think that separation of waste is one of the best solutions for waste management. Separating waste is better for the environment and processed in the right way. It also ensures that recyclable materials get reused when making new products." With the tools available in the Atal Tinkering Lab, they started building the prototype of their Smart Dustbin with wet and dry waste separation technology. When a user brings their hand near the dustbin, the ultrasonic sensor detects it and opens the lid. On dropping the waste, the moisture sensor senses whether it is dry or wet and passes the command to the servo motor to tilt and separate it. The waste is then collected separately in either of the containers placed inside the Smart Dustbin.

With STEM Spark, Innovation @ Schools program, students are infused with research skills and are aware to understand social problems and apply their problem-solving and critical thinking skills to find solutions. All three are first-generation learners and belong to poor households, but this never stopped them from transforming into enlightened green ambassadors and finding a solution to waste management. As their journey continues, we wish to see more innovations and give them our best in all their future endeavours.

The SMART Fan

Santosh Chary, a bright Grade 8 student from Telangana Model School, Shankarpally, was always eager to learn new approaches for solutions to day-to-day problems. At the CGI STEM SPARK - Innovation at Schools program, he got the opportunity to apply his critical thinking and problem-solving skills outside the box in real life.

Earlier, he would often witness his classmates fighting over the fan's speed. Especially during the winters, some of his classmates would keep the fan speed high, which would become difficult for the rest of the class to bear. Some of them would catch a cold or fall sick. He wanted to make a device that would control the fan's speed as per the room temperature. In this project, he used a temperature sensor to sense the classroom's temperature and adjust the fan's speed accordingly. When we asked him how the sensor knows what should be the speed of the fan, Santosh replied,

"I have programmed the controller in such a way that if the room temperature is less than 20 degrees, the fan speed will be low. On the contrary, if the room temperature is more than 32 degrees, then the fan speed will be high."

After finishing the project, he shared, "As I had to deal with Alternating Current (AC), I was scared of getting electrocuted, but my mentors always helped me whenever I dealt with AC and high voltages. Our school principal always helped and encouraged me to generate new ideas." Santosh calls his project "The Smart Thermo Sensitive Fan." His smart approach helped to stop the fighting among his classmates.
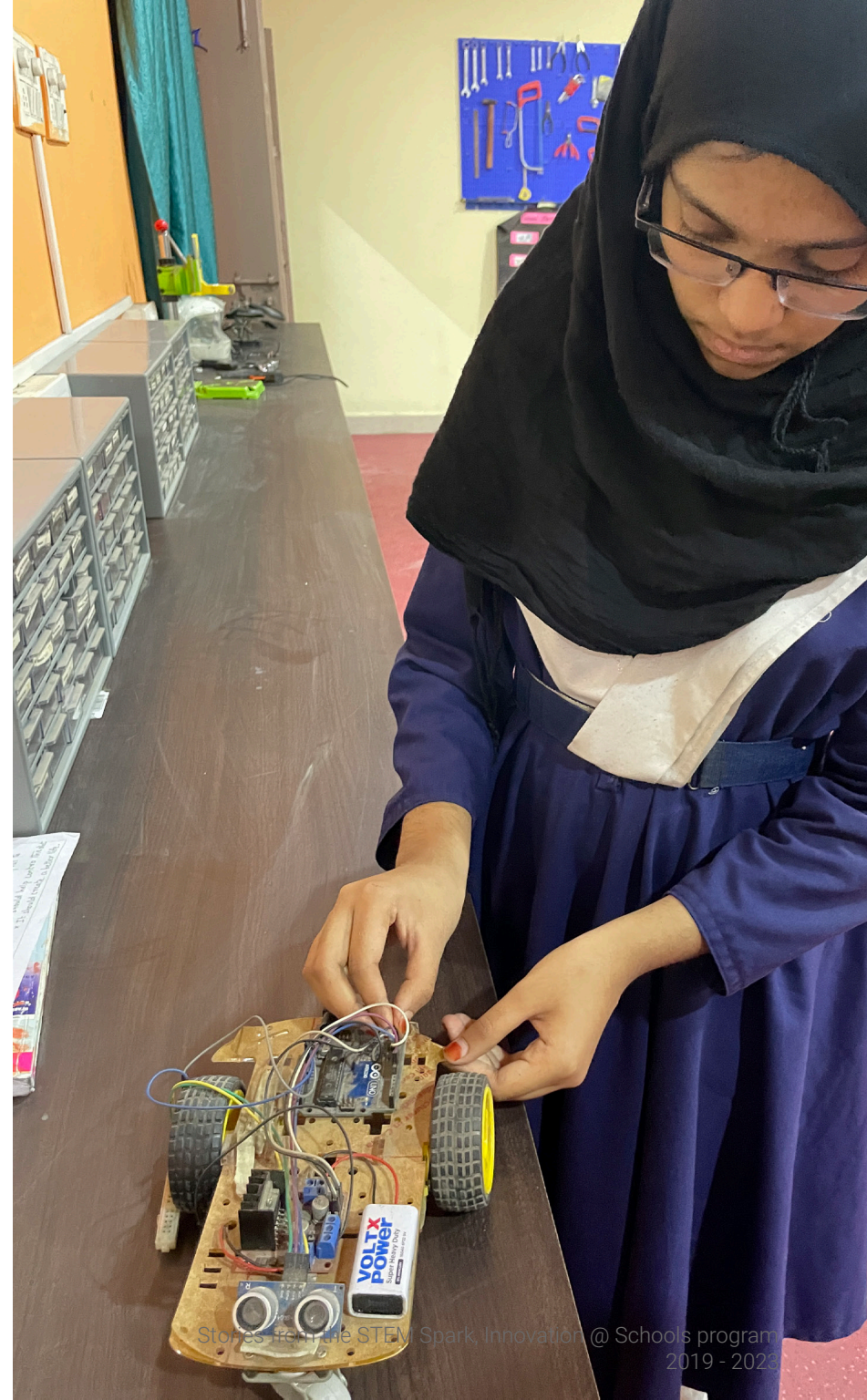
One of the most beautiful qualities of children is they do not know their limitations. With the right approach, we often get surprised by what can come from a kid's ingenuity and imagination.
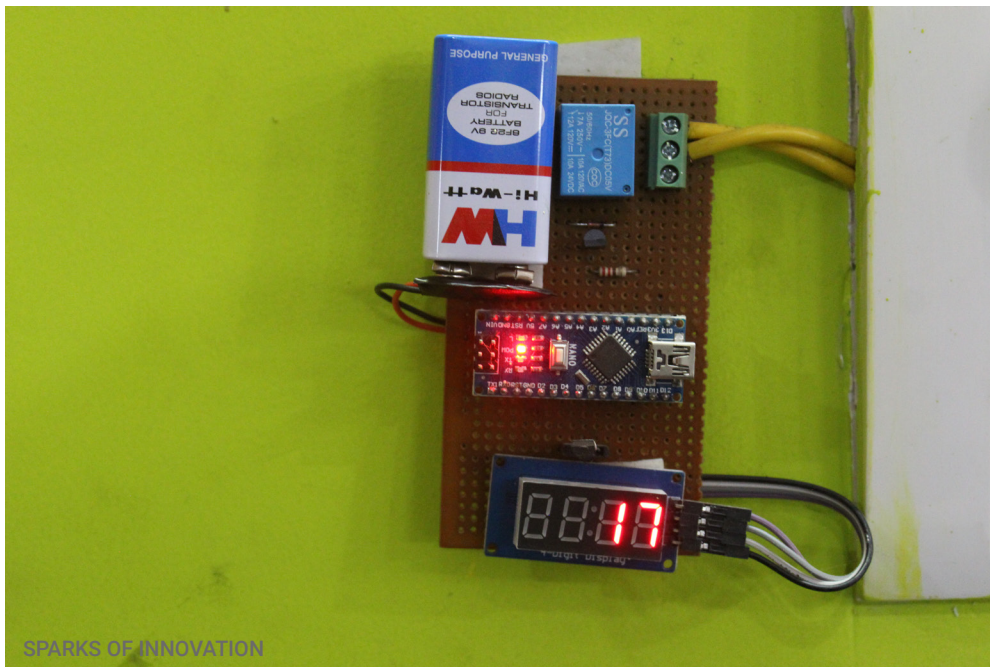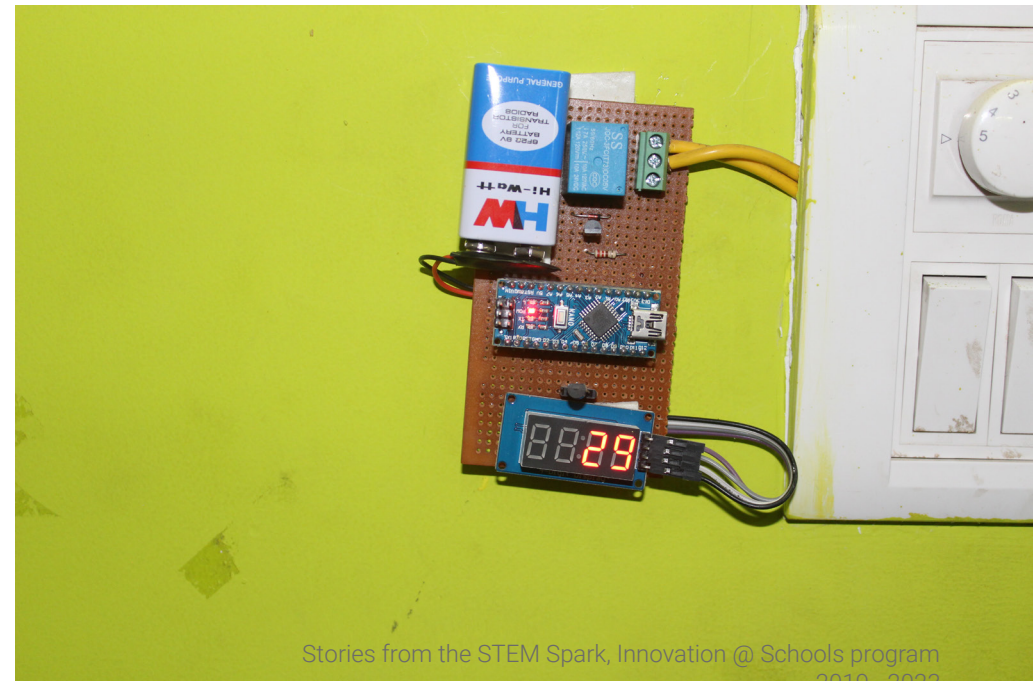
Managing Care for Speedy Recovery

Stories from the STEM Spark Innovation @ Schools program
2019 - 2023

Every child is free to dream big. Sadiya Mahaveen, a Grade 9 student of Government High school in Chaderghat, Hyderabad, has dreams to make the world a better place. She aims to work for people from underserved communities and help them lead better lives. Her passion gained momentum when CGI and Learning Links Foundation introduced the Atal Tinkering Labs in her school. She received guidance from the Innovation Coach and an opportunity to learn about Design Thinking, Circuits, Bread Boards, Series and Parallel Connections, etc. which equipped her to begin working on a prototype of a solution she had in mind.

She wanted to design a mobile application with features like medication, diet plans, exercises, home remedies, etc. These particular features were selected based on her aspiration to make her grandmother's life easy. For over seven years, Sadiya had seen her grandmother suffer from various ailments and take medication regularly. She wished she could find a way so aid her grandmother and hasten the recovery process. With time, Sadiya's prototype evolved catering to the needs of the user and improving the ease of access. She is now working on a feature that would send SOS calls/messages to the local emergency number in case of any distress.

Just like Sadiya, the program team is supporting and helping hundreds of students to lean into their world of imagination and empowering them to bring their ideas to fruition.
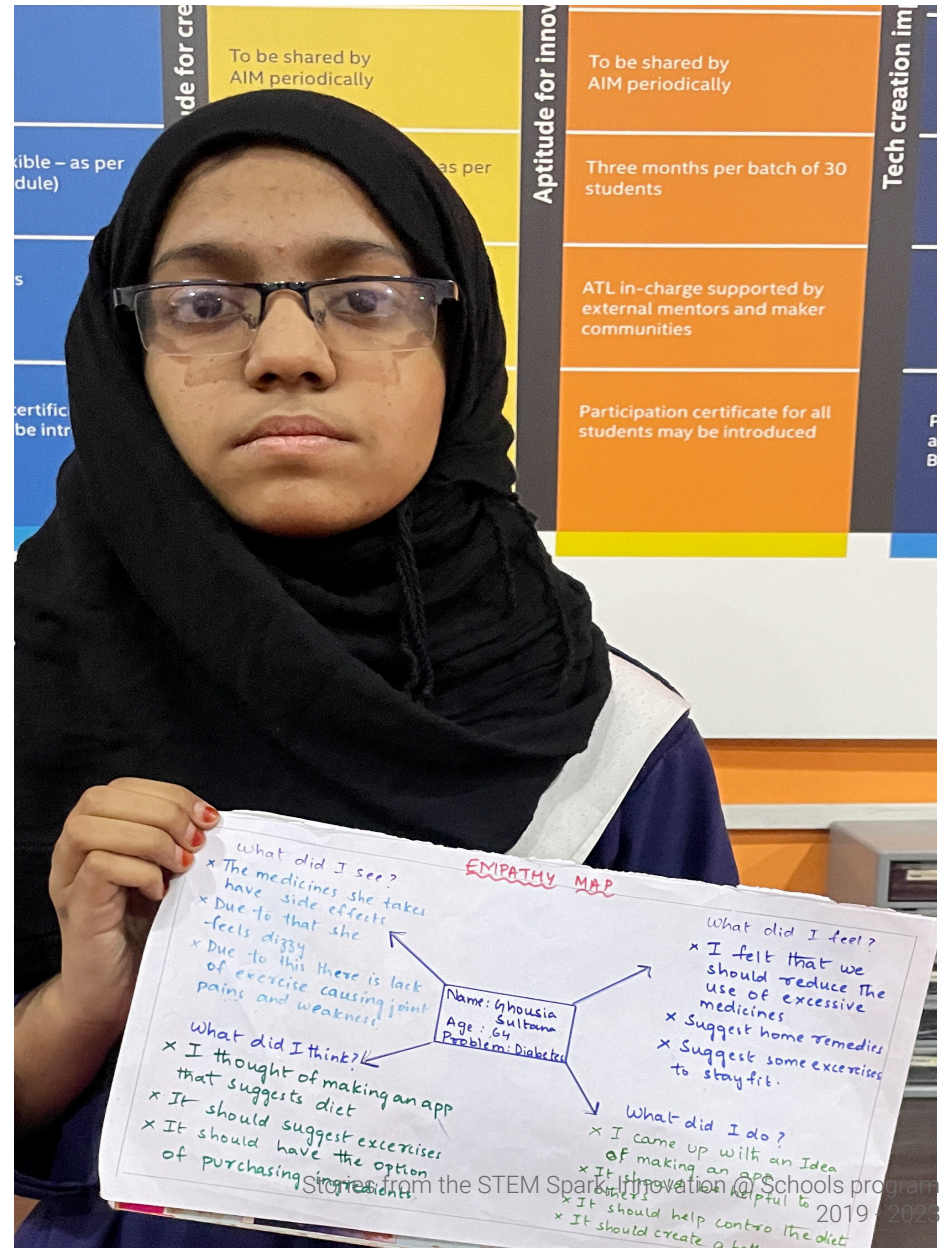
Enabling Students with Disability Shine in STEM

Stories from the STEM Spark, Innovation @ Schools program
2019 - 2023

Learning Links Foundation and CGI India value the importance of STEM education. Together they have promoted technical literacy and innovation among students. They are committed to inspiring, training and mentoring young minds in STEM and are supporting Atal Tinkering Labs across four cities - Bengaluru, Chennai, Hyderabad and Mumbai. Recently, CGI and Learning Links Foundation shifted their focus towards promoting the inclusion of children with disabilities in STEM education.

In 2022, both organisations conducted several STEM Camps for children with disabilities in Bengaluru, Chennai, Hyderabad and Mumbai. These events aimed to spark curiosity among students in science and technology and gravitate them towards courses and careers involving STEM.

To help the participants succeed, the team members from Learning Links Foundation supported the students in various tasks such as building simple paper circuits, LED circuits on breadboards, using ultrasonic sensors, etc. The students were fascinated and excited to work with LED, batteries, copper tapes and jumper wires. These camps kindled the students' innovative spark within.

After the sessions, the participants were awarded the "I am an Innovator" badge. In addition, the participants shared their work with the students from nearby communities and helped them learn about their work. The activities of the students and the overwhelming response of the school leaders, HMs, teachers and community members showcase the outcome of these camps. Such workshops are the stepping stones to creating a unique platform to allow children with disability to access the real-life experiences of STEM activities.

SPARKS OF INNOVATION

Stories from the STEM Spark, Innovation @ Schools program
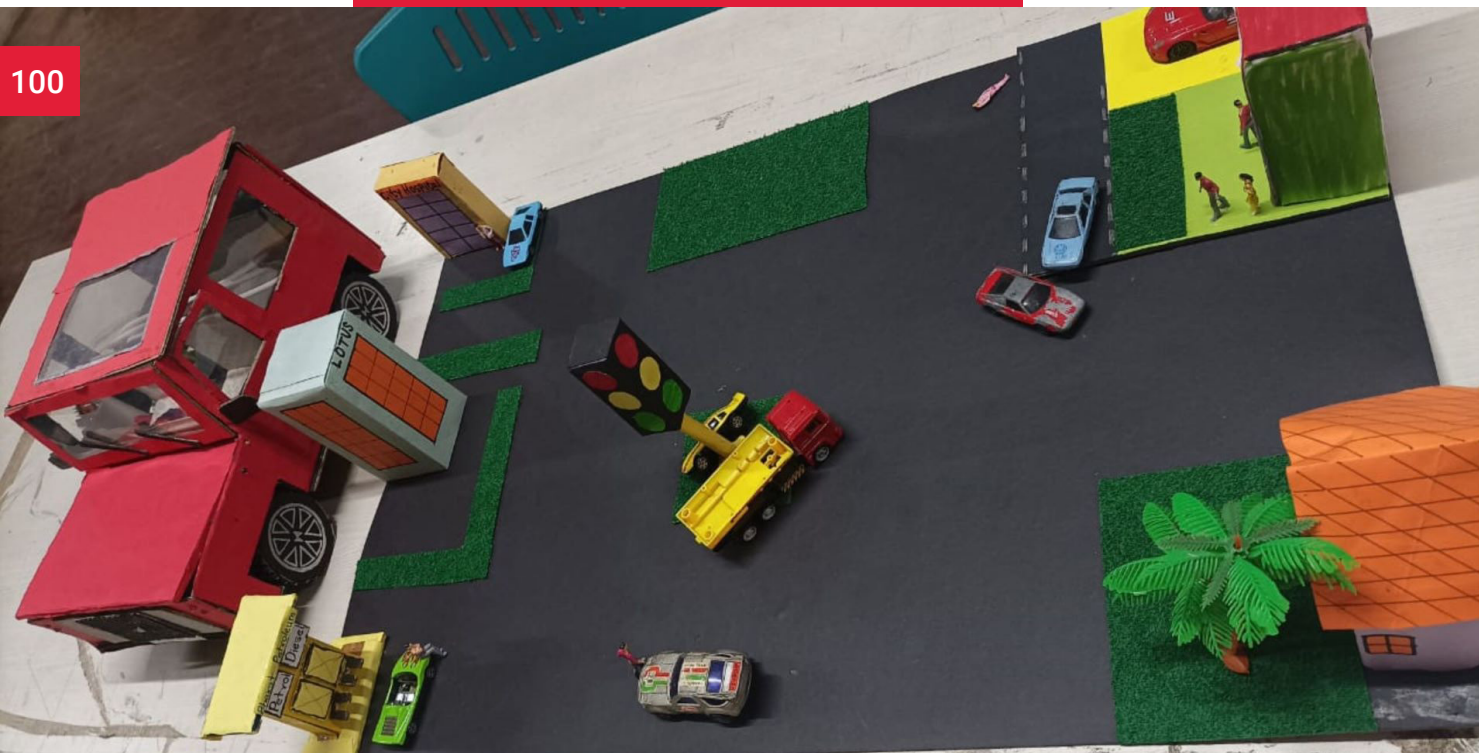2019 - 2023

Drizzling Creativity and Innovation

There is a hustle when it rains, and there is chaos! Zoha and Rushada Ansari were familiar with the sight of their mother and neighbours scrambling and rushing to the roof to prevent the clothes from getting drenched in the rain. Everyone was familiar with the problem, and these young girls wanted to explore a solution.

How can they protect clothes from the rain? The question nudged them into working on a rain detector sensor that could sense rainfall and send data to a controller. They attached two servo motors to two pillars, and the motors had a roller to roll out the plastic cover. Whenever it rained, the servo motor would rotate and spread the plastic cover to protect the clothes.

The Ansari duo shared, "This project helped us to learn about the rainwater sensor, servo motor and Arduino microcontroller, along with their functions." They have named their prototype 'Rain Cover for Clothes'. Initially, they had a simple design of a cover plate for the clothes, but the outlook of the Atal Tinkering Labs and guidance from their mentor helped them modify and upgrade their prototype. Zoha and Rushada are students of Anjuman I'Islam Saif Tyabji Girls High School in Mumbai and are studying in Grade 9. Their innovative yet simple idea is just the first of many more to come.

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Stories from the STEM Spark, Innovation @ Schools program
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'Locked Out' for Safety

SPARKS OF INNOVATION

Stories from the STEM Spark, Innovation @ Schools program
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Perhaps, Dr Seuss wasn't expecting to inspire Affan Khan and Arya Patel when he said, "Kid, you'll move mountains." With their innovation — Safe Drive, they aim to promote safety on the roads. Affan and Arya are from Hansraj Morarji Public School, Andheri and study in Grade 7. They got the idea for their project when they learned about the increasing number of road accidents across the country due to driving under the influence of alcohol. Their project 'Safe Drive' emphasises the importance of following traffic rules which promotes traffic safety. The main component is an alcohol sensor, which is placed at the door that controls the servo motor near the keyhole. If a person is drunk, the sensor will detect it, and the latch fitted at the servo will come on the keyhole. Hence, the driver will not be able to open the door.

Their project has won several awards, such as the - first prize at Interschool, a District-level competition and was selected for the INSPIRE Manak Award. Affan and Arya have said, "The project aims to reduce the number of increasing accidents and damage to property caused due to drunk driving." With the help of the Atal Tinkering Lab and mentors, these curious young innovators developed a prototype to help drivers take accountability for both their safety and that of other passengers on the road. This is just the beginning of their adventures to experiment with solutions for the problems they see around them.

TEAM

Smiles of satisfaction glow on the faces of the CGI and Learning Links Foundation team members, who have striven to bring the spark of innovation to every school in this program.

Stories from the STEM Spark, Innovation @ Schools program
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