

MACMILLAN BUDDING SCIENTIST AWARD

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MACMILLAN

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Contents

Foreword	iv
Message from MD	v
About <i>Macmillan Budding Scientist</i>	vi
Message from the Principal's Desk	vii
Macmillan Budding Scientist, powered by Springer Nature 2021-22	1
Macmillan Budding Scientist, powered by Springer Nature 2019	32
Macmillan Budding Scientist, powered by Springer Nature 2018	37

Foreword



It was a pleasure for me to be approached by Macmillan Education India (MEI) in 2018 to explore the possibility of my involvement in their initiative “Macmillan Budding Scientist” (MBS). Right from the outset, it was clear to me that this was a somewhat unique beginning in the landscape of Indian school education system. At the time, I had already been professionally introduced to the school education system in India through (a) several invited and “popular” guest lectures for school students both at IIT Delhi and/or their respective schools, (b) an MHRD (now MoE) programme called IIT-Professor Assisted Learning (IIT-PAL) for class XI and XII school students that I was given the responsibility to initiate from IIT Delhi (along with a few of my colleagues), and (c) an honour of serving as an “Eminent in Education” member in the management committee of a Kendriya Vidyalaya (KV) in Delhi. Through the latter two, it was my sheer privilege to closely interact with KV teachers, who inspired me to appreciate the key foundational roles school teachers play in our lives and the unparalleled efforts they put in towards executing their responsibilities, beyond any prior experience of mine.

In 2018, MEI took the bold step of advancing the concepts of co- and extra- curricular initiatives of the Government of India that aim at enhancing the school education experiences of students by integrating beyond-the-classroom exploratory avenues for teachers and students. Inspired by Neil Armstrong, I would go to the extent of stating *“That first Macmillan Budding Scientist in 2019 was one step for Macmillan Education India, but a giant leap for corporate involvement in the Indian education sector”*.

Having successfully completed three iterations since the first one in 2019, MBS initiative has fast established itself as a benchmark for recognizing co- and extra- curricular academic efforts of student-teacher teams from schools across the country. While encouraging beyond-the-classroom engagements of teachers with their students in schools, MBS initiative encourages students who wish to push their educational explorations beyond their books. Additionally, an abstract achievement of the MBS initiative is that it recognizes and celebrates those teachers who push their own limits in guiding students beyond classrooms. I feel privileged to have been asked to write this foreword for the first edition of this booklet showcasing projects of the MBS initiative. I hope that these projects will inspire students towards pushing the boundaries of their educational experiences beyond-their-classrooms but within-their-school-systems. More importantly, I hope this booklet will be seen as a first-of-its-kind effort in recognizing the often-unsung champions in our society – the teachers in schools who push their limits for every pupil entrusted to them.

Prof Aditya Mittal, B. Tech., Ph. D.
Kusuma School of Biological Sciences,
Indian Institute of Technology Delhi



Message from MD

Today STEM pervades every part of our lives and science's marvels can be seen and experienced everywhere we look in the world. STEM education links disciplines into a cohesive system and creates critical thinkers, increases science literacy, and prepares the next generation of innovators capable of transforming society through innovative solutions.

Being an integral part of India's education ecosystem, it is Macmillan's desire and duty to foster their interest, and ambition and give them a platform to showcase their creativity, which will spearhead tomorrow's technology.

At the Google Science Fair 2019, Tuan Dolmen from Turkey received the Scientific American Innovator Award for a digital agriculture module design that can capture tree vibrations. Further Aman KA and AU Nachiketh Kumar from India took home the National Geographic Explorer Award for a natural coagulant for rubber latex.

All of these children have done India proud, and we can't wait to see what they come up with in the future. You children should look up to young scientists like them as role models and strive to solve India's pressing problems, such as pollution, hunger and infant mortality.

I also encourage teachers to embrace STEM education because children are born with a natural curiosity for exploration and discovery.

We look forward to taking Macmillan Budding Scientist to schools across the country giving young learners an opportunity to showcase their ideas at a national level.

Rajesh Pasari
Managing Director
Macmillan Education India

About Macmillan Budding Scientist



I remember the town hall hosted by the entire Springer Nature senior management team, on a cool November evening in 2016, in India. The Springer Nature group launched an innovative initiative to encourage and develop scientific talent in schools across India - Macmillan Budding Scientist, powered by Springer Nature. The thought behind it was to develop curiosity and scientific temper in young learners and promote research and innovation for sustainable development. The announcement came after an education conclave was organized by Springer Nature to discuss strategies and evolve solutions to challenges in science education in the years ahead. This initiative was to be integrated with the efforts of IIT Delhi towards school outreach and taken to thousands of schools in India, by Macmillan Education India. I would like to acknowledge the support of Ms. Subhra Priyadarshani, Chief Editor, Nature India who was instrumental in the conceptualization of the Budding Scientist initiative, enabled the partnership with IIT, and promised workshops on Science Communication to students.

At the launch event, a student of Amity International School Gurgaon Vaishali Tikko, was honoured by Springer Nature for the novel instrument she developed to help her fellow students facing learning difficulties. From 2016 to 2022 Macmillan Budding Scientist has grown in stature and today the engagement with IIT Delhi has extended to IIT Mumbai, Bhubaneswar and Chennai. This will allow more students across the country to experience Science.

Macmillan Education is looking to expand this programme in the coming years and deepen its impact.

Vandana R Juneja
Director Marketing
Macmillan Education India



Message from the Winning Schools



MSB is a group of institutions around the globe. At MSB, students are given the maximum opportunity and supportive intervention to bloom and explore the field of their interest.

At MSB, science is not taken as a separate subject but as a way of life. To enhance and sharpen the creative skills fully equipped laboratories for juniors and seniors are maintained. It is the curious mind which is active all the time with keen observation and in-depth understanding of all day-to-day activities.

At MSB, with this conducive environment students participating in Macmillan Budding Scientist Competition achieved State and National Level Awards. Who could think of creating “Mobiscope” using your regular smartphone, from which one can observe the tiny little creatures present in the water and nature? But here MSB’s students created this spectacular monumental piece of treasure that all shall benefit from!

To develop scientific acumen amongst young minds, hard work by the students, guidance by the teachers and a platform like Macmillan Budding Scientist paves a way forward to establish young identities in the scientific world.

Dr. Raziya Husain

Principal,

MSB Educational Institute, Nagpur



National and West zone winning team from MSB Educational Institute, Nagpur



“Knowledge is of no value till you put it into practice”

What better way to do so than a Science Competition! We have always encouraged our students to participate in various interactive platforms that help to accentuate their skills, help in self-assessment and consequently boost their confidence by giving them varied experiences.

It was evident that Macmillan Budding Scientist would be the apt platform for our students to showcase and foster their scientific acumen. Our students enjoyed the challenge and very much benefited from the competition. Securing the second position from the West Zone (2021-22) was the cherry on top.

Our management encourages maximum participation from the students because the exposure they get is unparalleled.

Mrs Rajni Ghai,
Principal,
Stemfield International School,
Baldeobagh Jabalpur



Runner-up team (West zone) from Stemfield International School, Baldeobagh Jabalpur



Studying Science involves the development of important skills such as Observing, classifying, reasoning, analyzing and applying. Many of these skills can be taught by using the scientific method but at Silver Oaks School these skills are best taught through hands-on activities and experiments. It is very important to develop the science acumen amongst the students to hone their reasoning and understanding abilities.

Various brainstorming sessions such as expert talks, case studies and nature walks are organized where the students express different views and list their observations. Students are made to learn difficult concepts through easy and small hands-on activities using daily life materials. Nature walk is a very good way to familiarize students with various phenomena. Each concept is concluded with a small experiment where the students apply their knowledge and discuss the outcomes with peers.

To sensitize the students to global issues and foster scientific talent amongst our Silverians we always try to initiate small projects in school where students try and find innovative solutions to real-life problems and here Macmillan Education India gave our students a platform to express themselves. Through such competitions, students gain confidence and obtain immense exposure as they compete with students from all over India. Two of the projects which we initiated in our school “Eco Ink”, where students made marker ink using soot coming from the generator and “Parali Murals”, in which the students found innovative ways to reduce stubble burning were applauded by renowned personalities from the scientific community.

Ms Ravinder Sra
Principal, Silver Oaks School,
Dabwali Road, Bathinda



Macmillan Budding Scientist, powered by Springer Nature 2021-22

**The below articles have been shared by schools and we have reproduced them verbatim.*

Finalists:

- School Name:** MSB Educational Institute, Nagpur
Winner: National and West Zone
Students: Mohammed Khiilchipur, Ali Akbar Sunelwala & Haider Kapdawala
Project Supervisor: Ms. Rashida Merchant
Project Name: Mobiscope - Making Microscope From Old Mobile

Scan the code to watch the video of the project



Summary:

Technology has improved so rapidly in the past few decades that today it's hard to imagine what the world would be like without smartphones, GPS maps, laptops, and other electronic devices. These devices contain toxic chemicals like mercury and lead, and while they're safe to use once they get placed in a landfill those toxins can seep out into the soil and water, contaminating both. If those toxins get into your drinking water, then that presents a health hazard for you and your family.

As all of you know that the volume of e-waste is growing enormously because people do not bother to repair the damaged device and discard it. There are now more mobile phones around the world than the number of people.

So the main aim to prepare our model is to reuse the e-waste, we have used all scrap things to make this model.

Technology has improved so rapidly in the past few decades that today it's hard to imagine the world without smartphones, GPS maps, laptops, and other electronic devices. These devices contain toxic chemicals like mercury and lead. They are safe to use, but the disposal of these devices in landfills contaminates the soil and water. These toxins pose a health hazard. As everyone knows, the volume of e-waste is growing because people nowadays discard their damaged devices rather than repair them.

Using a smartphone, we can build our microscope for a much smaller cost than buying one.

Though smartphone cameras cannot replace a microscope as is, adding an extra lens helps them get the desired magnification. In this way, we can increase the efficiency of a smartphone.

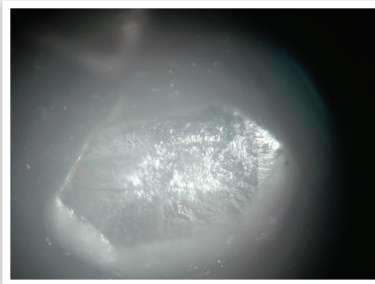
We can directly attach this lens to the smartphone, but it is hard to keep the phone steady when taking zoomed-in photos. That is why we need to build a stand! The scrap glass and plywood were used to make the microscope stand. Plywood acts as a base of the stand. Here we have used two pieces of glass. The upper glass of the stand is called the camera stage, and the lower one is the specimen stage. We have inserted a lens in the camera stage precisely in the center.

Amazing things you can do with this microscope:

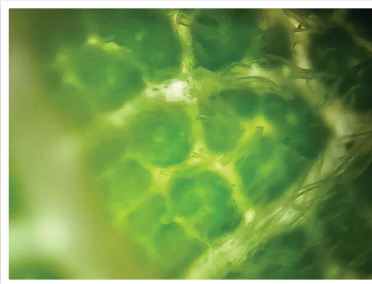
- You can see epidermal cells and hairs on the leaf.
- You can see tiny algal cells and tiny microbes in pond water.
- You can connect our cell phones to a laptop to make it digital.

It is a portable microscope, which can serve as an additional microscope in the lab. It is helpful when schools do not have funding to purchase microscopes, then Mobiscope is a viable option.

Some pictures taken with the Mobiscope



1. Sugar Crystal



2. Soil Algae



3. Leaf epidermal hair Cell



4. Salt Crystal



5. Bryophyta[moss

2. **School Name:** Somerville School, Vasundhara Enclave, New Delhi

Winner: North Zone

Students: Ashrit Das, Atharv Mittal, and Rajit Sharma (Class VII)

Project Supervisor: Ms. Savitha

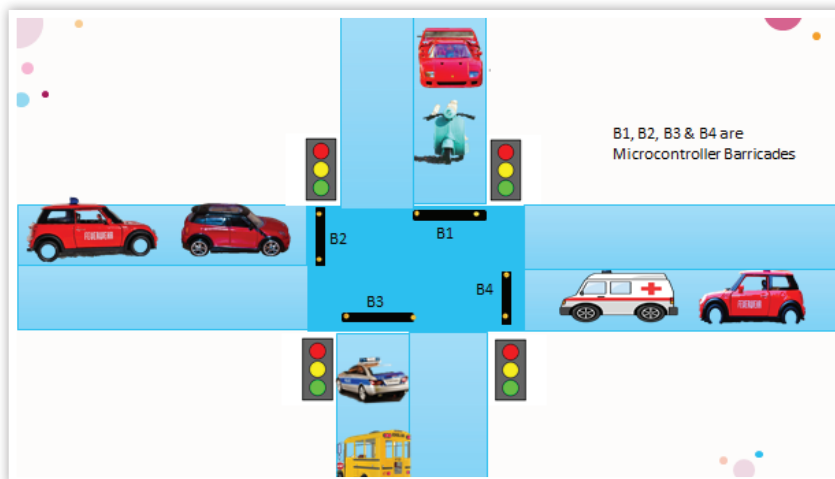
Project Name: Smart Traffic Control System - Traffic Lights with Smart Barricades

Scan the code to watch the video of the project



PROBLEM: A newspaper report in the Times of India provided some statistics showing that an average 1.5 lakh deaths are caused due to accidents in India each year. A major reason is the flouting of traffic rules, especially red light jumping.

BASIC IDEA: Our idea was to ensure strict observance of traffic light rules, we suggest putting up smart barriers at crossroads that close with red lights to stop any movement of vehicles, open with green lights and start coming down slowly with yellow lights, giving an indication to drivers to slow down and stop.



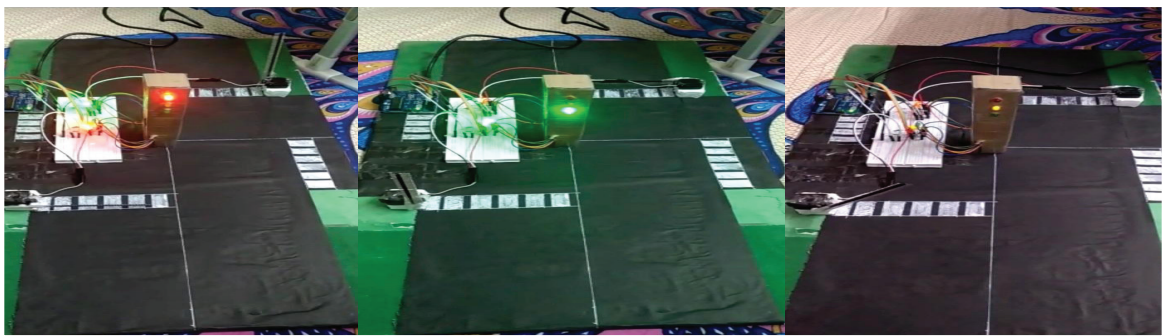
The Basic working barricade model was made using servo motors and coding.



Material needed for the project:

1. Arduino – an open-source platform.
 - a) Arduino IDE - software available for all computers which provide a text editor for writing code with integrated library support.
 - b) Arduino UNO microcontroller - physical programmable circuit board to run the code.
2. LED lights (red, yellow and green).
3. Servo motors, which get an electric signal to create mechanical movement, rotatory and linear.

With the signal changing every 7 seconds, the servo motors rotate accordingly and change the position of the barricades.



ADVANTAGES:

1. Disciplined traffic.
2. Lesser accidents.

CHALLENGES: Developing countries like India face practical issues like power failure, unexpected technical failure, congested/narrow crossroads, stray animals, etc., but with proper modifications/adjustments, we are sure this idea can one day be implemented successfully on Indian roads and make our roads safer.

3. School Name: La Martiniere For Boys, Kolkata**Winner:** East Zone**Students:** Sayandip Ganguly, Stav Sengupta & Deeptangshu Dasgupta**Project Supervisor:** Mrs. Bishakha Banerjee**Project Name:** Self-Monitoring Alarm to Resist Touch

Scan the code to watch the video of the project

**Problem statement:**

People especially children have the habit of touching their face (nose, mouth & eyes) without properly cleaning or sanitizing their hands. This habit is a major problem in the current pandemic. People can easily contract Coronavirus because of this habit. Hence it is important to alert people from unknowingly touching their faces. So, we have designed a device that alerts us whenever we touch our face.

Principles used:

- Piezo buzzer makes a sound when there is a flow of current through it.
- Current can only flow through a closed circuit.
- Heavy objects fall due to gravity.
- Metals are good conductors of electricity.

Proposed Solution:

The device consists of a circuit with a Piezo buzzer and a movable metallic weight, which acts as a switch. The device will be worn on the wrist along with a wrist watch, a band, or a bangle. Normally our wrist points in a downward direction. Hence during a normal condition, the device will also be in a downward position. The heavy metallic weight is not in contact with the terminals of the circuit. So, the circuit is open and the current does not flow through the circuit and the buzzer. Hence, the buzzer does not make any sound.

Whenever a person tries to touch their face, the wrist points upwards. Hence in this condition, the device will also point in the upwards direction. The heavy metallic weight will fall on the terminals due to gravity and thus close the circuit. As soon as the circuit is closed current starts flowing through the circuit and in turn through the buzzer. Hence the buzzer makes a sound that alerts the person of their action.

Advantages:

- Compact in size.
- Economic. Costs around Rs 60.
- Low current requirement hence safe to wear.
- Constructed using components easily available in the market.

Other Applications:

- It can also be used by the patients to call for assistance.
- It may be used as an SOS signal in bikes or cars.

4. School Name: Silver Oaks School, Dabwali Road, Bathinda**Runner-up:** North Zone**Students:** Hargunpreet Singh, Gurmanpal Singh & Simreet Sokhal**Project Supervisor:** Mr. Rajdeep Singh**Project Name:** PARALI MURALS: A multi purpose approach to solve the problem of pollution due to stubble burning

Scan the code to watch the video of the project



The process of burning farm residue is one of the major causes of air pollution in parts of north India, deteriorating the air quality every year. Farmers burn stubble because they don't have any other feasible alternative that is economically viable.

Therefore, this is the biggest problem our region has been facing lately and we thought of finding an economical and feasible solution to this, as a result, we came up with an idea which we named "Parali Murals". We have been stimulated for this project by Kriya Labs, and the component which makes our challenge special from Kriya Labs is that we have tried to make this assignment on a household stage so the farmers can effortlessly make this at a domestic level.

The process is that it works on lignocellulose biomass. We collect the stubble and extract fibre from it and then make it into things of domestic use. The process is pretty simple, first the stubble is cut into small pieces and put into a utensil with some water into it and boiled for four to five hours. After that, it is bleached and left in the sunlight so that the moisture content reduces and the stubble dries up. The dried stubble is then crushed using a crusher to make fibre. This fibre is the ultimate product which could further be processed into various things for domestic use or for business purposes as well. For example, we can blend it with cotton and use it to make cushions, blankets or even mats. We can also process it into biodegradable plates and cups. The production cost of this fibre is very low which makes it very affordable and it does not require any complex machinery due to which the process could be followed very easily at a domestic level.

5. **School Name:** Stemfield International School, Baldeobhag, Jabalpur

Runner-up: West Zone

Students: Raghav Rusia, Sarvesh Tadse & Arav Borker

Project Supervisor: Mr. Sanjay Pandey

Project Name: Third Eye for the Specially-abled People(Blind)

Introduction: "When you start utilizing your third eye to seek the truth, you will then learn to see, that the divine is within you."

In our project "The third for the specially-abled people (blind)" is an amazing gift for visually challenged people. The device we made is actually a smart goggle. This smart goggle helps visually challenged people to walk easily and navigate confidently by detecting the nearby obstacles by using ultrasonic sensors. If any obstacles come across, this device notifies them with a vibration and buzzer sound. By using this device, the lives of visually challenged people would become more comfortable and would also avoid the chance of an accident.

Things required for the device are: Goggle, Arduino UNO, Buzzer, and a vibrator.

We have assembled Arduino UNO, Buzzer, and vibrator on both the sides on the temple of the goggles.

According to WHO 39 million people are estimated to be visually impaired worldwide. They are suffering lots of hardship in their daily life. The aim of our project is to develop a cheap, feasible, and efficient device to help visually challenged people for walking with greater comfort, speed, and confidence.

Scan the code to watch the video of the project



6. School Name: The Pentecostal Assembly School, Bokaro Steel City**Runner-up:** East Zone**Students:** Arpan Kumar, Satyam Chauhan & Amandeep**Project Supervisor:** Mrs. Rani Basanti Singh**Project Name:** Self Watering Plant System

Scan the code to
watch the video
of the project



Introduction

Self Watering Plant System (SWPS) is a device that can convert water vapour from the atmosphere into liquid water.

It is highly efficient due to compatibility with solar energy and no manpower requirements.

It is truly automatic and doesn't require any human interventions.

It is capable enough to bring a revolution in the agro-technology and liquid water scarcity management fields.

Basic Components

Water Generation

There's glass in the first part which is cooled by a Peltier module. A fan on the top sucks in moist air from the atmosphere into a pipe. The moist air comes in contact with the cooled glass and condenses on its surface to form droplets of water which are collected in the primary storage container.

Storage

These water droplets, thus formed, collect into the storage tank for further use. The container has a float switch which stops the cooling process once enough water has been collected. This water is then used to water the plants.

Distribution

The water from the storage tank is then distributed to the plants through a highly efficient drip irrigation system to minimise water wastage.

Implicative Sectors

It can be used in any water-based industry without direct supply requirement. Broadly it is developed for the agro-tech industry but the first two parts can suit any level of water requirement, even liquid water scarcity-related issues or water supply to places which are away from municipality regions can be solved by this.

7. **School Name:** Vivekananda Mission School, Joka, Kolkata
Students: Sayak Bhattacharya, Priyodip Saha & Samraj Das Adhikary
Project Supervisor: Ms. Anamika Sen & Mr. Arindam Roy
Project Name: Plant-Based Monitor

Scan the code to watch the video of the project



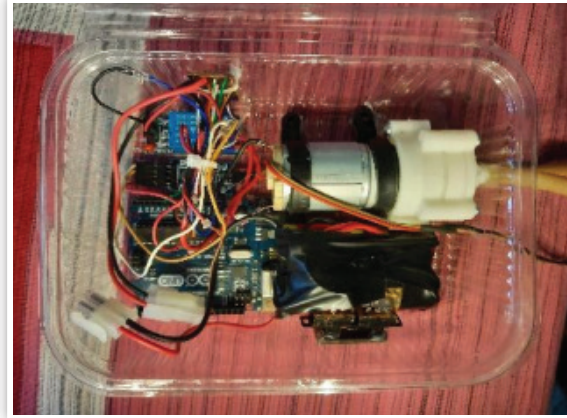
Every one of us likes gardening and planting plants. We always look after our plants so that they grow healthy and bear fruits or flowers in the future. But we can not tend to them all the time, because whenever we go out from our home for a trip or something else, the plants are left unattended. There is no one to take care of the plants and give them water from time to time. We have tried to solve this problem with our model - A plant-based monitor.

The plant-based monitor is such a machine that can detect the moisture in the soil and give water to the plants accordingly, [which means that this machine will release water to the plants when the soil is dry]. The Plant-based monitor takes power from a lithium-ion battery. The lithium-ion battery is charged using a mobile adapter and it can also be charged with sunlight using Solar panels. The water is stored in a plastic bottle tank that acts as a rain harvester. The plant-based monitor also uses a mist sprayer which makes the air laden with moisture and ensures faster growth of the plant body. The processor of this model is made of a single-core processor named Arduino. This model is best suited for people who are always busy with their work but at the same time, they want to take care of their plants. This model also applies to farmers who have become old and don't have enough physical strength to give water to the whole land. The model's pump, solar panel, and battery need to be upgraded for a big farm. This

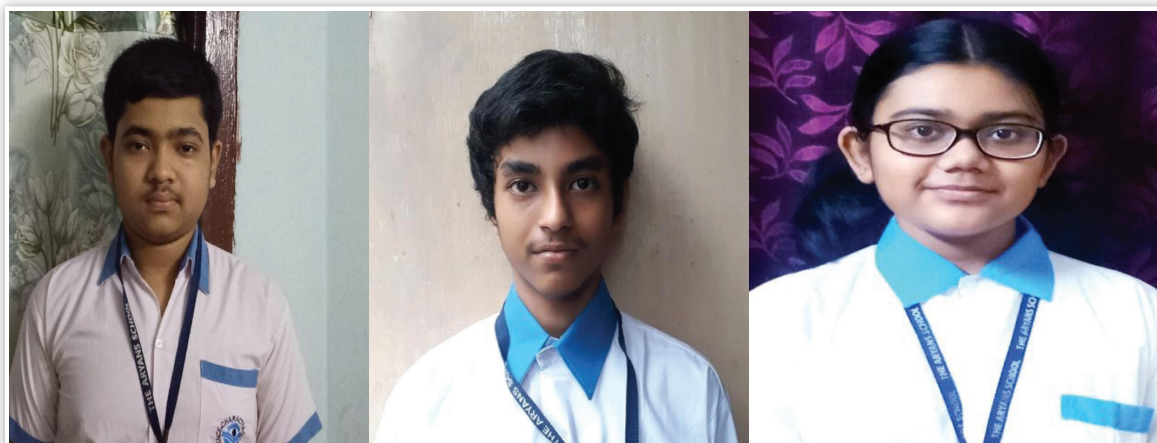
model can also be used to water the trees on the side of roads which are neglected every day by people. It is critical to take care of them because we know that trees and plants are the only sources of oxygen on Earth.



Pictures of the model:



Save trees, Save lives.

8. School Name: The Aryans School, Kolkata**Students:** Arpan Roy, Subhayu Dev & Rittika Bhattacharjee**Project Supervisor:** Ms. Sreeparna Sur**Project Name:** Earthquake Alarm Model WorkingScan the code to
watch the video
of the project

An Earthquake, often known as a tremor or trembler, causes great harm to life and property every year. Though nowadays many modern instruments have been discovered through which we can detect earthquakes but they are not always available to us and also their cost is high and unaffordable for villagers. To avoid this problem we planned to create some device, which is simple and affordable to make people aware and alert about the earthquake instantly. Thus we created the earthquake alarm model out of the following materials.

To construct our model we have used:

- Two 9-volt batteries
- Two 9-volt clip connector
- Two vibrators
- A buzzer
- One small LED flashing light
- Two on/off switches
- Metal nut
- Copper wires
- Eye screw
- Choksi boards and card boards



- Both-sided gum tape
- Glue gun, fevicol
- Scissors/knife
- Grass mat

It works on the principle that during the earthquake when the vibration of the ground occurs, the naked wire which is passing through the eye screw (here it is working as a pendulum), makes contact with the eye screw. On the base plate, a buzzer has been fixed and there is a light fixed on the lower end of the vertical axis, just below the eye screw. These are connected with the eye screw with a very thin and fine wire. So when the wire touches the eye screw, as a result of vibration, the circuit gets completed and the buzzer starts ringing and the light glows. This indicates that the ground or the earth is trembling due to an earthquake. The instrument thus acts like an earthquake alarm.

9. School Name: Young Horizon School, Kolkata**Students:** Abhipsa Bhowmik, Nilarka Pahari & Srijit Ghosh**Project Supervisor:** Ms. Mahua Mukherjee**Project Name:** Sun Tracker

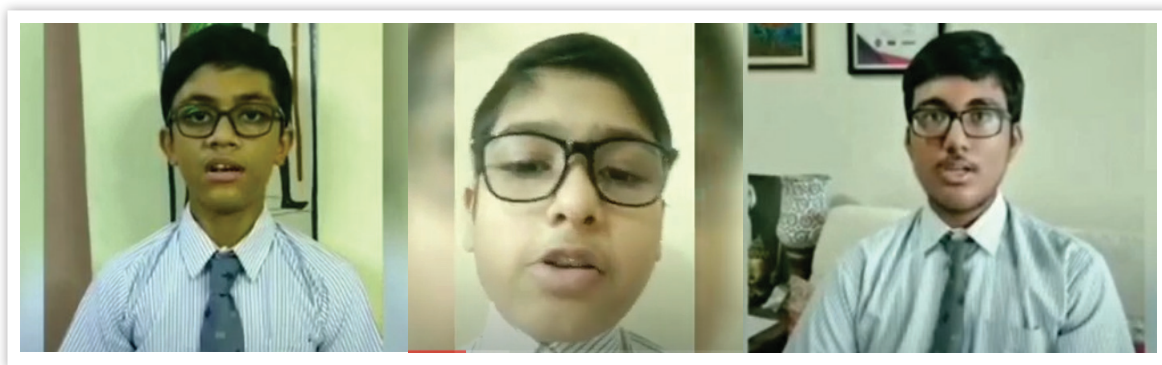
Scan the code to
watch the video
of the project



A solar tracker is a system that positions an object at an angle relative to the Sun. Solar trackers are mostly used in positioning solar panels so that they remain perpendicular to the sun's rays. The aim of the solar tracking systems is to improve and better utilize the current technology of solar trackers.

We made a single-axis solar tracker that rotates the panel in the east-west direction to align the solar panel with the sun throughout the day. The model we made works by getting light energy inputs from 2 light-detecting resistors placed on opposite sides. The sun moves from East to West and as the light energy inputs on the LDRs change, we can resolve which LDR has a lower input and then turn the Panel towards it until we get similar input from both sides.

A real-world usage for this technology could be implementing this technique in solar-powered street lamps that are used in many parts of India. By implementing this technology, an extra amount of energy is collected by the solar panels. We can conserve that extra power collected by each solar-powered street lamp in a power conservation facility, and then use that extra power for a variety of uses, like supplying free electronic vehicle charging stations for electronic vehicles.

10. School Name: Birla High School, Kolkata**Students:** Debarshi Bhattacharjee, Riddhiman Pal & Khushal Jaiswal**Project Supervisor:** Ms. Binay Biswas**Project Name:** Mobile App To Monitor Efficiency Of Oxygen Concentrator, Smart Dustbin And Other MachinesScan the code to
watch the video
of the project

Nowadays human mortality due to Covid-19, and especially child mortality due to pneumonia is a major global health problem and is associated with hypoxemia. Access to concentrated oxygen can be the difference between life and death. Safe and continuous oxygen therapy can save a person's life; however, low-income countries may lack the necessary resources for oxygen delivery.

In this experiment, we have developed a solar-powered oxygen concentrator that can reliably provide medical oxygen with minimal access to electricity. This oxygen concentrator is also cost-effective. We have produced the oxygen with the help of water electrolysis. Moreover, this oxygen concentrator is monitored by an app which increases its efficiency.

To develop our model, we have used basic materials such as air-tight containers, plastic bottles, tap water, etc. This makes our product more economic as compared to the conventional oxygen concentrator. To set up a conventional oxygen concentrator, the cost is around 12 crore rupees while our oxygen concentrator will cost just around 500 rupees. This shows that our model can be used in regular households for emergency purposes. Keeping the current situation of the world in mind, our model works on solar energy which is a renewable form of energy. Hence, it is also eco-friendly. The recent pandemic has shown us how important oxygen is. Thus our oxygen concentrator can help the common people, who need oxygen but are not in the economic condition of buying a conventional oxygen concentrator. This oxygen concentrator can save the lives of many desperate people.

Smart Dustbin is a bin integrated with some hardware components such as Arduino, Servo Motor, Ultrasonic sensors. These components help in opening the lid on the detection of

the human hand and also sending the notification in the form of LED. The code required to perform the above-mentioned operation is dumped in Arduino. IOT-based dustbins help people to manage waste easily and help them reduce the work of calling or waiting for the specific person to make the area clean and make a healthier environment to live in. There won't be any kind of diseases and the people will be fit and not prone to diseases caused by these waste materials. The mission Swachh Bharat can also be implemented easily. This system ensures the cleaning of dustbins soon when the garbage level reaches its maximum. It will take power with the help of Battery. If the dustbin is not cleaned in a specific time, then the record is sent to the Sweeper or higher authority who can take appropriate action against the concerned contractor. It ultimately helps in keeping the surroundings clean and waste management can be much easier.

Nowadays the world is going through a phase of new innovation and technology. However, most of the machines will eventually falter without correct maintenance. Maintenance is an integral part for the functioning of the machine. If the machines stop for a day or two due to improper use then the incurring losses would be immense. Keeping in mind the importance of resources and the ease of calculation we have created the app to not only provide efficiency at the fingertips but also suggest the proper type of maintenance to be applied in case any problem occurs.

11. **School Name:** **Adamas International School, Kolkata**
Students: Soumyarup Yadav, Rishabh Chatterjee & Srijan Das
Project Supervisor: Mrs. Liya Das
Project Name: Freedom From Diabetes: Is Artificial Pancreas The Answer?

Scan the code to watch the video of the project



Our school's project, "**Artificial Pancreas: Freedom from Diabetes**", focused on making a simplified model of the artificial pancreas and explaining its working principle by comparing it with neutralisation reaction. A basic solution represents high blood glucose levels, and a more neutral solution represents normal blood glucose levels in this setup. A conductivity sensor made by constructing an electrical circuit becomes the glucose sensor and it controls whether a pump in the circuit turns on or not. When the solution is basic, the conductivity sensor will make the electrical circuit run the pump. The pump will move acidic solution, which represents insulin, into the basic solution to neutralize it. The conductivity sensor will stop the pump when the basic solution becomes neutralized. This means high blood glucose levels being lowered by the addition of insulin until the glucose levels are normal and no more insulin needs to be added to the bloodstream.



While insulin shots are common ways to deal with insulin but artificial pancreas has sophisticated features which shines as a bright beam of light in the future of diabetes treatment. The aim of this project was to bring awareness among people about this device and let people know about its pros and cons so that they can make a wise decision during their fight with diabetes.

12. **School Name:** Purushottam Bhagchandka Academic, Kolkata

Students: Aditi Das, Arnab Das & Debarpan Chakraborty

Project Supervisor: Ms. Anindita Nayak

Project Name: Improving Efficiency of Machines at Home

“The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them” -William Lawrence Bragg

All great things begin with a small step and one such endeavour of P.B.Academic School, Kolkata was its participation in “Macmillan Budding Scientist Award-2021”. It was the team of Physical Science composed of Aditi Das, Debarpan Chakraborty, and Arnab Das with the project on “Improving Efficiency of Machines at Home”.

The project was based on simple household and commercial appliances - water dispenser, candy vending machine, and vacuum cleaner. The working model was created from waste materials. It also included simple circuits and cost-effective materials. The scientific principles of the models are as follows:-

1. **WATER DISPENSER** - In a water dispenser, the main concept is pressure and gravity. Here, when the cap of the water bottle is opened, water flows through the straw and when it is closed, it stops the water flow. So, when the cap of the water bottle is opened, air starts to press the water and water flows via the straw. When the cap is closed, then the pressure is absent thus stopping the water to flow.
2. **CANDY VENDING MACHINE** - It shows the transition from potential to kinetic energy. When a Candy slides down, it gains more and more speed, thus kinetic energy increases. When a Candy is placed at a certain height then it possesses maximum potential energy.

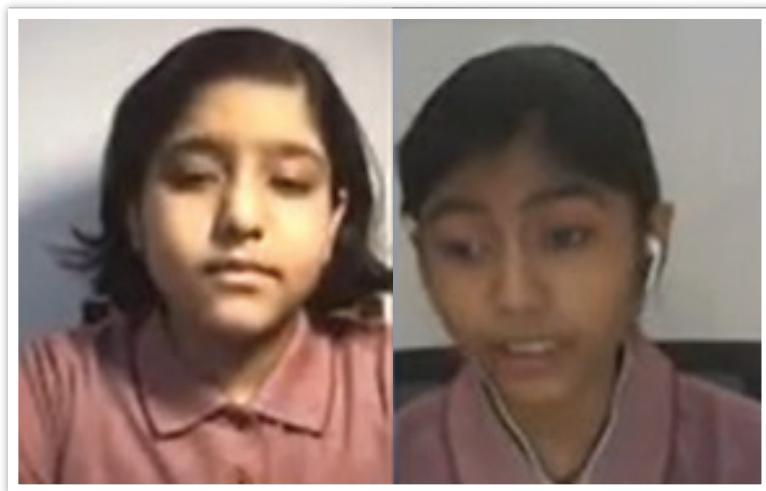
Scan the code to watch the video of the project



3. VACUUM CLEANER - Materials flow from one location to another when a pressure difference is created between two locations. This phenomenon is the basic working principle of an ideal vacuum cleaner. In this appliance, the rotating fan of the motor creates a vacuum and begins to draw in air through the suction nozzle.



The vacuum cleaner is highly known for its flexibility, motor control, and versatility. The students enthusiastically participated in the event. The team spirit and the confidence of these students deserve a special mention. Their effort and hard work enabled the school to compete at a National Level Competition.

13. School Name: Patanjali Rishikul, Prayagraj**Students:** Tushti Pandey, Vaibhavi Mitra & Sanjam Preet Singh**Project Supervisor:** Mr. Saurabh Shukla**Project Name:** Smart virtual supervisor for monitoring cleanliness of public toilets in India

Scan the code to watch the video of the project



In India, the concept of smart restrooms involves developing smart monitoring, auto-flushing and auto-dispensing toilets. Building such a toilet costs around 4 to 5 lakhs. Modifying these toilets would require major transformations and is a costly alternative. The cleaning and monitoring of the cleanliness of the public toilets is manual and follows a fixed routine. However, the restroom located near bus stations, railway stations, and densely populated areas are used more frequently and need multiple cleaning sessions. An alternative to facilitate clean toilets is to install smart auto-cleaning toilets. The major objective of our proposal is to design an Internet of Things(IoT) and AI-based smart virtual supervision equipment that can transform the conventional cleaning methods of scheduled cleaning and periodic monitoring into data-driven intelligent cleaning operations. The manual cleaning process should be augmented with a smart supervision system to improve the hygiene level of the existing restrooms. Restrooms should be deployed with sensors for monitoring footfall trends, ammonia levels, wetness values, air quality, soap dispensing levels, etc. The sensors are deployed on an Arduino kit. Data collected from sensors would be transferred to a computing server(RaspberryPi/fog/cloud). Then the summarized data would be processed by an app. This platform will be utilized to generate timely alerts regarding the condition of the toilet. It may also help in learning usage patterns for the predictive deployment of cleaners. Further, the proposed system would also increase the transparency of the system and make significant improvements in saving time and cost while improving customer satisfaction. A feedback collection app can also be developed. Cleaners are assigned a unique ID and the information regarding each cleaner is updated in the cloud database.

14. **School Name:** Sophia Girls' Sr. Sec. School, Bhilwara
Students: Sejal Vagrecha, Hiya Surana & Subhra Dhadhich
Project Supervisor: Mrs Anuradha Rathore
Project Name: Environmental Science- solution for air pollution



Scan the code to
watch the video
of the project



The aim of our project was to create an economically viable pollution absorber. The principle behind our model was to reduce harmful pollution by passing the air through a chamber housing a plate with a petroleum jelly surface, which absorbs the pollutants and filters the air.

In this pollution absorber, a fan sucks the polluted air inside, and the pollutants in this air while passing through the chamber, sticks to the petroleum jelly. After a few minutes, we discovered tiny pollutants accumulating on the plate which is kept inside. We tried our best to avoid using non-biodegradable items like thermocol and plastic. This effort was done with the hope that the pollution levels could be decreased and we can breathe in a cleaner environment.

15. School Name: Raghav Global School, Noida**Students:** Aviska Chaurasia, Taksh Sagar Khanduri & Kaushiki Pandey**Project Supervisor:** Ms. Koyeli Mazumdar**Project Name:** Environmental Science- solution for air pollution
- Best air PurifierScan the code to
watch the video
of the project

It all started with the mail we received from the “Macmillan Budding Scientist Award”. The task was to make a project or a model very unique to solve present-day problems.

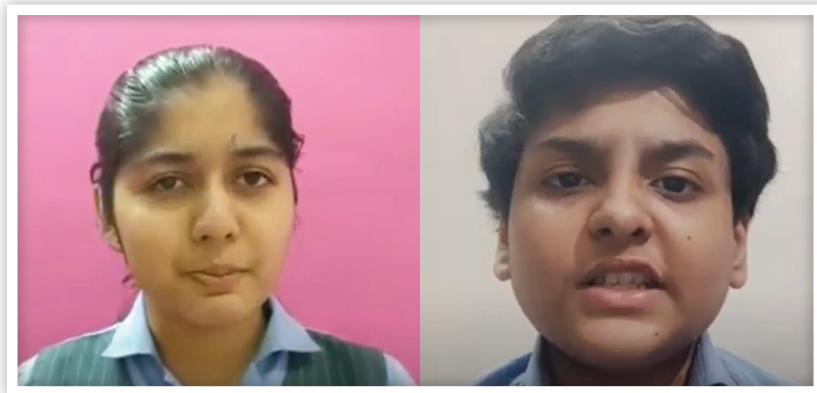
An online meet was called for all the students of grades 6-8. Three children from grade 6-8 were picked up. They came up with the unique idea of making an air purifier using the used disposable facemask.

Taksh Sagar Khanduri and Kaushiki Pandey from Grade 7 and Avishka Chaurasia from Grade 6 teamed up for the project. Taksh took the responsibility of making the air purifier using the carburetor of a car, while Avishka and Kaushiki started by making the mask carpet.

The Idea was good as during covid there were many disposable masks that were being dumped into the ecosystem. This mask carpet is actually recycling these used masks and preventing them to go into the surroundings. A fan fitted with a switch and a bulb completed the circuit. Keeping Bernoulli’s principle in mind the “best air purifier” was made.

The purifier was taking air from the surroundings and throwing out fresh air from the top. The particulate materials were stuck within the mask carpet which is washable and can be cleaned on a regular basis. This air purifier was very cheap to make and can be easily used in homes and offices.

16. **School Name:** Vivekanand School, Anand Vihar, Delhi
Students: Shreya Giri, Navaneet Nambissan & Maitri Das
Project Supervisor: Ms. Anju Moorjani
Project Name: Environment Friendly Edible Cutlery



Scan the code to watch the video of the project



Plastic pollution is a global problem. Governments, foundations, and some social welfare organisations are all attempting to raise awareness about this issue. Plastic pollution has several negative effects on our climate. Some state governments are imposing strict regulations to reduce the usage of single-use plastic so that people are aware of the effect of plastic waste on the environment. As a result, action must be taken to address this issue before it is too late.

Keeping this in mind, students of Vivekanand School came up with a wonderful idea of making environment-friendly edible cutlery which is an alternative to non-biodegradable single-use plastic cutlery. Edible utensils help limit the use of plastics, resulting in the reduction of plastic waste. These are also biodegradable and would decompose. These types of utensils are better alternatives to using plastic cutlery at home and in business operations.

It is made out of completely natural materials, with no extra coatings, or additives, and it is perfectly safe to be eaten once the meal is over. Of course, this is not entirely necessary, as if you throw it away, insects, dogs, and birds can eat it too. And if it is not eaten, it will decompose within a week. The shelf-life of the cutlery is 18 months.

The ingredients for making home-made utensils are basic to most kitchens:

- 3 and ½ cups of flour
- 1 cup of water
- 1 teaspoon of salt

The tools required are:

- Small knife
- Scissors

- Rolling pin
- Baking sheet
- Metal spoons

The steps are simple, but some hands-on skills are required:

1. Preheat the oven to 375 degrees Fahrenheit.
2. Pour the water into a bowl, stirring in the flour gradually until the mixture is too thick to stir.
3. Dust a cutting board or surface with flour and transfer the flour mixture to it. Pat the mixture with both hands and roll it into a ball. Lightly dust the dough with flour.
4. Use the rolling pin to roll out the dough until it is $\frac{1}{4}$ inches thick.
5. Cut out spoon, knife, and fork shapes using the metal spoon as a guide for the handle lengths and utensil shapes. Use the small knife to carefully cut out the dough cutlery.
6. Cover the baking sheet with parchment paper, now place the dough in the pan and bake until it turns into golden brown for about thirty minutes.
7. Let the cutlery to cool down.
8. Use the cutlery for eating, and then eat the utensils.

Edible cutlery is environment-friendly, biodegradable, and generates less waste. It's a great solution to reduce plastic waste. Most importantly it provides occupation to the unemployed women in rural areas. It is chemical free and contains no additives and preservatives. So the students of Vivekanand School request you all to stop using plastic cutlery and move towards a green India.

17. **School Name:** Sevasadan Saksham CBSE School, Nagpur

Students: Kanak Joshi & Aadit Kapse

Project Supervisor: Mrs. Ritu Sharma

Project Name: Solutions For Noise Pollution



Scan the code to watch the video of the project



This model aims to decrease the noise pollution caused due to honking of automobiles, which are major contributors to noise pollution, especially in urban areas. Sighting this major problem, a unique horn has been designed using Arduino Uno Microcontroller. The primary objective of this system is to limit the number of times the horn is used, which ensures that the driver does not overuse the horn which will help in reducing the noise levels.

Technical Detailing:-

The model is programmed on Arduino Uno Microcontroller and the components like buzzer, LED's (Light Emitting Diodes), push button, resistors, jumper wires, etc are connected to it through the breadboard. When the push button is pressed, the buzzer makes a sound and the Arduino counts the number of times the push button is pressed and keeps a record of it. When the count exceeds the target limit (here set as three), it deactivates the buzzer (horn) for a certain period of time. After the stipulated delay, the buzzer (horn) can be used again. All these components are collaborated by coding the Arduino in C++ language.

Advantages and Future Prospects:-

1. With the advancement in technology of manufacturing vehicles and software advancement, we can incorporate this idea easily and can be made cost-effective also.
2. This circuit can also be integrated with powerful technologies such as Machine Learning, Global Positioning System and Artificial Intelligence which can enable this circuit to adapt to different scenarios and make it more efficient.

18. School Name: Ambuja Vidya Niketan, upparwahi

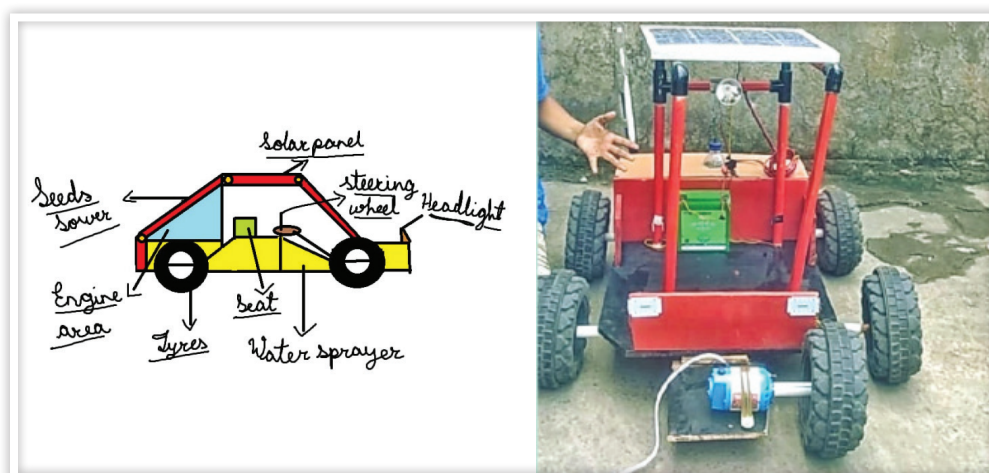
Students: Shivraj Wadai, Tanmay Gokhare & Bhargav Awande

Project Supervisor: Mr. Rohit Shukla

Project Name: Farmers Friendly Kart(physical Sciences)

Farmers-friendly kart is a model that can help farmers in many different ways. This model can replace bullock carts in the future. It works on solar energy and can save electricity and can also replace petrol and diesel which are very bad pollutants. The main aim behind making this model is to reduce the use of petrol and diesel and save time for the farmers. This model can do some extra work like spraying water and sowing seeds in the field. This project works on solar energy from the sun's rays. In the solar panel, there are many small solar cells that directly convert light energy into electrical energy through the photovoltaic effect. Photovoltaic cells convert sunlight into direct current (DC). Advantages of this kart -This model can be used for many purposes. In many villages, electricity is the main problem, keeping this in mind this project uses solar panels to charge the battery. It requires less maintenance. If kept in a sunny day, the battery charges automatically if wires are connected. This model helps the farmers in many ways so that their work becomes easy. This model uses only solar energy and helps to reduce air pollution. This model reduces the transportation time and the bullocks used in bullock carts can now be healthy and fit to be used for other purposes rather than used for transportation. This model can be used for many purposes.

Scan the code to watch the video of the project



19. School Name: Sri Sathya Sai Vidya Vihar, Indore**Students:** Angel Tiwari, Aaradhy Goyal & Vihaang Dalal**Project Supervisor:** Ms. Taranjeet Vyas**Project Name:** Air Purification

Scan the code to
watch the video
of the project



A simple, economical, and highly efficient air purifier consisting of different layers of filters in a stainless body to purify the air. The air passed through the filters becomes clean, breathable, and sanitized. The Purifier is portable and can fit on the dividing belts of the road. The simplicity and the minimalist design makes it efficient. It is self-sustainable and uses clean and green energy.

Design/Working

Stage I - The suction fans suck the air inside the air purifier, while exhaust fans push the air out from the top. It creates pressure and moves the air upward. This upward-moving air passes through the pre-filter that blocks all the large dust particles from the air to make it dust free.

Stage II - The air passes through the HEPA filter that blocks all the particles as small as 3 microns.

Stage III - The carbon filter absorbs deadly contaminants such as the VOCs and the carbon monoxide particles.

Stage IV - This air passes through the correctly tuned UV light that disables air-borne bacteria and viruses, thus making it germ-free and odourless. Then, this air is pushed out of the air purifier.

Sustainability of the project:

We use the energy produced by solar panels, winds, and traffic turbines. This extra clean and green energy produced can be used to power the street lights.

Commercial viability

- Selling Carbon Credits achieved by the air purifier will raise funds.
- Extra electricity can be sold to different organizations to generate money.
- Wi-Fi routers installed inside the lower section of the Purifier will attract sponsors from internet companies.
- The maintenance and nationwide use of the Purifier will offer more job opportunities.

The idea mentioned above will bring down the API, thus increasing the health quotient of the citizens.

20. **School Name:** Jawaharlal Nehru School, Bhel, Bhopal

Students: Latika Malthare, Pawan Patil & Anushree Soniya

Project Supervisor: Mrs. Parineeta Shakya

Project Name: Hydrogen Gas As A Future Fuel



Scan the code to watch the video of the project



In our daily lives, as we use methods of different equipment and appliances etc. to make our life easier, the consumption of energy is increasing day-by-day. As the energy sources are limited and the population is increasing per second, the demand is also increasing each day. To meet this type of energy crisis we should adopt some alternative source of energy that is capable of meeting the energy needs of individuals while at the same time, it should be eco-friendly and economically affordable. Hydrogen can be used as a future fuel. Electrolysis of water to obtain hydrogen is a safe and economic option. We can use seawater for electrolysis as it already consists of a huge amount of salts that act as electrolytes. Hydrogen gas is an energy carrier that can be used in internal combustion engines or fuel cells producing virtually no greenhouse gas emission when combusted with oxygen. The only significant emission is water vapor.

Method of preparation in lab by electrolysis of water --

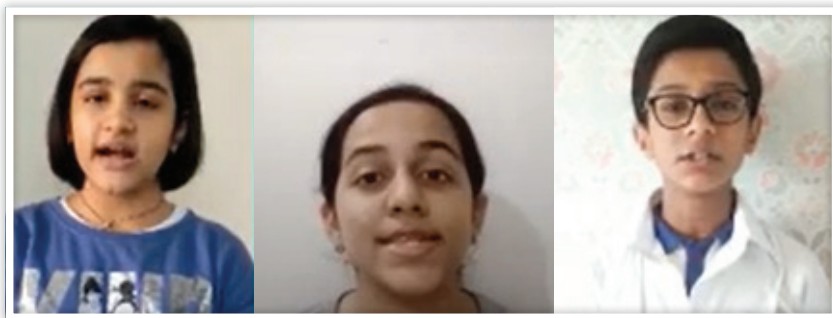
The electrolysis of water produces hydrogen and oxygen gases. The electrolysis cell consists of a pair of platinum electrodes immersed in water to which a small amount of an electrolyte such as H₂SO₄ has been added.

At cathode: $2\text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g}) + 2\text{OH}^-$ $E^\circ = -0.42 \text{ V}$

At anode: $2\text{H}_2\text{O} \rightarrow \text{O}_2(\text{g}) + 4\text{H}^+ + 4\text{e}^-$ $E^\circ = +0.82 \text{ V}$

The net reaction of electrolysis of water is given as; $2\text{H}_2\text{O} + \text{Electrical energy} \rightarrow \text{O}_2 + 2\text{H}_2$
 $E^\circ = -1.24$

Electrolysis is a promising option for carbon-free hydrogen production from renewable and nuclear resources. Electrolysis is the process of using electricity to split water into hydrogen and oxygen. The hydrogen produced can be stored in suitable chambers and oxygen produced as a byproduct can be used for medical purposes for patients having medical emergencies for oxygen cylinders.

21. School Name: Bombay Scottish School, Powai, Mumbai**Students:** Swasti Singh, Parth Naik & Vaibhavi Venkateshwaran**Project Supervisor:** Ms. Riya Joseph**Project Name:** Treatment Of Injuries, Diseases, Vaccinations

Scan the code to
watch the video
of the project



Statistics show the third major cause of death worldwide is COPD (Chronic Obstructive Pulmonary disease). Research also revealed that by 2050, COPD will turn out to be the major cause of death worldwide, thus there is a necessity to create awareness about the same.

We made a 3-minute video for the first round which comprised the causes, symptoms, ways to prevent COPD, the government's role in imposing stricter measures, mention of the app to create awareness, and how one must not self-medicate or google their symptoms but consult the doctor.

A survey was conducted for students of grades 6, 7 & 9 to gauge their awareness of COPD. The survey results showed that there is very low awareness of COPD among people. They are aware of what causes lung issues but do not know how to avoid it.

Our app "Pulmofit" aims at creating awareness, encouraging people to practice breathing exercises, checking pollution levels anywhere and taking necessary precautions.

Macmillan Budding Scientist, powered by Springer Nature 2019

Finalists:

1. **School Name:** Silver Oaks School, Bathinda
Winner: North Zone
Students: Agamveer Singh, Harshveer Singh, Harkirat Kaur
Project Supervisor: Man Mehak Sidhu
Project Name: Eco Ink: Solution To Air Solution

Scan the code to watch the video of the project



Recycle smoke from the chimneys, in the form of soot and convert it into eco-friendly ink that helps reduce air pollution. The resultant ink is very dark and durable. It does not fade easily.

2. **School Name:** Sri Padmapat Singhania school, Kota
Runner-up: North Zone
Students: Anusha Saxena, Indra Prataph Singh Rajawat
Project Supervisor: Ms. Shipla Saxena
Project Name: Bricks from PET



Recycle plastic waste and made bricks from them. Melting the plastic by heating it with sand particles to form a paste-like substance, which is then put in a mould to set. The bricks made are economical and can be used for insulation.

Scan the code to watch the video of the project



3. **School Name:** St. Xavier's International School
 Zirakpur Zirakpur, Ramgarh
Students: Kiranjot Kaur, Vaibhav Ghai, Nandini Sharma
Project Supervisor: Ms Manisha Gulleri
Project Name: Bioshearing Wool Harvesting System



An effective way to shear sheep while reducing the chances of injury to the sheep and minimizing the chances of contracting Anthrax.

Scan the code to watch the video of the project



4. **School Name:** Ahlcon International School, Delhi
Students: Rudraksh Arora, Aditya Acharya and Nisha Gupta
Project Supervisor: Ms Mayank Dugar
Project Name: Eco-Signal-Glasses for the blind



Scan the code to watch the video of the project



Using ultrasound-equipped goggles and walking stick which triggers a warning to the user when objects are close. These two smart devices enable the visually impaired by innovative use of technology.

5. **School Name:** Mount Carmel School, Dwarka, Delhi
Students: Akhyaan Kumar, Abhaas Dhayal and Maanya Dhawan
Project Supervisor: Ms. Deepshikha Kaur
Project Name: Cure For Cancer



Explore how copper plays an important role in starving the cancer cells and controlling cancer growth, and thus open a doorway to a cure for cancer.

6. **School Name:** St. Xavier's School, Bhuj
Students: Pandya Parv, Thacker Rudra
Project Name: Mobile Microscope



Explore how you can use your smartphone camera as a microscope with materials that are easily available.

Scan the code to watch the video of the project



7. **School Name:** K.V. IIT School, Mumbai
Students: Ishana Mukherjee, Tanisha Srivastava, Madhav Pillai
Project Name: Solar Energy Based Net To Control Mosquito



A clean and cost-effective solution for mosquito control. Use of a solar-powered net to keep the mosquitoes at bay!

Scan the code to watch the video of the project



8. **School Name:** Amarajyothi school, Pathapatnam, srikakulam
Students: D.MOHITH, CH.MOUNIKA, S.JASWANTH
Project Supervisor: Ms. L Suneetha
Project Name: Water purification



Explore how sedimentation using simple machines like a water wheel can help you purify water.

Scan the code to watch the video of the project



9. **School Name:** Carmel convent sr. sec. school, Amlai
Students: Aastha Pandey, Shreya Chaturvedi and Lakshay Gauta
Project Name: Solution to control Air pollution



Scan the code to watch the video of the project



Explore innovative ways in which you can recycle pollution (Air Pollution) and use it to generate electricity, form ink, and other interesting things and take a positive step to curb air pollution.

Macmillan Budding Scientist, powered by Springer Nature 2018

Finalists:



Winners

Students of Carmel Convent Senior Secondary School, Amlai, Madhya Pradesh India. Presenting their project on "Increasing Efficiency of Machines"



Winners

Students of Ujjawal's Sprouter International School, Jalgaon, Maharashtra, India with their project on "Generating Electricity from Solid Wastes".



Winners

Students of Vivek High School, Mohali, Punjab, India, with their project "Rigator -- an easy irrigation machine that reuses surface runoff water"

Glimpses from 2018





Participate in Macmillan Budding Scientist 2022-23

ELIGIBILITY

Classes

6 to 8

Team Size

3 students & 1 coordinating teacher

CATEGORIES

Environmental Science

Solutions for water/air purification, noise pollution etc.

Biological Sciences

Treatment of injuries, diseases, vaccinations etc.

Physical Sciences

Improving efficiency of machines/tools etc.

Chemical Sciences

Identifying adulterants

REGISTRATION

Registration is going on and closes on 30th November, 2022

To Register



Scan the QR Code for the nomination form

OR

Enter this URL in your browser

<https://macmillaneducation.in/nomination-form/>

SELECTION PROCESS

ROUND 1

Upon successful nomination, participants will be sent a google drive link on their registered email id. They should upload a **3-minute-video** explaining the novelty and application of the working model/experiment/idea.



Last date for submission of entries in 30th November, 2022



Entries will be **judged by an independent jury** comprising scientists and academicians.



8 teams will be selected for the Round Two

ROUND 2

Top 8 Teams along with their coordinating teachers will be called to present their working model/experiment/idea to the jury in a presentation at one of the following IITs - New Delhi, Mumbai, Bhubaneswar and Chennai Campuses.



The winner and runner up will be eligible for participation in the grand finale along with the winners and Runners up of other zones.

AWARDS

First Prize

₹25000

along with the certificate of achievement and study materials.

Second Prize

₹20000

along with the certificate of achievement and study materials.

Macmillan will honour the contribution of the scientific mentor and the Head of the concerned institution for fostering scientific talent in awardees.

Certificate of Participation for all students

CONTACT DETAILS

Write to Somanjan.bandyopadhyay@macmillaneducation.com for queries.