

March 2025

# Young Scientist India

A Science & Innovation Magazine for School Students

## INNOVATIONS FOR HOME

SANTANU BHATTACHARYA  
SHIVRAM BABURAO BHOJE  
DR. VIJAY PANDURANG BHATKAR  
SIR MOKSHAGUNDAM VISVESVARAYA

SWOT ANALYSIS  
SIX THINKING HATS  
MOBILE APP DEVELOPMENT  
INNOVATION VS INVENTION



# Young Scientist India

## Table of Contents

### COVER STORY

12 Innovations for Home

### ARTICLES

18 Quantum Computing

30 Innovation vs Invention

34 Mobile App Development

### INDIAN SCIENTISTS

04 Sir Mokshagundam Visvesvaraya

17 Dr. Vijay Pandurang Bhatkar

29 Santanu Bhattacharya

37 Shivram Baburao Bhoje

### INVENTIONS & INNOVATIONS

26 Radio & Wireless Communication

38 USB - Universal Serial Bus

41 Mangalyaan

### INNOVATIONS FOR INSPIRATION

05 A Simple Menstruation Device  
Adjustable Stand for Cooler

16 Modification of an Umbrella  
Innovative Mechanic Repairing Seat

21 Fan Cleaner  
Walker with Chair for Senior Citizen

28 A Cooler Basket  
AI-Based Coma Patient Monitoring  
System

32 Caliper-X - Prosthetic Leg  
Improved Model  
A Shoe with Odometer and Alarm

### INNOVATION TRAINING MODULES

06 Six Thinking Hats

22 SWOT Analysis

### S&I LABS & ORGANIZATIONS

11 The Anusandhan National Research  
Foundation (ANRF)

20 National Innovation Foundation (NIF)

33 Department of Science & Technology  
(DST)

40 Department of Space (DoS)

15 Brain Teasers

42 This Month in the History

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## Chairman's Message

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My dear Young Innovators, getting ready for the Summer Holidays?

It's time to forget the regular syllabus and have some fun. This issue of Young Scientist Magazine gives you a change from the routine. With many dynamics in International Commerce recently, countries are moving towards self-reliance, reducing dependencies on others. At our end too, the Atmanirbhar Bharat strategy now needs Innovation, Research, Development, and Indigenous Products more than ever.

This March 2025 issue covers Innovations for Home to trigger new ideas as you spend the holidays at home. You will have the GYS Avishkar Awards 2025 announcement soon. You might pick up some summer projects too. As you work with teams and gear up to present your innovations at Competitions, the Six Hat Thinking technique helps you make the solution comprehensive, and SWOT Analysis makes the Innovation competitive as well as sustainable. These are two life skills to acquire.

Many-a-time people are confused between Innovation and Invention. There is an article in this issue to bring clarity. Quantum Computing is a buzzword in recent times and hence we presented a little insight here. Indian heritage is driven by intellect. This month features four great Indian personalities, viz., Santanu Bhattacharya, Shivram Baburao Bhoje, Vijay Pandurang Bhatkar, and Mokshagundam Visvesvaraya. Do look at how they contributed to the Nation's legacy. You may be aware that the National Innovation Foundation (NIF) is the pinnacle organization for Grassroots Innovation. Besides NIF, you would also get to know three other premier organizations in the country that promote Scientific Research.

As always, a few successful Student Innovations from competitions like INSPIRE MANAK and Avishkar are presented to derive inspiration from. The YoungScientistIndia.org website has been revamped for you. Visit to experience valuable content helpful to participate in Science & Innovation competitions during this Summer and beyond. Do look at the Award Winning Innovations section. In case you haven't had a chance to read the previous issues of Young Scientist India magazine, do download them from the website. You may also join the Telegram Channel and WhatsApp Channel to get information on forthcoming events and contests.

Dear Teachers and Students, the time is never better than now. The Viksit Bharat goal throws many opportunities for everyone to pick up and excel. Do avail the next couple of months towards joyful learning, and, probably, to develop some innovations. Best wishes to you all.

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# Indian Scientist

# Sir Mokshagundam Visvesvaraya

1955: Bharat Ratna, India's Highest Civilian Award



15 SEP 1861 - 14 APR 1962

A renowned Civil Engineer, Administrator, and a Statesman, Mokshagundam Visvesvaraya served as the 19th Dewan of Mysore from 1912 to 1918. He is often called "the maker of modern Mysore." His birthday, September 15, is celebrated as Engineer's Day in India, Sri Lanka, and Tanzania.

## Achievements & Accomplishments

- Visvesvaraya's major achievement was the **Krishna Raja Sagara Dam**, completed in 1932, which revolutionized irrigation in Mysore.
- He designed **Flood Protection and Irrigation Systems**, boosting agricultural productivity with canals and embankments.
- In 1903, he designed **Hyderabad's Water Supply System**, improving sanitation and public health.
- He established **Mysore Iron and Steel Works**, improved infrastructure, and advised on the Mokama Bridge over the Ganga in Bihar.

## Dewan of Mysore (1912-1918)

He introduced many reforms as Dewan of Mysore:

- Established the University of Mysore in 1916.
- Founded Bangalore Polytechnic and Government Engineering College in 1917 which is now known as University of Visvesvaraya College of Engineering (UVCE).
- Built Mysore Soap Factory in 1916, now known as Karnataka Soaps and Detergents Limited (KSDL).
- Instrumental in formation of State Bank of Mysore in 1913.
- Formed Kannada Parishat for the development of the Kannada language.

## Awards and Honors

- **1911:** Companion of the Order of the Indian Empire (CIE).
- **1915:** Knight Commander of the Order of the Indian Empire (KCIE).
- **1955:** Bharat Ratna, India's highest civilian award.
- **1923:** President, Indian Science Congress.

## Legacy and Recognition

- Visvesvaraya Technological University (VTU) and Visvesvaraya National Institute of Technology (VNIT) are named after him.
- Metro stations in Bangalore and Delhi and a railway terminal in Bangalore bear his name.



### A Simple Menstruation Device

The student is aware of the challenges that girls face during their menstrual period. Because they do not have access to sanitary pads, rural girls are reluctant to attend school. Due to the high cost of sanitary pads, 90% of girls in rural regions still use reusable clothes instead of pads. Using clothes to maintain hygiene during menstrual cycles is tough for girls. With this in mind, Shrivalli created a multipurpose menstruation tool kit that may assist any girl throughout her monthly period, reduce pain, and improve hygiene and safety. Two bowls, a basket, and string are the essential components of this kit. The student created a tool to wash, dry and carry the cloth easily worn during menstruation.



**Sailu Sai Shrivalli**  
6th Class

This washing tool uses less detergent and water than a barrel. The fabric will ring as a result of the spinning action, reducing the drying time. Student also noticed that girls are hesitant to dry their clothes in the sun, so she created a basket out of paper waste. Without being shy, girls can effortlessly dry their clothes in this basket. Shrivalli made a pouch out of high-density polyethylene fiber to carry used and unused pads to school or wherever else. According to the student, by utilizing her kit, girls will have access to dry and clean pads. Preventing disease and making them more physically and emotionally comfortable. "Menstrual issues will never stand in the way of a girl's dreams or ambitions", says Shrivalli.

*(Source: INSPIRE MANAK NLEPC 2023 Booklet)*

### Adjustable Stand for Cooler



During Summer, coolers are kept outside of windows. In many homes, windows vary in size and height. Since not every window can accommodate a cooler of the same size, Khushveer created an adjustable cooler stand. It is adjustable in height. It has wheels making it movable to any location. These wheels are rotatable so that it can be set to the desired direction.



**Khushveer Kaur**  
6th Class

*(Source: INSPIRE MANAK NLEPC 2023 Booklet)*

# Six Thinking Hats

Unlock Your Best Ideas!

## Introduction

The Six Thinking Hats technique, developed by Edward de Bono, is a powerful tool for structured thinking, creativity, and problem-solving—ideal for students working on science and innovation projects. It helps team members look at problems from multiple perspectives and streamline their thinking. This technique offers a systematic way to brainstorm, evaluate, and refine ideas.

Each “hat” represents a different mode of thinking: The White Hat focuses on facts and data, the Red Hat allows intuitive and emotional insights, the Black Hat highlights potential risks and challenges, the Yellow Hat explores benefits and opportunities, the Green Hat fosters creative solutions, and the Blue Hat ensures organized thinking and process management. By intentionally “wearing” each hat during discussions, students can explore solutions more thoroughly and collaboratively.

This technique is particularly valuable for fostering both individual critical thinking and effective teamwork. Instead of team members getting bogged down in simultaneous arguments or unfocused discussions, the Six Thinking Hats allows for parallel thinking, where everyone focuses on one specific mode of thought at the same time. By mastering the Six Thinking Hats, one should be able to achieve more successful innovations for INSPIRE MANAK, GYS Avishkar Awards, ATL Tinkerfest, NCSC, etc.



## Benefits

- Develops Structured Approach (Blue Hat)
- Improves Creativity (Green Hat)
- Encourages Critical Thinking (Black Hat)
- Promotes Empathy and Emotional Awareness (Red Hat)
- Enhances Efficient Decision-Making (Yellow Hat)
- Facilitates Fact-based Reasoning (White Hat)
- Trains on Team Collaboration and Focus
- Strengthens Holistic Thinking

## The Technique

Schedule a session for one to two hours where six students participate. The facilitator gives a hat to each of them in six different colors, i.e., White, red, Black, Yellow, Green, and Blue. Explains roles. The team members contribute ideas and thoughts strictly from the perspective of the designated hat.



The facilitator ensures everyone participates and stays focused. Each student writes down questions as well as answers for later use. Facilitator moderates inputs from team members giving a couple of minutes to each and moving on to the next one. Goes through 4 to 5 rounds. Summarizes outcomes at the end of the session.

The Blue Hat may play the role of the Facilitator without involving the Teacher. Roles (Hats) may be shuffled after a couple of rounds, if helpful. Worksheets with guided questions for each Hat may be used, if preferred.

### Six Hats, Six Roles

Here's a role each of them to play based on the hat they are wearing along with illustrations:

#### 1. The White Hat - Facts and Information:

This student focuses on understanding the problem, objective data, available information, evidence, and identifying what information is missing.

**Context:** Solar-Powered Irrigation System for Small Farms in Maharashtra

**Q:** What percentage of farmers in our state rely on rain-fed agriculture?

**A:** 68% of small farmers depend solely on monsoon rains (Agriculture Dept. 2023 report).

**Q:** What's the average landholding size of local farmers?

**A:** 1.2 acres (2021 land records).

**Q:** What's the average water requirement for 1 acre of vegetables?

**A:** 2,500 liters/day in summer (ICAR irrigation guidelines).

**Q:** What irrigation methods are currently used?

**A:** 80% use flood irrigation, wasting 45% water

**Q:** What solar panel efficiency can we realistically achieve?

**A:** 15-18% with recycled panels, 20-22% with new monocrystalline.

**Q:** What solar panel efficiency can we realistically achieve?

**A:** 15-18% with recycled panels, 20-22% with new monocrystalline.

**Q:** What's the cost of a commercial solar pump?

**A:** ₹75,000 for 3HP systems – too expensive for small farmers.

**Q:** What government subsidies are available?

**A:** PM-KUSUM gives 60% subsidy on solar pumps.



**2. The Red Hat - Emotions and Intuition:** This student focuses on feelings, hunches, gut reactions, and subjective opinions without the need for justification.

**Context:** Solar-Powered Water Purifier for Rural Areas

**Q:** How do we feel about working on this problem?

**A:** Excited but nervous – clean water could save lives, but the technical challenges seem daunting.

**Q:** What personal experiences motivate us?

**A:** Seeing villagers drink muddy water during our field trip last year.

**Q:** What frustrates us about existing solutions?

**A:** RO systems waste water – feels unethical in drought-prone areas.

**Q:** How might rural families feel about our solution?

**A:** Skeptical at first, but open to trying if we involve local leaders in demos.

**Q:** What cultural sensitivities might affect adoption?

**A:** Elders might resist 'student-made' tech – we'll highlight guru-shishya tradition.

**Q:** What excites us most about the design?

**A:** Using discarded plastic bottles – turns trash into treasure!

**Q:** What intuitive hunches guide our approach?

**A:** Gut says coconut fiber might work better than activated charcoal.

**Q:** How does this project align with our values?

**A:** Matches our belief in 'Jal Shakti' – every drop counts!

### SIX THINKING HATS A Role Playing Technique

#### 3. The Black Hat - Caution and Critical Judgment:

This student focuses on identifying potential problems, risks, weaknesses, and obstacles. Encourages critical thinking and helps anticipate challenges.

**Context:** Low-Cost Air Quality Monitor for School Campuses

**Q:** How might dust affect outdoor sensor accuracy?

**A:** PM2.5 readings drift by 30% weekly – designing wiper mechanisms.

**Q:** What if teachers find the data too technical to interpret?

**A:** Adding color-coded alerts (green/yellow/red) based on CPCB standards.

**Q:** Could extreme summer heat damage the electronics?

**A:** Components fail at 50°C – adding aluminum heat sinks.

**Q:** How might vandalism affect installed units?

**A:** Mounting sensors 3m high with tamper-proof screws.

**Q:** Could the alarm function cause panic during class?

**A:** Replacing sound alerts with silent SMS to teachers.

**Q:** How might sensor placement affect readings?

**A:** Avoiding AC exhaust zones – creating a 10-point placement guide.

**Q:** How might power outages affect continuous monitoring?

**A:** Adding supercapacitors for 6-hour backup (cost: ₹350/unit).

**Q:** What if the sensors need frequent recalibration?

**A:** Designing auto-calibration using baseline nighttime readings.

#### 4. The Yellow Hat - Optimism and Benefits:

This student focuses on highlighting the positive aspects, benefits, opportunities, and feasibility of an idea.

**Context:** AI-Based Crop Disease Detection App for Farmers

**Q:** How could this reduce pesticide overuse?

**A:** Early detection could cut chemical use by 30%, saving farmers ₹8,000/acre/season.



**Q:** Could this data help government agencies?

**A:** District agriculture officers need real-time blight maps – we could partner!

**Q:** How might this improve food security?

**A:** Saving 15% of tomato crops = 8,000 more meals/year in our district.

**Q:** Can we use existing smartphone penetration?

**A:** 72% of farmers own Android phones – no extra hardware costs!

**Q:** How could this utilize ISRO's data?

**A:** Integrate with BHUVAN satellite imagery for macro-trends.

**Q:** How might this reduce migration to cities?

**A:** Better yields = 25% higher income to retain youth in farming.

**Q:** Might this reduce farmer suicide rates?

**A:** Early disease alerts could prevent 80% of cotton crop failures in Vidarbha.

**Q:** Could this create rural employment?

**A:** Training local youth as 'tech mitras' to operate drones for imaging.

**Q:** Could this be adapted for kitchen gardens?

**A:** Home version possible using cheaper 5MP phone cameras.

**Q:** What learning opportunities does this offer our team?

**A:** Gain Python, IoT and agri-science skills simultaneously – great for college apps!

### 5. The Green Hat - Creativity and New Ideas

**Ideas:** This student focuses on generating new ideas, exploring alternatives, thinking outside the box, and encouraging innovation.

**Context:** AI-Powered Smart Dustbin for School Waste Segregation

**Q:** What if the dustbin could "talk" to students?

**A:** Add voice prompts: 'Thanks for recycling that paper!' in 3 languages.

**Q:** Could social media integration help?

**A:** Auto-tweet @eco-club when bin's full: 'Help! I'm stuffed with wrappers!'

**Q:** How might we use school mascot?

**A:** Shape like our tiger mascot – paper goes in mouth, plastic in belly!



**Q:** How might we use school mascot?

**A:** Shape like our tiger mascot – paper goes in mouth, plastic in belly!

**Q:** Could we use school art to decorate it?

**A:** Student mural contest – winning design gets 3D-printed as bin casing!

**Q:** What if it predicted waste patterns?

**A:** AI tracks that most plastic waste comes from canteen on Wednesdays (samosa day).

**Q:** How could festivals boost engagement?

**A:** Diwali special: Firework-shaped bin that lights up when used.

**Q:** How might gamification improve participation?

**A:** House points system: 10 points/kg recycled, displayed on LED leaderboard.

**Q:** What if it rewarded users instantly?

**A:** Token system - 5 recyclables = 1 canteen coupon (sponsored by PTA).

**Q:** What if it composted organic waste automatically?

**A:** Integrate solar-powered rotator with EM bacteria pods (cost: ₹200/month).

**Q:** What if it grew plants?

**A:** Vertical garden on sides watered by liquid compost from bin.

### 6. The Blue Hat - Process Control and Management

This student focuses on managing the thinking process itself. Sets the agenda, summarizes discussions, and ensures that the group is using the other hats effectively.

**Context:** IoT-based System to Automatically Control Lights/Fans Based on Occupancy

**Q:** What are our key development phases?

**A:** Phase 1: Sensor prototyping (Aug-Sept), Phase 2: AI training (Oct-Nov), Phase 3: School deployment (Dec).

**Q:** How to handle summer break disruptions?

**A:** Complete Phase 1-2 before April, pause deployment until new academic year.

**Q:** How to ensure equitable workload?

**A:** Weekly rotation: One team handles sensors, one handles data, one documents.

**Q:** What's our budget breakdown?

**A:** ₹8,500 total: ₹3,200 for PIR sensors, ₹2,500 for Raspberry Pi, ₹2,800 contingency.

**Q:** How do we define success?

**A:** 1) 25% energy reduction, 2) Adoption in 50% classrooms, 3) Feature in School newsletter.

**Q:** What if sensors fail during exams?

**A:** Manual override switch installed near blackboard in each classroom.

**Q:** What's the cybersecurity plan?

**A:** Separate VLAN for IoT devices + regular password rotations.

**Q:** How to measure student comfort impact?

**A:** Pre/post surveys on classroom environment + temperature logs.

**Q:** How will we present to school board?

**A:** 5-slide deck highlighting 3-year ROI + live demo of worst-case scenarios.

**Q:** How will we track energy savings?

**A:** Compare electricity bills pre/post installation + live dashboard in computer lab.

**Q:** What's our data backup system?

**A:** GitHub for code + Google Sheets for sensor logs (auto-backup daily).

### Conclusion

The Six Thinking Hats technique is a powerful tool for students with a multilateral approach to innovation and problem-solving in their projects. This method moves beyond unstructured brainstorming, enabling students to systematically explore diverse perspectives, anticipate challenges, and identify opportunities inherent in projects.

The Six Thinking Hats technique holds significant potential for nurturing a generation of thoughtful and resourceful problem-solvers not only of their current projects but also instills invaluable lifelong skills. The ability to think systematically, consider diverse viewpoints, and communicate effectively prepares the Young Innovators for the future.



# The Anusandhan National Research Foundation (ANRF)

ANRF is a legal body under the Department of Science and Technology, Government of India. Established by an Act in 2023. ANRF replaces the **Science & Engineering Research Board (SERB)**, established in 2009.

ANRF/SERB was set up for promoting basic research in science and engineering and to provide financial assistance to scientists, academic institutions, R&D laboratories, industrial concerns and other agencies for such research.

## Purpose

- ANRF/SERB's primary mandate is to support basic research in emerging areas of science and engineering.
- It aims to elevate the quality and reach of Indian science and engineering to global standards.

## Key Objectives

- Promote innovative and high-impact research to contribute to national development.
- Support interdisciplinary research.
- Encourage young scientists through early-career support and fellowships.
- Facilitate international collaborations.

## Functions

- It serves as a premier national funding agency.
- It provides financial assistance to scientists, academic institutions, R&D labs, and industries.
- Through its programs, it connects industry with those doing research.

## Major Programs and Schemes

- MAHA – Mission for Advancement in High-impact Areas: to address priority-driven, solution-focused research in mission mode that would catalyze multi-institutional, multi-disciplinary and multi-investigator collaboration.
- PMECRG – Prime Minister Early Career Research Grant: For individual and group-led indigenous research and development.
- SRG – Start-up Research Grant: For young researchers to establish independent research.
- SUPRA – Scientific and Useful Profound Research Advancement: To fund high-risk, high-reward research.
- JC Bose and Ramanujan Fellowships: To pursue high-end research.
- TARE – Teachers Associateship for Research Excellence: For faculty to work in premier institutions.
- PRISM – Project Information System & Management: It is an online platform that promotes transparency and accountability by providing information on funded research.

## Funding

Reflecting the commitment to indigenous research and development, the ANRF was allocated Rs. 966 crore in FY 2024-25. The same has been increased to Rs. 2,000 crore in FY 2025-26. Collaborating industry also contributes at least 10% to these projects.

# Innovations for Home



*Transforming  
Everyday Living  
in India*



# Innovations for Home

Home is a place where the family spends good amount of time in a day. Innovations for Home, in the name itself, refers to the modernization of products, ideas, or technologies that are useful for a home enhancing everyday life. Home innovations improve lives in terms of safety, efficiency, productivity, convenience, cost-effectiveness, waste reduction, reusability, and whatnot.

For the sake of convenience, let us look at these home innovations in four categories, viz., (1) smart home devices, technologies, and automation, (2) energy-efficient appliances, (3) space-saving furniture as well as creative interior design solutions, and (4) health and wellness innovations.

## 1. Smart Homes

- **Smart Assistants & Automation:** You can convert your homes into voice-controlled, intelligent, and self-operating spaces. The Smart Home Automation Devices include Smart Hubs, Smart Thermostats, Smart Lights, Smart Plugs. These are commonly combined with Security Appliances. Typically, you instruct Smart Assistants using voice commands and mobile apps. Examples of Smart Assistants for Home Automation are Amazon Alexa, Google Assistant, Apple HomeKit & Siri, and Samsung SmartThings.
- **Smart Surveillance Cameras:** Provide 24/7 live streaming including cloud storage. They come with amazing features of AI-powered motion detection and facial recognition. Examples are Arlo Ultra, Google Nest Cam, and Ring Stick Up Cam.

- **Video Doorbells:** These come with two-way audio device specially designed for remote communication and offer advanced features like Motion-activated alerts and night vision. Examples are Ring Video Doorbell, Google Nest Doorbell, and Eufy Security Doorbell.
- **Smart Door Locks:** These are used to improve home security via Keyless entry through fingerprint, PIN, or smartphone app with remote access to lock/unlock doors. Examples are August Smart Lock, Yale Assure Lock, and Schlage Encode.
- **Smart Alarm Systems:** These come with real-time security, instant alerts, and automation. Integrated with cameras, motion sensors, and smart assistants. Types of Smart Sensors are Motion sensors, Door & Window Sensors, Glass Break Sensors, Smoke & Carbon Monoxide (CO) Detectors, Water Leak & Flood Sensors, Temperature & Humidity Sensors, and Air Quality Monitors. Examples are SimpliSafe, ADT Smart Home, and Abode Security.
- **AI-Powered Threat Detection:** This technology will improve home safety and security simply by calculating real-time data from cameras, sensors and also detect potential threats with the help of alarms. These are completely AI-driven systems, monitor unusual activity, and perfectly distinguish the identity of objects, people, and animals. Examples are Deep Sentinel, Wyze Cam AI Detection.

At times, you also integrate these systems as an Integrated Security Hub.

## 2. Energy-efficient appliances

Using smartphone apps, you can monitor and control appliances remotely, lower power consumption, reduce costs. You can set schedules or voice commands. Besides appliances, you can also manage AI assistants. Such apps send notifications related to filter changes, power usage, or malfunctions so you can prevent hazards. Commonly connected Appliances for home are...

- Smart Refrigerators (Samsung Family Hub) with touchscreens and food tracking.
- Smart Ovens, Microwaves & Air Fryers (June Oven, Tovala) with recipe automation.
- Water-Saving Dishwashers, Smart Washing Machines with AI load detection.
- Touchless Faucets with motion sensors.
- Smart Coffee makers, Smart Air Conditioners & Heaters, and Smart Vacuum Cleaners & Mops.
- Robot Vacuums & Mops (Roomba, Roborock, Narwal).
- Self-Cleaning Toilets with built-in bidets.
- Air Purifiers with Smart Sensors for Indoor Air Quality Control.
- Smart Lawn Mowers (Husqvarna Automower) for automated yard care.



There are Eco-Friendly Innovations for home that will decrease energy consumption, reduce environmental impact, and lower utility bills. Water usage monitoring and leak prevention helps conserve water.

Typical sustainable and eco-friendly Smart Home Innovations are Smart Thermostats, Smart Lighting, Solar Energy & Battery Storage, Smart Water Conservation, Smart Power Strips & Plugs and Smart Waste & Composting.

- **Solar Energy Integration:** Decreases electricity bills, carbon footprint and optimises the consumption of energy storage and efficiency. These include High-Efficiency Solar Panels, Smart Solar Inverters, Smart Solar Batteries, Smart Energy Monitors, and Smart Home & Solar Integration.
- **Water Conservation Technologies:** These technologies are used to lower the water waste, reduce utility bills and improve the lifestyle. Smart leak detectors are used to prevent water damage or detect leakage. Smart irrigation systems are used to decrease the outdoor water usage with watering schedules depending upon the weather conditions. Greywater recycling systems are used to reuse the water.
- **Green Building Materials:** Manufactured from recycled, renewable, or low-impact resources. They are low-cost and provide insulation. Eco-friendly Bamboo Flooring is an alternative to hardwood. Cork Flooring, VOC Paints and Recycled Materials using Wood, Bricks, and steel come under this category.

## 3. Space-saving furniture and creative interior design

Sky is the limit to this category of innovations. With urbanization, space became pretty expensive. So, creative interior designers keep innovating on smaller sized furniture, multi-functional units, space-saving ideas transforming furniture into different things for different occasions. General categories are...

- Foldable Furniture (Murphy beds, expandable tables).
- Convertible Workspaces (desks that transform into shelves).
- Hidden Storage Solutions (under-floor storage, wall beds).

In conclusion, Home Innovations improve our quality of life, save money, and protect the environment. Home automation technologies improve the smartness in the livelihood of our homes.

## 4. Health and wellness innovations

Smart Air Purifiers, Smart beds, and Home fitness tech are some home innovations that support health and wellness. Smart Air Purifiers remove toxins, pollutants, bad bacteria, allergens, and dust particles from the water.

- Smart Beds (Sleep Number, Eight Sleep) that adjust firmness and temperature are used for improving the quality of sleep. Circadian Rhythm Lighting also improve sleep and well-being.
- Fitness plays an important role in this. Home fitness tech like Peloton, Mirror are devices that give support to exercise routines.
- Air Quality Monitors to detect pollutants and allergens.

## Word Search 2503 - Planets



SOLAR SYSTEM, STARS, PLUTO, VENUS, NEPTUNE, URANUS, MARS, MOON, MERCURY, SUN, JUPITER, SATURN, EARTH

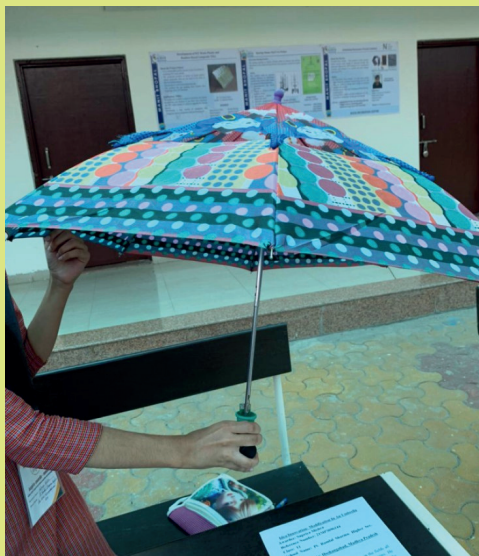
## Sudoku Challenge 2503



Solutions are on Inside Back Cover.



## Modification of an Umbrella



Supriya has witnessed her father enduring hardships during rainy weather while working in the fields all season. He uses an umbrella, but when it's stormy, the umbrella turns upside down, making it impossible for him to control both the torch and the umbrella. Supriya was inspired by this need to create a multifunctional umbrella.

She created a non-flipping umbrella with a torch and battery attached at the handle. Additionally, connected to it is a speaker that can be Bluetooth synced with a phone.



**Supriya Mishra**  
10th Class

As a result, while walking in the rain, one can easily listen to the news and make a call. If the product is commercialised with the right inputs and suggestions, this can be very beneficial.

*(Source: INSPIRE MANAK NLEPC 2023 Booklet)*

## Innovative Mechanic Repairing Seat

When Brahmi was once traveling outside with his family, a part malfunction caused their car to start making noise. Slowly and steadily, her father made his way to the repair shop. Brahmi observed that the mechanic must crawl underneath the vehicle to understand the real issue and to ensure his safety because the vehicle is raised by the front wheels.



**Brahmi Jain**  
6th Class

Brahmi created this inventive mechanical seat with the help of his teachers. Because the cars have a torch and a tool tray with storage space, mechanics can easily repair them. This seat will have a jack, a full-face shield, a whistle, safety glasses, and a neck pillow. The jack will help them lift the heavy components, and the padding will make the mechanics more comfortable. Additionally, there is a phone stand there where people can call those outside.

*(Source: INSPIRE MANAK NLEPC 2023 Booklet)*

# Dr. Vijay Pandurang Bhatkar

Padma Shri (2000) & Padma Bhushan (2015)



**BORN 11 OCT 1946**

He is an Indian computer scientist who developed India's first indigenous supercomputer, the **PARAM**. His contributions to technology earned him prestigious awards like the Padma Shri, Padma Bhushan, and Maharashtra Bhushan.

He strongly advocates IT education, digital learning, and e-governance initiatives to bring technology to rural areas.

## Career and Contributions

- **PARAM Supercomputer Series:** Led the development of PARAM 8000 (1991) and PARAM 10000 (1998), making India self-reliant in supercomputing.
- **National Supercomputing Facility:** Established the National PARAM Supercomputing Facility for Space research, weather forecasting, defense and medical data analysis.
- **Leadership Roles:** Served as Chancellor of Nalanda University, Chairman of IIT Delhi's Board of Governors, and President of Vijnana Bharati.

## Education & Research

Dr. Bhatkar played a crucial role in establishing institutions such as...

- **C-DAC** - Center for Development of Advanced Computing: India's leading high-performance computing research center.
- **ER&DC** - Electronics Research and Development Centre, Kerala
- **IIITM-K** - Indian Institute Of Information Technology and Management, Kerala
- **I2IT Pune:** International Institute of Information Technology, Maharashtra.
- **MKCL** - Maharashtra Knowledge Corporation Limited: A digital education platform for students.

## Awards and Recognitions

- **Maharashtra Bhushan** in 1999, **Padma Shri** in 2000, **Padma Bhushan** 2015, **Asian Scientist 100** in 2016 for contributions to science and technology.
- **Lifetime Achievement Awards** in computing and engineering.
- **Honorary Doctorates** from multiple universities.

## Legacy and Vision for the Future

- Made India a global player in supercomputing. Focuses on exascale computing for future developments.
- Advanced research in AI, cloud computing, and high-performance computing.
- Inspired students to pursue careers in science and technology.

# Understanding Quantum Computing

## Introduction

Computing is the process of using computers or other devices to perform tasks like processing, storing, and communicating information. It covers a wide range of activities, from simple calculations to complex data analysis, software development, and artificial intelligence.

Quantum computing is a new type of computing that follows the principles of quantum physics, which explains the behaviour of tiny particles such as atoms, electrons, and photons. Compared to classical computers, Quantum computers are radically different. Computing is multitasking, it comprises computer science, physics, and mathematics that follows quantum mechanics to solve complex problems faster than on classical computers. It involves hardware research and application development.

## Concepts in Quantum Computing

### 1. Superposition

Superposition means a quantum bit (called a qubit) can be in multiple states at the same time. Qubits can represent many possible combinations of states at once, a quantum computer can solve certain problems much faster than classical computers like factoring big numbers, simulating molecules, etc.

- A classical bit = either 0 or 1
- A qubit = 0 and 1 at the same time
- It turns on the parallelism, i.e., at a time it can handle many tasks, i.e, multitasking.

Example: Spinning a coin in the air—it's both heads and tails until it lands.

### 2. Entanglement

Entanglement is where two or more qubits become linked, so that the state of one qubit instantly affects the state of the other, no matter how far apart they are. It perfectly allows qubits to share information instantly and perform operations in a highly coordinated way, and also turn on the quantum things like Quantum teleportation, Superdense coding, and massive parallelism in computation. Two qubits can become entangled, meaning their states are linked—changing one instantly changes the other, even across long distances.

Example: A pair of magic dice—roll one, and the other shows a matching result, no matter where it is.





## 3. Quantum Interference

Quantum interference is the process of combining the probabilities of different quantum states, reinforcing each other, and canceling out.

As qubits can be in a superposition of 0 and 1, when a quantum algorithm runs, it controls the phases of these superpositions. Correct answers are made more likely, and wrong answers are canceled out.

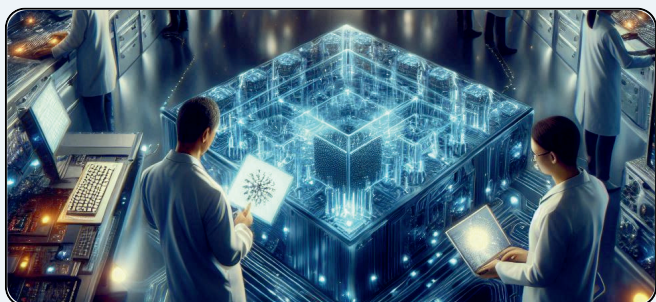
## The Future Impact of Quantum Computing

### 1. Scientific Discovery & Innovation

- Drug discovery & genomics: Simulate molecules and proteins to accelerate new treatments and personalized medicine.
- Material science: Design new materials for batteries, superconductors, or carbon capture—faster and cheaper.
- Climate modeling: Run high-resolution simulations to better understand and combat climate change.

### 2. Business & Finance

- Portfolio optimization: Quantum algorithms can evaluate countless financial strategies simultaneously.
- Risk analysis & fraud detection: Spot patterns and anomalies that classical computers miss.
- Supply chain optimization: Improve logistics, routing, and resource planning on a global scale.



## 3. Cybersecurity

- Breaking traditional encryption: Algorithms like Shor's could break widely used systems (RSA, ECC).
- Rise of post-quantum cryptography: A shift toward new, quantum-resistant security standards is already underway.

## 4. AI & Machine Learning

- Quantum machine learning: Enhance training of models, pattern recognition, and data classification—especially in large, complex systems.
- Better decision-making tools: Real-time data processing for smarter AI applications.

## 5. Societal Impact

- Economic transformation: Industries will shift, and new jobs will emerge in quantum software, hardware, and cybersecurity.
- Global competition: Countries are investing billions—quantum leadership will impact economic and national security.
- Ethical questions: As with all powerful tech, responsible development and access are crucial.

## Challenges in Quantum Computing

- Qubits are very thin and easily disturbed
- Quantum computers require the utmost cold environments
- Error correction is not an easy task
- Not suitable for all tasks—only specific types of problems

In conclusion, Quantum Computing is a new computing paradigm. Though still evolving, it may be the most important technological innovation in the 21st Century.

# National Innovation Foundation (NIF)

A synonym for Indian Rural Innovations

NIF is a flagship organization promoting Rural Innovation in India. It was set up in March 2000 under the Department of Science & Technology (DST), Government of India. It is to strengthen grassroots technological innovations and support outstanding traditional knowledge in India. It encourages grassroots innovations via awards, exhibitions, and publications. This mission supports rural innovators by documenting, validating, and supporting their innovations.

So far, NIF gathered 3,45,000 unique and distinct technological ideas, innovations, and traditional knowledge practices from 625 districts of the country. It recognized 1145 grassroots innovators and school students at the national level in its annual Dr. A.P.J. Abdul Kalam Ignite Awards and National Biennial Grassroots Innovation Awards.

Every year, DST and NIF organize the INSPIRE – MANAK competition for Indian High School Students. INSPIRE stands for Innovation in Science Pursuit for Inspired Research and MANAK is Million Minds Augmenting National Aspiration and Knowledge. School students compete with unique and creative ideas and innovations.

By organizing Awards like these, NIF encourages innovators through recognition. NIF also publishes research reports, case studies, and success stories. Offers training and mentorship for grassroots innovators.



## Key Functions

**Scouting, Documentation & Database Management:** It identifies, gathers, and records grassroots innovations and recognizes the outstanding traditional knowledge and practices all over India. Works with the Honey Bee Network to contact rural and tribal communities, particularly, villagers, farmers, artisans, and students.

**Value Addition, Research & Development:** NIF collaborates with research institutions, laboratories, and supports the prototype development. It enhances and filters the grassroots innovations through scientific validation.

**Intellectual Property Rights (IPR) Protection:** NIF helps innovators in patent filing and protecting their IPR, i.e., patents, copyrights, and trademarks.

**Business Development and Commercialization:** NIF facilitates innovators to commercialize their ideas through partnerships with industries and businesses. It runs Micro Venture Innovation Fund (MVIF) for financial support.

**Policy Advocacy and International Collaboration:** NIF advises policymakers on innovation-led development and collaborates with international organizations to promote Indian grassroots innovations globally.

Recent focus of NIF is on Agriculture and Farming, Healthcare and Traditional Medicine, Renewable Energy and Environment.

## Fan Cleaner



Palak observed that her mother struggled to clean the ceiling fan because of her short stature and used a stool or a table to reach the fan. It might be dangerous if it slipped. Palak came up with the idea to create a cleaner that uses two foam rollers to clean the fan in order to solve the problem. He used PVC pipe and 2 DC motors.

The pipe looks smaller to our eyes but we can adjust its height according to our needs.



**Palak Meghwal**  
10th Class

The cotton brush on foam, cleans the middle part of the fan apart from the wings very effectively. Overall, it is an effective approach that would be used by many without posing danger of using stool, chair or table.

*(Source: INSPIRE MANAK NLEPC 2023 Booklet)*

## Riddles 2503

Solutions are on Inside Back Cover.

1. What element is derived from a Norse God?
2. What can eat a lot of Iron without getting sick?
3. Give me food, and I will live. Give me water, and I will die. What am I?
4. I can burn your mouth and sting your eye, but I am consumed everyday. What am I?

## Walker with Chair for Senior Citizen

Himashu saw his grandfather's discomfort while walking with the traditional walker. Thus this idea of a chair in walker strike his mind for which he worked as assisted by his teacher. This walker comprises of a seat to rest where senior citizens can sit after being tired.



**Himanshu Dongre**  
10th Class

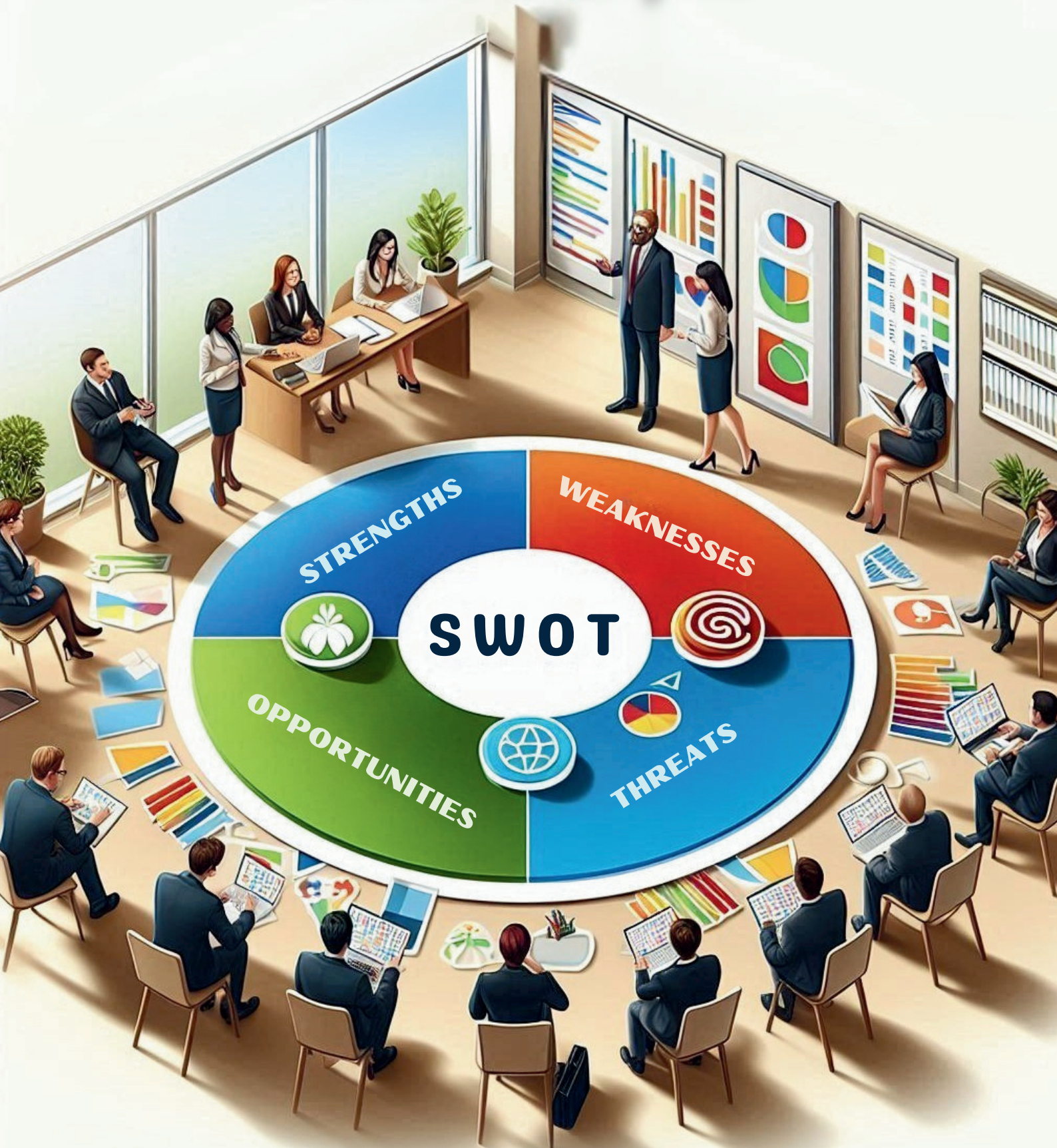


It has a feature of a torch for visibility during night time. It also has a honking system to alert creatures ahead. This walker developed by Himanshu is completely foldable and lightweight that makes it easy to carry around while travelling.

*(Source: INSPIRE MANAK NLEPC 2023 Booklet)*



# SWOT Analysis



## Introduction

National competitions INSPIRE MANAK and GYS Avishkar Awards are not just looking for good ideas—they're looking for ideas that are Relevant to society, Technically sound, Scalable (can grow bigger), and Sustainable (eco-friendly, cost-effective). Before you dive too deep, it's super helpful to take a step back and look at your project from all angles. That's where SWOT Analysis comes in.

SWOT stands for Strengths, Weaknesses, Opportunities, and Threats. It is a simple but powerful tool that helps you understand what you're good at and what challenges you might face, both from within your team and from the world around you.

Knowing strengths of your innovation helps you build on them, understanding your weaknesses allows you to find solutions, recognizing opportunities lets you seize beneficial situations, and being aware of threats helps you plan ahead and minimize risks.

To reiterate, SWOT gives you an edge by helping you identify what makes your idea unique, fix problems before judges spot them, discover ways to scale or expand, and be prepared for tough questions. It's like a mirror that shows the complete picture of your innovation.

With SWOT, you dissect your project, understand its inner workings, its place in the larger world, craft a more compelling narrative, stand out in the competition, and impress the evaluators. Ultimately, SWOT analysis empowers you to make your innovation projects even more successful and impactful!

## The Technique

Steps to do SWOT Analysis on your project are simple. Draw a big "+" sign on paper, making four quadrants or boxes. Label each of them as Strengths (top-left), Weaknesses (top-right), Opportunities (bottom-left), Threats (bottom-right). Fill in these boxes with 3 to 5 short bullet points, i.e. less than 6 words each. Talk to your team, teachers, or family. Once you write down items, look at what needs fixing, what can grow, and how you'll stand out.

Now, let's look at these S, W, O, T's...

**Strengths** are inherent advantages, i.e., internal to the idea or solution. Understanding the positives of your innovation is helpful either to develop further on them or at least not to ignore them in the process.

### Examples:

- Use renewable energy is a strength in case of a Solar-powered Water Purifier
- Being able to save water is a strength in case of an IoT-based Low-Cost Smart Irrigation System

**Weaknesses** are, in a way, disadvantages or gaps internal to the innovation. Once you are aware, you would start working on fixing them and thereby the solution is improved. One should not feel shy to acknowledge or mention weaknesses.

### Examples:

- Initial investment and regulations are a kind of weaknesses in case of Drones for Air Quality Monitoring in Cities
- Difficulty to simulate real conditions for testing is, perhaps, a weakness in case of a Portable Earthquake Alarm for Rural Homes



**Opportunities** are the favourable factors external to the innovation. Many-a-time, you do not control them. However, it would be smart to take advantage of them for better success.

## Examples:

- Government schemes like "Har Ghar Jal" is an opportunity in case of a Solar-Powered Water Purifier
- Increased smartphone penetration in rural areas is an opportunity in case of App to Connect Farmers with Buyers

**Threats**, on the other hand, are the likely risks and unfavourable things external to the solution. Having known upfront, you would be able to install mitigation approaches in the project. Or, incorporate design changes in the product or solution eliminating the possibility of negative influence by the identified threats.

## Examples for Threats:

- Cost of existing commercial purifiers could be a threat to a Solar-Powered Water Purifier
- Possibility of false alarm due to accuracy challenges is a likely threat to a Portable Earthquake Alarm for Rural Homes

## Case Study 2

Innovation: Solar-Powered Water Purification System for a Village School	
Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Utilizes renewable solar energy</li> <li>• Provides access to clean drinking water in a resource-constrained setting</li> <li>• Simple maintenance requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Initial setup cost might be high</li> <li>• Reliance on consistent sunlight</li> <li>• Potential for vandalism or theft in a public space</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• Government grants for clean water initiatives in schools</li> <li>• Availability of local technicians for maintenance</li> <li>• Increasing awareness of waterborne diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Inconsistent power supply during monsoons</li> <li>• Potential for community resistance to new technology</li> <li>• Need for regular filter replacement</li> </ul>
<p>How this helps win: This SWOT emphasizes the project's positive impact on a local community (clean water access), its sustainability (solar power), and alignment with government priorities. Addressing threats like monsoon impact with potential solutions (e.g., battery backup) showcases foresight</p>	

## Case Studies

Look at these Case Studies for a greater understanding of how to apply SWOT...

### Case Study 1

Innovation: Low-Cost Mud Brick Making Machine for Rural Housing	
Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Utilizes locally available mud and minimal external resources</li> <li>• Simple and easy-to-operate design</li> <li>• Addresses the need for affordable housing in the community.</li> </ul>	<ul style="list-style-type: none"> <li>• Production rate might be lower than industrial methods</li> <li>• Durability of mud bricks might be a concern in heavy rainfall areas</li> <li>• Team has limited engineering expertise.</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• Government initiatives promoting affordable rural housing</li> <li>• Availability of local artisans who can be trained to use the machine</li> <li>• Growing awareness of sustainable building practices</li> </ul>	<ul style="list-style-type: none"> <li>• Resistance to adopting non-conventional building materials</li> <li>• Potential for inconsistent mud quality</li> <li>• Competition from established brick manufacturers</li> </ul>
<p>How this helps win: This SWOT highlights the local relevance (affordable housing need, local materials), resourcefulness (minimal external resources), and potential for sustainability. Acknowledging weaknesses like durability and outlining plans to address them (e.g., exploring natural binding agents) demonstrates a practical approach.</p>	

### Case Study 3

Innovation: Natural Pesticide from Locally Sourced Plants for Small Farmers	
Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Utilizes locally available plant resources</li> <li>• Reduces reliance on expensive chemical pesticides</li> <li>• Promotes organic farming practices</li> </ul>	<ul style="list-style-type: none"> <li>• Effectiveness against a wide range of pests needs thorough testing</li> <li>• Shelf life of the pesticide might be limited</li> <li>• Knowledge about optimal extraction methods is still developing</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• Growing demand for organic produce</li> <li>• Availability of traditional knowledge about medicinal plants in the community</li> <li>• Potential collaboration with agricultural universities for research</li> </ul>	<ul style="list-style-type: none"> <li>• Resistance from farmers accustomed to chemical pesticides</li> <li>• Potential for inconsistent effectiveness depending on plant quality</li> <li>• Regulatory hurdles for new agricultural products</li> </ul>
<p>How this helps win: This SWOT showcases the project's grassroots nature (local plants, traditional knowledge), its environmental benefits (reducing chemical use), and its potential to empower local farmers. Acknowledging weaknesses and outlining research plans demonstrates a scientific approach.</p>	



## Case Study 4

## Innovation: Bamboo-Based Furniture for Rural Households

### Strengths

- Utilizes locally abundant bamboo resources
- Provides affordable and durable furniture options
- Promotes sustainable use of natural materials

### Weaknesses

- Requires specific skills for bamboo processing and crafting
- Potential for pest infestation if not treated properly
- Design aesthetics might need improvement for wider appeal

### Opportunities

- Growing demand for eco-friendly furniture
- Availability of skilled local artisans who can be trained
- Potential for creating local employment opportunities.

### Threats

- Competition from mass-produced plastic and wooden furniture
- Lack of awareness about the benefits of bamboo furniture
- Potential for unsustainable harvesting of bamboo if not managed properly

How this helps win: This SWOT highlights the use of local resources (bamboo), its economic benefits for the community (affordable furniture, potential employment), and its environmental friendliness. Addressing threats like pest infestation and design limitations shows a comprehensive understanding.

## Case Study 5

Innovation: A Low-Cost Soil Testing Kit for Small Landholders	
Strengths	Weaknesses
<p>Affordable and easy to use for farmers with limited resources</p> <ul style="list-style-type: none"><li>• Provides crucial information for optimizing fertilizer use</li><li>• Potential to improve crop yields</li></ul>	<p>Accuracy might be lower than sophisticated lab tests</p> <ul style="list-style-type: none"><li>• Requires training for proper usage and interpretation of results</li><li>• Limited data analysis capabilities in the basic kit</li></ul>
Opportunities	Threats
<ul style="list-style-type: none"><li>• Government initiatives promoting soil health</li><li>• Availability of agricultural extension workers who can help disseminate the kit</li><li>• Increasing awareness among farmers about the importance of soil testing</li></ul>	<ul style="list-style-type: none"><li>• Hesitancy among some farmers to adopt new testing methods</li><li>• Potential for misinterpretation of results leading to incorrect fertilizer application</li><li>• Competition from existing soil testing services (though often costlier)</li></ul>
<p>How this helps win: This SWOT emphasizes the project's accessibility and affordability for small landholders, its direct benefit to local agriculture, and its alignment with national goals of improving soil health. Acknowledging limitations in accuracy and outlining training plans demonstrates a practical approach to implementation.</p>	

## Conclusion

Winning projects in innovation competitions stem from a deep understanding of local problems and offer practical, sustainable solutions. SWOT analysis aligns with this focus by helping you:

- **Highlight Local Relevance (Opportunity & Strength):** By identifying specific local needs your project addresses (Opportunity) and leveraging your understanding of the community's context (Strength), you can showcase the direct relevance and potential impact of your grassroots innovation.
- **Address Practical Challenges (Weakness & Threat):** Acknowledging potential limitations in resources or implementation challenges specific to your local setting (Weakness & Threat) and demonstrating how you plan to overcome them shows a realistic and problem-solving approach highly valued in these competitions.
- **Showcase Resourcefulness (Strength & Opportunity):** Grassroots innovation often thrives on resourcefulness. SWOT helps you highlight how you are creatively utilizing locally available materials and knowledge (Strength) and tapping into local support systems (Opportunity).
- **Demonstrate Sustainability (Opportunity & Threat Mitigation):** By considering environmental and economic sustainability within your SWOT (Opportunities for eco-friendly solutions, Threats from resource scarcity), you can align your project with the long-term vision often sought in grassroots innovation awards.
- **Craft a Compelling Narrative:** A well-conducted SWOT analysis provides a structured way to articulate your project's journey, its potential impact, and your strategic thinking to the judges.

So, the next time you're polishing your innovation, stop and ask: "Have I done my SWOT yet?" Because the students who win are the ones who think smart.

# Radio and Wireless Communication

### Introduction to Communication Systems

Communication is the process of exchanging information between individuals or devices. From ancient times, humans have used various means to communicate, such as smoke signals, carrier pigeons, and written letters.



However, with technological advancements, communication has evolved significantly, leading to the development of radio and wireless communication systems. These technologies have revolutionized the way we connect and interact with the world.

### What is Radio Communication?

Radio communication is a method of transmitting and receiving signals using electromagnetic waves.

It was first discovered by scientists like James Clerk Maxwell and later demonstrated practically by Guglielmo Marconi. Radio waves are a type of electromagnetic radiation with frequencies ranging from 30 Hz to 300 GHz.

### How Radio Communication Works?

1. A transmitter generates radio waves that carry information, such as voice or data.
2. The antenna transmits these waves through the air.
3. A receiver picks up the radio waves and converts them back into meaningful signals.

### Wireless Communication: The Evolution of Connectivity

Wireless communication refers to the transfer of information without the use of physical connections like cables. It includes technologies such as:

- **Mobile Networks (2G, 3G, 4G, 5G):** Enabling mobile phone calls and Internet access.
- **Wi-Fi:** Providing wireless Internet connectivity in homes, schools, and offices.
- **Bluetooth:** Facilitating short-range communication between devices.
- **Satellite Communication:** Supporting GPS navigation and international broadcasting.

### Importance of Communication Systems

**Global Connectivity:** Radio and wireless technologies allow instant communication across the world, enabling people to stay connected regardless of distance.

**Emergency Services:** Wireless communication plays a crucial role in disaster management, allowing authorities to coordinate rescue operations.



**Education and Research:** Online learning and access to global knowledge have become possible through wireless networks.

**Healthcare Advancements:** Telemedicine and remote patient monitoring rely on wireless communication to deliver healthcare services efficiently.

**Business and Economy:** Industries depend on communication systems for trade, banking, and management.

## How these Communication Systems affect the World

**Social Impact:** The ease of communication fosters relationships, enhances social interactions, and promotes cultural exchange.

**Economic Growth:** Businesses can operate globally, creating new job opportunities and boosting economies.

**Scientific Progress:** Wireless technologies support space exploration, climate research, and advancements in artificial intelligence.

**Security and Defense:** Wireless communication is essential for military operations, ensuring national security and protection.



## Future of Radio and Wireless Communication

With continuous advancements, the future of wireless communication holds promising developments such as:

**6G Networks:** Expected to offer ultra-fast speeds and low latency for smart cities.

**Internet of Things (IoT):** Connecting devices like smart homes, wearable technology, and autonomous vehicles.

**Quantum Communication:** Providing ultra-secure data transfer methods.

**AI Integration:** Enhancing communication networks with intelligent automation.

## Conclusion

Radio and wireless communication systems have transformed human life by enabling fast and efficient information exchange.

As technology continues to evolve, communication will become even more advanced, shaping the future of industries, society, and global development.





### A Cooler Basket

The cooling device is a simple cooling basket that contains a steel container; it's been kept inside a basket that is made of bamboo. The banana stem has been placed inside the container. Banana stem helps to reduce the temperature by around 5°C inside the cooling basket.



**Salam Lingjel Chanu**  
10th Class

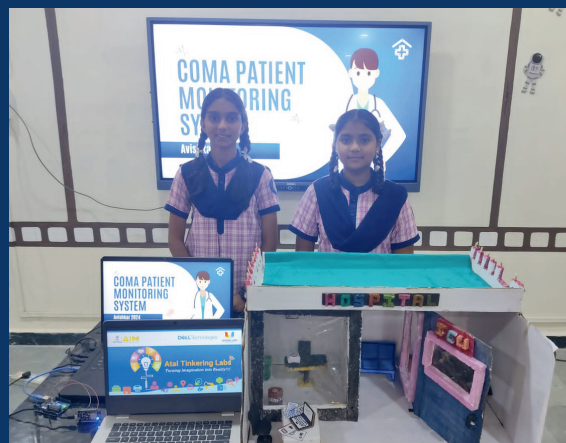
Food items and vegetables can be preserved in this cooling basket for 5 to 15 days. It works on the scientific principle of evaporation. This model is low cost, easily transportable, eco-friendly, and can be affordable for everyone.

*(Source: INSPIRE MANAK NLEPC 2023 Booklet)*



### AI-Based Coma Patient Monitoring System

The Coma Patient Monitoring System is an advanced AI and IoT-based solution designed to enhance the continuous monitoring of coma patients. This system utilizes a webcam to track the patient's eyes and mouth in real time. When the patient opens their eyes or mouth, an audible alert is triggered, and real-time notifications are sent to medical staff via the Blynk IoT platform. The integration of a microcontroller ensures the efficient management of alert signals, making this system highly reliable for use in critical care units, home care settings, and rehabilitation centers.



**Keerti R Kumavath**  
9th Class



**Vedashri Kulkarni**  
9th Class

Employing OpenCV technology, the system accurately detects movements such as eye-opening and yawning, ensuring precise monitoring. Upon detecting such movements, it generates an instant audible alert. Simultaneously, a signal is sent to an ESP8266 module, to transmit real-time notifications via email and mobile on the Blynk IoT platform. This swift communication enables healthcare providers to respond quickly and take necessary action, ensuring better patient care. The production cost per unit is an affordable ₹2000 approximately.

*(Source: GYS Avishkar Awards 2024 Booklet)*

# Santanu Bhattacharya

Ranbaxy Research Award (2013) for pharmaceutical advancements



**BORN ON APRIL 23, 1958 IN KOLKATA**

He is working as a Director of the Indian Institute of Science Education and Research, Tirupati. One of the Indian chemical biologists, he is a former professor in Indian Institute of Science (IISc), Bengaluru. He is a Pioneer in Chemical Biology and Nanotechnology.

Scientific Community Honored Bhattacharya with prestigious awards and recognitions. He is a member of Indian National Science Academy, the Indian Academy of Sciences, and The World Academy of Sciences. He Established a bio-organic and supramolecular chemistry lab at IISc.

## Education and Career

- **Early Education:** Bachelor's in Chemistry from Calcutta University; Master's from Rajabazar Science College.
- **Ph.D. & Postdoctoral Research:** Ph.D. in bioorganic chemistry from Rutgers University, USA (1988), under Prof. Robert A. Moss; postdoctoral research at MIT with Nobel Laureate Har Gobind Khorana on membrane protein signal transduction.

- **Academic Roles:** Served as a professor at IISc, Chair of Organic Chemistry, and Director of IACS (2015–2021) before joining IISER-Tirupati (2023).

## Awards and Honors

- For his outstanding contributions to chemical sciences, he was honored with **Shanti Swarup Bhatnagar Prize** for Science and Technology.
- From the Department of Biotechnology in 2002, Bhattacharya received the **National Bioscience Award for Career Development**.
- The World Academy of Sciences honored with the **TWAS Prize** in 2010. In 2013, he received the **Ranbaxy Research Award** for his research in pharmaceutical sciences and drug development.
- He was also recognised and awarded **J.C. Bose National Fellowship**.

## Research Contributions

- **Gene Delivery Vehicles:** Developing systems to deliver genes for gene therapy.
- **Unnatural Amino Acids & Oligopeptides:** Contributions to molecular biology and pharmaceuticals, applications in medicine and environmental monitoring.
- **DNA Binding Molecules:** Potential cancer therapy targeting G-quadruplex DNA and create Synthetic Natural Product Mimics.

# Innovation vs Invention

Understanding the Difference and Their Impact on Society

In the modern world, technological advancements and groundbreaking ideas drive progress. However, two terms often used interchangeably—innovation and invention—carry distinct meanings and implications. While both contribute to societal development, understanding their differences is crucial for appreciating how new ideas transform into real-world applications. This article explores the core differences between invention and innovation, their roles in various industries, and their impact on shaping the future.

## What is Invention?

Invention refers to the creation of a novel product, process, or concept that did not previously exist. It involves discovering something entirely new, often through research, experimentation, and creativity. Inventions are the foundation of technological progress and can stem from individual ingenuity or extensive scientific research.

## Characteristics of Invention

- **Originality:** Inventions introduce something entirely new to the world.
- **Scientific Discovery:** They often emerge from scientific research or engineering breakthroughs.
- **Patentability:** Many inventions are eligible for patents, which protect the rights of inventors.
- **Prototype Development:** Inventions usually require extensive prototyping and testing before practical use.

## Examples of Invention

- The telephone (Alexander Graham Bell)
- The light bulb (Thomas Edison)
- The airplane (Wright brothers)
- The internet (Various scientists and engineers)

## What is Innovation?

Innovation, on the other hand, is the process of improving, refining, or applying existing inventions in a way that creates significant value. Innovation does not necessarily require the invention of a completely new product but often involves making something more efficient, accessible, or commercially viable.

## Characteristics of Innovation

- **Value Addition:** Innovation improves upon an existing concept or product.
- **Commercial Viability:** Many innovations make products more accessible or affordable to the public.
- **Market Driven:** Innovations are often influenced by consumer needs and market demand.
- **Iterative Process:** Innovations undergo continuous refinements and enhancements.

## Examples of Innovation

- Smartphones (evolution of mobile phones)
- LED light bulbs (improvement of Edison's original invention)
- E-commerce platforms (enhancing traditional retail through technology)
- Electric vehicles (advancements in automobile technology)



## How Invention and Innovation Complement Each Other

Although invention and innovation are different concepts, they are deeply interconnected. Invention provides the raw foundation upon which innovation thrives. Without invention, there would be no base for innovation to enhance, and without innovation, many inventions would remain obscure, unused, or commercially unviable.



For example, the first personal computer was an invention, but its widespread use and accessibility came through continuous innovations in design, processing power, and user-friendly interfaces. Similarly, the electric car was first invented in the 19th century, but only recent innovations in battery technology have made it a viable alternative to traditional gasoline-powered vehicles.

Both Inventions & Innovation are essential in shaping the modern world, driving technological progress, and improving human lives.

## The Role of Invention and Innovation in Different Industries

### Technology Industry

- **Invention:** Artificial Intelligence (AI) algorithms
- **Innovation:** AI-driven applications like Chatbots and Self-driving cars

### Healthcare Industry

- **Invention:** MRI machine
- **Innovation:** Portable MRI devices and AI-based diagnostics

### Energy Sector

- **Invention:** Solar panels
- **Innovation:** Highly efficient and flexible solar technology

### Transportation Industry

- **Invention:** The internal combustion engine
- **Innovation:** Hybrid and electric vehicles

## The Future of Invention and Innovation

As the world advances, the line between invention and innovation continues to blur. Emerging fields such as artificial intelligence, biotechnology, and quantum computing offer both new inventions and groundbreaking innovations. The integration of sustainability, smart technology, and digital transformation ensures that both invention and innovation remain essential for future progress.

Governments, businesses, and educational institutions play a critical role in fostering an ecosystem where invention and innovation can thrive.

### Caliper-X - Prosthetic Leg Improved Model

Caliper-X is an improved version of a prosthetic leg support device designed to be more affordable and user-centric. Unlike existing caliper models, which are often expensive and developed without user feedback, Caliper-X has been created through a user-driven approach, incorporating insights from 20 real test trials to enhance its effectiveness in improving people's lives. The inspiration for this innovation came from Divyam, who observed the daily struggles of his parents, both Polio patients, facing challenges such as knee bending issues, skin cuts, difficulty in carrying their calipers, excessive weight, and the high cost of better-supporting instruments.



To address these problems, Caliper-X features an improved structural arrangement with enhanced locks that provide better support to the leg region. The development process follows a systematic approach to ensure a proper fit, functionality, and comfort for the user.



**Garvit Agrawal**  
10th Class



**Divyam Agrawal**  
12th Class

Users can conveniently customize their caliper by providing their leg dimensions, making the product easily accessible. Each unit is priced at approximately Rs. 4600, with a profit margin of around Rs. 200 per unit. However, by placing bulk orders of around 3000 units, the production cost can be reduced to Rs. 3500 per unit, making it even more cost-effective and accessible to those in need.

*(Source: GYS Avishkar Awards 2024 Booklet)*

### A Shoe with Odometer and Alarm

Derian likes to track and explore new places. Once he was going to school, and he got an idea for a pair of shoes that could keep track of the distance we walked. So he designed shoes with an odometer and alarm. First we need to set the kilometers and then start walking. With the completion of set kilometers, the alarm would indicate by ringing. These kinds of shoes are effective in speed training and in sports like marathons, the Olympics, and athletic games.



**Derian Chesan N Marak**  
9th Class



*(Source: INSPIRE MANAK NLEPC 2023 Booklet)*

# Department of Science and Technology (DST)

DST is a department within the Ministry of Science and Technology in India. It was established in May 1971 to promote new areas of science and technology and to play the role of a nodal department for organizing, coordinating, and promoting scientific and technological activities in the country.

It gives funds to various approved scientific projects in India. It also supports researchers in India to attend conferences abroad and to go for experimental work. The DST is a vital government body that drives scientific and technological progress in India, contributing to the Nation's development.

## Key Responsibilities

- **Scientific Research Promotion:** It supports high-end basic research and the development of cutting-edge technologies.
- **Technology Development:** The department facilitates technology development and transfer, ensuring that technological advancements benefit various sectors of society.
- **Socio-Economic Programs:** The department implements programs aimed at leveraging science and technology for societal development, including initiatives focused on women and marginalized communities.
- **Formulates policies** related to science and technology.
- **Engages in coordinating and integrating** science and technology areas with cross-sectoral linkages.

- Promotes science and technology at state, district, and village levels.
- Supports the growth of the startup ecosystem.
- Fosters innovation and promotes international science and technology cooperation.

## Autonomous Institutions

DST oversees several autonomous institutions that contribute significantly to scientific research and development in India. Notable among these are

- Agharkar Research Institute, Pune
- Aryabhata Research Institute of Observational Sciences, Nainital
- Birbal Sahni Institute of Palaeosciences, Lucknow
- Bose Institute, Kolkata
- Indian Institute of Astrophysics, Bengaluru

## Vision and Mission

DST aims to enable Indian society to achieve scientific excellence by providing leadership, direction, and support in the field of science and technology.

Its mission encompasses fostering and promoting science and technology as a vehicle for socio-economic development.

Through its diverse programs and initiatives, the Department of Science and Technology continues to play a crucial role in advancing India's scientific landscape and addressing societal challenges through innovative solutions.



# Mobile App Development

## Build Your First Mobile Application

Dear Student, mobile app development is a technical skill that plays an important role in your generation. Everything around you is on mobile apps these days. Starting with your attendance, syllabus tracking, academic performance at school to booking tickets for movies, trains, buses, etc. is on apps. Here is an insight on developing mobile apps.

### Necessity of App Development

- **Problem-solving & Logical Thinking:** It improves and encourages analytical thinking and decision-making skills. Coding helps to break down problems into steps.
- **Creativity & Innovation:** When you think of solutions for real-life problems, you look at creative way of design, various possibilities in coding, and effective user interface.
- **Career Opportunities:** Present software developers in tech careers have the highest demand and priority. It also helps to get internships, scholarships, and college admissions. You can also monetize your apps and start businesses, become an entrepreneur.
- **Digital Literacy & Tech Skills:** Survival in this digital world demand this app development knowledge, if not the skill itself.
- **Connect with a global community:** Joining in open-source projects, online forums, and coding bootcamps, you can collaborate with students worldwide.

There are two major Mobile App platforms by their operating systems, viz., Android and iOS. Android platform is more common in India and is the common OS for most of the mobiles. iOS is exclusive to Apple iPhones and iPads. So, when you think of an app, you may choose to develop it for Android, iOS or for both.

### App Development Life Cycle

Here are some primary steps for app development that you should know about...

#### 1. Plan Your App

- Document the app's purpose and priority.
- Draw a rough outline of the app.
- Know the market demand and competition.
- Define target users.
- Besides the desired functionality, decide on Login, Data storage, and Notifications, etc.

#### 2. Select a Development Process

Here are some choices to choose from...

- Native Apps (Swift/Xcode for iOS, Kotlin/Java for Android) – Best for performance.
- Cross-Platform Apps like React Native, JavaScript, Flutter, Google's UI toolkit. They help faster and simultaneous development for both iOS and Android.
- Web Apps (HTML, CSS, JavaScript) – Accessible via browsers.
- No-Code/Low-Code (Bubble, Adalo) – Good for quick prototypes.

Dear Student, we mentioned names of a few tools and platforms in various contexts, starting with UI design, development, testing, and until publishing apps for customer use. These names are suggestions to you to get started. You choose the ones that are helpful to your project goals. Some of them are free and some others are licensed. Even if it is free for trial period, you will have to pay later. Some of the vendors offer Student Licenses, either free or at a very low price. However, once your app is commercially successful, they would charge you a regular license. So, check the prices before you select a tool or platform. Seek advice of seniors or teachers. Good luck.

## 3. Design the User Interface (UI/UX)

- Easier the User Interface (UI), better will be the User Experience (UX). UI/UX design is a crucial aspect in an app's success.
- Plan the app's layout using Figma or Adobe XD tools for mockups, where you can create wireframes and prototypes simulating the outcome in advance.
- Know about UI elements, i.e., buttons, text fields, and navigation.
- Study the user interaction, i.e., handle button clicks and input validation.
- Define Authentication, i.e., Google Sign-in, Email/Password, etc.

## 4. Develop the App

- Create a Development environment (e.g., Xcode, Android Studio, VS Code).
- Write code for frontend (UI) and backend (database, authentication, etc.)
- Where needed, use APIs and third-party services.
- For Data Storage, use SQLite, Firebase, Supabase, or AWS (cloud), etc.
- For user authentication, use Firebase, OAuth, etc.

## 5. Test Your App

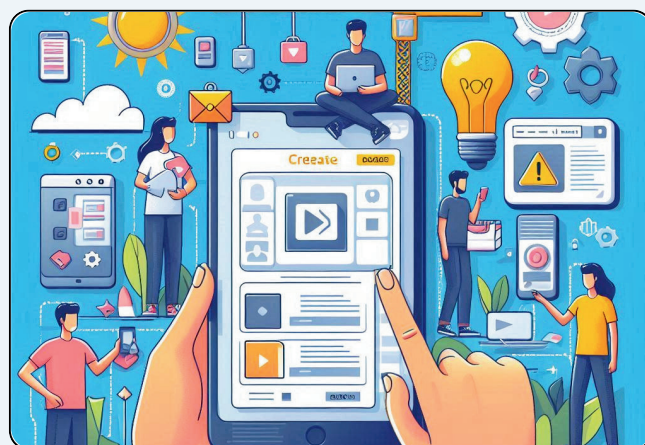
- Conduct functional, usability, and performance testing.
- Use emulators/simulators and real devices.
- Use Android Studio Android Emulator.
- Use iOS Simulator Xcode.
- For React Native apps, use Expo Go.
- Fix errors and improve performance.

## 6. Publish the App

- For Android, create a Google Play Developer account.
- Upload APK/AAB and enter the necessary information.
- Submit the app and take feedback from users.
- For iOS, join the Apple Developer Program, upload through App Store Connect, and submit for approval.
- For web apps, publish on hosting services like Vercel, Firebase or AWS platforms.
- Submit the app and take feedback from users.

## 7. Maintain & Update the App

- Monitor app performance, fix issues if necessary.
- Collect user feedback. Release updates and new features periodically.



**You may want to know...**

**Thunkable** (Drag-and-drop app builder),  
**Adalo** (Visual app development, good for prototypes),  
**MIT App Inventor** (Beginner-friendly for Android apps)  
 are some No-Code/Low-Code Tools for for Students  
 who have zero knowledge of coding.

## Future of App Development

In our social environment, dependence on mobile apps is increasing each day. Even Governments are offering more and more services on mobile without needing to go to an office. For example, you can download your exam hall tickets and education certificates from apps nowadays. Here are some aspects of apps as well as terminologies the you may appreciate to choose the right project for your app development.

### 1. AI & Machine Learning Integration

- **Smarter Apps:** AI-powered assistants (like Siri & Google Assistant)
- **Personalization:** AI-driven recommendations in shopping, healthcare, and education apps
- **Automation:** Chatbots & virtual assistants for businesses

### 2. AR & VR

- **Augmented Reality (AR) Apps:** Pokémon GO, IKEA Place (3D furniture placement)
- **Virtual Reality (VR) Apps:** Gaming, virtual tours, and immersive learning experiences
- **Metaverse:** Apps integrating with virtual worlds

### 3. 5G Technology

- **Faster internet speeds:** Real-time app experiences
- **Enhanced Cloud Gaming:** Mobile apps without needing high storage
- **Better Video Streaming:** High-quality live streaming

### 4. Cross-Platform Development

- **Flutter & React Native:** Write once, run everywhere (iOS & Android)
- **Progressive Web Apps (PWAs):** Apps that work like websites but feel like mobile apps

### 5. Internet of Things (IoT) & Smart Devices

- **Smart Homes:** Appliances with mobile apps
- **Wearables:** Smartwatches, fitness bands, and AR glasses
- **Connected Cars:** Apps that control vehicles remotely

### 6. Blockchain & Decentralized Apps (DApps)

- **Secure Transactions:** Blockchain for mobile payments
- **Decentralized Social Media:** More privacy & ownership of data
- **NFT & Crypto Wallets:** Managing digital assets on mobile

### 7. Super Apps

- **All-in-One Platforms:** Apps that offer multiple services (like WeChat)
- **Financial Services:** Banking, payments, shopping, & entertainment in one app
- **Social + Commerce:** Instagram & TikTok integrating shopping experiences

## Conclusion

The future of app development is AI-driven, cross-platform, faster, and more immersive. Students who learn about app development will shape the next generation of apps.

You may choose subject areas like social communication, work and life, business, education, entertainment, or healthcare, to name a few. AI, AR/VR, 5G, and IoT are emerging technologies to look into. Learn app development as a hobby or for a project. You never know, you could become an entrepreneur out of that app and business opportunity!

All the best!!!



# Indian Scientist

# Shivram Baburao Bhoje

A Distinguished Indian Nuclear Scientist – Padma Shri (2003)



**BORN 9 APR 1942**

He obtained a Bachelor's degree in Mechanical Engineering from the College of Engineering Pune (COEP) in 1965.

## Career and Contributions

Bhoje trained in Nuclear Science and Engineering at the Bhabha Atomic Research Centre (BARC) and began his career as a Scientific Officer at BARC, Trombay. In 1969–70, he was deputed to France, where he worked on designing a fast-breeder test reactor (FBTR).

Upon returning to India in 1971, he joined the Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam, leading the design and construction of India's 40 MW FBTR. Under his leadership, the reactor successfully generated electricity in 1997.

As Head of the Nuclear Systems Division (1985), Bhoje played a key role in designing the 500 MW Prototype Fast Breeder Reactor (PFBR). By 1992, he became the Director of the Reactor Group, overseeing FBTR operations and PFBR research. His expertise contributed to the clearance and approval of PFBR construction in 2003.

Bhoje made significant contributions to nuclear reactor safety, engineering, and research. He was instrumental in establishing Bharatiya Nabhikiya Vidyut Nigam Limited for PFBR operations. He published over 200 research papers and represented India at the International Atomic Energy Agency (IAEA) from 1987 to 1997. He also served on the IAEA Senior Advisory Group on Nuclear Energy.

## Awards and Recognition

- **Padma Shri (2003)** – India's fourth-highest civilian award.
- **H K Firodia Award (2006)** – For excellence in science and technology.
- **VASVIK Industrial Research Award (1992)** – In Mechanical Sciences and Technology.
- **Sir Visvesvaraya Memorial Award** – From the Engineers Foundation.

## Later Life and Legacy

After retiring in 2004, Bhoje continued contributing to education as an advisor to Shivaji University and a member of AICTE's postgraduate research board. His work advanced India's self-reliance in nuclear energy, inspiring future generations in science and engineering.

His remarkable contributions to nuclear science and energy research have left a lasting impact on India's technological progress, making him an inspiration for students interested in nuclear engineering and scientific innovation.

# USB – Universal Serial Bus

## Introduction

USB is the short form of Universal Serial Bus. It is a standard technology that allows electronic devices to communicate, connect, and transfer data and power with each other. USB ports are used in computers, smartphones, gaming consoles, and other gadgets. It easily transfers data among devices ( files from a flash drive to a PC) and supplies power. USBs are useful to connect peripherals like keyboards, mice, printers, external hard drives, etc. and is the replacement version of older ports like serial, parallel, PS/2, and so on.

USB was invented by an Indian-American Ajay Bhatt in 1995, an Intel employee at the time. He led a team from seven companies, Compaq, DEC, IBM, Intel, Nortel, Microsoft, and NEC, to develop the USB standard. In January 2025, He was honored with the Padma Shri, India's fourth-highest civilian award, by the Government of India.

USBs are often referred by their connector types, generation versions, and power delivery technology standard. Connector Types are by the design influencing data transfer speeds, power delivery, and device compatibility. USBs have evolved through several generation versions offering increased data transfer speeds and power capabilities. And, USB Power Delivery is a fast-charging technology standard adopted by different USB versions.

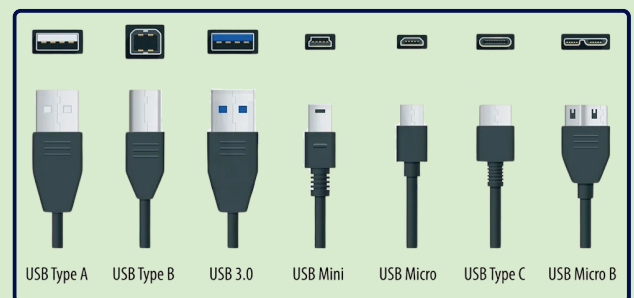
## USB Connector Types

The connector design evolved over a period of time in connecting various devices. Here are various USB types...

**1. USB-A:** It is a connector type used across multiple USB versions and is a standard Flat Rectangular Connector. Used for laptops, desktop computers, gaming consoles, and chargers. USB Type-A is compatible with USB versions from 1.0 through 3.2.

**2. USB-B:** It is a Square-shaped connector, often used for printers, scanners, and external hard drives. Now, rarely used due to newer alternatives. Compatible with USB 1.0 through 3.1 Gen 1.

**3. USB-C:** This is the most popular connector type. It has a reversible design, meaning no wrong way to plug it in. It supports fast data transfer & power delivery. It is used in modern laptops, smartphones, tablets, and gaming consoles. Type-C is compatible with USB 2.0 through the latest USB4 v2.0.



USB Connector Types

**4. USB-Mini:** It is smaller than USB-B, used in older cameras, MP3 players, and game controllers. It has been replaced by micro-USB. It is compatible with USB 2.0 and USB 2.0 OTG.

**5. USB-Micro:** This is compact, widely used for Android smartphones, wireless headphones, and portable devices. There is also a variant Micro-B. However, it has been phased out by Type-C. It is compatible with USB 2.0, USB 2.0 OTG, and USB 3.0.

**6. Lightning:** It is an Apple's proprietary connector like micro-USB. Used in iPhones, iPads, and AirPods.

### USB Versions

Evolution of USB Versions is defined by the Data Speed and Power Specifications. Here is a table to depict the same...

USB Version	Speed	Max Power (Standard)
USB 1.0	1.5 Mbps	2.5W (5V, 0.5A)
USB 1.1	12 Mbps	2.5W
USB 2.0	480 Mbps	2.5W (5V, 0.5A)
USB 3.0, 3.1 Gen 1	5 Gbps	4.5W (5V, 0.9A)
USB 3.1 Gen 2	10 Gbps	4.5W (5V, 0.9A)
USB 3.2 Gen 2x2	20 Gbps	4.5W (5V, 0.9A)
USB4	Up to 40 Gbps	Depends on implementation
USB4 v2.0	Up to 80 Gbps	Depends on implementation

### USB Power Delivery

USB Power Delivery (USB PD) as power negotiation standard is adopted to deliver much higher power over USB. Implemented in USB-C. Increasingly used in phones, tablets, laptops, monitors, and more. Not all Type-C cables support USB PD, though. Here are USB PD standards...

PD Version	Release	Max Power	Voltage Levels
USB PD 1.0	2012	10W–100W	5V, 12V, 20V
USB PD 2.0	2014	100W	5V–20V @ 5A
USB PD 3.0	2016	100W	Same as PD 2.0 + PPS
USB PD 3.1	2021	240W	New levels: 28V, 36V, 48V

### Conclusion

As the technology evolves, USB version 4 is transforming and shaping how we power, connect, and transfer data across devices. USB4 v2.0 is already giving a speed up to 80 Gbps and is expected to grow further. That would enable quicker file transfers, smoother video streaming, and better performance for high-end applications.

With improving Power Delivery support, USB Type-C is able to go up to 240 Watts. This enables charging laptops, monitors, and even some household appliances. Type-C is such a success, even Governments are mandating that standard for all devices to reduce e-waste. It helps less clutter and fewer cables due to compatibility with more devices.



# Science & Innovation Organization

## Department of Space (DoS)

The Department of Space (DoS) is an Indian government department established in 1972 in Bengaluru, responsible for the administration of the Indian space programme. It manages several agencies and institutes related to space exploration and space technologies. It aims to promote the development and application of space science and technology for the socioeconomic benefit of the country. DoS is directly under the Prime Minister's Office and the Executive Head is usually the Chairman of ISRO.

It includes two major satellite systems: INSAT for communication, television broadcasting, and meteorological services, and the Indian Remote Sensing Satellites (IRS) system for resources monitoring and management. It has also developed two satellite launch vehicles, the Polar Satellite Launch Vehicle (PSLV) and Geosynchronous Satellite Launch Vehicle (GSLV), to place IRS and INSAT class satellites in orbit. The Space Commission formulates the policies, and the DoS implements them. The DoS oversees a network of centers and institutions across India.

### Core Functions

- The DoS is responsible for the overall planning, execution, and promotion of space-related activities in India.
- Its primary goal is to advance space science and technology for national development.
- Responsible to formulate space policies.
- Develop and launch satellites for communication, navigation, remote sensing, and meteorology.
- Advance space science and technology.

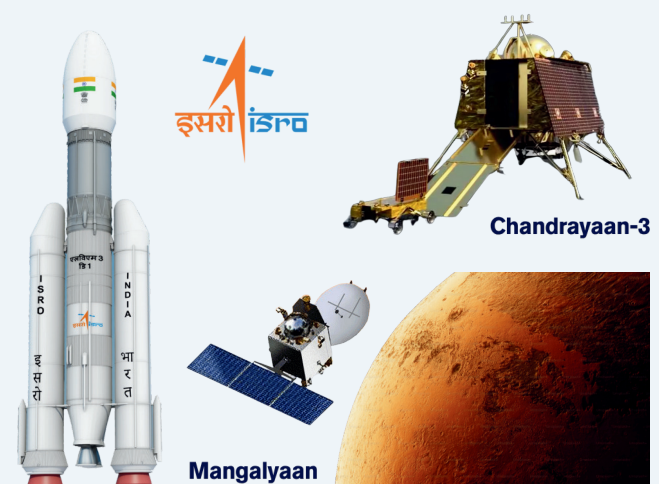
### Objectives

- To harness space technology for various applications that benefit society, such as Communication, Remote sensing, Meteorology, and Navigation
- To conduct scientific research and explore space, including planetary missions.
- The DoS plays a vital role in India's technological advancement and its position in the global space community.
- Its work has many practical applications that improve the lives of Indian citizens.
- The Department of Space is the driving force behind India's ambitious space endeavors, contributing to scientific knowledge and national progress.

### Key Achievements

- **Chandrayaan Missions:** India's lunar exploration program.
- **Mangalyaan (Mars Orbiter Mission):** India's first interplanetary mission.
- **PSLV** and **GSLV** launch vehicles.

DoS holds a record for launching 104 satellites in a single mission in 2017.



# Indian Innovation

# Mangalyaan

## Introduction

India's first interplanetary space mission is Mangalyaan, also known as MOM – Mars Orbiter Mission. It was launched by the Indian Space Research Organization (ISRO) on November 5, 2013, at Satish Dhawan Space Centre, Sriharikota, India.

Mangalyaan was launched by Polar Satellite Launch Vehicle PSLV-C25 and the Mars Orbit Insertion was held on September 24, 2014. It was designed for a 6-month mission, but it lasted over 8 years and in September 2022, the mission was declared closed.

## Objectives

The Primary goal of Mangalyaan is to demonstrate India's capability to reach and orbit Mars, i.e., as a technology demonstrator project, it is to develop the technologies for designing, planning, management, and operations of an interplanetary mission.

The scientific objectives are to study Martian surface features, morphology, and atmosphere, explore Mars' mineral composition, and measure methane levels in the Martian atmosphere.

## Scientific Instruments loaded in MoM

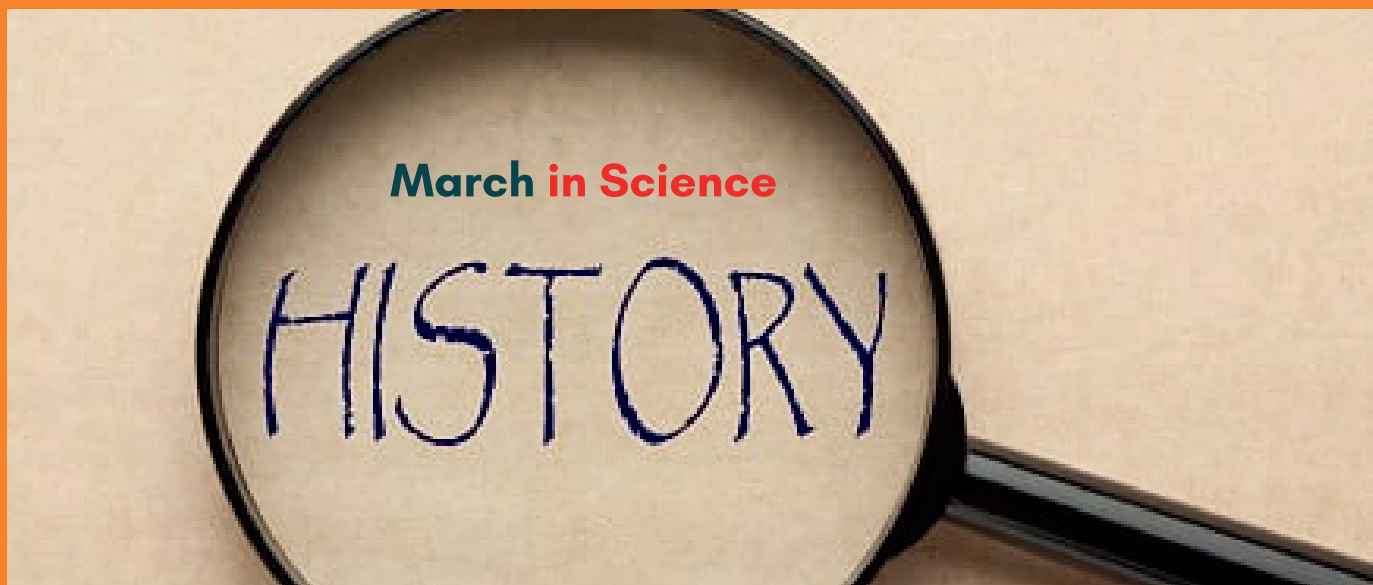
- **Mars Colour Camera (MCC):** It captures the Mars surface.
- **Methane Sensor for Mars (MSM):** Identifies and detects methane presence (a potential indicator of life).

- **Thermal Infrared Imaging Spectrometer (TIS):** Perfectly analyzes thermal emissions.
- **Mars Exospheric Neutral Composition Analyser (MENCA):** It studies the upper atmosphere of Mars, the Solar wind, and radiation effects.
- **Lyman Alpha Photometer (LAP):** Measures hydrogen and deuterium.

The spacecraft weighed just 1,337 kg, using minimal fuel with maximum efficiency. To save fuel, it used a clever slingshot trajectory (Earth orbit maneuvers). It used remote sensing techniques to capture data on Mars. It captured stunning high-resolution images of Mars, including its full disk and atmospheric features. It also offered first views of the far side of the Martian Moon Deimos.

## Achievements

- Mangalyaan is completely developed, designed, and managed by ISRO. It demonstrated India's space capabilities.
- It was designed and launched in just 15 months, which is incredibly fast for an interplanetary mission.
- Mangalyaan is the most economical Mars mission at a cost of \$74 million, cheaper than a Hollywood movie budget.
- The mission life is extended, originally planned for 6 months, it lasted over 8 years in Mars orbit.
- ISRO became the fourth space agency (after NASA, Roscosmos, and ESA) to reach Mars. India became the first country to succeed in its maiden Mars mission.



March holds significant importance in the Indian context for contributions to science, technology, and notable events in history. Here are some key milestones and events in science and related fields from India during the month of March:

### **Notable Birth Anniversaries**

March 2, 1920: Birth of Satyendra Nath Bose, the renowned Indian physicist after whom the "Boson" particle is named. His work in quantum mechanics, particularly Bose-Einstein statistics, laid the foundation for the discovery of the Higgs boson.

March 30, 1887: Birth of Subroto Mukherjee, the first Chief of the Indian Air Force, symbolizing India's advances in aeronautics and defense technology.

### **Space Science and Exploration**

March 3, 2019: ISRO successfully launched the GSAT-7A, a communication satellite enhancing the capabilities of the Indian Air Force.

March 24, 2007: ISRO launched its PSLV-C7 rocket, which successfully deployed four satellites, showcasing India's growing space technology capabilities.

By the way, there were 58 successful PSLV launch missions till December 2024.

### **Medical and Biological Advances**

March 14, 1969: The All-India Institute of Medical Sciences (AIIMS), New Delhi, performed its first successful open-heart surgery, marking a milestone in Indian medical science.

### **Environmental Initiatives**

March 19, 1980: The Gir National Park in Gujarat was declared a national park, highlighting India's efforts in conserving the Asiatic lion and promoting wildlife conservation.

### **Technological Innovations**

March 10, 2010: India's Tata Nano, the world's cheapest car, was introduced. It showcased Indian engineering innovation in cost-effective manufacturing.

### **Historical Scientific Contributions**

March 16, 1966: Dr. Homi J. Bhabha, the father of India's nuclear program, tragically passed away in a plane crash. His work laid the foundation for India's nuclear energy and atomic research.



# Key for Brain Teasers

## Solution Sudoku Challenge 2503

8	5	6	9	1	7	4	2	3
2	1	3	8	6	4	5	9	7
9	4	7	2	3	5	8	1	6
1	8	5	3	9	6	7	4	2
7	6	2	1	4	8	3	5	9
3	9	4	5	7	2	6	8	1
5	2	1	6	8	3	9	7	4
4	3	9	7	5	1	2	6	8
6	7	8	4	2	9	1	3	5

## Solution Word Search 2503

U	R	A	N	U	S	N	E	S	T	R	U	S	T
M	U	N	O	T	N	E	N	N	O	O	M	L	M
S	A	S	R	T	J	H	U	U	N	U	T	E	
O	L	R	A	N	U	N	T	S	U	A	P	R	U
L	R	N	S	A	P	O	P	S	U	H	N	U	T
A	N	L	S	U	I	U	E	T	S	N	T	U	M
R	R	S	L	S	T	S	N	Y	M	O	E	A	S
S	U	S	S	R	E	O	E	Y	M	T	U	V	O
Y	T	S	R	M	R	C	A	R	T	U	R	R	U
S	A	E	C	A	P	T	R	U	Y	L	Y	O	E
T	S	N	S	S	T	S	T	C	N	P	R	T	E
E	S	T	S	S	S	S	H	R	U	S	P	A	S
M	T	U	T	U	S	U	M	E	A	E	A	U	N
P	U	R	R	U	U	P	T	M	T	P	Y	A	N

**Riddle 2503 Answer:** 1. Thorium 2. Rust 3. Fire 4. Salt

# GYS SAMASYA KHOJ Contest

A National Problem Identification Competition for High School Students

Samasya Khoj is a national contest to nurture the habit of observation and problem definition. The contest is just on the problem description, not solving it. Intent is that repeated practice of identifying and narrating problems accelerates the opportunity for useful innovation.

**Theme:** Real-life Problems relevant to Student Innovation

**Submit at**  
**[www.YoungScientistIndia.org](http://www.YoungScientistIndia.org)**

**Last Date for Submission:** 20-May-2025

### Prizes

First Prize: Rs. 3,000, Certificate, Medal  
Second Prize: Rs. 2,000, Certificate, Medal  
10 Consolation Prizes: Rs. 500, Certificates

### Evaluation Criteria (100 Points)

20 points = Problem Title  
30 points = Problem Description  
10 points = Affected Audience  
20 points = Quality of Submission  
20 points = Relevance to Student Innovation.

### Competition Terms & Conditions

- Students from Class 6 to Class 12.
- Students from Government, Aided, Corporate and Private Schools in India can participate.
- One student can submit multiple entries.
- Entries submitted should be Student's own, and should not copy from someone else or from the Internet.
- Language for submission is English.
- There is NO ENTRY FEE to participate.
- Prize distribution would be virtual. Cash Vouchers and Digital Certificates would be distributed via email. Print Certificates would be sent via Post/Courier.

# GYS *Avishkar* AWARDS 2025

## A National Science Projects Competition

**Theme:** Low Cost Grassroots Innovation

**Mode:** Online Video Submission (3 to 7 mins)

**Eligibility:** Students from Classes 6 to 12

**Winners:** Certificates, Trophies, Cash Prizes

**Attention:** Guide Teachers are Rewarded



Rs. 1,00,000  
One Lakh  
Rupees  
Cash Prizes



₹ 20,000

for Student

₹10,000

for Guide Teacher



₹ 15,000

for Student

₹10,000

for Guide Teacher



₹ 10,000

for Student

₹10,000

for Guide Teacher

+ 10 Consolation Prizes

Visit today...

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Ph. 9966775534, 9966332456