



ATAL INSTITUTE OF SCIENCE AND TECHNOLOGY

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1. Introduction

A study by Accenture predicts that India could lose \$1,970 billion in GDP by 2028 if it doesn't address its digital skills gap, and 2.3% of GDP growth is at risk every year. That's a significant amount of money, and it could have a major impact on any organization that relies on digital talent.

The National Education Policy (NEP) 2020 recognizes the importance of digital skills and emphasizes the development of scientific temper, creativity, problem-solving, and logical reasoning skills, as well as digital literacy, coding, and computational thinking [Point 4.23 of NEP 2020]. These skills are essential for India to become a dominant global economy.

NEP 2020 also recognizes the importance of mathematics and mathematical thinking for India's future and India's leadership role in numerous upcoming professions that will involve artificial intelligence, machine learning, data science, etc. [Point 4.25 of NEP 2020]. Thus, mathematics and computational thinking have been given increased emphasis throughout the school years. NEP 2020 has recommended that activities involving coding be introduced in the primary and middle stages as well.

1.1 Computational Thinking and Algorithmic Literacy in Primary Education

In today's increasingly digitized world, the significance of equipping young learners with foundational skills for the future cannot be overstated. Among these essential skills, Computational Thinking (CT) and Algorithmic Literacy stand out as critical competencies for the 21st century. Computational Thinking, a problem-solving process that includes understanding and applying computational processes and algorithms, is integral to computer science and extends beyond to various aspects of daily life. Algorithmic Literacy, on the other hand, involves understanding the nature, functionality, and impact of algorithms in our digital society. It equips students with the ability to critically assess and engage with the technology that permeates their lives.

These competencies enable children not only to interact effectively with technology but also to develop a deeper understanding of the digital environment that surrounds them. CT and Algorithmic Literacy foster a mindset that encourages breaking down complex problems into manageable parts, identifying patterns, abstracting general principles from specifics, creating step-by-step strategies (algorithms) for problem-solving, and critically evaluating the solutions and processes.

Research supports the introduction of these concepts at a young age, indicating that children from the age of 6 can begin to understand and apply basic principles of computational thinking and algorithmic processes. Early exposure to these concepts does more than prepare children for future careers in technology; it develops critical thinking, problem-solving, and analytical skills that are applicable across all academic disciplines and real-life situations.

Furthermore, integrating CT and Algorithmic Literacy into early education is a step towards democratizing technology education, providing all children, regardless of background, with the tools to navigate and succeed in a tech-centric world. It also fosters an informed understanding of how technology works, laying the groundwork for responsible and ethical engagement with digital tools and platforms.

1.2 NIPUN Bharat



NIPUN Bharat, standing for National Initiative for Proficiency in Reading with Understanding and Numeracy, is an integral component of the National Education Policy (NEP) 2020, aimed specifically at revolutionizing primary education in India. This initiative is designed to ensure that every child in the country, ideally by the end of Grade 3, attains foundational literacy and numeracy, which are deemed essential for higher learning and overall cognitive development.

Key Objectives

- **Foundational Literacy and Numeracy:** The primary goal is to ensure that every child achieves foundational literacy and numeracy by the end of Grade 3.
- **Universal Access to Education:** NIPUN Bharat aims to bridge educational disparities by providing universal access to high-quality primary education across India.
- **Innovative Pedagogies:** The initiative promotes the use of innovative teaching-learning methodologies to engage children and facilitate effective learning.

Strategies and Approaches

- **Holistic Curriculum:** The curriculum under NIPUN Bharat is holistic, focusing on language and mathematics but also integrating environmental awareness, arts, and physical education.
- **Teacher Training:** Emphasis is placed on comprehensive teacher training programs to equip educators with the skills and knowledge necessary for effective implementation.
- **Community Engagement:** The initiative encourages community and parental involvement in primary education to create a supportive learning environment.
- **Regular Assessments:** Regular assessments are conducted to monitor progress and provide early interventions when necessary.

NIPUN Bharat leverages technology to enhance learning experiences. Digital tools and platforms are utilized to support and supplement traditional classroom teaching, making education more interactive and accessible. The initiative focuses on tangible outcomes, aiming to ensure that children not only learn to read and write but also develop comprehension skills and the ability to perform basic arithmetic. The ultimate goal is to lay a strong foundation for lifelong learning and critical thinking. Special attention is given to underprivileged and differently abled children, ensuring that the benefits of NIPUN Bharat reach the most marginalized sections of society.

2. Nirmaan Bal Shikshan Program for Primary Schools

The Nirmaan Bal Shikshan Program is an innovative educational initiative aligned with India's National Education Policy (NEP) 2020, specifically designed to enhance primary education. This program aims to equip young learners with critical digital literacy and computational skills, preparing them for the demands of a rapidly evolving digital world. Key aspects of the Nirmaan Bal Shikshan Program include:

1. **Adherence to NEP 2020:** The program closely follows the objectives set out in NEP 2020, emphasizing the importance of digital literacy, computational thinking, and foundational skills such as mathematics in the education system.



2. **Emphasis on Computational Thinking and Algorithmic Literacy:** A core focus of the program is to introduce and strengthen computational thinking and algorithmic literacy from an early age. This involves teaching children how to approach problems with a computer scientist's mindset, understanding algorithms, and applying these skills across various life aspects.
3. **Holistic Educational Approach:** The Nirmaan Bal Shikshan Program adopts a comprehensive educational approach. It integrates computational skills with other essential areas like language, environmental awareness, arts, and physical education.
4. **Innovative Teaching Methodologies:** The program employs innovative, interactive teaching methodologies, utilising technology to make learning more engaging and effective for children.
5. **Focus on Foundational Learning:** In line with the principles of NIPUN Bharat, the program targets foundational literacy and numeracy, ensuring every child acquires these essential skills by a certain educational stage.
6. **Inclusivity and Accessibility:** A significant emphasis of the program is on making quality education accessible to all children, irrespective of their socio-economic background. It focuses particularly on underprivileged and differently abled children, to ensure an inclusive education system.
7. **Preparation for a Digital Future:** By incorporating essential digital skills and computational thinking into the curriculum, the Nirmaan Bal Shikshan Program aims to prepare students adequately for the challenges and opportunities of a technology-driven future.

The Nirmaan Bal Shikshan Program represents a significant step towards modernising India's educational framework, ensuring that the next generation is not only well-versed in digital technologies but also equipped with critical thinking and problem-solving skills essential for success in the 21st century.

3. Curriculum/Syllabus

The syllabus of the Nirmaan Bal Shikshan Program is designed to cater to the developmental needs of students of class 1 to 5. It is structured into two levels, each targeting specific age groups with tailored educational content that focuses on developing computational thinking, algorithmic literacy, and foundational academic skills.

- **Target Classes:** Students of classes 1-5 in government schools.
- **Duration:** One 40-minute class per week dedicated to the Lab.
- **Curriculum Structure:** A year-long curriculum, with 25 sessions for learning and 5 sessions for project building annually.
- **Learning Focus:** Developing computational thinking, algorithmic literacy, and foundational academic skills.
- **Learning Approach:** Emphasis on self-learning, peer learning, and project-based learning.
- **Assessment:** Quarterly evaluations of student and lab performance.



Level 1 to 2 (Class 1 and 2)

Cognitive and Mathematical Skills:

- **Logical Reasoning:** Introduction to basic logic and reasoning skills through simple puzzles and problems.
- **Task Segmentation:** Learning to break down tasks into smaller, manageable steps.
- **Sequence Building:** Understanding sequences and the order of events or actions.
- **Pattern Recognition:** Identifying and creating patterns using objects, numbers, or symbols.

Numeracy Skills:

- **Numbers and Arithmetic up to 2 Digits:** Basic arithmetic operations and number recognition up to two digits.
- **Shapes and Spatial Understanding:** Recognition and understanding of basic shapes and spatial relationships.
- **Measurement Concepts and Directions:** Introduction to basic measurement concepts and understanding directions.
- **Simple Data Interpretation**

Language Skills:

- **Aksharas Recognition:** Recognition and understanding of Aksharas (basic writing units in Indian languages).
- **Word and Picture Association:** Associating words with corresponding pictures to enhance vocabulary and understanding.
- **Reading Fluency:** Developing basic reading skills and fluency.
- **Listening Comprehension:** Enhancing listening skills through storytelling and audio materials.

Level 3 to 5 (Class 3 to 5)

Advanced Cognitive Skills:

- **Logical Reasoning:** Advancing logical reasoning skills with more complex problems.
- **Task Segmentation:** Further development of breaking down complex tasks.
- **Algorithm Building:** Introduction to basic algorithm creation, understanding steps and processes.
- **Decision Making:** Learning to make simple decisions based on given information.

Numeracy Skills:

- **Numbers and Arithmetic Operations up to 4 Digits:** Handling larger numbers and more complex arithmetic operations.
- **Spatial and Spatial Understanding:** Deeper exploration of spatial concepts and relationships.
- **Measurements and Directions:** Advanced concepts in measurement and understanding of complex directions.
- **Data Handling and Heuristics:** Introduction to handling data and using heuristics for problem-solving.

Language Skills:



- **Word and Picture Association:** Continued development of language skills through more complex word-picture associations.
- **Reading Fluency:** Enhancing reading skills with more challenging texts.
- **Creative Storytelling:** Encouraging creative expression through storytelling.
- **Reading Comprehension:** Focusing on understanding and interpreting written material.

This syllabus is crafted to build a strong foundation in computational thinking and algorithmic literacy, while also nurturing essential academic skills. It balances cognitive development with creative expression and practical application, ensuring that students are well-prepared to meet the challenges of the digital age. The Nirmaan Bal Shikshan Program thus represents a comprehensive approach to primary education, fostering a generation of thinkers, problem-solvers, and digitally literate citizens.

4. Execution Plan and Methodology

To successfully execute the Nirmaan Bal Shikshan Program in government schools, a detailed and systematic plan of execution is outlined as follows:

1. Infrastructure Setup
2. Capacity Building of the Teachers
3. Student Facing Program and Initiatives

4.1 Infrastructure Setup

We will do the material supply, infrastructure setup and commissioning of the lab. The following packages will be supplied in the Nirmaan Bal Shikshan Program:

Package Number	Package	Utility in Program
P1	Intelligent Toys and Hardware	Provides practical tools and equipment for hands-on learning in computational thinking, fostering experiential learning.
P2	Books and Learning Content	Books, Activity Sheet, and Teacher Guide for each class.

The detailed equipment list is attached in Annexure 1.

- **Quality of the Equipment:** STEMpedia will supply materials with appropriate certificates, Child Safe and comply with the specifications as per Annexure 1. We will also provide 1 years of OEM warranty on the equipment.
- **Branding of Intelligent Bal Vikas Kits:** STEMpedia will be cobranding the kits for the program.

4.2 Capacity Building for Teachers

The Capacity Building Program for Teachers, integral to successfully implementing the Nirmaan Bal Shikshan Program in Government schools, is structured as a comprehensive two-day training. Here's the detailed plan:



- **Duration:** 2 days.
- **Participants:** 5 primary teachers from each school.
- **Attendance:** Mandatory for all teachers, with attendance and data reported for evaluation.
- **Objective:** Equip teachers to conduct classes, organise lab inauguration, motivate students, and maintain lab reports.
- **Implementation Timeline:** Within 4 weeks for all schools, prior to lab inauguration.

The capacity building of the teachers will be implemented in a centralized location. All the teachers from the nearby districts will join the training.

STEMpedia will be responsible for the implementation of the Capacity Building, including the following:

- Equipment required for the training.
- Implementation of the training by the experts.
- Pre and post assessment report for the capacity building.
- Certification of the teachers on the completion of the training.

STEMpedia will be responsible for submission of the report of the Capacity Building for the Nirmaan Bal Shikshan Program.

4.3 Student Facing Program

The student facing program for the Nirmaan Bal Shikshan Program will have the following components to be executed:

- **Activity Books:** Designing and distributing custom-designed Activity Books for Classes 1-5 in both Hindi, ensuring compatibility with the existing curriculum, and enhancing the learning experience.
- **Incorporation into Curriculum:** Integrate the program activities into the regular school curriculum, ensuring a seamless learning experience.
- **Bal Vikas Festival:** Organize an annual festival focused on SDG-related problem statements, promoting innovative thinking and solutions among students.
- **Recognition of Innovation:** Acknowledge and celebrate innovative ideas and solutions developed by students, fostering a culture of creativity and problem-solving.
- **Dedicated Helpdesk:** Establishing a helpdesk for ongoing support and maintenance of the Nirmaan Bal Shikshan Program.
- **Thematic Sessions and Calendar:** Implement bi-weekly thematic sessions per learning level, guided by a monthly calendar aligned with the state curriculum.

This comprehensive plan ensures a structured and effective rollout of the Nirmaan Bal Shikshan Program across schools, aligning with the objectives of NEP 2020 and focusing on developing foundational skills critical for the 21st century.

5. Expected Outcomes of the Program



The Nirmaan Bal Shikshan Program, aligned with the National Education Policy (NEP) 2020, aims to address India's digital skills gap and foster foundational skills in primary education. This initiative is crucial for India's position in the global economy, especially considering the rapid advancements in technology and digitalization.

5.1 Qualitative Outcomes

- **Enhanced Digital Literacy and Computational Skills:** Students develop essential digital competencies, including computational thinking and algorithmic literacy, preparing them for future technological challenges and opportunities.
- **Improved Critical Thinking and Problem-Solving Abilities:** The Program cultivates critical thinking and problem-solving skills among students, enabling them to approach complex issues methodically and innovatively.
- **Increased Inclusivity in Education:** By providing resources and training in regional languages and focusing on diverse backgrounds, the Program ensures equitable access to quality education, bridging the educational divide.
- **Empowered Teachers with Advanced Teaching Skills:** Teachers gain enhanced capabilities in delivering computational thinking and foundational literacy, enabling them to foster a more engaging and effective learning environment.
- **Community Engagement and Parental Involvement:** The Program fosters a collaborative learning environment by involving parents and the community, enhancing students' overall educational experience and support.
- **Ethical and Global Perspective in Education:** Students are equipped with a global outlook and an understanding of the ethical implications of technology, preparing them to be responsible global citizens.

5.2 Quantitative Outcomes

- **Literacy and Numeracy Proficiency Rates:** Improvement in foundational literacy and numeracy rates, as measured by regular assessments and benchmarks aligned with NEP 2020.
- **Teacher Training and Proficiency Levels:** Successful training and upskilling of primary school teachers, as evidenced by pre- and post-assessment results, with refresher sessions ensuring continuous improvement.
- **Student Participation in Bal Vikas Festival:** Engagement and participation rates in the annual Bal Vikas Festival, showcasing innovative ideas and solutions aligned with Sustainable Development Goals (SDGs).
- **Usage and Effectiveness of Learning Aids:** Quantitative data on using learning aids and activity books and their impact on student learning and engagement.
- **Feedback and Support Metrics:** Analysis of feedback from the toll-free helpline and online sessions, providing insights into the effectiveness and areas for improvement in teacher support mechanisms.



The Nirmaan Bal Shikshan Program represents a comprehensive approach to modernising primary education, focusing on developing crucial 21st-century skills and foundational academic competencies. Its success will be measured not only through quantitative metrics but also through qualitative improvements in the educational landscape.



Annexure 1: Equipment, Software and LMS Requirement List

Package 1: Intelligent Toys and Hardware

S. N.	Name	Description	Type	Qty
1	Computational Thinking Classroom Pack for Class 1 and 2 & Class 3 to 5	The Computational Thinking Kit for Class 1 and 2 & Class 3 to 5 is tailored to support the development of computational thinking skills among students in these age groups. This kit provides an array of interactive and educational tools, focusing on hands-on learning and problem-solving. Components of the Classroom Pack: Robot Kits ● Quantity: 6 ● Warranty: 2-year manufacturer's warranty Teacher's Kit ● Content: Teacher's Robot Kit and Accessories Teacher Handbooks ● Regional Language: 1, with a dedicated lesson plan ● English: 1, with a dedicated lesson plan Interactive Learning Arenas ● Colour Coded Grid Arena cum Match the Following Arena: 6 ● Number Line Arena: 6 ● 10x10 Number Grid Arena: 1 Educational Tools and Accessories ● Paper Cube - Numbers: 6 ● Paper Cube - Navigation: 6 (plus spares) ● Coding Cards: 6 Sets (plus spares) ● Theme Cards: 6 Sets (plus spares) ● Brush Pen: Pack of 12 ● Paper Claw for Robot: 6 Sets (plus spares) ● Elastic Rubber Band: 100 ● Drawing Sheets: 30 ● AAA Batteries: 40 ● Spares - Robot Wheel: 6 ● Spares - Fasteners: 10 Sets ● Hardware Tools: Screwdriver and Spanner, 1 Set	Kit	2



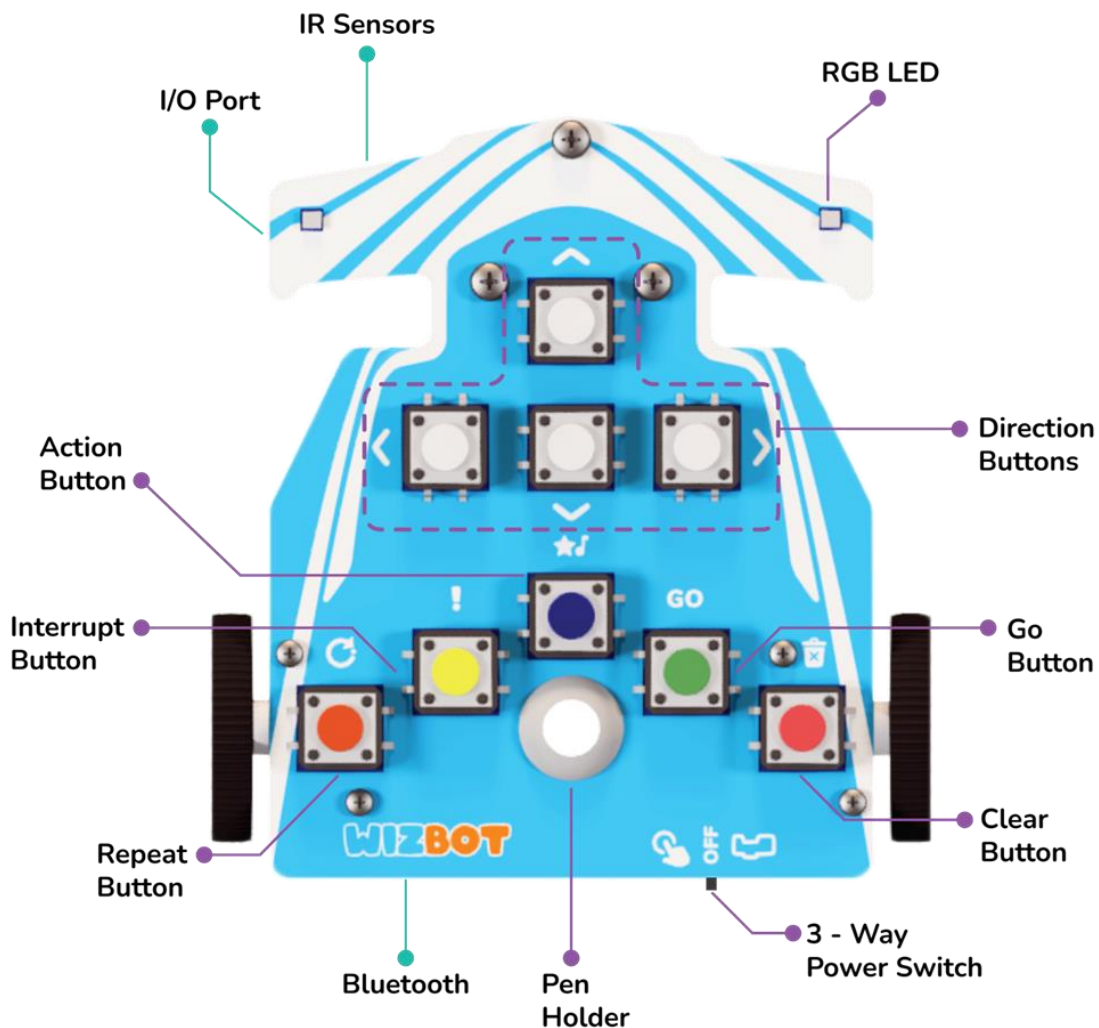
		Additional Notes: ● Ample Consumables and Spares: Sufficient consumables and spares should be included for all kit components to ensure durability and uninterrupted use. ● Play-Based Learning Focus: The kit should be designed to engage students in play-based learning, enhancing their creativity, exploration, and problem-solving skills. ● Inclusivity in Language: Materials and handbooks are provided in both regional languages and English to cater to different linguistic backgrounds.		
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Package 2: Books and Learning Content

S. N.	Name	Description	Type	Qty
1	Computational Thinking Books for Class 1	25 Activities in Regional Language	Book	10
2	Computational Thinking Books for Class 2	25 Activities in Regional Language	Book	10
3	Computational Thinking Books for Class 3	25 Activities in Regional Language	Book	10
4	Computational Thinking Books for Class 4	25 Activities in Regional Language	Book	10
5	Computational Thinking Books for Class 5	25 Activities in Regional Language	Book	10

Annexure 2: Wizbot Classroom Bundle - A Kit for Early Learning on Computational Thinking and Foundational Numeracy

What is Wizbot?



- Wizbot is the versatile robotics platform with focus on Computational Thinking and Foundational Numeracy programs for kids of age 4 to 9 years.
- Use of technologies like Electronics, Coding, AI and Robotics to engage kids.
- Powered by AAA batteries the Wizbot kit is portable and ideal for classroom learning.
- No wiring or assembly required.
- 25+ screenless hands-on activities.
- 50+ hands-on activities with progressive learning in a gamified way.
- Inbuilt Bluetooth and Wi-Fi connectivity.

Modes in Wizbot



Screenless Button-Based Coding

- Create and execute Playlist with Buttons
- Solve challenges on the grid
- Eliminates use of Mobile or Laptop



Drawing Mode

- Draw shapes with Pen
- Learn about Robot Locomotion
- Program with Button

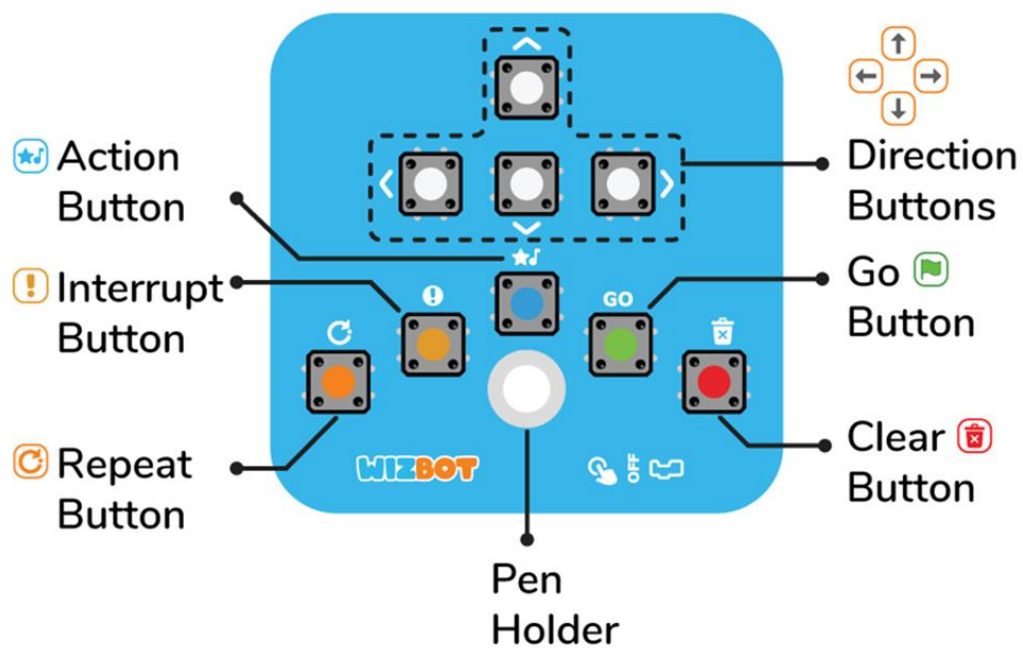


Block Coding with Phone / Computer

- Colorful Puzzle Blocks for Coding
- Use AI Extensions for Projects
- Learning coding concepts

How Wizbot Screenless Coding Works?

Wizbot has 9 buttons which allows the kids to create a Coding Playlist which can be executed for solving challenges!



Example: In this challenge, the robot has to move from Orange (B1) to Orange (C3) box.



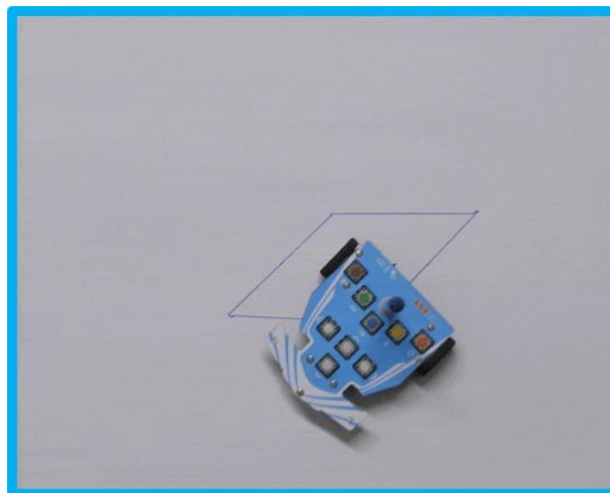
What is Wizbot Draw Mode?

Wizbot has provision to attach a Pen to the robot. Then the robot can be programmed through Button, Block or Text coding to draw various shapes.

Challenge: Make a Square!

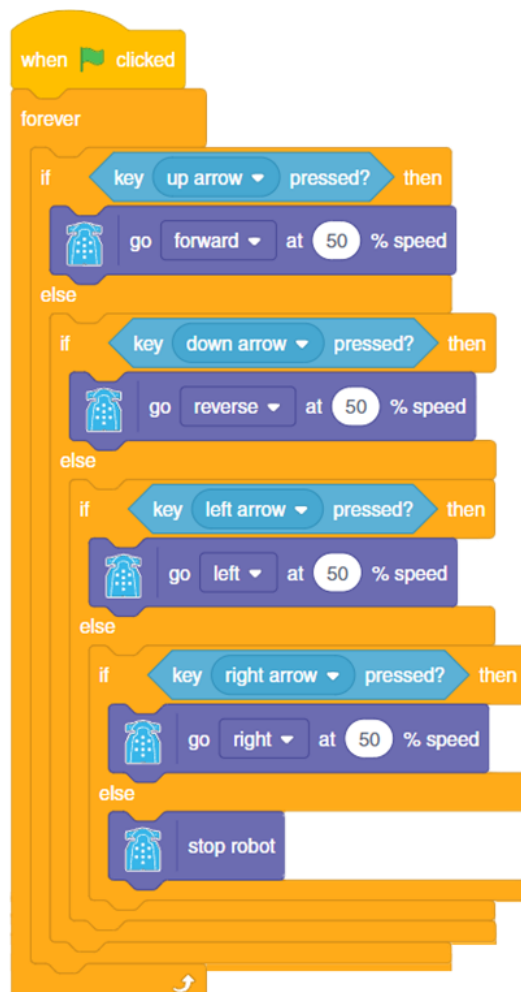
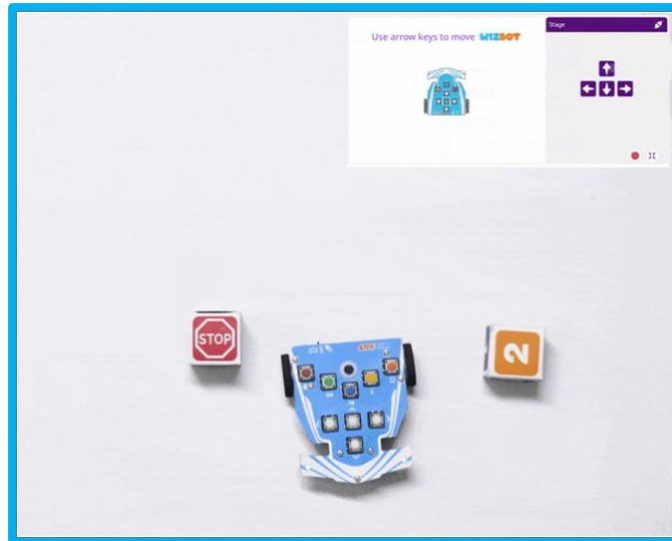


Challenge: Make a Parallelogram!



How Does Wizbot Picto Mode Works?

Wizbot can connect with Mobile or Laptop using Bluetooth. Once connected it can get the instructions from PictoBlox directly from Block Coding and Python Coding.





Key Learnings from Wizbot

- Button Based Coding
- Relative Motion
- Actuators
- Trajectory Planning
- Directional Awareness
- Critical Thinking
- Graph Theory
- Basic Arithmetic
- Geometry
- Pattern Recognition
- Temporal Awareness
- Block Based Coding
- Motor Skills
- 2D Animation
- Game Development
- Sensors
- Line Following
- Artificial Intelligence
- Python Programming
- Algorithmic Thinking
- Problem Solving
- Key Coding Concept
- Robotics