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# Smart Narrator Robot: Enhancing Experiential Learning through Conditional Autonomy

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**Abstract: This work presents a new teaching robotics platform meant to offer interesting and motivating experiences in labs, museums, and educational institutions. The robot motivates human interaction with an integrated sound system that offers contextual information, safety concerns, and procedural instructions even as it performs tasks including material handling, guided tours, and work demonstrations. The robot's conditional decision-making module is a novel invention as it adjusts its behaviour to satisfy the needs of certain tasks and outside cues. This makes autonomous navigation, intelligent guest interaction, and context-sensitive information delivery feasible. Because of its complex programming, which enables it to offer specialist assistance in many situations, the robot functions as a cooperative assistant and teaching tool. As this work combines flexibility, automation, and interactive storytelling shows, robots are becoming more and more important in enhancing operational efficiency and learning settings.**

***Keywords:*** *Components; Arduino Mega; Arduino IDE; Husky Lens; Bluetooth Module.*

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## I. INTRODUCTION

As a part of a fast-expanding industry impacting new approaches of teaching and learning robots are used in education. When robots are included into the classroom as part of a creative and interesting teaching approach, students' involvement and grasp of STEM (science, technology, engineering, and mathematics) subjects is much improved. Through chances for actual learning, educational robots, claims Eguchi [1], fosters critical thinking and creativity.

Robots have been used in a variety of educational settings recently, including labs, classrooms, and speciality locations such museums and college inquiry centres. These robots improve the learning process by acting as interactive helpers, giving guests and students information. By means of mobile and interactive technology, Zurita and Nussbaum [2] claimed that robots may enhance collaborative learning, therefore offering a strong case for their inclusion into institutional systems.

To meet the requirements for delivering on-demand information, such robots necessitate three fundamental capabilities: an audio output system, interactive sensors, and wireless connectivity. An Arduino board combined with an SD card facilitates efficient control and real-time data transmission. This setup ensures the robot's efficacy as a stationary yet interactive knowledge resource, hence fostering a progressive learning atmosphere.

The article "Smart Narrator Robot: Enhancing Experiential Learning Through Conditional Autonomy" adheres to a systematic, tiered approach. The introduction delineates the emergence of robotics in education and the particular demand for interactive robots inside academic environments. The literature study emphasises pertinent

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previous studies, encompassing the application of Arduino in educational robotics and progress in autonomous robotics. The problem statement delineates the issue of redundant laboratory tours and proposes a robotic solution. The approach delineates the design process, encompassing the use of Husky Lens, conditional programming, and sound system integration. The steps of testing, optimisation, and deployment guarantee operational functionality in real-world settings.

## II. LITERATURE REVIEW

Driven by the demand for better engagement, accessibility, and operational efficiency, the integration of robots in sectors including healthcare, manufacturing, education, and material handling has greatly expanded. This development depends on the Arduino platform as its open-source flexibility and low cost have made it a common tool for the building of assistive and teaching robots (Das et al., 2020; Kumar et al., 2021).

Educational robots are very essential if we want to support STEM education by means of interactive, hands-on activities fostering active student involvement (Eguchi, 2014). Eguchi claims that the interactive features of robots improve students' academic achievement as they promote teamwork and problem-solving capacity. the publication of a model by Zurita and Nussbaum about the application of mobile robots with context awareness to support group learning. Thanks to their built-in sensors and buttons, their research showed that these robots might be helpful as interactive assistants in locations where people are encouraged to ask enquiries, including admissions offices and instructional displays.

With an eye towards enhancing artificial intelligence in robots, the Alimisis studied condition-based programming His results imply that these features allow robots to react in real time to environmental and human signals, therefore promoting more active learning and improved general results.

Das et al. (2020) showed in their Arduino-based voice-activated robot the possibilities for an intelligent and responsive system attained by means of sensor and conditional logic integration. Kumar et al. (2021) constructed a robot with Internet of Things (IoT) capabilities and ESP8266 modules to show the effectiveness of wireless communication in educational contexts by means of robot control and interaction enhancement.

Moisés and Neto (2019) supported this approach more fully using a reasonably priced assistance robot built from Arduino and Raspberry PI. Their design gave educational goals first priority, proving that in robotic systems cost and function may live peacefully.

With an eye towards how reasonably priced platforms like Arduino may inspire creativity, interactive learning, and quick assistance, these studies show overall how robots are increasingly included into educational and institutional settings.

## III. PROPOSED METHODOLOGY FOR AUTONOMOUS DETECTION SYSTEM

➢ *Problem Statement*

During college admission seasons, a lot of visitors—including parents and students—need guided tours of university buildings including labs, classrooms, and sporting facilities. This strategy aims to help to reduce some of the problems that surface at these times the suggested use of a robot to conduct guests around the facility on their own results from insufficient personnel and boredom of laboratory visits. This robot independently negotiates the lab using a Husky Lens, identifying tools and turning on audio playback of relevant info, therefore providing a complete and effective tour.

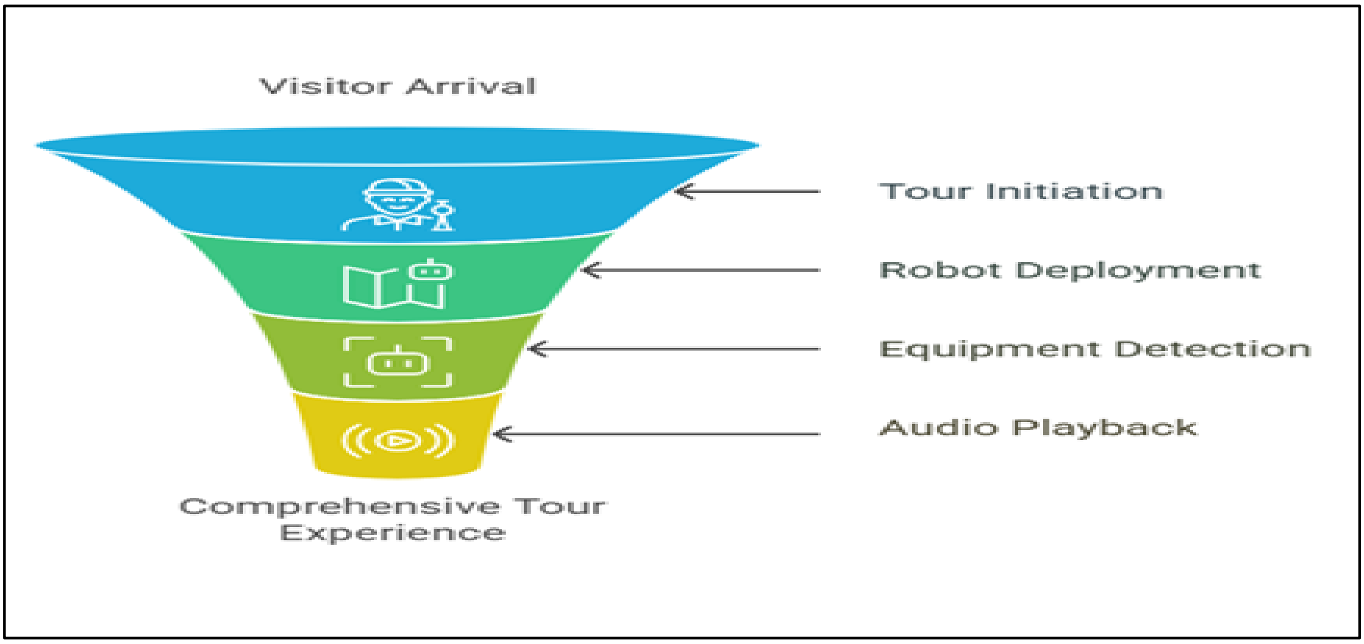


Fig1 Enhancing Lab Tour Using Robot

- *Objective*

The robot's main objectives are to find required laboratory tools on its own using the Husky Lens, obtain relevant information from an SD card or database predefined, and create audio explanations. It then moves on to the next piece of equipment, ensuring that the guests have all required tour tools.

- *Methodology*

While choosing suitable technologies such the Husky Lens for real-time object detection and machine learning algorithms for enhanced decision-making, the approach for building an autonomous robot for laboratory visits starts with the identification of exact objectives, including the detection of objects, obstacles, and equipment. Although conditional programming using the Arduino IDE and C++ drives the robot's actions and sensor data processing, an ideal path is designed for effective navigation depending on the laboratory setting. Carefully chosen key components including sensors and speakers, together with an audio system for sound descriptions, have the robot uses a database or SD card to locate information on lab equipment, therefore improving the tour experience.

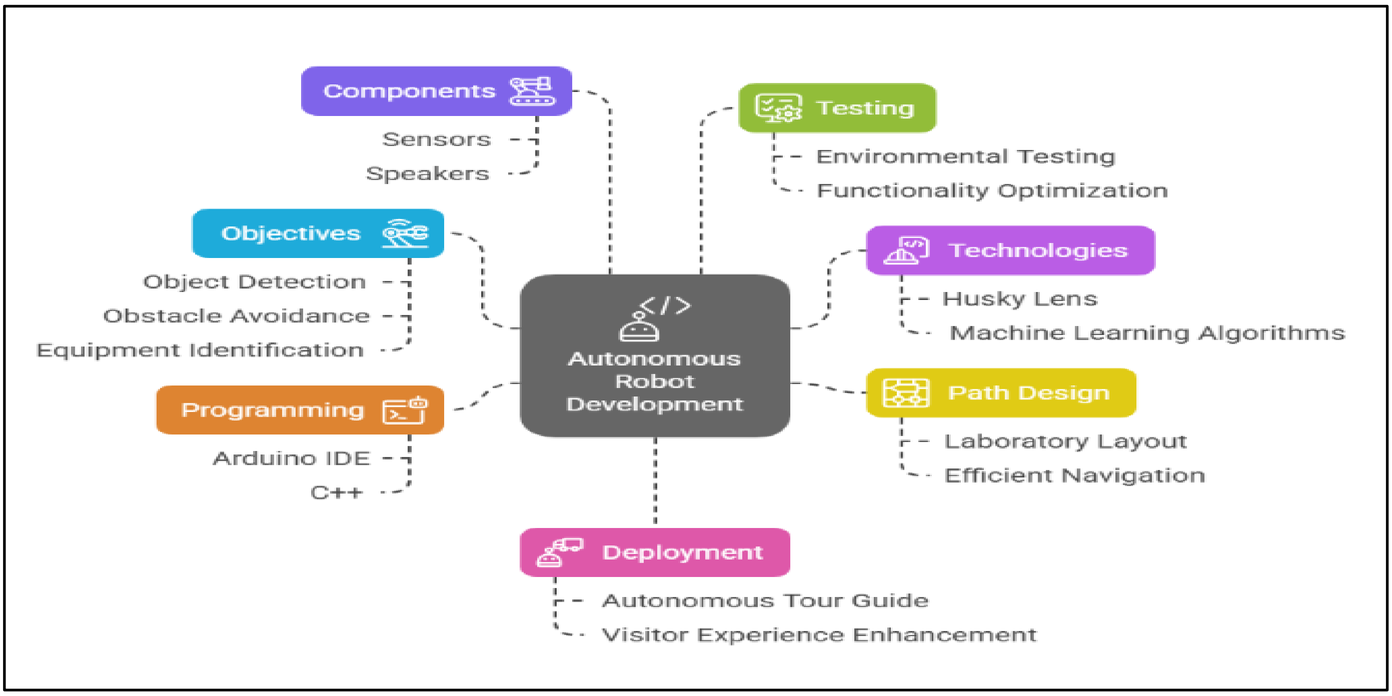


Fig 2 Autonomous Robot Development for Lab Tour

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Comprehensive testing guarantees the robot functions stably in diverse surroundings as its performance is adjusted for laboratory conditions. Using affordable parts, the system guarantees a balance between cost and performance. Acting as a teaching tool, the robot encourages robotics' inventiveness. After testing and development, the robot serves as an autonomous tour guide in laboratories, therefore enhancing the visitor experience and reducing staff effort.

## IV. 3D MODELLING AND DIMENSIONS OF ROBOT

We utilised AUTO CAD software to enable 3D modelling. The robot's measurements are: width and length of 25 cm, and height of 40 cm. The wheels have a diameter of 9 cm and a width of 1.8 cm. The robot's upper body exhibits a conical frustum configuration, characterised by a base circle with a diameter of 24 cm and a taper angle of 7 degrees. The upper body height measures 27.5 cm.

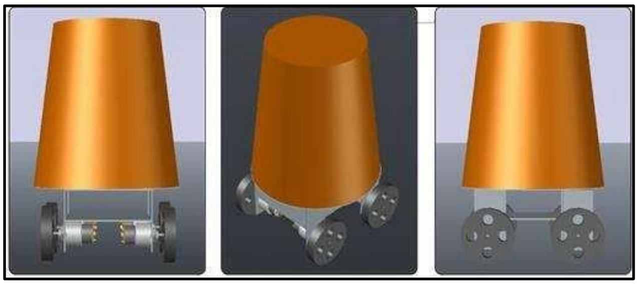

Fig 3 Three Dimensional Model Of Robot

## V. ROBOT'S WORKING AND ELECTRONIC SYSTEM

The robot functions by employing a Husky lens located at the front bottom. The lens possesses several functions enabling the real-time detection of objects, faces, lines, colours, and more via its camera. This enables the robot to sense its environment and manoeuvre autonomously, without reliance on predetermined routes or floor markings. Should the lens fail to identify any impediments within its range, the robot proceeds to advance. Nevertheless, if one of the sensors identifies an obstruction, the robot modifies its trajectory to avert collision, veering aside to ensure an unobstructed passage.

Integration of an ESP8266MOD Wi-Fi module, a single-channel relay, and the Blynk IoT Android app controls the movement of the robot. The Wi-Fi module lets users remotely control the robot's power supply, therefore enabling communication with the Blynk IoT application. The motor driver moves over the relay upon app activation, allowing the robot to progress. Deactivated cuts off the power source, allowing the mechanics to start and stop rapidly. The robot also features a specifically tuned sound system for audio output. This system triggers audio recordings when particular pieces of equipment or sites are detected, therefore providing users with the correct information or directions. The robot guarantees operational efficiency as it returns automatically to its starting place after traversing its surroundings.

Its Husky lens, communication components, and audio output powers ensure the robot can efficiently negotiate and communicate with its surroundings. The capacity of ultrasonic technology to provide precise object recognition and obstacle avoidance without of human intervention reveals its adaptability in robotics. Robotics has advanced with this robot and will find use in many more sectors.

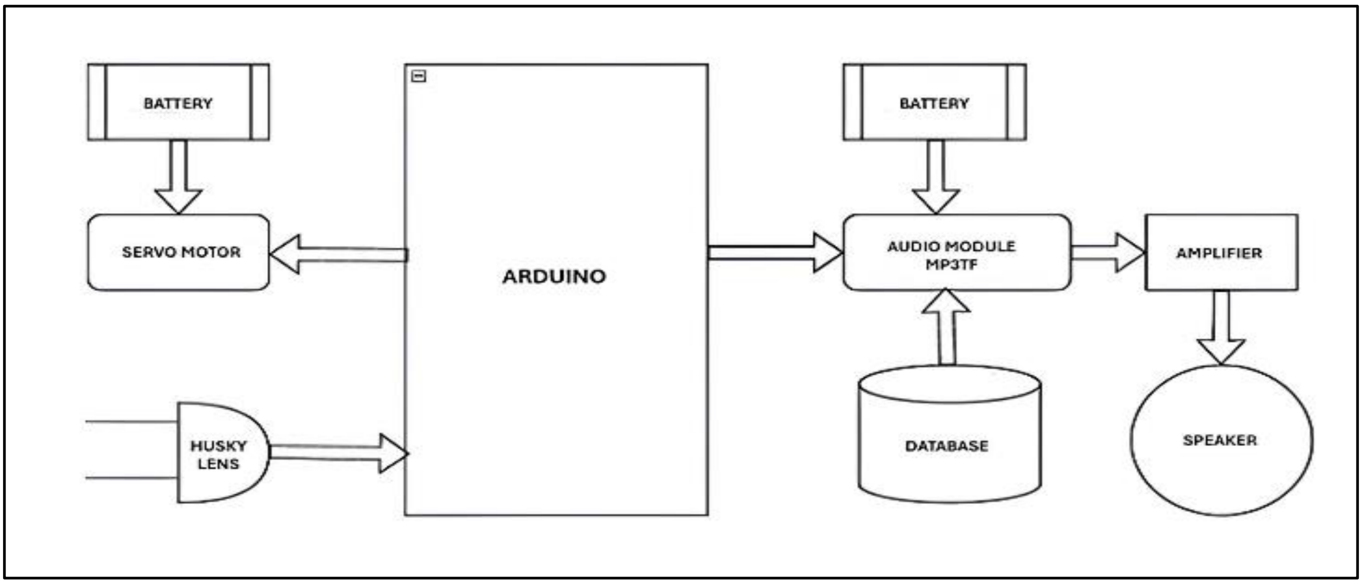


Fig 4 Block Diagram of Smart Narrator Robot.

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## VI. TESTING AND VALIDATION OF ROBOT

Operating this robot using a single-channel relay, Blynk IoT Android software, ESP8266MOD Wi-Fi module is easy. The Wi-Fi module of the Blynk IoT system lets users control the power supply from far away, therefore facilitating interaction with the robot. The motor driver is positioned above the relay upon application activation thereby allowing the robot to move. Deactivated switches provide quick start and stop of the mechanics by disconnecting the power source.

Further more included on the robot is a sound system designed especially for audio output. When specific equipment or sites are found, this system triggers audio recordings, therefore giving users correct information or directions. By independently returning to its starting point after negotiating its surroundings, the robot ensures operational efficiency.

The Husky lens, components for communication, and audio output features guarantee the robot can effectively explore and interact with its environment. In robotics, ultrasonic technology shows adaptability as it allows accurate object detection and obstacle avoidance without of human involvement. Because of its great general application, this robot represents a historical success in the field of robotics.

The strong lens let the robot to move precisely. Using a detecting mechanism instead than following a set course, it detected its surroundings. Fast and simple control of robot movement inside its surroundings was made possible by the single-channel relay, Blynk IoT Android software, and ESP8266MOD Wi-Fi module. By use of its ideal activation and deactivation algorithms, the Blynk app enabled quick start and completion of tasks.

The robot had a specialist sound system to improve its capabilities. Focussing on aural outputs, the robot identified QR codes using the husky lens. The robot enhanced user experience by generating important auditory information by scanning codes close to the laboratory equipment. Having explored the whole complex on its own, the robot returned to its starting point effectively and precisely fulfilling its task. The completely integrated sensing system, communication modules, and voice output capabilities of the robot show its mobility and interaction with its surroundings' efficacy.

## VII. CONCLUSION

This Smart Navigation Robot makes conditional decisions and adjusts its behaviour to satisfy the needs of certain tasks. This makes it autonomous navigation, intelligent guest interaction, and context-sensitive information delivery feasible. The ESP8266MOD Wi-Fi, a single-channel relay, and Blynk IoT Android app controls robot movement. A Blynk IoT app may remotely manage the robot's power supply via the Wi-Fi module. The relay powers the motor driver, advancing the robot when the app is engaged. Deactivation interrupts power supply for fast start-up and halt. A robot-specific sound system outputs audio. This system activates audio files in response to equipment or location recognition to offer appropriate information or directions. After exploring, the robot returns to its starting point for efficiency. Husky lens, communication modules, and audio output help the robot navigate and engage. It illustrates how ultrasonic technology may help robots avoid obstacles without touching them. This robot improves robotics and its versitality. The study suggested a novel robot-in-classroom lab demonstration method. Robot detection is used in material handling, healthcare, accommodation, and navigation. A thorough test of the robot's navigation without black lines was described in the report. Using an IoT device to make the robot work seamlessly was the biggest breakthrough. The robot's Husky Lens, which scans QR codes for efficient environment interaction, is another major breakthrough. A QR code provides actual data to assist the robot to grasp its environment and improve user experience. The Arduino Uno board makes the robot cheap and easy. The study demonstrated that detecting robots can do more than line following and teaching.

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