1. Introduction

Arduino obstacle-avoiding car with voice and Bluetooth control is a customizable and versatile robot that combines several features for an engaging and interactive experience. The robot is built using an Arduino board, a motor driver, ultrasonic sensors, and a Bluetooth module, among other components.

Figure 2: Arduino-based obstacle-avoiding robot with voice and Bluetooth control

The robot is capable of detecting obstacles in its path and maneuvering around them using the ultrasonic sensors. Additionally, it can be controlled through voice commands or a Bluetooth-enabled device, such as a smartphone or tablet.

To add voice control, the robot uses a speech recognition module and a microphone. Users can record voice commands for the robot to perform, such as "go forward" or "turn left."

For Bluetooth control, the robot utilizes a Bluetooth module that communicates with a paired device via a dedicated app. Users can use the app to send commands to the robot and even control its movements in real-time.

2. Problem Description:

In our modern world with the advancement of technology we should strive to make human life safer, increase efficiency enhance accessibility and bring innovation to various industries.

This technology gives us that very opportunity. It can be used in various different aspects of life such as:

1. Assistance for Visually Impaired: The robot could be programmed to guide visually impaired individuals through complex environments, helping them navigate safely by detecting obstacles and responding to voice commands.

2. Warehouse and Industrial Safety: In warehouses and industrial settings, the robot could navigate autonomously to identify potential hazards and obstacles, enhancing safety by alerting workers or taking necessary actions to avoid accidents.

3. Elderly and Disabled Assistance: The robot could assist the elderly or people with mobility challenges by fetching items, opening doors, and navigating around the home to provide companionship and help with various tasks.

4. Search and Rescue Operations: In disaster-stricken areas, the robot could navigate through rubble and debris, detecting survivors and relaying their locations to rescue teams. Voice commands could be used to control its movements and focus its search.

3. Related Work:

The development of an Arduino-based robot with obstacle avoidance, voice control, and Bluetooth control is a popular topic in the field of robotics. There are lots of variations of this kind of robot and a lot of research is done on this topic. Two such examples are given below:

i. "**Obstacle Avoidance and Path Planning for Autonomous Robots in Unknown and Dynamic Environments**", This paper addresses the challenge of obstacle avoidance and path planning for autonomous robots operating in unknown and dynamic environments. The authors present a probabilistic approach that combines sensor data with probabilistic map representations to enable robots to navigate safely while avoiding obstacles. The main concept revolves around using probabilistic techniques, such as the use of Bayes filters and Monte Carlo methods, to update the robot's belief about its environment in real-time. The approach allows the robot to plan its path while considering uncertainties in sensor measurements and environmental changes. The research is foundational in the field of robotics and has contributed to advancements in autonomous navigation.

ii. "**Voice-Controlled Intelligent Wheelchair**", This paper presents the development of a voice-controlled intelligent wheelchair system. The main concept is to enhance the mobility and independence of individuals with motor impairments by allowing them to control the wheelchair using voice commands. The authors propose a design that integrates speech recognition technology with robotic control algorithms. Users can issue commands like "move forward," "turn left," or "stop" using voice input, which is processed by the speech recognition module and translated into control signals for the wheelchair's motors. The research

focuses on making wheelchair navigation more accessible and intuitive for users who might have difficulty operating traditional joystick-controlled wheelchairs.

4. Methodology:

The challenge of designing and creating the **" Arduino-based obstacle-avoiding robot with voice control and Bluetooth "** robot lies in integrating advanced functionalities, including obstacle avoidance, voice control, and Bluetooth communication, into a single compact and engaging robot companion. This project aims to build an innovative and endearing robotic solution that can navigate autonomously, respond to voice commands, and be controlled remotely using Bluetooth technology.

Obstacle Avoidance: Developing a robust obstacle avoidance system involves designing and implementing sensors, such as ultrasonic or infrared distance sensors, to detect obstacles in the robot's path. The challenge lies in accurately sensing obstacles, calculating distances, and programming the robot to make timely decisions to avoid collisions. The robot's navigation algorithm needs to ensure safe and smooth movement even in dynamic environments.

Voice Control: Implementing voice control requires integrating speech recognition technology to interpret spoken commands. The project involves selecting and configuring appropriate voice recognition modules or APIs, training the system to recognize specific keywords or phrases, and enabling the robot to respond appropriately to recognized commands. Ensuring accuracy, responsiveness, and compatibility with various accents and languages adds complexity to this aspect of the project.

Bluetooth Control: Enabling Bluetooth control allows users to interact with the robot remotely using a smartphone or other Bluetooth-enabled devices. The challenge here is to establish a reliable Bluetooth connection, design a user-friendly control interface, and implement bidirectional communication between the robot and the controlling device. Latency, range, and connection stability are critical factors to address.

4.1 Major Components:

Here's an explanation of each component used in the context of developing an Arduino robot with obstacle avoidance, voice control, and Bluetooth control:

- **Arduino Uno:** The Arduino Uno is a microcontroller board based on the ATmega328P. It serves as the brain of the robot, executing programmed instructions, processing sensor data, and controlling motors and other components. It provides the necessary computing power and interfaces for seamless integration of various functionalities.

Figure: Arduino Uno

- **Gear Motor:** Gear motors are compact motor units with attached gearboxes. They provide rotational motion to the robot's wheels, converting electrical energy into mechanical movement. Gear motors are vital for propelling the robot and enabling it to navigate its surroundings.

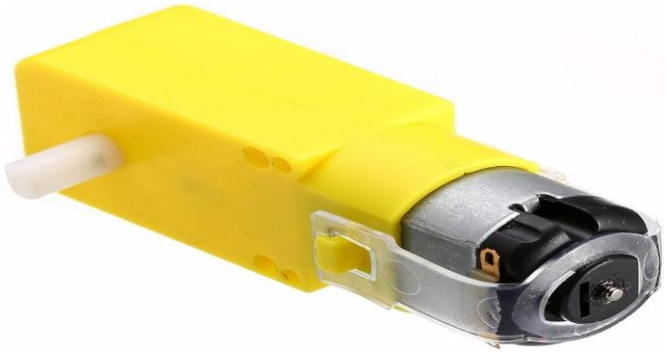

Figure: Gear Motor

- **Robot Wheel:** Robot wheels are essential components for mobility. They are attached to gear motors and facilitate movement across different surfaces. The design and type of wheels influence the robot's stability, traction,

Figure: Robot Wheel

- **Motor Driver (L293D):** The L293D motor driver is an integrated circuit that controls the direction and speed of DC motors, such as the gear motors used for wheel propulsion. It acts as an interface between the Arduino and the motors, enabling precise motor control.

Figure: Motor Driver

- **Ultrasonic Sensor:** The ultrasonic sensor emits ultrasonic waves and measures the time it takes for the waves to bounce back after hitting an object. This information is used to calculate the distance between the sensor and the obstacle, enabling the robot to detect and avoid objects in its path.

Figure: Ultrasonic Sensor

- **Bluetooth Module:** A Bluetooth module facilitates wireless communication between the robot and external devices like smartphones or tablets. It allows users to control the robot remotely via a Bluetooth-enabled app, enabling real-time interaction and commands.

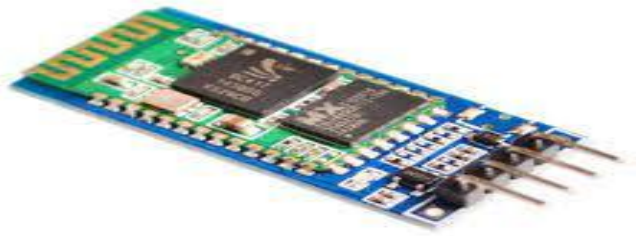

Figure: Bluetooth Module

- **Li-ion Battery:** Li-ion (Lithium-ion) batteries provide a rechargeable power source for the robot. They offer a high energy density, making them suitable for powering the motors, sensors, and other electronic components. Li-ion batteries provide a balance between capacity and weight.

Figure: Li-ion Battery

- **Li-ion Battery Holder:** The battery holder securely houses the Li-ion battery, preventing it from moving around or disconnecting during robot movement. It ensures a stable power supply while simplifying battery replacement and recharging.

Figure: Li-ion Battery Holder

- **Jumper Wires:** Jumper wires are flexible cables with connectors at each end. They establish electrical connections between different components on the robot, enabling data and power transfer. Jumper wires help organize the wiring and simplify the circuit connections.

Figure: Jumper Wires

- **Chassis 3WD models:** A 3WD chassis refers to a type of robot platform that features three wheels for movement. It typically consists of a central wheel and two additional wheels on either side. This configuration offers a balance between stability and maneuverability. The central wheel provides support and stability, while the two side wheels enable the robot to turn and navigate effectively.
- In a 3WD chassis, the arrangement of the wheels and the distribution of weight impact the robot's ability to move forward, backward, turn, and avoid obstacles. This type of chassis is commonly used in robotics projects where a combination of stability and agility is required. It's worth noting that 3WD chassis designs can vary, and the placement of the wheels and the overall structure can differ based on the specific project requirements and goals**.**

Figure: Chassis 3WD models

For this project, the following timeline would be monitored approximately:

SI NO	Activity	2023	
		August	September
1	Preparation and presentation of Project Proposal	1st weak	
2	Purchasing Equipment	2nd weak	
3	Coding and testing	3th weak	
4	Assemble the project		1st weak
5	Finalizing the project		2nd weak

5. The Total approximate cost:

Components	Unit required	Total unit price
Arduino Uno	1	850tk
Gear motor	4	900tk
Motor Driver(L293D)	1	210
Ultrasonic sensor	1	100tk

Bluetooth module	1	350tk
Li-ion battery	2	300tk
Li-ion battery holder	1	200tk
3WD chassis	1	1200tk
Switch	1	50tk
Glue Gun	1	350tk
Jumper wires	1	200tk
Multimeter	1	950tk
Soldering Iron	1	1050tk
Soldering Lead	1	140tk
Soldering Past	1	60tk
Voltmeter	1	190tk
Wire Cutter	1	190tk
	Total	=7290tk

6. Conclusion

In conclusion, the Arduino-based obstacle-avoiding robot with voice and Bluetooth control showcases a versatile and interactive robotic solution. By integrating Arduino programming, obstacle detection sensors, voice recognition, and Bluetooth communication, the project achieves successful remote control and autonomous navigation capabilities. This combination of technologies offers practical applications in areas such as home automation, surveillance, and education. The project's success underscores the potential for innovation through the integration of diverse technologies, while also highlighting opportunities for further refinement and expansion in the future.

7. References:

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