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Ardubot - The Maze Runner

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Abstract: *The Avoidance of Obstacles Robot using IoT is a robotic system that is guided by the software we develop and makes use of IoT technologies to avoid obstacles in its route. The robot utilizes sensors to identify obstructions, which it then transmits to a microcontroller, which analyses the information and commands the robot's motors to change course. This kind of robot can be beneficial for a number of tasks, including exploration, search and rescue, and surveillance. The main challenge in building mobile robots is the ability to identify and avoid obstacles. The robots now have the senses necessary to navigate unknown environments safely owing to this technology. This project involves designing an obstacle-avoiding robot that can navigate around obstacles without colliding with them. It is a robot that uses three ultrasonic distance sensors to find obstacles and runs on an Arduino microcontroller. The microcontroller platform chosen was the Arduino board, and the programming was done using Arduino Software, the board's software counterpart. Higher accuracy in spotting nearby impediments is provided by the incorporation of three ultrasonic distance sensors. Being a fully autonomous robot, it navigated new settings without colliding with anything. The project's hardware is widely accessible and reasonably priced, making it simple to replicate the robot.*

Keywords: Autonomous, Colliding, Navigate, Robot, Arduino, obstacle

I. INTRODUCTION

The Internet of Things (IoT) is a powerful technological development that allows objects, devices, and machines to communicate and exchange data with one another through interconnected networks. This technology holds the potential to revolutionize various sectors such as healthcare, manufacturing, transportation, agriculture, and more, by enabling machines and devices to operate efficiently, minimize waste, save time, and reduce human intervention. The method employed for ardubot the maze runner is based on ultrasonic distance sensing algorithm and motor control logic algorithm. The design and development of the robot, along with the hardware and software components employed, are thoroughly explained in this paper. The authors want to build a fully autonomous robot that can move around a space without assistance from a person. The robot's powers include the ability to recognize impediments and alter its course to avoid them. In conclusion, this research emphasizes the significance of creating robots that can maneuver through complicated situations and offers a helpful illustration of an effective application of obstacle avoidance technology. The hardware and software components of the robot are thoroughly described in the paper. The three ultrasonic sensors, an Arduino, and a motor controller are included in the hardware. The Arduino code used to direct the robot's movements and the obstacle detection algorithm are among the software components.

II. METHODLOGY

ARDUINO UNO:

The board has a USB port, a power jack, 14 digital input/output pins, a 16 MHz quartz crystal, 6 analogue inputs, and a reset button. It may be programmed using the Arduino IDE, an easy-to-learn programming environment. A wide variety of projects, including robots, interactive installations, and Internet of Things (IoT) devices, can be built using the Arduino Uno. In general, anyone interested in learning more about microcontrollers and embedded systems should start with the Arduino Uno.

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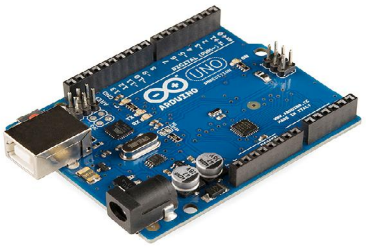

Figure 1: Arduino UNO

L293D MOTOR DRIVER

A stepper motor or two DC motors can be controlled simultaneously by the dual-channel H-bridge motor driver L293D. Since the shield has two L293D ICs, it is technically feasible for it to manage a total of four DC motors. This is appropriate for robot platforms with two and four wheels.

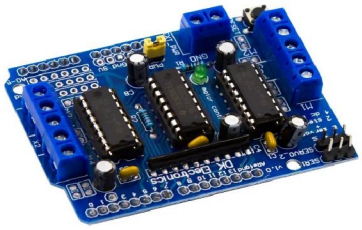

Figure 2: Motor Driver (L293D)

HC-05 BLUETOOTH MODULE

The following list lists the four connection points that make up the HC-06 Bluetooth module.
Vcc is coupled with 5 V.
Ground is linked to GND.
TXD is linked to the Arduino's receiver.
The Arduino gearbox is connected to the RXD device.

Figure 3: Bluetooth Module (HC-05)

It should be noted that in order to connect TXD and RXD, the program has to be loaded into the Arduino.

HC-SR04 ULTRASONIC SENSOR

The ultrasonic sensor helps the cart avoid the obstacles that it runs into. It also helps calculate the time to maneuver and avoid an obstacle

Sensor consists of 4 connection points that are presented as follows:

- Vcc is connected to 5 V.
- GND is connected to ground.
- ECHO is connected to pin A0.
- TRIG is connected to pin A1.

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Figure 4: Ultrasonic Sensor (HC-SR04)

It is also needed the use of 3 li-ion batteries for powering the system.

III. PROBLEM DEFINITION

POINTS OF IMPROVEMENT	THE CURRENT STUDY	THE PREVIOUS WORK	THE ACCURACY VALUE OR COST
Moving Object Detection	Completed By using Ultrasonic Sensor	Previous research measured the moving object with stereo cameras and more complex algorithm.	Cost: Ultrasonic sensor costs 270 Tk but the average range of a stereo camera costs 7384.68 Tk. Complexity: The algorithm of this experiment is simple
Object Detection moving	Accomplished by using only one ultrasonic sensor.	Previous research used two ultrasonic sensors to detect the movement of the object.	Cost: This experiment cost is lower. Performance: The proposed system can detect the velocity of an object

Table 1: Problem Definition

IV. ALGORITHM

ULTRASONIC DISTANCE SENSING ALGORITHM

An ultrasonic sensor can detect the distance between itself and an object with the use of a software programme called an ultrasonic distance sensing algorithm. High-frequency sound waves are emitted by ultrasonic sensors, which then time how long it takes for the waves to return from an object.

MOTOR CONTROL LOGIC ALGORITHM

A motor control logic algorithm is a software program that controls the speed and direction of a motor. The algorithm takes input from various sensors, such as encoders or potentiometers, to calculate the speed and position of the motor. The motor control logic algorithm then adjusts the motor's speed and direction based on the input received.

V. WORKING PRINCIPLE

Table 2:Working as an obstacle avoider

Sensors	Motors
Obstacle found	returns and makes a left
No obstacles were found	Moving ahead
Right finds an obstacle	returns and makes a left.
Left finds an obstacle	returns and makes a right.

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VI. MODELING AND ANALYSIS

- **Sensing:** This module uses various sensors (such as ultrasonic sensors, infrared sensors, or cameras) to detect obstacles in the robot's path.
- **Analysis:** This module processes the sensor data and analyzes the environment to determine the position, distance, and type of obstacles.
- **Path planning:** This module uses the map and the analysis results to plan a safe path for the robot to avoid obstacles.
- **Control:** This module controls the robot's movement based on the planned path.
- **Avoidance:** This module implements the actual obstacle avoidance behavior of the robot, using the control module to steer around obstacles.
- **Communication:** This module enables the robot to communicate with other devices or systems, such as a remote control or a central computer system.

VII. CONCLUSION

In conclusion, obstacle-avoiding robots are a promising innovation that can revolutionize industries and daily life. With advanced sensors and intelligent algorithms, these robots can navigate complex environments, avoid obstacles, and improve productivity and safety in industries like manufacturing, logistics, and transportation. They also have potential applications in household chores, healthcare, and search and rescue operations. Despite challenges, advancements in robotics and AI are driving the development of more capable obstacle-avoiding robots. Overall, these robots represent a significant advancement in technology with the potential to transform industries and improve our lives. Further research and development will lead to even more sophisticated robots that shape the future of automation and robotics.

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