DAYANANDA SAGAR UNIVERSITY

KUDLU GATE, BANGALORE – 560068

Bachelor of Technology in

CSE(Artificial Intelligence and Machine Learning)

INTERNET OF THINGS & EMBEDDED COMPUTING

(Detect the Obstacle using IR Obstacle Avoidance Sensor)

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(2023-2024)

CERTIFICATE

This is to certify that Mr. AAYUSH GUPTA , ABHILASH .S. BHARADWAJ, ABINASH DUBEY , AMAN ANAND, ANCHIT SRIVASTAVA bearing USN ENG20AM0001 , ENG20AM0002 ENG20AM0003,ENG20AM0008 & ENG21AM3001 has satisfactorily completed their Mini Project as prescribed by the University for the 6th semester B.Tech programme in Artificial Intelligence & Machine Learning during the year at the School of Engineering, Dayananda Sagar University., Bangalore.

Date: 12/05/2023

Signature of the faculty in-charge

Max Marks	Marks Obtained

Signature of Chairman

Department of Artificial Intelligence & Machine Learning

DECLARATION

We hereby declare that the work presented in this mini project entitled - "**Detect the Obstacle using IR Obstacle Avoidance Sensor** ", has been carried out by us and it has not been submitted for the award of any degree, diploma or the mini project of any other college or university.

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ABSTRACT

The Internet of Things (IoT) has revolutionized various industries by enabling the interconnection of everyday objects. In this project, we propose a novel IoT-based solution for obstacle detection using an infrared (IR) obstacle avoidance sensor and Arduino microcontroller. The objective is to enhance the safety and efficiency of autonomous systems, such as robotic devices or automated vehicles, by detecting and avoiding obstacles in their path.

The system consists of an IR obstacle avoidance sensor, which emits infrared rays and measures the reflected signal to determine the presence of obstacles. The Arduino microcontroller acts as the central processing unit, receiving the sensor data and executing control commands accordingly. By implementing appropriate algorithms and logic, the Arduino can identify potential obstacles and trigger appropriate actions, such as halting or redirecting the device to avoid collision.

The IoT aspect of the project comes into play through wireless connectivity. The Arduino is equipped with Wi-Fi capabilities, allowing it to transmit obstacle data and status information to a centralized server or cloud platform. This enables remote monitoring, analysis, and decision-making, making it suitable for applications requiring real-time obstacle detection and avoidance.

The proposed IoT-based obstacle detection system offers several advantages, including reduced human intervention, enhanced safety, and improved operational efficiency. By leveraging the power of IoT, the project opens doors to future advancements in autonomous systems, paving the way for safer and more intelligent environments.

CHAPTER 1 INTRODUCTION

The Internet of Things (IoT) has emerged as a transformative technology, connecting physical devices and objects to the digital world. Its application spans across various domains, including healthcare, transportation, and automation. In this project, we focus on utilizing IoT principles to develop an obstacle detection system using an infrared (IR) obstacle avoidance sensor and Arduino microcontroller.

The ability to detect and avoid obstacles is crucial in many autonomous systems, such as robotic devices and automated vehicles. Traditional obstacle detection methods often rely on visual or proximity-based sensors. However, these methods may have limitations in certain scenarios, such as low light conditions or unreliable distance measurements. To overcome these challenges, the use of IR obstacle avoidance sensors provides an effective solution.

The proposed system combines the IR obstacle avoidance sensor with the Arduino microcontroller, which acts as the brain of the system. The sensor emits infrared rays and detects their reflection to determine the presence of obstacles. The Arduino processes the sensor data in real-time and executes appropriate actions to avoid collisions or accidents.

In addition to local obstacle detection and avoidance, the integration of IoT capabilities further enhances the system's functionality. By enabling wireless connectivity through Wi-Fi, the Arduino can transmit obstacle data and status information to a centralized server or cloud platform. This opens up possibilities for remote monitoring, analysis, and decision-making, enabling real-time responses to potential obstacles.

The project aims to provide a cost-effective and efficient solution for obstacle detection in autonomous systems. By leveraging the power of IoT, the system offers improved safety, reduced human intervention, and enhanced operational efficiency. This project sets the stage for future advancements in autonomous technologies.

CHAPTER 2 PROJECT DESCRIPTION

The goal of this project is to design and develop an obstacle detection system using an infrared (IR) obstacle avoidance sensor and Arduino microcontroller, with the integration of IoT principles. The system will provide a reliable and efficient solution for detecting and avoiding obstacles in autonomous systems, such as robotic devices or automated vehicles.

The main components of the system include the IR obstacle avoidance sensor and the Arduino microcontroller. The IR sensor emits infrared rays and measures the reflection to determine the presence of obstacles in the vicinity. The Arduino acts as the central processing unit, receiving the sensor data and executing control commands based on the detected obstacles.

The system will be implemented using Arduino programming language, which provides a user-friendly and versatile platform for controlling and integrating various hardware components. The Arduino will be programmed to analyze the sensor data and make decisions in real-time to avoid collisions or accidents.

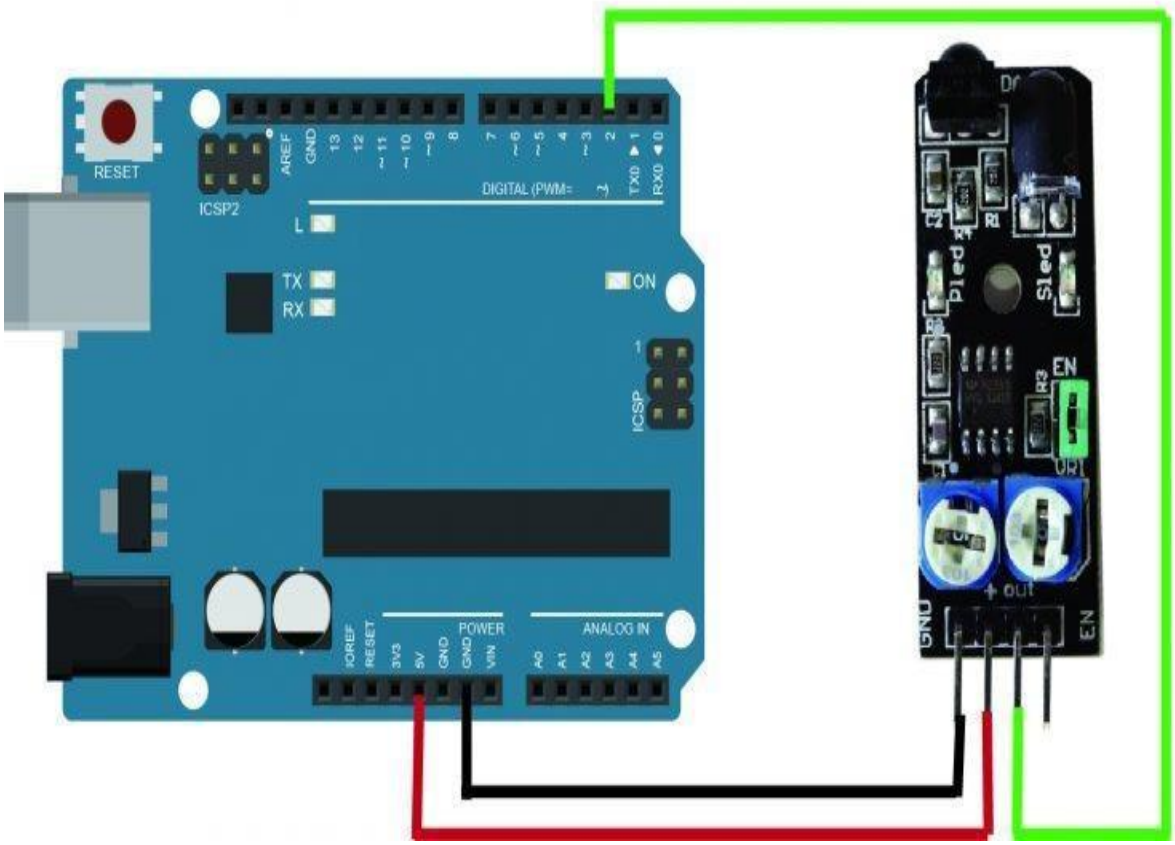
To leverage the capabilities of the IoT, the Arduino will be equipped with Wi-Fi connectivity. This will allow the device to transmit obstacle data and status information to a centralized server or cloud platform. Remote monitoring and analysis can be performed, enabling real-time responses and decision-making based on the obstacle detection information.

The project will involve designing the circuitry to interface the IR sensor with the Arduino, programming the Arduino to process sensor data and control actions, and setting up the IoT connectivity for remote monitoring. Testing and validation of the system will be conducted to ensure accurate obstacle detection and appropriate response mechanisms.

The anticipated outcomes of this project include an efficient and cost-effective obstacle detection system that enhances the safety and efficiency of autonomous systems. The integration of IoT capabilities enables real-time monitoring and decision-making, expanding the system's potential applications in various industries.

Overall, this project aims to leverage the power of IoT and IR sensors to develop a robust obstacle detection system that can be implemented in autonomous systems, contributing to safer and smarter environments.

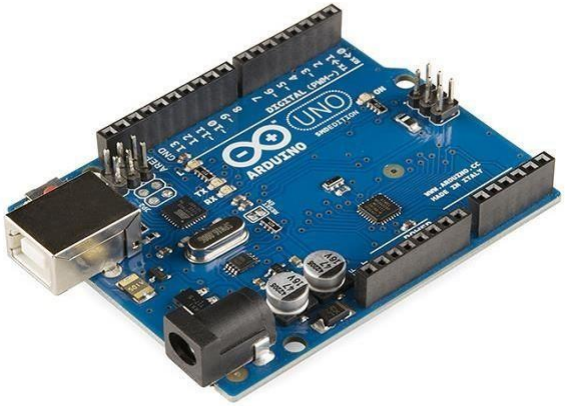
2.2 CIRCUIT DIAGRAM



CHAPTER 3 EACH COMPONENT DESCRIPTION

3.1 ARDUINO UNO :

Arduino Uno is an open-source microcontroller board based on the ATmega328P microcontroller. It was designed to make electronics more accessible to artists, designers, and hobbyists. It has 14 digital input/output pins, 6 analog input pins, a 16 MHz quartz crystal, a USB connection, a power jack, and a reset button. The board can be powered by a USB cable or an external power supply. The board is compatible with a wide range of sensors, actuators, and other electronic components. It can be programmed using the Arduino software, which is based on the C++ programming language.



The Arduino Uno board has become a popular platform for DIY electronics projects, and its ease of use and flexibility make it a great choice .

3.2 INFRARED OBSTACLE SENSOR :

Infrared Obstacle Sensor Module has builtin IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to presence of any obstacle in front of the sensor module. The module has on board potentiometer that lets user adjust detection range. The sensor has very good and stable response even in ambient light or in complete darkness.

The Obstacle Avoidance Sensors usually come in two types – with 3 and 4 pins. The 3 pin version does not have the ability to be enabled/disabled. The 4 pin version has optional Enable pin. Here I am describing the 4 pin version that I have. The information should also be relevant to other versions of the sensor.

3.3 CONNECTING CABLE-

Connecting wires are electrical conductors that are used to establish a connection between two or more electronic components. They are typically made of copper or aluminum and are coated with an insulating material to prevent electrical interference and short circuits.

Connecting wires come in various lengths, colors, and gauges, depending on their intended use. They are used to transfer power, signals, and data between electronic components such as sensors, actuators, and microcontrollers.

Connecting wires are available in different types, including solid core and stranded wires. Solid core wires are made of a single solid wire and are used in applications where stiffness and durability are important. Stranded wires are made of multiple smaller wires twisted together and are used in applications where flexibility and resistance to breakage are important.

The gauge of the wire refers to its diameter, with smaller numbers indicating a thicker wire. The gauge of the wire used depends on the amount of current that will flow through it, with higher currents requiring thicker wires.

Connecting wires can beconnected to electronic components using various techniques, including soldering, crimping, and wire nuts. It is important to use the correct type and gauge of wire and ensure that the connection is secure to prevent electrical interference or failure of the component.

CHAPTER 4 : CONCLUSION

In conclusion, the development of an obstacle detection system using an infrared (IR) obstacle avoidance sensor and Arduino microcontroller, with the integration of IoT principles, offers significant benefits for autonomous systems. By combining the precise obstacle detection capabilities of the IR sensor with the processing power of the Arduino and the connectivity of IoT, the system provides a robust solution for enhancing safety and efficiency.

Through the implementation of the proposed system, obstacles in the path of autonomous systems can be accurately detected, enabling timely and appropriate actions to avoid collisions or accidents. The real-time processing and decision-making capabilities of the Arduino ensure rapid response to changing environments, minimizing the risk of potential hazards.

The integration of IoT principles further amplifies the system's functionality by enabling wireless connectivity and remote monitoring. This allows for continuous monitoring and analysis of obstacle detection data, providing valuable insights for improving system performance and enabling proactive maintenance.

The project showcases the potential of IoT in revolutionizing autonomous systems, paving the way for advancements in various industries, including robotics, transportation, and automation. By leveraging the power of IoT, the system enhances operational efficiency, reduces human intervention, and improves overall safety.

In conclusion, the obstacle detection system presented in this project offers a practical and reliable solution for autonomous systems, contributing to the creation of smarter and safer environments. Further research and development in this field can unlock even more potential for enhancing the capabilities and applications of autonomous systems through IoT integration.

CHAPTER 5 : FUTURE ENHANCEMENT

Multi-Sensor Integration: Incorporating multiple sensors, such as ultrasonic sensors or lidar, in addition to the IR obstacle avoidance sensor, can provide a more comprehensive and accurate obstacle detection system. By fusing data from different sensors, the system can better analyze and perceive the surrounding environment, enabling improved obstacle detection and avoidance capabilities.

Machine Learning and AI: Integrating machine learning algorithms and artificial intelligence techniques can enhance the system's ability to learn and adapt to different environments. By training the system with large datasets of obstacle scenarios, it can improve its decision-making process and optimize obstacle avoidance strategies in real-time.

Advanced Communication Protocols: Implementing advanced communication protocols, such as MQTT or CoAP, can enhance the efficiency and reliability of data transmission between the Arduino and the centralized server or cloud platform. This ensures seamless and secure communication, enabling faster response times and improved remote monitoring capabilities.

Advanced Obstacle Classification: Instead of solely detecting the presence of obstacles, the system can be enhanced to classify different types of obstacles. This can be achieved by incorporating image processing techniques or object recognition algorithms. The ability to classify obstacles can enable more precise and context-aware avoidance strategies.

Energy Efficiency: Optimizing the power consumption of the system is crucial for long-term operation, especially in battery-powered autonomous systems. Implementing power-saving techniques, such as sleep modes or energy harvesting methods, can prolong the system's battery life and enhance its overall energy efficiency.

Integration with Mapping and Localization Systems: Integrating the obstacle detection system with mapping and localization technologies, such as GPS or SLAM (Simultaneous Localization and Mapping), can provide a more comprehensive understanding of the environment. This integration enables accurate obstacle detection and avoidance

Scalability and Distributed Systems: Designing the system to be scalable and capable of distributed processing can accommodate larger-scale deployments and enable cooperative obstacle detection and avoidance among multiple autonomous devices. This can be particularly useful in scenarios where collaborative efforts are required, such as in autonomous

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APPENDIX A
CODE/PROGRAM

```
int LED = 13; // Use the onboard Uno LED
int isObstaclePin = 2;  // This is our input pin
int isObstacle = HIGH;  // HIGH MEANS NO OBSTACLE

void setup() {   pinMode(LED,
OUTPUT);
pinMode(isObstaclePin, INPUT);
  Serial.begin(9600);
}

void loop() {
  isObstacle = digitalRead(isObstaclePin);
if (isObstacle == LOW)
  {
    Serial.println("OBSTACLE!!, OBSTACLE!!");
    digitalWrite(LED, HIGH);
  }
  else
  {
    Serial.println("clear");
digitalWrite(LED, LOW);
  }
  delay(200);
}
```