INDUSTRY ORIENTED AUTOMATION ROBOT

V. Sai Akshita
Department of Information Technology
BVRIT HYDERABAD College of Engineering for Women, Hyderabad, Telangana.
19wh1a1212@bvrithyderabad.edu.in

Athiya Fathima
Department of Information Technology
BVRIT HYDERABAD College of Engineering for Women, Hyderabad, Telangana.
19wh1a1232@bvrithyderabad.edu.in

Priyanka Kolli
Department of Information Technology
BVRIT HYDERABAD College of Engineering for Women, Hyderabad, Telangana.
19wh1a1236@bvrithyderabad.edu.in

M. Preethi
Department of Information Technology
BVRIT HYDERABAD College of Engineering for Women, Hyderabad, Telangana.
19wh1a1259@bvrithyderabad.edu.in

Project Guide, Ch. Sai Lalitha Bala, Assistant Professor, Department of Information Technology, BVRIT HYDERABAD College of Engineering for Women, Bachupally, Hyderabad, Telangana sailalithabala.ch@bvrithyderabad.edu.in

Abstract— ***The industrial automation robot is a cutting-edge tool that is revolutionizing industrial safety and efficiency. It features advanced sensors such as an LDR, three ultra-sonic sensors, a fire sensor, a gas sensor and a metal sensor. The robot can pick up tiny metal pieces on the floor with a magnet, making it an asset in facilities that handle metal parts. One of the key features of this robot is its connectivity to a Telegram bot. The robot sends alerts to the bot if any abnormal values are detected by its sensors. This real-time monitoring allows for quick and efficient responses to potential hazards. The LDR allows for adaptation to changing light conditions, and the ultra-sonic sensors provide 360-degree coverage around the robot, enabling obstacle detection and collision avoidance. The fire sensor and gas sensor ensure a safe working environment by detecting potential hazards, while the metal sensor and magnet make it easy to remove metal debris from the floor. Overall, the industrial automation robot offers unparalleled safety, making it a must-have in any industrial setting.***

Keywords—LDR, ultra-sonic sensors, fire sensor, gas sensor, metal sensor, ESP 32 microcontroller.

I. INTRODUCTION

The rise of industrial automation has transformed the way industries operate, with robotics playing a crucial role in enhancing efficiency, safety, and productivity. Industrial robots have been widely adopted in factories, warehouses, and other industrial settings to streamline production processes, reduce costs, and improve overall quality. One of the latest innovations in industrial robotics is the industrial automation robot that features advanced sensors such as an LDR for light detection, three ultra-sonic sensors for obstacle detection, a fire sensor, a gas sensor for detecting harmful gases, and a metal sensor for detecting metal pieces on the floor. In addition, the robot has a magnet that can be used to pick up metal debris from the floor.

The LDR is a device that detects changes in ambient lighting conditions and is useful for adapting to its surroundings. The three ultra-sonic sensors provide a 360-degree view of the robot's environment, enabling it to detect obstacles and avoid collisions. The fire sensor and gas sensor are critical safety features that detect potential hazards and help prevent accidents. The metal sensor and magnet are particularly useful in facilities that handle metal parts, allowing the robot to pick up and remove metal debris from the floor.

This robot's interaction with a Telegram bot is one of its unique characteristics. If any aberrant values are identified by the robot's sensors, the robot sends alerts to the bot, and an administrator or a concerned official of the industry can access the bot to view the robot's performance in real-time. This capability enables for quick and effective reactions to possible threats, making it particularly helpful in emergency situations.

Overall, the industrial automation robot represents a significant breakthrough in the field of industrial robotics. With its advanced sensors, it offers unparalleled safety and efficiency features that can help industries operate with greater ease and peace of mind. The integration with the Telegram bot further enhances its value by providing real-time monitoring and alerts, enabling swift and decisive action to address any issues that may arise.

The robot's capabilities extend beyond safety and efficiency, as it can also increase productivity and reduce costs. By automating tedious and repetitive tasks, it frees up human workers to focus on more complex and creative tasks that require higher-level thinking. Additionally, the robot's precision and accuracy in carrying out tasks can improve the quality of the products produced and reduce waste.

The industrial automation robot is a cutting-edge tool that is revolutionizing industrial automation, to sum up. It offers unmatched safety, efficiency, and productivity qualities that make it a necessity in any industrial setting thanks to its sophisticated sensors and connectivity with the Telegram bot. As technology develops, we may anticipate seeing more innovations that improve industrial processes and make businesses run more efficiently.

The objectives of the industrial automation robot are to:

- improve safety
- enhance efficiency
- improve quality
- provide real-time monitoring
- offer adaptability
- remove metal debris

These objectives work together to create a versatile and effective solution for industrial automation.

II. RELATED WORK

Rashmi Vinod Patil et al. [1], IOT Based Fire Detection System paper acknowledged that A fire condition is considered when the temperature is above 40 degrees Celsius. Thermal sensors are the classic choice when the temperature reaches a certain level. Thermal sensors give false alarms, but are slow, as the temperature rises slowly when there is a fire. A smoke alarm will catch the fire before it actually starts because in the initial stage of the fire there is more smoke than heat. Also, we can't put smoke in the cool areas. If one sensor does not detect the fire in the above conditions, the other sensor will detect the fire. Therefore, they use two types of sensors to get accurate results. They used the ThingSpeak cloud to monitor the temperature. Bluetooth is used for communication between FDS and phone application. The sensors are directly connected to the Microchip ATmega328P based microcontroller, other smoke sensors, temperature and humidity sensors to the NodeMCU to send data in the cloud. This makes security monitoring better by providing a buzzer on hardware installation and instant alert by sending SMS when gas, fire, smoke is detected.

V. Naren et al. [2], Intelligent Gas Leakage Detection System with IoT Using ESP 8266 Module. The main purpose of this article is to identify gas emissions from LPG cylinders commonly used in homes in India and to warn users and surrounding society using IoT. Using the solenoid will also stop the gas and, as a result, prevent accidents. The project uses open source IoT software called "Thingspeak". The software can interact with the Arduino and interact with the user's mobile phone and social media such as Twitter to send notifications. Neighbors can also be involved in an emergency. MQ5 LPG gas sensor is used for feedback. A 12V buzzer is connected to the circuit to indicate that the user is offline.

Yousif Elfatih Yousif et al. [3], Design and Simulation of Metal Detection System, this article presents a new direct method for GPS based RF Arduino remote sensing with advanced solutions and metal detector concept. In the past, circuits of wirelessly controlled robots had disadvantages such as low efficiency, limited radio frequency, and limited control. These limitations can be overcome using GPS Arduino microcontroller and RF robot control. It has the advantage of strong management operating as large as the service provider in the region, without interfering with other management. The device can detect metal in the area around the sensor. This article describes the design, functionality, functionality and originality of the product.

Thimmapuram Swat et al. [4], Industrial Process Monitoring System Using Esp32, in this article, IoT application is used to monitor various non-automated industrial applications such as smoke, gas, fire, humidity and machine control using IoT. In this application, the ESP32 Wi-Fi module is used to collect data from the device and send it to the wireless internet, the parameters are placed in the cloud and the user is regularly monitored by the mobile application toolkit or the internet using cloud data. ESP32 is the industry's most integrated Wi-Fi module with a low-cost inbuilt microcontroller and antenna. So, this will help to transfer data, statistics, logs and various parametric data of various devices to improve the performance of the system. The industrial monitoring system as 5 applications: remote machine control, hazardous gas level monitoring, humidity monitoring, fire monitoring and gas monitoring.

Omkar Paste et al. [5], A Review on Wireless IOT Based Industrial Security Robot, the main purpose of this project is to design and build a robot that can move to different places and get the details of the field with the help of its built-in sensors, there are two main elements in the system, Nodemcu Esp8266 microcontroller. and Esp32Cam. Here Esp32Cam is used for monitoring purposes as well as controlling the L298N Driver Module. L298N motor driver is used to control the speed and direction of rotation of DC motors. The PWM technique is used to change the input voltage to control the speed of the motor, while the H-Bridge circuit is used to control the direction of rotation of the motor. NODEMCU Esp8266 microcontroller is used to control the robot's sensors such as MQ2 gas sensor and flame detector.

Mohammad Farhan Ferdous et al. [6], Design and construction of a light-detecting and obstacle-sensing robot for IoT. The first goal is to build a robot car using a 14-pin microcontroller. Functional components such as ultrasonic sensors, LDRs, DC motors, transistors and other devices are connected to microcontroller. There is a program in the microcontroller whose direction should help define the light and problem of the robot car, and the second

purpose is to create the light and problem perception of the robot. Built-in LDR sensors can detect any kind of light. When the light beam falls on the LDR sensor, the car will stop and be sensitive to light. They also use ultrasonic sensors that can detect any discomfort. When the robot sees a problem in front of the car, it should stop moving, otherwise the car will go in forward direction.

Components: *-*

- ***a)*** *Battery*
- ***b)*** *Switch*
- ***c)*** *ESP 32*
- ***d)*** *DC Motor*
- ***e)*** *Ultrasonic Sensor*
- ***f)*** *LDR sensor*
- ***g)*** *Fire sensor*
- ***h)*** *Gas sensor*
- ***i)*** *Metal sensor*
- ***j)*** *Magnet*

III. ARCHITECTURE DESIGN

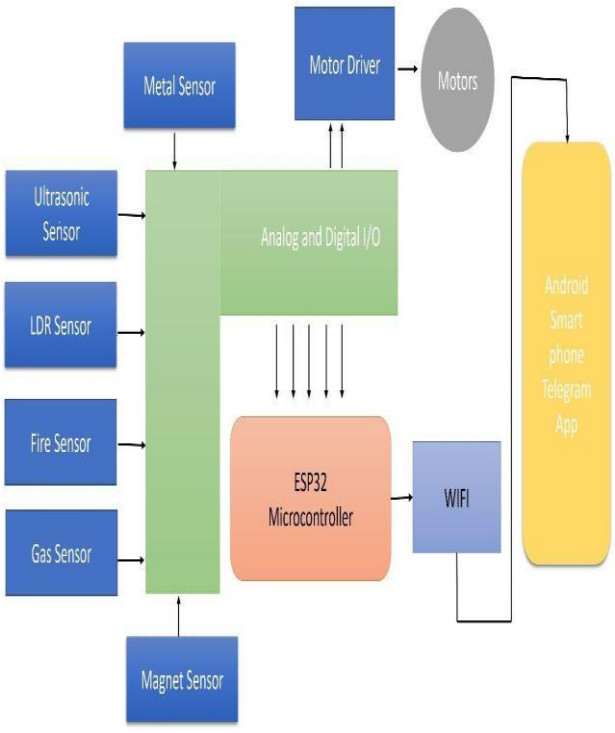

Figure 1: Block diagram of Industrial Automation Robot.

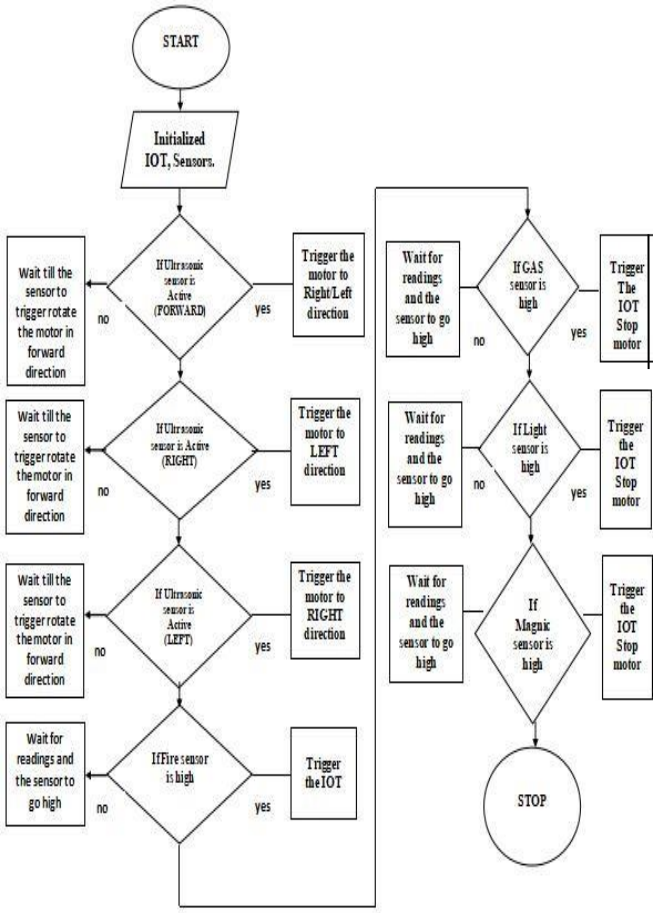

Figure 2: Flowchart Diagram.

IV. MODULES

a) Light Detection:

In our project, we employ an LDR sensor to measure light intensity. The abbreviation LDR stands for "light-dependent resistor," which refers to a resistor whose resistance is light-sensitive. In this instance, the voltage drop is entirely caused by the fluctuating resistance because the LDR's resistance decreases when the light hits it. Since the LDR has a high resistance when no light is shining on it, a significant voltage drop occurs across it. By changing the present, it is possible to modify the circuit's sensitivity. When there is no light falling on the LDR, its resistance increases and practically the full voltage drop occurs across it.

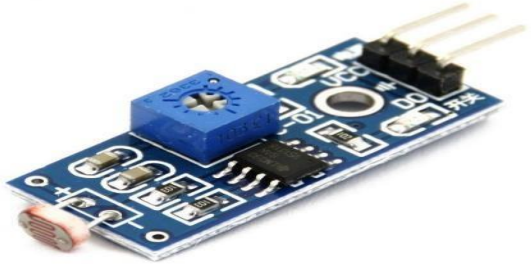

Figure 3: LDR Sensor.

b) Obstacle Detection:

An electrical charge is given to the ceramic transducer of this sensor, which causes it to vibrate. As waves travel from the sensor face to a target item, vibrations compress and expand air molecules. In a transducer, sound is both transmitted and received. By first generating a sound wave, the ultrasonic sensor determines the distance by "listening" for a predetermined amount of time to capture the sound wave's return echo after hitting the target. Its range is between 2 and 500 cm, and its resolution is 0.3 cm. Less than 2mA of standby current is required for it to run from a 5V DC supply. The component sends out an ultrasonic signal, detects its echo, calculates the time difference between the two events, and outputs a waveform.

Figure 4: Ultrasonic Sensor.

c) Robot Motion:

By emitting sound waves at a frequency that is audible to humans, ultrasonic sensors work. After that, the distance is determined using the amount of time required to wait for the sound to be reflected back. Radar uses a similar method to determine how long it takes for a radio wave to return after colliding with an object. Despite the fact that some sensors use separate sound emitters and receivers, it is also possible to combine both tasks into a single package device by using an ultrasonic element that alternately sends and receives signals. Based on an ultrasonic signal, the robot moves right and left. When a right-side object is spotted, a DC motor helps the robot move left, and vice versa.

Figure 5: DC Motor.

d) Fire detection:

Flame or light source wavelengths can be detected using the fire/flame sensor infrared receiver module ignition source detection module, which is Arduino compatible. Flame sensors, which are sensitive to light intensity and are used to identify flames based on intensity, are typically embedded with alarm functions in industrial applications to detect fire incidents. This module can identify flames in the visible light spectrum between 760 and 1100 nanometers. Up to 100 cm is the detection range. 60 degrees is the detection angle. Analogue or digital signals are produced by the sensor.

Figure 6: Fire Sensor.

e) Gas Detection:

Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gases. They are frequently used to detect dangerous or explosive gases. The MQ135 Gas Sensor Module for Air Quality includes both digital and analogue output. The MQ135 gas sensor uses SnO2, which has a reduced conductivity in clean air. When the target flammable gas is present, the sensor conductivity rises along with the gas concentration. The MQ135 gas sensor has a high sensitivity to ammonia, sulphur dioxide, and benzene steam; it is also sensitive to smoke and other hazardous gases. It is inexpensive and versatile.

Figure 7: Gas Sensor.

f) Metal detection:

A metal detector is a device that detects metal in its immediate vicinity. Metal detectors can assist you in the detection of metal objects on the ground. Metal detectors employ electromagnetic induction. Inductor coils in metal detectors interact with metallic elements in the ground. If the circuit detects any metal in the vicinity, it activates the proximity sensor, which turns on the LED and transmits a message to the user.

Figure 8: Metal Sensor.

g) Collection of metal particles:

As the magnet sensor identifies the presence of metal particles, the magnet positioned next to it can be helpful in collecting the metal particles. It is possible to use a magnet to collect metal particles that are identified by a metal sensor. The magnet can be positioned near the metal particles, and the magnetic force of the magnet will attract and hold the particles. This can be a useful method for collecting metal particles in various industrial and manufacturing applications.

Figure 9: Magnet.

V. RESULTS

This robot can be used to monitor the industrial environment using sensors that perform particular tasks. If any abnormal values were measured in sensors, the robot sent an alert to the Telegram bot. Based on values measured in IoT, particular measures willbe taken by the user to avoid accidents.

Significant Features of Industrial Oriented Automation Robot:

- **Fire detection by *Fire Sensor***
- **Gas detection by *Gas Sensor***
- **Light detection by *LDR Sensor***
- **Metal detection by *Metal Sensor***
- **Obstacle Detection by *Ultrasonic Sensor***
- **Collection of metal particle by *Magnet Sensor***

These are the important features that are implemented in this robot which makes it special and unique based on its multi-tasking features when compared to other papers.

In [1] gas leakage, fire, smoke is detected and Temperature and Humidity are measured.

In [2] Gas leakage detection system for Household and it activates the alarm and also sends alert messages to the users within a short time.

In [3] metal detector to study the frequencies of various metals and send information data to the users as well as protect the person from the risks.

In [4] meter monitoring, DC speed control, Temperature, Humidity, Gas levels and Fire accidents are monitored through android mobiles, and parameters data can be updated periodically by using cloud.

In [5] Esp32-Cam is used for surveillance purpose and MQ2 Gas Sensor is used to detect the presence of gases like LPG, CO and Smoke. The flame sensor is used to detect andrespond to the occurrence of a fire or flame.

In [6] the light and obstacle sensing capability of the robotic vehicle.

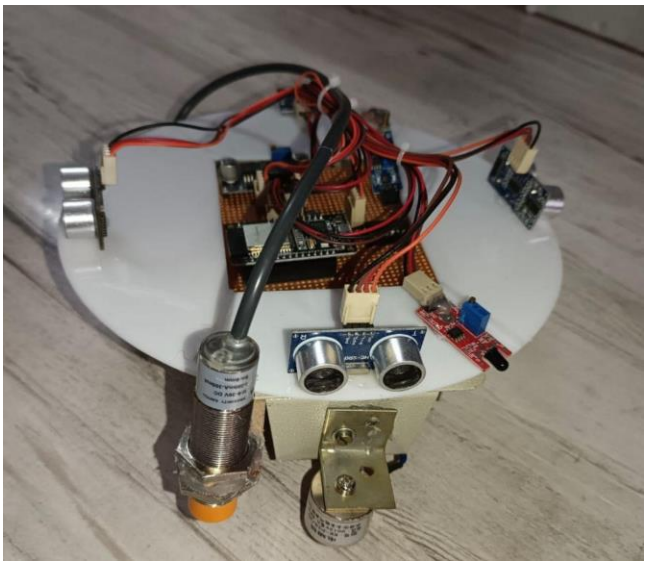

Figure 10: Industry Oriented Automation Robot

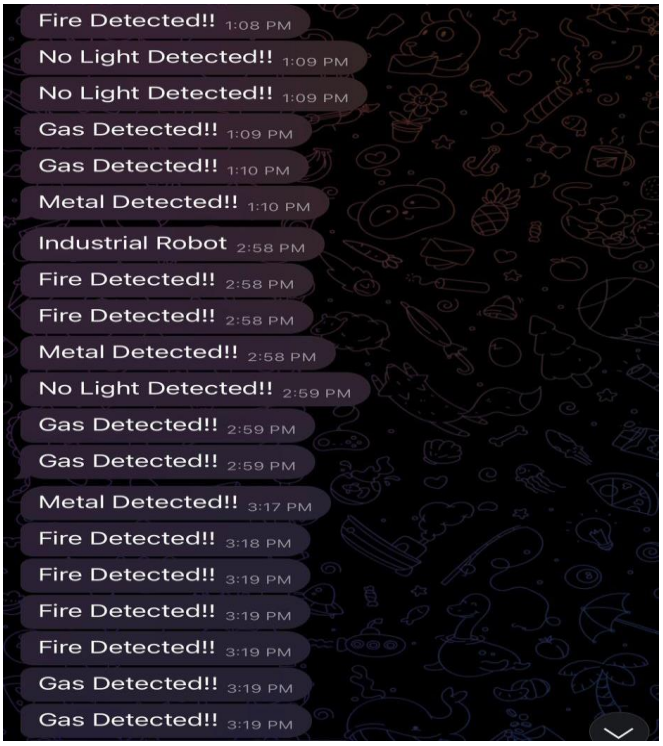

Figure 11: Alert Messages in Telegram App.

VI. ADVANATGES

- Driver less control.
- Industrial parameter monitoring.
- Accurate and fast in response.
- Avoids fire Accidents.
- Protects from harmful gasses.
- Wi-Fi & Bluetooth Modulations.

VII. CONCLUSION & FUTURESCOPE

The proposed system, presents the advancement of Internet technology in day to day life. The system is suitable for real time small scale industrial process monitoring and controlling applications. proposed module implemented on ESP32, one of the best solutions to avoid industrial accidents and saves lives of workers and equipment's. The objectives of the industrial automation robot are to improve safety, enhance efficiency, improve quality, provide real-time monitoring, offer adaptability, and remove metal debris. These objectives work together to create a versatile and effective solution for industrial automation.

Along with these features that we have implemented, we can also try do add a vacuum module that can pick-up any dust particles that are present on the floor on which the robot moves and High-end computers allow us to integrate machine learning, which will eventually eliminate the need for sensors. In order to improve our ability to judge from our gaze, controlled cameras can help with vision-related issues.

VIII. REFERENCES

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