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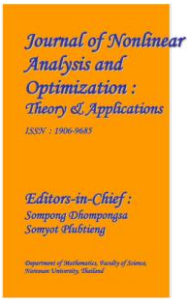

AUTOMATIC INDUSTRIAL FAULT DETECTION AND IOT-BASED REMOTE MONITORING SYSTEM

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Abstract:
In this paper "Automatic Industrial Fault Detection and IoT-Based Remote Monitoring," a comprehensive system is designed to detect and monitor various industrial parameters for enhanced safety and remote supervision.The system utilizes multiple sensors for different aspects of industrial operations. A flame sensor is incorporated to detect fire incidents, while a current sensor is employed to measure overcurrents and a voltage sensor to monitor overvoltage conditions. The DHT11 sensor is utilized for temperature measurements, and a gas sensor is included to detect the presence of hazardous gases.The obtained data from these sensors is processed by an Arduino controller. The NodeMCU module is employed for efficient communication and uploading of the sensor data to a remote server.In the event of any parameter exceeding predefined threshold values, a buzzer is triggered, providing an immediate alert for potential industrial faults. This integrated system not only enhances safety measures by detecting critical parameters but also enables real-time monitoring from a remote location, contributing to proactive maintenance and management of industrial processes.

Keywords:
Arduino UNO Board, DHT11 Sensor, Flame Sensor, Gas Sensor, Current Sensor, Voltage sensor & Node MCU.

1.Introduction

Safety is the utmost priority of all industrial sectors as evenminimal malfunctions in the mechanisms can lead to unavoidable deteriorating circumstances. Human monitoring system although with good efficiency has its drawbacks as turbulences in the accuracy rate in checking and monitoring mechanisms are inevitable. Totalprevention of accidents in industrial workspaces is impossible but preventive measures to near perfection in our motive are achievable. A specified system with diverse technical devices such as sensor- based network integrated monitoring devices lowers the random and human errorsproduced in the validation process. Common factors such as gas leakage, fire explosion, and unauthorized entry that lead to inconveniences can be detected with optimum precision levels to avoid these disastrous scenarios. The modern automation system provides the mechanism with desired parametric sensors to analyse the performable and structural states with historic component data and execute the required output based on the analysis made by the sensors. In recent years, the Internet of Things has emerged as an important topic within industry and academia; with considerable potential

for its use in numerous actual-world applications. This paper discusses the challenges in diagnosing and predicting malfunctioning due to Internet of Things data collected from industrial sectors. We're proposing an SAP solution, using technologies available to the Internet of Things. First, the causal link is identified in the proposal solution. of the physical devices by analyzing only the device sensor data Without having any knowledge of the physical manufacturing system. While it is possible to detect malfunctioning of some devices by checking them. A healthy measure of these instruments in real-time, possible failures: On the basis of causal relationships, additional devices may be predicted. The discovery of which had been made in the preceding step. Such prediction. SIM900 GSM Module: GSM (Global System for Mobile communications) is a digital cellular technology used for transmitting mobile voice and data services. The GSM/GPRS- compatible Quad-band device can provide data transfer speeds of up to 9.7 Kbits per second, allowing the transmission of basic SMS. It can also be used for various applications such as surfing the Internet, calling, and sending and receiving text. It mainly works through a set of predefined instructions called AT Commands, where AT stands for Attention. “Internet of Things: Wildlife Conservation and its Challenges”Prof.Ratnesh Kumar Choudhary is an expert in the field of wildlife conservation and the Internet of Things (IoT). He has conducted extensive research on the use of IoT in wildlife conservation and the challenges associated with its implementation.work, he highlights the potential of IoT to improve conservation efforts, but also the need for careful planning and consideration of ethical issues. Possible solutions IOT was used for toxic gas detection and monitoring. Harmful gas leakage incidents are the biggest cause of death for workers in factories that primarily use chemicals. When gas leaking, it can be easily monitored and managed by using the latest developments in information technology using the Internet of Things. This project proposed avoiding industrial accidents besides monitoring harmful gases and sending intimate alert messages to the safety control board of manufacturing using Arduino Uno R3 and the Internet of things. Arduino Uno R3 board is utilized as a focal microcontroller that is associated with the sensor. For example, temperature, gas sensor, liquor sensor which can consistently screen individual ecological boundaries. Thus, this gadget might be utilized as a multi-gas identification device more over the fast reaction pace[1-5].

2.Proposed system

The proposed method for the "Automatic Industrial Fault Detection and IoT-Based Remote Monitoring" project involves the integration of various sensors for comprehensive industrial monitoring. Arduino acts as the central controller, collecting data from different sensors, including flame sensor for fire detection, current sensor for overcurrent measurement, voltage sensor for monitoring overvoltage, DHT11 sensor for temperature measurement, and gas sensor for detecting harmful gases. The collected data is then processed to determine if any of these parameters exceed the defined threshold values, indicating a potential industrial fault.

To enable remote monitoring and real-time alerts, the project incorporates a NodeMCU module. This module facilitates the transmission of sensor data to a server, allowing industrial operators to access real-time information about the operational conditions of the industrial environment. The system also includes a buzzer that activates when any of the monitored parameters cross their respective thresholds, providing an immediate alert for timely intervention. This proposed method not only automates fault detection but also enhances the overall safety and efficiency of industrial processes.

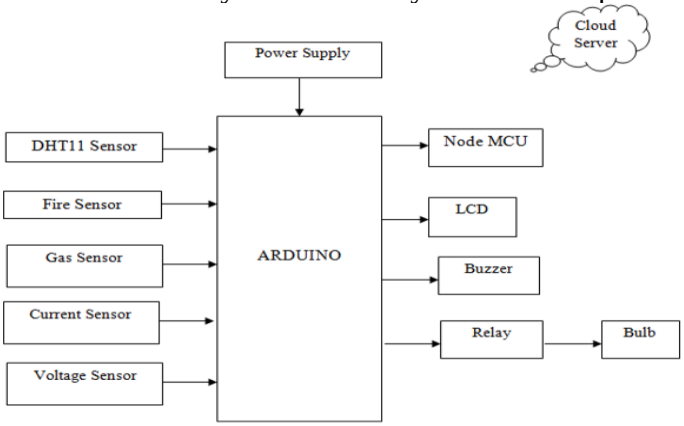

Figure.1.Block Diagram of Proposed System

2.1 Hardware description

2.1.1 Introduction to Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It consists of a microcontroller that can be programmed to sense and control objects in the physical world. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. They are used for a variety of purposes, including creating interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino boards come in various shapes and sizes, each with its own set of features and capabilities. Some of the most popular Arduino boards include:

Arduino Uno: The Uno is one of the most popular Arduino boards. It features a microcontroller, digital and analog input/output pins, USB connection, and a power jack.

Arduino Mega: The Mega is similar to the Uno but with more digital and analog input/output pins, making it suitable for larger projects that require more I/O.

Arduino Nano: The Nano is a compact board with similar features to the Uno but in a smaller form factor, making it ideal for projects with space constraints.

Arduino Due: The Due is based on a more powerful microcontroller than the Uno, making it suitable for projects that require more processing power.

Arduino Leonardo: The Leonardo is similar to the Uno but with built-in USB communication, making it easier to interface with computers.

In addition to the hardware, Arduino also provides a software development environment that allows users to write, compile, and upload code to their Arduino boards. The Arduino IDE (Integrated Development Environment) is a simple yet powerful tool that is used to write code in the Arduino programming language, which is based on Wiring, and upload it to the board.

Overall, Arduino is a versatile platform that is used by hobbyists, students, and professionals alike to create a wide range of projects, from simple blinking LED lights to complex robotics projects. Its ease of use, coupled with its affordability and flexibility, has made it one of the most popular platforms for electronics prototyping and experimentation.

2.1.2 Features of the Arduino

Arduino boards come with a variety of features that make them suitable for a wide range of projects. Some of the key features of Arduino boards include:

Microcontroller: Arduino boards are equipped with a microcontroller, which is the brain of the board. The microcontroller is responsible for executing the program and controlling the inputs and outputs of the board.

Digital Input/Output Pins: Arduino boards come with a number of digital input/output (I/O) pins that can be used to connect the board to external devices such as sensors, LEDs, and motors. These pins can be configured as either inputs or outputs, allowing the board to read data from sensors or control external devices.

Analog Input Pins: In addition to digital I/O pins, Arduino boards also feature analog input pins that can be used to read analog signals from sensors. These pins allow the board to measure variables such as light intensity, temperature, and sound level.

PWM (Pulse Width Modulation) Pins: Some Arduino boards come with PWM pins, which can be used to generate analog-like signals. PWM is often used to control the brightness of LEDs or the speed of motors.

USB Connection: Arduino boards feature a USB connection, which allows them to be connected to a computer for programming and serial communication. The USB connection also provides power to the board, eliminating the need for an external power source.

Power Jack: Arduino boards come with a power jack that can be used to connect an external power source, such as a battery or a wall adapter. This allows the board to be powered independently of the USB connection.

Reset Button: Arduino boards feature a reset button that can be used to restart the board and re-run the program.

Integrated Development Environment (IDE): Arduino boards are programmed using the Arduino IDE, which provides a simple and intuitive interface for writing, compiling, and uploading code to the board.
Open-Source: Arduino is an open-source platform, which means that the hardware designs and software libraries are freely available for anyone to use and modify. This has led to a large community of Arduino users who share their projects and collaborate on new ideas.
Overall, Arduino boards are versatile and easy-to-use platforms that are ideal for beginners and experienced makers alike. Their combination of features, affordability, and flexibility make them a popular choice for a wide range of projects, from simple blinking LED lights to complex robotics applications.

2.1.3 Arduino Pinout

• Arduino Uno is based on an AVR microcontroller called Atmega328. This controller comes with 2KB SRAM, 32KB of flash memory, and 1KB of EEPROM. The Arduino Board comes with 14 digital pins and 6 analog pins. ON-chip ADC is used to sample these pins. A 16 MHz frequency crystal oscillator is equipped on the board. The following figure shows the pinout of the Arduino Uno Board

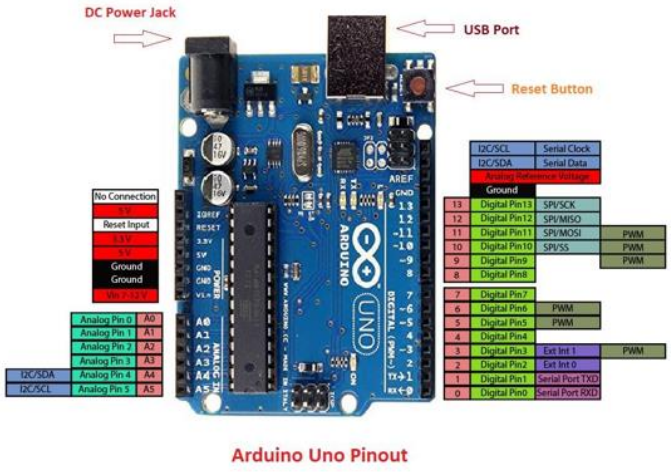

Figure.2. Arduino UNO Pinout diagram

3.Results and Discussion

Figure.3.INDUSTRIAL FAULT DETECTION

The LCD display interface of our project "Automatic Industrial Fault Detection andIoT-Based Remote Monitoring," a comprehensive system is designed to detect and monitor various industrial fault parameters for enhanced safety and remote supervision.

Figure.4. CURRENT & TEMP SENSOR

The Current sensor is employed to measure overcurrents & Temperature/DHT11 sensor is utilized for temperature measurements.Here is the key results obtained from thecurrent sensor and Temp sensor .As shown in above figure 8.3 we get sensor vaules of current is 0.15 A & Temp is 33*C.

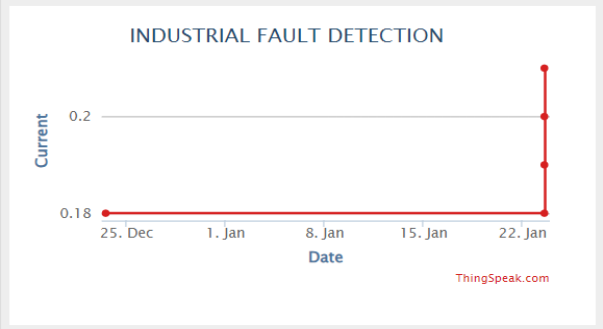

Figure.5 Response of Current sensor

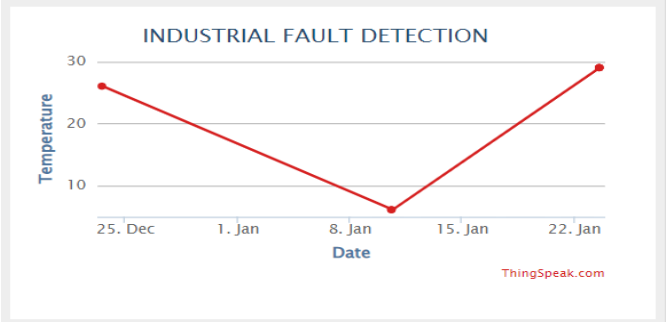

Figure.6.Response of Temperature sensor

Figure.7. FIRE & GAS SENSOR VALUES

A flame sensor is incorporated to detect fire incidents & a gas sensor is included to detect thepresence of hazardous gases. It displays two values either 0 or 1. If it is 1 it indicates there is no fire & gas detect.whether it displays 0 which means there is fire & gas detected.

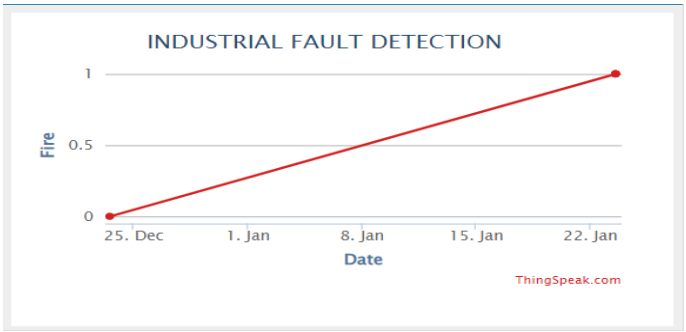

Figure.8. Response of Fire sensor

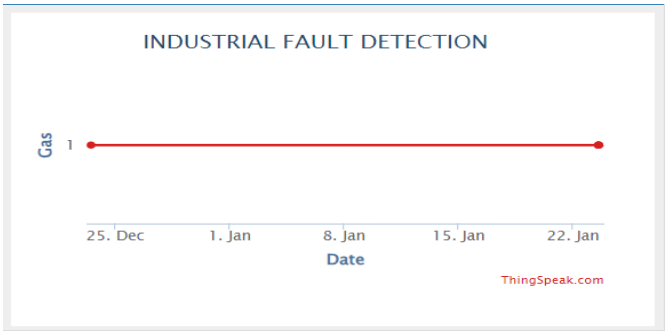

Figure.9.Response of Gas sensor

Figure.10. VOLTAGE SENSOR

The voltage sensor to monitor overvoltage conditions. Here key result is abtained from voltage sensor we get value is 11.04V. Whenever fault occurs voltage value is changes gradually.

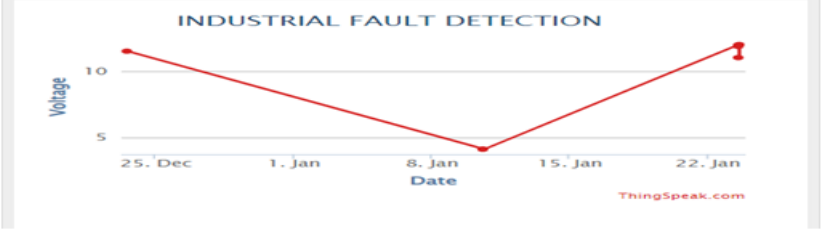

Figure.11.Response of Voltage sensor

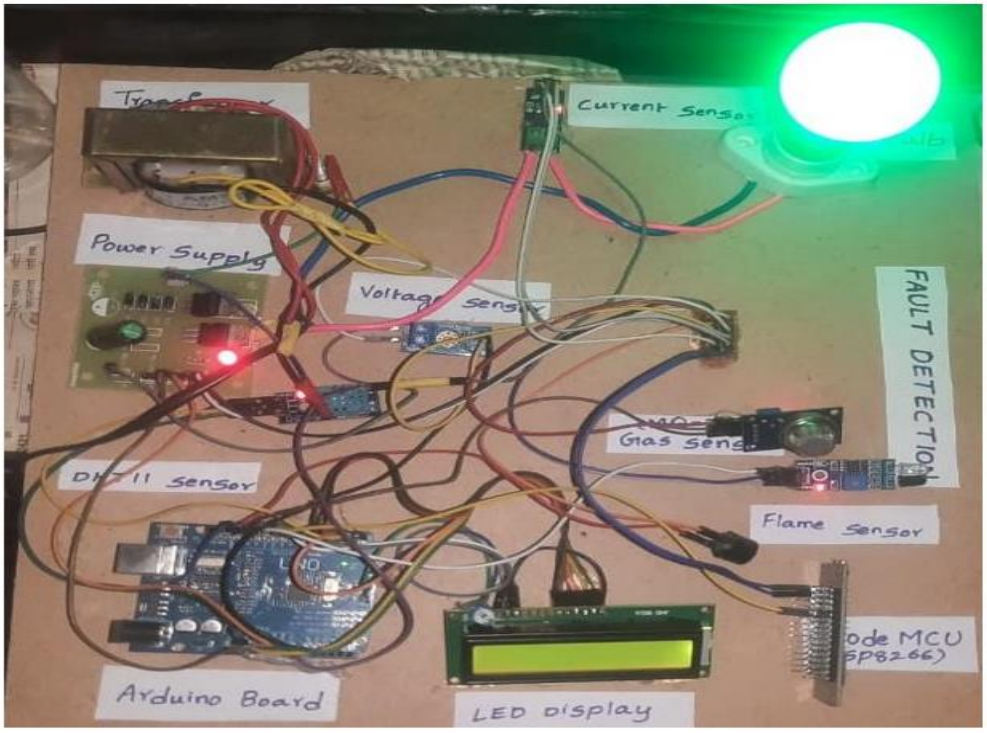

Figure.12.Overview of the Project

4.Conclusion

In conclusion, the Automatic Industrial Fault Detection and IoT-based Remote Monitoring project represents a significant advancement in industrial automation and maintenance practices. By leveraging IoT technologies and real-time monitoring capabilities, the system offers proactive fault detection, remote accessibility, and data-driven decision- making, thereby enhancing operational efficiency and minimizing downtime. Through the integration of sensor networks, cloud computing, and data analytics, the project empowers industrial facilities to transition from reactive to predictive maintenance strategies, resulting in cost savings and improved reliability.

Furthermore, the project's ability to remotely monitor equipment health and performance enables operators to gain insights into asset utilization, energy consumption, and process optimization. By continuously analyzing sensor data and detecting anomalies in machinery behavior, maintenance teams can prioritize and schedule maintenance tasks more effectively, reducing the risk of catastrophic failures and prolonging equipment lifespan. Additionally, the project facilitates condition-based monitoring, allowing operators to identify early signs of wear and tear, address potential issues proactively, and optimize resource allocation for maintenance activities.

Moreover, the implementation of IoT-based remote monitoring not only enhances operational efficiency but also contributes to a safer working environment for personnel. By providing real-time alerts for abnormal conditions, such as temperature fluctuations, vibration levels, or gas emissions, the system helps mitigate safety risks and prevent accidents in industrial settings. Overall, the project underscores the transformative potential of IoT technologies in revolutionizing industrial maintenance practices, driving improvements in asset management, reliability, and workplace safety.

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