Iot based Industrial Protection System Using ESP 32

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Abstract: ***This project involves designing and implementing an IoT-enabled safety system tailored for industrial environments using a ESP 32. The primary objective is to enhance industrial safety by continuously monitoring vital parameters such as temperature, gas levels, smoke presence, and unauthorized access. The system utilizes a variety of sensors—including gas, flame, motion, and temperature sensors—to gather real-time environmental data. The ESP 32 functions as the core processing unit, analyzing sensor inputs and making decisions based on predefined safety thresholds. Whenever abnormal conditions are detected, the system instantly notifies authorized personnel through a web-based dashboard and mobile application. Additionally, it incorporates automated response features, such as shutting down machinery or activating alarms, to mitigate potential dangers. By harnessing IoT technologies, this solution provides a cost-effective, scalable, and efficient approach to industrial safety. It not only reduces the likelihood of accidents but also enables proactive interventions. The system is flexible and can be adapted to suit various industrial applications, making it a robust choice for enhancing workplace safety across different sectors.***

I. INTRODUCTION

This project presents a smart, IoT-based industrial protection system designed around the Esp 32 to ensure continuous safety monitoring in factory and plant environments. The system leverages a suite of sensors to detect critical issues such as abnormal temperature changes, gas leaks, smoke or fire, and unauthorized movement.

By gathering real-time data from the environment, the system ensures constant surveillance of safety-related parameters. Upon identifying any potentially dangerous condition, it promptly issues alerts through alarms and mobile notifications, enabling quick responses by the concerned personnel.

In addition to notifications, the system includes automated safety features—such as shutting down machinery or activating emergency systems—to help prevent incidents and reduce damage. These automated controls function without requiring manual intervention, improving both the speed and reliability of emergency responses.

The system is designed to reduce dependency on human monitoring, thereby minimizing the chances of oversight or delayed reactions. This IoT-based solution enhances workplace safety, protects valuable assets, and boosts operational efficiency by fostering a proactive safety culture. Its scalable design allows easy adaptation across different industrial sectors, making it a practical and flexible solution for various operational needs.

II. PROBLEM DEFINATION & SCOPE

1. *Problem Statement*

This project aims to tackle common safety issues found in industrial settings, particularly the lack of effective real-time monitoring for hazardous conditions. Traditional systems often fail to provide immediate alerts, which can lead to delayed responses, increased risk of workplace accidents, and potential damage to valuable machinery and infrastructure.

2. *Scope:*

The system is intended for both individual and commercial use, making it suitable for environments such as warehouses, factories, and other industrial facilities.

- *Technical Scope:*

The solution includes both a web-based dashboard and a mobile application, supported by a cloud database for real-time data storage and analysis. Additionally, the system is compatible with smart

devices, offering enhanced features and integration flexibility when required.

3. Project Area

This project center's around improving safety standards in industrial operations. It is applicable in environments such as production units, storage facilities, and research labs, providing enhanced monitoring for hazardous events and aiding compliance with occupational safety protocols. The system is designed to safeguard both personnel and equipment by detecting and responding to potential threats effectively.

4. Goals and Objectives

To strengthen safety measures in industrial environments through continuous and real-time hazard detection.

Objectives:

- *Develop an automated system for detecting unsafe conditions.*
- *Deliver instant alerts to responsible personnel.*
- *Facilitate quick and effective responses to reduce harm to workers and prevent equipment failure.*

2. Software Requirement Specification

2.1 Software Requirements

- *Controller: ESP32 or Raspberry Pi as the core processor.*
- *Backend: Python for logic and data handling.*
- *User Interface: Mobile app for alerts and interactions.*
- *Database: Cloud storage (e.g., Firebase or MongoDB).*
- *Visualization: Tools for real-time data analytics.*

2.2 Hardware Requirements

- *Microcontroller (ESP32)*
- *Barcode/QR Code Scanner*
- *RFID/NFC Reader*
- *LCD/LED Display*
- *Temperature & Humidity Sensors*

2.3 Functional Requirements

- *Item entry via scan or manual input*
- *Timestamp logging for all entries*
- *Inventory tracking with low-stock alerts*
- *Expiry notifications for items*
- *Usage reports and analytics*

III. HARDWARE' S SPECIFICATIONS

- Voltage Sensor – ZMPT101B

The ZMPT101B module is used for precise AC voltage measurement. It outputs an analog signal proportional to the input voltage, making it ideal for energy monitoring and IoT-based power management systems.

- Current Sensor – ACS712

The ACS712 sensor is designed to measure both AC and DC currents. It provides an analog output corresponding to the current flow and is widely used in automation, IoT applications, and power tracking systems.

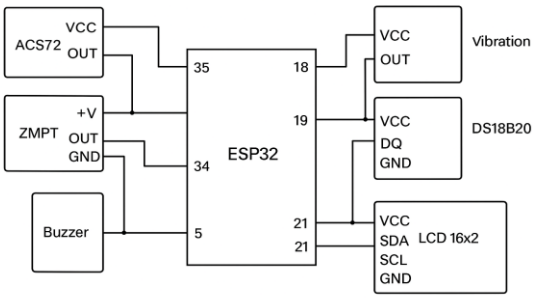
- LDR Sensor

An LDR (Light Dependent Resistor) detects ambient light levels. It helps automate lighting systems to reduce energy waste caused by manual control or user negligence.

- Temperature Sensor – DS18B20

The DS18B20 is a waterproof digital temperature sensor with a measurement range of -55°C to 125°C and ±0.5°C accuracy. It uses the 1-Wire protocol and includes three connections: VCC (Red), GND (Black), and Data (Yellow).

VI. BLOCK DIAGRAM



V. CONCLUSION

The IoT-based Industrial Protection System significantly improves inventory management by enabling automated monitoring and timely alerts. It helps reduce waste—particularly in sensitive areas like food storage—and enhances overall operational efficiency. This project highlights the impactful role of IoT in modernizing industrial processes across diverse applications.

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