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IoT Based Theft Detection Shop Shuttering Monitoring System

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Abstract

The "IoT-based Shop Shutter Monitoring System" project aims todevelop a reliable and cost-effective solution for monitoring the security and status of commercial shop shutters using Internet of Things (IoT) technology. Shop shutters play a critical role in safeguardingbusinesses and their assets, and this systemoffers a convenient and efficient way tomonitor their status remotely. The project utilizes a combination of IoT sensors, a microcontroller, and a cloud-based platform to provide real-time information about the status and security of shop shutters. The system enables shop owners and security personnel to receive instant notifications and access detailed dataabout the shop shutter condition through auser-friendly web or mobile application. Shop owners and managers encounter various challenges, including security concerns, operational efficiency, and the need for remote management. The IoT- based Shop Shutter Monitoring System addresses these challenges by providing a comprehensive solution that utilizes IoTdevices and technologies to monitor, control, and manage shop shutters.

Keywords: ESP 8266 Node MCU, GSM Module, Vibration Sensor , Laser Sensor, Flex Sensor

INTRODUCTION

The current wave of innovation is advancing dangerously quickly, especially in wealthy countries [1].

Everyone wants things to be faster and easier. The Internet of Things (IoT) is a network that enables real devices, health, services, businesses, cars, security, and other items equipped with hardware, actuators, sensors, programming, and organizational networks to collect and exchange data. The object may be detected or controlled remotely via the Internet, which was designed to increase production, decrease human intervention, and increase precision. The framework can be screened by the customer in a excellent method of applying the IoT approach, and direct interaction with the framework is not necessary. AC, window, ceiling fan, siren, light, smoke detector, fire sprinkler, thermostat, power meter, battery, door (shutter), motion detector, webcam (vs CCTV), car (smoke generator), heating element (fire), solar panel, computer, router, printer, switch, and smartphone [5, 8].

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Everything is remotely usable through a variety of mobile applications. This is a result of the productivity and fresh innovation of the framework. Besides, the telephone remote controller has always been an option due to its ease of use and low power consumption. For example, a shop manager can use IoT to manage

their security system. The project aims to support small shops in maintaining the security framework when they are not in the store. The framework ensures that a shop representative may reach the shop from any location and can be used in any telephone application. As a key component, we can also examine their ingenious shopping basket charging architecture. The window, roof fan, and forced air system—all of which have LCD screens and infrared sensors are connected to the remote sensor [24].Every item in the store will be connected to the remote association. Recently, the Internet of Things has gained widespread recognition across a number of industries. Many experts predict that the Internet of Things will completely transform how people interact with their surroundings and spark the growth of a billion-dollar sector that will serve as the new focal point for the extension of data innovation. The term "web of things" refers to the most popular method of connecting items to the internet and enabling them to share and exchange data in order to achieve intelligent identification, ongoing tracking, observation, and more. A few of the data-detecting technologies used in the Internet of Things include radio recurrence ID (RFID), electronic name (EPC), remote detecting innovation, global positioning framework, and standardized identification per user. The IoT-based Shop Shutter Monitoring System is a project aimed at im- proving the security and management of retails stores and shop using Internet Of Things (IoT) Technology. This system provides real-time monitoring and control of shop shutter, ensuring the safety of the shop in its contents while enhancing operational efficiency. The project leverages IoT device. Sensors and cloud-based platform services to offers a comprehensive solution for shop owners, Managers and security personal [67]. The Security of retails shops and commercialsspaces is of utmost important, and traditional security system often fall shortof meeting the requirement of modern business. Manual shutter management can be time-consuming The IoT-basedShop Shutter Monitoring System addressthese challenges by using Iot Sensors, Camera and smart devices to monitor and control the shop's Shutters the re- motely. Providing real-time insights and automation features to shop owners and security personal and managers. The project report introduces of the IOT- based shop shutter monitoring system designed to enhance security and convenience of shop owners and operators the system utilizes combination of Hardware components and software applications to monitor and control shop shutters remotely.

Literature Survey

In a paper by Sourav Bhattacharya and Ritwik Chakraborty (February 2022), titled"Shop Smart Lock System Using IoT," the authors propose a solution aimed at enhancing security in various settings such as jewelry shops, banks, apartment complexes, offices, and vehicles. The system integrates smart locks with the Internet of Things (IoT) to address challenges like theft and robbery[10].

Abhay Kumar Ray and Ashish Bagwari (June 2021) discuss the importance of communication security in IoT-based smarthomes. Their paper emphasizes the need tosafeguard sensitive data during devicecommunication and storage to ensure privacy [11].

Homero J. Velastegui and Acurio M.Santiago (January 2020) present a project focused on preventing the detection andcreation of alerts in security systems. Theirwork aims to mitigate risks associated with the continuous exchange of information among sensors, central systems, and globalservers [12].

System Architecture and Implementation

The hardware components are interconnected and integrated into thesystem architecture to perform specific functions and tasks.

The ESP8266 Node MCU serves as thecentral processing unit, receiving inputs from sensors, analyzing data, and controlling system operations.

The GSM module enables communication with external devices and networks, allowing the system

to send alerts and notifications.

Sensors are strategically placed around the shop shutter to monitor various aspects of security and detect potential threats or breaches.

System Description
ESP8266 Node MCU

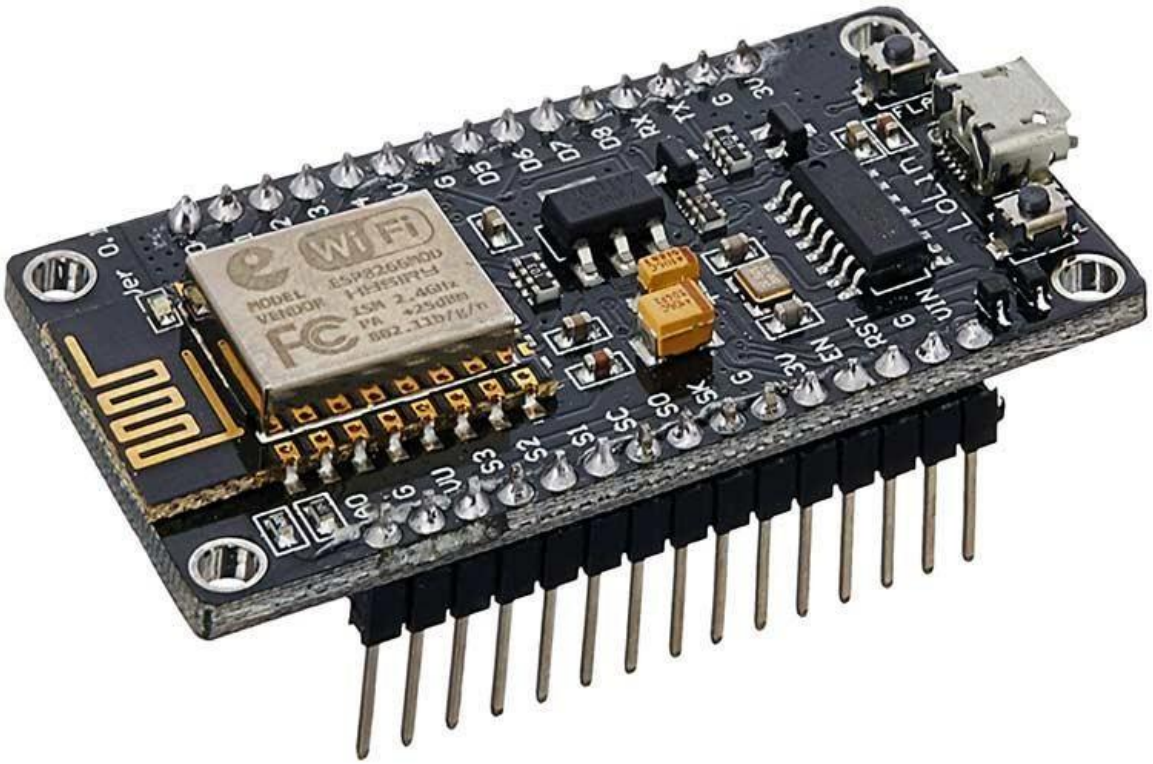


Figure 1. 2D model of ESP8266 node MCU

Description
ESP8266 Node MCU is a low-cost Wi-Fi-enabledmicrocontroller unit based on theESP8266 chip. 2D model of ESP8266 node MCU is shown in Figure 1.

Function
Acts as the main control unit, responsible for collecting sensor data, processing information,and controlling system operations.

Features
Integrated Wi-Fi connectivity, GPIO pins for sensor connections, and compatibility withArduino IDE for programming [9].

Lazer SensorModule
Description
Laser sensor as shown in Figure 2. emits a laser beam and detects interruptionsor changes in the beam.

Function
Creates a virtual barrier ortripwire around the monitored area to detect any obstruction or movement.

Features
Typically includes a laseremitter, receiver, and signalprocessing circuitry to detect interruptions in

the laser beam.

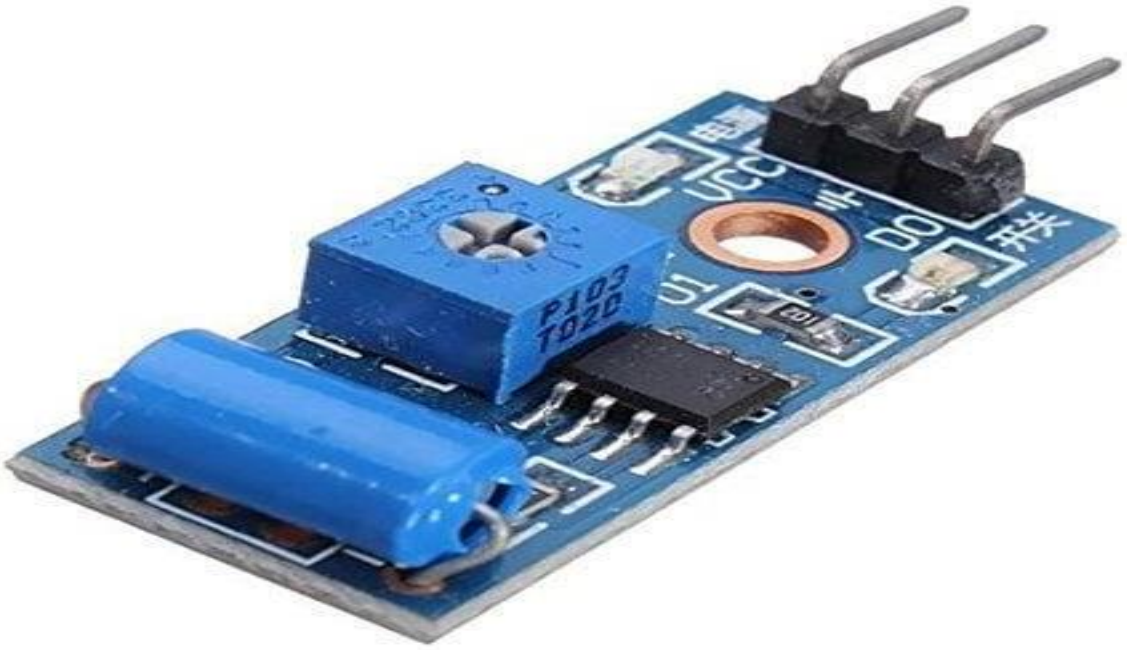


Figure 2. Lazer Sensor Module

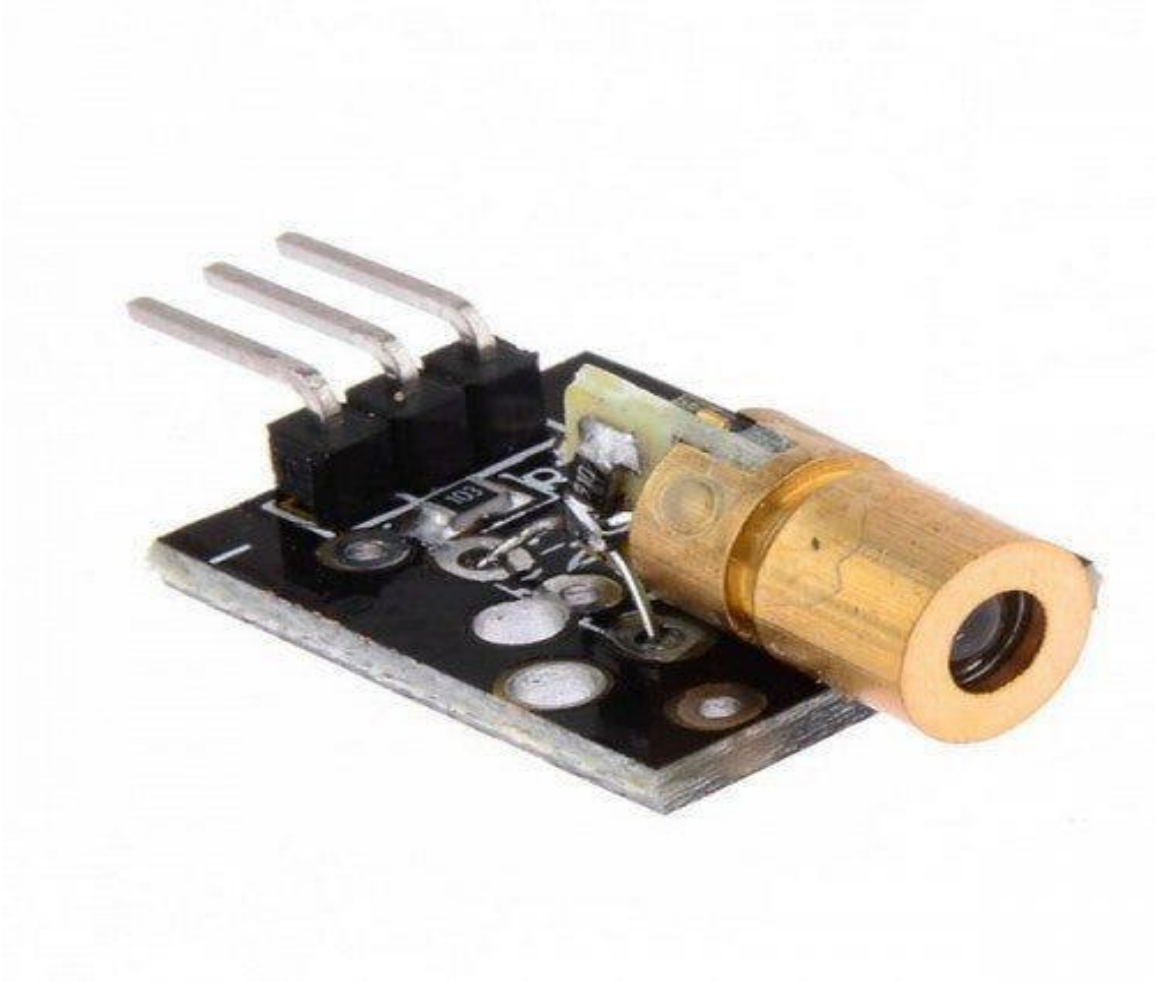


Figure 3. 2D Model of Vibration Sensor

Vibration Sensor

Description

Vibration sensor, as shown in Figure 3. also known as a vibration switch or accelerometer, detects vibrations ormovements in its environment.

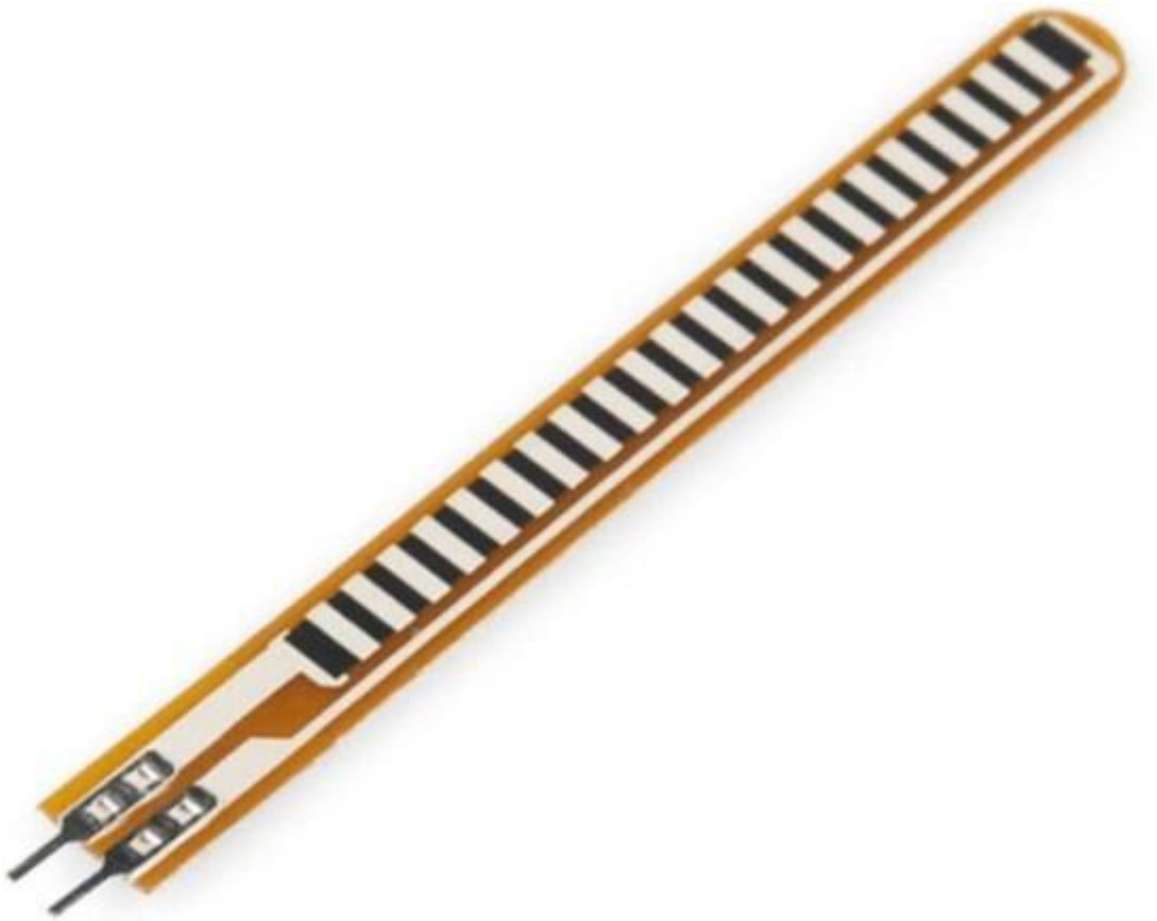
Function

Monitors physical movement or vibration of the shop shutter, indicating potential tampering or attempted break-ins.

Features

Typically consists of a sensitive component that reacts to vibrations and a digital output signal indicating the presence or absence of vibration.

Flex Sensor



Description

Flex sensor as shown in Figure 4. is a type ofresistive sensor that changes its resistance based on the degree of bending or deformation.

Function

Detects bending or flexing of the shop shutter, which may indicate attempted intrusion ortampering.

Features

Flexible construction thatchanges resistance with bending, analog output signal proportional to the degree of bend.

Resistance Range

Flex sensors typically have a resistance range,commonly around 10k ohms to 100k ohms. This resistance changesas the sensor is bent.

Physical Dimensions

This includes the length, width, and thickness of the sensor. Flex sensors come indifferent sizes to suit various applications.

Operating Temperature Range

The range of temperatures in which the sensor can function effectively. This is important for applications in different environments.

GSM Module

Figure 5. 2D Model of GSM Module

Description

GSM module as shown in Figure 5. is a cellular communication module that enables communication over the GSM network.

Function

Facilitates sending SMS alerts to predefined phone numbersin case of security breaches or system events.

Features

SIM card slot for cellular connectivity, UART interface for communication with the microcontroller, and support for ATcommands for control andconfiguration.

Result

Detection of Security Threats

The system effectively identifies various suspicious activities including physical tampering, bending of the shop shutter, changes in light levels, and obstruction ofthe monitored area.

Real-time Alerting

Upon detecting suspicious activity, the system promptly triggers alerts andnotifications. SMS alerts are transmitted todesignated phone numbers via the GSMmodule, notifying the owner or security personnel of the security breach.

Swift Response Time

Leveraging real-time monitoring and instant alerting features, the systemminimizes response time to security threats. Owners or security personnel can promptly intervene to prevent potential theft or vandalism, thereby mitigating potentiallosses or damages.

Dependable Security Monitoring

Through the integration of multiple sensors,the system provides thorough securitysurveillance of the shop shutter and itssurroundings. It consistently identifiessecurity breaches and unauthorized access attempts, bolstering overall security measures.

Remote Accessibility

Users enjoy seamless remote monitoringand control of the system via a web ormobile application. Access to real-time sensor data, security status updates, andalerts is available from any location at any time, enhancing user convenience andpeace of mind.

CONCLUSION

In conclusion, the IoT-based theft detectionshop shutter monitoring system, integrating ESP8266 Node MCU, GSM module, vibration sensor, flex sensor, LDR sensor, and laser sensor, provides a robust solutionfor enhancing security in variousenvironments. Through comprehensivemonitoring and detection capabilities, the system successfully identifies suspicious activities such as physical tampering, bending of the shop shutter, changes in lightlevels, or obstruction of the monitored area.Upon detecting security threats, the systempromptly triggers real-time alerts and notifications, ensuring that owners or security personnel can respond swiftly to prevent theft or vandalism. This reduced response time significantly contributes to minimizing losses or damages to the property.

The integration of multiple sensors enables reliable security monitoring, ensuring that security breaches and unauthorized access attempts are detected accurately. This enhances overall security measures, providing peace of mind to users and strengthening the deterrence effect against potential intruders.

Furthermore, the system offers remote accessibility through web or mobileapplications, allowing users to monitor real-time sensor data, security status, and receive alerts from anywhere at any time. This accessibility enhances convenience and facilitates proactive security management.

Future Scope

The future scope for an IoT-based shopalarm security monitoring system project ispromising, as the demand for enhanced security and automation in commercial andretail spaces continues to grow. Here are some areas of future development and opportunities for such a system

Enhanced Sensor Technology

Future systems can benefit from more advanced and sensitive sensors for detecting intruders, temperature changes, smoke, andother security-related events. Advancements in sensor technology will

improve the accuracy and reliability of security monitoring.

Energy Efficiency

Energy-efficient IoT devices and sensors are crucial for long- term sustainability and cost-effectiveness. Low-power sensors and optimized battery life will be important considerations to reduce energy consumption and operationalcosts.

Scalability

As shops expand or changetheir layouts, the system should be easily scalable. The ability to add or relocate sensors and devices without significant disruption is essential to accommodate evolving security needs.

Remote Monitoring and Control

Future systems may offer shop owners the ability to remotely monitor and control security systems through smartphones or web interfaces. This allows for real-time access to data and control over the security of the shop from anywhere, enhancing convenience and flexibility.

Cost-Effective Solutions

Cost remains a critical factor for small and medium-sized businesses. Future developments should aim to make IoT-based security solutions more cost-effective and accessible, ensuring affordability for a wider range of businesses.

Predictive Maintenance

Implementingpredictive maintenance capabilities for the security system's components can help prevent downtime and ensure continuous operation. Predictive analytics can anticipate maintenance needs and schedulerepairs proactively, minimizing disruptionsto security operations.

Data Analytics and Reporting

Advanceddata analytics can provide insights into security events, trends, and vulnerabilities, helping shop owners make informed decisions. Analyzing security data can identify patterns of behavior, detectanomalies, and improve overall security effectiveness. By focusing on these areas of development, future IoT-based shop alarm security monitoring systems can offer advanced capabilities, improved efficiency, andenhanced security measures to meet theevolving needs of commercial and retailspaces.

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