AN ANTI-THEFT FLOORING SYSTEM USING NODEMCU

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Abstract: This paper presents the development of an Anti-Theft Flooring System designed to enhance security measures in various environments. The system integrates an ultrasonic sensor and NodeMCU, a compact computing device, to detect unauthorized movement and alert users in real-time. The ultrasonic sensor continuously monitors changes in distance above the flooring surface, while NodeMCU facilitates communication via Wi-Fi to send instant notifications to designated mobile devices upon detecting movement. Additionally, the system incorporates visual and auditory alerts, including an LED indicator and a buzzer, to ensure immediate attention to security breaches. Through a comprehensive approach, the Anti-Theft Flooring System offers reliable and efficient protection against theft or unauthorized access. The paper discusses the system's components, integration process, and functionality, along with potential applications in homes, offices, or commercial spaces.

I. Introduction

Security is very important in both residential and commercial settings, with theft and unauthorized access posing significant risks to property and assets. Traditional security measures, such as alarms and surveillance cameras, are effective but often reactive, requiring human intervention after an intrusion has occurred. In response to this challenge, there is a growing demand for proactive security solutions that can detect and deter potential threats in real-time. The development of innovative technologies, such as ultrasonic sensors and Internet of Things (IoT) devices like NodeMCU, presents opportunities to create advanced security systems that can address these needs. The Anti-Theft Flooring System introduced in this paper leverages the capabilities of ultrasonic sensors and NodeMCU integration to provide a proactive security solution for various environments. By embedding sensors directly into the flooring surface, the system can detect unauthorized movement with high precision and sensitivity. This real-time detection capability enables immediate response to potential security breaches, enhancing overall security effectiveness. Additionally, the integration of NodeMCU allows for seamless communication and remote monitoring, enabling users to receive instant alerts on their mobile devices regardless of their location.

One of the key advantages of the Anti-Theft Flooring System is its comprehensive approach to security, which goes beyond traditional alarm systems. In addition to sending notifications to designated mobile devices, the system incorporates visual and auditory alerts to ensure immediate attention to security breaches. A combination of LED indicators and buzzer alerts provides multiple layers of

notification, increasing the likelihood of timely response and deterrence of intruders. Moreover, the system's user-friendly design and ease of installation make it accessible for a wide range of users, from homeowners to business owners seeking to enhance their security measures.

The Anti-Theft Flooring System represents a significant advancement in proactive security technology, offering precise detection capabilities, seamless communication, and comprehensive alerting mechanisms. Through the integration of ultrasonic sensors and NodeMCU, the system provides a reliable and efficient solution for protecting property and assets against theft or unauthorized access. This paper aims to explore the development process, functionality, and potential applications of the Anti-Theft Flooring System, highlighting its contributions to enhancing security measures in various environments.

II. Literature survey

The field of security systems has seen significant advancements in recent years, with researchers exploring various technologies to enhance protection against theft and unauthorized access. Patchava et al. [1] introduced the Advanced Raspberry Pi Surveillance System (ARS), which leverages Raspberry Pi technology for advanced surveillance capabilities. This system offers valuable insights into the use of single-board computers for security applications. Sharma [2] presented an Android Interface-Based GSM Home Security System, highlighting the integration of mobile technology and GSM communication for remote monitoring and control. This research emphasizes the importance of user-friendly interfaces and mobile connectivity in modern security systems.Pavithra and Balakrishnan [3] introduced an IoT-based monitoring and control system for home automation, demonstrating the potential of IoT technology in enhancing home security. This study sheds light on the integration of IoT devices for comprehensive monitoring and control of home environments.

Das and Neelanarayan [4] proposed an IoT-based anti-theft flooring system, which is closely related to the subject of this study. This research provides valuable insights into the development and implementation of a similar security solution using IoT technology.Sirisha et al. [5] presented an IoT-based anti-theft detection and alerting system using Raspberry Pi, offering insights into the use of Raspberry Pi for theft detection applications. This study contributes to the understanding of hardware platforms suitable for security system development. Dixit et al. [6] introduced a Raspberry Pi-based anti-theft security system, highlighting the potential of Raspberry Pi technology in developing cost-effective security solutions. This research provides valuable information on the practical implementation of such systems. Suresh et al. [7] proposed an anti-theft flooring system using Raspberry Pi and IoT technology, offering insights into the development of similar systems. This study contributes to the existing literature by presenting a specific application of IoT technology in security systems. Anjum and Babu [8] presented an IoT-based theft detection system using Raspberry Pi, demonstrating the versatility of Raspberry Pi in developing innovative security solutions.

This research adds to the understanding of IoT applications in theft detection.

III. Existing System

Traditional security systems, such as alarm systems, CCTV surveillance, access control, GPS tracking, and smart home security systems, offer varying levels of protection against theft and unauthorized access. These systems rely on sensors, cameras, access control methods, and remote monitoring to detect and deter intrusions. While effective, these systems may have limitations such as blind spots, reliance on external monitoring services, or complex installation and maintenance requirements.

IV. Proposed System

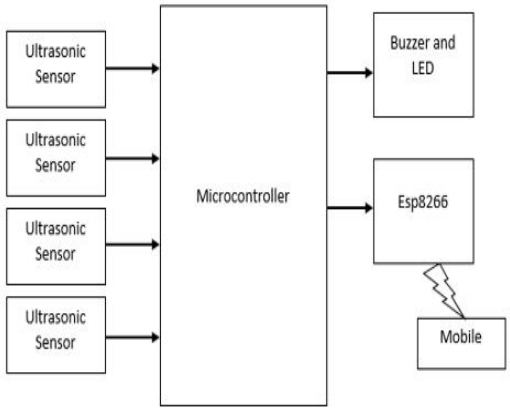

Fig 1: Proposed system block diagram

The proposed Anti-Theft Flooring System integrates ultrasonic sensors, arduino Uno and NodeMCU IoT devices directly into flooring surfaces to detect unauthorized movement with precision and efficiency. When movement is detected, the system triggers alerts via Wi-Fi communication to designated mobile devices, accompanied by visual and auditory alerts for immediate attention. This approach provides real-time notifications and deters potential intruders effectively, offering seamless integration and ease of use for enhanced security in various environments.

V. Components used and its use

Arduino Uno: Arduino Uno serves as the primary microcontroller in the system, responsible for sensor data processing and control of the LED indicator and buzzer. It receives data from the ultrasonic sensor and triggers actions such as illuminating the LED indicator and activating the buzzer when unauthorized movement is detected. Arduino Uno acts as the interface between the sensors and the NodeMCU, coordinating the system's functions and providing additional processing power.

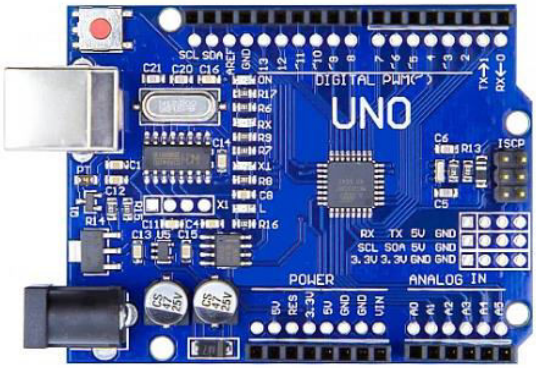

Fig 2: Arduino Uno Board

Ultrasonic Sensor: The ultrasonic sensor detects changes in distance above the flooring surface by emitting ultrasonic waves and measuring the time it takes for the waves to bounce back. It serves as the primary detection mechanism for unauthorized movement. Arduino Uno reads the sensor data and processes it to determine if there is any potential security breach.

Fig 3: Ultrasonic sensor

LED Indicator: The LED indicator provides a visual alert when unauthorized movement is detected. Arduino Uno controls the LED, illuminating it to catch the user's attention and indicate the presence of a potential security breach. The LED indicator enhances the system's responsiveness by providing immediate visual feedback in addition to notifications.

Fig 4: LED indicator

Buzzer: The buzzer emits a loud sound when unauthorized movement is detected, providing an auditory alert to draw attention to the security breach. Arduino Uno controls the buzzer, activating it to alert users of potential intrusions. The buzzer serves as an additional layer of notification, ensuring that users are alerted even if they are not actively monitoring their mobile devices.

Fig 5: Buzzer

Wi-Fi Module (NodeMCU): While not directly connected to the Arduino Uno, the Wi-Fi module integrated into NodeMCU enables wireless communication between the system and designated mobile devices. NodeMCU receives alerts from Arduino Uno and sends them to users' smartphones or tablets, providing real-time notifications of potential security breaches. The Wi-Fi module ensures seamless connectivity and enables remote monitoring and control of the system.

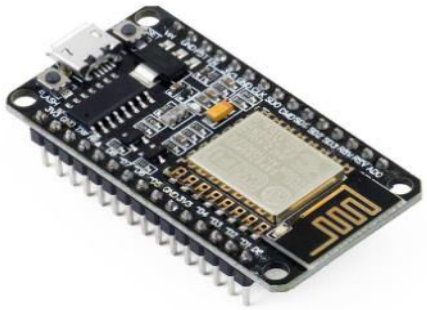

Fig 6: NODE MCU Wi-Fi Module

VI. Working principle

The working principle of the Anti-Theft Flooring System can be summarized in the following steps:

Detection: The system utilizes an ultrasonic sensor placed beneath the flooring surface to continuously emit ultrasonic waves.

Measurement: These waves bounce off objects above the flooring surface, and the sensor measures the time it takes for them to return.

Distance Calculation: Based on the time taken, the sensor calculates the distance between the sensor and the object.

Movement Detection: Any movement within the detection range alters the calculated distance, indicating potential unauthorized activity.

Alert Trigger: Upon detecting movement, the system triggers alerts by illuminating an LED indicator and activating a buzzer.

Notification: Simultaneously, NodeMCU communicates via Wi-Fi to send instant notifications to designated mobile devices.

User Response: Users receive the notification and can take appropriate action, such as investigating the security breach or contacting authorities.

In essence, the system continuously monitors for changes in distance above the flooring surface and promptly alerts users when unauthorized movement is detected, ensuring timely response to potential security threats.

VII. Results

This figure 7 depict the physical setup of the Anti-Theft Flooring System, showcasing how the various components such as the Arduino Uno, ultrasonic sensor, LED indicator, buzzer, and NodeMCU are integrated together. It might include labels or annotations to identify each component and illustrate how they are connected.

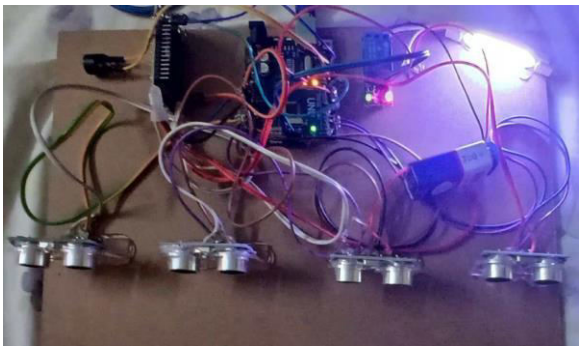

Fig 7 LED Turning on when object detected

Figure 8 showing Notification on mobile, after the detection of an object: This figure would display a screenshot or mockup of a mobile device receiving a notification after the system detects an object. The notification might include details such as the time and location of the detected movement, along with instructions or options for the user to respond to the alert.

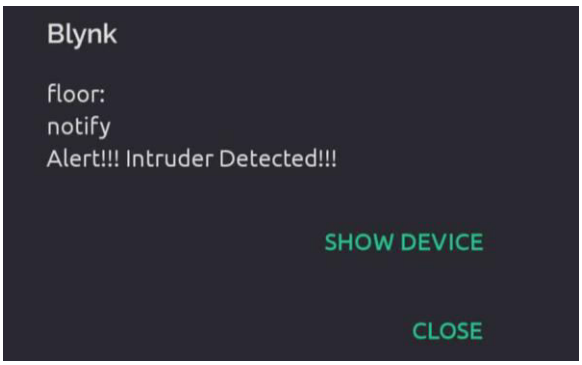

Fig 8 Notification on mobile, after the detection of an object

The figure 9 shows a screenshot or mockup of the Blynk app dashboard displaying relevant information and controls related to the detected object. It might include real-time data updates, visual indicators, or buttons for users to interact with the system, such as viewing live camera feeds or activating deterrent measures.

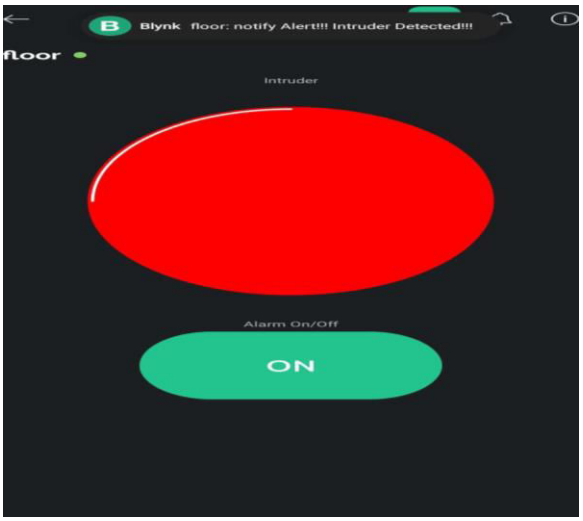

Fig 9 Notification on mobile, after the detection of an object

The figure 10 shows the Blynk app dashboard in a state where no object is detected, showing static or inactive visual elements indicating that the system is in a normal or idle state. It might include status indicators or logs to provide users with reassurance that the area is secure.

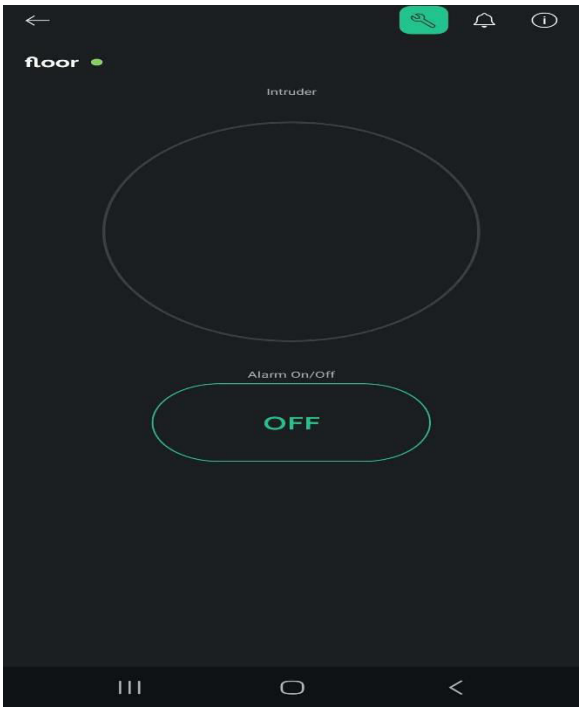

Fig 10 Blynk app dashboard when no object is detected.

Conclusion

The development of the Anti-Theft Flooring System presents a comprehensive and proactive solution for detecting and deterring unauthorized access. By integrating ultrasonic sensors, Arduino Uno, NodeMCU, and mobile app notifications, the system effectively detects movement above the flooring surface and promptly alerts users through visual and auditory indicators as well as notifications on their mobile devices. The system's integration with mobile applications such as Blynk allows for convenient remote monitoring and control, enhancing user responsiveness to security threats. Overall, the Anti-Theft Flooring System offers a reliable, efficient, and user-friendly security solution suitable for deployment in various environments, providing peace of mind and enhanced protection against theft or unauthorized access.

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