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Parking Assistance System

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Abstract: This paper aims at the design of an Io T-based vehicle proximity and anti-theft alert system with the usage of an infrared (IR) sensor, Blynk IoT platform, and a Node MCU micro controller. It intends to increase the safety of the vehicles by the detection of surrounding objects, providing timely anti-theft alerts. In this design, an IR sensor has been used in order to measure the distance between the parked vehicle and the surrounding objects, which is displayed on the Blynk mobile app. This feature allows its users to see the environment around their car from directly on their smartphone. When some object moves close to a car, over a determined threshold distance, the system sends multiple warnings to a vehicle owner. It has an LED light, generates a buzzer sound and sends an immediate notification with Blynk's cloud service. These combined signals help quickly identify nearby movement or possible impact to enhance the safety of the vehicle. The system further has an anti-theft feature that uses the IR sensor to identify any unauthorized access to the vehicle. It will activate the same set of warnings and send an alert to the user's smartphone to quickly respond to theft incidents. Emphasis in its development was given to affordable hardware, friendly design, and full adaptability for most car types. It's well suited for both personal and commercial vehicles to need extra security. The testing showed that the system correctly identifies and alerts about possible intrusions regarding access. To summarize, an IoT-based solution gives accurate, real-time protection of any vehicle against modern intrusion trends. This is a practical solution for car owners who have a means of reducing these risks of accidental damage and theft, bringing greater peace of mind through advanced, user-friendly technology.

Keywords: IoT-enabled, Vehicle proximity, Anti-theft notification, Real-time monitoring, Obstacle detection, Anti-theft measures, Vehicle safety, Smartphone notifications, Cloud AI

1. Introduction :

The vehicle safety and anti-theft system is an IoT-based application which tackles modern security issues using innovative technology. Using the IR sensor, Node MCU micro controller, and the Blynk IoT platform, this system identifies obstacles around parked vehicles and

immediately gives a real-time alert to objects approaching too close to them. Users are then alerted through an LED light, buzzer, and a Blynk app on a smartphone, ensuring quick reactions to potential hazards [1]. The anti-theft feature adds another layer of security by monitoring for unauthorized access attempts. When detected, the system triggers alerts through the Blynk cloud, notifying the vehicle owner immediately [2]. This proactive approach provides a faster response than traditional alarms, enhancing vehicle safety and owner confidence. Designed to be cost-effective and user-friendly, the system uses affordable, widely available hardware, making it suitable for both personal and commercial use [3]. Blynk lets the alert settings be tailored, with remote access offered for versatile, real-time monitoring [4]. The performance test ascertains that the system is trustworthy enough to detect both obstacles and theft, thereby giving timely and adequate warnings. With a boom in demand for sophisticated automotive safety, this IoT-based technology has easy usability, adaptability, and affordability, turning out to be a significant tool for modern vehicle security as well as peace of mind [5].

2. Literature Review:

R. J. Wang et al, "A Real-Time Object Detection System on Mobile Devices," in Neural Information Processing Systems. This paper discusses the development of a real-time object detection system optimized for mobile devices, emphasizing computational efficiency and practical applications in various fields [6]. Y. Liu et al, "Real-Time Lightweight Single Shot Detector for Mobile Devices," in Proceedings of the VISIGRAPP Conference. The study presents a lightweight single-shot detector tailored for real-time object detection on mobile devices, balancing performance and resource constraints [7]. W. Park et al, "An Enhancement of Optimized Detection Rule of Security Monitoring and Control for Detection of Cyber threat in Location-Based Mobile System," Mobile Information Systems, vol. 2017, pp. 1–13, 2017. This paper enhances security detection rules in location-based mobile systems, focusing on cyber threat monitoring and real-time control [8]. Z. A. Karam et al, "Implementation of Cell Phone Detection Mobile Robot for Restricted Areas Using NodeMCU," Iraqi Journal of Information & Communications Technology, vol. 1, no. 1, pp. 27–35, 2018. DOI: 10.31987/ijict.1.1.6. This study demonstrates a mobile robot system for detecting unauthorized cell phone usage in restricted areas using NodeMCU and associated sensors [9]. P. Mangal, S. Kumar, and S. Rajkumar, "A Better Approach to Detect the Presence of Cell Phones Being

Used in Prohibited Areas," International Journal of Computer Applications, vol. 168, no. 2, pp. 12–14, 2017. This research proposes an enhanced methodology for identifying cell phone usage in prohibited zones, focusing on accuracy and reliability [10]. A. Rehman et al, "Detection of Cell Phone Usage in Restricted Areas." This study outlines a framework for identifying unauthorized cell phone usage, with a particular emphasis on practical implementation in secure zones [6]. V. Iu. Loskutov, D. S. Mudrik, and G. P. Slukin, "Detection of Unauthorized Cell Phone Use During Exam," Radio Engineering, 2023. This research focuses on detecting unauthorized cell phone usage in academic settings during examinations, incorporating advanced signal processing techniques [11]. M. Chilukuri, S. Yi, and Y. Seong, "A Robust Object Detection System with Occlusion Handling for Mobile Devices," Computational Intelligence, 2022. The paper introduces a robust object detection framework for mobile devices, with special attention to scenarios involving occlusionv [12]. T. Singh, F. D. Troia, C. A. Visaggio, T. H. Austin, and M. Stamp, "Support Vector Machines and Malware Detection," Journal of Computer Virology and Hacking Techniques, vol. 12, no. 4, pp. 203–212, 2015. This study applies support vector machines to malware detection, demonstrating high accuracy and adaptability to evolving threats [13].

3. Working Principle:

The IoT-based Intrusion Detection and Alert System uses sensors, a microcontroller, and a mobile app to detect movement or obstacles and alert users right away. It is composed of the NodeMCU ESP8266, PIR sensor, IR sensor, buzzer, LED, and the Blynk app.

1. System Initialization: Upon startup, the NodeMCU is connected to Wi-Fi and will connect to the Blynk server. The connectivity will allow the system to forward notifications to the user's phone.

2. Intrusion Detection: The PIR sensor detects motion by sensing changes in temperature from objects or people. The IR sensor detects things around it by infrared signals. These sensors continuously monitor the environment and send feedback to the NodeMCU if something is detected.

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3. How Alerts Work: A buzzer sounds to alert people nearby. The LED lights up to indicate something has been detected. NodeMCU sends a signal to the Blynk server, which will then send a notification to the user's phone, alerting him even from afar.

4. Continual Monitoring: The system then resets itself and continues its monitoring for new movements or obstacles after it sends an alert.

5. User Interaction: The Blynk app allows users to see alerts and event logs on their phones. This helps them monitor the system and stay informed about any activity.

4. Design and Simulation:

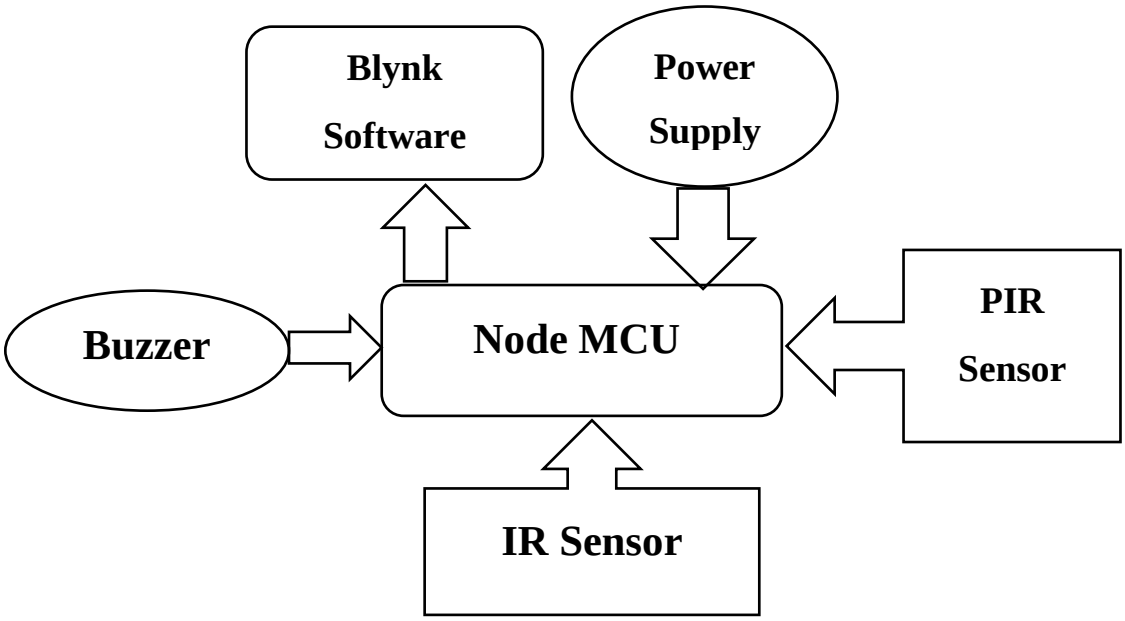

Figure 1: Block Diagram of Parking assistance system using Node MCU

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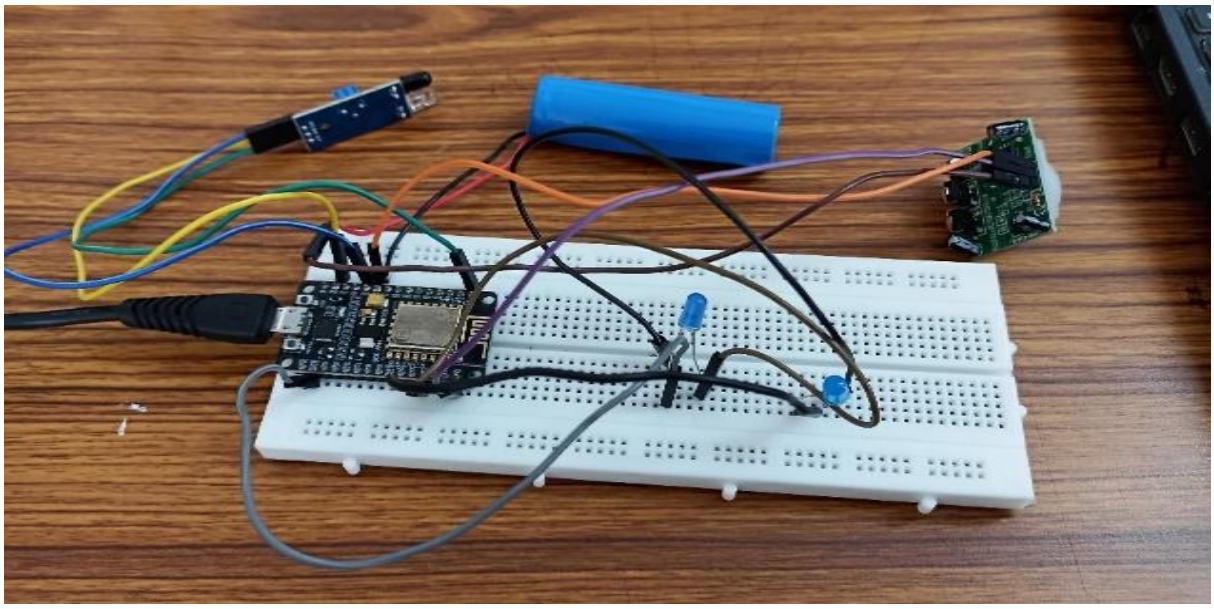

Figure 2: Circuit Design of the parking assistance system using hardware components

5. Simulation Parameter :

Table 1: Components Required for Designing the Circuit

Sl. No.	Components	Specifications
1	IR Sensor	1
2	PIR Module	1
3	Node MCU	1
4	Battery	1 (0v - 3v)
5	LED	2

6. Working Procedure :

The IoT-based Intrusion Detection and Alert System is implemented by using sensors, a microcontroller, and a mobile application to detect intrusion and alert the users on the spot.

This begins when the system is switched on. The NodeMCU ESP8266 links up with a Wi-Fi network and creates a link with the Blynk server for remote notifications.

The PIR sensor detects motion through a change in infrared radiation, which is usually caused by moving people or objects. In the meantime, the IR sensor constantly scans for nearby obstacles by emitting infrared signals and then detecting their reflection. Whenever the sensors detect any activity, they send signals to the NodeMCU to process them.

If movement or an obstruction is found:

1. The system has the ability to activate a buzzer to produce an audible alarm and turn on an LED as a visual alert to whoever is nearby.

2. The NodeMCU sends a notification to the user's smartphone through the Blynk app, showing the intrusion.

After a triggering alert, the system resets and starts monitoring for further activity. The Blynk app enables viewing alerts and logs, hence keeping the user continuously updated on the status of their property. This system ensures a reliable real-time solution for home and property security.

7. Result Analysis :

The IoT-based Intrusion Detection and Alert System successfully detects motion and obstacles, providing immediate local alerts through a buzzer and LED while sending real-time notifications to the user’s smartphone via the Blynk app. It demonstrates quick response times, reliable performance, and accuracy in detecting intrusions under proper sensor placement and environmental conditions.

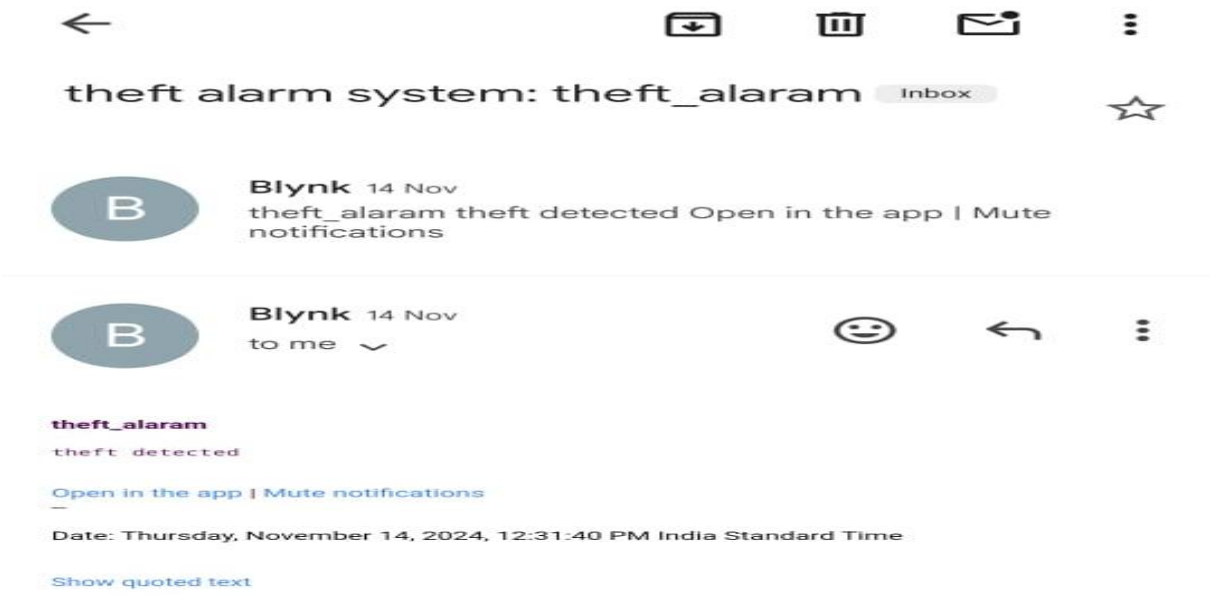

Figure 3: Output of the alarm system in mail from the blynk app

8. Conclusion :

The IoT-based Intrusion Detection and Alert System is a reliable, cost-effective security solution aimed at achieving real-time motion detection and remote monitoring. Sensors were integrated with the NodeMCU and Blynk app for immediate alerts via the buzzer, LED, and mobile notifications so that the system could respond in good time to possible threats. It brings out the efficiency in terms of detecting any motion and responding to it with promptness. This makes it versatile in many applications like home security, office monitoring, and safeguarding facilities in warehouses. It's pretty easy to incorporate into any existing security design and fits well with various IoT platforms. The system is still at its infancy, but improvement is still possible, including the integration of SMS alert, camera, or enhanced detection technology, thus enhancing the security and reliability of this system.

9. Acknowledgement :

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