

# **SMARTGUARD: IOT-BASED REAL-REALTIME INTRUSION DETECTION USING ACTIVE AND PASSIVE INFRARED SENSORS WITH ALERT NOTIFICATION VIA TELEGRAM APPLICATION**

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**ABSTRACT** - The SmartGuard prototype is an innovative IoT-based real-time intrusion detection system designed to enhance home security using active and passive infrared sensors. This prototype utilizes the NodeMCU ESP8266 platform and leverages the Telegram application to deliver instant alert notifications to users. The primary objective of the project is to develop a reliable and efficient home security system that detects and notifies users about potential intrusions in real time. The functionality of the SmartGuard prototype is thoroughly evaluated through comprehensive testing methods, including functionality testing, network testing, and usability testing. Functionality testing focuses on assessing the prototype's ability to detect different objects accurately, while network testing analyses the system's performance regarding response time and reliability. Usability testing involves gathering user feedback to evaluate the ease of use, security features, and overall user experience. Results from the testing phase demonstrate the prototype's effectiveness in detecting intruders and promptly notifying users through the Telegram application. The prototype exhibits reliable functionality, with the ability to distinguish between humans, animals, and other objects, thereby minimizing false alarms. However, certain limitations are identified, including the susceptibility of the infrared sensors to motion and the limited detection range of the active infrared sensor. In conclusion, the SmartGuard prototype showcases the potential of IoT technology in revolutionizing home security systems. By leveraging active and passive infrared sensors and the Telegram application, this prototype offers users real-time intrusion detection and prompt notifications, contributing to an enhanced sense of security and peace of mind for homeowners.

**Keywords:** infrared sensor, NodeMCU, notification, home security, motion

## **1. INTRODUCTION**

Malaysia is a multiracial country that promotes diversity and a peaceful environment among its people. This helps the nation to grow and develop in terms of its economy. Being a multiracial nation would increase the likelihood of internal conflicts between the various races, which might endanger the peace and security of the country (Zahirah et al., 2021). A city's reputation, along with its industry economics, habitation, and habitation rates, suffer from high burglaries. Because of this, crime index which used real-time data is used to view the current trends in crime and to ensure efficient and effective solution to negate it.

## **2. METHODOLOGY**

For this project, the Waterfall model was used. There are six total phases for the creation of this prototype which are initiation, planning and development, experiment, analysis and, documentation. The methodology section provides a clear overview of the steps taken to develop the prototype and evaluate its functionality, network performance, and user experience. Network testing are conducted to assess the prototype's performance in terms of response time for alert notifications while usability testing was carried out through questionnaires administered to users. Overall, it demonstrates a systematic and comprehensive approach to ensure the prototype's effectiveness and suitability as a real-time intrusion detection with alert notification for home security.

## **3. RESULTS AND DISCUSSION**

Four scenarios were conducted in three situations to evaluate the sensor's performance for network testing with varying obstacles and distances. From this in can be concluded that, the response time of the Telegram application to detect signals and send alert notifications to users was influenced by factors such as the condition of the sensor (dusty, reflective, or clean), distances between people and the IR sensor, and the presence of obstacles. The further the

distance, the longer the response time for the sensor to detect and send signals to the Telegram application. Additionally, the sensor functions optimally without obstructions or obstacles, enabling precise detection of intruders or individuals in its range. Another aspect considered in the analysis was the type of telecommunication used for the Telegram notification, which varied in each test. Finally, The SmartGuard prototype and Telegram Application were shown to help with their daily tasks regarding ease of use and security using the usability testing.

#### **4. NOVELTY OF RESEARCH / PRODUCT**

Previous research on home security systems has been done: Motion and Movement Detection for DIY Home Security Systems (Papatungan et al., 2019). There is also previous research that uses only a passive infrared sensor (PIR) to detect motion for its security system, which is Arduino Based Security System using Passive Infrared (PIR) Motion Sensor (Akinwumi et al., 2021). Other than that, Research also uses motion sensors to track animals, which is IoT Based on Remote Surveillance for Animal Tracking Near Railway Tracks (Rajan et al., 2023). This research helps a lot in understanding motion sensors for tracking animals. Finally, there are also research that uses other type of application to send alert notification.

#### **5. CONCLUSION**

In conclusion, the implementation of a smart home security system was suggested as a viable study subject in this project. This implementation's main goal was to improve network speed so that controlling smart home security may be done effortlessly and quickly. It was essential to offer the best internet access because the prototype depends on a Wi-Fi connection. Several ideas and recommendations exist to improve this research project for future work.

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