



## **UNDERGRADUATE THESIS**

# **DESIGN AND CONSTRUCTION OF AN IoT-BASED MOTION DETECTION SYSTEM FOR HOME SECURITY USING PIR SENSOR AND FUZZY LOGIC METHOD WITH TELEGRAM NOTIFICATION**

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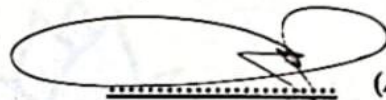
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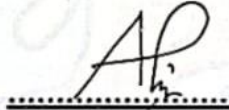
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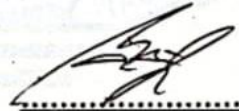
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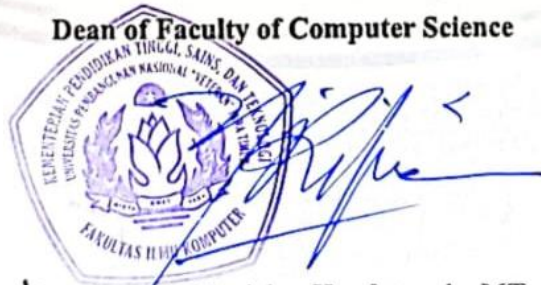
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## STATEMENT OF ORIGINALITY

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Hereby declares that this undergraduate thesis contains no part of any other scientific work that has been submitted to obtain an academic degree at any higher education institution. Furthermore, it does not contain any work or opinions previously written or published by others, except for those which are explicitly cited in this thesis and listed completely in references.

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Surabaya, June 18 2026  
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## ABSTRACT

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Thesis Title : Design and Construction of an IoT-Based Motion Detection System for Home Security Using PIR Sensors and Fuzzy Logic Methods with Telegram Notifications  
Advisor : 1. Prof. Dr. Basuki Rahmat, MT  
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The development of technology in the digital era, particularly in the concept of Internet of Things (IoT), has driven the creation of smarter, automated, and integrated home security systems. The high rate of house burglary crimes and the limitations of conventional security systems that are unable to provide real-time notifications serve as the background of this research. This research aims to design and build a motion detection system using a Passive Infrared Receiver (PIR) sensor integrated with the Telegram application as a notification medium. The method used in this research is the prototype method, which includes the stages of requirements analysis, system design, prototype development, testing, and system evaluation. The hardware used includes the ESP32-CAM as the main microcontroller, a PIR HC-SR501 sensor with a detection range of up to 5 meters as the motion detector, and a buzzer as an alarm. The system works by detecting changes in infrared radiation by the PIR sensor, then transmitting signals to the ESP32-CAM to be processed every 200 ms cycle, capturing images, and sending notifications along with captured images to users via Telegram in real-time. The Fuzzy Logic method with the Simplified Mamdani approach is applied to process detection data so that the system is able to differentiate threat levels into three categories, namely Aman, Waspada, and Bahaya, based on the accumulated value of detected motion intensity with an Waspada threshold of 3.50 and a Bahaya threshold of 7.00. The results show that the system achieves a Fuzzy Logic classification accuracy of 100% from six environmental disturbance scenarios tested, an average notification response time of 2,050 ms under stable network conditions and 4,520 ms under unstable network conditions, and an overall system accuracy of 96%. The integration of the sensor, microcontroller, and Telegram application produces a home security system that is responsive, efficient, and easy to implement. Therefore, this system is expected to serve as a more affordable and effective alternative solution for improving home security based on IoT technology.

**Keywords:** Internet of Things (IoT), Fuzzy Logic, Passive Infrared (PIR) Sensor, Home Security System, Real-Time Notification

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The author realizes that in the preparation of the following thesis there are many shortcomings. For this reason, constructive criticism and suggestions from all parties are highly expected for the perfection of writing the following thesis. Finally, with all the limitations that the author has, hopefully the following report can be useful for all parties in general and the author in particular.

Surabaya, June 18 2026

Elfredo Yustrada Bomantoro

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