

## **ABSTRACT**

*Separation of elderly pilgrims from their groups during the Hajj pilgrimage poses a serious safety concern. The crowded environment, unfamiliar surroundings, and the physical and cognitive limitations of elderly pilgrims significantly increase this risk. To address the issue, this research proposes a monitoring system based on Received Signal Strength Indicator (RSSI) using the ESP8266 module to measure signal strength and estimate the distance between elderly pilgrims and an Access Point. The Firebase platform is utilized to send real-time notifications to the Muthawwif (pilgrimage guide) when the distance exceeds a certain threshold. The accuracy of the system is influenced by factors such as signal interference and environmental conditions. To enhance performance, calibration and the selection of an appropriate path loss index ( $n$ ) were conducted. Test results show that the value of  $n$  significantly affects accuracy, with the lowest average error of 5.25 meters at  $n = 2.7$ , and the highest error of 8.06 meters at  $n = 3.5$ . The overall average error was 6.48 meters. This RSSI-based distance monitoring system proves to be a practical solution to reduce the risk of elderly pilgrims becoming separated. A lower path loss index results in more accurate distance estimation, making the choice of model crucial. Integration with GPS technology is also recommended to enhance real-time tracking. Overall, this system contributes significantly to improving the safety and comfort of elderly pilgrims during the Hajj pilgrimage.*

**Keywords:** ESP8266, Firebase, Hajj Elderly, Pathloss, Quality of Service (QOS), Received Signal Strength Indicator (RSSI).