Realtime Notifications On Visitor Tracking Systems Using Android and Arduino

R F Rahman1*, I D Sumitra2
1,2Postgraduate Faculty, Magister Of Information System, Universitas Komputer Indonesia, Indonesia

Email: *rizki.75118004@mahasiswa.unikom.ac.id

Abstract. The visitor tracking system is a system to provide security to users against visitors who come to a place. This journal has several objectives to inform the importance of using this system, it is easy to find out visitors who come to a place, get notifications quickly through the user’s smartphone when there are visitors who come to the place and provide a sense of security to users. The method used in this journal is the results of an indexed international journal review and in this journal can design a visitor monitoring system using Android combined with Arduino to get real-time notifications to users, using this service update information about visitor arrivals will be sent immediately as a notification message. This study explains and concludes the establishment of a visitor monitoring system to a place using Android and Arduino. Nowadays, many places are already using CCTV but sometimes users do not always monitor CCTV monitors, which results in many unknown events. This system has the potential to assist users in monitoring visitors who come to a place because users will get notifications in real time and it is expected that with this system can increase the level of security of the place.

1. Introduction
The development of technology is currently growing rapidly, especially in the field of information technology, where many systems have many benefits, and make it easier for every human being to do daily activities, one of them is Android. Android is a cellular operating system running on Linux kernel which is a new generation. Its development is based on java language code. These codes are useful for controlling mobile devices through java libraries located on Google [1]. In this research, we use elements of Android, Arduino, push notifications, and smartphones in the use of the system to be run. The thing to note is that this system has a big connection between Android and Arduino in the process so that users get push notifications in real time. This is obtained from papers that have been published internationally. Safety and comfort are important factors for the purpose of making a visitor tracking system.

Android applications are able to provide access to various libraries and tools that are useful for use in building rich applications. Android also has a complete set of tools to provide developers with high productivity and insight into their deep applications [2]. The system programming hardware is called Arduino. The microcontroller is programmed using the Arduino programming language which has a syntax similarity with the C programming language. Basically, it creates a way of handling input and producing output as needed. open hardware aimed at anyone who wants to create a prototype of interactive electronic equipment based on hardware and software that is flexible and easy to use [3]. Nowadays, the majority of mobile phone usage is 'smartphones', which provide more sophisticated capabilities in connectivity issues than ordinary cellphones. According to an investigation by ABI
Research, at the end of 2013, 1.4 billion smartphones had been used: 798 million were running Android, 294 million were running Apple iOS, and 45 million were running Windows Phone [4]. Smartphones can make data access everywhere, provide computer mobility, and broad intelligence that is used almost every aspect of business processes by everyone [5]. Content delivery on smartphones enables intervention while traveling through push notifications that can be sent in real-time to users or when certain intervention content is needed [6,7]. Many visitor tracking systems have been developed to find out and assist in monitoring or overseeing the situation and activities that occur at the location that is attached to the system. Based on previous research, there is already a system created to convey information about visitors to a place using services such as email and SMS. However, these services are less effective in providing information. It is because there are several constraints that have among them, namely, users forget to open emails that inform visitors. By using SMS the user can be informed of visitor information but will be charged a fee and if there is a problem on the network the system cannot automatically resend the message that has been sent [8-10]. In this study, the system will use push notification to send real-time visitor information to users using Arduino and WiFi networks [11].

This research was analyzed from several papers. The thing analyzed is the occurrence of notifications in real-time from Arduino to Android via a WiFi connection. Therefore, the purpose and purpose of this study is monitoring visitors who come to a place and it is hoped that this system can help increase the level of security to provide a sense of security to users. The recommended method is a number of papers related to this study.

2. Method
In this study, the system development method used was obtained from the results of the analysis taken by several studies.

2.1 General System Design
The general design of this system is a series of Arduino microcontrollers, which have a PIR sensor, 16x2 LCD and Bread Board. Arduino processed the data obtained from the PIR sensor and then display it on the LCD 16x2 as a form of notification when someone passes the sensor, then after processing the data, Arduino will send a notification via a WiFi connection to the user's android smartphone.

![Figure 1. General System Design](image)

This system is used to monitor every visitor who comes to a place, the PIR sensor is used to detect something that passes through the sensor then sends it to the Arduino microcontroller and is processed into a notification sent to the user's android smartphone via a WiFi connection. This condition is done to provide notice to the user in real time if something passes through the sensor, this will have an impact on increasing the level of security of a place [12].
2.2 Software Design

The design and manufacture of software for processing analogue signals into digital data that is displayed on the LCD, then the data will be sent to the user’s Android smartphone using a WiFi network. The software used to program Arduino is the Arduino IDE Application, the programming language used in the Arduino IDE is C++ [12,13].

![Software Design Diagram](image)

**Figure 2. Software Design**

The visitor tracking system developed in this project is based on the SDLC (Systems Development Life Cycle) Methodology as shown in Figure 4. About the system development life cycle. SDLC is a development that functions as a device for identifying software [14,15]. This study used the SDLC (System Development Life Cycle) model because with this model the system phase will be carried out in stages starting from planning, analysis, design, implementation, and maintenance [11]. The workflow process for the SDLC model is as follows:

![System Development Life Cycle Chart](image)

**Figure 3. System Development Life Cycle Chart**
The following is a description of Figure 3. About the system development life cycle:

Planning:
The initial stage of the SDLC which describes the purpose of the application made, contains the strategy and plans everything related to the application to be made. Planning is the most important thing because without planning it will not be directed.

Analysis:
At this stage it is an activity, activity and design process and summarizes the raw data in order to know what will be done in the process stage.

Design: to create, think and design an application to be made

Implementation:
Process to ensure the implementation of an application

Maintenance: After the application is released there must be a maintenance system and the addition of new features so that the application can be demanded by many consumers.

3. Results and Discussion
The hardware created connected via a WiFi network to communicate with the user's smartphone. To perform the communication, Push-Notification will be used so that the user can know in real-time if something moves past the sensor on the hardware. On the hardware, there is an LCD to display the results of the motion detected by the sensor.

3.1 Motion Detection Testing
The system designed in this study is a visitor monitoring system that will detect motion and provide push Notifications. The system is based on motion detection done by the PIR sensor, then the Arduino will send push notifications to the Android smartphone using a real-time WiFi network to the user [8,9].

| Table 1. PIR Sensor Testing's |
|-----------------------------|
| No            | PIR Sensors     | LCD and Notification |
|               |                 | On   | Off |
| 1             | Motion Detected | Yes  | No  |
| 2             | Motion Undetected | No   | Yes |

To enable push notifications on this system that must be done first is to connect the system on the WIFI network so that the system can send push notifications on Android smartphone users.

3.2 Objects and Distance Testing
The visitor tracking system will send push notifications when there is a human movement or object detected by the PIR sensor, at the moment, the light will turn on automatically where the PIR sensor is located. The PIR sensor aims to find out if the sensor is capable of detecting any detected movements. This study was tested using human objects and dead objects that passed through the PIR sensor [9].

| Table 2. Objects Tested Result |
|-----------------------------|
| Object             | Sensor Status  | Detected | Accuracy |
| Human              | Active         | Yes      | 100%     |
| Inanimate objects  | Non-Active     | No       | 0%       |

Based on Table 2 above can be seen that the PIR sensor can detect humans because of the thermal temperature that belongs to humans and the sensor does not detect dead objects [10].
Table 3. Distance Detection Test Results

| Distance Detection Test | Detection | Explanation | Time Range Of Push Notifications |
|-------------------------|-----------|-------------|----------------------------------|
| 50 cm                   | Yes       | Detected    | 4 seconds                        |
| 100 cm                  | Yes       | Detected    | 2 seconds                        |
| 200 cm                  | Yes       | Detected    | 2 seconds                        |
| 300 cm                  | Yes       | Detected    | 3 seconds                        |
| 400 cm                  | Yes       | Detected    | 4 seconds                        |
| 500 cm                  | No        | Undetected  | -                                |
| 600 cm                  | No        | Undetected  | -                                |
| 700 cm                  | No        | Undetected  | -                                |

3.3 Notification Pages
Notification pages are pages that show all notifications that come in to users when something passes through the tool. The tool will automatically send notifications to users in the form of push-notifications. When the notification is received, the user can see the notification details [16].

4. Conclusion
This system used smartphones and Arduino microcontrollers to monitor the movements that occur at the entrance of the place and in real-time provide responses to users and for data, communication using a WiFi network. A successfully moved system that passes through the device and is sent to the user. The internet connection is very important in using the system. Further development in order to be able to add CCTV to the device to find out something is happening and put the tool in a more effective position.

References
[1] Holla S and Mahima M K, 2012 Android Based Mobile Applications Development And Its Security Int. J. Comput. Trends Technol. 3(3) p. 486–490.
[2] R. Yoele, A Bramhankar S M D. Wani M M A M M P, 2015 Smart Phone Controlled Robot Using ATMEGA328 Microcontroller Int. J. Innov. Res. Comput. Commun. Eng. 03(01), p. 352–356.
[3] Naing M and Hlaing N N S, 2019 Arduino Based Smart Home Automation System Int. J. Trend Sci. Res. Dev. 3(4), p. 276–280.
[4] Lia Kamelia, Alfni Noorhussanah S.R, Mada Sanjaya and W.S. E M, 2016 Door-Automation System Using Bluetooth-Based Android For Mobile Phone ARPJ J. Eng. Appl. Sci. ©2006-2014 9(10) p. 1759–1762.
[5] Rosslin J R and Tai-hoon K, 2010 Applications, Systems and Methods in Smart Home Technology : A Review Int. J. Adv. Sci. Technol. 15 p. 37–48.
[6] Ben-Zeev D Schueller S M Begale M Duffecy J Kane J M and Mohr D C, 2015 Strategies for mHealth Research: Lessons from 3 Mobile Intervention Studies Adm. Policy Ment. Heal. Ment. Heal. Serv. Res.
[7] Morrison L G et al., 2017 The Effect Of Timing And Frequency Of Push Notifications On Usage of A Smartphone-Based Stress Management Intervention: An Exploratory Trial PLoS One 12(1) pp.1-15.
[8] Jusoh M H Jamali M F Bin Abidin A F B Z Sulaiman A A and Hussin M F, 2015 Wi-Fi and GSM Based Motion Sensor for Home Security System Application IOP Conf. Ser. Mater. Sci. Eng. 99(1) p. 1–7.
[9] Munawir Ihsan A and Mutia E, 2019 Wi-Fi and GSM Based Motion Detection in Smart Home Security System IOP Conf. Ser. Mater. Sci. Eng. 536(1), p. 1–8.
[10] Darmawan E and Taufan R, 2019 Space Security System Using Motion Sensor and Notification of Short Message Service with Arduino-Based Fuzzy Logic Algorithm J. Phys. Conf. Ser. 117(1), p. 1–7.
[11] Syazlina Mohd Soleh S S Som M M Abd Wahab M H Mustapha A Othman N A and Saringat M Z, 2019 Arduino-Based Wireless Motion Detecting System IEEE Conf. Open Syst. ICOS 2018 1(18) p. 71–75.

[12] Mulyana Y and Hakim D L, 2018 Prototype of Water Turbidity Monitoring System IOP Conf. Ser. Mater. Sci. Eng. 384(1) p. 1–6.

[13] Mohamad Ishak D N F Abdul Jamil M M and Ambar R, 2017 Arduino Based Infant Monitoring System IOP Conf. Ser. Mater. Sci. Eng. 226(1), p. 0–6.

[14] Sarker I H Faruque F Hossen U and Rahman A, 2015 A Survey Of Software Development Process Models In Software Engineering Int. J. Softw. Eng. its Appl. 9(11), p. 55–70.

[15] Mishra A and Dubey D, 2013 A Comparative Study of Different Software Development Life Cycle Models in Different Scenarios Int. J. Adv. Res. Comput. Sci. Manag. Stud. 1(5), p. 2321–7782.

[16] Warandi H A and Wirawan P W, 2019 Mobile-Based Sensor Notification Application J. Phys. Conf. Ser. IOP Pabl. 121(1), p. 1–5.