Eco Friendly Emergency Alert System (EFEAS) based on microcontroller and android application

Muhammad Edo Syahputra, Daniel Patricko Hutabarat*, Santoso Budijono, Jonathan Lukas

Computer Engineering Department, Faculty of Engineering, Bina Nusantara University, Jakarta, Indonesia 11480

*Corresponding Author: dhutabarat@binus.edu

Abstract. Eco Friendly Emergency Alert System (EFEAS) is a home security system that aims to help residents to get emergency response assistance when a threat enters their home. EFEAS is developed using a microcontroller, android application and solar panel devices. Microcontroller is used to develop a main device of EFEAS that functions to activate siren, send SMS, switch electrical power from solar panels to conventional source or vice versa, and communicate with an android smartphone. Android application is developed and used to connect the android smartphone to the system. This system will activate sirene, send alerts and the location of the house when the panic button pushed by the user. With the implementation of this system residents are expected to be able to get faster handling when there are hazardous conditions in the house. This system developed can achieve the objective of being able to be operated using an Android smartphone to control all components within the system with 100% successful rate to send SMS within 13 seconds and 100% successful rate to switch between solar panel and adaptor.

Keywords: Home security system, Panic button, Arduino Uno, ESP8266, Android Application

1. Introduction

During 2015-2017 crime rates tend to increase including home burglary. In 2015, the number of crimes was 352,936 crimes and increased to 357,197 in 2016. In 2017, the number of crimes decreased but the number was still high at 336,652 crimes [1]. Some of the crimes that have occurred have led to the killing of residents of the house who spotted the crime. [2].

Home security equipment is currently widely sold in the market and has sophisticated functions. One of the home security equipment on the market is CCTV. Many functions can be performed by CCTV where the main function is to carry out monitoring and recording. The problem associated with home security equipment at this time is the absence of a manual function that can be used to turn on an alarm if the occupant sees a threat coming into the house. In addition, CCTV is also unable to provide notification to the authorities so that emergency response cannot be done immediately and residents of the house have to deal with those who will threaten its security.
Currently there are many studies on smart home security systems that use Arduino as a microcontroller [3 - 5] and android applications as its monitoring systems [6 - 8]. From research on smart home security systems it can be seen that there are various technologies used to establish connections between the devices such as GSM [9 - 10], WiFi and internet [11 - 12], Wireless Sensor Sensors [13], etc. In this study, EFEAS is developed using Arduino, ESP8266, SIM900L, solar panel devices and android application. Arduino as the main microcontroller will be connected to ESP8266, SIM900L, siren and power supply. ESP8266 as access point will connect smartphone to the microcontroller through the android application developed. Panic button as the application developed will be used for user registration, network setup, and mainly for activate siren and send alert through SIM900L when users press the panic button on their smart phone. To power the device, solar panels will be used as the main source for reducing the use of conventional electricity and support the energy sustainability. The power system will be switch from solar panel to conventional electricity and vice versa based on certain limit.

2. Research Method

The network design for the system developed in this research is shown in Figure 1. The transmission of data from smartphone to the EFEAS device is transmitted over TCP by using the local Wi-fi network. The smartphone will send a string data contains three phone numbers to the device and ask the device to activate the siren and send three sms to the authorized person through SIM800L by using cellular network.

Block diagram of the system can be seen in Figure 2. The system consists of three parts, power supply, microcontroller, and user. Power supply consists of solar panel, adaptor, and battery as provider of electricity of the system. Microcontroller consists of Arduino UNO and ESP8266. The function of Arduino Uno is the main controller that communicates to SIM900L and siren while ESP8266 is the bridge to the Wifi network that connect android smartphone with the microcontroller. User use panic button application that is installed in the smartphone to send data to the system and activate SIM900L to send three messages and siren as its output.

![Figure 1. Network Communication Design](image)
Figure 2. Block Diagram of System

The flowchart and the main page of the panic button application can be seen in Figure 3 and Figure 4 while the EFEAS device can be seen in Figure 5. The application developed consists of a main page that corresponds to the panic button and a setting button to configure address, port number and the authorized recipient numbers.

Figure 3. Flowchart of Panic Button Application
### 3. Result and Analysis

In this research, several tests have been conducted to measure the reliability of the developed system. The first test is conducted to see the respond of system to activate the alarm and send SMS after the panic button is pressed by user. The result of the test can be seen in Table 1.

#### Table 1. Reliability of The System to Activate Alarm and Sending SMS

| Trial | Count of panic button pressed | Alarm active | Recipient 1 (seconds) | Recipient 2 (seconds) | Recipient 3 (seconds) | SMS content |
|-------|-------------------------------|--------------|-----------------------|-----------------------|-----------------------|-------------|
| 1     | 1                             | Yes          | 17                    | 20                    | 20                    |             |
| 2     | 1                             | Yes          | 11                    | 11                    | 12                    |             |
| 3     | 1                             | Yes          | 7                     | 18                    | 18                    | Need Help!! |
| 4     | 1                             | Yes          | 10                    | 12                    | 20                    |             |
| 5     | 1                             | Yes          | 13                    | 14                    | 16                    | Blok B No.1 |
| 6     | 1                             | Yes          | 8                     | 10                    | 9                     | coordinate :
| 7     | 1                             | Yes          | 15                    | 16                    | 15                    | 6.2014308,106.782028 |
| 8     | 1                             | Yes          | 6                     | 13                    | 17                    | 9           |
| 9     | 1                             | Yes          | 13                    | 13                    | 13                    |             |
| 10    | 1                             | Yes          | 6                     | 7                     | 7                     |             |
|       | Average / SMS                  |              | 10.6                  | 13.7                  | 14.7                  |             |
|       | Average of all 3 recipients    |              | 13 seconds            |                       |                       |             |

The second test involves testing on the switching system between solar panel and adaptor. This test conducted by running the system where solar panel and adaptor is active for 24 hours. Between these two sources it can be known which source is charging the battery by seeing the LCD on the charger controller. The value of voltage and current indicates whether solar panel or adaptor is active.
to charge the battery. During this test, the system is able to switch from solar panel to adaptor when the output of solar panel reached less than 5.6 Volt and switch again to solar panel after it reach more than 5.6 Volt as can be seen in Table 2.

### Table 2. Power Supply Switching

| Time  | Output of solar panel (Volt/Ampere) | Output of adaptor (Volt/Ampere) | Display on LCD of charger controller | Information          |
|-------|-------------------------------------|---------------------------------|--------------------------------------|----------------------|
| 9:00  | 8.8/0.42                           | 12/1.9                          | 8.8/0.42                             | Solar panel active   |
| 10:00 | 8.9/0.45                           | 12/1.9                          | 8.9/0.47                             | Solar panel active   |
| 11:00 | 9.2/0.45                           | 12/1.9                          | 9.2/0.47                             | Solar panel active   |
| 12:00 | 11.7/0.47                          | 12/1.9                          | 11.7/0.45                            | Solar panel active   |
| 13:00 | 11.8/0.47                          | 12/1.9                          | 11.8/0.45                            | Solar panel active   |
| 14:00 | 11.75/0.47                         | 12/1.9                          | 11.75/0.42                           | Solar panel active   |
| 15:00 | 5.6/0.32                           | 12/1.9                          | 5.6/0.45                             | Solar panel active   |
| 16:00 | 4.36/0.28                          | 12/1.9                          | 12/1.9                               | Adaptor active       |
| 17:00 | 2.8/0.14                           | 12/1.9                          | 12/1.9                               | Adaptor active       |
| 18:00 | 1.2/0.08                           | 12/1.9                          | 12/1.9                               | Adaptor active       |
| 07:00 | 5.3/0.42                           | 12/1.9                          | 12/1.9                               | Adaptor active       |
| 08:00 | 7.2/0.42                           | 12/1.9                          | 12/1.9                               | Solar panel active   |
| 09:00 | 8.5/0.45                           | 12/1.9                          | 12/1.9                               | Solar panel active   |

### 4. Conclusion
The EFEAS works very well which is indicated by the reliability test of the panic button application to activate alarm and send SMS to the recipients. The switching system developed also works well it can automatically switch from solar panel to adaptor and vice versa. It also can be seen that the power supply system developed can supply the EFEAS device for 24 hours.

### References

[1] Badan Pusat Statistik 2018 Statistik Kriminal 2018 Retrieved from [https://www.bps.go.id/publication/2018/12/26/89c06f465f944f3be39006a1/statistik-kriminal-2018.html](https://www.bps.go.id/publication/2018/12/26/89c06f465f944f3be39006a1/statistik-kriminal-2018.html)

[2] Wijaya LD 2019 Punya Senjata Api, Polisi: Pencuri Tak Ragu Tembak Penghalangnya. Arjanto, D (Ed.) Retrieved from [https://metro.tempo.co/read/1171816/punya-senjata-api-polisi-pencuri-tak-ragu-tembak-penghalangnya](https://metro.tempo.co/read/1171816/punya-senjata-api-polisi-pencuri-tak-ragu-tembak-penghalangnya)

[3] ViswanathaV, Venkata Siva RR and Ashwini KP 2018 Multilevel Home Security System using Arduino & GSM Journal for Research 4(10) 1-6

[4] Thakur S, Verma M and Sahu L 2018 Security System using Arduino Microcontroller International Research Journal of Engineering and Technology 5(4) 3124-3127

[5] Kumar BS and Ramesh S 2017 Burglar System using Arduino and PIR Sensor with SMS Alert International Journal of Current Engineering & Scientific Research 4(12) 16-22

[6] Shafana ARF and Aridharsan A2017 Android based Automation and Security System for Smart Homes International Journal of Computer Science and Information Technology Research 5(3), 26-30.
[7] Bolaji AQ, Kamaldeen RA, Samson OF, Abdullahi AT and Abubakar SK 2017 A Digitalized Smart Home Automation and Security System via Bluetooth/Wi-Fi using Android Platform International Journal of Information and Communication Sciences 2(6), 93-99
[8] Chandramohan J, Nagarajan R, Sateeshkumar K, Ajithkumar N, Gopinath PA and Ranjithkumar S 2015 Intelligent Smart Home Automation and Security System Using Arduino and Wi-Fi International Journal of Engineering & Computer Science 6(3) 20694-20698.
[9] Seosa O and Promise E 2014 GSM Based Intelligent Home Security for Intrusion Detection International Journal of Engineering and Technology 4(10), 595-605.
[10] Parab AS, and Joglekar A 2015 Implementation of Home Security System using GSM Module and Microcontroller International Journal of Computer Science & Information Technologies 6(3), 2950 – 2953.
[11] Kodali RK, Jain V, Bose S and Boppana L 2017 IoT Based Smart Security and Home Automation System International Conference on Computing, Communication and Automation System 1286-1289. DOI: 10.1109/CCAA.2016.7813916
[12] Hutabarat DP, Budijono S, Saleh R 2018 Development of home security system using ESP8266 and android smartphone as the monitoring tool IOP Conf. Series: Earth and Environmental Science 195(1) 012065. doi:10.1088/1755-1315/195/1/012065
[13] Anitha A 2017 Home Security System Using Internet of Things IOP Conf. Series: Material Science and Engineering 263 042026. doi:10.1088/1757-899X/263/4/042026