

A Simulation Approach to IoT Based Safety Keychain Device Using Proteus Software

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Abstract: Nowadays there are many crimes like theft, robbery, rape cases, murder and others. These cases especially theft and rape are common among women. Hence, this project introduces a safety device for women which is easy to use and portable. This project aims at designing an IoT based safety device that relies on providing security to women. The applications used for this project consist of Proteus and Blynk app. The system is using Neo-6 GPS module with antenna as GPS tracker to track the location of the device. Arduino Uno replaces NodeMCU as the main controller that connects GPS tracker and push button to the Blynk app. The system works when an individual is in an emergency, they will press the switch on the device and automatically the light from the LED will turn on and the buzzer will make a sound and act as an alarm system. Blynk app is used to map location and send notification to immediate receivers in the form of blynk notification, email and twitter.

Keywords: IoT, NodeMCU, Arduino, Blynk, GPS tracker, Buzzer

1. Introduction

According to crime statistic shown in Figure 1, peak cases appeared in 2006 to 2009 where index cases reported to the police were more than 250,000. Every year, there will be an alarming rate of reports on sexual harassment towards women. Figure 2 shows the number of rape cases in 2,000 until 2017 in Malaysia. It has recorded 3,000 above cases from rape cases in 2009 and the next years the number are decreasing but still significant [2]. Both records of data show equally that 2009 was the highest year of crime cases [1][2]. Mostly, this thing happens at damp area, an alley or a crowded area. It has come to extend that the women would get used to her being harassed on a daily and that is never a good thing.

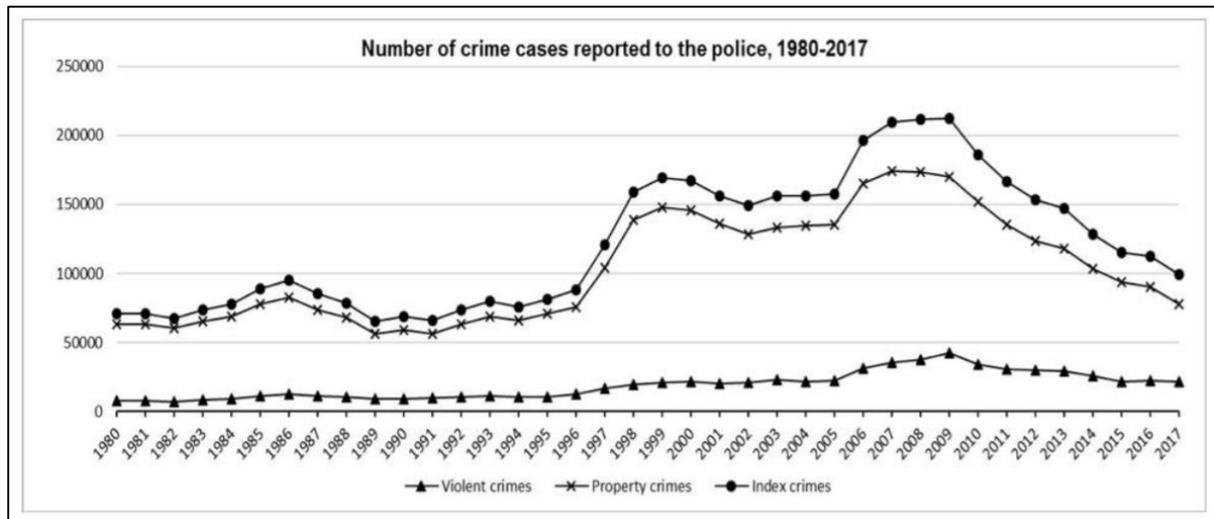


Figure 1: Crime statistics, Malaysia 1980-2017 [1]

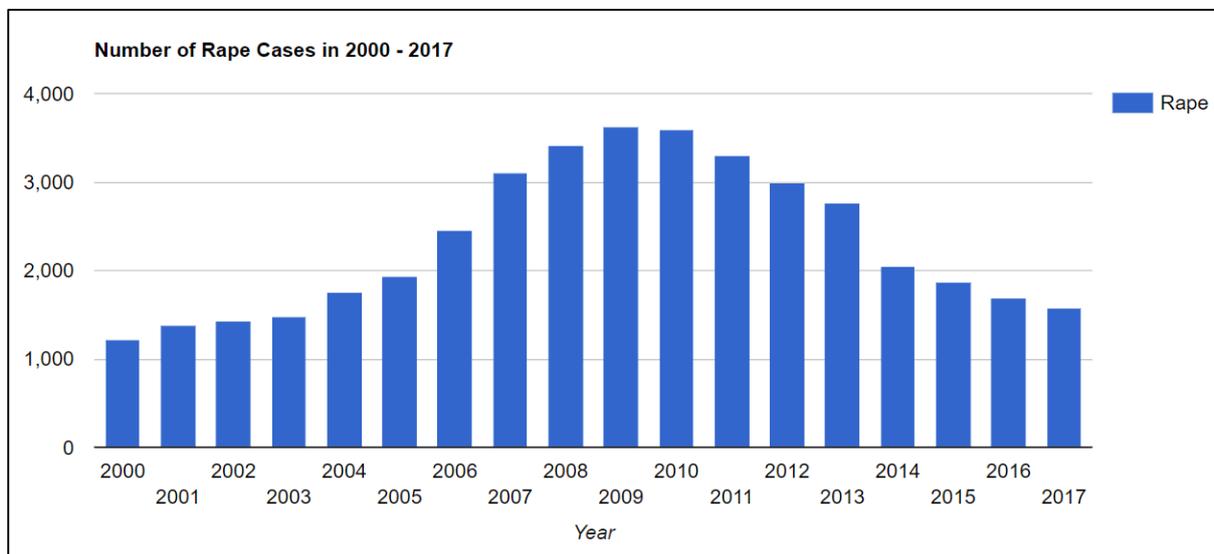


Figure 2: Women rape statistics, Malaysia 2000-2017 [2]

There have been many studies performed to improve the system of security and how to track location using Smartphone device such as the study in. This study is focuses on portable GPS and resulting GPS track logs have recently been used to fill in part of this knowledge gap. This Project form a system that provides a detection likelihood map that estimates the probability that each point in a search area was seen well enough to detect the search object if it was there [3]. In [4], the GPS data will be sent to the web server which will be then stored into the database. In the case of a button press, the device will also send images to the server which will be then displayed in the mobile app. The web server will further send a notification to the mobile app in case of a button press, signifying an emergency situation. The monitoring device, in either case will retrieve the GPS coordinates from the database for the particular device ID and locate the person on Google Maps also suggesting the fastest route to that location as well [4]. A study in [5] uses GSM to send coordinates detected by GPS to a device in order to pinpoint location of trapped victims in an earthquake. GSM requires no internet connectivity hence a preferred choice for certain situation. This is noted in [6], whereby a smartphone is utilized to get estimated position of a victim. Among the radio chips in a smartphone, GSM has the highest probability to be turned on. It also has a long range which makes it the most desirable radio frequency to use in a SAR system. The positions of the mobile agents are determined using the GPS unit on the smartphones.

This project introduces a safety device for women ideally in the form of a keychain that is highly portable. The aim for this project is for women to have an outlet to inform others when they are in danger. Usually victims may be dragged to remote locations with no crowd hence a device that can be activated as soon as possible to alert others is indeed would be very helpful. It can give peace of mind and let them know someone will always be there in case of an emergency. The scope of the project is focused on the software and simulations development for technical and engineering application which complies with the standard and technical needs. For the software and simulations, this project uses Proteus Professional 8.9, Arduino IDE and Blynk App to develop the coding, local server and project simulations. For the electrical components, this project mainly use Arduino uno, GPS Module, Buzzer and Push Button. This project helped to enhance the safety among women in general. This device is capable to track location and send notification using IoT. The location tracking function allows family members and friends to track down the user. The emergency alarm button will help to alert the surroundings / crowd. The notification system is a powerful tool that can be used by the user to notify her family members and friends that she is in emergency situation and needs immediate help.

2. Materials and Methods

The simulation approach taken by this project is done using Proteus simulation software. For this project, an Arduino uno is used instead of NodeMCU due to lack of library support. Arduino as the main controller that connects both GPS sensor and emergency button to the Blynk app and buzzer. A Blynk local server and virtual serial port is created so the Blynk app is able to communicate with the proteus software. The block diagram in Figure 3 shows the concept of this project simulation.

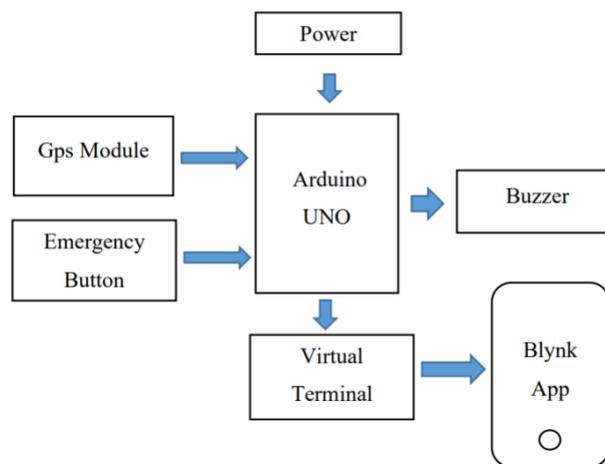


Figure 3: Block diagram of IoT based safety keychain device

2.1 Coding flowchart

The flowchart in Figure 4 shows how the safety keychain device operates. The device system will function when the emergency button is pressed. When the emergency button is pressed, the red LED will turn on and the buzzer would also be turned on hence making a sound that will then act as an alarm to alert the surrounding people or crowd for immediate attention. It will also send an email and a notification that has a message that is declared in the coding to close family members or friends' devices that have the specific Blynk account. The GPS will trace the location and the location will be mapped in the Blynk app.

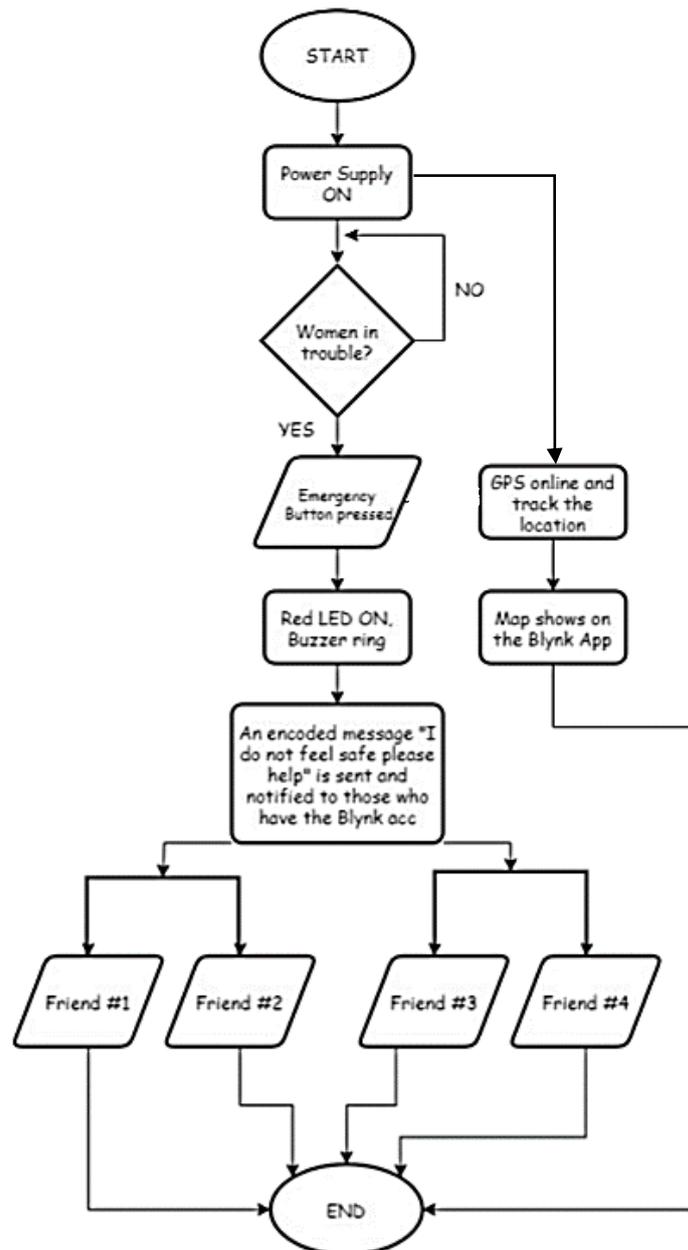


Figure 4: Coding flowchart

2.2 Proteus simulation circuit and Blynk app

Figure 5 shows the safety keychain circuit constructed in Proteus software and the Blynk app interface. COMPIM is needed to allow virtual connection between Blynk app and Proteus simulation circuit. The virtual connection allows Arduino to send GPS location and also push button status (pressed or released) to the Blynk app. The push button status is displayed by an LED widget in Blynk app, red LED is displayed when pressed. Meanwhile the buzzer is connected to Arduino only. An LED is also added at the Arduino circuit as an indicator for push button status.

The Blynk app is also equipped with map widget, e-mail widget, notification widget and twitter widget. Several options for notification is included to increase the chances of immediate attention and help from notified receivers.

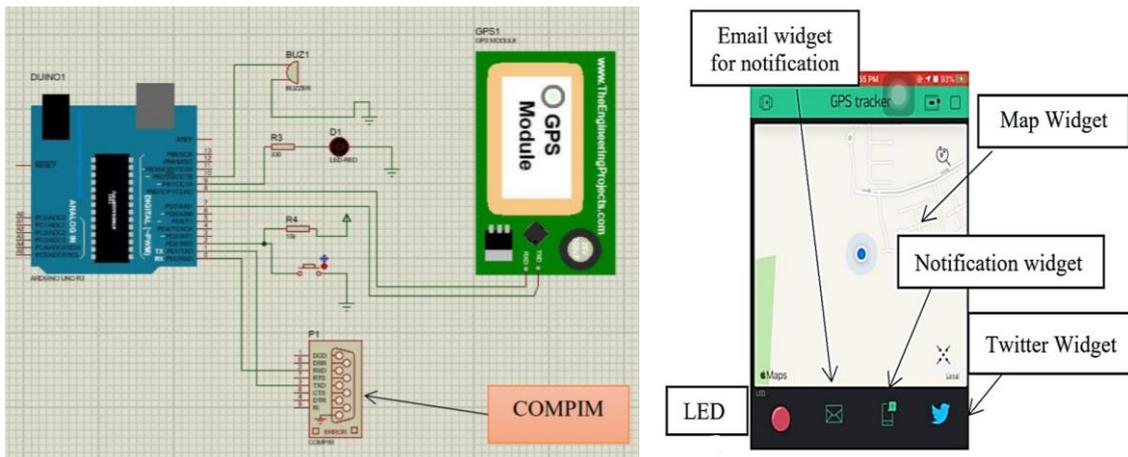


Figure 5: Safety keychain simulation circuit in Proteus and Blynk app interface

Figure 6 shows the earlier part of the Arduino coding. Several libraries are required to ensure the components are defined properly. The libraries are Blynk library, SoftwareSerial library and the GPS library. In order to pair the Arduino and Blynk app project, an authentication code that is specific to the Blynk app project must be declared as char auth.

```
#include <BlynkSimpleStream.h>
#include <SoftwareSerial.h>
#include <TinyGPS++.h>
int button = 2;
int LED = 9;
int buzzer = 10;
char auth[] = "hg27Y9z5_bwKnNiNY074iBEHfZMrGSPQ";
```

Figure 6: Arduino coding

2.3 Virtual Serial Port

A virtual serial port software is needed to allow communication between the Proteus simulation circuit via COMPIM to the Blynk app. Local bridge is created and COM port is assigned accordingly. In this project, COM port 1 is assigned to Blynk local server and COM port 2 to COMPIM and Arduino. The interface of the virtual serial port is shown in Figure 7.

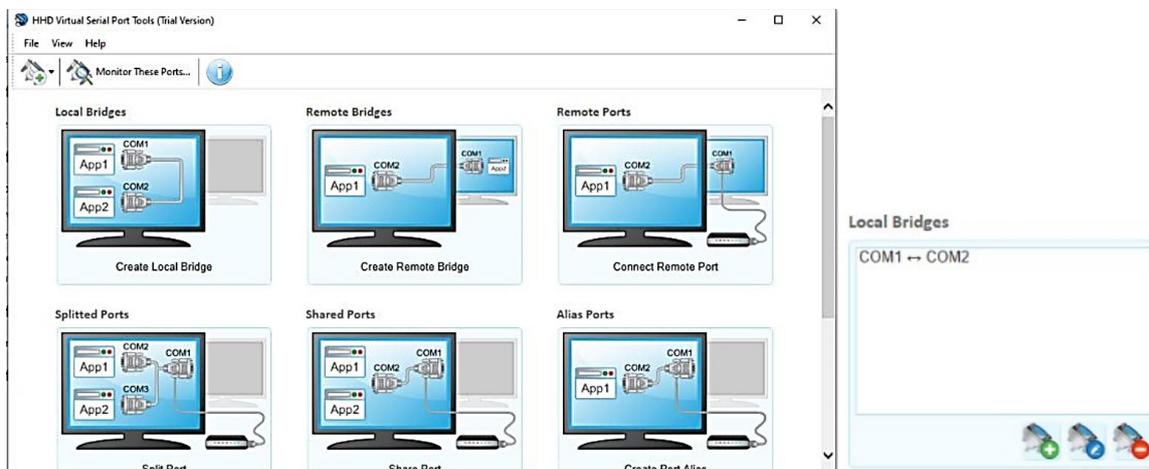


Figure 7: Virtual serial port

2.4 Blynk local server

A local server must be created to store and deliver the data received from the Arduino to the Blynk app. In order to create a local server, a JAVA jdk file and the latest Blynk server is installed. After that the IP address of the device is obtained so it can be put in the Blynk server file as `SERV_ADDR` and change the `COMM_PORT` as `COM1` as seen in Figure 8.



```

blynk-ser - Notepad
File Edit Format View Help
Echo off
setlocal EnableDelayedExpansion

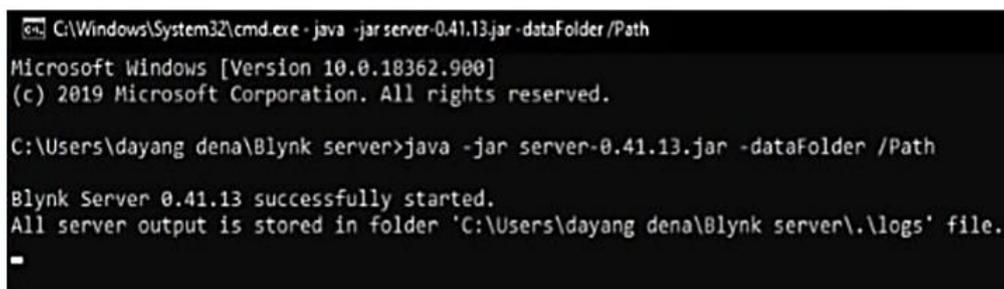
REM === Edit these lines to match your need ===

set COMM_PORT=COM1
set COMM_BAUD=9600
set SERV_ADDR=192.168.68.111
set SERV_PORT=80

```

Figure 8: Blynk local server configuration

Figure 9 shows how to start the local server. A specific command is written in command prompt which is `java -jar server-0.41.13.jar -dataFolder /Path`. This step has to be completed before the simulation in Proteus can be initiated.



```

C:\Windows\System32\cmd.exe - java -jar server-0.41.13.jar -dataFolder /Path
Microsoft Windows [Version 10.0.18362.900]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\dayang dena\Blynk server>java -jar server-0.41.13.jar -dataFolder /Path

Blynk Server 0.41.13 successfully started.
All server output is stored in folder 'C:\Users\dayang dena\Blynk server\.\logs' file.

```

Figure 9: Blynk local server launch

3. Results and Discussion

3.1 Simulation Result in Proteus

Figure 10 shows the safety keychain circuit in simulation run mode and also the Blynk app emulator. This simulation circuit is successfully connected to the Blynk app using COMPIM, virtual serial port and the Blynk local server. As shown in Figure 10, when the push button is pressed, the LED will light up and the buzzer will turn ON. The Blynk app can be accessed on both smartphone and also via Blynk app emulator which allows Blynk app to run on personal computer. The same Blynk account can be log in at many devices hence many users can have access to the safety keychain device. Figure 11 shows COMPIM status before (left) and after (right) the Blynk app is virtually connected to the simulation circuit in Proteus.

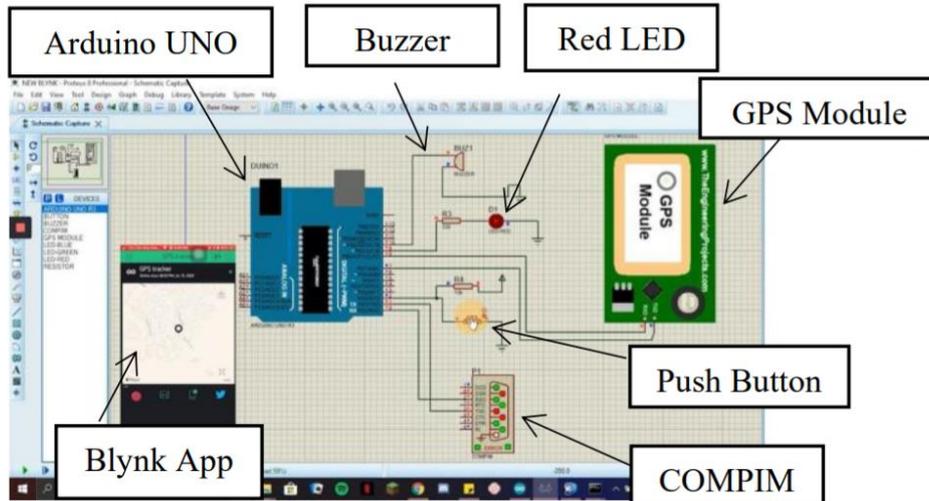


Figure 10: Proteus simulation circuit and Blynk app emulator

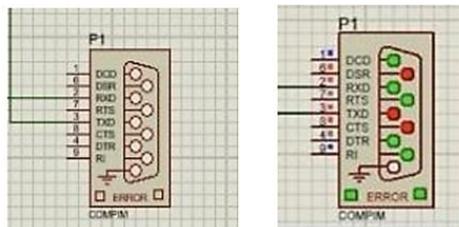


Figure 11: COMPIM status

3.2 Simulation Result in Blynk App

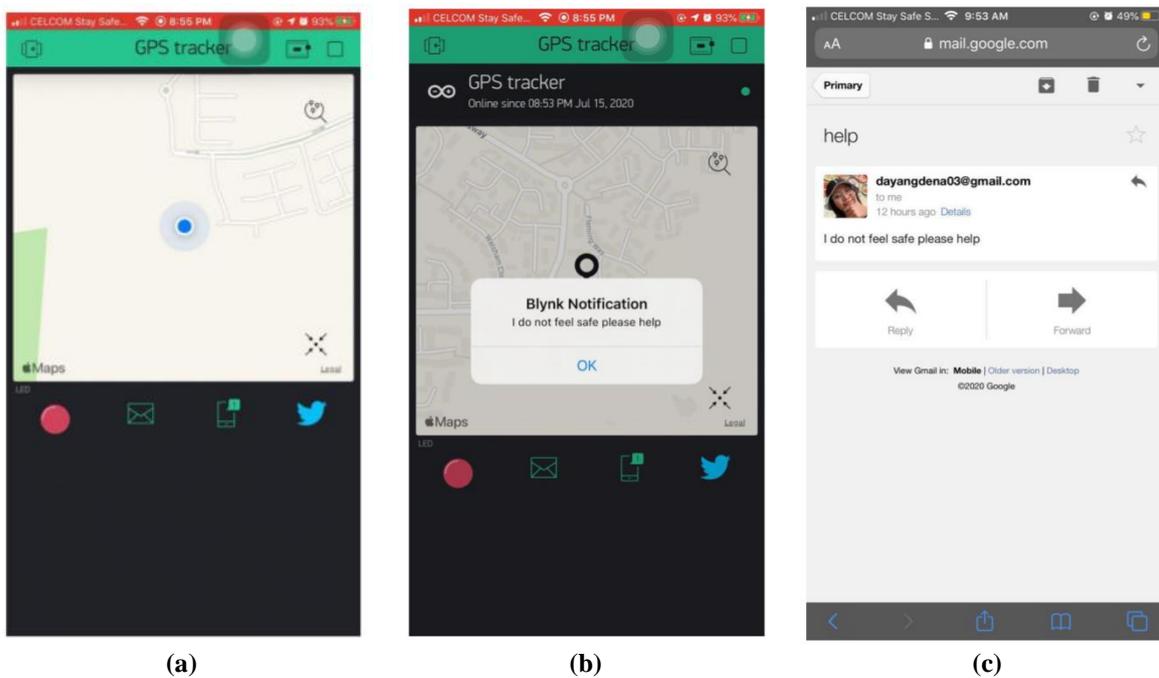


Figure 12: (a) GPS location mapped, (b) Blynk notification alert, (c) Email notification alert

Figure 12(a) shows the exact location of the safety keychain detected by the GPS tracker and displayed on the map in the Blynk app. This location is always mapped and not dependent on the push button. Figure 12(b) and 12(c) shows a notification message and email received by the receiver when push button is pressed with a dedicated message of “I do not feel safe please help”. The LED also turned to red when the push button is pressed.

The twitter widget was unable to tweet an alert post using the local server configuration. However, it can be launched successfully when the LED status is manually turned on in the Blynk app. Figure 13 shows the twitter status.



Figure 13: Twitter notification

4. Conclusion

This project has been implemented successfully via simulation approach. The simulation conducted have shown positive outcome whereby the Proteus simulation is able to communicate with the Blynk app through virtual connection. As the system goes online, the location is immediately mapped on Blynk app. When the emergency button is pressed, the LED and buzzer are turned on while on the Blynk app, a notification message is displayed and an email is sent to specified receivers. Hence connected friends and family are notified right away. A twitter post is also immediately posted online to reach a wider audience. This safety keychain concept is developed for women as a safety device that can help them whenever they feel unsafe. Multiple notification outlet is activated to increase the chances of immediate help can be delivered to the victim.

Future improvement include direct contact to local authorities representative and allows access of device location for immediate action by police and related departments. Besides, an online platform / cloud can be developed to store the location data of the user which will help authorities to analyse the location accurately. A digital camera would be a nice feature to add on to record unsafe situations for further analysis and action.

Acknowledgement

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References

- [1] Department of Statistics Malaysia (DOSM), Crime Statistics 2019, 27 November 2019, Available online: https://www.dosm.gov.my/v1/index.php/index.php?r=column/cthemByCat&cat=455&bul_i

[d=MEs4QzNxWkNZZDEyM08yM0Jsd05vQT09&menu_id=U3VPMldoYUxzVzFaYmNkWXZteGduZz09](https://doi.org/10.1109/ICSMC.2012.6377722)

- [2] Women Aid's Organization, Rape Statistics, Available online: <https://wao.org.my/rape-statistics/>
- [3] M. Roscheck and M. A. Goodrich, "Detection likelihood maps for wilderness search and rescue," *2012 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, Seoul, 2012, pp. 327-332. doi: 10.1109/ICSMC.2012.6377722
- [4] P. A. Shinde and Y. B. Mane, "Advanced vehicle monitoring and tracking system based on Raspberry Pi," *2015 IEEE 9th International Conference on Intelligent Systems and Control (ISCO)*, Coimbatore, 2015, pp.1-6, doi: 10.1109/ISCO.2015.7282250
- [5] S. Sarkar, A. Patil, A. Hartalkar and A. Wasekar, "Earthquake rescue robot: A purview to life," *2017 Second International Conference on Electrical, Computer and Communication Technologies (ICECCT)*, Coimbatore, 2017, pp. 1-7. doi: 10.1109/ICECCT.2017.8118044
- [6] J. Lim, S. Lee, G. Tewolde and J. Kwon, "Indoor localization and navigation for a mobile robot equipped with rotating ultrasonic sensors using a smartphone as the robot's brain," *2015 IEEE International Conference on Electro/Information Technology (EIT)*, Dekalb, IL, 2015, pp. 621-625, doi: 10.1109/EIT.2015.7293407