

Design and Development of Home Security Systems based on Internet of Things Via Favoriot Platform

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Abstract

Internet of Things can prove that technology has rapidly evolves. Nowadays, the usage of internet had been widely used around the world. However, as technology advanced the need for home security system using Internet of Things had becoming more crucial. However, current system used by the developers are merely too simple and focusing more on home automation system. Besides that, current home security system on the market was too expensive due to the complexity of the devices which sometimes used an expensive microcontroller or microprocessor. Therefore, a development of home security system using Internet of Things with online database server, FAVORIOT is needed. The devices will be equipped with Passive Infrared sensor and Infrared sensor. This sensors will monitor the presence of intruder and any unauthorized entry. The usage of Blynk application on this device as the main switch which can activate the device even the users are across the world. The data receive from the sensor then send to the microcontroller which has already equipped with internet module. The FAVORIOT platform will received data that can helps the user to monitor the house and sending a real-time alerts to the users. Therefore, a home security system based on Internet of Things can help the users to monitor the house even they are absent and FAVORIOT platform will help the user to receive alerts as soon as possible.

INTRODUCTION

Nowadays, technology develops and evolves rapidly. With current technology keeps on developing, some of the system has to be constantly evolving in order not to be obsolete. Many years ago, home monitoring system cannot be managed without human operation but with current technology discovery especially on Internet of Things (IoT), it had given a new face for monitoring and security system of home. By understanding the basic concept of home security using Internet of Things, the concept and its application can be explored. Once this happen, development using the technology concept is possible. Various home security system has been developed where the communication link is using Bluetooth, RFID, Android application and short message services (SMS) [2]. All of this have different approach of home security system but serve the same purpose which is to monitor the security and safety of homes.

Home security using Internet of Things focusing on the safety, security and comfort for the user to feel secure at home. New technology and devices had made people's life more comfortable and convenient [1]. Smart devices are capable to

share data intelligently and it is good to our community because the internet will be totally inclusive. Besides that, Internet of Things had made great impact on everyday life by providing better safety, saving time and monitoring health.

Academics, manufacturers, engineers and students around the whole world are seriously making Internet of Things to be part of our daily life. Malaysia not exempted from the IoT wave, as multiple sectors and professions are trying to get their hands on IoT. Agriculture, manufacturing, medical and many more could turn to IoT and advance their business as well as productivity [6]. With internet access in Malaysia is getting much faster and accessibility is wider, this factor indirectly contributing to implementation IoT. Many developers and R&D engineers could develop and deploy more IoT system in real world. Soon Malaysia will be ready and become advance country in IoT field. Ongoing technology sometime create problems that need to be solved. This can also be seen on Internet of Things as it is considered a new technology. To fulfil the current demand for high standard of living, home security using the latest system which is Internet of Things is crucial [1]. Therefore, the first problem that occurs the current system used on every household can be considered too simple. Current system in the market only provide basic switching, remote controlling which is less safety and secure. Besides that, current products or systems available focusing more on comfort rather than safety and security. Due to this, home owners are vulnerable despite they have a security system for their home. They might not aware that their home is not safe and secure [2]. Thus, can lead to many unwanted events such as unauthorised entry and burglary.

As mentioned by few verified buyers on certain home security products, the system they purchased are difficult to operate. With the functionalities of the devices are too simple, users frustrated with products that are not being user friendly. Due to this, implementing or installing a home security system is has been a disinclination to home owners.

Next, home security using Internet of Things can be consider as high-end products. The concept of home security originally consists of a product that is complex, high cost and incompatibility with existing devices [1]. This is due to the devices and type of microcontroller used which make it quite expensive. Although some products may appear cheap, but in terms of total cost of ownership (TCO) it is high. This usually happen when the users pay for the system but need constant follow up which will make it more expensive. It is advisable users and manufacturers to focus on TCO compared to product cost when comparing various products.

The reason why this paper was written because it is the current

technology and still developing. By looking at the trend, it doesn't seem IoT will obsolete in the near future. With connected devices are increasing significantly, IoT appears to be in run a long time thus making this project to integrate with IoT a justified step. Another reason is because this project can be utilized on current household regardless of locations. In general, home security using IoT can be used to avoid unwanted event such as explosion due to gas leakage, burglary and discomfort. In fact of that, this project was developed to study more on this technology in order to gain extra knowledge on current technology invented.

The inventors that play great roles in inventing home security is Marie Van Brittan and her husband, Albert Brown from New York. On 1966, Marie Van Brittan and her husband, Albert, began drafting a home security system due to the increasing of crime rate and slow response from police. One of the main concern was having to answer door to identify a visitor. With her husband knowledge on electronics, they create closed-circuit television (CCTV) system to be used for home monitoring.

The crime rate increasing over the year is one of the purpose home security system is in demand. Based on FBI statistics for 2016, it recorded increase number of murder cases compared to year 2015. Although property cases decrease slightly, the total number of cases show a rise of 4.1%. [11]

Every year there are many inventors trying to improve this technology to develop the best home security correspond with the advanced technology. But creating an absolute outstanding sensor based home security system requires high technology and methodical system which need to be connected wirelessly and ensuring a real-time operation and indication of home threat [6]. This can be seen on current home development where the idea of comfortable living had changed. Current home security focusing more on current technology trend that used digital, wireless and Internet of Things.

The concept of Internet of Things (IoT) is an idea of remotely connecting and monitoring real world object (thing) through internet [7]. The idea of combining Internet of Things in home

security is brilliant as it brings leverage. This concept of home security can be incorporated to make it smarter, safer and automated [7]. The advantages of incorporated home security that it can be accessed anywhere and monitor wirelessly.

Internet of Things (IoT) can be considered as trending concept as it currently developing more prototypes and new inventions. New inventions can explore more on Internet of Things and its benefits. Another advantage of Internet of Things is it offers more advanced connectivity of devices, system and services. This is because the connectivity is beyond machine to machine communications and can covers variety of protocols, domains and applications [8].

METHODOLOGY

The Home Security system composes of two different sensors which can monitor the home conditions. The sensors used in this paper are Passive Infrared sensor and Infrared sensor. Next, the ESPresso Lite V2.0 is used to connect all the sensors together and act as the main controller. The Blynk application is used as a switch to turn ON and OFF the device. The FAVORIOT platform is used to receive the data send from the ESPresso Lite V2.0.

Based on Figure 1, this paper used an ESPresso Lite V2 as the microcontroller. The ESPresso Lite V2 will be connected to the UC00A that will supplied a 3.3V to power up the board. As the ESPresso Lite V2 operated, it will automatically connected to the internet via build in Wi-Fi board. This microcontroller used ESP-WROOM02 as the WiFi board and send data to the FAVORIOT platform. The inputs for this project are the data from the PIR sensor and IR sensor which will monitor the home surrounding and send the data to the ESPresso Lite V2. This project will only operate when the user are not at home, thus, a 'Blynk' application will be used to act as a switch to turn the project 'ON' and 'OFF'. The OLED display will show the output for each conditions and the data is send to the webserver which is FAVORIOT. The webserver will automatically send an alert to the user via smartphone.

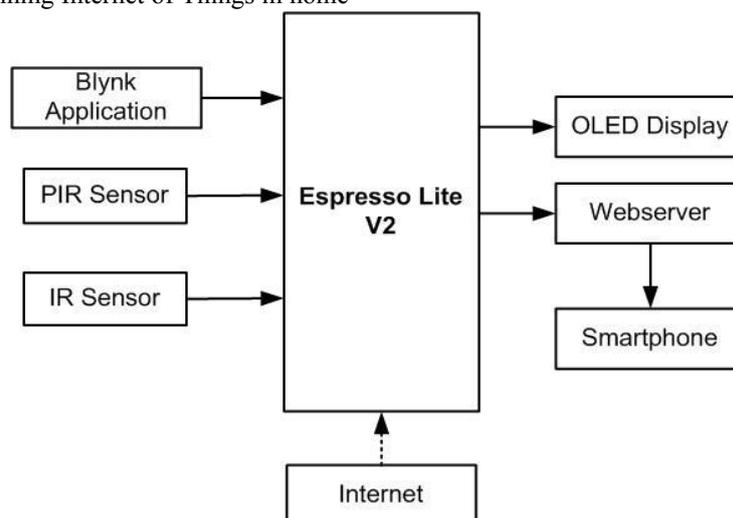


Figure 1: The block diagram of the project

Figure 2 shows the initial process of the project. It starts by connecting to the Blynk and Wi-Fi. After Wi-Fi mode was chosen, the OLED will display if the internet is connected or it will constantly searching for internet. Then, Blynk virtual switch is used to turn ON the device. If the Blynk switch is ON, it will display 'Device ON' and displayed 'Device OFF' if it turns OFF.

Firstly, it will detect if there any motion presence and at the same time, it also will monitor the door. If certain conditions were meet, the OLED will display the output. The data from the input will then be send to the platform and store in Data Stream and the graph will automatically plotted. Lastly, the platform will send alerts to the users. However, it can only send data to platform if the Blynk switch is turned ON. If the switch is turn OFF, the device will automatically turn OFF.

Figure 3 shows the continuation from Figure 2. On this figure, the sensors will read all the data if only the device is turn ON. The device will only send data if it meets certain conditions.

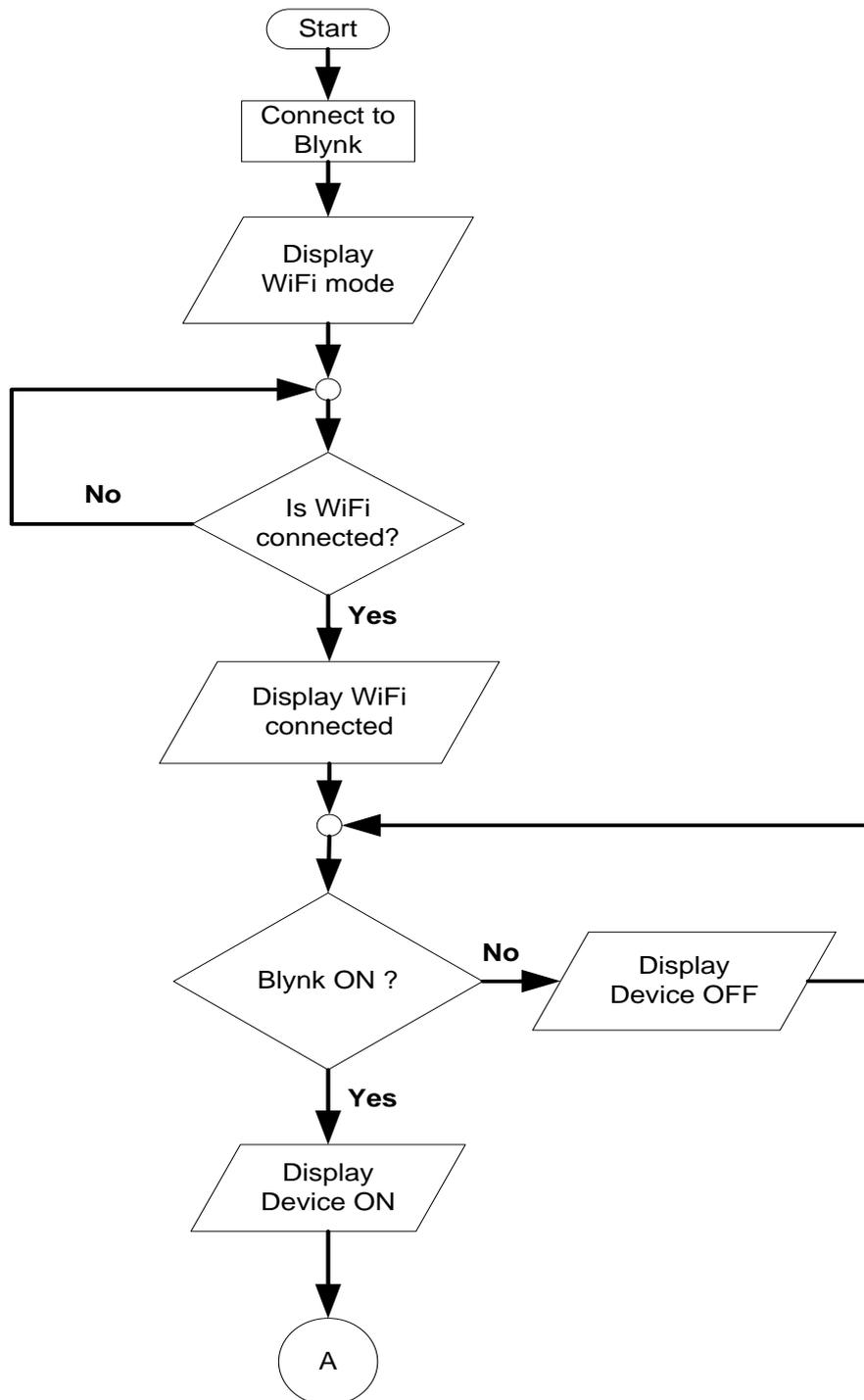


Figure 2: Flow chart of the project

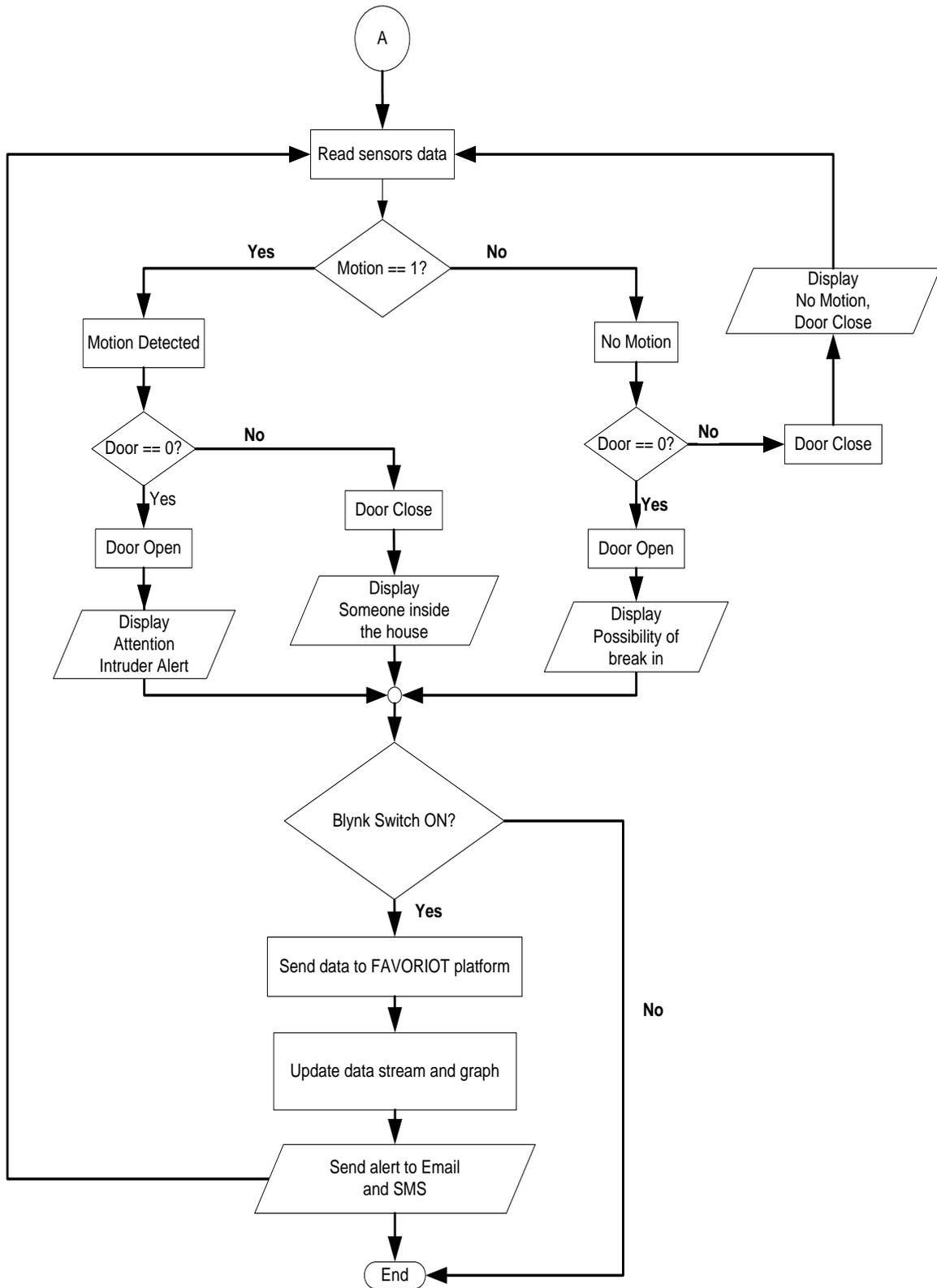


Figure 3: Flow Chart of the Project (cont.)

Figure 4 shows the circuit diagram of the project. This project uses ESPresso Lite V2.0 as the microcontroller that act as the main board which connecting every component and device used. The board will be wired with several component

including sensors, OLED and UC00A. This project also will be connected virtually by Blynk application.

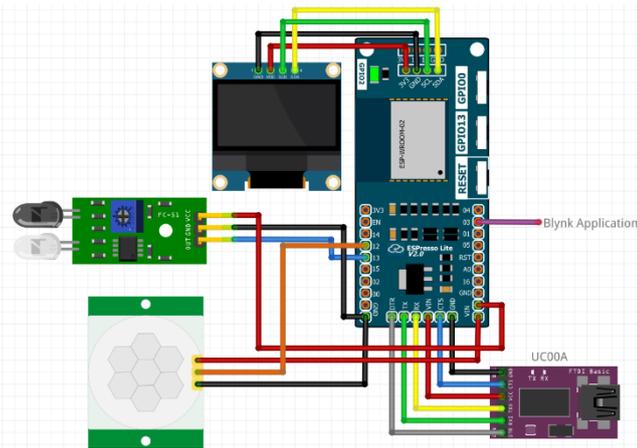


Figure 4: The circuit diagram of the project

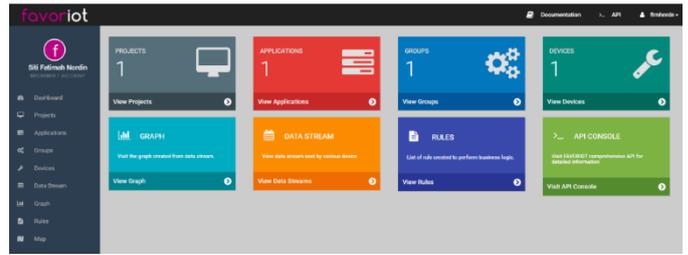


Figure 7: The dashboard of FAVORIOT platform

To manage and administer Expresso Lite microcontroller, an emulator is required. In this case, Arduino IDE being used to define variables and create lines of commands to carry out instructions. Expresso Lite device has to be connected to PC to be loaded with script via the emulator.

The FAVORIOT could played an important component in IoT in the future. Easy to use Graphic-User-Interface (GUI) also contribute to the increase number of user of FAVORIOT. Figure 5 to 9 show the tabs that must be used to create the project.

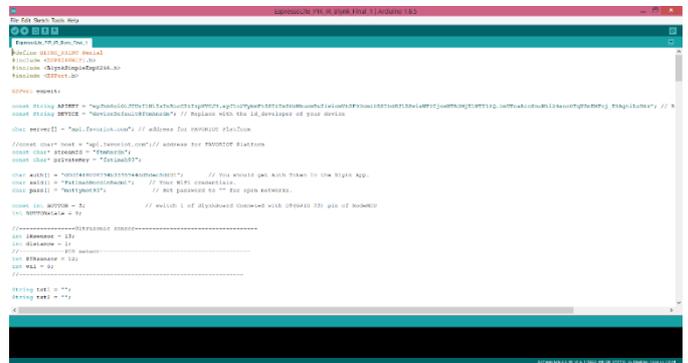


Figure 8: The interface of Arduino IDE 1.8.5

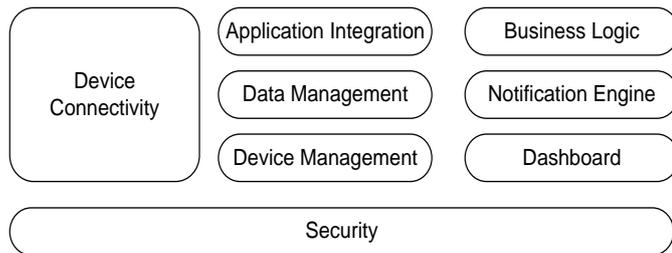


Figure 5: The building block of FAVORIOT middleware platform

Few settings on the application has to be configured in the emulator in order to make sure the application and device able to communicate and work seamlessly. All the settings can be configured at “Preferences”.

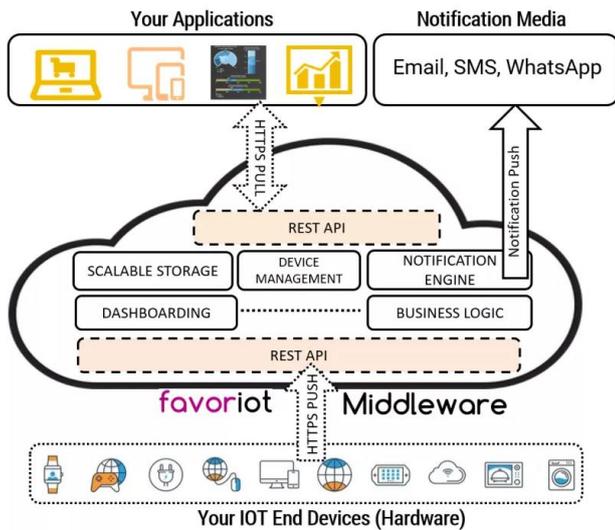


Figure 6: The role of FAVORIOT IoT middleware in an IoT projects

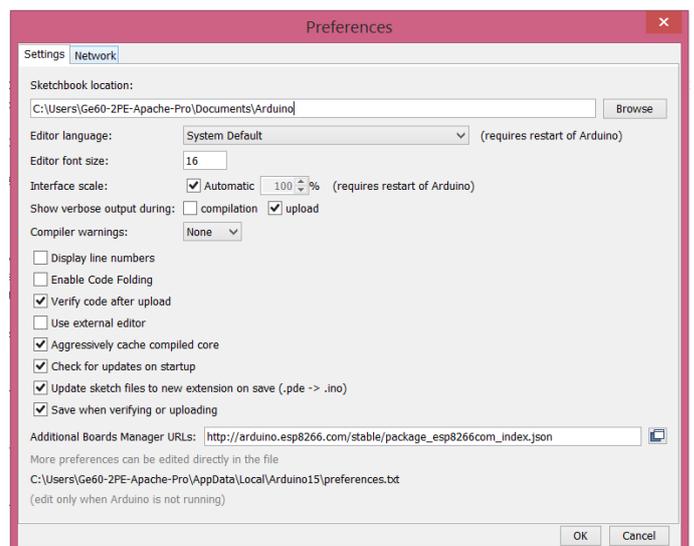


Figure 9: Preferences for installing additional board managers

Blynk is a mobile application that can communicate with Arduino devices wirelessly with a user-friendly GUI. With the compatibility on iOS and Android, it has created its fame in IoT world. In this paper, Blynk help to switch on or off the system by acting like a switch for the user. Once the user presses a virtual button on his or her phone, message will be sent over the cloud to the hardware, doing what it is supposed to do. Figure 10 sows the Blynk application.

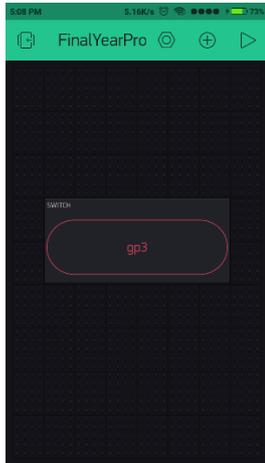


Figure 10: The interface of BLYNK

RESULTS

The project used BLYNK application that acted as a switch. It is being programmed to switch ON and OFF the project. This paper focuses on the safety of the house if users were absent. This method with help of BLYNK application will temporarily stop the process since the owner of the house is present which will decrease the possibility of unused data sent to the platform. Figure 11 and Figure 12 show the interface of BLYNK as a switch when it was ON and OFF.

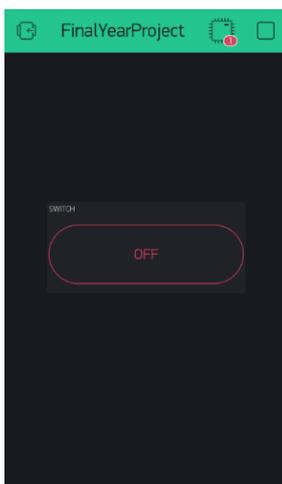


Figure 11: The switch is OFF

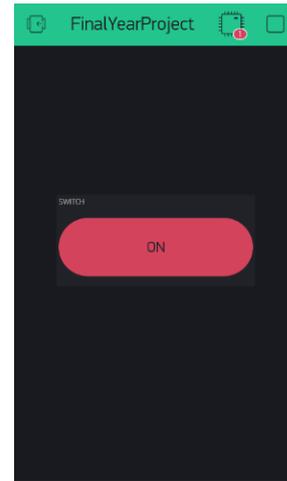


Figure 12: The switch is ON

Figure 13 shows the output produced when the switch is in OFF state. The OLED displayed 'Device OFF' that indicated that the device is not operating. Meanwhile, the OLED will display 'Device ON' after the virtual switch was switched ON based on Figure 14.



Figure 13: The OLED displayed when switch is OFF



Figure 14: The OLED displayed when switch is ON

After the data was sent to the platform, the platform had been set to produce graph for both, motion and door. As stated in previous explanation, the data on the 'Data Stream' only receive 1 (HIGH) output. The graph produced for motion and door can be seen on Figure 15 and Figure 16. The graph also followed the data taken in real-time.

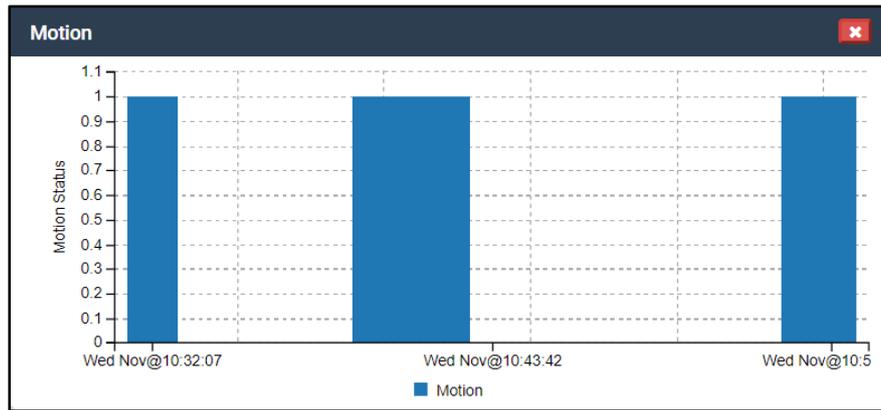


Figure 15: Graph for motion status

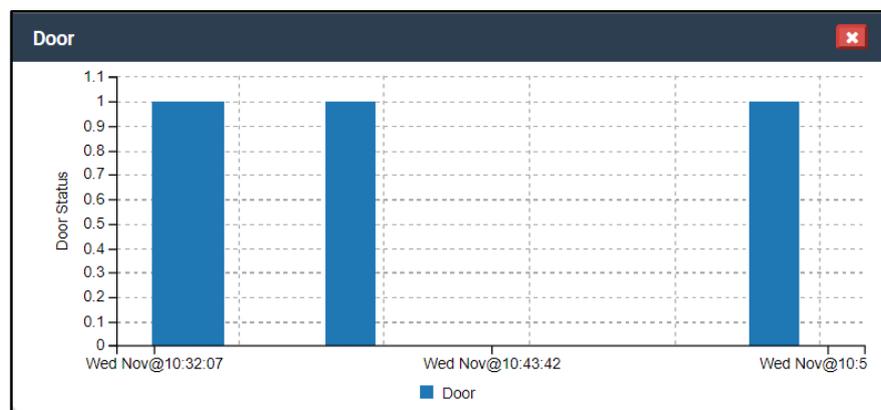


Figure 16: Graph for door status

CONCLUSION

Recently IoT has become a hot topic in engineering world. With increase number of smart devices, people looking at what can be done more using their smart phones, TV and other wireless enabled devices. One of the field that is in high demand to be integrated with IoT is home security system based on Business Insider. They also stated that the number of smart home used by consumer by 2020 will increase in large scale. Based on this finding, paper called Development of Home Security System using IoT being conducted.

The objective of the paper is to develop a home security system using IoT with FAVORIOT platform. Users using the product able to monitor any movement inside and outside of their house. With this product, any motion or entry can be notified to the user via email or SMS depends on the user preferences. The

security of connection between microcontroller and mobile phone is encrypted providing a secure system that is not vulnerable to hijacking. Secure connection can be provided as the password need to be hardcoded via direct connection.

When the product has been configured properly, the product can be mounted at the area where user wanted to monitor. Whenever the system is activated by click on Blynk application, any motion and door activity will be recorded and

sent to Expresso Lite V2.0 microcontroller. Any activity can be seen in FAVORIOT application, as well as wireless notification in order to use IoT technology.

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