

Home Automation Security System

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Abstract:

At this era, the pandemic still has impacted on economic uncertainty among the people's lives and livelihoods. Thus, this situation has caused the cases of burglary have been increased within these few years. By this time a remote-control system that will be easily controlled by the house owner is able to penetrate the market. This report presents the basic design of a Home Automation Security System. This is a proposal about how to build a low-cost security system to protect both the life and property of the house owner. After this project, I have understood how important it is that home security systems will reduce the chance of intrusion. Hence, using the micro controller technology I design a Home Automation System where the entire electrical item will be controlled. With the Wi-Fi module people can also set door locks with the appropriate use of motion sensors while the alarm of buzzer rings to give notification to surrounding around the house and makes an automatic SMS notification system by Blynk application. Compared to others this system is low cost, attractive user-friendly interface which is platform independent and it's very easy to install. After implementation of all functions, the system is tested by entering coding into the Arduino IDE and it works successfully.

Keywords: Remote-Control System, Home Automation Security System, Micro Controller Technology, ESP32 Wi-Fi Module, Blynk Application, Arduino IDE

1. Introduction

Nowadays, the criminal cases are increasing around the world even the police still cannot stop this tragedy from happening. These criminal cases and theft still have a solving way to break into a building like house, offices, schools and even a bank guided by a secretary and have been locked. The security system plays an important role in preventing these types of cases from happening again to the victim to protect their property from burglary.[1]. Depend on the research to the peoples for thus who have burglar before, almost half of them give up or failed to implement their plan to break into house because of the complete security system based on alarm, and intruders afraid of getting attention from resident who has living around that area. [2].

However, there are many kinds of security system have been created to handle the difficulties at different scenario no matter from simple alarm system to fully monitored system that attract different age group of people to select the security system to used. The fully monitored system is quite unique and most effective among the whole types of security system, there are many solutions offered from maximum protection to simply coverage from intrusion. The users can solve problems but there is a lot of money spent on creating a security system to handle the situation with the monthly fee or cost of maintenance on equipment. The goal of this system is giving notification when the difficulties have been facing but might be the owner go outside and do not know about incident occurred during that period, a notification SMS sent to the owners if this system is triggered, Intruder are afraid of high blast noise from buzzer sound that would be attracted the neighbor who live at that area. It works just like a safety precaution in a secure home away from danger.

1.1 Home Automation Security System

In 1889, the concept of Home Automation is first introduced in applying a water heater. The use of home automation was being increased around the world. Nowadays, home automation has become more popular among society and has its own market value which can perform the creativity and work of engineer on a product. It can be predicted the market value of home automation become more than 45-billion-ringgit Malaysia within 2030[3].

It can become very flexible and helps users interact with wireless network technology by using the concept of IoT. Home Automation systems have become more effective to society with the existence of wireless network technology, for example internet, Wi-Fi, GSM, Bluetooth. Home appliances can be controlled no matter how far the distance is, both the iOS and android users can use the wireless network technology as well. The combination of IoT and Home automation system will be helpful in creating a smart and intelligent home and people will get benefits without any burden on automatically controlled home appliances.

A Home Automation system based on IoT is controlled by a microcontroller board to control any kind of electronic appliances with devices while the security system is based on alarm system which can give notification to the peoples located around at that area. For example, Arduino board is the most useful among the microcontroller boards depends on its features with using ethernet cable then can be connected to a specified internet. Besides that, users can set a specified IP address to access the web application which can be installed in the IOS or android devices. Alarm systems like fire smoke alarm, LPG gas leak alarm and also thief alarm, all of this security system which can be connect to this web application if there is internet connect with the same IP address. This IP Web application is available to control the electrical devices from district distance around the world. Notification SMS will be given from web application alarm system will be triggered at the same time if there was happening of someone trying to enter the room or fire occurred. [9]

Home automations are popular and often used as a modern facility which is essential to anyone. [4]. IoT based on home automation is more focused on security and it can remotely control the devices with the connection of internet. Home automation can help people living in a safety environment. [5] Internet can be an assistant of home automation security system in developand divided work to each of the output devices.

2. Materials and Methods

Throughout the project and development of the home automation security system, the project flowchart as shown in figure 1 is used to represent the overall workflow of the development process.

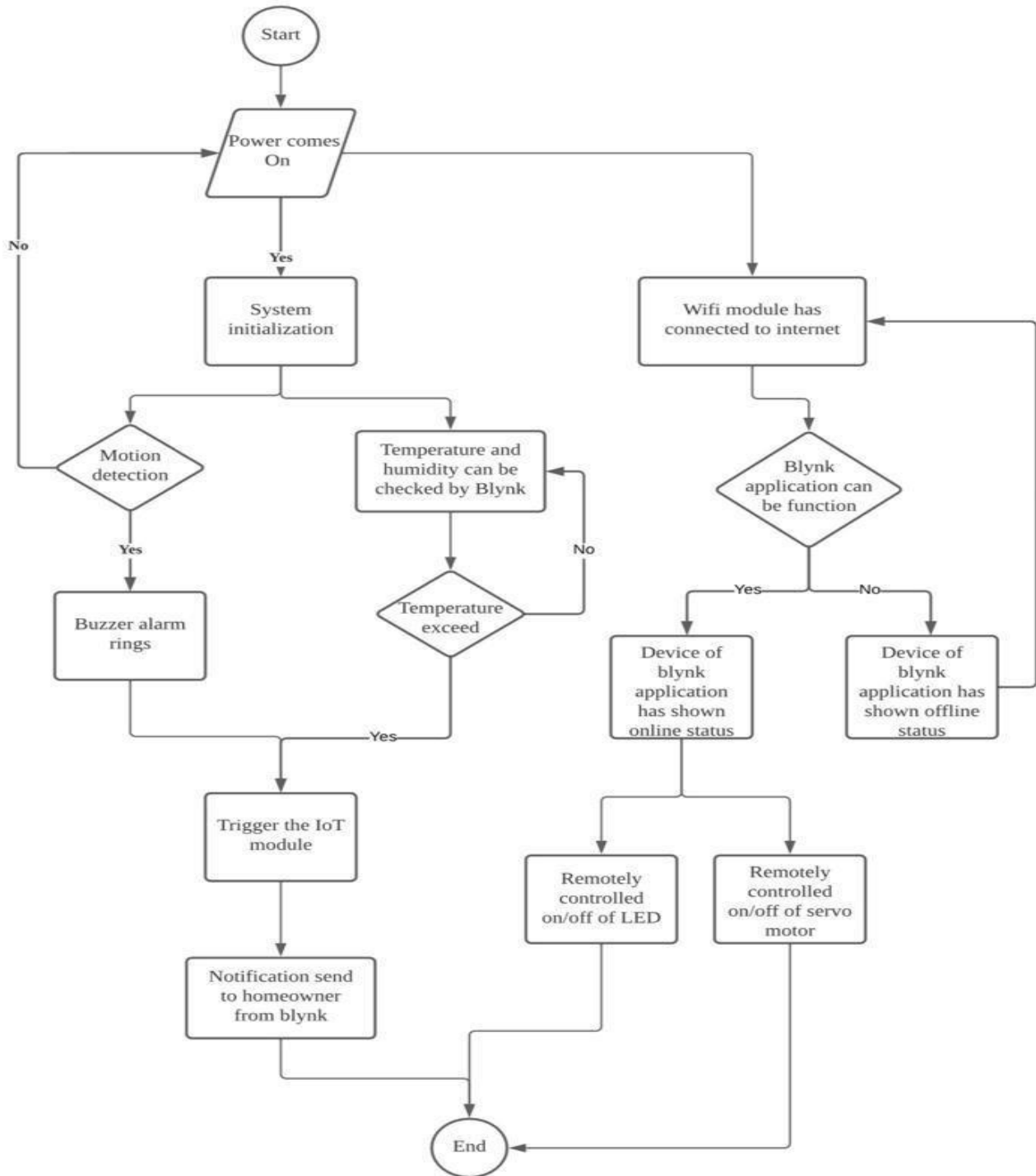


Figure 1: Project Flowchart

The whole project is started with a 5v power on the security system and then the motion sensor will be linked to ESP32 used for monitoring and observing motion within the range estimated. When someone interrupted the area of the security system, at the same time the buzzer was giving an alarm ring which means

that data transmitted from esp32 has changed to the physical form of noise, and the system has already operated if the homeowner give power to supply it while the ESP32 programmed and yellow LED will turn on. If more detailed, when there is different motion in the customer's home when he or she is not there, the PIR motion sensor will detect the motion of a thief using IR and Lens, and the ESP32 will automatically provide a data link to a remote network, which will send a short message to the customer via blynk application. The data from the PIR motion sensor will be read by the ESP32 boards, which will then be sent to buzzer, servo motor, and red LED. When someone enters the user's residence, the buzzer will create a noise in the surrounding area, alerting the neighbor. The alert ring will continue for five seconds to make sure that the neighbors who lived at that area can be noticed with situation of an intruder have entering that area. Finally, the yellow LED will light up and when the push button is pressed that means the security system will switch off. Temperature and Humidity sensor used for ensuring the temperature at that living area is normal, if exceed the temperature specified, the blynk application will send notification SMS through the email of the user with the existence of internet. If the device has shown the offline status, it might be loss connection from internet. However, since the Wi-Fi module has connection with internet, the owner mobile phone can automatically turn on/off the servo motor and led by clicking on/off the button setting in the blynk application.

2.1 System Block Diagram

Block diagram is used to visualize the operation or screen navigation of the whole system of home security system. The simple block diagram in figure 2 shows the ESP32 Wi-Fi module which is the main switch board. There are few input components used such as power adaptor, motion sensor and temperature and humidity sensor. While the output parts which has included LED, Servo Motor, Buzzer, IOT module and lastly with the IOT Website

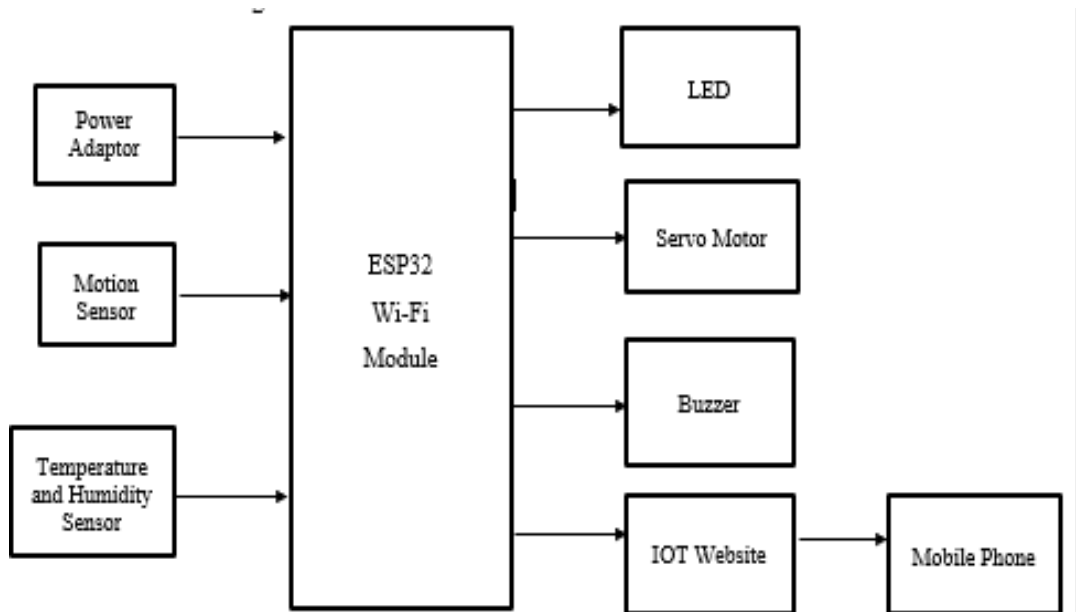


Figure 2: Simple system block diagram of Home Security System

The content presented in esp32 Wi-Fi module has shown figure 2 which includes the software features from the coding, and it will transmit the data from the input to give announcement sent to the output to act estimated. Since the security system cannot function without the existence of power, there are five-volt insert into power pin of esp32 development board. The security system will be initialized with the signal of yellow LED light up and the motion sensor started to detect the range of sensor detection. If a motion sensor has detected someone unauthorized, it will send data to the main switch board which is esp32 module and esp32 will transmit the data change into physical form of sound which made from buzzer alarm rings to alert the owner and people who lived at that area. At the same time, IOT website have received the data as well and has been triggered to send notification to the mobile phone of owner. The temperature and humidity sensor has started to function as well with the exist of power, it detected and monitoring the temperature of air

surrounding at that place, if there is any exceed temperature which is over thirty degrees Celsius, the IOT Website have received data and transmitted to the action of giving notification which is setting in the device event of blynk application to the owner's mobile phone.

2.2 ESP32 Wi-Fi Module

The esp32 is more popular than esp8266 and it is still growing on both hardware and software due to it having a lot of development if insert with Arduino coding. [6]. ESP32 chips have a wide range attracted among this community since it can provide the wide use in various area [7]. Besides that, esp32 works as main switch board during the connection with internet and it transmits data from the input to give announcement to the output devices. [8]

2.3 Blynk Application

Blynk application is a platform for both the ios and android user that can be used as micro controllerboard to connect other with hardware modules like Raspberry Pi, Arduino, NodeMCU and othermodules too. There are many choices in uses of the esp32 hardware module since it can connect with Wi-Fi Internet, USB, Serial and Bluetooth. Blynk can be a platform for anyone to perform their creativity on coding after that implementation in the hardware devices [10]. The GUI (Graphic User Interface) at the smartphone using Blynk App is very simple and friendly user by adding the widget only and then just remotely controlled at any time by clicking on/off the button has been setting before the system is triggered.

2.4 Arduino IDE

Arduino IDE is a programming platform to be used among all types of hardware modules. It plays an important role in helping people to perform the creativity on the action of the devices. Since Arduino IDE has offered the library parts to the programmers, developers have saving a lot of time for no wasting time anymore in finding coding which want to use on internet\

3 Results and Discussion

All these components had been used to collect the data about states of before and after to observe between these two kinds of data, the detection of input and output devices. Besides that, the input devices include a pir motion sensor and DHT11 temperature sensors while the output devices include buzzer and two LED (red and yellow).

Throughout the whole project, the temperature of detection had collected and analyzed the value by five minutes per time. Since the power charged into esp32 Wi-Fi module, the system has been triggered and sends data to each of the devices to act which followed the coding write before in the Arduino IDE programming.

3.1 Results of states on components after being triggered.

The result of states of components used after detection was done with the data collection and recorded by Microsoft word. The proportion of ratings were divided to 0 and 1 and the data is visualized in figure 3.

Table 1: Results of states on components used when home automation security system has been detected a motion and exceed temperature.

No	Items	States	
		Before	After
1	PIR Motion Sensor	0	1
2	Buzzer	0	1
3	Red LED	0	1
4	Yellow LED	1	0
5	DHT11 Temperature Sensor	0	1

0=Turn off
 1=Turn on

Since the power has charged into the esp32 hardware module so that the system has been triggered with the indicator of yellow LED light up. The PIR motion sensor becomes monitor and observed the motion within range of detection, if it has detected motion or action of people unauthorized, it will send data to the buzzer and make it ring at that time in 5 second which has been setting before. Afterwards, the indicator of red LED will light up simultaneously until the action or motion is stopped. Neighbors will pay attention to the sound of alarm rings and mighttake further action like calling police. The DHT11 temperature sensor works as a monitor in temperature and humidity at a place. When the temperature at that place has exceeded 30 degrees Celsius, it will send the signal back to the esp32 main switch board while the blynk application will send notification via email if it has connected to the Wi-Fi.

Table 2: The states of servo and LED switch on/off by using blynk application.

No	Items	Status	
		Switched the button on	Switched the button off
1	Servo Motor	90°	0°
2	LED 1	1	0
3	LED 2	1	0

0=Turn off
 1=Turn on
 0°=closed the door
 90°=opened the door

Houseowner can set anything that can solve problem at different scenario on blynk application for example like door and light bulb can be control by houseowner. Since the button have switched on from houseowner by using blynk application, the servo motor will rotated to ninety degrees to make the door opened to help houseowner can entering the house easily withoutasking someone’s help if losing the key to the door or if forgot the password of the electronic lock. Moreover, houseowner can manually turn on/off the light bulb by clicking the button setup on blynk application in order saving electricity which can be reduce burden on the living cost. Nowadays, if there is someone fewer turn on the light bulb, it can help reduce global warming crisis.



Figure 3: Alert notification given from the blynk application

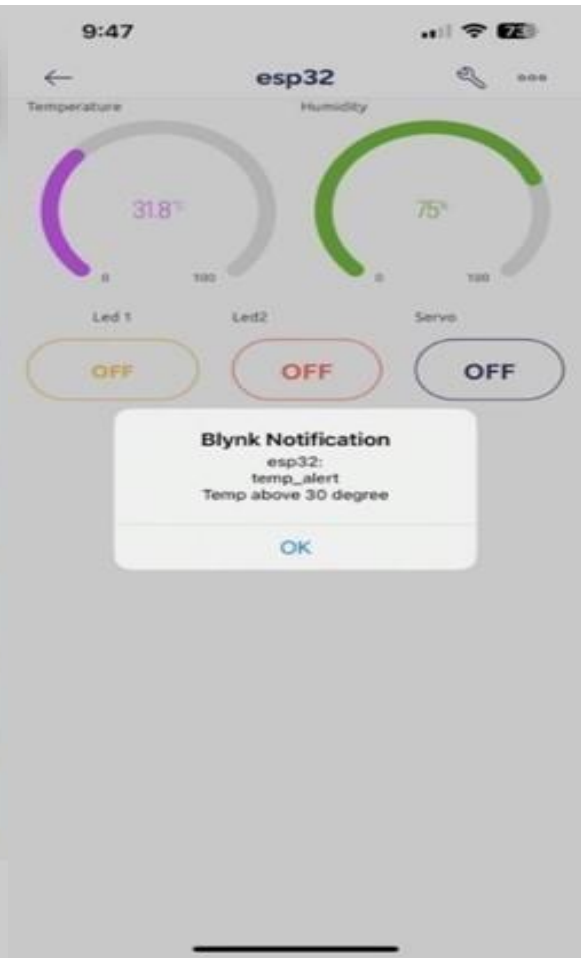


Figure 4: Temperature alert notification given from the blynk application



Figure 5: Temperature alert notification using email given from the blynk application.

Notification from blynk application will be given to the houseowner to alert his/her household has been breaking into by others have shown in figure 3. So that he/she can give further action like calling police to avoid the loss of valuable things stolen by others. However, when temperature sensor detects temperature from air surrounding more than temperature specified, it will give notification to the user by the blynk application has shown in figure 4 and send to the email which has setting before in the device info of blynk application have shown in figure 5. In conclusion, there are also additional items for the program to be more efficient such as yellow and red LED as indicator, servomotor for locking door. ESP32 as a brain of the circuit is being used and programmed to message users from the blynk application. Although there has been a lot of development in security, it is still enough and such work as a security system which can be handled by most families.

Table 3: Table of result of testing on DHT11 temperature sensor

TEMPERATURE/°C	HUMIDITY/%
28.9	71.1
29.3	68.9
29.5	69.2
33.4	70.1
32.9	69.7
32.5	70.3
29.8	70.4
29.1	69.9

From figure 5, the security system has been powered on by the 5V from either battery or power adaptor, the DHT11 temperature sensor will be function on with signal of yellow LED light up and red LED on the sensor will be light up too that means it started to detect temperature from air surrounding. If there is less than thirty degrees Celsius, it is quite maintained in normal condition and continued detected the temperature and humidity from air surrounding. But if it exceeds thirty degrees Celsius when a sudden fire disaster happens, the notification will be sent promptly to users to take further action. If referred from the table above, there was several minutes over thirty degrees Celsius, the notification event which is setting before by the user was going to function and send SMS to email of user which also can be setting before started powered on the security system. For the percentage of humidity part, it is normal and maintain with around 69.2% to 71.1% so that in conclusion if refer the data given from the table, the more probability of fire disaster will be happen than the probability of an intruder break into the house because of the temperature detected has been over a specified value while the percentage of humidity which is maintained at a value with almost the same that means no one was detected within the range of detection of DHT11 temperature and humidity sensor.

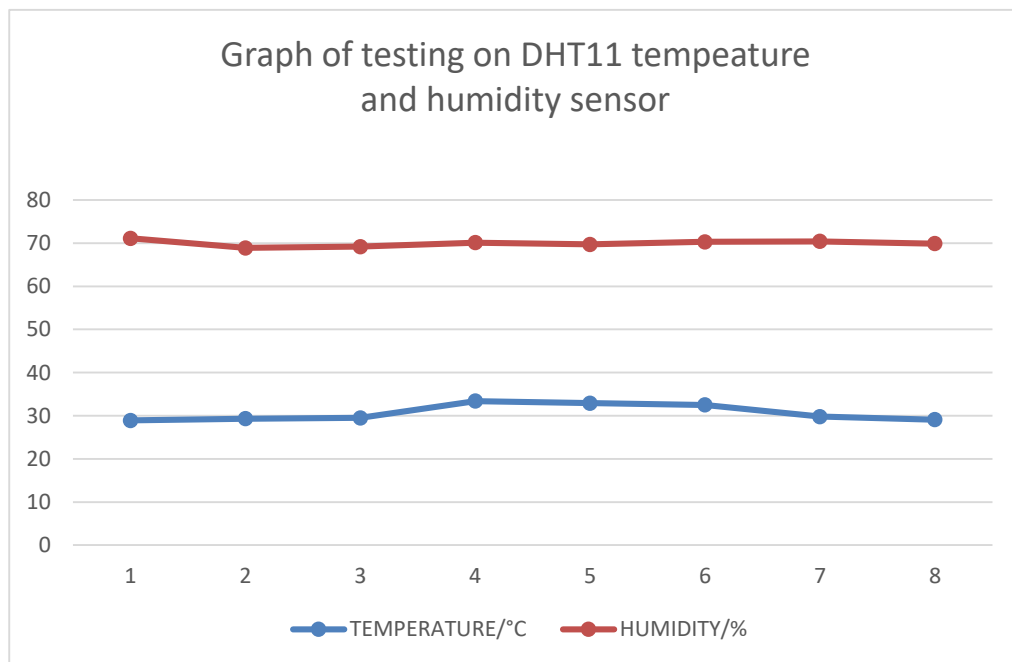


Figure 6: The graph of result of testing on the DHT11 temperature sensor

From figure 6, the result has been recorded by using blynk application with observed the value of detection on temperature and humidity of the DHT11 type of sensor. The average temperature is maintained around twenty-nine degrees Celsius which is close to the room temperature. After few minutes, the highest value thirty-three point five of degree Celsius has been reached if fire up of a lighter. The action will cause temperature of air surrounding increased, and it will maintain this kind of high value up to the air temperature has been declined. However, the value of temperature will slide down until close to the room temperature after few minutes if referred to the table above. With the reading of humidity percentage, the sensor just gets the value of almost the same which is 69% to 71% and that means there is less possibility that someone has been break into the house at that time. Discussed about the temperature security system, the user for thus who has setting notification event on temperature in the blynk application, user feeling relieved on the temperature of air surrounding which is under monitor of temperature sensor.

4 Conclusion

The purpose of this project was to create a security system in the house to prevent the any theft from entering the house. The components include push button, esp32, motion sensor, buzzer, servomotor, LED, and

DHT temperature and humidity sensor. The security system will detect anyone who tried to break into user house and automatically message user phone and ring the buzzer. Users will be alerted by phone message through blynk application and neighbors will be alerted by alarm thus they can act as soon as possible and call police. The push button on the program is being used to press on and restart the program and the alarm will be turned off simultaneously.

The circuit diagram of the home automation security system has been drawn using Fritzing software. If there is a power supply which the value is 5V to the circuit. The circuit will be simulated successfully within the coding have been saving into the circuit before started to simulate the circuit with the signal of yellow light up. After the indicator, which is yellow LED has light on, meaning that the current has been passing through the whole circuit with the successful coding.

By The way, this security system worked as safety equipment when a thief trying to intrude the user house, the motion sensor will detect any movement at every second that come across the sensor. After that, the motion sensor will send as signal input to ESP32 as a brain and will send signal to red LED changed to light up status and at the same time, buzzer will ring, and ESP32 will send a message to the user phone through blynk application. The program will restart when the push button is being pushed. In the security system also created with temperature with humidity, users can check time by time on the blynk about the temperature and humidity of air surrounding. If it exceeds thirty degrees Celsius, blynk will send notification to user to mention about the temperature of air surrounding has been over the temperature estimated. The living area might be at high risk of fire and blynk notification can help user to act immediately to call family and neighbor to leave from that area.

4.1 The advantage of home automation security system

In conclusion, an intelligent home automation security system has been successfully developed according to its objectives and desired specifications. However, the stakeholders lack security against burglars and are discomfort in leaving the house. These problems often lead to the loss of material things, properties and even the loss of lives. To provide the solution to this issue, an idea of "Home automation Security System" has been designed. This system describes an economic anti-theft setup which is convenient in use. The design of the project is simple, and all the components used are easy to get which all these items are available at low cost. This is a real time-based setup which is difficult to hack. Also, the system has low maintenance costs.

Thus, this system can be effectively applied anywhere. Although, there is scope for improvement in future. Better and more security layers can be added to enhance security in future. However, this home automation security system is designed using ESP32 Wi-Fi module function as a center for sending and receive the programming data to the input and from the output as well, It can be triggered by the system with the exist or connection to the internet. ESP32 can help people become more convenient in their daily lives since ESP32 can be used in wide range if connect Wi-Fi internet, Bluetooth, hardware board and others.

4.2 Recommendations

Both Arduino and ESP32 are microcontroller-based boards that can take inputs and generate output accordingly. But ESP32 WIFI module is much more difficult compared to the Arduino board due to Arduino having a lot of detailed documentation, video practical and lessons on the Arduino IDE can be referred from internet. Based on the reason of creating an easy operated security system, Arduino board is much suitable used as a main switch board not the ESP32 Wi-Fi module in this project because its coding is easier when equipped with other sensors and modules.

PIR is quite passive in the types of motion sensor and it is not sensitive as IR sensor since the IR sensor has connected with a relay module which can correctly detected the motion of someone or something moving within the range of detection. If the PIR motion sensor has connected to the alarm system, it might be making the buzzer alarms ring at the wrong moment. Since the PIR motion sensor is not sensitive as expected, maybe it can be changed to IR sensor to increase the sensitivity of this security system.

Since there is a limit on the number giving of notifications on blynk application, which is 100 times per

day, it is hard for user of blynk application to get know the state of the house after get notification 100 times from blynk application. To solve the difficulties, the sim GSM module is suggested to be used for giving messages to the required users without the limited times. Also, the advantages of GSM module are it can be setting the notification call not the notification message only to help especially the elder people easier to get noticed of involving a dangerous situation like someone who has been intruded without asking the permission of houseowner.

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