

**DEPARTMENT OF INFORMATION AND
COMMUNICATION TECHNOLOGY**

**DIPLOMA IN INFORMATION TECHNOLOGY
(DIGITAL TECHNOLOGY)**

DFT50114

INTERGRATED PROJECT(NETWORK)

SMART MONITORING SYSTEM

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SESSION: SHORT SEMESTER 2023

Declaration

We, the members of our project group, hereby declare that the project titled "Smart Monitoring System", represents our group's original work created under the direction and supervision of Madam Nurul Ain Bin Amir Adli. All of the material and data in this report are the result of our collaborative study and analysis. External sources have been properly acknowledged and credited.

We confirm that this report has not been submitted for academic credit or review elsewhere.

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1.0 ABSTRACT

A Smart Monitoring System has been develop for real-time monitoring and notification of intruders into the school's hostels due to the insecurity circumstance. The system intends able to detect unauthorized entry attempts by utilizing infrared sensor technology. It can also send notification to security personnel during any unauthorized access attempts are detected using apps and developing a notification using alarm system for hostel students. The type of methodology that we used is prototype.

2.0 PROJECT PLAN

2.1 Problem Statement

- i. There is no monitoring system at the hostel. The guard has been monitoring the hostel manually by rounding around the hostel. Moreover, there is no preventive measurement of security for the students.
- ii. The supervision is done conventionally by the guard. The number of students in the hostel with the ratio of guards working for 1 session /1 night is 3:9. We are going to use one at the front fence, one in front of the hostel and also one at the back of the hostel (where we want to put our project).
- iii. There is no preventive measure for the security of students at the hostel in case of any unauthorized person gaining access to the hostel, posing potential risks to the student's safety and well-being.

2.2 Objective

The main objective in this project as follows:

- i. To develop an IOT based motion detection system implementing infrared sensors.
- ii. To send a notification to security personnel during any unauthorized access attempts are detected using apps.
- iii. To develop a notification using an alarm system for hostel students.

2.3 Scope of Project

Project scope

- i. The Smart Monitoring System project's scope is to detect the unauthorized person. Furthermore, it will send a notification to the user which is the guard in any detection of any unauthorized person. Moreover, it will produce alarm as awareness to the guard and also the hostel students.

User scope

- i. **Security personnel**

It allows the users to stay informed and updated by receiving the notifications using apps (Telegram).

- ii. **Hostel students**

Receiving notifications using an alarm system for any unauthorized person entering the hostel provides an added layer of security and helps to ensure the safety of the students.

2.4 Literature Review

We will contrast this project to others in this literature review.

Table 1.0 : Table of Comparison Literature Review

Prototype	 180° PIR Sensor	 PIR (Passive Infrared Sensor) Transmitter
Description	180° PIR Sensor uses an infrared motion detector that can detect any large movement such as human movement from a distance of 12 Meters.	The NEW PIR Sensor Transmitter will trigger the EchoChime300™ receiver and/ or the Echo Vibrating Pager™ when it detects movement, providing a simple option for alerting careers or family members to the movement of people.

Advantages	1. Can help the security guards and also the school to supervise the hostel area. 2. Able to warn quickly and help hostel wardens and security guards take quick action. 3. Can tighten the security of the hostel area.	1. Detects motion reliably in indoors as well as in day or dark. 2. It consumes less energy (0.8W to 1.0W) compare to microwave sensor. 3. They are cheaper compare to microwave sensors.
Disadvantages	1. The maximum distance that can be reached is 12 meters. 2. Smart Monitoring System not very sensitive if the room itself is warm. 3. It does not operate greater than 35 degree C.	1. They have lower sensitivity and less coverage compare to microwave sensors. 2. It works effectively in LOS (Line of Sight) and will have problems in the corner regions. 3. It is insensitive to very slow motion of the objects.
Cost	RM57.21	RM213.52

2.5 METHODOLOGY

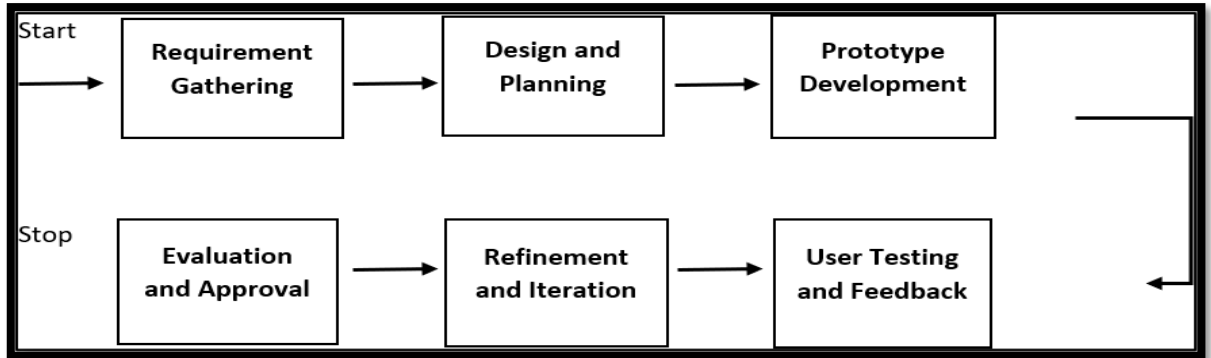


Figure 1.0 : Prototype Method

Source: <https://www.researchgate.net/>

A prototype is a tangible or virtual model or representation of a product, system, or concept that is used to test, evaluate, and validate its design and functionality.

Table 2.0 : Table of the phases in prototyping

Phases	Activities
Requirement Gathering	i) Discuss with the client about the safety and security concerns specific to the girl's hostel. ii) Identify the requirements for the Smart Monitoring System. iii) Document the gathered requirements and prioritize them based on their importance and impact on the security system.
Design and Planning	i) Create a high-level design for the Smart Monitoring System, considering the specific needs of the girl's hostel.

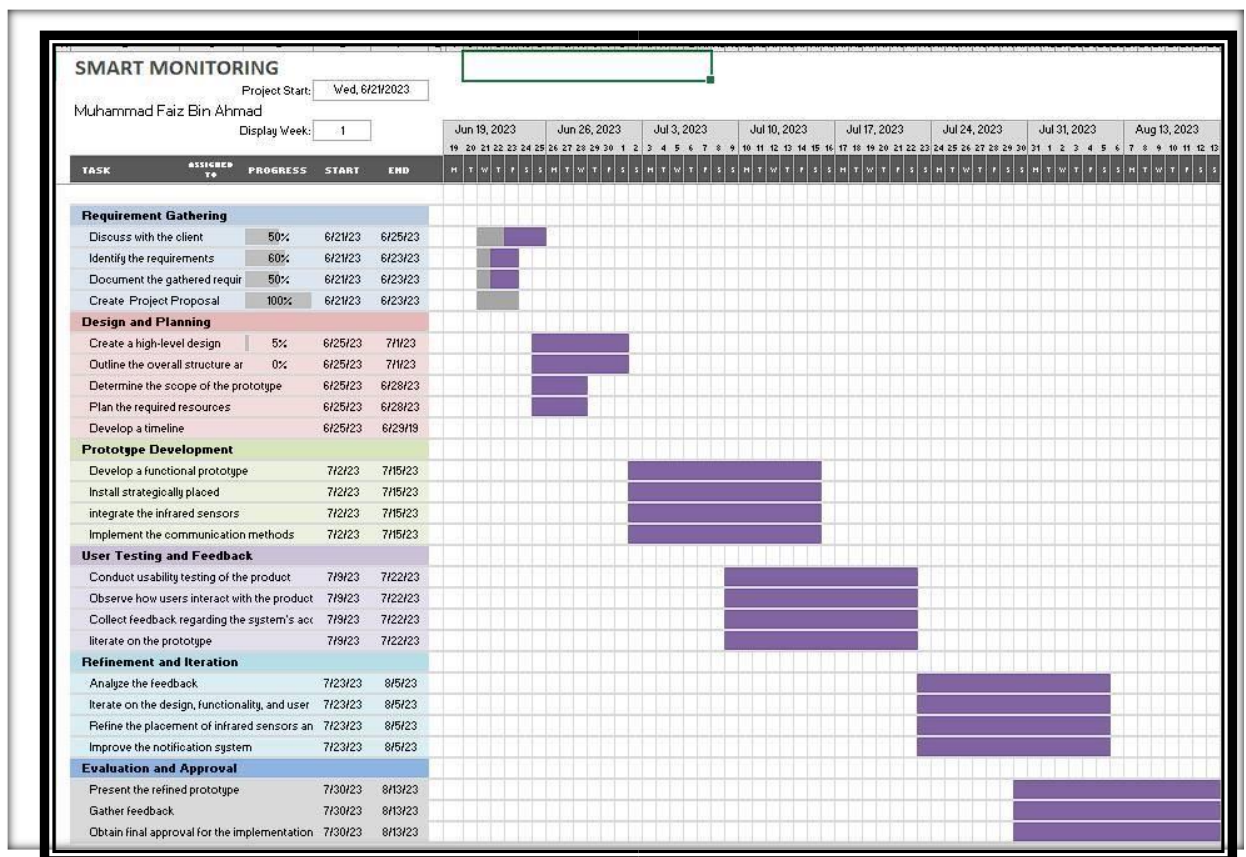
	ii) Outline the overall structure and functionality of the security system. iii) Determine the scope of the prototype, defining the features and interactions necessary for realtime monitoring and notification of entry into the hostels. iv) Plan the required resources, such as infrared sensors, microcontrollers, communication devices, and any additional hardware or software components. v) Develop a timeline and budget for the prototyping phase, considering the installation, testing, and refinement of the security system.
Prototype Development	i) Develop a functional prototype of the Smart Monitoring System based on the design specifications. ii) Install strategically placed infrared sensors at entry points to detect unauthorized entry attempts. iii) Integrate the infrared sensors with the central control unit or microcontroller (e.g., Arduino) to process sensor data and trigger notifications. iv) Implement the communication methods for fast notifications, such as smartphone applications, emails, or text messages, to selected staff members.
User Testing and Feedback	i) Create a high-level design for the Smart Monitoring System, considering the specific needs of the girl's hostel.

	ii) Outline the overall structure and functionality of the security system. iii) Determine the scope of the prototype, defining the features and interactions necessary for realtime monitoring and notification of entry into the hostels. iv) Plan the required resources, such as infrared sensors, microcontrollers, communication devices, and any additional hardware or software components. v) Develop a timeline and budget for the prototyping phase, considering the installation, testing, and refinement of the security system.
Refinement and Iteration	i) Conduct usability testing of the Smart Monitoring System with the school administration, staff, and hostel individuals. ii) Observe how users interact with the system, monitor its performance, and gather feedback on its functionality, ease of use, and effectiveness. iii) Collect feedback regarding the system's accuracy in detecting unauthorized entries and the responsiveness of notifications. iv) Iterate on the prototype based on user insights and identified areas for improvements.
Evaluation and Approval	i) Present the refined prototype of the Smart Monitoring System to the school administration and stakeholders for evaluation. ii) Gather feedback, address any remaining concerns or suggestions, and incorporate necessary changes.

	iii) Obtain final approval for the implementation of the security system in the girl's hostel, considering its dependability, efficiency, and cost-effectiveness.
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2.6 GANTT CHART

A Gantt chart is a project management tool that helps with the planning and scheduling of projects of all kinds, but they are especially beneficial for simplifying complex tasks. Gantt charts assist teams in properly allocating resources and planning work around deadlines. Gantt charts are also used by project planners to keep a bird's eye view of projects. They show the relationship between the start and end dates of tasks, milestones, and dependent tasks, among other things.



3.0 REQUIREMENT SPECIFICATION

Requirements specification, which is a set of documented requirements to be used in the design, project. It is very important to document for future reference.

3.1 Functional Requirement

i) Motion Detector :

This system able to detect any unauthorized people who is around the girl's hostel.

ii) Alarm and Alert System :

In a scenario of unauthorised access attempts, this system can create alarms or alerts.

iii) Receiving Notification:

This system will send a notification to the guard if any unauthorized people are around the girl's hostel through Telegram app.

3.2 Non-Functional Requirement

Performance

This system have fast and efficient alerting times, ensuring quick authentication and make sure the guard can go that particular place as soon as possible.

Availability

This system has been designed to be simple to maintain and update.

Security

System restricts access only to those who are authorized to be in the girl's hostel compound.

3.3 Hardware and Software Requirement

Hardware Requirement

i. **180° PIR Sensor**

A Passive Infrared (PIR) sensor is a type of motion detector that detects variations in infrared radiation generated by objects in its range of vision.



ii. **NodeMCU V3**

The NodeMCU V3 is a well-known development board that is based on the ESP8266 microcontroller. It's intended to be a simple and convenient platform for creating IoT (Internet of Things) projects and Wi-Fi-enabled applications.



iii. **Jumper Wire**

Jumper wires are simple and flexible electrical lines that are commonly used in electronics and prototype projects. They are normally made of insulated copper or

tinned copper conductors and are terminated with a connection, such as a male header pin or a female socket, at each end of the wire.



iv. **Alarm**

In security systems, an alarm buzzer acts as an audible alert to signal potential security breaches or unauthorized entry. It contributes significantly to the security of homes, businesses, and other establishments.



v. **Powerbank**

A power bank is a portable, rechargeable device that stores electrical energy and transfers it to other electronic devices when needed.



vi. **LED light**

An LED is a little light that consumes very little power.

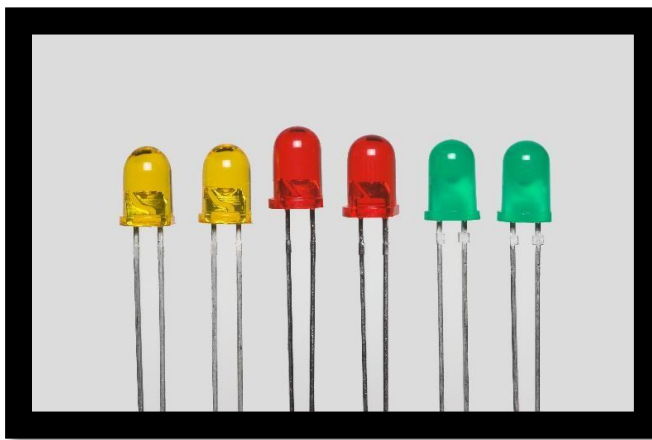


Table 3.0 : Hardware Requirement cost

No	ITEM	QUANTITY	PRICE(RM)
----	------	----------	-----------

1.	PIR Sensor	2	RM 50.00
2.	NodeMCU V3	1	RM 22.90
3.	Jumper Wire	3	RM 8.70
4.	Alarm Buzzer	2	RM 11.00
5.	Powerbank	1	RM 70.00
6.	LED Light	3	RM 9.00
Total Price			RM 171.60

Software Requirement

i. ARDUINO IDE (Free)

The Arduino Integrated Development Environment (IDE), often known as the Arduino Software, comprises a text editor for writing code, menus, a message box, a text console, a toolbar with basic operation buttons, and other features. It connects to it in order to upload programmes and communicate with the actual hardware.



ii. **Canva (Free)**

Canva is used to create visuals for social media, presentations, posters, publications, and other purposes.



Table 4.0 : Software Requirement cost

No	SOFTWARE	PRICE(RM)
1.	Arduino IDE	FREE

2.	Canva	FREE
TOTAL COST		-

3.4 System configuration

```
int LED = 2;

int SENSOR_OUTPUT_PIN = 5;

void setup() {

    pinMode(SENSOR_OUTPUT_PIN, INPUT);

    pinMode(LED, OUTPUT);

    Serial.begin(9600);

}

void loop() {

    int sensorvalue = digitalRead(SENSOR_OUTPUT_PIN);

    Serial.println(sensorvalue);

    if (sensorvalue== HIGH) {

        digitalWrite(LED, HIGH);

        delay(1000);
    }

    else {

        digitalWrite(LED,LOW);

    }

}

#include <ESP8266WiFi.h>
#include <WiFiClientSecure.h>
#include <UniversalTelegramBot.h>
#include <ArduinoJson.h>

// Replace with your network credentials
const char* ssid = "Dialog 4G 025";
const char* password = "b2016ee3";

// Initialize Telegram BOT
```

```

#define BOTtoken "6006820331:AAE3THFGgYAFO1d7_Ck5VaW_w2S6jJ4gbLM" //
your Bot Token (Get from Botfather)

// Use @myidbot to find out the chat ID of an individual or a group
// Also note that you need to click "start" on a bot before it can
// message you
#define CHAT_ID "5583222894"

X509List cert(TELEGRAM_CERTIFICATE_ROOT);
WiFiClientSecure client;
UniversalTelegramBot bot(BOTtoken, client);

const int motionSensor = 14; // PIR Motion Sensor
bool motionDetected = false;

// Indicates when motion is detected
void ICACHE_RAM_ATTR detectsMovement() {
  //Serial.println("MOTION DETECTED!!!");
  motionDetected = true;
}

void setup() {
  Serial.begin(115200);
  configTime(0, 0, "pool.ntp.org"); // get UTC time via NTP
  client.setTrustAnchors(&cert); // Add root certificate for api.telegram.org

  // PIR Motion Sensor mode INPUT_PULLUP
  pinMode(motionSensor, INPUT_PULLUP);
  // Set motionSensor pin as interrupt, assign interrupt function and set RISING mode
  attachInterrupt(digitalPinToInterrupt(motionSensor), detectsMovement, RISING);

  // Attempt to connect to Wifi network:
  Serial.print("Connecting Wifi: ");
  Serial.println(ssid);

  WiFi.mode(WIFI_STA);
  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
    Serial.print(".");
    delay(500);
  }

  Serial.println("");
  Serial.println("WiFi connected");
  Serial.print("IP address: ");
  Serial.println(WiFi.localIP());

```

```

    bot.sendMessage(CHAT_ID, "Bot started up", "");
}

void loop() {
    if(motionDetected){
        bot.sendMessage(CHAT_ID, "Motion detected!!", "");
        Serial.println("Motion Detected");
        motionDetected = false;
    }
}

int Balarm = 14; //Buzzer alarm connected to GPIO-14 or D5 of nodemcu
int PIRsensor = 5; //PIR sensor output connected to GPIO-5 or D1 of nodemcu

void setup() {
    pinMode(PIRsensor, INPUT); // PIR sensor as input
    pinMode(Balarm, OUTPUT); // Buzzer alarm as output
    digitalWrite (Balarm, LOW); // Initially buzzer off
}

void loop(){
    int state = digitalRead(PIRsensor); //Continuously check the state of PIR sensor
    delay(500); //Check state of PIR after every half second

    if(state == HIGH){
        digitalWrite (Balarm, HIGH); //If intrusion detected ring the buzzer
        delay(5000);
        delay(5000);
        delay(5000); //Ring buzzer for 15 seconds
        //Serial.println("Motion detected!");
    }
    else {
        digitalWrite (Balarm, LOW); //No intrusion Buzzer off
        //Serial.println("Motion absent!");
    }
}

```

3.5 Security Requirement

This project's security need is authentication procedures to ensure that only authorized personnel can access the girl's hostel. In addition, strong access control measures will be implemented as part of this project to prevent unauthorized access to the girl's hostel. System configuration and management functions should be accessible only to authorized administrators.

4.0 Final Design

The term "Final Design" refers to the last and fully developed version of the project's design that is ready for implementation or presentation. It is the culmination of the design process, which involves planning, research, ideation, and refinement.

Diagram 1 : Front View Of The Hostel

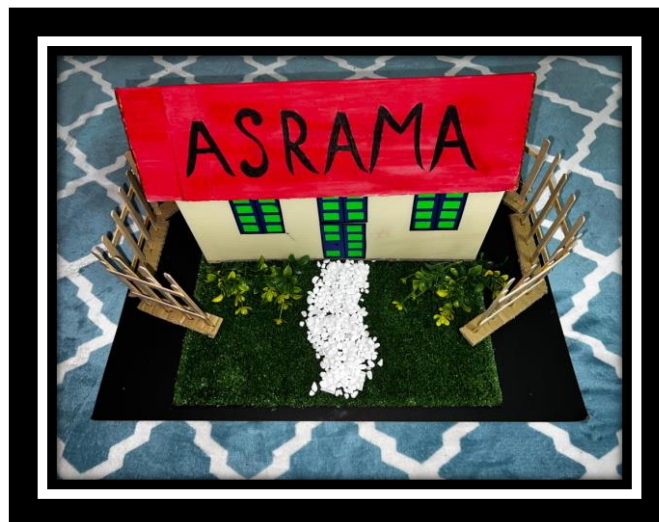
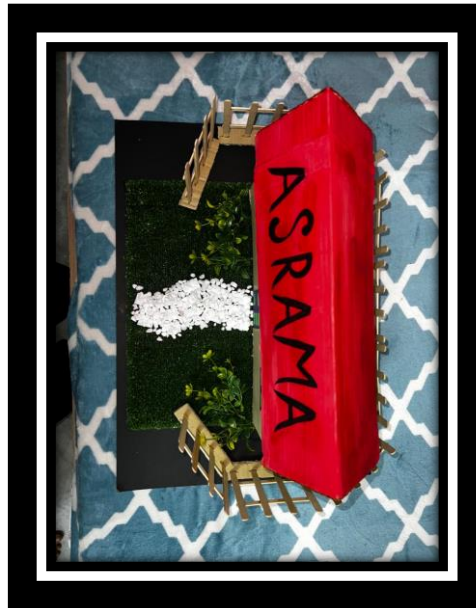


Diagram 2 : Full view of the girl's hostel

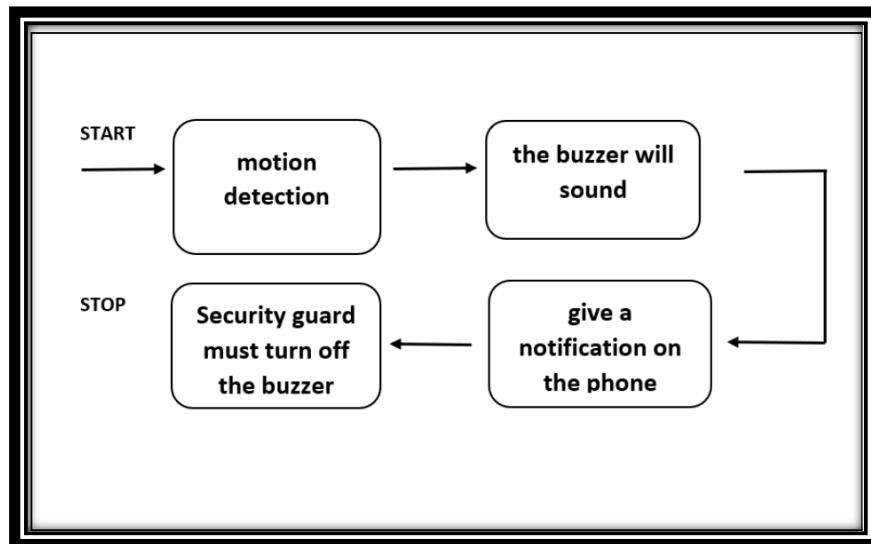


The Prototype methodology for the Smart Monitoring System involves creating an initial working model of the monitoring system. This model, or prototype, is a simplified version of the final system that displays fundamental functionalities such as data collection from numerous sensors and analysis for intelligent insights and alarms.

4.1 Flow Chart

This is how the products work, its starting with motion detection and it will end with the security must turn of the buzzer manually.

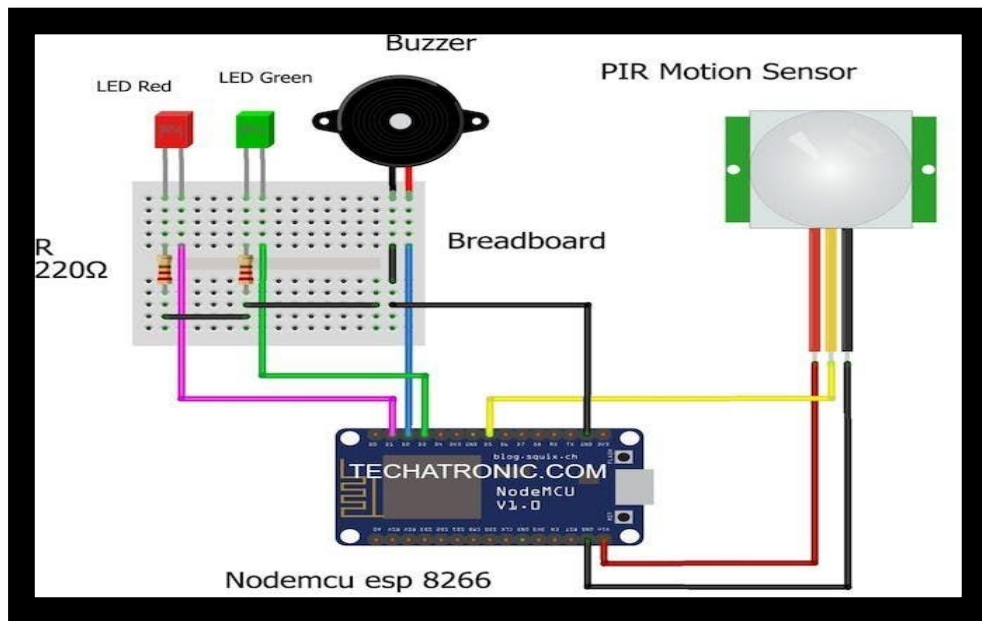
Diagram 3 : Flow Chart of Smart Monitoring System



4.2 Schematic Diagrams

The component that we use in Smart Monitoring System is buzzer, red and green led, esp8266 and PIR Motion Sensor. For breadboard we change into PCB soldering board.

Diagram 4 : Schematic Diagram

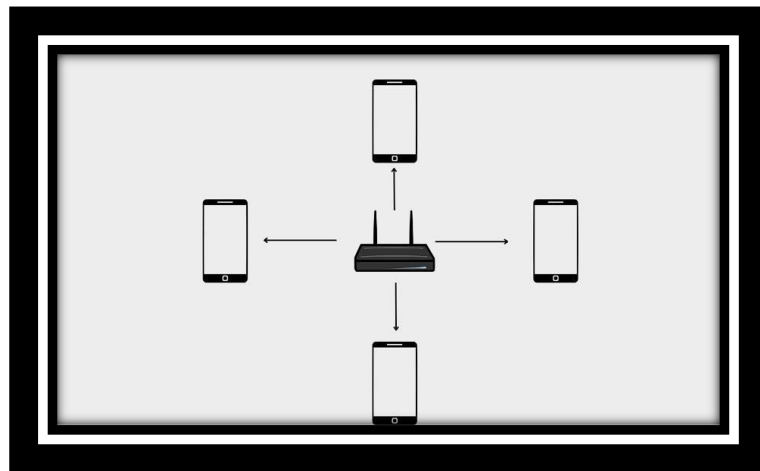


4.3 Logical Network Topology

For a PIR (Passive Infrared) motion detection system, a logical network topology is not typically used. PIR sensors are standalone devices that do not require a traditional network topology for their operation. Instead, they are simple devices that detect changes in infrared radiation and trigger an output signal when motion is detected.

However, if you want to integrate PIR sensors into a larger smart home or security system that involves network connectivity, you may use various networking technologies to connect the sensors to a central control unit or a monitoring system. In this case, you might consider using a star or mesh network topology.

Diagram 5 : Logical Network Topology



5.0 Test Description and Result

A test description provides an overview of the purpose, objectives, and specific details of a test that is conducted to evaluate a particular product, system, or component. It outlines what is being tested, the test conditions, test steps, expected outcomes, and any specific criteria that will be used to assess the test results. A well-written test description helps ensure that the testing process is systematic, repeatable, and aligned with the project's goals.

5.1 Unit Testing Plan

Table 5.1 : Unit Testing Plan

No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result Passs/Fail
1	Motion detection	User must move his hand or body towards the PIR Motion Sensor	PIR detect the motion	PIR detect the motion	Khairul Fauzi Bin Muhammad	Pass
2	Buzzer	When PIR detect any motion the buzzer will sound and give alert to security guard	none	The buzzer sound after PIR detect any motion	Khairul Fauzi Bin Muhammad	Pass

3	Notifications using telegram	Notification will pop up after PIR detect any motion	none	Notification from telegram was pop up and it's say 'motion detected!'	Khairul Fauzi Bin Muhammad	Pass
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5.2 Integration Testing Plan

For Integration Testing Plan for Smart Monitoring Sensor all the functions that we want successfully function. The motion detection will detect any motion and if there were motion it will make the buzzer sound and lastly it's will send a notification through telegram.

Table 5.2 : Integration Testing Plan

No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result Passs/Fail
1	Motion detection	Smart Monitoring Sensor can detect movement using PIR Motion Ditector	PIR detect the motion	PIR detect the motion	Khairul Fauzi Bin Muhammad	Pass
2	Buzzer	User can hear the buzzer sound when there is movement	none	The buzzer will sound after PIR detect any movement	Khairul Fauzi Bin Muhammad	Pass
3	Notifications using telegram	User check the notifications from telegram	none	Notification from telegram was pop up and it's say 'motion detected!'	Khairul Fauzi Bin Muhammad	Pass

6.0 Major Findings and Discussion

Major findings refer to significant results or discoveries obtained during research, experiments, testing, or investigations. These findings could be positive or negative and often have a significant impact on the subject under study. In different domains, major findings could be related to scientific research, product development, data analysis, market research, or any other area where investigations are conducted to gain insights. Major findings refer to significant results or discoveries obtained during research, experiments, testing, or investigations. These findings could be positive or negative and often have a significant impact on the subject under study. In different domains, major findings could be related to scientific research, product development, data analysis, market research, or any other area where investigations are conducted to gain insights.

6.1 Advantages of Project

a. Security

Smart Monitoring are designed to help strengthen security, and also to help the security guards to increase the safety and security of the dormitory area from any external threats such as intruders, thieves and animals such as monkeys

b. Efficiency

Smart Monitoring System operate using a minimal amount of power. They are designed to detect changes in infrared radiation, which requires very little energy compared to active sensors that continuously emit signals or use more power-intensive technologies. Smart Monitoring System also have fast response times, meaning they detect motion events and trigger actions almost instantly. This quick response reduces the amount of time the sensor needs to be active, further contributing to energy efficiency.

c. Flexibility

Smart Monitoring System not only detect any human motion but it's also detect motion from animals that often disturb the dormitory area such as monkeys. Monkeys are always trespass and make a mess in the dormitory area. With using Smart Monitoring System it will help reduce trespass and any threats from outside.

6.2 Disadvantages of Project

a. Limited Sensing Range

Smart Monitoring System have a finite sensing range, typically ranging from a few meters to tens of meters. This limited range makes them unsuitable for applications that require long-distance motion detection. For our device the distance only can detect around 12 meters.

b. Cold Temperature Performance

In extremely cold environments, Smart Monitoring System may become less sensitive to detecting motion due to the limited infrared radiation emitted by cold objects. But in Malaysia the coldest weather is during the monsoon season, so Smart Monitoring System can still be used.

c. Single Sensing Mode

Smart Monitoring System only detect changes in infrared radiation caused by moving objects. They are not suitable for detecting non-moving or stationary objects, making them less versatile for certain applications.

7.0 Recommendation and Conclusion

The Smart Monitoring System is functioning properly and according to design, but there are certain improvements we can make to this project, such as:

a. Security Assessment

Conduct a comprehensive security assessment of the Smart Monitoring System to identify any potential vulnerabilities and risks.

b. User Training and Awareness

Emphasize the importance of user training and awareness programs to ensure the seamless adoption and effective usage of the Smart Monitoring System.

c. Scalability and Future Expansion

Plan for the system's scalability and future expansion to accommodate growing needs and technological advancements.

Conclusion :

1.The Pir smart monitoring sensor is a highly effective and efficient solution for enhancing security and automation in various settings.

2. Throughout this report, we have explored the benefits and functionalities of the Pir sensor, and its applications in different scenarios.

3. The Pir smart monitoring sensor has proven to be an invaluable asset in both residential and commercial environments, detecting motion accurately and promptly. Its ability to trigger actions, such as turning on lights or alerting security systems, ensures a safer and more convenient experience for users.

8.0 References

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