IOT BASED DUST ALERTING AND SMARTBIN SYSTEM FOR ASTHMA PATIENT

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Bachelor of Computer Science (Software Engineering) with Honours

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ABSTRAK

Projek ini bernama sebagai “IoT Based Dust Alerting and Smartbin System for Asthma Patient” manakala “Agile” methodologi di fasa pelaksanaan dengan menggunakan peranti inovasi dalam kos yang rendah. Peranti akan mengesan habuk dan megukur tahap sampah di dalam tong sampah. Peranti akan menghantar notifikasi emel kepada pengguna. Peranti ini merupakan sebagai alat penting bagi wad pesakit asma untuk mencegah mesej yang tidak dimaklum kepada pembersih wad. Terdapat beberapa pernyataan masalah yang disenaraikan. Pertama sekali, kualiti udara dapat menyebabkan pesakit menjadi tidak sihat dan sukar bernafas sehingga sistem yang mencadang akan memberi peringatan kepada pembersih. Kemudian, pembersih mesti mendapat pemberitahuan awal untuk membersihkan wad pesakit yang disebutkan. Kualiti udara yang rendah memberi kesan kepada kesihatan manusia dan jika tong sampah penuh, ia boleh menyebabkan bau busuk kepada pesakit yang terlibat di hospital. Beberapa objektif meggunakan dengan Arduino Wemos D1 R2 untuk sistem ini. Pertama sekali, untuk mengkaji batasan amaran debu berasaskan IoT dan sistem smartbin untuk pesakit asma yang dapat mengesan zarah debu di wad pesakit asma dan menghantar notifikasi kepada pembersih, untuk membangunkan sistem amaran debu berasaskan IoT dan sistem smartbin untuk pesakit asma menggunakan Arduino dan aplikasi mudah alih dan untuk menilai sistem amaran debu dan smartbin berasaskan IOT yang mengembangkan kepada pesakit asma. Hasilnya, sistem ini berjaya mengesan habuk dan mengukur tahap sampah tong sampah. Sistem ini mengirim notifikasi dengan meggunakan “Wi-Fi” melalui aplikasi blynk.

ABSTRACT

This project name as IoT Based Dust Alerting and Smartbin System for Asthma Patient where it used agile methodology for implementation phase by using innovation device with low cost. The device detects the dust and measure the rubbish level and send the notification to the user using email. This device is a crucial device for an asthma patient ward to overcome the uninformed message to the cleaner. There are several problem statements related to this project. First of all, the air quality may put the patient into more severe level of unhealthy and difficulty of breathing as well so the proposed system will give some alert to the cleaner. Then, the cleaner must get the early notification to clean the mentioned patient ward. The low air quality effect human health and if the dustbin is full, it may cause some bad smell to the affected patient at the hospital. The are some objectives for this system are implemented using Arduino Wemos D1 R2. Firstly, to study limitation of IOT based dust alerting and smartbin system for asthma patient that can be detect the dust particles in asthma patient ward and send the notification to the cleaner, to develop IOT based dust alerting and smartbin system for asthma patient using Arduino and mobile application and to evaluate the developed IOT based dust alerting and smartbin system for asthma patient. As a result, this system is successfully detected the dust and measure the rubbish level of the dustbin. It sends the notification using Wi-Fi using blynk application.

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IOT DASSAP	IoT Based Dust Alerting and Smartbin System for Asthma Patient

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i.

INTRODUCTION

i.1 Introduction

Asthma is a common and chronic respiratory state which is affecting 300-400 million people in global. Asthma is the vital source of health assets usage and decreases the patient life quality. There is no remedy is found for asthma however it can be controlled by some medicaments through existing asthma management guidelines. The survey found that the asthmatic patients shows severity of incidence of the asthma rise up with higher healthcare costs, reduce the lifestyle of a patient like health of the patient and increase mortality. Furthermore, asthma related death cases reduced over last decagons but still in worldwide scale, assume accounts are around 250000 deaths for per year. Rising up the age, lower domain level, smoking habit and bad asthma supervise have been linked while increasing of the death cases.

Asthma is a condition of thin airways, expand and produce additional mucus. So, it's makes the breathing problem, trigger coughing, shortness of breathing and wheezing. There some types of asthma such as adult-onset asthma, allergic asthma, asthma- COPD overlap, exercise-induced Bronchoconstriction (EIB), Nonallergic asthma and occupational asthma by healthline. [1]. Asthma was stated as physician diagnosed asthma according to the existing of at least one asthma particular disease code with prescriptions of asthma drugs within 3 months before either after an asthma disease code. On patient view, tools designed to improve heath care of them whom are sustain more asthma trouble. Through bilingual research assistants (Ras) discussed an electronic triage board for respiration chief protests like breathing problem (difficulties of breathing, coughing, wheezing and respiratory distress).

Air impurities and ashes allergies are also cause of asthma to a particular person. So, a patient should be aware from the pollen particles time to time. They should keep in the clean environment to prevent the severity of the asthma. So, plan to keep the environment in hygiene way and collect the rubbish from the dustbin.

So, invent an idea to develop an Internet of Thing (IoT) Based Dust Alerting And Smartbin System For Asthma Patients. First of all, the kit may contain dust detection sensor to detect the dust, LED lights in green, red colours are to give alerting notification. The green colour LED light will be lights while there is dust free the place is and instead of red colour of LED light lights when there are dust particles is detected by the sensor itself. Then, the cleaner will receive the notification through email to their mobile at the same time the cleaner may collect the rubbish from the dustbin

while the blynk app is notify the cleaner. There is some device use by this project such as LED lights, MQ-135 (dust sensor), resistor, Arduino WEMOS, Ultrasonic sensor, jumper cable, powerbank and breadboard.

i.2 Background of the Problem

There are several problems were raised while the IOT Based Dust Alerting and Smartbin System for Asthma Patient such as air impurities and the hospital cleaning management get delay information about hygiene of the ward. First of all, the air quality may put the patient into more severe level of unhealthy and difficulty of breathing as well so the proposed system will give some alert to the cleaner. Then, the cleaner must get the early notification to clean the mentioned patient ward. The low air quality effects human health and if the dustbin is full, it may cause some bad smell to the affected patient at the hospital.

i.3 Objective

i. To study limitation of IOT based dust alerting and smartbin system for asthma patient that can be detect the dust particles in asthma patient ward and notify the cleaner.
ii. To develop IOT based dust alerting and smartbin system for asthma patient using Arduino and blynk.
iii. To evaluate the developed IOT based dust alerting and smartbin system for asthma patient.

i.4 Scope

i. Internet

This system must be connected to the internet to get the notification to the mobile application.

ii. Cleaner

The cleaner must be having an email account to register to log in the IOT Dust Alerting and smartbin System For asthma patient by each cleaner of the hospital to get the notification. The cleaner may collect the rubbish from the dustbin after getting the notification and able to vacuum the ward.

iii. Android
This system may use in Android mobile application only.

iv. Hospital
This system is specifically will invent for asthma patient due to improve the air quality level.

i.5 Thesis Organization

This chapter 1 is discussed about the introduction of project, problem statement, objective and scope as well. Then, the following chapter will discuss about the literature review of the existing system.

ii.

LITERATURE REVIEW

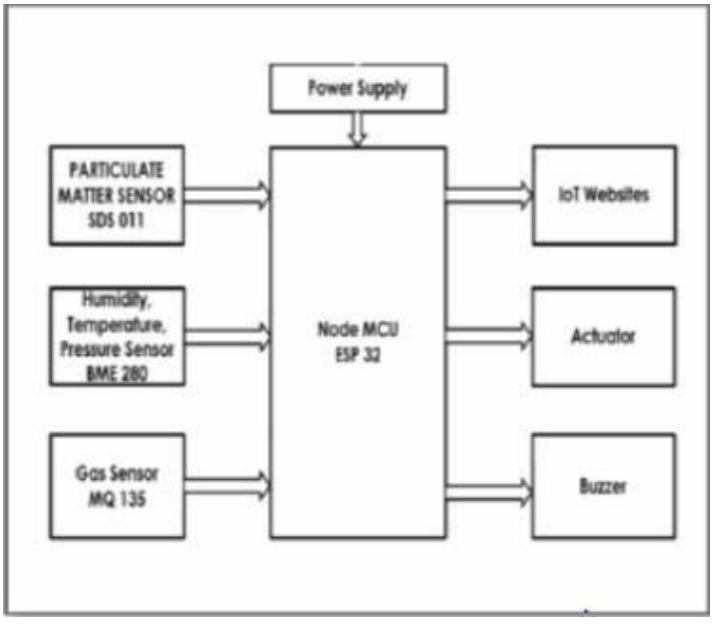
ii.1 Introduction

In this literature review of the project are contents the concept, theory and the method of the project that is used to solve the problem happened. The proposed solutions are depending on the of the problem statement of the project. This chapter shows the function or features of existing systems like notification, sensor type, development board, platform, transmission, user, interface, security and database as well.

ii.2 Four Related Work

2.1.1 IoT based real time air quality monitoring and control system to improve the health and safety of industrial workers

Figure 2.1: shows IoT based real time air quality monitoring and control system to improve the health and safety of industrial workers



IoT based real time air quality monitoring and control system to improve the health and safety of industrial workers is by Dr T Veeramanikandasamy.[2] The mentioned system that to guess the quality of air. The proposed embedded system model includes several sensors. It used by humans and any other

living thing which subsist on the universe. The notification is sending through email for high security purpose and used sensors are MQ 135 gas sensor, SDS011 optical dust particle sensor, BME280 humidity and temperature sensor. The development board used to develop this is NodeMCU ESP32 MCU. ThingSpeak IoT is the platform in mobile. The GPRS module is the transmission to transmits the data over the remote server. The system uses Virtuino to codes the code the program.

2.1.2 Personal Exposure Estimates via Portable and Wireless Sensing and Reporting of Particulate Pollution

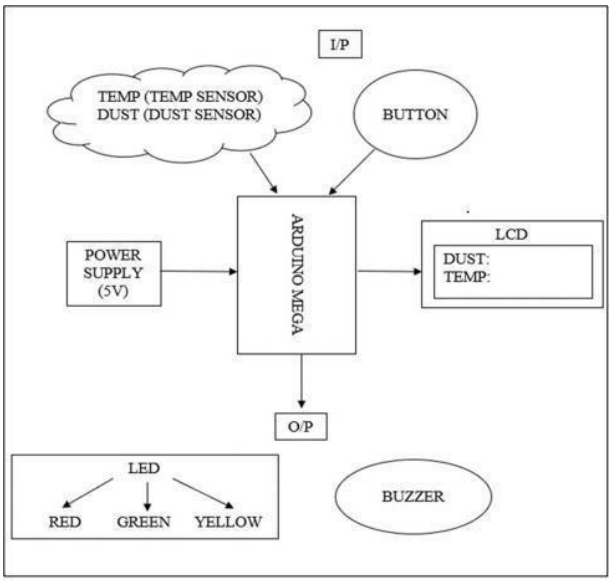
Figure 2.2: shows Personal Exposure Estimates via Portable and Wireless Sensing and Reporting of Particulate Pollution

Figure 2.2: shows Personal Exposure Estimates via Portable and Wireless Sensing and Reporting of Particulate Pollution

The second existing system is Personal Exposure Estimates via Portable and Wireless Sensing and Reporting of Particulate Pollution by Harsshit Agrawaal, Courtney Jones and J.E. Thompson. [3]. This system to imply portable observing, concentration values from the dust sensors were sent wirelessly in real time. It used by people. The kit is developed using Sharp GP2Y1010AU0F dust sensor, GPS sensor with ThingSpeak, Android OS App, logIT platforms. The system uses FONA808 3G development board. It's uses the wireless to transmit and store into the SD card. It's uses the Arduino Uno R3 board to develop the project with high security.

2.1.3 Smart Air Quality Monitoring System Using Arduino Mega

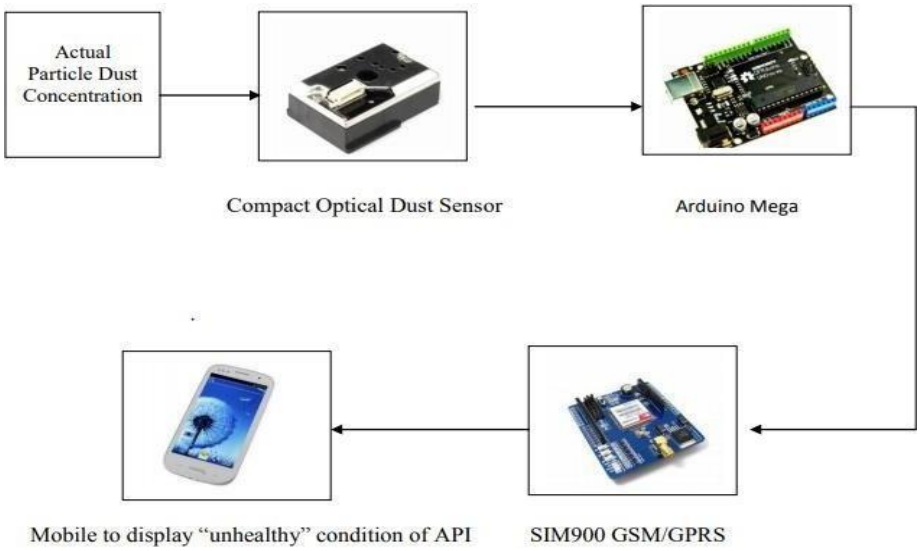
Figure 2.3: shows Smart Air Quality Monitoring System Using Arduino Mega



The third existing system is Smart Air Quality Monitoring System Using Arduino Mega by M K Fadzly. [4]. The mentioned system is to monitor and prevent the effect of high temperature and dusty air to the child and human. It is deployed in greener smart cities. The kit is developed using Dust sensor, temperature sensor with Arduino platform. The system uses Arduino Mega board to invented the project. The system remote server with high security.

2.1.4 Real Time Air Quality Reporting System

Figure 2.4 shows Real Time Air Quality Reporting System



The fourth existing Real Time Air Quality Reporting System use by Mohd Shariff, Sha-Sha Shelyn. [5]. This system to detect reading as a tool for reading the air pollution index (API). This kit sends the notification through SMS with high security. The system uses Compact optical dust sensor with arduino DFRduino UNO R3 board to developed. The kit transmits the data through SIM 900 GSM/ GPRS. The project coded in Arduino platform with Arduino interface. It uses by the human.

ii.3 Comparative Analysis

The table 2.1 shows the summary of the specification existing system.

Table 2.1 Shows table of specification.

Specification	IoT based Real-time Air Quality Monitoring and Control System to Improve the Health and Safety of Industrial Workers	Personal Exposure Estimates via Portable and Wireless Sensing and Reporting of Particulate Pollution	Smart Air Quality Monitoring System Using Arduino Mega	Real Time Air Quality Reporting System	Proposed System
Notification	Email	Not Available	Not Available	SMS	Email& Notification
Sensor	MQ 135 gas sensor, SDS011 optical dust particle sensor, BME280 humidity and temperature sensor	Sharp GP2Y1010 AU0F dust sensor, GPS sensor	Dust sensor, temperature sensor	Compact optical dust sensor	MQ135 sensor, HC-SR04 sensor
Development Board	NodeMCU ESP32 MCU	FONA808 3G	Arduino Mega	Arduino DFRduino UNO R3	Arduino Wemos D1

Platform	ThingSpeak IoT	ThingSpeak, Android OS App, logIT	Arduino	Arduino	Arduino, Blynk
Transmission	GPRS	Wireless	Not Available	SIM 900 GSM/ GPRS	Wireless
User	People and other living things in the earth	Human	Human and child	Human	Cleaner of ward, staff nurse and doctor
Interface	Virtuino	Arduino Uno R3	Arduino	Arduino Mega	Arduino Wemos D1 R2
Security	High	High	High	High	High
Database	Remote Server	SD Card	Remote server	Not available	Cloud Server

As mentioned from previous section, IoT based Real-time Air Quality Monitoring and Control System to Improve the Health and Safety of Industrial Workers is a system that to guess the quality of air. One of the advantages of this system is [estimate the quality of air for human and any other living thing which subsists on the universe: flexible]. This system helps different types of user to use the developed kit. The second advantage of this system is [Measures and control air pollution: observability]. This system is measures and control air pollution to prevent the air pollution. Apart from that, this system also has some disadvantages. The first disadvantage is [only for android user: limited user]. This system is developed for android user cause the Virtuino displays the sensor data graphically. The second advantage of this system is [cannot be accessible if no internet connectivity: Connectivity]. The online application supplies the universal access to calculate data by utilize any device which has the internet connectivity.

Personal Exposure Estimates via Portable and Wireless Sensing and Reporting of Particulate Pollution is a system that imply portable monitoring, concentration values from the dust sensors were sent wirelessly in real time. One of the advantages of this system is [Outdoor and indoor air quality measurements: Flexible]. The air quality measurements were made at various locations and times while people brought the sensors. The second advantage of this system is to improve air

quality [to improve air quality: better quality]. To improve the data stream quality, the impact of averaging copy individual pulses of the Sharp sensor when inspecting zero air has been studied. Apart from that, this system also has some disadvantages. The first disadvantage is [not sensitive enough for monitoring in all environments: Restriction]. This system is specifically sensitive to some dust particular only. The second disadvantage of this system is [can be exposed to very high levels of particulate matter: Inefficient]. This system is economically frequently can be exposed to high level of dusty when stoves were in used.

Smart Air Quality Monitoring System Using Arduino Mega is a system that is to monitor and prevent the effect of high temperature and dusty air to the child and human. One of the advantages of this system is [save cost: Cheap]. The development components are cheap. The second advantage of this system is [easy to access: accessibility]. The collected data of the system is easily accessible by a remote server. Apart from that, this system also has some disadvantages. The first disadvantage is [monitor limited place: Not flexible]. This is system monitor the air quality for limited place. The second disadvantage of this system is [can be use by the child: Inaccuracy]. The system handle by a child is not good and may can have complication if a child used.

Real Time Air Quality Reporting System is a system that [the main purpose of the system]. One of the advantages of this system is [cheaper: Inexpensive]. This system developed with low-cost component and the developed system in low budget. The second advantage of this system is [unhealthy condition of IPU will quickly: usability]. The unhealthy condition is easily detected in very early stage. Apart from that, this system also has some disadvantages. The first disadvantage is [limited accessibility: accessibility]. It's helps the user to gain some knowledgeable information about the Air pollution index at the someplace like home. The second disadvantage of this system is [Processing power is fixed: power consume. This system is recommended 7voltage to 12 voltage of power. The more than 12voltage cab be burn out the circuit.

Table 2.2 shows the summary of advantages and disadvantages of existing systems.

Table 2.2 shows the summary of advantages and disadvantages of existing systems.

Systems	Advantages	Disadvantages
IoT based Real-time Air Quality Monitoring and Control System to Improve the Health and Safety of Industrial Workers	[Flexible]: estimate the quality of air for people and any other living thing which exists on the earth [Observability]: Measures and control air pollution	[Limited User]: only for android user. [Connectivity]: Cannot be accessible if no internet connectivity.
Personal Exposure Estimates via Portable and Wireless Sensing and Reporting of Particulate Pollution	[Flexible]: Outdoor and indoor air quality measurements [Better Quality]: To improve air quality	[Restriction]: not sensitive enough for monitoring in all environments [Inefficient]: can be exposed to very high levels of particulate matter
Smart Air Quality Monitoring System Using Arduino Mega	[Cheap]: Save cost. [Accessibility]: easy to access.	[Not flexible]: Monitor limited place. [Inaccuracy]: can be use by the child.
Real Time Air Quality Reporting System	[Inexpensive]: cheaper. [Usability]: unhealthy condition of IPU will quickly	[Accessibility]: limited accessibility. [Power Consume]: Processing power is fixed.
Proposed System	[Security]: Highly protected [Inexpensive]: Low cost of sensor maintenance.	[Restrictions]: restricted users [Less Accuracy]: restricted stakeholders

ii.4 Chapter Summary

This chapter have been discussed regarding the different kind of the existing system which is related to the proposed project title. The table of specification and table of advantage and disadvantage are included in this chapter. The first existing system at the above is just Real-time Air Quality Monitoring and Control System, the second existing system at the above is about Personal Exposure Estimates about air pollution, smart air quality monitoring system and the fourth existing system at the above is checking real time air impurities however the proposed system check the air impurities and check the volume of the space of the dustbin.

iii.

METHODOLOGY

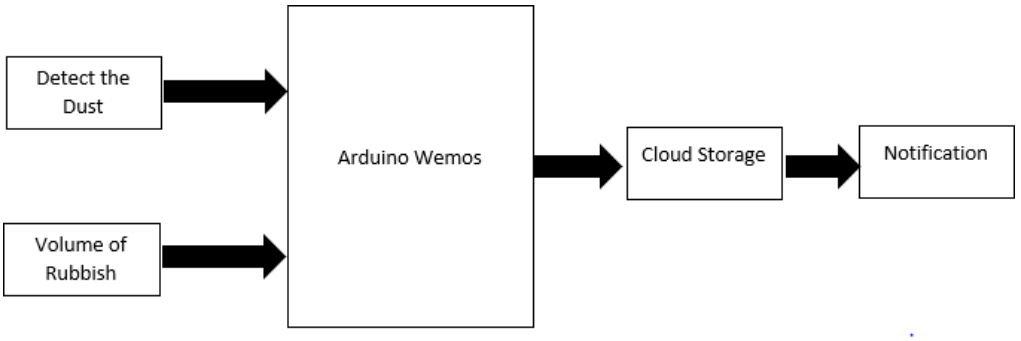
iii.1 Introduction

To make sure hardware and software will develop or design within budget and deadline. To invent a good software must be use software development life cycle. There are various types of software methodology to invent a satisfactory software which comprise some own pros and cons. In this chapter, there are some stages to build a system to notice the model through the system necessity and how it would be uses to build the software.

Methodology is isolated thing which can get the better of project twist in each stage. It is a variety of a documentations which covers the procedures and a diagrammatic representation of a tool or substances to be used. Each various software development life cycle explains their particular roles of phases in detailed. This IOT Based Dust Alerting System for Asthma Patient is using Agile methodology to be accomplished effectively.

Agile methodology is a training which encourages development of iteration and testing throughout the software development lifecycle. Agile is a process by which a team may cope up a project by segregating into small chunk phases to accomplishes the project within short period. There are six stages in this proposed methodology namely requirement, design, development, testing, deployment and review. This methodology assists the developers to develop the project within the budget and flexibility of the development phase.

Figure 3.1 Shows the Block Diagram

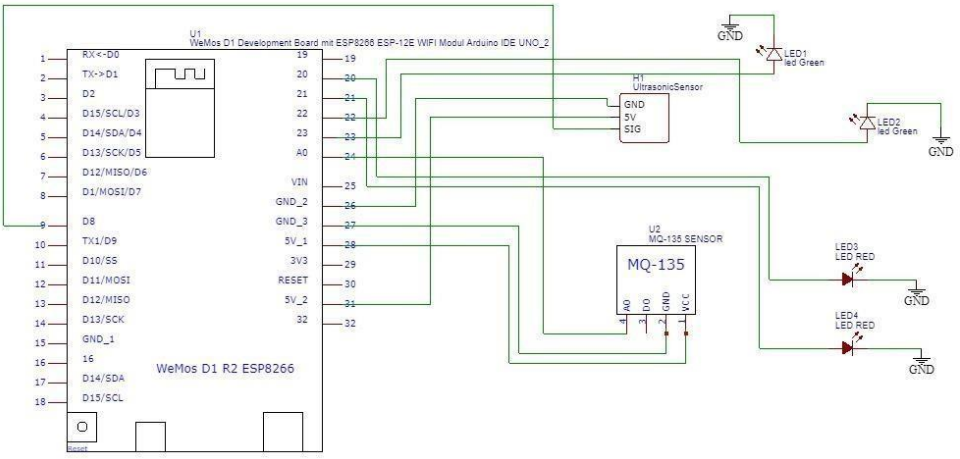


The above block diagram shows the general concept of the proposed design system. The proposed system first identifies the dust if exist through the MQ-135 sensor while indicates different colours of the LED for the notification to received and then the volume of the dustbin is checked by the ultrasonic sensor to occupied the space is not full the dustbin is. Later, the notification will send to the cleaner via the mobile application which is known as BLYNK application.

ARDUINO FRAMEWORK

Arduino Wiring-based Framework allows writing cross platform software to control devices to the Arduino board to develop program, interactive device. The example of framework for this purposed project is below.

Figure 3.2.1 shows Arduino Framework for dust sensor (MQ-135) and ultrasonic sensor (HC-SR04)



This framework is a bit relatable circuit of the proposed project and sensor to develop the project.

THRESHOLD VALUE OF AIR POLLUTION

The air quality is an important object in a human life. The air impurities are most important for an asthma patient to live longer. The better air quality is better for an asthma patient to breath peacefully.

Figure 3.3.1 shows Air Pollution Index

API	DESCRIPTOR
0 - 50	good
51 - 100	moderate
101 - 200	unhealthy
201 - 300	very unhealthy
>300	hazardous

This Air pollution Index (API) is helpful to check the air impurities in the asthma patient ward.

Figure 3.3.2 shows sample ward of the asthma patient

This figure is explained about the asthma patient ward. The larger size of the ward the more sensors should be added up into the breadboard to sense the air impurities and the larger size of the dustbin also require more sensors to sense the rubbish into the dustbin.

SOFTWARE DEVELOPMENT METHODOLOGY

Figure3.3 Agile Model

A. Requirement

During in this phase, all the requirements of a stakeholder will gather, analyze and written in SRS document.

B. Design

In this phase, the SDD document is documented for detailed design to be implemented as a hardware later.

C. Development

The programming codes and integration is made by this phase by module by module.

D. Testing

Test the project quality to produce a better quality of a product using quality assurance.

E. Deployment

Testing environment that is accessible by a specific user and close as possible to a real- world environment.

F. Review

An informal meeting or formal meeting by the panel and supervisor to get the feedback. The project kit must be demonstrated and evaluated and can be redevelop if there is any modifications needed.

iii.2 Proposed Design & Interface

All the detailed design and interface is explained in Appendix A which is Software Requirement Specification document and in Appendix B which is Software Design Description document.

iii.3 Hardware & Software Specification

All the detailed design and interface is explained in Appendix A which is Software Requirement Specification document and in Appendix B which is Software Design Description document.

iii.4 Chapter Summary

In this chapter, the needed requirement and methodology is discussed detailed in SRS and SDD document. The implementation of the proposed project is discussed in Chapter 4.

iv.

RESULTS AND DISCUSSION

iv.1 Introduction

This chapter is to discuss the implementation of the IoT Based Dust Alerting System and Smartbin for Asthma patient (IOT DASSAP) using Blynk application. The implementation process and data gathering and research are discussing in this chapter. The coding apply will be justified and reasoning for each module of the IOT DASSAP system. Testing method will be stated to be used in testing process of proposed system and result discussion will be analyzed. This system will be received the notification through Blynk application and the gmail as well.

iv.2 Result

The IOT DASSAP system is tested with gmail and Blynk application notification. The Arduino integrated development (IDE) is an open-source software that used to communicate with all type of the Arduino board. The open-source Arduino ide makes easy to program the code. sketches and upload to the Arduino board. For this proposed project, the chosen board is Arduino Wemos D1 R2 which contain the WIFI module to configure the codes. The Arduino 1.8.13 version is used to develop the project with downloaded Blynk Simple Esp8266 board manager. The first test data, the dust sensor can detect the dust particles around the asthma patient ward and send the notification through email. The second test data is ultrasonic sensor which can measure the distance of the rubbish into the dustbin and then send the notification through email too. The figure
4.2 shows the IOT DASSAP system for sensor detection.

Figure 4.2 shows the IOT DASSAP system

4.2.1 APLHA TESTING

Alpha testing is an acceptance testing type, it's executed to discover some possible bugs before delivering the final product. Alpha test accomplishes by the tester. The aim of this test is to recognize the final product by the tester team. Alpha test tests at the developer site. The alpha testing is capable to distribute the early error detection with functionality.

Table 4.2.1 Shows the result table of the system.

Test Data	Expected Result	Actual Result	Pass / Fail	Comment
MQ- 135 Sensor with Arduino Wemos D1 R2	Detect Dust	Detect Dust and send the notification	Pass	All work
Ultrasonic Sensor with Arduino Wemos D1 R2	Measure the rubbish level into the dustbin	Detect rubbish level	Pass	All work
Send notification through email	Receive the email notification	Receive the email notification and the blynk notification.	Pass	All work

The table 4.2.1 shows the result table of the system. All the part is work well. The MQ-135 sensor and the ultrasonic sensor detects the air impurities quality and the rubbish level. Once the air impurity level and the rubbish level tested, the notification will be sends to the email through Blynk application.

iv.3 Discussion

The MQ-135 sensor and ultrasonic sensor detection is the significant process of the proposed project. The figure 4.3.1 shows the connection between the sensors with Arduino Wemos D1 R2 board.

Figure 4.3.1 shows the IOT DASSAP system's connection

The hardware connected with jumper cables to receive the notification by email. This system is user friendly for the users. The figure 4.3.2 shows the ultrasonic sensor detection codes to function the sensor.

Figure 4.3.2 shows the ultrasonic sensor detection codes

```
void sendSensor()
{
  digitalWrite(trig, LOW);   // Makes trigPin low
  delayMicroseconds(2);       // 2 micro second delay
  digitalWrite(trig, HIGH);  // tigPin high
  delayMicroseconds(10);      // trigPin high for 10 micro seconds
  digitalWrite(trig, LOW);   // trigPin low

  duration = pulseIn(echo, HIGH);   //Read echo pin, time in microseconds
  distance = duration * 0.034 / 2;   //Calculating actual/real distance

  Serial.print("Distance = ");        //Output distance on arduino serial monitor
  Serial.println(distance);
  digitalWrite(ledgreen,HIGH);
  digitalWrite(ledred,LOW);

  if(distance <= 5){
    //Blynk.tweet("My Arduino project is tweeting using @blynk_app and it's awesome!\n #arduino #IoT #blynk");
    Blynk.notify("Dustbin is full");
    Blynk.email("Dustbin Status", "Dustbin is full");
    digitalWrite(ledred,HIGH);
    delay(2000);
    digitalWrite(ledgreen,LOW);
    delay(2000);
    Serial.println("led red is high");
    delay(1000);}
  Blynk.virtualWrite(V0, distance);
  delay(1000);                          //Pause for 3 seconds and start measuring distance again
}
```

The figure 4.3.3 shows the MQ-135 sensor codes to check the air impurities. The dust particles detect and notify with the notification through email and the blynk application to alert the staff of the asthma patient ward.

Figure 4.3.3 shows the codes of check the air impurities

```
void sendAnalog()
{
  sensorData = analogRead(A0); //reading the sensor on A0
  Blynk.virtualWrite(V5, sensorData); //sending to Blynk
  Blynk.notify("Dust detected");
  Blynk.email("Dust Status", "Dust Detected");
  Serial.print("mq135: ");
  Serial.println(sensorData);
}
```

The email notifies the motion of the MQ-135 sensor and the ultrasonic sensor to get the notification for the cleaner of the asthma patient ward to keep the surrounding in clean way.

Figure 4.3.4 shows email notification

The ultrasonic sensor and the MQ-135 sensor to set up to display the value of the frequency rate in Blynk application. The value only accessible by the asthma patient ward.

Figure 4.3.5 shows ultrasonic sensor and MQ-135 sensor display setting of Blynk application

iv.4 Chapter Summary

This chapter discuss briefly about the result and discussion of the proposed project. The implementation process checked and tested in this chapter by the tester team or developer site. The conclusion of the proposed project will be discussed in next chapter.

v.

CONCLUSION

v.1 Objective Revisited

The target of these objectives is to develop IOT DASSAP by applying the agile methodology with the functionalities. In this system, the development phase is based on the objectives stated as below achieve at chapter 4 of the thesis writing report:

i. To study limitation of IOT based dust alerting and smartbin system for asthma patient that can be detect the dust particles in asthma patient ward and send the notification to the cleaner.
ii. To develop IOT based dust alerting and smartbin system for asthma patient using Arduino and mobile application.
iii. To evaluate the developed IOT based dust alerting and smartbin system for asthma patient.

The first objective is met whenever the sensor reads the data of the sensors, notify the notification to the staff of the asthma patient ward. The IOT DASSAP device able to detect the dust particles and the rubbish level and give an alert to the asthma patient ward cleaner. The second objective is met while the sensors detect the dust particles and measure the level of rubbish into the smartbin. The last objective is tested while the alpha test is executed by the developer site of the proposed project.

v.2 Limitation

The IOT DASSAP device has low-cost maintenance for development process. This because of the system apply the agile methodology with limited time and budget. This concept inspires from the asthma patient survivor. The system will detect the air impurities quality and the measure the level of the rubbish into the smartbin, send the notification through the email. Email is more secure and formal at the workplace to give an alert message to the cleaner.

During the development phase of any system, it can be had pros and cons to develop the project. The issues may appear before either after completing the project. There are some aspect or performance is to be discussed for the improvements. The proposed device must be added more sensors to receive the accurate result for the big scale of the ward. Replace the air- conditioner remote control with the mobile phone. So, the staff of the hospital may control the air- conditioner process like switch on or off it using mobile. So, the staff of the respective ward can be switch off or on if any new patient admitted either discharged. The smart air-conditioner can be the future work for the proposed project.

v.3 Future Work

To check whether the IOT DASSAP device can be perfect device with few recommendations have been made for future improvement. has low-cost maintenance for development process. The suggestions are as below:

i. Using more sensors to ensure accuracy of the device.
ii. The remote control of air- conditioner of the ward must be replace with the mobile.

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APPENDICES

Appendix A: SRS

2020

SOFTWARE REQUIREMENT SPECIFICATION (SRS)

[IOT BASED DUST ALERTING AND SMARTBIN SYSTEM FOR ASTHMA PATIENT]

DOCUMENT APPROVAL

	Name	**Date**
Authenticated by: _____ Innarasi Periasamy	Innarasi Periasamy	1/7/2020
Approved by: _____ Client		

Software : Microsoft Office 2016, Azure Rp 8 Enterprise Edition, Blynk, PDF

Archiving Place : Google Drive

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PROJECT DESCRIPTION

In project description, it's explains the project description in simple way. First the MQ-135 dust sensor, will detect the dust and give some alert notification through Blynk application to the cleaner. So, it's having LED to lights to indicate the dust in the surrounding. The Red LED light shows free from dust the place is and instead the green LED shows the detection of the dust in the surrounding of the ward. The second module explains about the smart dustbin which is prevent the rubbish overflow and having the LED lights to detect the dustbin is overflow or empty. The green LED shows the dustbin is empty and red light shows, its full with the rubbish. This project uses Arduino to develop. This project uses Arduino WEMOS, LED light, battery, MQ-135 sensor (dust sensor), Ultrasonic sensor, breadboard to develop the project. This kit develops for the asthma patient ward to detect the dust or to keep the environment clean.

SYSTEM IDENTIFICATION

System Tittle: IOT based dust alerting and smartbin system for the asthma patient

System Abbreviation: IOT DASSAP

System Identification Number: IOT DASSAP_2020_V01

CONTEXT DIAGRAM

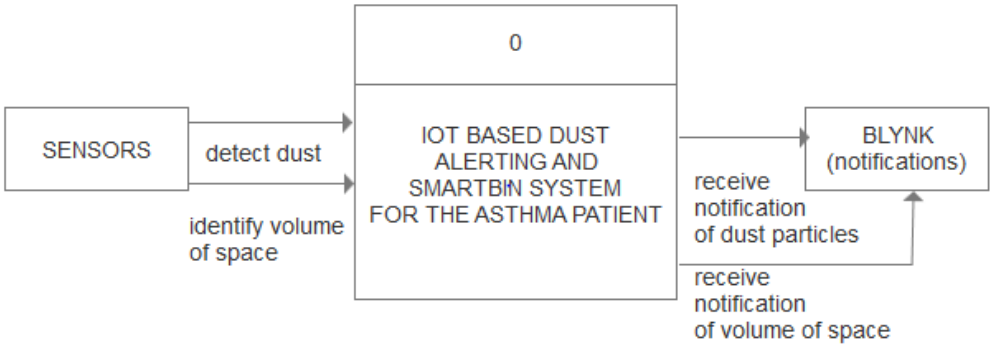


Figure 1 Shows Context Diagram

Sensor

This kit uses two different types of the sensors such as ultrasonic and MQ-135 sensor to detect the dust at the surrounding of the asthma patient ward. The ultrasonic sensor helps to identify the volume of space through measures the distance between the top of dustbin cover and the rubbish. So, its limits or prevents overflow of the dustbin's rubbish.

Blynk

Is an application which can send the notifications through the application and email then give an alert to the cleaner of the asthma patient ward at the hospital.

DATA FLOW DIAGRAM

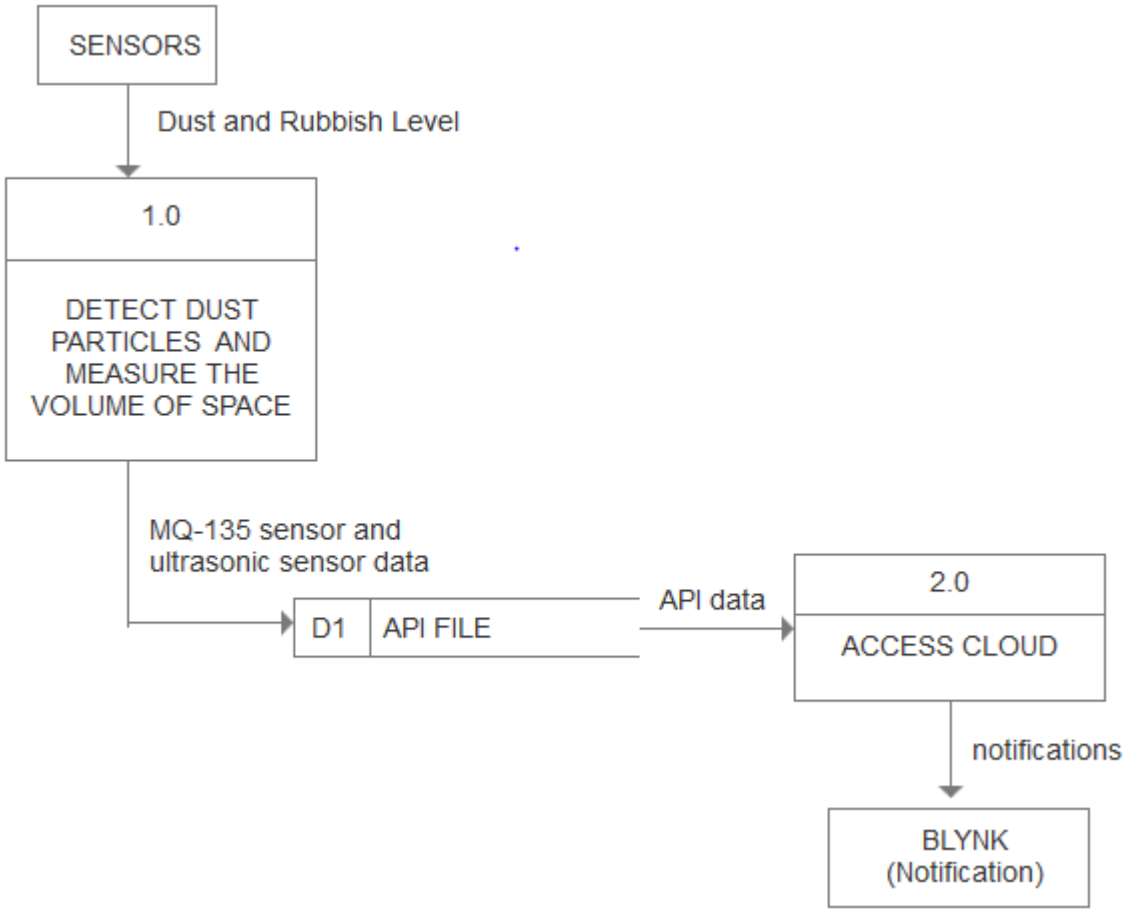


Figure 2 Shows the DFD Level 0

In this level -0 diagram, it contains 2 processes such as Detect dust particles and measure the volume of space, access cloud and source as API file. It has one input with one output. The MQ-135 sensor and ultrasonic sensor data access the API file by access the storage of blynk cloud to receive the email notifications.

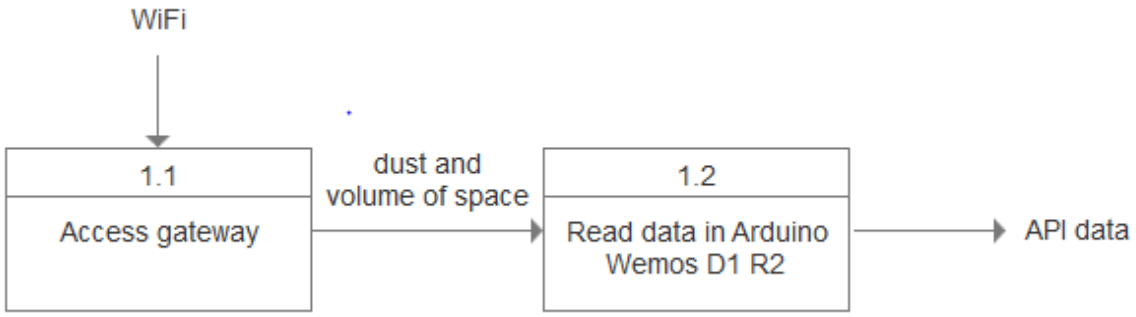


Figure 3 Shows the DFD Level 1 of reads data

In this level 1 access the gateway using WiFi to read the data in Arduino Wemos D1 R2 board using API of blynk application.

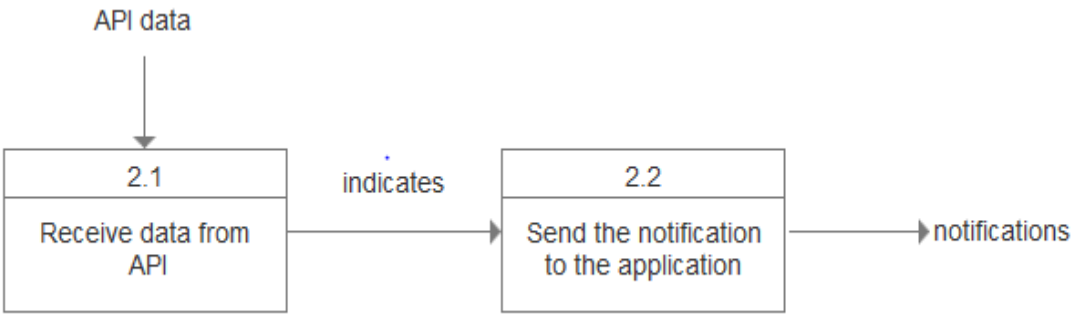


Figure 4 Shows the DFD Level 1 of Notifications

In this level 1 the API must be send the data of Arduino Wemos D1 R2 data to the application using email notification.

CHAPTER 2

2.1 USE CASE DIAGRAM AND DESCRIPTION

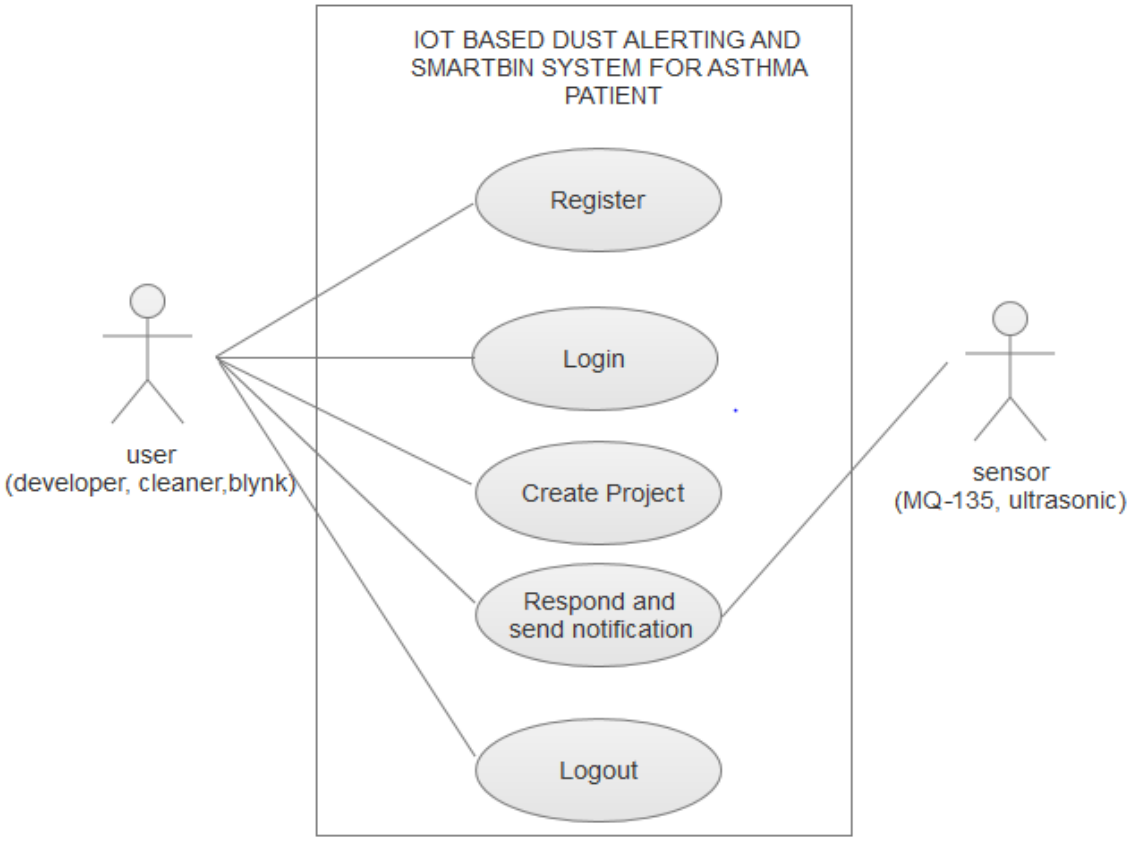


Figure 5 Shows the use case IOT based Dust Alerting And Smartbin System For Asthma Patient

This project contains four use cases such as Register, Login, Respond and send notification and Logout. The Register use case, must be enter an email and password to register to login. Then, the login must be entering a valid email address and password to login. The developer must create a new project by entering new project name, hardware model then clicks create to create a new project. Next, the respond and send notification, will detect the dust and the notification to the cleaner. The ultrasonic sensor will detect either the dustbin is containing some rubbish or empty to send the notification through BLYNK application. There are two actors in this use case such as user and sensor. The user as a developer can register and login the system. The MQ-135 sensor and ultrasonic sensor detect the dust and rubbish and then send the notification to the cleaner as the user. The user as a developer must click the logout button to exit the system.

CHAPTER 3

3.1 INTERFACE DESIGN

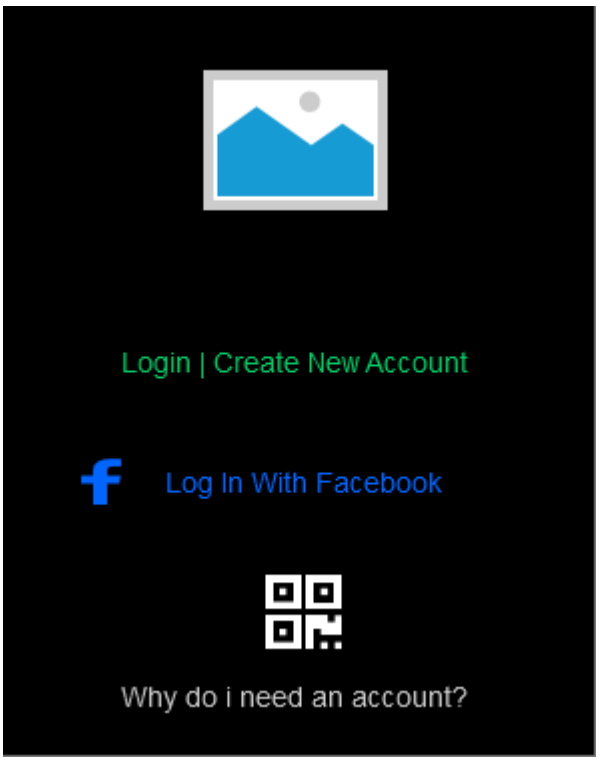


Figure 6 Shows Home page of BLYNK application

This diagram explains the main page of the application. The user may log in from here either register a new account.

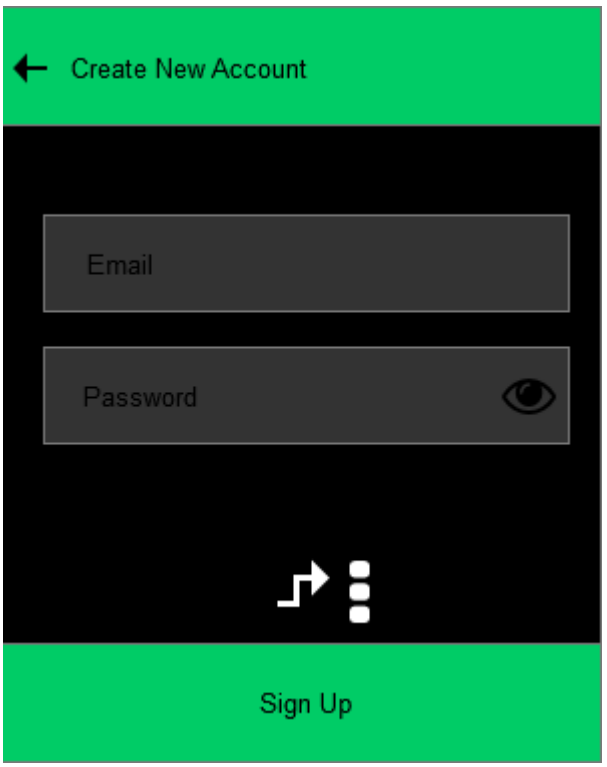


Figure 7 Shows the Register interface of BLYNK application.

The developer may register an account to develop a project by key-in the email and password then click Sign Up button to login.

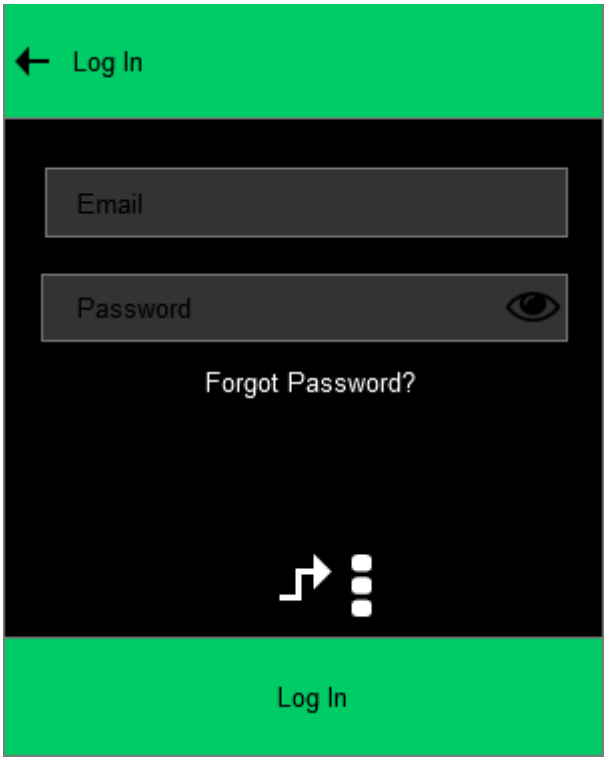


Figure 8 Shows the Login interface of the BLYNK application

The developer or cleaner must key in email and password to login the system. Then click Log In button to get the new project screen.

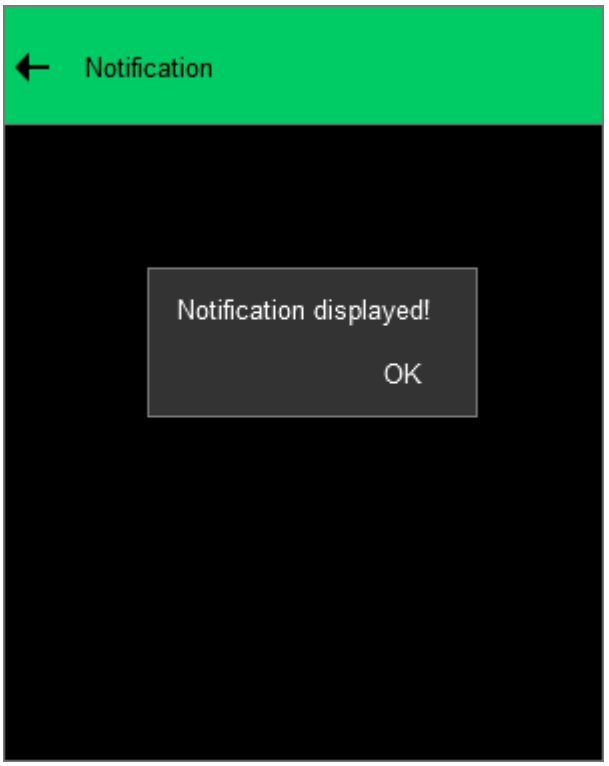


Figure 9 Shows the notification screen.

This interface shows the notification of the dust and rubbish after the sensor detected.

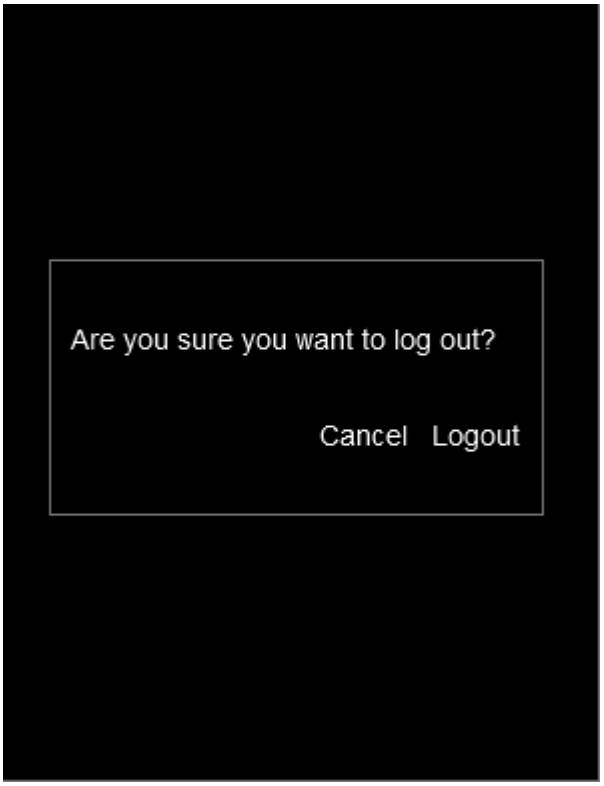


Figure 10 Shows the Log Out Interface

This interface shows an interface to exit the application.

3.2 HARDWARE AND SOFTWARE SPECIFICATION

Hardware	Purpose	Quantity
Arduino WeMos D1 R2 ESP8266	WeMos D1 R2 ESP8266 is may programmable through Arduino IDE. This is an ESP8266 based wifi enabled microprocessor unit on Arduino UNO footprint which means this board is works or looks like the Arduino UNO as well. Sensors, output devices and built in WIFI are also included in this board. CH340 USB is include to serial interface giving it the ability to be connected and programmed directly from your computer and requiring only a common micro USB cable. This board is using 3.3voltage logic module. Developer may program it using OTA or micro USB for auto programming.	1
MQ-135 Air Quality Detector Sensor Module	MQ-135 is an air quality or air pollution measuring sensor device. When the target pollution gas exists, the sensor's conductivity gets higher along with the gas concentration. This sensor is suitable for buildings, office to detect NH3, NOx, alcohol, benzene and smoke, CO2.	1
Ultrasonic Sensor Distance Measuring HC-SR04	Ultrasonic Sensor is used for distance measuring or for object detection. The sensor uses sonar (sound navigation ranging) is to determine to an object. So, the operation not affected by the sunlight, spotlight and object's surface colour which is going to be affect any infrared distance sensor's reading. It can offer non- contact range detection with high accuracy with stable reading.	1
Breadboard	Breadboard is a solderless device for a temporary kit for electronic circuit. The developer or inventor of the kit may experiment the kit without none of soldering with the components. The breadboard can be reusable for any projects. The developer or	1

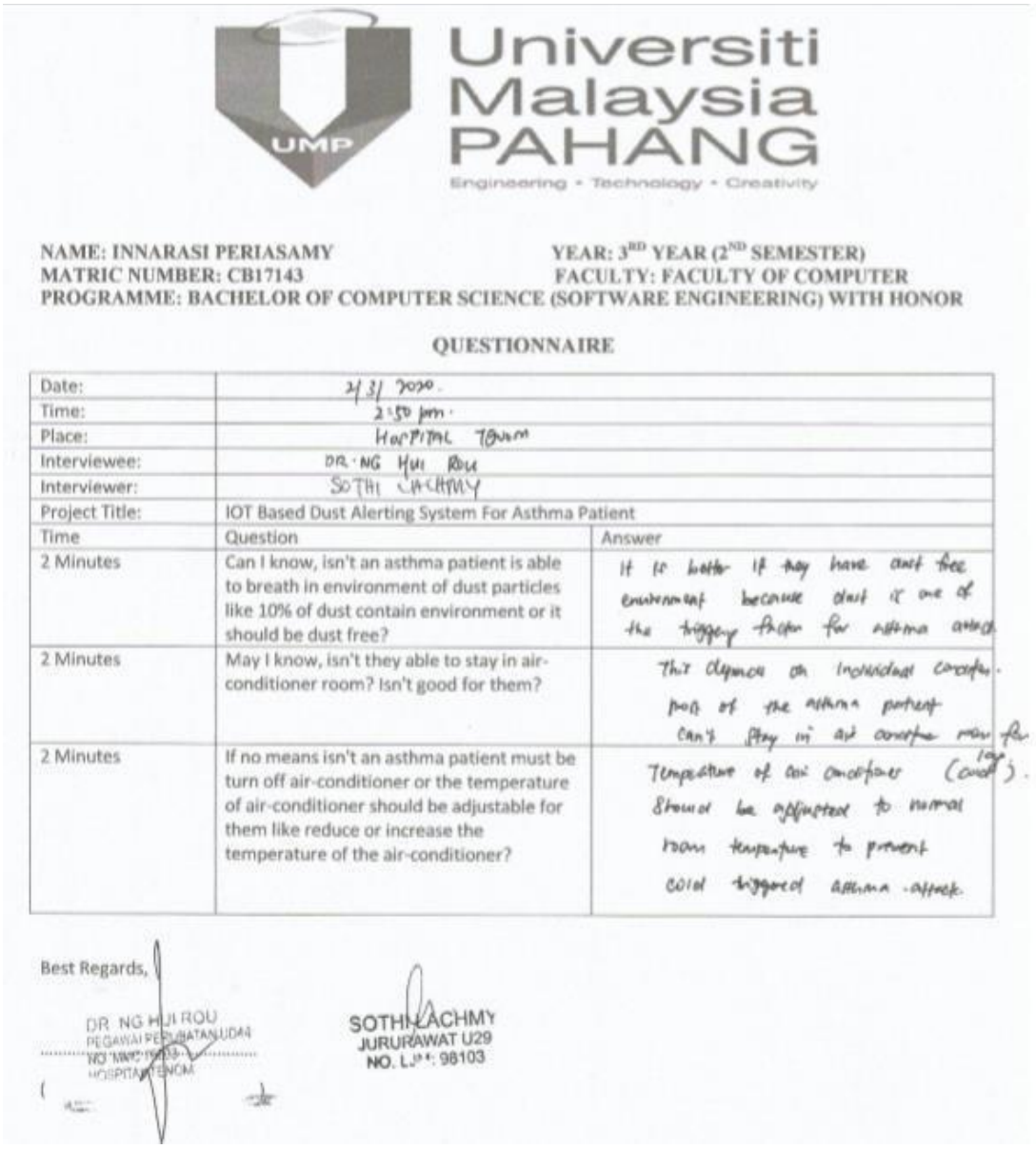
	inventor may modify the circuit whenever its needed.	
Jumper Wire	Jumper wires is using breadboard to connect with the components. The inventor may change the circuit as needed. There are three types of jumper wire is provided such as male-to-male, male -to-female and female- to- female. The colour of jumper wire doesn't mean anything but the connection can be difference by different colour of the cable such as power and ground.	13
LED	LED is stands for Light Emitting Diode. LED have two wires such as anode (positive) and cathode (negative). The both wires have different names because LED work at only one side. The LED available in some colours such green and red.	2
Resistor	Resistor is a one electrical component. The resistors used to reduce the current flow, adjust signal level and to divide the voltages of a battery. They are categorizing into two types such as variable resistor and carbon fixed resistor. The resistance measures in ohm.	2
Power bank	Power bank can be charged up the device. It's portable to bring along.	1

Table 1 Shows the hardware that use in this project to develop

Software	Purpose
Microsoft Word	To edit and prepare the report or thesis writing.
Google Chrome	To search and gain some useful information through the search engine.
Arduino	Codes the kit to alert the dust and if the rubbish is overflow. Monitor the system's input and output.
Blynk	To control the system through the mobile phone. To receive the notification from the kit.
Axure Rp 8	To design sequence diagram, use case and interface for SRS document.
Adobe Reader	Convert the reports into the PDF format.
Frizting	To sketch the framework of the proposed system.

Table 2 Shows the used software for the purposed project

Appendix



Universiti Malaysia PAHANG
Engineering • Technology • Creativity

NAME: INNARASI PERIASAMY
MATRIC NUMBER: CB17143
PROGRAMME: BACHELOR OF COMPUTER SCIENCE (SOFTWARE ENGINEERING) WITH HONOR

YEAR: 3RD YEAR (2ND SEMESTER)
FACULTY: FACULTY OF COMPUTER

QUESTIONNAIRE

Date:	2/3/ 2020.	
Time:	2:50 pm.	
Place:	HOSPITAL TAWAM	
Interviewee:	DR. NG HUI ROU	
Interviewer:	SOTHI LACHMY	
Project Title:	IOT Based Dust Alerting System For Asthma Patient	
Time	Question	Answer
2 Minutes	Can I know, isn't an asthma patient is able to breath in environment of dust particles like 10% of dust contain environment or it should be dust free?	It is better if they have dust free environment because dust is one of the triggers factor for asthma attack.
2 Minutes	May I know, isn't they able to stay in air-conditioner room? Isn't good for them?	This depends on individual condition. most of the asthma patient can't stay in air conditioner room for long (cold).
2 Minutes	If no means isn't an asthma patient must be turn off air-conditioner or the temperature of air-conditioner should be adjustable for them like reduce or increase the temperature of the air-conditioner?	Temperature of air conditioner should be adjusted to normal room temperature to prevent cold triggered asthma attack.

Best Regards,

DR. NG HUI ROU
PEGAWAI PERUBATAN/UD44
NO. MMC: 70613
HOSPITAL TENOM

SOTHI LACHMY
JURURAWAT U29
NO. LJP: 98103

Questionnaire 1. Shows Questionnaire 1

Universiti Malaysia PAHANG

NAME: INNARASI PERIASAMY YEAR: 3RD YEAR(2ND SEMESTER)
MATRIC NUMBER: CB17143 FACULTY: FACULTY OF COMPUTER
PROGRAMME: BACHELOR OF COMPUTER SCIENCE (SOFTWARE ENGINEERING) WITH HONOR

QUESTIONNAIRE

Date:	2nd March 2020	
Time:	7.00PM	
Place:	Cheras,Selangor	
Interviewee:	NandaKumari Sabapathy	
Interviewer:	Innarasi Periasamy	
Project Title:	IOT Based Dust Alerting System For Asthma Patient	
Time	Question	Answer
2 Minutes	Is that an asthma patient can able to breath in the environment which contains of 10% of dust particles? Or it should be dust free environment?	It should be dust free environment.
2 Minutes	Is that asthma patient could able stay back in air conditioning room? Is it good for them?	Avoid spending long hours in air conditioning room.It's not advisable for asthma patient inview of reduced humidity and cold can trigger the asthma attack.
2 Minutes	If Not, asthma patient should be turn off the air conditioner to reduce the temperature or be reduce the temperature of a air conditioner room?	Need to maintain indoor humidity between 35 percent and 40 percent. Air- conditioned room temperature should not dip below 24 degree Celsius.

Best Regards,
Nandakumari
Physiotherapist II
UTAR
(NANDAKUMARI SABAPATHY)

Best Regards,
(DR.BALASUBRAMANIAM A/L SUBRAMANIAM)

Questionnaire 2. Shows Questionnaire 2

Appendix B: SDD

2020

SOFTWARE DESIGN DESCRIPTION (SDD)

[IOT BASED DUST ALERTING ANS SMARTBIN SYSTEM FOR ASTHMA PATIENT]

DOCUMENT APPROVAL

	Name	Date
Authenticated by: _____ Innarasi Periasamy	Innarasi Periasamy	
Approved by: _____ Client		

Software : Microsoft Office 2016, Azure Rp 8 Enterprise Edition, Blynk, PDF

Archiving Place : Google Drive

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1.1 PROJECT DESCRIPTION

In project description, it's explains the project description in simple way. First the MQ-135 dust sensor, will detect the dust and give some alert notification through Blynk application to the cleaner. So, it's having LED to lights to indicate the dust in the surrounding. The green LED light shows free from dust the place is and instead the red LED shows the detection of the dust in the surrounding of the ward. The second module explains about the smart dustbin which is prevent the rubbish overflow and having the LED lights to detect the dustbin is overflow or empty. The green LED shows the dustbin is empty and red light shows, its full with the rubbish. This project uses Arduino to develop. This project uses Arduino WEMOS, LED light, battery, MQ-135 sensor (dust sensor), Ultrasonic sensor, breadboard to develop the project. This kit develops for the asthma patient ward to detect the dust or to keep the environment clean.

1.2 SYSTEM IDENTIFICATION

System Name: IOT based dust alerting and smartbin system for the asthma patient

System Name Abbreviation: IOTDASSAP

System Identification Number: IOT DASSAP_2020_V01

Module System Identification:

<System name>_<Module number>_<Module ID> <Module name>

IOTDASAP_M1_01 Register

IOTDASAP_M2_01 Login

IOTDASAP_M3_01 Respond and Send the Notification

Class Identification:

<System name>_<Class number>_<Class ID> <Class name>

IOTDASAP_C1_01 Register

IOTDASAP_C2_01 Login

IOTDASAP_C3_01 Respond_and_Send_the_Notification

Data Dictionary Identification:

<System name>_<Data number>_<Data ID> <Data name>

IOTDASAP_D1_01 project

1.3 ARCHITECTURE / BLUE PRINT

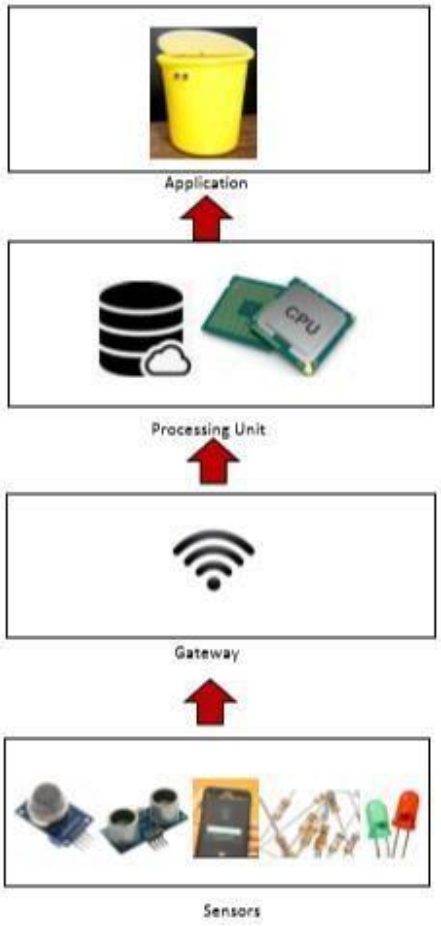


Figure 1 shows the Architecture for the purposed Project

This purposed project is going to develop using some sensors such as MQ-135 and ultrasonic sensor with LED lights, resistors by using Mobile to access to system. This system has gateway to register or login by using WIFI or mobile data to reach the storage at the cloud. Then, the system will work by displaying the notification.

1.4 ARCHITECTURE / BLUEPRINT DESCRIPTION

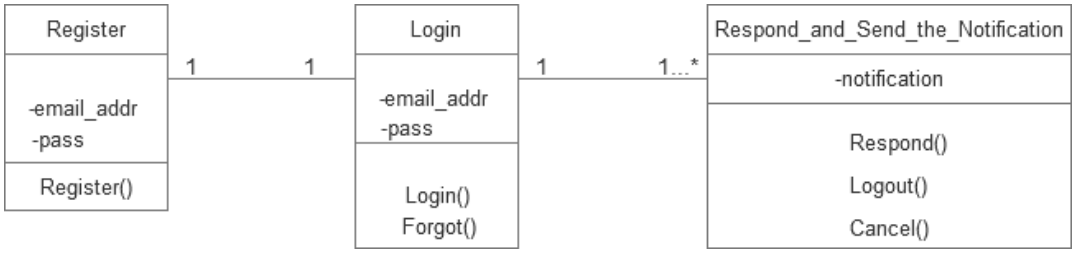


Figure 1 shows Class Diagram of the IOT Based Dust Alerting And Smartbin System For Asthma Patient

This class diagram explains the Register, Login and Respond_and_Send_the_Notification classes. The Register class only have one method as Register which have the relationship with the Login class. The Register and the Login has two different attributes such as email_addr and pass. Then, the Respond_and_Send_the_Notification class have many methods which is not a loosely coupling and have an attribute such as notification.

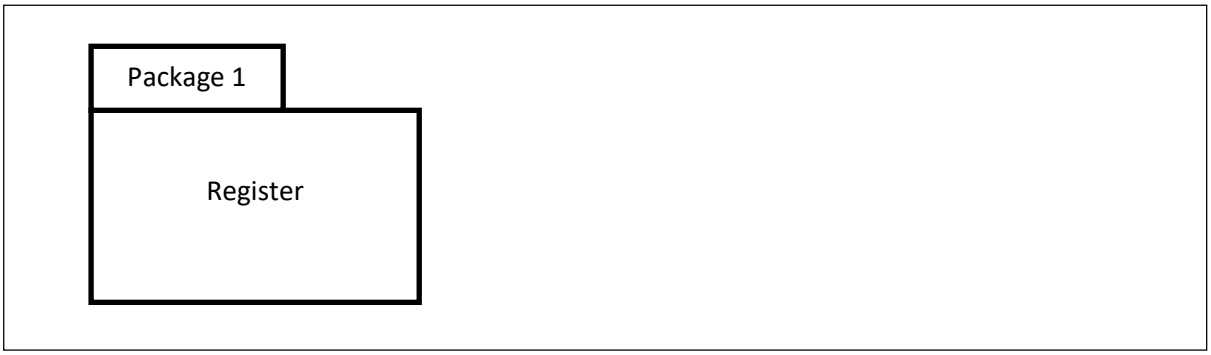
Table 1 Class Diagram [SDD-IOTDASAP-01]

Class Name	Description
Register	All cleaner should register on the website to login.
Login	All cleaner must have an email address and password to login the IOT based Dust alerting system for Asthma Patient.
Respond_and_Send_the_ Notification	The cleaner will get the notification from the BLYNK application to clean the ward if there any dust particles exist or the dustbin is full.

CHAPTER 2

2.1 DETAILED DESCRIPTION

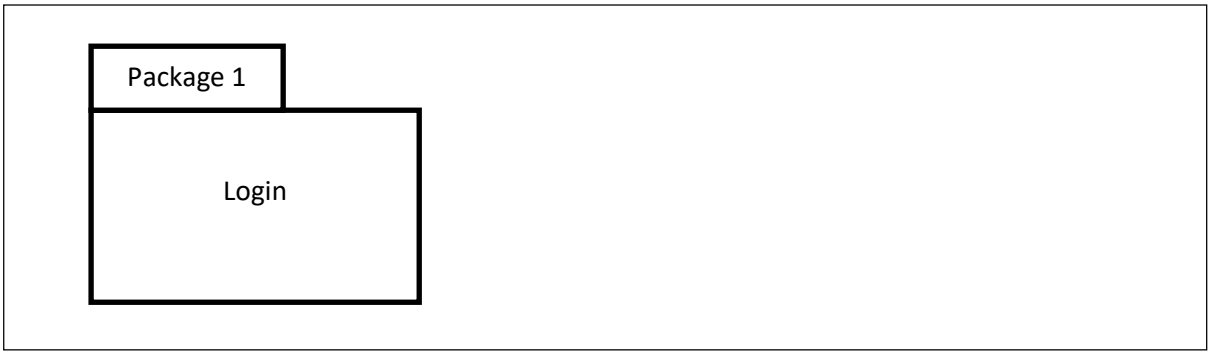
2.1.1 Register [SDD-IOTDASAP-M1_01]



2.1.1 Register [SDD-DASAP-M1_01]

Class Type	**Physical**	
Responsibility	A storage to hold the email address and password of the system.	
Attributes	Attributes Name	Attributes Type
	email_addr pass	String String
Methods	Method Name	Description
	Register()	To login the system at different browser.
Algorithm	BEGIN Click “Create New Account”. Enter email address. Enter password to register. Click ‘Sign Up’ button. END	

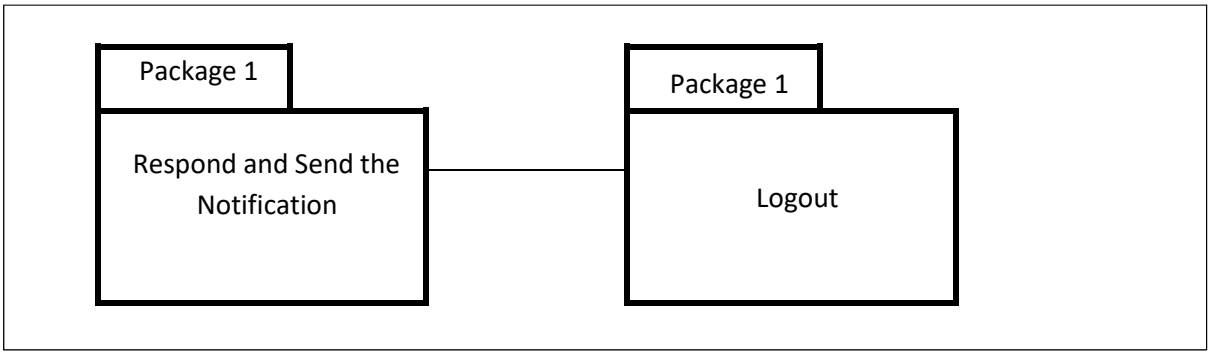
2.1.2 Login [SDD-IOTDASAP-M2_01]



2.1.2 Login [SDD-IOTDASAP-M2_01]

Class Type	**Storage**	
Responsibility	A storage layer to login the device by using email address and password from the physical layer.	
Attributes	Attributes Name	Attributes Type
	email_addr pass	String String
Methods	Method Name	Description
	Login() Forgot()	To access the system. To reset the password.
Algorithm	Login() BEGIN Enter email address. Enter password to register. Click ‘Log In’ button. END Forgot() BEGIN Enter email address or scan QR code if already have it. Click “Send” to receive email to reset the password. Display notification to login the system by clicking “Back to Login” button. END	

2.1.3 Respond and Send the Notification [SDD-IOTDASAP-M3_01]



2.1.3 Respond and Send the Notification [SDD-IOTDASAP-M3_01]

Class Type	**Integration**	
Responsibility	An integration layer to detect the dust and measure the volume of the rubbish into the dustbin and to logout the device by using the physical layer.	
Attributes	Attributes Name	Attributes Type
	MQ-135 sensor Ultrasonic sensor Green LED Red LED Resistor Notification icon	component component component component component String Button
Methods	Method Name	Description
	Respond() Logout() Cancel()	To get the information of dust and volume of space into the dustbin. To exit from the system. To do not logout the system.
Algorithm	Respond() BEGIN The MQ-135 sensor detects the dust in asthma patient ward. The LED lights to display a valid notification. The ultrasonic sensor measures the volume of the space of the dustbin.	

	The LED lights to display a valid notification. Send notification to the cleaner. END Logout() BEGIN Click the Logout icon at the left top of the system. Display a message box. Click “Logout” to exit. END Cancel() BEGIN Click the Logout icon at the left top of the system. Display a message box. Click “Cancel” button to do not logout the system. END

2.2 DATA DICTIONARY

2.2.1 project

Field Name	Description	Data Type	Constraint
email_addr	Email address used by the developer or the cleaner to register and login the system.	VARCHAR(50)	PK
pass	Password used by the developer or the cleaner to register and login the system.	VARCHAR(50)	
notification	The notification send to the cleaner through the BLYNK application.	VARCHAR(50)	
projectName	The title of the project is used to recognize the project by the developer.	VARCHAR(50)	
device	The hardware used for the Arduino to connect the WIFI model.	VARCHAR(50)	
theme	The colours of the interface by the BLYNK application.	VARCHAR(50)	
authToken	Helps the validated privileges to access the system through email.	VARCHAR(50)	
qrCode	Helps the user to login through the QR Code generated by the BLYNK application.	VARCHAR(50)	