IOT BASED CLASSROOM AUTOMATION SYSTEM

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This report is submitted in partial fulfillment of the requirements for the Bachelor of [Computer Science (Computer Networking)] with Honours.

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DEDICATION

Specially dedicated to

My beloved parents, sister and friend who have encourage, guided and inspired me throughout my journey of education.

To my helpful lecturer, thank you for the guidance from the beginning until the end of the final year project.

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ABSTRACT

Leaving the classroom without switching off the classroom appliances such as fans and lights is a common problem due to busy life style. Such a careless behavior does not only result in wastage of electricity and money but also bring potential danger to the University building. Thus a system called IoT based classroom automation system invented to gives security to the user's classroom if they are away. This system is created using Android application that the classroom appliances such as fans, air conditioner and lights can be controlled by the users. Through this system the safety of user guaranteed. Research is conducted throughout this project progress to acquire and understand more details about smart classroom system. The smart classroom system concept is similar with home automation system which controls surrounding light and fan using sensors and IoT communication with users.

ABSTRAK

Meninggalkan kelas tanpa menutup suis peralatan kelas seperti kipas dan lampu adalah masalah biasa yang dihadapi disebabkan masalah lupa dalam gaya hidup yang sibuk. Tingkah laku yang sedemikian tidak hanya mengakibatkan pembaziran elektrik dan wang tetapi juga mengundang bahaya kepada bangunan Universiti. Oleh itu, sebuah sistem yang dipanggil sistem automasi kelas IOT telah direka untuk pengguna kelas demi membantu mereka memastikan keadaan kelas dalam keadaan selamat selepas penggunaanya walaipun mereka berada jauh dari kelas yang digunakan. Sistem ini direka menggunakan aplikasi Android supaya pintu dan peralatan kelas seperti penghawa dingin dan lampu boleh dikawal oleh pengguna. Melalui sistem ini keselamatan pengguna dijamin. Penyelidikan dijalankan sepanjang projek ini untuk memperoleh maklumat dan memahami lebih mendalam mengenai sistem bilik darjah pintar. Konsep sistem bilik darjah pintar adalah serupa dengan sistem automasi rumah yang mengawal cahaya dan kipas dengan sensor yang diintegrasikan IoT untuk berhubung dengan pengguna.

TABLE OF CONTENTS

	PAGE
DECLARATION	i
DEDICATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
ABSTRAK	V
TABLE OF CONTENTS	vi
LIST OF TABLES	vii
LIST OF FIGURES	xi

CHAPTER 1 INTRODUCTION	1
1.1 Project Background	1
1.2 Problem Statement	2
1.3 Project Question	2
1.4 Objectives	2
1.5 Project Scope	3
1.6 Significant of project	3
1.7 Thesis Outline	4

CHAPTER 2 LITERATURE REVIEW		
2.1 Introduction	5	
2.2 Overview of IoT Classroom automation system	5	

2.3. Previous related work.	6
2.3.1 Classroom System based on GSM	6
2.3.2 Classroom based on Wi-Fi	8
2.3.3 Classroom Appliance based on ZigBee primarily	10
2.3.4 Ubiquitous Classroom System using android application	11
2.3.4.1 System style	11
2.3.5 Software package development of the robot platform app	12
2.3.6 Sensible Classroom machine-driven system exploitation Android Application and Microcontroller	12
2.3.6.1 Classroom System	12
2.4 Critical Review of Current Problem and Justification	13
2.5 Conclusion	14

(CHAPTER 3 METHODOLOGY15		
	3.1 Project Introduction	15	
	3.2 Prototype Development	15	
	3.2 .1Block Diagram	15	
	3.2.2 Flowchart for the Classroom System	16	
	3.2.3 Wi-Fi as communication pipeline	17	
	3.3 Development Platform.	17	
	3.3.1 Android	18	
	3.3.2 Wi-Fi	18	
	3.4 Wi-Fi Interfaces with Microcontroller	19	
	3.5 Project Milestone	20	
	3.6 Conclusion	21	

CHAPTER 4 ANALYSIS AND DESIGN.	
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4.1 Introduction	
4.2 Problem analysis	22
4.3 Requirement analysis	23
4.3.1 Data Requirement	23
4.3.2 Functional requirement	24
4.3.3 Software requirement	25
4.3.3.1 Arduino IDE	25
4.3.3.2 Blynk application	
4.3.4 Hardware Requirement	27
4.3.4.1 Microcontroller (Arduino uno)	27
4.3.4.2 Wi-Fi Module	
4.3.4.3 Relay Module	
4.3.4.4 Jumper Wire	
4.3.4.5 DHT Sensor	
4.3.4.6 12 v bulb	
4.3.4.7 PIR Sensor	
4.3.4.8 DC Fan	
4.4 Design specification	
4.5 Design diagram	
4.6 Model Design	
4.6 Conclusion	
Refrences	

LIST OF FIGURE

TITLE	PAGE
Figure 1.1 Classroom system based on GSM	8
Figure 2.2: Diagram of Classroom Appliance.	9
Figure 2.3: Diagram of Transmission Unit	10
Figure 2.4: System diagram	11
Figure 2.5: Connection of Appliances	13
Figure 3.1: System Diagram of the project	15
Figure 3.2: Flow chart for program	16
Figure 3.3: Wi-Fi module connectivity with microcontroller	19
Figure 4.1: Data flow	23
Figure 4.2: Functional diagram	24
Figure 4.3: Arduino IDE software	25
Figure 4.4: Blynk interactions with Arduino	26
Figure 4.5: Arduino Uno	27
Figure 4.6: Wi-Fi Module	28
Figure 4.7: Relay module	29
Figure 4.8: Male to Male jumper wire	30
Figure 4.9: DHT Sensor	31
Figure 4.10: 12v bulb	31
Figure 4.11: PIR Sensor	32
Figure 4.12: DC Fan	33
Figure 4.13: Design Diagram	35
Figure 4.14: Model Design	36

LIST OF TABLE

TITLE	PAGE
Table 2.1: Comparision of previous related projects	14
Table 3.1: Comparison between Wi-Fi and ZigBee	17
Table 3.2: Project Milestone	20

CHAPTER 1

INTRODUCTION

1.1 Project Background

Enhancement in improving home appliance technologies has been encouraged by numerous devices which are fully equipped in house where most of the devices are perfectly automated where this category is called technology advancement. Convenient and energy preserving in classroom has also been encouraged from the development of classroom appliances. When Malaysia is still mostly working on about carrying out the utilization of renewable energy, classroom appliances with controlling capabilities provides less wastage of power. To comfort human work time, all of the devices at home does not need human decision or inspection where all devices works automatically and this activity is linked with the phrase home appliances.

Advanced enhancement has attained far beyond than expectation to the Android, bringing performance and huge convenient leading from utilization of classroom appliances because of it is easy to do alteration and also the OS is free. One step ahead is obtain for the Android where the Android layers, which is a functional concept, empowers fluid device control. The device will have its own capacity and as the Wi-Fi communication works flawlessly with Android for relocating anywhere.

Without walking towards the classroom switches, you can control from distance using Android for home appliances, and can manipulate many types of protocol for classroom control with the android gadget, explaining that never really need Wi-Fi features to connect numerous types of connection among devices and Android.

Luminance, ventilation, and other home essentials can be taken over by classroom appliances system thus numerous adjustment can be taken as the implementation is reasonable in the expansion of hardware. Using android which is free, modernized system is achieved so at any time when the new OS released, user can just update the version without even purchasing.

1

1.2 Problem Statement

In below showing about the problem statement that identify by these project are:

Nowadays, people leave their classroom without switching off the classroom appliances such as fans and lights due to busy life style. Such a careless behavior does not only result in wastage but also bring potential danger to the University building. High cost on electricity due to light and fan are switched "ON" for 24 hours per week. Owing to the above problems, an automated classroom control and monitoring system is needed to keep the wastage and danger to the very minimum.

1.3 Project Question

This study attempts to answer the following research questions:

- 1. How to detect motion movement and temperature reading?
- 2. How to control the switch?
- 3. How to control the appliances in classroom?

1.4 Objectives

This project's objectives are to enhance a system towards a better efficiency and functions. Thus, the project aim had been listed at below numbering:

- 1. To develop mobile based classroom appliance system with sensors that will be able to detect motion and temperature.
- 2. To provide an efficient electric usage by managing the switch control online using mobile application.
- 3. To explore on how to controlling classroom appliances through Wi-Fi connectivity.

1.5 Project Scope

This project purpose is with the help of android, classroom appliance system is being enhanced. Utilizing the Android platform, system is able to control and handle the whole classroom appliances. This system also gives security to the user's classroom if they are away. Safety of user guaranteed. Using the Android application, classroom appliances such as fans, air-conditioner and lights and be controlled over by the user. Motion sensor provides switching "ON" and "OFF" if the user enters or exits the room.

1.6 Significant of project

This project is a result from analyzing manual system which were found to be in classroom like controlling fan and lights. Designing mobile based classroom appliance system offers easy to use, low course and open source platform for better energy saving convenience and efficiency.

1.7 Thesis Outline

There are 7 chapters in this thesis which are included of Introduction, Literature Review, Methodology, Analysis & Design and Implementation, Testing and Conclusion.

Chapter 1 is about the introduction of this project. There are problem statement, project objectives, project questions, scope of the project has been discussed and presented in this chapter. Chapter 2 is about the literature review which explains about preceding studies that was done before this system was introduced to the community. Greater overview of this project is achieved by using the studies as a reference.

Chapter 3 is about project's methodology, which contains projects prototype and block diagram. Chapter 4 is about analysis and design of project. In this chapter, the requirement of analysis and hardware design will be presented.

Chapter 5 is about Implementation of the project which contains hardware configuration and software setup. Project's prototype development is widely explained.Chapter 6 is about testing the whole projects accomplishing its objectives. There are testing connection of Arduino, on/off switch testing, sensor detection testing, and mobile app connection with Arduino testing.

Finally, chapter 7 is about the overall projects conclusion. This chapter also provide the future ideas that able to upgrade the current prototype.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will contains entirely about Smart classroom system hardware's, software's and research on previous existing system. Research is conducted throughout this project progress to understand more details about smart classroom system. The smart classroom system concept is similar with home automation system which controls surrounding light and fan using sensors and IoT communication with users.

2.2 Overview of IoT Classroom automation system.

IoT (Internet of Things) is the ability to make everything around us starting from (i.e. Machine, Devices, Mobile phone and Cars) even (Cities and Roads) are expected to be connected to the Internet with an intelligent behaviour and taking into account the existence of the kind of autonomy and privacy Invalid source specified. inter-networking of devices. embedded physical systems, buildings, sensors, and other similar devices to stay connected actuators IoT allows the objects and exchange data. to be sensed or controlled remotely network infrastructure, also creating across existing for direct integration of the physical world into opportunities more computer-based systems, and resulting in improved accuracy and efficiency in addition to reduced human intervention.

The application of Internet of Things in the modern world is the center of interest of many researchers and standardization bodies since several years. Internet of things mainly consists of two parts automation and analysis. Automation is an important topic which is mostly covered by various actors in the intelligent transportation systems, home automation field via many proposed solutions. Thus, in order to achieve the dream of automation, a special attention has given to the treatment of classroom automation and home management problem; especially when it comes to operating things with the help of mobile applications.

In this context systems based on wireless operational technologies, are proposed to address this situation. Moreover, with increasingly high-speed networks, it is increasingly important to have mechanisms that keep throughput high. Our systems will certainly contribute to the concept of home automation and classroom automation is some way. This paper will present the adaptation of the methodologies of the efficient classroom automation systems.

2.3. Previous related work.

2.3.1 Classroom System based on GSM

Using three kind of inputs such as Speech identification, Internet source and GSM network, the classroom appliance system could be controlled. Monitoring the whole house's atmosphere from indoors to outdoors is the core purpose of this project. The commands is being transmitted by the input in the system. The PC is the major control to the whole system. The program with user's code is done by the PC (Rozita Teymourzadeh, 2013).

From any location the whole system can be mastered by the user. The use of GSM in the system is can use to send data even though that particular location has less internet connection. AT commands are used to interact with GSM modem by user. Four kinds of engines that can be categorized for this whole system server. They are database, Web Server, voice identification program and main control. Short Message System (SMS) is sent for confirmation text and the systems comment (B. I. Ahmad, 2011)(Y. Zhai and X. Cheng, 2011).

Conveying the package through charismatic time algorithm done by the voice identification process. Achieved numerous experiment and test to accomplish the level of direction through speech activation. To have constant level of input, the speech identification gadget is installed around the user's classroom. Four divisions can be classified about the classroom appliance system which will be the receiver,

transmitter, microcontroller and input or output devices. At any moment, output according to the input commands is controlled by the microcontroller which plays a crucial act on the system (H. ElKamchouchi and A. ElShafee,2012).

To conduct the whole system, in classroom server is constructed with microcontroller and GPRS or SMS module. Through mobile phones, monitoring and controlling of the whole classroom appliances is done by using Java program. Any sort of convenient interfaces are usually suitable to be attached by smartphones. Using Short Message Service (SMS), directions can be received and sent to the server in house. On the equipment system, the RS232 serial port is connected from the microcontroller(H. ElKamchouchi and A. ElShafee,2012).

To make sure relevant and concrete data are stored, on the system, EEPROM memory is installed. For added maintenance, passkey is needed to get entry for the system to be reprogramed. The user must enter a correct passkey to read the text message (M. S. Khandare and A. Mahajan,2010)(Gu and G. Peng,2010). Because it is an open network, text message is encrypted with a passkey to avoid any security breach.(C. Felix and I. J. Raglend,2011)

GSM network is used to generate SMS sending to the user to control the classroom appliances. System block diagram is shown In Figure 2.1. Output and input flow is controlled by the microcontroller. System is connected by the user using their smartphone. Upon improving the system Android app, a visual programming service is provided by 'App Inventor'.



Figure 2.1 Classroom system based on GSM

2.3.2 Classroom based on Wi-Fi

In Figure 2.2, as represent, can dope Wi-Fi module with the Wi-Fi innovation on a smartphone. Because of convenient rate of manufacturing and guaranteed atmosphere, it would be best if Wi-Fi is installed on the model system so Wi-Fi is used. Installed python language program to enable the communication between the user and the system. In between of the input/output ports and Wi-Fi module, relay is installed so that the user has master control of the system (C. Peijiang and J. Xuehua,2008).

An encryption passkey for the classroom appliance system is granted by Wi-Fi connectivity for security reason. The Wi-Fi module capable of transmitting information in an area of hundred meter and it dwells of 2.4GHz bandwidth. The system flow is controlled by the Python app while communication with smartphone (B. S. Rao, S. D. V. Prasad, and R.M. Mohan,2010)(C. K. Das, M. Sanaullah, H. M. G. Sarower,2009). Investigation arrangement is done to identify any fault all over the system. For added security, all comments about the system is saved for every authentication. Any minor issues within the system will be solved automatically

following to its program. Wi-Fi would not do any harm regarding energy conservation (L. Pu,2009).

Classroom appliances is commanded by the Wi-Fi innovation which has been imposed. The system acts in a flow that the PC can send information to the Wi-Fi module via USB and the Wi-Fi module would send it all over the board. The microcontroller master in transmitting data to all over the system (L. Wei, Y. Min, C. LiangLiang, and C. Ping,2011). Easily search with smartphone and connect to the right Wi-Fi name to ensure that it is synchronized.



Figure 2.2: Diagram of Classroom Appliance.

2.3.3 Classroom Appliance based on ZigBee primarily

Wireless connection innovation which is the ZigBee can be used for the classroom appliance. Speech identification and PIC microcontroller are used. For speech instruction to be taken, inside the classroom is installed with an electro-acoustic transducer. The speeches that square measure saved inside the memory are distinguished and processed. Whole system block diagram is shown in Figure 2.3 (Khusvinder Gill, Shuang-Hua Yang, Fang Yao, and Xin Lu,2009)(Dave Locke,2010). The hardware used also is shown on Figure 2.3. Through the ZigBee, PIC microcontroller sends instruction to the receiver. Instruction is being run by the receiver where a different PIC microcontroller is inside of it. To manage many appliances relay is used. Less interaction medium in a place is the Zigbee's disadvantage. It has been inconvenient to use the system from further. With this technique a smoke detection is being used. A message will be sent to the user's phone whenever smoke detected by the detector.



Figure 2.3: Diagram of Transmission Unit

2.3.4 Ubiquitous Classroom System using android application

2.3.4.1: System style

It is logical that classroom system is used to manage and monitor in every houses with a low rate. In Figure 2.5.1 shows the entire system. In the future operation robot buddy degreed LAN module is predicted (Wolber David, Hal Abelson, Ellen Spertus,2011). A small web-server can control the classroom appliance with the usage of LAN module. In the classroom , relays and sensing element is being installed as controller. A simple classroom application can be used by user from distance to monitor the classroom. The app get information from the small web-server (Delgado, A. R., Picking, R., & Grout,2006).



Figure 2.4: System diagram

2.3.5 Software package development of the robot platform app

With appropriate mobiles, classroom appliance application using Windows Mobile and android Operating system to square measure. Most of the classroom appliance are controlled mainly by the android . Before introducing robot operating system into this technique, this app was doing 100% well. For whoever buys it, to control the system, a free tutorial is given. The tutorial is software package Development Kit (SDK). To know about the system codes, there will be any libraries.

2.3.6 Sensible Classroom machine-driven system exploitation Android Application and Microcontroller

2.3.6.1 Classroom System

The ability of the residential and remote transmitter is integrated into system of logical appliance. Most of the sensors installed classroom appliance can all be managed by a microcontroller. The entire system flow is described in the methodology. The whole sensible classroom system is shown in Figure 2.5. If any fault occur in the system, many kinds of microcontrollers are there to solve it automatically (Laur.I,2010). Between the microcontroller and remote, a secondary property is represented and installed into this device which is Wi-Fi module and RF wireless. All classroom appliances has to be electronically controlled to brainstorm this logical classroom idea.



Figure 2.5: Connection of Appliances

2.4 Critical Review of Current Problem and Justification

From the related work that being study, there are many types of development and methods being used. Many classroom and home devices now have Wi-Fi and can interact with other classroom devices, smartphone applications and classroom computers. The main issue is that these particular devices cannot communicate with each other or require an additional device to do so and also need an individual application on the smartphone to be controlled. The best option is to unify these devices into one program or device that controls them. For instance, one can control the lights, fan, projector, TV, air-conditioning and door locks through one application on the smartphone. This gives the consumer more control of their home, for example, it allows them to set up conditions for when the lights turn on, or if they are on their way classroom. Moreover, classroom automation can simplify many manual actions. Most of the articles discussed about usage of Bluetooth, zigbee and other applications which is quite backward. Implementation of Wi-Fi is much diversify and better to overcome the other existing issues in utilizing the entire system.

Title	Author	Technology Category	Microcontroller
Classroom System based on GSM	(Rozita Teymourzadey, 2013)	Control classroom appliances via(sms) Short Message Service	Arduino,Gsm module
Classroom Appliance based on ZigBee	(Khusvinder Gill, Shuang-Hua Yang, Fang Yao, and Xin Lu,2009)	Control classroom appliances via zigbee network	Pic microcontroller
Classroom System using android application	(Wolber David, Hal Abelson, Ellen Spertus,2011)	Android application and lan module	Arduino ethernet
Proposed System – lot based classroom automation system	(sattish kumaran,2019)	PIR sensor, WiFi module ,dht sensor,android application	Arduino.

 Table 2.1: Comparision of previous related projects and proposed system

2.5 Conclusion

In sum, literature review is a necessary chapter and it is very important part to build the project concept, it helps to understand the existing features of the system and to get clear picture to implement the system. The research and study will make the progression on doing this project smoothly and more understanding.

CHAPTER 3 METHODOLOGY

3.1 Project Introduction

The project development is focused in this chapter. Proper approach is ensured in this project. Reviewed literature review got to know that classroom appliances has various perception. The methodology used to help continue the next phase in relevant way. It is also based on key events that map progress to the project.

3.2 Prototype Development

3.2 .1Block Diagram

This chapter introduces the steps in developing this project in a systematic way, as for the Automation, it means that every devices works on Auto based system via system control.





This project is mainly about classroom appliances controlling part. Android is utilized on this project as a controller for the users. Therefore, android platform does provide a comfortable environment for the user . This android device would enable the user to interact with the entire system. The interaction point between the android and microcontroller will be the Wi-Fi module. The Wi-Fi module would convey the information towards the microcontroller. Therefore, the microcontroller would send the commands towards the relay circuit. The relay circuit will be responsible in switching on the classroom appliances or make it works as demanded.





Figure 3.2: Flow chart for program

This flowchart will be representing the entire coding flow. The system will be initializing and it will undergo with a password rules. If the user had used the right password, he will gain access to go forward otherwise it will be restarting the flows. Once the password had been entering, the microcontroller would verify whether it is the right or wrong one. Then, the user can select his classroom appliances and ask it to work according to his requirement. Later, the microcontroller would transmit the commands towards the relay circuit. The relay circuit would enables the particular appliances and make sure it works according to the user's requirement.

3.2.3 Wi-Fi as communication pipeline

Because of the recent update for Wi-Fi it has various advantages upon this project. Preventing collision and data loss is called technology. Most of the interaction is done by Wi-Fi in this project. Comparison between Wi-Fi and ZigBee is done in Table 3.1 for what is going to be used in this project:

CriteriaforComparison	Wi-Fi	ZigBee
The IEEE standard	The IEEE 802.15.1	The IEEE 802.15.4 Compliant
Modulation	GFSK/PSK.	COMMUNICATION using BPSK w/ (868/915 MHz) ,OQPSK (2.4 GHZ)
Number of RF channels	79	1/10.16
Standard Deviation	FHSS	DSSS
Performance	Hours	Year
Main window	Piconet	Star
Simpler	Medium	Low
Density.	255 Plus	7
Authentication	Secret	CBC-MAC
Data protection	16-Bit CRC	16-Bit CRC
Simple to use	Medium	Simple
Delay Time	>3 Sec	One can see 15.
Interference	Large	Low
Encryption	EO river encoders	The AES block cipher
The basic window	Scatternet	Net
Frequency Band	2.4 GHz	2.4 GHz, 868MHz, 915MHz
Antenna/HW	Shared	Independent
Performance	100 MW	30 MW
Power Consumption	40 Ma TX, standby 0.2 ma	30 Ma standby TX, 3 # & 956 as

 Table 3.2: Comparison between Wi-Fi and ZigBee

3.3 Development Platform.

This is a part of methodology explains the event of technology in mobile phones application supported Classroom system. The transportable application is advanced on the subsequent technologies that are robot and Wi-Fi. Android application could be a developing stage for developing and deploying robot based mostly application on mobile devices supporting it. Wi-Fi has its own normal as a wireless interaction technology for sturdy and itinerant devices. The connectivity between the user's android platforms with Wi-Fi module would allow the changes and managing the classroom appliance.

3.3.1 Android

The implementation of android is all over the globe. The phones, tablets, TVs and set-top boxes are supercharged by Google on this growing era. For future development, android platforms are being installed on cars, in-flight recreation system on planes and even in business robots. Originally android platform was created by Andy Rubbin as associate degree software package for mobile phones.

In 2005, Google began to maintain and develop robot OS. several assume the acquisition was mostly in response to the emergence of the Apple iPhone around that time; but, there have been enough alternative giant players, like RIM Blackberry, Nokia Symbian, and Microsoft Windows Mobile, that it appeared a salient business call for Google to buy the talent and belongings necessary to say the corporate into this rising house, that has become referred to as net 2.0 version.

Android applications are written within the Java artificial language. The android tool kits are resources files that compile and pre-packed the committal to writing information. ".apk" file is employed to put in the applying into android OS into smart devices. Android application will permits new creations and code to upgrade its own OS. Android had distinctive support for Wi-Fi in devices.

Android OS supports Wi-Fi property. Android cannot be a master if Wi-Fi is absent. Upon developing wireless network of Android, Wi-Fi stack network is available in smartphones. Finally, receiving and transmitting for the whole system can be done by Wi-Fi module.

3.3.2 Wi-Fi

Diverse sorts about Wi-Fi provisions is formed abuse robot stage configuration abuse the Wi-Fi profiles. The gadget makers the table those benefits misuse those help from claiming the individuals profiles in their units on fare thee well about similarity to those Wi-Fi engineering organization.

The Wi-Fi profile used over classroom appliance system robot transportable requisition is that those Wi-Fi port Profile (btspp). RFCOMM Might a chance to be a connection-oriented protocol. It gives streaming correspondence between those units. The btspp profile Also RFCOMM protocol are used in the applying will right the port also convey abuse streaming data. The whole Wi-Fi class App may be out there inside the robot.

18

3.4 Wi-Fi Interfaces with Microcontroller

Wi-Fi module is most comfortable connected with Arduino. Minimum one serial port is there in the microcontroller. Later configuring HC-05 in the HyperTerminal, it can later than interact with the microcontroller. Configuring HC-05 because it operates at baud rate 38400 and the microcontroller could not interact with it. Configuring it to baud rate 9600 so that it could interact with the microcontroller. Interaction between microcontroller and Wi-Fi module is shown in Figure 3.3.



Figure 3.3: Wi-Fi module connectivity with microcontroller

3.5 Project Milestone

Project Milestone as a reference point that will used to monitor the project's progress and marks the major activity in a project. In order to make sure the flow of this project runs smoothly, the project milestone will be created and well planned to ensure all the activities in the project are able to be completed within the project timeline.

Table 3.2: Project Milestone

Activity	Duration
Proposal PSM	1 week
Chapter 1 : INTRODUCTION	1 week
Chapter 2 : LITERATURE REVIEW	2 weeks
Chapter 3 : PROJECT METHODOLOGY	1 week
Chapter 4 : ANALYSIS AND DESIGN	3 weeks
Project Demo	1 week
PSM 1 : FINAL PRESENTATION	1 week
Chapter 5 : IMPLEMENTATION	4 weeks
Chapter 6 : TESTING	2 weeks
Chapter 7 : CONCLUSION	1 week
PSM 2 : FINAL DEMONSTRATION (PRODUCT AND REPORT)	3 weeks

3.6 Conclusion

As a conclusion, this chapter explains the methodology that will be use in this project. The milestone set the time to finish the project so that the progression of the project will always in track. This is very important to make sure the project can finish in time.

CHAPTER 4 ANALYSIS AND DESIGN

4.1 Introduction

In this chapter will defines the results of the analysis of the preliminary design and the result of the detailed design. It will also focus on the analysis of the requirements of the project. The block diagram for this project will also be stated to ensure the project can be completed and well designed. The requirements such as the hardware and software needed on this project are includes in this chapter.

4.2 Problem analysis

Nowadays, we have remote controls for our television sets and other electronic systems, which have made our lives real easy. We have come up with a new system called Arduino based home automation using ESP8266 Wi-Fi module. This system is super-cost effective and can give the user, the ability to control any electronic device without even spending for a remote control. This project helps the user to control all the electronic devices using his/her smartphone.

4.3 Requirement analysis

4.3.1 Data Requirement



Figure 4.1: Data flow

The Figure 4.1 above show the data flow of the system from sensors to Arduino IDE to ESP8266 to relay until the electrical appliances. The Arduino IDE is the middle thing which control the entire system.

4.3.2 Functional requirement



Figure 4.2: Functional diagram

The Smart phone will receive the result of temperature and humidity by the ESP8266 wifi module which connects to the microcontroller (arduino uno) and dht sensor. The function of pir sensor is once detected the motion movement of students the pir sensor will sent command to arduino uno.Once received the command from pir sensor arduino will sent command to relay module to on the lights. The function of Smart phone is sent command to the arduino by blynk app to on/off the fan. Furthermore, the speed of the fan will control by the temperature which detects by the dht sensor.

4.3.3 Software requirement

4.3.3.1 Arduino IDE

Arduino IDE is a cross-platform application can be supported with Windows, MacOS and Linux. It is used to write and upload programs into Arduino compatible boards. It uses to communicate under programming language of Java. It has a general public license GNU version 2 that is newly released on market. Arduino IDE uses language C and C++ specially for code structuring. Software library had been supplied into Arduino IDE.

🖲 😑 🛑 Blink Arduino 1.8.5
Blink §
This example code is in the public domain.
http://www.arduino.cc/en/Tutorial/Blink */
<pre>// the setup function runs once when you press reset or power the board void setup() { // initialize digital pin LED_BUILTIN as an output. pinMode(LED_BUILTIN, OUTPUT); }</pre>
<pre>// the loop function runs over and over again forever void loop() {\$ digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level) delay(1000); // wait for a second digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW delay(1000); // wait for a second } </pre>
32 Arduino/Genuino Uno on COM1

Figure 4.3: Arduino IDE software

4.3.3.2 Blynk application

Blynk is an IoT software that interact between user and system through internet connectivity. It is uses to display and receive input from user. For this project, it is used to display temperature reading that being capture by both DHT11 sensor. It is a supportive IoT application that able to interact between various systems and provide multiple symbols such as gauge, level and pin out features.



Figure 4.4: Blynk interactions with Arduino

4.3..4 Hardware Requirement

4.3.4.1 Microcontroller (Arduino uno)

By the user's command, monitoring and controlling the whole system is done by the micro-controller. In the output devices, a reply commend can be transmitted on analyzation of the input frequency by the micro-controller in this system. The input is being transmitted by the user with the android app. Objectives are being responded from the analyzed computer file by the micro-controller. Arduino Uno is used into this system. 40 pins are available in the particular micro-controller. Arduino boards are programmable electronic boards and are integrated into a wide range of projects from simple to complex. The arduino board contains a programmable microphone to detect and control objects in the real world. By reading the responses from sensors and inputs, Arduino will process these reactions and control various outputs such as LEDs, motors and LCD displays. The Arduino Uno is a microprocessor board or control device in a chip that is capable of controlling inputs and outputs according to the encoded instructions. The Arduino Uno board comes with an ATMEGA328P microphone. The Arduino Uno board has 14 digital input and output pins (Pin 0 through 13) while 6 of its digital input and output pins can be configured in PWM (Pulse Width Modulation) mode. Has 6 analog input pins (Pin A0 through A5). The Arduino Uno board can be encoded using the Arduino IDE software. The code uses simple English called Arduino which is inherited from C ++.



Figure 4.5: Arduino Uno

4.3.4.2 Wi-Fi Module

System and the user are gains connection to each other by the Wi-Fi module. Android app creates system commands. Wi-Fi is used for transmission of data. Commands the user gives is transmitted by Wi-Fi. Wi-Fi connected in the smartphone is the master and while the slave is the Wi-Fi module. Version 4.0 is the Wi-Fi module's latest version. Per delivery, 512 bytes of package can be carried by the Wi-Fi module 2.4 GHz is the working frequency. Minimum of 3.3 volts of power supply is needed. Wi-Fi module version 4.0 is shown in Figure 4.6.

Wifi module ESP8266 is a very cheap open source software and hardware based on the On Chip System (SoC) called ESP8266. This makes it the best choice for Internet of Things (IoT) based projects. This ESP8266 board incorporates an ESP8266 chip on a user-friendly circuit board. This ESP8266 board has a wifi antennas, LED lights, and standard-size GPIO pins to allow users to place this board on the project board.



Figure 4.6: Wi-Fi Module

4.3.4.3 Relay Module

This 2-channel relay board is designed to be controlled by 3.3V, 5V and 12V voltages. The 2-channel relay board can be controlled by Arduino Uno, Raspberry Pi and PLC. The board is designed using transistors and opto-isolators to allow direct connection to the controller pin. This relay output can hold up to 10Amps at 250V. Features:

- Relay Type: Single Pole Double Throw
- Package: DIP 5 pins
- Relay Input (Low Active): 3.3V, 5V and 12V (Depending on the VCC pin)
- Maximum Output Relay Output: 10A at 250Vac
- Maximum Voltage Rating: AC 250V or DC 30V
- Control various appliances with high voltage



Figure 4.7: Relay module

4.3.4..4 Jumper Wire

Jumper wires is an easily way that used to establish connections with other devices for example sensors, Arduino, and Raspberry Pie. Jumper wires can have difference color, length and type. There are totally 3 types of jumper wire which are male to male, male to female, and female to female. Every type of jumper wires basically has the same function but it suits of difference device that they are working with. The figure 4.8 show the example of male to male jumper wires.



Figure 4.8: Male to Male jumper wire

4.3.4.5 DHT Sensor

DHT11 is a sensor for measuring the temperature of the surrounding area and the humidity of the surrounding area. This type of sensor produces digital outputs that can be used and processed by the Arduino boards and Raspberry Pi boards. Both of these sensors are compatible with both the Arduino board and the Raspberry Pi board, and are also suitable for 5V and 3.3V voltage levels. The main difference between DHT22 and DHT11 is in the level of accuracy of reading where DHT22 is more accurate than DHT11.



Figure 4.9: DHT Sensor

4.3.4.6 12 v bulb



Figure 4.10: 12v bulb

4.3.4.7 PIR Sensor

A PIR sensor is a sensor capable of detecting movement through infrared waves emitted by both the human body and the animal. The PIR acronym is derived from the word "Passive Infra-red" which means that the sensor operates passively by receiving only infrared waves from external sources without transmitting the infrared itself. There are also infrared sensors that operate actively by transmitting the waves themselves through the transmitter, which then receives the reflection of the wave through the receiver. The main component of this sensor is pyroelectric material which is very sensitive to infrared waves. This sensor module also comes with a special dome-shaped lens called Fresnel lens. The function is to focus infrared waves from various directions to the pyroelectric sensor.



Figure 4.11: PIR Sensor

4.3.4.8 DC Fan

DC fan uses DC motors. This fan can be used as one of the components or components of the refrigerator in the electronic circuit or in the electronic component. This miniature fan only needs a 12V DC voltage to function and can be placed in a place or component that feels right. The dc fan is a very important module for projects involving the movement mechanism of the direct current motor.



Figure 4.12: DC Fan

4.4 DESIGN SPECIFICATION

The system is designed keeping in mind the following key requirements:

- Change in the status of an appliance should be propagated to all software comp. in real-time.
- Customizable time-based profiles to automatically activate and deactivate appliances based on the time of day.
- Hardware should be widely compatible with different Configurations.
- Server should run in the background without disturbing regular activities on the desktop PC.
- Provide a simple and user-friendly interface on the client side.

4.5 DESIGN DIAGRAM

After initiating the program, user needs to send commands to the server(laptop). The microcontroller is connected to the server(laptop) via USB. On receiving commands, server sends commands to the microcontroller over the USB connection. The microcontroller is directly connected to the relays and it can enable or disable them. The relays are connected to the electrical system of the building so that they can control the plug points.



Figure 4.13: Design Diagram

4.6 Model Design

A proposed model will be designed for the Iot based Classroom system. The figure below shows the example of purposed design.



Figure 4.14: Model Design

4.6 Conclusion

Analysis and design is one of the important part to implement a project. All software and hardware requirements need to be identified and studied before carry out a project. This chapter is the pre-preparation stage for the implementation and include the flow of the overall system so that to have a better understanding before implement it.

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