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Automated Appliances using Microbit

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Abstract: The lamps and fans play an essential part in our daily lives. It makes our life more comfortable. We often need to get up from our seats to the switch, either to ON or OFF the electrical appliances, but forgetting to turn OFF the electrical appliances after using it will lead to wastage of electricity. The main objective of our project is to overcome these problems and make people's life more comfortable especially for elderly people who have memory problems or for those who are immobilized [1]. With this project, the electrical appliances, lights and fans will turn ON automatically when someone present and turn OFF automatically when they leave. This is achieved by using 2 type of sensors. Appliances can still be controlled using switches, but in addition it also can be controlled from smartphone by just sitting on chair. Mainly, the system consists of Microbit, to instruct the system properly and will automatically turn ON the fan when there is motion detected and turn OFF when there is no motion detected using Passive Infrared (PIR) Sensor. Furthermore, lamp will also turn OFF when the presence of light is detected (daytime) and turns ON when no presence of light is detected (night-time) by light dependent (LDR)sensor. Apart from that, the fan and lamp can be also controlled manually by using smartphone. Smartphone and the microbit are linked via Bluetooth connection. Therefore, by just installing 'micro:bit' and 'MIT A12 Companion' applications from playstore, we would be able to control our electrical appliances at home easily without much effort. The goal of this final project is to make our lives more comfortable and easier and to move towards advanced technologies as modern technology has helped us in every sphere of life.

Keywords: Smart Home, Microbit, Bluetooth

1. Introduction

In this modern era, the world is moving towards Internet of Things, and one of its components is home automation, where household item such as electrical appliances being automated and able to be controlled via Bluetooth usually from a Smartphone apps [2]. Therefore, the sales of electronic appliances are increasing and consumers are more likely to purchase electrical appliances which have special features like Bluetooth implemented elements which can make their daily life much easier. One of the reasons is nowadays people face many difficulties in their daily life leading them to live a stressful life. Thus appliances are designed to help them ease the burden using automation and wireless

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connectivity. For example, forgetting to switch off appliances after using it may lead to wastage and higher electrical bill. There are also cases which may lead to a major disaster which can harm people's life. For example, forgetting to turn off iron after ironing, and left it on the ironing board, and overheated lamps or fans may cause a short circuit and leads to fire if the lamps and fans are not handled properly after using it.

House lighting can change the appearance of a room or any other places in the house. It also an important aspect of interior design as it enhances the aesthetic appeal and creates the mood and ambiance of a living space. Lighting can make or break the ambiance of a place.

Meanwhile, fans are important because according to the Department of Energy, fans particularly ceiling fan can help reduce the cooling costs. The benefits of fans is the evaporative cooling effect of moisture wicked from the skin, providing a cooling sensation.

2. Literature review

The purpose of this literature review is mainly for describe the use of smart appliances in the market. There are a few smart appliances that is stated in **Table 1** with its features description. Smart home appliances are device or machines which can be controlled by tablets or smartphones remotely.

Table 1: Smart appliances and features

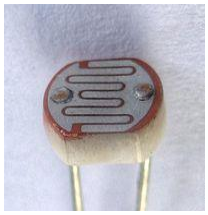
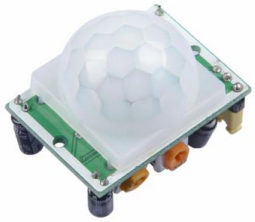
Smart Appliances	Features
The Family Hub Refrigerator 	Samsung's The Family Hub refrigerator comes with a Wifi enabled touchscreen that lets the users manage their groceries, connect with their family and entertains them. This is one of Samsung's line of smart fridges equipped with Family Hub and Bixby, Samsung's voice assistant.
Philips Hue Bulbs 	The Philips Hue lighting range has evolved into a formidable presence in the smart home scene. These bulbs are easy to set up, streamlined app experience, good integration with other services and have decent automation options. This Philips Hue bulbs enable the user to control both intensity of light, dimming or brightening on command and the colour of lights.
Robot Vacuum Cleaner 	DEEBOT N79S provides a versatile cleaning solution.With its multiple cleaning modes, DEEBOT efficiently cleans the floor and has an appropriate cleaning mode for every job. User can control the robot with the ECOVACS Home App, a simple remote or smart home system.

Automatic Pan Stirrer 	This pan stirrer has a few features that help it stand out from the pack.Instead of being made from stainless steel, the legs are made from plastic. Its powered by 4XAA batteries, which will give it a battery life of approximately four hours. It also has three speed settings and the legs can be easily removed if want to put it in the dishwasher.
GeniCan Scanner 	GeniCan is a stick on attachment for trash can that uses a barcode scanner and voice recognition to help user compile grocery lists based on what the user throwing away. Simply scan an item before tossing it into the trash and GeniCan automatically adds it to an accompanying smartphone app.
Nest Outdoor Security Camera 	The Nest Outdoor Security Camera takes what's great about the indoor camera and combines them to make one of the best outdoor security cameras out there today. This thing does everything .Its weatherproof, it has high end picture quality, combining 1080 HD resolution with a 4K image sensor and HDR.

There are a few electronic materials that has been used in the making of this project. The three most important materials are Microbit, Light Dependent Resistor (LDR) and Passive Infrared Sensor (PIR) and its own function as listed in **Table 2**.

Table 2: Electronic materials

Component	**Description**
Microbit 	Is an open source hardware ARM based embedded system designed by the BBC for use in computer education in the UK. The device is described as half the size of a credit card and has an ARM Cortex-M0 processor, accelerometer and magnetometer sensors, Bluetooth and USB connectivity, a display consisting of 25 LEDs, two programmable buttons, and can be powered by either USB or an external battery pack.

Light Dependent Resistor 	Light Dependant Resistor (LDR) is a passive component that decreases resistance with respect to receiving luminosity (light) on the component's sensitive surface. An LDR can be applied in light-sensitive detector circuits and light-activated and dark-activated switching circuits acting as a resistance semiconductor.
Passive Infrared Sensor 	Passive Infrared (PIR) sensor measures infrared light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications. PIR is made of a pyroelectric sensor, which can detect different levels of infrared radiation.

3. Methodology

The Automated Appliances using Microbitis operated by using both ways, which operates under controlof sensor and smartphone. For the sensor, it uses Passive infrared sensor (PIR motion sensor) to control the fan and Light dependent sensor (LDR sensor) to control the light. When the PIR sensor detect the motion, the fan will turn on. When the LDR sensor read the analoguesignal, which is less than 400, the light will turn on. For the smartphone, it is using Bluetooth to control the light and fan. Before that we need to download the app ‘micro:bit’ and the app MIT AI2 Companion.

This schematic in **Figure 1** consists of Microbit, Expansion board, 2 AA battery holder, PIR sensor, LDR sensor, Fan Motor, Led light, 10k Resistor and Breadboard. The 2 AA Battery Holder connected to expansion board. Detailed connection for each component is shown in **Table 3 – 6**.

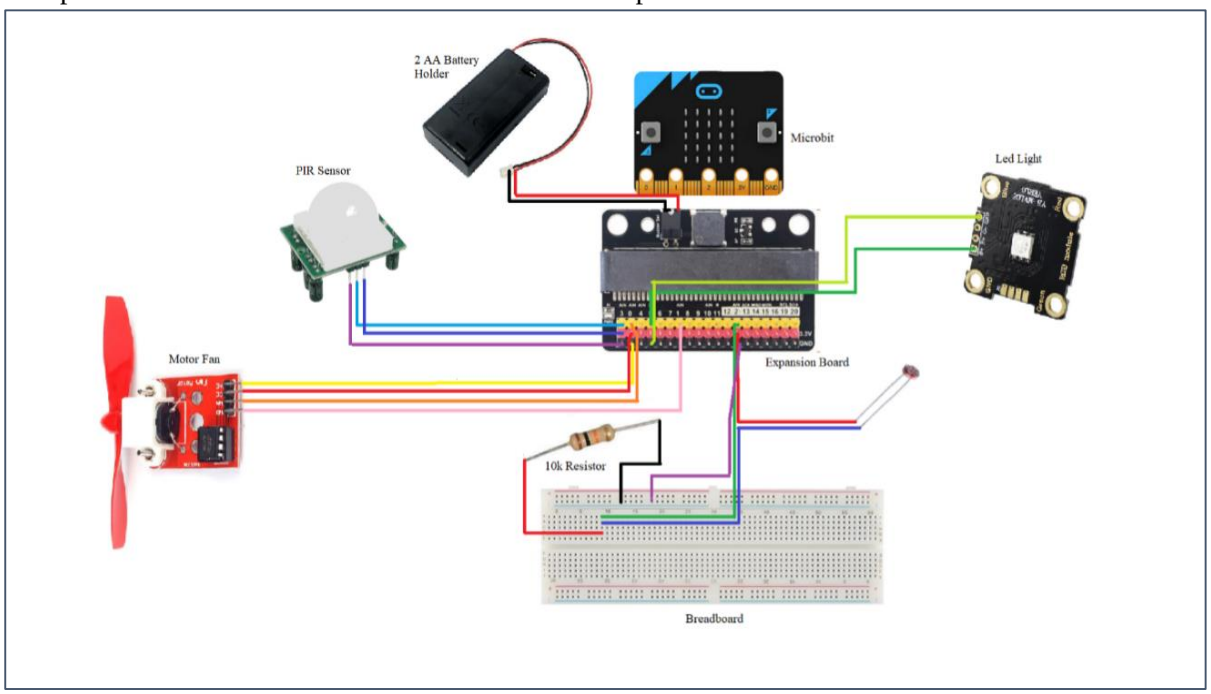


Figure 1: Connection of all components

Table 3: PIR Connection to Expansion Board

The PIR Sensor Pin	Microbit Expansion Board Pin
Ground	Ground
Output	P3
VCC	3.3V

Table 4: Fan Motor Connection to Expansion Board

Motor Pin	Microbit Expansion Board Pin
Ground	Ground
VCC	3.3V
INA	P0
INB	P1

Table 5: LED Light Connection to Expansion Board

LED Pin	Microbit Expansion Board Pin
Ground	Ground
B+	P5

Table 6: LDR Sensor Connection to Expansion Board

LDR Sensor Pin	Microbit Expansion Board Pin
OUT	P2
VCC	3.3V

4. Results and Discussion

After circuit completed and programming successfully implemented, several test have been carried out to test this project accuracy and response. A responsiveness test to measure the amount of time it took for the PIR to detect motion, and the results are shown in **Table 7**.

Table 7: Time taken for sensors to detect input was measured with unit seconds

Test	Time taken for PIR sensor to detect motion /s	Time taken for LDR sensor to detect lamp level /s
1	0.7	0.3
2	0.9	0.2
3	0.8	0.2
4	0.8	0.3
5	0.6	0.2
Average Result	**0.76**	**0.24**

Next, the response for input from smartphone apps are measured. The results is shown in **Table 8** for time it took to turn it ON, and **Table 9** for time it took to turn it OFF.

Table 8: Time taken for fan and lamp to turn on based on smartphoneinstruction was measured with unit seconds

Test	Time taken for PIR sensor to detect motion /s	Time taken for LDR sensor to detect lamp level /s
1	0.3	0.3
2	0.4	0.3
3	0.3	0.4
4	0.4	0.4

5	0.4	0.3
Average Result	**0.36**	**0.34**

Table 9:Time taken for fan and lamp to turn off based on smartphone'sinstruction was measured with unit seconds

Test	Time taken for PIR sensor to detect motion /s	Time taken for LDR sensor to detect lamp level /s
1	0.4	0.3
2	0.3	0.4
3	0.3	0.3
4	0.4	0.3
5	0.4	0.4
Average Result	0.36	0.34

Table 10 shows the breakdown material cost for this project.

Table 10: Cost breakdown for real time model for production

No	Components	Price Per Unit (RM)	Cost(RM)
1	Microbit	72.00	72.00
2	Microbit extension board	26.50	26.50
3	Microbit colour light Module Recognition clip connection	11.64	11.64
4	HC-SR501-PIR Motion Sensor	5.00	5.00
5	Crocodile Clip Alligator 50cm (×10)	0.50	5.00
6	Energizer battery(AA 6 in 1 card)	9.80	9.80
7	Microbit Battery case (2 ×AA) with ON and OFF switch	2.90	2.90
8	L9110 fan Module for arduinomicrocontroller fan motor(DC fan module)	17.00	17.00
9	LDR sensor (×10)	0.95	9.50
	Total cost	-	**RM 159.34**

5. Conclusion

This project has been successfully implemented and achieved all of its objective. Lights and fan will turn on and off automatically depending on the environment, and they can also be controlled by smartphone apps. Thus, in the future this ideas and inspirations will be used for other electrical appliances too, to further make humans life much more easier and better.

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