Smart Living

Authors: *Abid Sahriyar & Farzana Momtaz Mithila, Department of Industrial & Production Engineering, Rajshahi University of Engineering & Technology, Bangladesh*

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1. INTRODUCTION

We are living in the era of fourth industrial revolution where we can hardly differentiate between what is natural and what is artificial. Technology is at its best and is continuously improving with the passage of time. Our lives are enhanced and made more efficient by the touch of modern technology. Machines are doing our works with high precision and accuracy. Also, various devices are designed for our comfort and reluctance. But these days people don't even want to operate machines manually. Operating machines to complete a job is considered ancient at present. With the help of IoT (Internet of Things) we can smartly communicate with the machines. The Internet of Things (IoT) acts as an expanded version of the internet, providing us with the data we need to live our lives more efficiently. It is based on connecting up devices used on a daily basis, such as lights, fans, refrigerators, thermostats, electric oven etc. to a centralized cloud system. The data that comes in from these IoT devices lets us access and control technology through a web-based app – and make sense of the myriad information coming in. On the other hand, a sensor is generally intended to a produce a variable signal over some measurement range as opposed to a switch which generally acts in a binary fashion, as in on or off. While this is not always true it helps when it comes to deciding between sensors or switches. Sensors are arranged by what is being sensed: pressure, temperature, proximity, etc. Intended application makes a good place to search for specific situations where a specifier might not know the sensor type. The light sensor is a passive device that convert this "light energy" whether visible or in the infra-red parts of the spectrum into an electrical signal output. The Light Dependent Resistor (LDR) is made from a piece of exposed semiconductor material such as cadmium sulphide that changes its electrical resistance from several thousand Ohms in the dark to only a few hundred Ohms when light falls upon it by creating hole-electron pairs in the material.

Why stand up and walk to machines to turn on switches when we can just sit back, relax and make a couple of touches on our smartphone to control a machine and also it is very convenient to turn off the electronic devices automatically. With this view this project was created that has the potential to change the lifestyle of people. The project named "Automated Smart Living" is based on the concept of IoT (Internet of Things) and LDRs (Light Dependent Resistors). In the project, mechanical switches can be controlled with the smart phone from anywhere in this world. Switches should be in a Wi-Fi range and the smartphone should have the internet connection too. Further LDRs, laser lights and relays were used to count the presence of people and turning off the electronic appliances when there was no presence of people.

2. BACKGROUND STUDY

In our country the usage of automation is mainly confined in the industrial section but on daily basis we do not apply the usage of automation or rather we are not habituated in doing so. Since automation and controlling the electronic devices enables the comfort on day to day life and also saves energy consumption and time the idea of the project “Automated Smart Living” was incepted. We chose LDRs over other sensors since it is cheap and it occupies a very less space. Previously a product was developed in Product Design II Lab through which the switches were controlled at large distances over Wi-Fi. On the idea of improving that product and adding features to it, we developed an improved system consisting of a mechanism to count the number of people present in the room. Besides communicating over WIFI, now the system is capable of turning electronic appliances on/off based on that counting mechanism.

3. OBJECTIVES

- To make life easier and more comfortable using IoT.
- To reduce the waste of electricity.
- Real-Time data monitoring.

4. METHODOLOGY

4.1 Components Used:

1. NodeMCU (*1)
2. Light Dependent Resistor (LDR) Diode (*2)
3. Bread Board (*3)
4. Plastic Wood (2*2ft)
5. Jumper Wires (*15)
6. Laser Diode (*2)
7. Bulb (*2)
8. Bulb Holder (*2)
9. Relay Board (2 Channel)
10. Plug (*2)
11. Adapter (*1 5V 2 Amp)
12. Wiring (11.9ft)

4.2 Circuit Diagram:

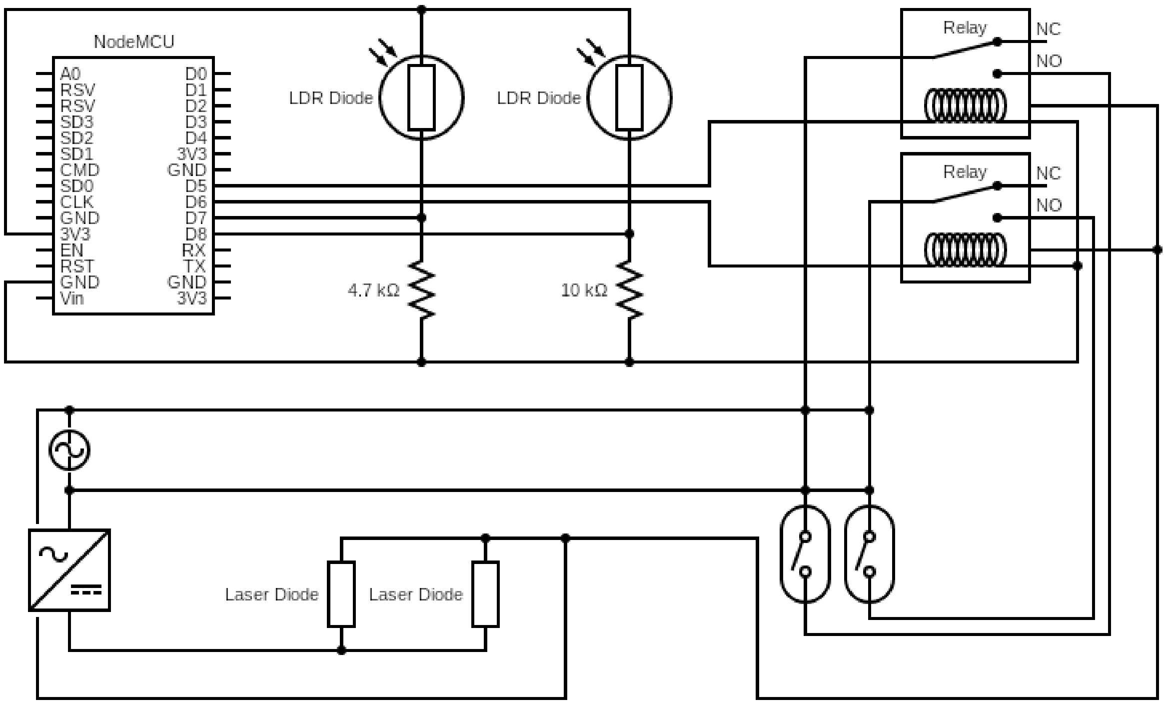

Fig: Circuit Diagram (created from www.circuit-diagram.org)

4.3 Programming (Coded in C++ at Arduino IDE):

```
#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>

#include <BlynkSimpleEsp8266.h>


int LDR1 = 13;

int LDR2 = 15;

int Aprev = 0;

int Bprev = 0;

int relay1 = 14;

int relay2 = 12;

int count = 0;
```

```
int LDR1Value = 1;
int LDR2Value = 1;

char auth[] = "B-I9lSS9kWWymZjjgZ_aRWQnElC49fYG"; //sent via email
char ssid[] = "Bolt From The Blue"; //Wi-Fi network name where to be connected
char pass[] = "musicislife"; //The corresponding Wi-Fi password

void setup() {
 Serial.begin(115200);
 Blynk.begin(auth, ssid, pass);
 pinMode(relay1, OUTPUT);
 pinMode(relay2, OUTPUT);
}

void loop() {
 Blynk.run();
 LDR1Value = digitalRead(LDR1);
 LDR2Value = digitalRead(LDR2);
 /*Serial.print(LDR1Value);
   Serial.print("    ");
   Serial.print(LDR2Value);
   Serial.println();
 */

 if ((Aprev == 1) && (Bprev == 1)) {

   if ((LDR1Value == 0) && (LDR2Value == 1)) {
     count = count + 1;
```

```
    Serial.print("Count: ");
    Serial.print(count);
    Serial.println();
   }
   else if ((LDR1Value == 1) && (LDR2Value == 0)) {
    count = count - 1;
    Serial.print("Count: ");
    Serial.print(count);
    Serial.println();
   }
  }

  if (count <= 0) {
   digitalWrite(relay1, HIGH);
   digitalWrite(relay2, HIGH);
  }

  Blynk.virtualWrite(V1, count);

  Aprev = LDR1Value;
  Bprev = LDR2Value;

  delay(4);

}
```

5. COST ANALYSIS

5.1 Estimated cost:

Criteria	Cost (TK)
1. Sensors (Laser)	1000
2. Wireless Devices	500
3. Vero Board	50
4. Batteries, cables, switchboard, switches etc.	400
Total	**1950**

5.2 Actual Cost:

Name of the component	Quantity	Price (TK)
NodeMCU	1 piece	380
LDR	2 pieces	12
Bread board	3 pieces	300
Plastic wood	2*2 feet	200
Jumper wires	15 pieces	30
Laser diode	2 pieces	70
Bulb	2 pieces (1 Watt each)	40
Holder	2 pieces	30
Relay board	5 Volt 2 Channel	150
Plug	2 pieces	30
Adapter	5Volt 2Ampere	140
Wiring	11.9 feet	40
Total		**1422**

The actual cost was less since no separate microcontroller module and Wi-Fi modules were used. NodeMCU is an integrated module consisting of both microcontroller and Wi-Fi module. Besides only two sets of laser diode and LDR diodes were used.

6. PERFORMANCE ANALYSIS

6.1 Sensitivity:

Trial No.	Passed objects/min	Detected objects	Error	%Error
1	20	20	0	0
2	20	20	0	0
3	20	20	0	0
4	30	28	2	6.66
5	30	29	1	3.33
6	30	29	1	3.33
7	35	28	7	20
8	35	25	10	28.57
9	35	27	8	22.85
10	40	25	15	37.5
11	40	22	18	45
12	40	24	16	40

It is seen that the system is capable of detecting objects accurately when the passing speed is 20 per minute. For human entering through doors this speed is enough to measure accurately. When the project will be used for practical cases the laser emitter and receivers shall be placed at an average human's chest height from ground. This is because hand swing is minimum in the chest area and chest width is also larger comparing to other parts of a human body. So, the ideal place for locating LDR and Laser diodes is at the chest level of an average human if minimum error is desired.

Even if a human literally runs at slower speed and enters through this system the chest to waist portion requires adequate amount of time to completely pass which is sufficient for the sensor to collect data precisely. Sensitivity could also be increased by building stronger programming logics that identifies pattern accurately.

6.2 Power Consumption:

The system consumes 13 Watt power of which 10 Watt was supplied from AC source through a 5V 2A Adapter and 3 Watt was supplied from a Laptop through USB cable.

The system consumed this much power to control 2 AC loads. Here, 4 I/O pins were used and more 7 pins could have been used in this setup. Addition of extra 2 AC loads would increase the power consumption by more 10 watts.

Evidently the current circuit consumes 0.013 KWH which is a very lesser amount of energy compared to other AC/DC loads connected with the mains. If a Tube light of 55 Watt and a fan of 75 Watt is kept on accidentally without purpose for even at least 30 minutes a day then the power loss will be ((55+75)/(2*1000)) or 0.776 KWH per day. Now, the project consumes (0.013*24) or 0.312 KWH per day. Hence the minimum amount of estimated power savings will be (0.776-0.312) or 0.464 KWH per day. Considering the per unit cost at TK 3.50 per KWH the monthly savings sums to TK (0.464*30*3.50) or TK 48.72. Obviously, this savings will vary from user to user since energy usage depends upon the ones using it.

7. TIME FRAME OF WORK

Time Frame																	
				Cycle													
#	Tasks	Start	End	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Project proposal	2	4														
2	Project selection	4	4														
3	Buying equipment	5	7														
4	Assembling the parts and completing circuit model	8	8														
5	App development and programming	9	9														
6	Test run	10	10														
7	Reserving days for un- pleasant occurrence or parts replacement	11	11														
8	Report and Final presentation	12	12														

Fig: Gantt Chart

8. ADVANTAGES

1. It saves electrical energy in our day to day life.
2. All the equipment's can be controlled through smart phone. So it makes our life easier. Manual labor is reduced in this project.
3. This project is easy to install.
4. It can be controlled from anywhere we want.
5. Number of persons can be easily detected. And it shows in mobile display.
6. Low installation cost.
7. We can connect devices, as much as we want.

9. DISADVANTAGES

1. Need seamless flow of electricity.
2. Need continuous internet connectivity.
3. Not more than one person can enter at a time.
4. Skilled manpower required for installation, repairing and maintenance.
5. Need better connection of internet for better performance.

10. APPLICATIONS

Where there is an active internet connection, this project can be used. Such as;

1. Houses
2. Industries
3. Offices
4. Hospitals
5. Universities
6. Railway gate controlling and so on.

11. FUTURE WORK

1) Incorporation of various sensors (motion sensor, sonic sensor, temperature sensor, accelerometer, proximity sensor, smoke, gas and alcohol sensor) for extended function ability of the project.

2) Generating stronger and logically more sound programming algorithm to count human presence.

3) Designing more cost-effective circuits by breaking down the integrated circuits.

4) Developing accessibility features from Google assistant, social networking sites and mobile sim cards.

5) Developing the circuit with rechargeable batteries to power and run the system even during temporary power cuts.

12. CONCLUSION

The decisions made during the design process have a great effect on the cost of the product and the cost is very little. The product is easy-upgradable in design and can be fully automated, equipped with Artificial Intelligence even.

This project will prevent unnecessary power consumption and save immense amount of energy in industries if applied in large-scale. Large-scale application in industries will cost more, yet affordable and cost-efficient considering the amount of energy that will be saved. If applied in households and offices, people will get a safe and improved lifestyle with less waste of efforts and energy.

13. REFERENCES

Software references -

https://blynk.io/

https://www.arduino.cc/en/main/software

Hardware references –

https://www.instructables.com/id/NodeMCU-With-LDR/

https://www.instructables.com/id/Interface-Relay-Module-With-NodeMCU/

Forums and articles references for code and concept -

https://www.nodemcu.com/index_en.html

https://community.blynk.cc/search?q=nodemcu

https://electrosome.com/home-automation-esp8266-blynk-app-iot/

https://maker.pro/arduino/tutorial/how-to-use-an-ldr-sensor-with-arduino

http://help.blynk.cc/en/articles/512061-what-is-virtual-pins

Circuit diagram creation platform -

https://www.circuit-diagram.org/