International journal of advances in engineering and management (IJAEM)
Volume 3, issue 6 June 2021, pp: 1283-1289 www.ijaem.net ISSN: 2395-5252

Operating Electric Equipment with IR Sensor and IOT

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Submitted: 01-06-2021 Revised: 14-06-2021 Accepted: 16-06-2021

ABSTRACT: Nowadays, there countless devices that have the use of Infrared (IR) sensors which mandates the remote controllers to control and appropriately make use of them. Therefore, the use of many remote controllers arises many difficulties to handle simultaneously. However, the application of IR and IoT (Internet of Things) technologies can solve such problems. The paper is focused to solve such problems and giving the application control to the users. Thus, the current work deals with the technology that will help the user to control their respective devices anywhere in the world by means of internet access with mobile applications. The technology in the present work can operate 360-direction devices.It is needed tofix it across the ceiling and connect it with WIFI, so the use ofthe mobile application, Google Assistant, Amazon Alexa, Google Home Mini to manage the device (one at a time) can be done. However, the only limitation of the technology is that the device must be connected to the internet.

Keywords: Infrared Sensors, Internet of Things.

I. INTRODUCTION

The Internet of Things is the interconnection between the different computing devices on the Internet, which enables them to interact with each other. The Internet of Things This improves the quality of life of end-users and improves efficiency and sustainability daily.Soon, many intelligent devices will communicate via IoT. The analyst company Gartner forecasts that there will be more than 20 billion Internet of Things devices connected by 2020. As we approach this value, about $6 billion is expected to enter various IoT domains such as app development, device hardware, system integration, data storage, security and connectivity. By 2025 almost $6 Billion of IoT solutions will be spent. Many of these devices contain IR (Infrared) sensors. An infrared (IR) sensor is a piece of electronic equipment that measures and detects infrared radiation in its surroundings [1].

We live in an automation-related world that is changing fast. Automation allows the organisation, through time-related or stimulus-driven programmes, of events for devices connected to a network or the Internet. The concept of automation is being implemented everywhere from large industries to small offices, to reduce human intervention and improve energy efficiency and productivity.Domestic automation or the automation of the different appliances in a house, thus turning it into a smart house. There are countless devices used in-housed that is automated [2].

The automation of heating, lighting, ventilation, air conditioning and various other built-in system devices which can be connected to the Internet is included. Remote monitoring and access to automatic types of equipment is another main feature of the current generation of home automation. With the development of smartphones and tablets, we can connect to our home network while we are away, and the development of different communication technologies like Wi-Fi, Bluetooth, or ZigBee. With home automation, there are many advantages. The huge potential for conservation of energy and saving costs is one of the advantages [3].

The various IR equipped devices such as AC, TV, STB, Projector, OTT Box, DVD, Air Cleaner, Wasser Hotter, Fan, Amplifier, SLR and IR Switches etc. are supplied to the home, industrial and commercial areas and hotel environments today. A remote controller is respectively available for these devices. The number of remote controllers is very difficult to handle, so there is a battery to control all IR devices that are our project instead of handling so many remote devices.Henceforth, the current paper deals with the control ofall IR equipped devices within the room with a single device with the help of the mobile application. These days the internet is widely used in human life. The main purpose of coming up with this project is to build a better solution to control these devices by a single

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controller (Not an individual controller for individual devices).

II. LITERATURE REVIEW

Using radio frequency control module 433 MHz for direct control of the home device. The central controller can be connected directly with gadgets like smartphones and tablets via a Wi-Fi interface. Radio signals are the only problem: they are easily intercepted and are susceptible to distortions due to interference [4].In [5] the author uses Blue tooth 4.0 to communicate with the user between the intelligent home equipment. To remotely control these devices, the user can use cell phones or tablets. Blue tooth technology only has the disadvantage of allowing short distance control of the devices. As an example in [6], the author proposed home automation systems based on the Blue tooth. This solution controls home appliances without Internet control on Android smartphones. All home appliances are connected physically and are regulated via Smartphones with the Blue tooth controller.However, home appliances are not connected remotely and cannot operate remotely in this solution.

It is proposed to use android phones in IoT-based home automation [7]. The authors used two different forms of home automation, i.e., Blue tooth and Ethernet. The custom mobile application on Android was also used to monitor domestic apps such as Fan, TV, AC and so on. However, prototype data sources are unclear and lead to an impasse when multiple Android phones attempt to access the same website.A smart data collection system has been created in [8] and an energy management system displays the necessary data using SMS, GPRS and email alerts on a web-based page. For control of devices and wireless communication, the ARM microcontroller has been used. The system was developed based on the IEEE1451 protocol to define the electronic datasheet for all transducers.

There is an affordable, flexible and all-embracing smart home system [9]. The Arduino Ethernet uses the custom app installed in Android mobile to communicate through the Internet. The Arduino device is integrated with several sensors such as moisture sensors, temperature sensors, and sensors for smoke and gas. The user controls all these sensors with the mobile app. The prototype is tested and the efficiency has been analysed. However, when the particular domestic application reaches the specified threshold, the system proposed generated email alerts.[10] The Intel Galileo Development Board has proposed an Ethernet-based intelligent home automation and energy management system. Different sensors were used both to control the domestic appliances and to maintain house safety.In [11] the launchpad for TI Wi-Fi CC3200 with a sensor for PIR sensing motion was integrated and a voice call was sent to the owner of the house. The owner can then decide if the security system can be disabled or not. The home appliances can also be controlled remotely. In terms of automation, this application also does very little.

III. EQUIPMENT

For capturing IR signal at the specified Range wavelength, the IR receiver sensor is used. The IR receiver sensor is a sensor designed to catch and send to the IR receiver's outcome pin that detects IR radiation falls in it at the particular wavelength according to the filter. Figure 1 depicts its picture.Led(IR) for the transmission to a specific frequency of the modulated IR signal. The IR Led is designed spatially for transmitting IR rays. In many IR Remote Appliances, it is not visible to humans by the electromagnetic specimen, which can transmit an IR signal between 760nm and 1mm wavelength.

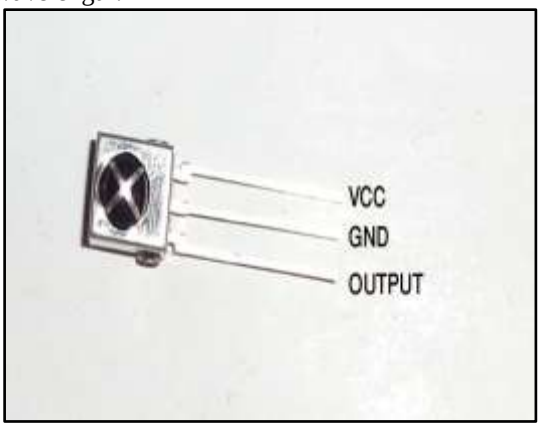

Figure 1 IR Sensor

We will use ESP-8266/Node MCU as the central controller. The use of ESP8266/Node MCU as a controller. The ESP8266/ Node MCU is an affordable Wi-Fi chip with full TCP/IP stack capability, which the Chinese manufacturing company Express if Systems based in Shanghai produces. This module connects the present work to Wi-Fi. Figure 2 demonstrates its picture. The use of a mobile phone is made to use the Reeva Smart Home mobile application, in which IR remotes must be added for the devices to be controlled through thecurrent device. It could be any IR-controlled electronic device, such as a television or

International journal of advances in engineering and management (IJAEM)
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an air conditioner. Any IR-enabled electronic device, such as an air conditioner, a television, a set-top box, an OTT box, a DVD player, an amplifier, or a fan can be controlled [12].

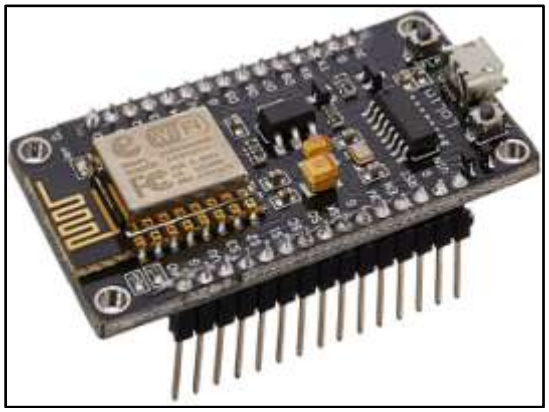

Figure 2ESP-8266

An infrared Blaster 360 (Figure 3) was used to automatically operate the device with a 360-degree control range and normally controlled only by controlled key presses with infrared remote control.A 5V 4 channel interface board (Figure 4) has been used, and a driver current of 15-20mA is needed for every channel. It can be used for the control of various large-scale appliances and appliances. The AC150V 10A or DC30V 10A is equipped with high-current relays. The interface is standard and can be directly controlled by the microcontroller.

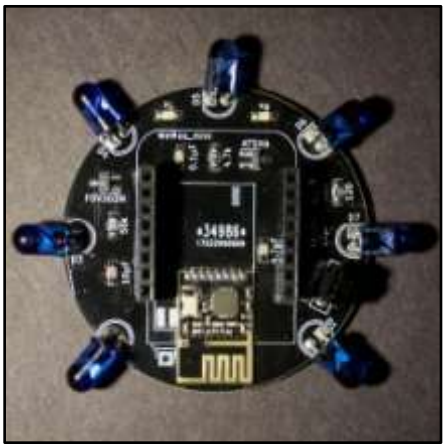

Figure 3IR blaster 360

Figure 4 Relay module

The sensor module is used to detect motion by a Passive Infrared Sensor (PIR) (Figure 5). It can be used for safety systems or robotics as a motion detector. It works on 5V DC and offers TTL output that can be transmitted directly to a transistor or micro-controller. The sensor and Fresnel lens consists of pyroelectric sensors, which detect movement by measuring changes in the infrared levels of objects emitted. Up to 20 ft. can be detected. This module is highly sensitive to infrared changes in human movement.

Figure 5PIR Sensor

IV. IR SPECTRUM

The present device must communicate by IR transmitter and receiver. This is part of the IR spectrum, in this case, the air is the medium for every signal to propagate. IR has anElectromagnetic Spectrum (EMS)and therefore IR is nothing but an EMW (Electromagnetic wave) with different wavelengths and energy. So this section discussed the Electromagnetic Spectrum.

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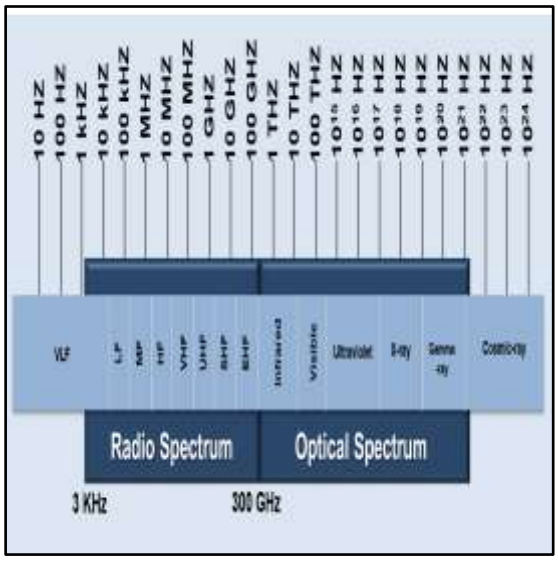

Figure 6Electromagnetic Spectrum

As shown in figure 6, Gamma Rays, X-Rays, UV visible, radio waves are a part of the Electromagnetic Spectrum include electromagnetic. When observing the figure we can see that it is decreasing and wavelength is increasing towards Gamma-Ray >> Radio Wavelength and that the advantage over the higher wavelength is greater. The attention rate of the signal is lower than with the lower wavelength signal, but it's not visible to us. So we can't see it. Sun is the main source of IR and UV rays. All waves have their applications.Normally, radio waves are used for data transfer in Near-Field Communication and Radio Waves are used for data transfer in Far-Field Communication. Visible light is now also used for data transfer (LIFI -Visible Light Communication).Near-Field wavelengths are used by IR appliances, while the Far-Field spectrum is used by thermal imaging. In the medium, the use of Near Field IR as a communication channel is made. So the protocol is required to send and receive data that different systems can understand.

1.1 IR Protocols

The message bits are encoded using pulse distance encoding in the NEC IR transmission protocol. At a carrier frequency of 38kHz (26.3s), each pulse burst (mark – RC transmitter ON) is 562.5s long. The following is how logical bits are sent:

- With a total transmit time of 1.125ms, logical '0' consists of a 562.5s pulse burst followed by a 562.5s space.
- With a total transmit time of 2.25ms, logical '1' consists of a 562.5s pulse burst followed by a 1.6875ms space.

When the remote control is pressed, the message sent consists of the following, in order:

- a 9ms leading pulse burst (16 times the pulse burst length used for a logical data bit)
- a 4.5ms space
- the 8-bit address for the receiving device
- the 8-bit logical inverse of the address
- the 8-bit command
- the 8-bit logical inverse of the command
- a final 562.5µs pulse burst to signify the end of message transmission

The coding of the work is demonstrated in the appendix section.

V. CONCLUSION

The SmartHome Automation system can be made using the technology developed in the present work. The experiment shows that all requirements relating to home automation are fulfilled. The project could contribute to increasing human life's productivity. As mentioned above, a person can control his/her home appliances more intelligently. Thus, human life's comfort can be steadily improved to solve problems worldwide. If the technology is used widely, the time can be saved upto great extent. The project result was generally focused on access to the desired person's equipment and on controlling the equipment from all over the world. Currently, the time is to build a smart home automation system to create opportunities for the various surveillance systems in turn. Home Automation has all the facilities to improve human life and the consumption of electricity Savings capacity. The security of the place can be enhanced using this technology.

VI. FUTURE SCOPE

The currenttechnologycan provide comfort to people through the use of artificial intelligence to create a fully automatic control system to optimise human comfort by taking data in the form of different sensors like temperature, radar sensor, sound sensor, the sensor of humidity, light sensor.To understand it better, consider the following scenario: when no human is detected by the sensor, the state of all switches and all IR operated devices should be in the Off position (if it is not Scheduled) when someone enters the room, the required lights should turn on automatically, and by comparing the room temperature with the outside temperature, the AC should turn on automatically.And if a long period of motion is detected, it indicates that you are looking for something, and all lights should be turned on at maximum intensity. In the future, Artificial

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Volume 3, issue 6 June 2021, pp: 1283-1289 www.ijaem.net ISSN: 2395-5252

Intelligence will be used to address the aforementioned situation, as well as many others.

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Appendix

1.2 Arduino IDE Software :

The figure 7, 8, 9, 10, 11, and 12shows the coding that is stored in the memory of the node MCU and can be changed to meet the needs. To programme the device, we use the Arduino IDE.

```
#include <Arduino.h>
#include <IRrecv.h>
#include <IRremoteESP8266.h>
#include <IRac.h>
#include <IRtext.h>
#include <IRutils.h>



#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#define BLYNK_PRINT Serial


#define MOTIONS_IN_INTERVAL 1
#define MOTION_INPUT D7
#define MOTION_INTR_INTERVAL 1000
#define MOTION_READ_INTERVAL 1000
#define MOTIONS_IN_INTERVAL 1
```

Figure 7 Programme

The highlighted data of the figure shows the required libraries in the programming.

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```
char auth[] = "yCRjd71Z7PPKJKAK3ENPEp1yjOfbc1Gg";
char ssid[] = "karan";
char pass[] = "karanpatel";
bool _acstatus = false;

const uint16_t ir_tx = 12;
const uint16_t ir_rx = 4;
const uint16_t rx_buffer_size = 2048;
const uint16_t min_unknown_size = 12;
const uint8_t ac_timeout = 50;

IRrecv irrecv(ir_rx, rx_buffer_size, ac_timeout, true);
decode_results results;
IRsend code(ir_tx);

int motion_count;
int motion_interval;

char msg[10];
```

Figure 8 Programme

char auth[] = "yCRjd71Z7PPKJKAK3ENPEp1yjOfbc1Gg";is an authentication key to identify the device which we are going to use here as the mobile phone
char ssid[] = "karan"; name of the particular WIFI, Node MCU has to connect with this WIFI
char pass[] = "karanpatel"; Password required to access the particular WIFI

```
IRrecv irrecv(ir_rx, rx_buffer_size, ac_timeout, true);
decode_results results;
IRsend code(ir_tx);

int motion_count;
int motion_interval;

char msg[10];

typedef enum
{
  FORWARD,
  REVERSE
} ac_state_direction_t;

uint8_t _motion = 0;
uint8_t _motion_count = 0;
uint32_t _previousMillis0 = 0;
uint32_t _last_motion_read_time = 0;
uint32_t _last_interrupt_time = 0;

bool _is_hit_makawana = false;

ac_state_direction_t _direction = REVERSE;
```

Figure 9 programme

The use of motion_count and motion interval as a variable to detect the motion via PIR sensor is made. The collected data from the PIR sensor enter in to nested if loop as shown in the belowfigure.

```
if (_motion_count >= MOTIONS_IN_INTERVAL)
{
  if (_direction == FORWARD)
  {
    AC_ON();
    _direction = REVERSE;
  }
}
else
{
  if (_direction == REVERSE)
  {
    AC_OFF();
    _direction = FORWARD;
  }
}
_motion_count = 0;
_previousMillis0 = _currentMillis;
}
else
{
if (_currentMillis - _last_motion_read_time > MOTION_READ_INTERVAL)
{
  _motion = digitalRead(MOTION_INPUT);
  if (_motion == 1)
  {
```

Figure **10** Programme

Nested if filter the data and execute the command accordingly, the executed command used to on and off the appliances via IR transmitter. For example in our experiment we are going to control the AC of my house, the unsigned integer motion is to detect the motion and the unsigned integer motion count is to detect the motion count, which means the motion is continuous or discontinuous. If the motion is discontinuous the AC will turn off after 10 seconds and if the motion is discontinuous the Ac remains on regardless of the 10 sec time delay.

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```
      {
        _motion_count++;
        Serial.println(_motion_count);
      }
      if (_is_hit_makawana)
      {
        if (_direction == FORWARD)
        {
          AC_ON();
          _direction = REVERSE;
        }
        _is_hit_makawana = false;
      }
      _last_motion_read_time = _currentMill
    }
  }
}

void setup()
{
    pinMode(D1,OUTPUT);
  pinMode(D2,OUTPUT);
  pinMode(D3,OUTPUT);
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
  Serial.begin(9600);
  irrecv.enableIRIn();
```

Figure 11 Programme

```
void setup()
{
    pinMode(D1,OUTPUT);
  pinMode(D2,OUTPUT);
  pinMode(D3,OUTPUT);
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
  Serial.begin(9600);
  irrecv.enableIRIn();
  code.begin();
  attachInterrupt(digitalPinToInterrupt(MOTION_INPU
  _direction = REVERSE;

}

void loop()
{
  Motion_Detection();
  Blynk.run();
}
```

Figure 12 Programme