Li-Fi(Light Fidelity) Based Unmanned Robotic Vehicle For Smart Data Transfer

Abstract

Light Fidelity (Li-Fi) is a data transfer technique that uses light. Light is analogous not only to illumination but also to speed. Li-Fi is also much secured since light cannot pass through walls. It uses visible light portion of the electromagnetic spectrum to transmit information. In this project we aim to use this technology in a way which might solve some of the emergency related problems. We'll be making a robotic vehicle which will travel on a pre encoded path. The path will have transmitters which will supply information to the robot. At a certain point there'll will a receiver which will collect all the transmitted data from the robot and it will transfer the data to the control room. The control room will then perform according to the data received. The lifi modules will enhance the data transmission rate and microcontroller will define the path and work of the robotic vehicle.

Keywords- Li-Fi, Robotic Control, VLC, Digital Communication, Light Technology, Smart control, Unmanned robot.

I.INTRODUCTION

The expanding demand for remote information, which is relied upon to be 49 exabytes for every month by 2021 , inspires both the scholarly world and industry to put resources into elective arrangements. These incorporate mmWave, huge various information numerous yield (MIMO), free space optical correspondence and Light-Fidelity (LiFi) to help the information traffic development and cutting edge fast remote correspondence frameworks. Among these advancements, LiFi is a novel bidirectional, fast and completely organized remote correspondence innovation. LiFi utilizes obvious light as the engendering medium in the downlink for the reasons for enlightenment and correspondence. It can utilize infrared in the uplink so the brightening requirement of a room remains unaffected, and furthermore to stay away from obstruction with the obvious light in the downlink . LiFi offers various critical benefits that have made it positive for later and future research.

LiFi uses VLC(Visible Light Coupling) of an electromagnetic spectrum to transmit information. These appear differently in relation to built up types of remote correspondence, for example, Wi-Fi, which utilizes radio recurrence (RF) signs to transmit information. With VLC, information is transmitted by balancing the power of the light so it isn't seen by the human eye. The information is gotten by a photosensitive locator that demodulates the light flag electronically. VLC is a class of remote optical interchanges (OWC).

OWC incorporates infrared and bright correspondences, just as unmistakable light. In any case, VLC is interesting in that the equivalent unmistakable vitality utilized for lighting can likewise be utilized for correspondence. At the point when a consistent current is connected to the LED light, a steady photon motion, saw as noticeable light, is produced by the knob. On the off chance that the present changes gradually and gradually, the force of the glowing transition is debilitated through and through. Since LED lights are semiconductor gadgets, we can really change the current and, accordingly, the optical yield at incredibly high speeds, imperceptible to the human eye, yet perceptible by a gadget.

Utilizing this strategy, rapid data can be transmitted from a LED light. RF correspondences require complex radio circuits, reception apparatuses, and beneficiaries, though VLC is a lot easier and utilizes direct tweak methods like those utilized in minimal effort infrared specialized gadgets, for example, remote control units.

Infrared correspondence has constrained power because of eye security necessities, while LED globules have a high force and can accomplish extremely high information exchange rates. VLC suppliers give segments containing circuits and firmware for the transmitter and recipient. These segments can be coordinated into the knob and gadgets of the customer gadget, separately. The transmitter incorporates an exclusive firmware to regulate the LED yield. The collector incorporates a photosensor and firmware to demodulate the yield of the photograph recipient.

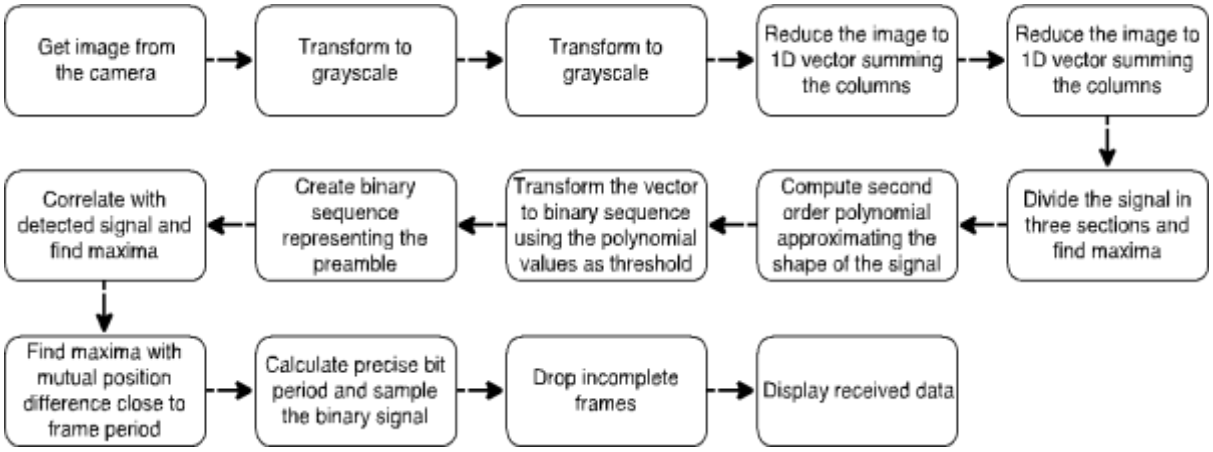


Fig. 4. VLC Detection Algorithm

II. LITERATURE OVERVIEW AND MOTIVATION

A large portion of the general population is utilizing Wi-Fi Internet gadgets, which will be helpful for 2.4-5GHz RF to convey remote Internet get to encompassed our home, workplaces, schools, and some open places too. We are very reliant upon these almost universal administrations . While Wi-Fi can cover a whole house, school, the transfer speed is restricted to 50-100 megabits for every second (Mbps). It is a most present Internet administration, yet deficient for moving vast information documents like HDTV motion pictures, music libraries, and computer games. The majority of the ward upon 'the cloud' or our own 'media administrations' to store the majority of our documents, including films, photographs, sound and video gadgets, recreations, the more and most transfer speed and speed ought to be expected to get to this information. Thusly RF-based advances, for example, the present Wi-Fi are not the ideal way. What's more, Wi-Fi may not be the most proficient approach to give new wanted capacities, for example, accuracy indoor situating and motion acknowledgment. The optical remote innovations, in some cases, called unmistakable light correspondence (VLC), and all the more as of late alluded to as Li-Fi. Then again, offer a completely new worldview in remote advancements in the terms of correspondence speed, ease of use and adaptability, dependability. VLC is the conceivable answer for the worldwide remote range lack. LiFi innovation is a quick and modest optical rendition of Wi-Fi. It is dependent on Visible Light Communication . The VLC is an information correspondence medium utilizing noticeable light between 400THz to 375THz as the optical bearer for the information transmission and enlightenment. The information is encoded in the light to produce new information stream by fluctuating the flashing rate, to be clearer, by balancing the LED light correspondence source . This is a totally different range of potential outcomes when contrasted with the radio waves range and is multiple times more in size. Obvious light isn't damaging to the vision and is an obligatory piece of infrastructure, therefore inexhaustibly accessible and effectively open. Contrasting the quantity of radio cell base stations (1.4 million) to the number of lights (14 billion) introduced as of now the proportion is coincidently the same for example 1:10000.

III. EXISTING SYSTEM

The proposed framework utilizes advanced balance strategy with RC5 encoding procedure to diminish blunder rate in information transmission. A powerful LED modulator is intended to work dependent on PWM regulation giving high yield control at LED light transmitter.

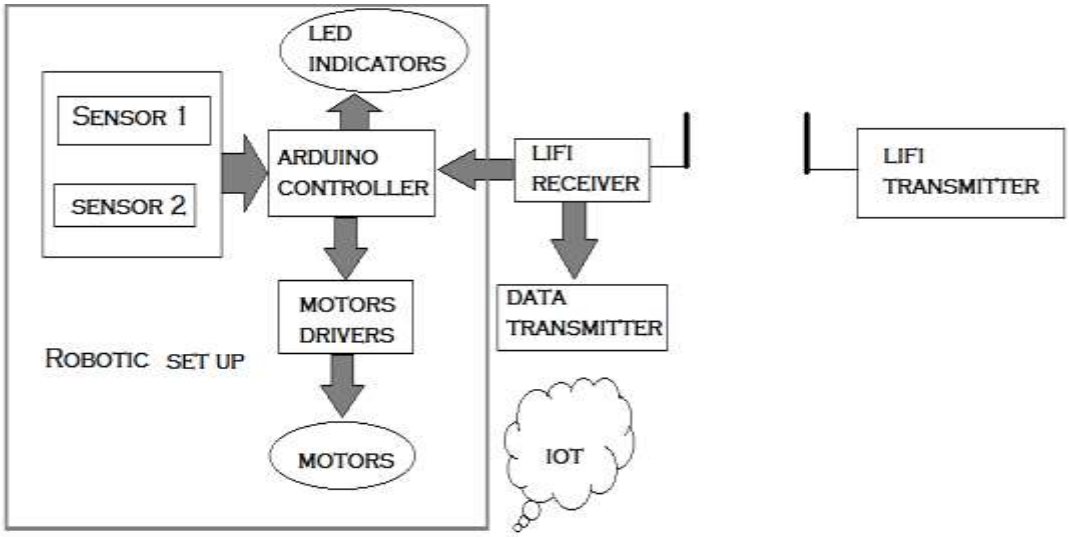
A mechanical control application is produced with a remote light modulator and demodulator joined to an automated control unit. Rapid information correspondence of baud rate 1200bps. Constant application for mechanical control is executed. RC5 Encoding PWM based Digital Modulation procedure . Blunder rate is less. High transmitter shaft control (250 lumens).

IV. PROPOSED SYSTEM

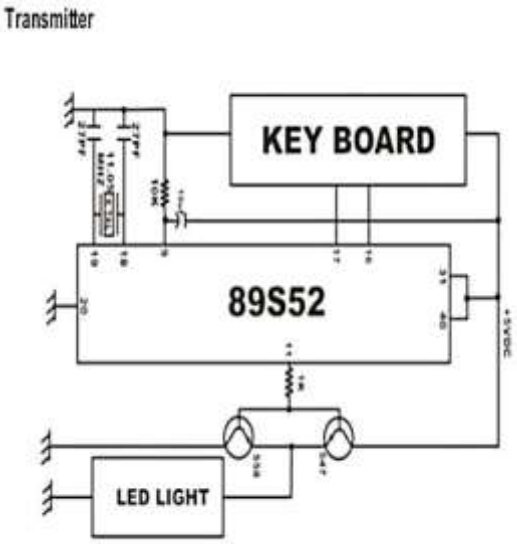
The proposed system utilizes the Li-Fi technology in a way which may explain a portion of the crisis-related issues. We'll be making an automated vehicle which will go on a pre-encoded way. The way will have transmitters which will supply data to the robot. At one point there will a collector which will gather all the transmitted information from the robot and it will exchange the information to the control room. The control room will at that point perform as per the information got. The Li-Fi transmitter and receiver modules will

improve the information transmission rate and the microcontroller will characterize the way and work of the automated vehicle.

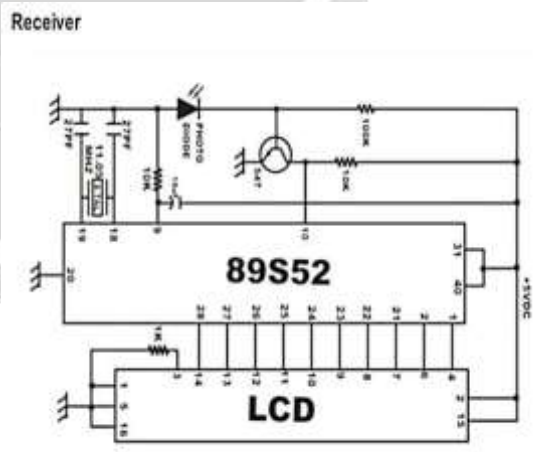
a) Block diagram of proposed system



b) Li-Fi Transmitter :



c)Li-Fi Receiver :

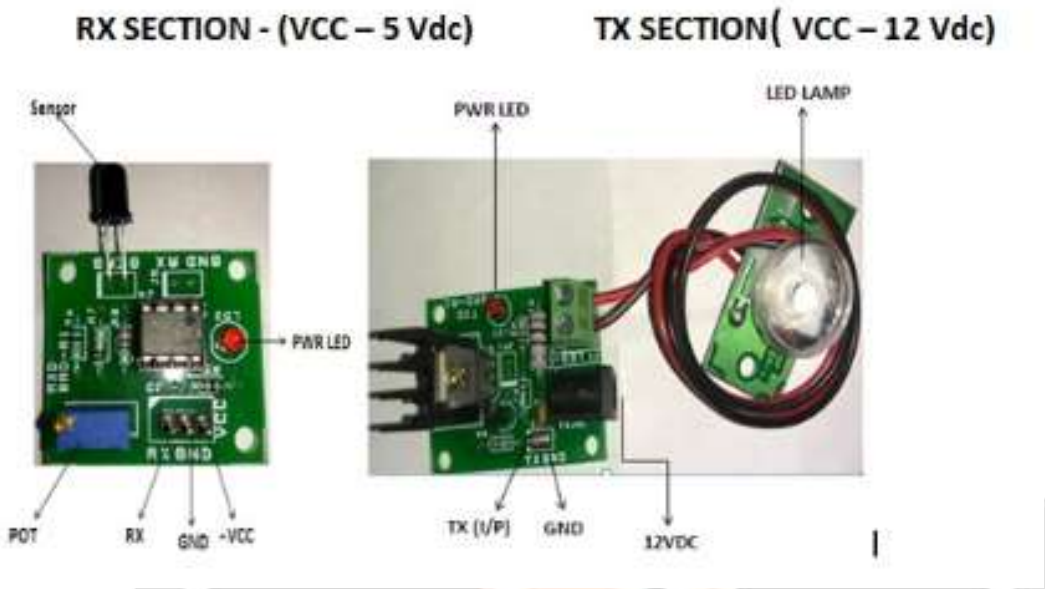


d) Description :

The transmitter unit comprises of a light modulator and a LED transmitter circuit. Changes over an advanced information motion into a tweaked PWM light flag. The receiver incorporates a light sensor and a PWM demodulator circuit. The demodulator removes the information motion from the light flag and sends it to the Arduino microcontroller. The microcontroller gets advanced information and controls the mechanical engine as needs are. The Li-Fi modulator depends on computerized regulation utilizing PWM innovation. The demodulator utilizes an LM358 Op-Amp based circuit that identifies the voltage flag of the photodiode and demodulates it into advanced information bits. The engine control conspire dependent on the L293D is utilized

to control the robot engines. The receiver after receiving the signal from the transmitter sends it to the control room where further actions are taken.

V. Li-Fi TRANSMITTER AND RECIEVER MODULE



Light Fidelity is normally executed utilizing white LED lights at the downlink transmitter. These gadgets are typically utilized for brightening just by applying a steady current. Be that as it may, by quick and unpretentious varieties of the current, the optical yield can be made to fluctuate at amazingly high speeds. This very property of optical current is utilized in Light Fidelity setup. The operational strategy is extremely straightforward, if the LED is on, you transmit a computerized 1 if it's off you transmit a 0. The LEDs can be turned on and off very rapidly, which gives decent open doors for transmitting information. Thus all that is required is a few LEDs and a controller that code information into those LEDs. Every one of the ones needs to do is to differ the rate which the LED's glimmer contingent on the information we need to encode. Further at improvements can be made in this technique, such as utilizing a variety of LEDs for parallel information transmission, or utilizing blends of red, green and blue LEDs to modify the light's recurrence with every recurrence encoding an alternate information channel. Such headways guarantee a hypothetical speed of 10 Gbps – which means one can download a full top-notch film in only 30 seconds. To additionally get a grip of Light Fidelity considers an IR remote. sends a solitary information stream of bits at the rate of 10,000-20,000 bps. Presently supplant the IR LED with a Light Box containing a substantial LED cluster. This framework, is fit for sending a huge number of such streams at an exceptionally quick rate. Light is characteristically protected and can be utilized in spots where radio recurrence correspondence is regularly regarded as risky, for example, in airship lodges or emergency clinics. So noticeable light correspondence not just can possibly tackle the issue of the absence of range space, yet can likewise empower novel application. The noticeable light range is unused.

VI. EXECUTION RESULTS AND DISCUSSION

This proposed framework yield information has been observed in terminal programming. The Robot was pre-encoded a specific path and we found a successful run after testing it. The transmitters were also successful in sending the signals according to the information obtained from the microcontroller. We observed very minimal or no lag while the working of the LiFi module. The receivers were also fitted in place and worked perfectly fine without any errors. The simulation of the microcontroller along with the Li-Fi module has been done in Proteus and shown below, The hardware has also been perfectly assembled as it can be observed below.

Software Results :

```
#include <LiquidCrystal.h>

// initialize the library with the numbers of the interface pins
LiquidCrystal lcd(13, 12, 11, 10, 9, 8);


// These constants won't change.  They're used to give names
// to the pins used:
const int analogInPine = A0;  // Analog input pin that the potentiometer is attached to
const int analogInPinb = A1;  // Analog input pin that the potentiometer is attached to

int sensorPin = A5;    // select the input pin for the potentiometer
int sensorValue = 0;  // variable to store the value coming from the sensor
int count=0,f1;
unsigned long time1=0;  // store the initial time
unsigned long time2;    // store the current time
  int count1;

int sensorValue1 = 0;        // value read from the pot
int sensorValue2 = 0;        // value read from the pot
int sensorValue3 = 0;        // value read from the pot
int sensorValue4 = 0;        // value read from the pot

long kc;

void txs(unsigned char val)
{
  Serial.write(val);
  delay(20);
}
```

```
void setup() {
  // initialize serial communications at 9600 bps:
    pinMode(sensorPin, INPUT);
  Serial.begin(9600);
    lcd.begin(16, 2);

  lcd.setCursor(0, 0);
  lcd.print("T1:       T2:             ");
  lcd.setCursor(0, 1);
  lcd.print("V:        I:              ");

}

void loop() {
  // read the analog in value:
  sensorValue1 = analogRead(A0)/2;
  sensorValue1 = analogRead(A0)/2;

  lcd.setCursor(3, 0);
  lcd.write((sensorValue1/100)+0x30);
  lcd.write(((sensorValue1%100)/10)+0x30);
  lcd.write((sensorValue1%10)+0x30);

 sensorValue2 = analogRead(A1)/2;

  lcd.setCursor(13, 0);
  lcd.write((sensorValue2/100)+0x30);
  lcd.write(((sensorValue2%100)/10)+0x30);
  lcd.write((sensorValue2%10)+0x30);
```

```
sensorValue3 = analogRead(A2)/2;

 lcd.setCursor(3, 1);
 lcd.write((sensorValue3/100)+0x30);
 lcd.write(((sensorValue3%100)/10)+0x30);
 lcd.write((sensorValue3%10)+0x30);

sensorValue4 = analogRead(A3)/2;

 lcd.setCursor(13, 1);
 lcd.write((sensorValue4/100)+0x30);
 lcd.write(((sensorValue4%100)/10)+0x30);
 lcd.write((sensorValue4%10)+0x30);

    txs('T');
    txs((sensorValue1/100)+0x30);
    txs(((sensorValue1%100)/10)+0x30);
    txs((sensorValue1%10)+0x30);
    txs('t');
    txs((sensorValue2/100)+0x30);
    txs(((sensorValue2%100)/10)+0x30);
    txs((sensorValue2%10)+0x30);

    txs('V');
    txs((sensorValue3/100)+0x30);
    txs(((sensorValue3%100)/10)+0x30);
    txs((sensorValue3%10)+0x30);
    txs('I');
    txs((sensorValue4/100)+0x30);
    txs(((sensorValue4%100)/10)+0x30);
    txs((sensorValue4%10)+0x30);
```

```
}


void serialEvent() {
  while (Serial.available()) {
    // get the new byte:
    char inChar = (char)Serial.read();
    // add it to the inputString:

    // if the incoming character is a newline, set a flag
    // so the main loop can do something about it:
    if (inChar == 'R') {
      pinMode(8, OUTPUT);
        digitalWrite(8,LOW);
    }


  }
}
```

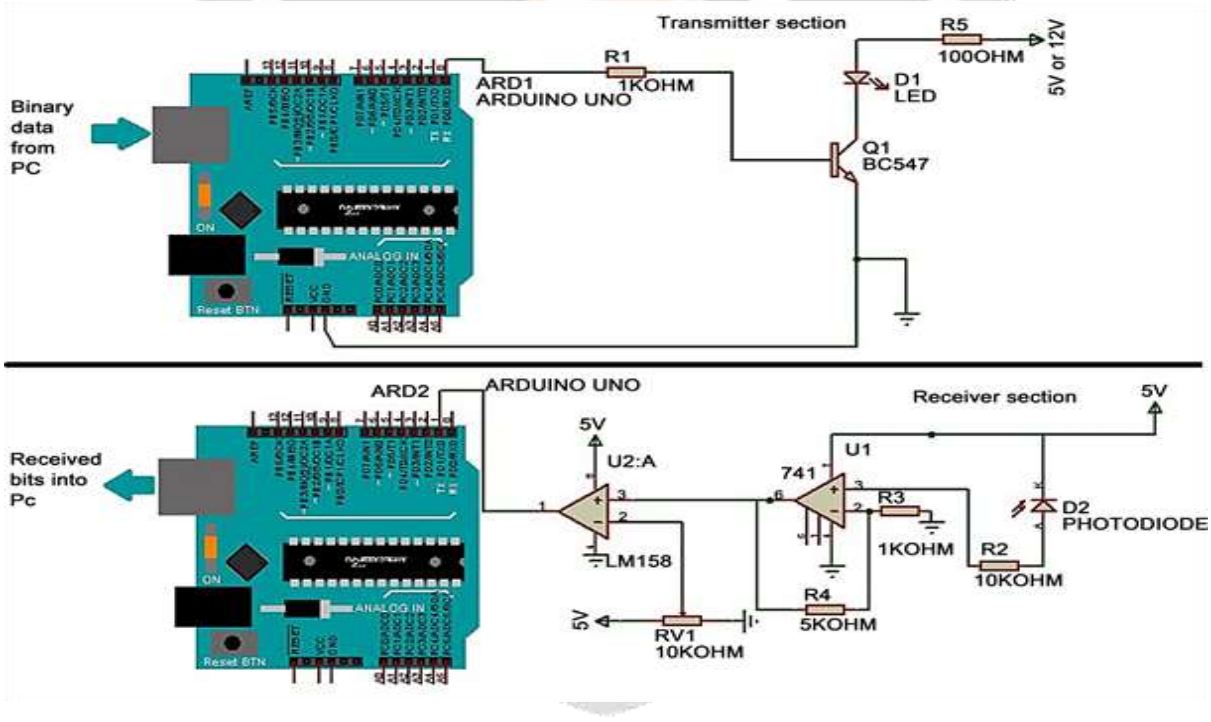
```
}
void increment()
{
   count++;
}

void counter()
{
   if(count>2)
   {
   count1=60+(count%20);
   }
   else
   {
    count1=0;
   }
   time1=0;
   time2=0;
   count=0;

   delay(200);

}
```

Simulation Result :



Hardware Result :

VII. CONCULSION

This project will almost certainly give a verified, minimal effort, simple information transmission and will give a solid correspondence utilizing Li-Fi. It can likewise be utilized in modern, restorative, military applications for automated controls where remote innovation is required. LEDs don't incite any wellbeing risks since there are no destructive radiations delivered in the light shaft. A more extensive scope of data transfer capacity is accessible to the clients because of the wide scope of unmistakable light range. It will likewise give a verified method of correspondence interface because of observable pathway method of correspondence in which no interloper can meddle with the light information correspondence