International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958 (Online), Volume-8 Issue-6S, August 2019

Indoor Industrial Monitoring System

G.Sasikala, S.Siva Sathya

Abstract:- Remote Monitoring in industries is most necessary criteria to raise production, profitability, availability of plant and for safeguarding health of the machines. Industries stand in need more man power to monitor; some occasion in faraway of technician it may occur abnormal condition. The system discussed here presents an alternative approach which consists of a robot capable of moving on its own and it has ability to gain information about their environment by keep on observing myriad parameters such as hazardous gas leakage, fire, variation in temperature, cracks in pipeline etc continuously in all the parts of an industrial complex to prevent catastrophic failure and can immediately convey message to central station using light fidelity (LIFI) Technology. It reduces the labor activities necessary in all industries for continuous monitoring of overall parameters using self reliant robot with aid of light fidelity (LIFI) application.

Index Terms: Gas sensor, LED, line following robot,light fidelity, temperature sensor

I. INTRODUCTION

The conventional methods such as electrical contact, remote monitoring using optical fibers and thermal cameras has downsides for monitoring critical infrastructures. These traditional contact methods create flaws on the equipments. The remote monitoring also has safety issues by the reason of energy scattering over long distance. In this technologically advanced area, engineers contemplate to replace human workers with smart systems to quicken work and to enhance operation and production. Nowadays the autonomous robots have rapid development in realm of research and development. It can operate desired tasks in challenging environment without continuous human intervention. Remote Monitoring in industries is most necessary criteria to raise production, profitability, availability of plant and for safeguarding health of the machines. Industries stand in need more man power to monitor; some occasion in faraway of technician it may occur abnormal condition. The system discussed here presents an alternative approach which consists of a robot capable of moving on its own and it has ability to gain information about their environment by keep on observing myriad parameters such as hazardous gas leakage, fire, variation in temperature, cracks in pipeline etc continuously in all the parts of an industrial complex to prevent catastrophic failure and can immediately convey message to central station using light fidelity (LIFI) Technology. It reduces the labor activities necessary in all industries for continuous monitoring of overall parameters using self reliant robot with aid of light fidelity (LIFI) application.

II. LITERATURE SURVEY

Shivaji Kulkarni and Amogh Darekar[2016 IEEE] describes an idea of LIFI communication. This new technology gives better bandwidth, efficiency and speed. It is transmitting data in both directions (send and receive) using light ranges from 390-700 nm. Mahesh.S.Kholgade, and et al [2017IEEE] explained the entire system which is using microcontroller to monitor the reading of gas sensor and transmit the message to activate alerting system such as display, buzzer, exhaust fan. This ideology is mainly used for detection of hazardous leakage of liquid petroleum gas by using MQ6 sensor. Sarguna Priya and et al (IJETT 2014) explained autonomous monitoring of the industrial parameter using different sensors such as temperature sensor, pressure sensor current sensor and level sensor and processed by microcontroller to convey message to the authorized person using CAN BUS. S.W Mohod and Rohit.S.Deshmukh [IJETT 2014] described the system which provides data from various sensors in the sensor module and it is fed to the controlling device of a microcontroller. It is interfaced with a GPRS enabled GSM module to get accessed remotely by users. An arrangement of accessing the main server remotely by mobile users can be achieved through TCP/IP protocol. Jadhavsunny.P and et al [IOSR-JEEE 2014] explained about the system that monitor and control the parameter through protocols and convey message through networkss, it also has another way to communicate the message to authorised client using GSM communication incase of any failure in web server . Chien-Lan Liao, and etal [2015 IEEE] explained about blue gallium nitride based LED's which exhibit a 3-dB modulation with bandwidth of 225.4MHZ and output power of light is 1.6mW at 35mA. This modulation bandwidth decreases temperature and increase the drive current so the high bitrates of 4.4GB/s is attained.

III. PROPOSED SYSTEM

The proposed system discussed here presents an alternative approach which consists of a robot capable of moving on its own and it has ability to gain information about their environment by keep on observing myriad parameters such as hazardous gas leakage, fire, variation in temperature, cracks in pipeline etc continuously in all the parts of an industrial complex to prevent catastrophic failure

Manuscript published on 30 August 2019.
* Correspondence Author (s)
Dr.G.Sasikala, AssociateProfessor,ECEDepartment,VelTech Rangarajan Dr.Sagunthala R&D Inistitute of Science and Technology,Chennai, Tamilnadu, India.(Email: Sasikalaeverest369@gmail.com)
S.Siva Sathya, M.Tech (Student), VelTech Rangarajan Dr.Sagunthala R&D Inistitute of Science and Technology, Chennai, Tamilnadu, India.

and can immediately convey message to central station using light fidelity (LIFI) Technology. It reduces the necessity of labor activities in all industries for continuous monitoring of overall parameters by using self reliant robot with aid of light fidelity (LIFI) application. Figure 1 and Figure 2 provides a skeleton idea of research concept.

This self reliant robot has vital features like portability, myriad-parameter measurement, and conveys data through wireless communication in challenging environments, where existing system may fall has drawn-out the proposed system to new level. The communication range could be widened by using concentrator's lens in LIFI module. Multitudinal sensors can be used based on essential parameter to be measured in that industrial environment. The main objective of proposed system is to employ the system without affecting the monitoring field where any replacement and rectification are not viable.

IV.SYSTEM DESIGN

A. Transmitter section:

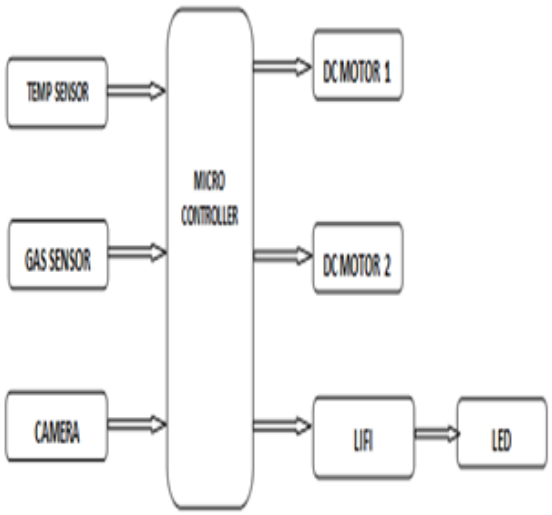


Figure1 Block Diagram of Transmitter Section

B. Receiver section:

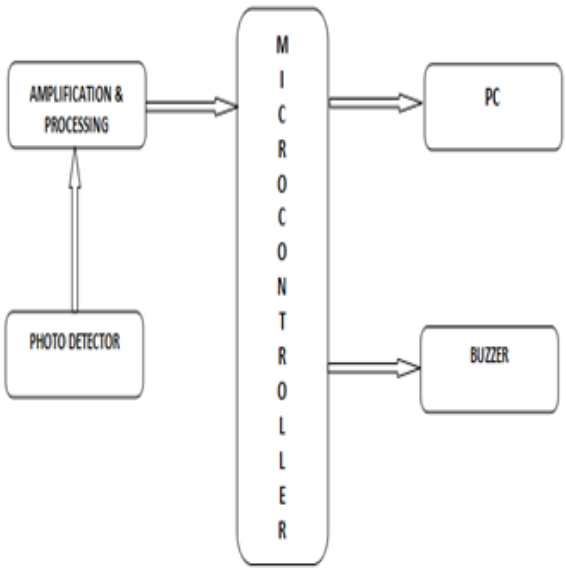


Figure2 Block Diagram of Receiver Section

C. Pic Microcontroller – PIC16F877A

Microcontroller is a mini computer present in single IC dedicated to perform specific application. Some features of microcontroller are operated at low clock frequency and consume low power, and its programs are stored in read only memory, it has dedicated input and output device.

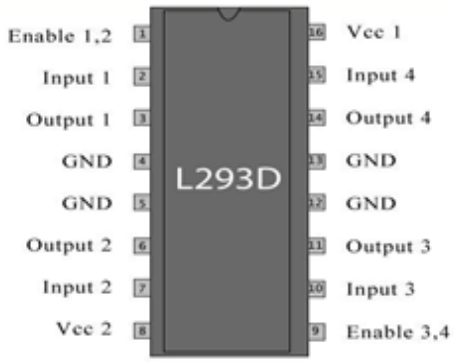
PIC - Peripheral interface controller was developed by microchip in 1993. PIC controller is easy to interface with the peripherals and easy to program. Special features of PIC microcontroller are 8-bit FLASH memory hence we can erase and rewrite the program several times. PIC6f877A is a 40 pins IC among these 33 pins are used for I/O. This IC is used in various applications such as remote sensing, home and industrial automation, security devices and industrial instruments.PIC is based on Harvard architecture (i.e.) it uses separate memory for instruction and data. It has 256 bytes of EEPROM memory possess only 35 instructions, it has five ports namely port A- 6 pins, port B- 8 pins, port C – 8 pins, port D - pins, Port E – 3 pins. Three timer modes are available in PIC controller Timer 0, timer 1, timer 2, this controller support timer interrupts and hardware interrupts, operating speed of PIC controller is 20MHZ, 200ns per instruction cycle. It has 16-bit capture input with maximum resolution of 12.5ns, 16-bit comparator, two 10-bit PWM and 8 channel 10-bit A/D converters.

D. MAX232

MAX232 IC is 16 pin IC which is used to convert signals from serial port like RS232 to use in TTL compatible circuits .it is necessary to communicate data between devices that operate on different signal levels. it has 2 driver and receiver channel, both receiver coverts signal to 5V TTL levels on other side take inputs from TX pin give to the PIC receiver pin and operates to maximum of 128kbps, it can communicate data to the distance of 12- 15 meters. It needs 4 capacitor ranges from 8 µf - 10µf for configuration.

E. L293D

Driver IC for dc motor is used in mobile robots only. Basic need of motor driver IC in robots is, Microcontroller works at low voltage level whereas DC motors operate at high voltage. So, the microcontroller could not deliver sufficient current to run DC motor. Driver IC is interfaced between microcontroller and motor in robot. L293 series IC like L293D, L293NE are used in all autonomous robots. L293d is 16 pin IC designed to run two dc motor concurrently. Drivers are enabled as pair by two enable pin. With respect to input each pair forms a full – H bridges.it provide a max current of 600 mA and voltage upto 36V.Thus L293D able to drive big motor. In figure 3 representing pin configuration and motor behavior for input condition



Direction	Motor 1		Motor 2	
	Input 1	Input 2	Input 3	Input 4
Forward	High	Low	High	Low
Reverse	Low	High	Low	High
Left	High	Low	Low	High
Right	Low	High	High	Low

Figure3 Pin configuration and motor behavior for input condition

F. Temperature Sensor LM35

The LM35 is 3 terminal high precision temperature sensors. This sensor does not require any peripherals for calibration. some of the special features of this sensors are, sense accurate temperature value directly in centigrade, measure temperature ranges from -55 degree Celsius to 150-degree Celsius, operating voltage ranges from 5V to 30 V, draws current less than 60 micro amps and has very low self-heating, very much suitable for remote application, available at low cost because of wafer level trimming.

G. MQ-6 Gas Sensor

The MQ6 is simple gas sensor used to detect presence of hazardous gas leakage such as butane, propane, LPG. It can notice gas concentration ranges from 200 to10000 ppm. This sensor has high sensitivity and quick response time. It is very cheap and suitable for various applications. It requires 5V supply and draw minimum current of 150ma, it can be used as analog as well as digital sensor, it requires preheating before working with it for duration of 20 seconds. The sensitivity of gas sensor can be varied by potentiometer. Pin description of MQ6 sensors are pin 1 – VCC, pin 2 – DOUT, pin 3- AOUT, pin 4 –GND as shown in figure 4.

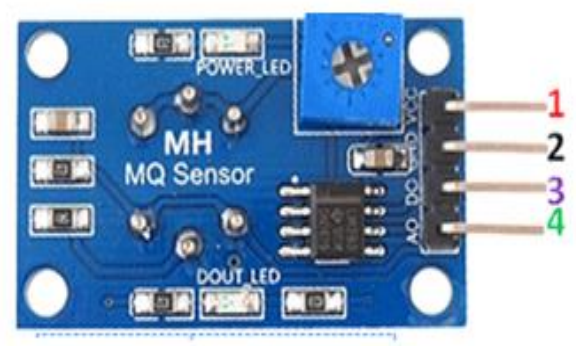


Figure 4 Pin Description of MQ6 gas Sensor

F. LIFI

The flash growth in gadgets usages and application development has encouraged many researches to look beyond WIFI. LIFI Technology means light fidelity, a new wireless communication technology, which employ light as a source of communication to replace the wired communication (i.e.) using Light emitting diode for high speed communication. It is also called as visible light communication or optical wireless technology.LIFI was recommended first time by German physicist Prof. Harald Haas, He call it as D-light technology, which has data rate faster than 10 mbps, The data is transmitted through a light emitting diode by simply switching ON/OFF respectively and received by photo detector, since switching speed of LED is less than 1µs, the human eye cannot identify any flickering. It is safer, greener and cheaper technology.

G. Line Follower Robot

A robot which senses either a black line or white line to alter its path and dash over it called as line follower robot. In proposed system line follower robot with IR sensor is used, motion of this robot is compared with light, if light ray fall on black line it gets observed in other case if light fall on the white area it gets reflected. This principle is used in line follower robot.

H. Concepts Of Line Follower

This line follower robot has two IR sensor modules namely left sensor module and right sensor module, each module has one comparator IC and on pair of IR sensor for detecting dark line on a path and pair of dc motor for wheel movement. Robot movement is fully based on information from the sensor; if the IR sensor recognizes a black line DC motor changes the wheel movement

- If the sensor does not notice any black line, both the wheels rotate simultaneously and robot will move in forward as shown in figure 5.

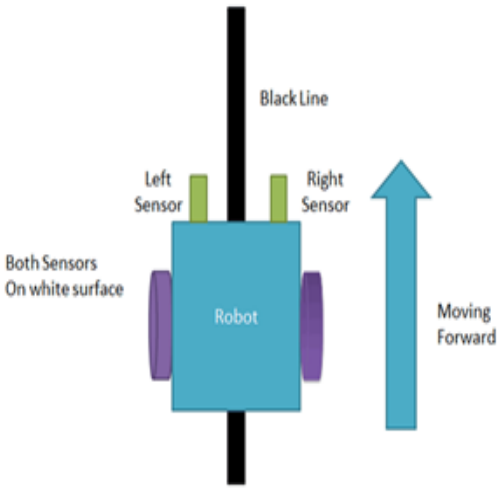


Figure 5 Movement of wheel 1

Published By:
Blue Eyes Intelligence Engineering
and Sciences Publication (BEIESP)

- Robot turns left, if the left sensor touches the black line, as shown in figure 6.

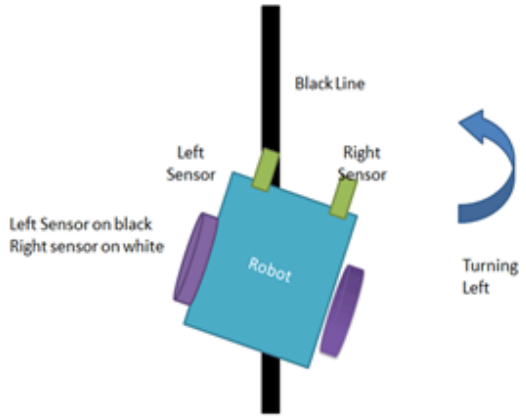


Fig: 6 Movement of wheel 2

- Once right side of IR sensor touches the black line robot turns right side as shown in figure 7.

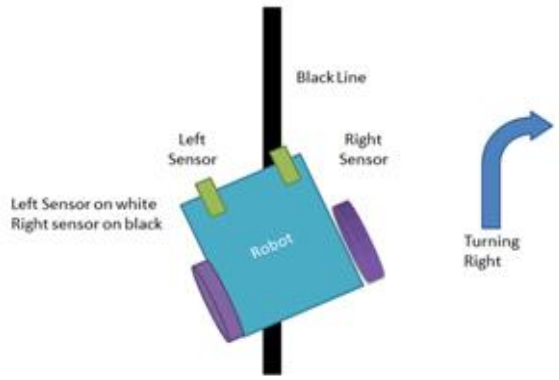


Figure7 Movement of wheel 3

- In case both left and right sensor senses the black line, DC motor stops the wheel rotation, so robot doesn't move as shown in figure 8.

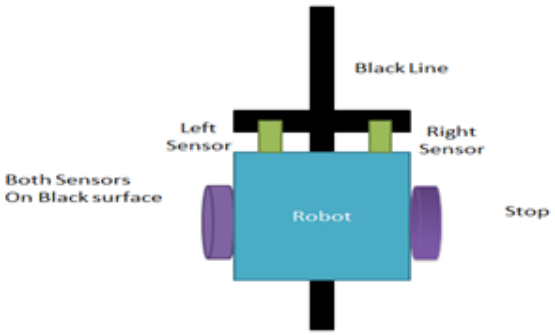


Fig: 8 Movement of wheel 4

V.SOFTWARE & RESULTS

A. Pic C Compiler

At early stage microcontroller was programmed using machine language as 0's and 1's. it was more challenging task for programmer, hence designer done some researches and rise up with the concept of assembler where programming codes are written in assembly language and get converted into machine code to create the hex file, finally this hex file is uploaded in Microcontroller. One drawback of assembly language is, we need to write many codes even for small task .so under some research work designer invented compilers.

Compiler provides environment for developing the efficient code using C, then compiler convert this code into machine language code and finally converted into hex file. Programming using compilers is quite simple and using additional features such as libraries helps us to code the complex task in 3 to 4 lines.

PIC microcontrollers are programmed using various compilers such as Micro C, MP Lab, CCS compiler etc. PIC compiler is the best suited compiler for PIC controller. This serves the programmer to access the hardware features in embedded language level and provide uniform syntax for special function for all IC families. Some of the special features of PIC C compilers are, automatic linking to link multiple code files, In-line assembly to insert assembly code everywhere in source and reference variables, also this compiler permits to generate bit-oriented code, it allows several functions with same name and difference in parameter types and numbers. it has built in libraries for delays, I/O operation, serial interfaces. The output hex files and debug files are more compactable with all emulators.

B. Proteus

Proteus software tool has powerful features which are used by electronic engineers to design schematic capture, simulation and PCB layout for electronic design automation .it was developed by British Lab Center Electronics Company. It is available in many configurations based on the requirements of microcontroller simulation. Microcontroller application can be simulated directly by uploading either debug file or hex file on sechmatic, hence output can be directly seen after simulation with the aid of visual instrument configuration like logical analyzer. Functions of proteus software are ISIS- software used for schematic and simulation of circuits in real time, ARES – used to view the designed PCB board along with components in 3D view, the schematic drawn in ISIS also can be directly viewed in ARES.

Steps to simulate in proteus are as follows:

- Double click ISIS software and select new design option from file menu.
- Save the current design and select the layout size from template.
- Select and place required components from component mode option.
- Click on the pick option from library to search the various components.
- Left click and place component in the design sheet.
- Make connection of one terminal to other terminal using wires. Double click component to remove the wire.
- Double click the component to change the properties of components.
- After completion of full design, click play option to run simulation.

Published By:
Blue Eyes Intelligence Engineering
and Sciences Publication (BEIESP)

- Simulation can be paused or stepped at any time.

C. Simulation Output

- Output for line follower robot wheel movement with temperature sensor and gas sensor detection is shown in Figure 9.
- Here circuit is designed for line follower robot wheel movement using Proteus

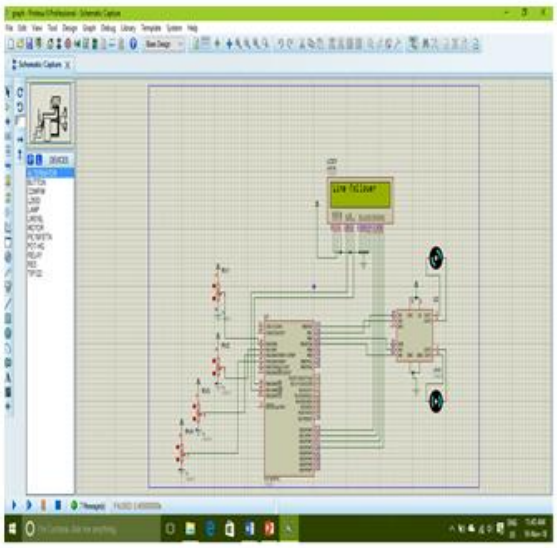


Figure 9 output of wheel movement 1

- Here circuit is designed for line follower robot wheel movement using proteus. When the left wheel touches the black line, signal from right sensor get decreases, right wheel start rotating in opposite direction, so the robot will turn left side as shown in figure 10.

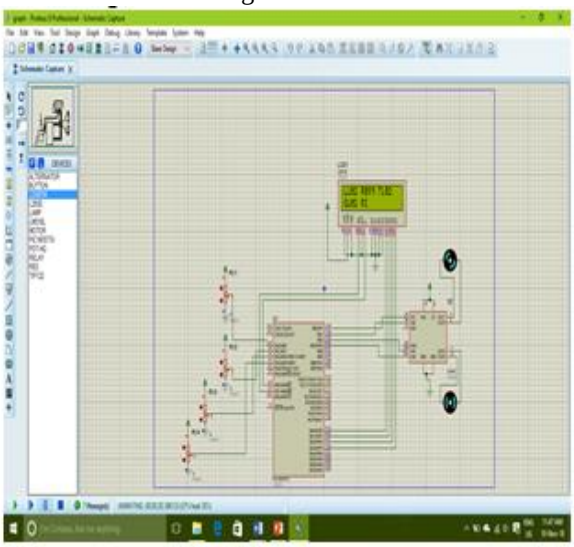


Figure 10 Output of wheel movement 2

- Here circuit is designed for line follower robot wheel movement using Proteus. When the left wheel touches the black line, signal from left sensor get decreases, right wheel start rotating in opposite direction, so the robot will turn left side as shown in figure 11.

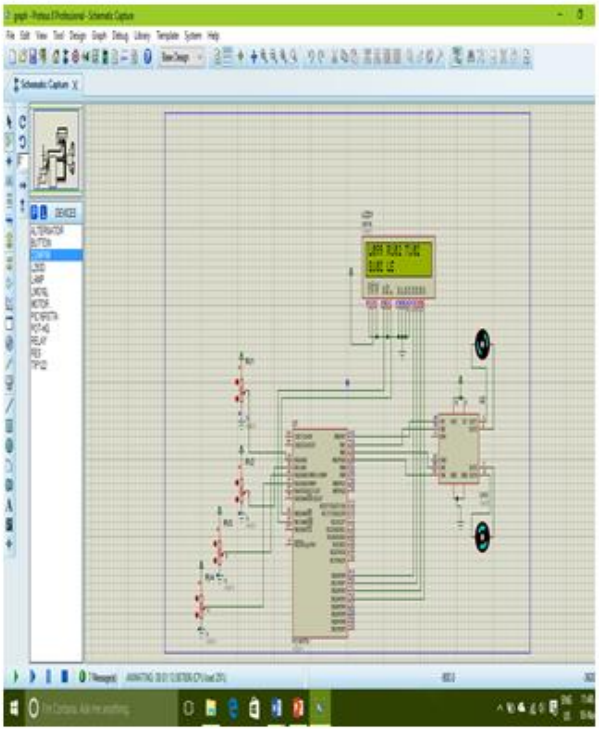


Figure11 Output of wheel movement 3

- Simulation output for light fidelity communication.
- Input signal is given to the ports, it gets modulated and converted into 0's &n 1's and transmitted through led, at the receiver end photo detector is used to receive the signal. Received signal output is shown in figure 12 and figure 13 using Proteus.

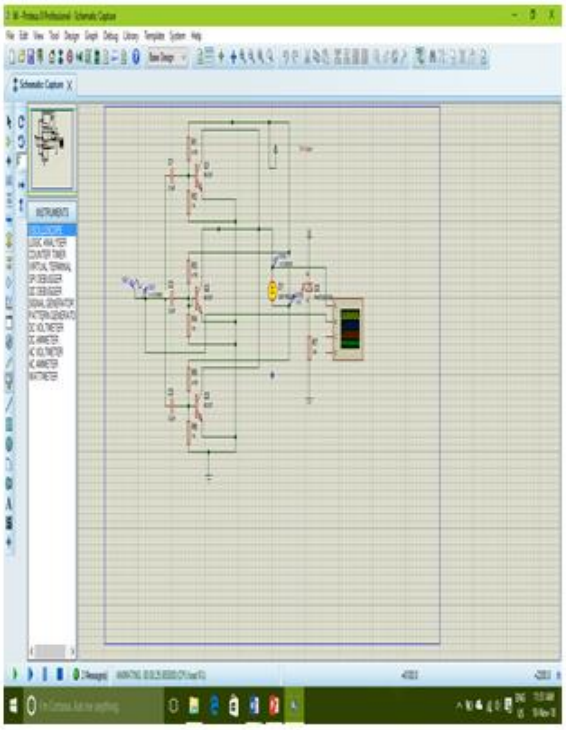


Figure 12 LIFI simulation screen1

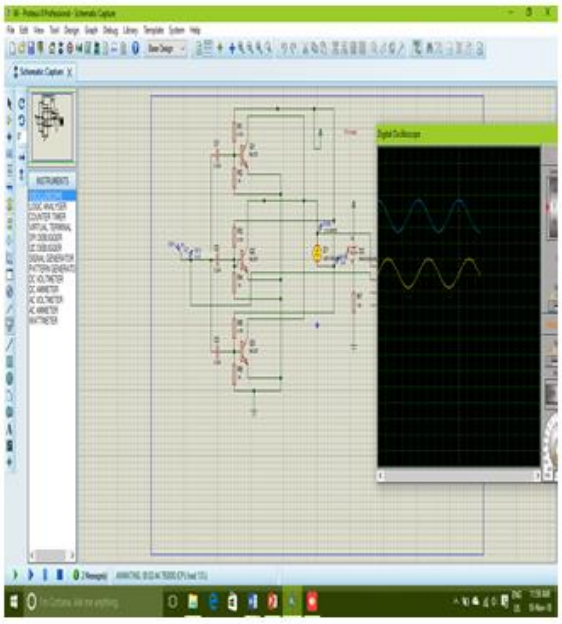


Figure13 LIFI simulation screen 2

VI. CONCLUSION

Thus, the system discussed above consists of a robot capable of moving on its own and gain information about their environment by keep on observing myriad parameters such as hazardous gas leakage, fire, variation in temperature, cracks in pipeline continuously in all the parts of an industrial complex is successfully verified and simulated in Proteus. In addition, with this conveying of output message through LIFI to the central station is successfully verified and simulated using software.

VII. FUTURE ENHANCEMENT

This same system can be extended practically by providing IOT technology. Similar concept can be extended and monitored to other plants viz petrochemical plant, nuclear plant, coal mine plant, hydrocarbon plant.

REFERENCES

1. Sivaji Kulkarni, Amogh Darekar. A Survey on Li-Fi Technology IEEE WiSPNET 2016 conferencec --2016 IEEE.
2. Mr. MaheshS.Kholgade,Ms.PujaS.Dukare, Ms.Vaishanavi R.Deshmukh(2016). LPG Leakage Detection and Control System by Using Microcontroller. International Journal of Research in Advent Technology (IJRAT--09th April 2017).
3. SargunaPriya., Jothi Mani.M, Amudha.P. Monitoring and Control System for Industrial ParametersUsing Can Bus. International Journal of Engineering Trends and Technology (IJETT) – Volume 9 Number 10 - Mar 2014.
4. Dr. S. W Mohod, Rohit S Deshmukh,.Internet of Things for Industrial Monitoring and Control Applications . International Journal of Scientific & Engineering Research, Volume 7, Issue 2, February-2016.
5. Mr. Jadhav sunny P, Mr. Gaikwad Siddesh R, Mr.Hase Kiran D, Mr. Mandlik . Industrial Parameter Monitoring and Controlling Using Gsm and Web Server. (IOSR-JEEE) Volume 9, Issue 2 Ver. VI (Mar – Apr. 2014), PP 71-7.
6. Asad M. Madni. Smart Configurable Wireless Sensors and Actuators for Industrial Monitoring and Control. International journal of advances in engineering & technology --2008 IEEE.
7. Vivekanandan S, 2Abhinav Koleti,. Autonomous Industrial Hazard Monitoring Robot with GSM Integration --2013 Nirma University International Conference on Engineering (NUiCONE).
8. Chien-Lan Liao, Yung-Fu Chang, Chong-Lung Ho, Light-Emitting Diodes for Visible Light Communication -- 978-1-4799-5344-8/15/$31.00 ©2015 IEEE
9. Ravi Prakash, Prachi Agarwal. The New Era of Transmission and Communication Technology-Li-Fi (Light Fidelity) LED & TED Based Approach.International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 3, Issue 2, February 2014.
10. Haibin Wang,Hehui Zou2 Wenkai Wu , The Research of Chemical Plant Monitoring Base on the Internet of Things and 3D Visualization Technology .International Conference on Information and Automation Yinchuan, China, ©2013 IEEE.
11. Sasikala Gurusamy and Aastha Shrivastava , " Design and Implementation of USB Driver and Firmware based on USBTMC protocol" , in Indian Journal of Science and Technology , Vol 9(3), 2016.