IOT BASED BEVERAGE INDUSTRIAL AUTOMATION USING VLC TECHNOLOGY

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Abstract: IoT is starting to become engrained in our everyday lives, as smart devices become part of life, and soon it will be hard to imagine life before it. It is predicted that there will be over 80 billion connected device by the year 2025 which is a very large number and the radio spectrum are limited and it will be difficult to handle such a large number of connected devices and the radio bandwidth will be insufficient. The VLC technology is gaining more and more popularities because of its larger bandwidth also it is energy efficient as well as it does not have any negative impact on the environment and human health unlike radio wave communication. Anywhere in industrial areas data has to be transmitted, VLC is capable of replacing slip rings, sliding contacts and short cables, such as Industrial Ethernet. Due to real time capability of VLC it is also an alternative to common industrial Wireless LAN standards. Due to constant growth of IoT and need of spectrum there is a growing interest in using IoT technology in industries. Automation in industry provides the advantages of improving productivity and quality. So a constant monitoring is required to avoid abnormal condition therefore, we have proposed IoT based beverage industrial automation using VLC technology.

***IndexTerms* - Li-Fi, IoT, Industrial Automation, Beverage, VLC.**

I.INTRODUCTION

The main objective is to design the monitoring system for industrial parameter reducing human efforts using Visible Light Communication. The industrial parameters are not monitored and controlled properly, it occur to an abnormal condition. Monitoring is most important in industry. Monitoring is done by sensor with most accuracy and reliability. Arduino decodes the commands are given through Visible Light Communication with the help of LED and monitor the industrial devices. The interfacing between LI-FI transmitter and LI-FI receiver is done by Arduino.

Transfer of data from one place to another is one of the most important day-to-day activities. The current wireless networks that connect us to the internet are very slow when multiple devices are connected. As the number of devices that access the internet increases, the fixed bandwidth available makes it more and more difficult to enjoy high data transfer rates and connect to a secure network. But, radio waves are just a small part of the spectrum available for data transfer.

VLC is a fast growing technology which provides low-cost, high speed, power efficient and secure data communication in addition to lighting using low cost Light Emitting Diodes (LEDs) which can be modulated at high-speed, offering the possibility of using them for simultaneous illumination and data communications. Research on VLC was originated in Japan with the majority of research carried out by the Visible Light Communications Consortium (VLCC) .

A solution to this problem is by the use of Li-Fi. Light Fidelity commonly known as Li-Fi is a 5G, visible light communication system that uses light from light-emitting diodes (LEDs) as a medium to deliver networked, mobile, high-speed communication in a similar manner as Wi-Fi. Li-Fi could lead to the Internet of Things, which is everything electronic being connected to the internet, with the LED lights on the electronics being used as Li-Fi internet access points. The Li-Fi market is projected to have a compound annual growth rate of 82% from 2013 to 2018 and to be worth over $6 billion per year by 2018. Visible light communications (VLC) works by switching bulbs on and off within nanoseconds, which is too quickly to be noticed by the human eye. Although Li-Fi bulb would have to be kept on to transmit data, the bulbs could be dimmed to the point that they were not visible to humans and yet still functional. The light waves cannot penetrate walls which makes a much shorter range, though more secure from hacking, relative to Wi-Fi.

II. GOALS AND OBJECTIVES

Our project mainly aims at alleviating the problem for the health of the machines and helps them monitor without depending on human. Now a days industrialization as increases as well as increasing population they are releasing unwanted things in environmental especially in industry. This is one of the most upcoming issues in industrial sector. The present idea of our project is monitor the machine health to interface LI-FI with machine and help to communicate with the LI-FI. Here input such as sensors temperature sensor, level sensor, flow sensor and infra-red sensor are given to ARDUINO development board. LI-FI is used to send a message through LED bulb. LI-FI provides uninterrupted output. This application is developed for monitor the machine health in industry. In existing project WIFI concept is used which is high cost and data transfer speed is 150Mbps .WIFI is difficult to transmit message to long range. The applicability of LI-FI concept is implemented in industrial sector itself to monitor the machine health. LI-FI is cheaper than WIFI because free band does not need license and it uses light.

III. OVERVIEW OF SYSTEM

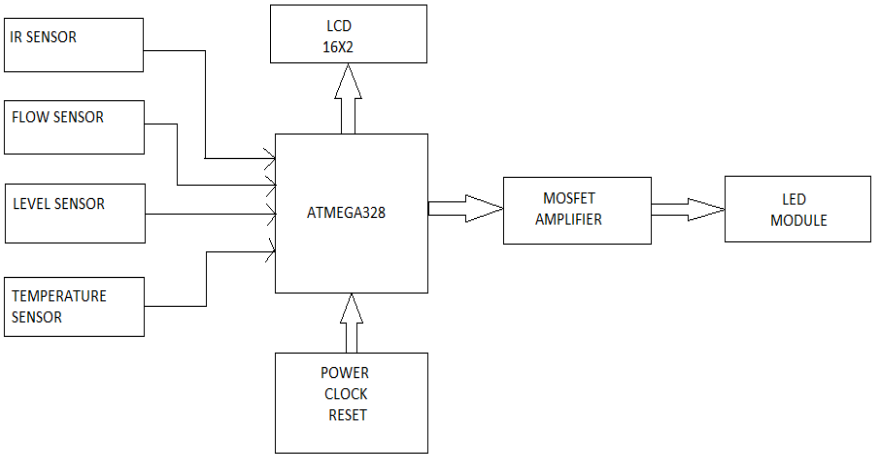

Fig 3.1 Transmitter

The transmitter section consists of sensors, controller, MOSFET amplifier, LCD, photo led for LIFI module and power supply. We are using ATMEGA328 controller which has 32Kb memory, 8 bit controller and has 28 pins, out of 28 pins VCC pin is given to the supply of 5V and ground pin is connected to ground. It works on crystal oscillator which works on 16MHz clock. It contains 16 analog pins and 14 digital pins, so that sensors are connected to analog pins. Here we are using Thermistor for temperature sensing, Float sensor for liquid level sensing, hall effect sensor for sensing the flow of the liquid, IR sensor for counting the product packages over a conveyer belt, these values are given to the controller. Controller performs three functions that are it converts the ac value to dc value of the sensor and also display it over an LCD. This information is then translated through LIFI module.

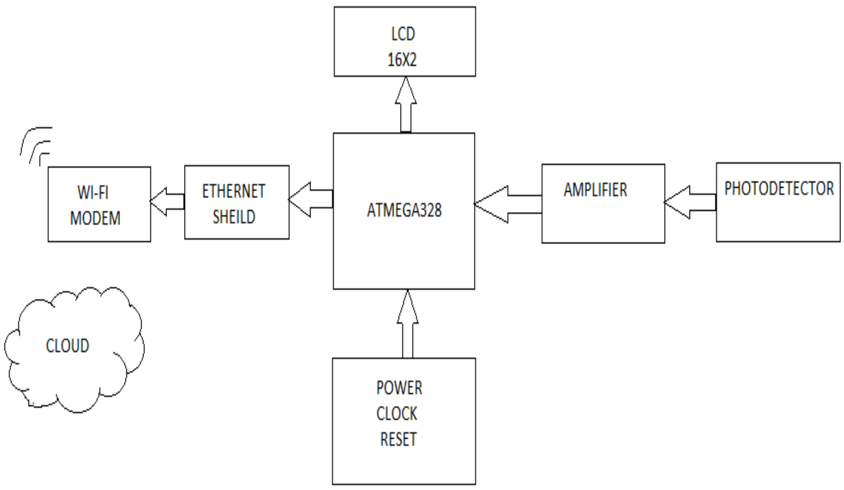

Fig 3.2 Receiver

In receiver section the transmitted light beam is received by the photo detector and given to the Rx pin of the controller but a received signal is very weak so the signal is first amplified by a transistor BD139 NPN transistor and is given to the controller. To check the data received at the controller and LCD is used to display the data. It is again a 16x2 LCD which is used in 4-bit mode. This processed data is also given to the receiver of the Ethernet shield where this Ethernet shield is used to write the data over the cloud using a software tool pubnub.com. Also this data is going to be displayed on dashboard using a software tool freeboard.io.

IV. HARDWARE DESCRIPTION

Hardware consists of various components like Arduino Ethernet shield, thermistor, flow sensor, infra-red sensor, potentiometer, led module (transmitter) and photo-detector (receiver).

4.1 THERMISTOR

Fig 4.1 Thermistor

FEATURES:

- Low cost solid state sensor
- Standard resistance tolerances down to ±2%
- High sensitivity to changes in temperature
- Suitable for temperature measurement
- Wide operating temperature range: -50°C to 150°C
- Suitable for PCB and probe mountings
- Available in a wide range of material systems
- Overall lengths from 18mm to 78mm

4.2 FLUID LEVEL SENSOR

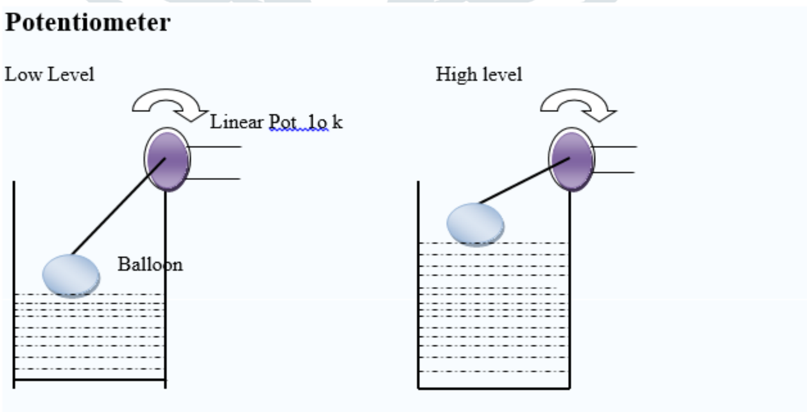

Fig. 4.2 Working of float sensor

A potentiometer (colloquially known as a "pot") is a three-terminal resistor with a sliding contact that forms an adjustable voltage divider. If only two terminals are used (one side and the wiper), it acts as a variable resistor or rheostat. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick.

4.2 IR SENSOR

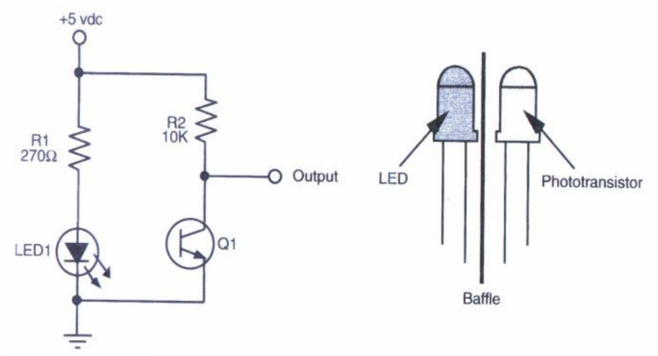

Fig. 4.2 IR Sensor

Principle of operation of the IR LED and Phototransistor:-

A Photodiode is a p-n junction or p-i-n structure. When an infrared photon of sufficient energy strikes the diode, it excites an electron thereby creating a mobile electron and a positively charged electron hole. If the absorption occurs in the junction's depletion region, or one diffusion length away from it, these carriers are swept from the junction by the built-in field of the depletion region, producing a photocurrent. Photodiodes can be used under either zero bias (*photovoltaic mode*) or reverse bias (*photoconductive mode*). Reverse bias induces only little current (known as saturation or back current) along its direction. But a more important effect of reverse bias is widening of the depletion layer (therefore expanding the reaction volume) and strengthening the photocurrent when infrared falls on it. There is a limit on the distance between IR LED and infrared sensor for the pair to operate in the desired manner. In our case distance is about 5mm.

4.3 FLOW SENSOR

Measure Air/water flow for your solar, computer cooling, or gardening project using this handy basic flow sensor. This sensor sit in line with your water line, and uses a pinwheel sensor to measure how much Air has moved through it. The pinwheel has a little magnet attached, and there's a Hall Effect magnetic sensor on the other side of the plastic tube that can measure how many spins the pinwheel has made through the plastic wall. This method allows the sensor to stay safe and dry. Water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow. The hall-effect sensor outputs the corresponding pulse Signal. The sensor comes with three wires: **red** (5-24VDC power), **black** (ground) and **yellow** (Hall Effect pulse output).By counting the pulses from the output of the sensor, you can easily track fluid movement: each pulse is approximately 2.25 milliliters. Note this isn't a precision sensor, and the pulse rate does vary a bit depending on the flow rate, fluid pressure and sensor orientation. It will need careful calibration if better than 10% precision is required.

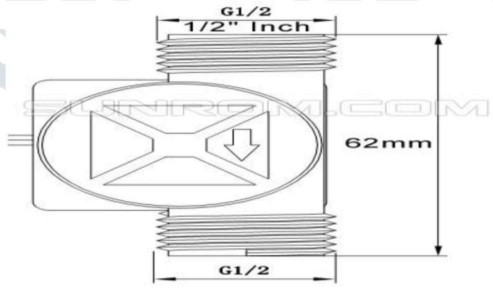

Fig. 4.3 Construction of air flow sensor

4.4 ETHERNET SHEILD

Communication:

The Arduino Ethernet has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports TWI and SPI communication. The Arduino software includes a Wire library to simplify use of the TWI bus; see the documentation for details. For SPI communication, use the SPI library. The board also can connect to a wired network via Ethernet. When connecting to a network, We will need to provide an IP address and a MAC address. The Ethernet Library is fully supported. The onboard microSD card reader is accessible through the SD Library.

Programming:

It is possible to program the Arduino Ethernet board in two ways: through the 6 pin serial programming header, or with an external ISP programmer. The 6-pin serial programming header is compatible with FTDI USB cables and the Sparkfun and Adafruit FTDI-style basic USB-to-serial breakout boards including the Arduino USBSerial connector. It features support for automatic reset, allowing sketches to be uploaded without pressing the reset button on the board. When plugged into a FTDI-style USB adapter, the Arduino Ethernet is powered off the adapter. We can also program the Ethernet board with an external programmer like an AVRISP mkII or USBTinyISP. To set up your environment for burning a sketch with a programmer, follow these instructions. This will delete the serial boot loader, however. All the Ethernet example sketches work as they do with the Ethernet shield. Make sure to change the network settings for your network.

Physical Characteristics:

The maximum length and width of the Ethernet PCB are 2.7 and 2.1 inches respectively, with the RJ45 connector and power jack extending beyond the former dimension. Four screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.

V. EXPERIMENT & RESULTS

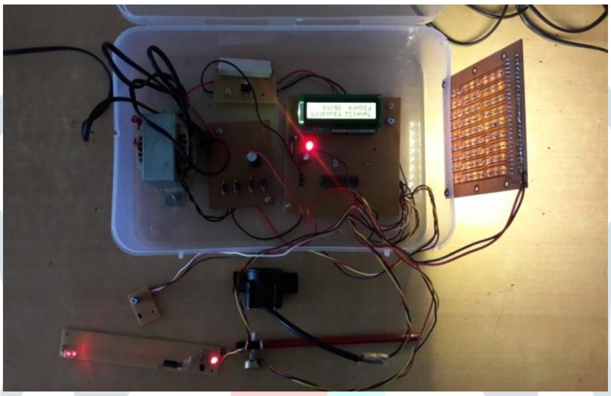

Fig. 5.1 Li-Fi Transmitter

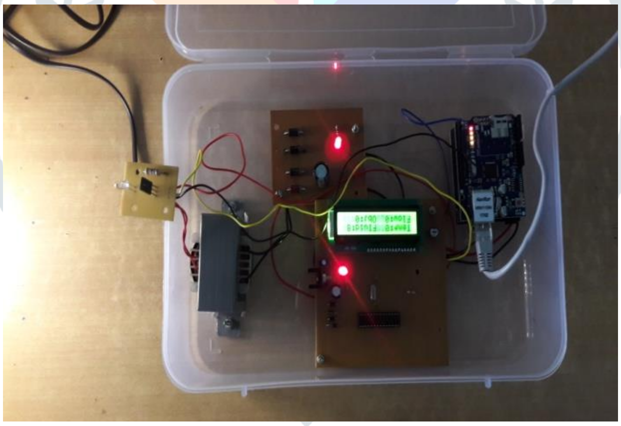

Fig. 5.2 Li-Fi Receiver

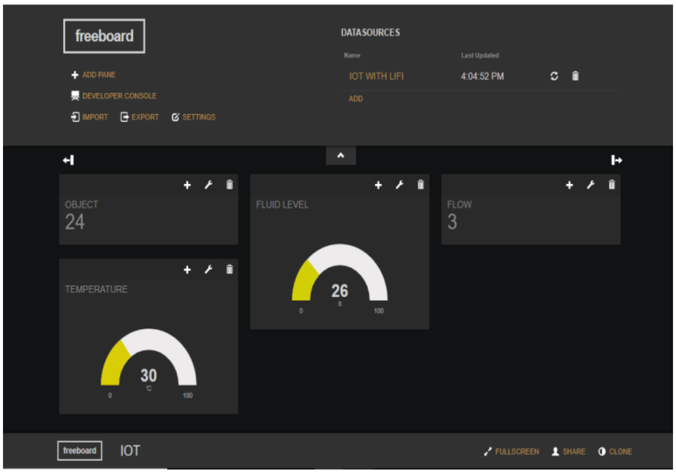

Fig. 5.3 Monitoring Dashboard

VI. CONCLUSION

We have designed the industrial system for monitoring the industrial parameters reducing human efforts using visible light communication and Internet of Things. The combination of both VLC and IoT is used to deliver uninterrupted output related to maintenance officer located anywhere at any time.

REFERENCES

[1] Qian. H , Xiaohang. L , Mark .S ,"Integrating Li-Fi Wireless Communication and Energy harvesting wireless sensor for next generation building management", *International high performance building conference at Prude*,2014.

[2] Li Da Zu," Internet of Things in Industries*",IEEE Transactions on Industrial Informatics,Vol.10*,November 2014.

[3] Ashwini.D,Prajakta.P,Sangita.S,"Industrial Automation Using Internet of Things (IOT)",*International Journal of advanced research in computer engineering and technology(IJARCET),Vol.5*,February 2016.

[4] Jovan.I,Borisalv.O,"Analysis of Visible Light communication system for implementation in sensor network",*Infoteh-Jahorina Vol.15*,March 2016.

[5] Ojaswini.D,P. Gawande,"Design and implementation of industrial automation system using internet of things(IOT)",*International research journal of engineering and technology(IRJET)Vol.3*,May 2016.

[6] K.Chintalapudi,A.Iyer,V. Padmanabham ," Indoor Localization without pain" , *Proc.16th Annual International Conference .Mobile Computer Network* ,June 2016.

[7] A.Deepika,S.Shalini,M. Sheela ,"Applicability of LIFI technology for industrial automation system", *International research journal of engineering and technology(IRJET)Vol.5*,February 2018.