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Prototype Design And Implementation Of Li-Fi Technology For Industrial Robot System

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Abstract: ***Light-Fidelity (Li-Fi) is a technology which is very similar to the fiber optics communication where the data is transmitted through a Laser that varies at a higher intensity that which cannot be recognized by human eye. This technology uses Laser for transmission and optocoupler for reception. Laser can toggle on and off very quickly where binary "1" is sent when Laser is ON and "0" is when Laser is OFF. Data can be encoded by varying the flicker rate of the Laser. Human eye cannot recognize the rate at which Laser changes the state from ON to OFF therefore the output appears constant. Light frequency can be altered by encoding different data channels by using red, green and blue Laser's which gives maximum speed of 10 Gbps. Due to use of light, Li-Fi can be employed successfully undersea where Wi-Fi cannot reach. It can also be used in applications which are likely to be interfered by the radio waves. Aircrafts, hospitals and military operations are the main applications where Li-Fi can be helpful.***

Here we are using Laser's for Transmission & Photodiodes for receiving the signals. The received signals are then given to Microcontroller, so that further movement of robot is obtained.

Keywords: Li-Fi, GPS, GSM

I. INTRODUCTIONS

The Wireless technology that made our lives so much more fun and way easy. Li-Fi is transmission of data through illumination by taking the fiber out of fiber optics by sending data through a Laser that varies in intensity faster than the human eye can follow. Li-Fi is the term some have used to label the fast and cheap wireless- communication system, which is the optical version of Wi-Fi. They can be switched on and off very quickly, which gives nice opportunities for transmitted data. The project "Prototype design and implementation of Li-Fi technology for industrial robot system" is based on Li-Fi system. By using Li-Fi it is possible to encode data in the light by varying the rate at which the Laser on and off to give different strings of 1s and 0s. The Laser intensity is modulated so rapidly that human eyes cannot notice, so the output appears constant .The Lasers act as both the emitter and photo diode to detect the light. Li-Fi has a transmitting speed in terms of Gigabytes per second. The overall system having circuit of Dimmer, Lasers, microcontroller, GPS, GSM, relay driver, motor driver, and line controller. In hazardous area by using this circuit we control robot and other appliances to perform the desire task.

II. RELATIVE STUDY

Using a standard white-light LED, researchers at the Heinrich Hertz Institute in Berlin, Germany, have reached data rates of over 500 megabytes per second Li-Fi Consortium was formed in October2011 by a group of companies and industry groups to promote high-speed optical wireless systems and overcome the limited amount of radio based wireless spectrum. According to the Li-Fi Consortium, it is possible to achieve more than 10 Gbps of speed, theoretically which would allow a high-definition film to be downloaded in just 30 seconds.

Researchers at the University of Strathclyde in Scotland have begun the task of bringing high-speed, ubiquitous, Li-Fi technology to market WANG Jia-Yuan, ZOU Nian-Yu,

WANG Dong, IRIEKentaro, IHA Zensei, NAMIHIRA Yoshinori. The Journal of China Universities of Posts and Telecommunications. In this paper, the illumination of the receiving surface for different distances between the LED and photodiode receiver was tested. It was found that with the increase in communication distance, the sillumination sharply reduced

In July 2011, Dr. Herald Hass, Professor, mobile communication, University of Edinburgh, demonstrated Light fidelity for the first time, a method of Visible light communication (VLC) technology. Li-Fi technology change the scenario of accessing the internet, stream video, receive emails and much more. This is come in familiar forms such as infrared, ultraviolet and visible light.

Research into this VLC has been conducted in 2003, mainly in UK, US, Germany, Korea and Japan. Experiments have shown that VLC is faster, safer and cheaper than other forms of wireless internet and also eliminates the need of costly mobile phone radio masts.

In 2007, Hass's assistant, Mostafa Afgani, first sent data using light signals in his small lab with equipment including table lamp and its box of electronics. Hass's invention centers on modulation o the information embedded from the LED's is transmitted by means of many subtle changes made to the intensity of the light at the ultra high rate of100 millions cycles per second (100MHZ).The photo detector in the Hass box converts this tiny variations into a digital signal from which the transmitted information is extracted.

The planet corporation in 1959 introduced a pick and place robot. In 1961, the first industrial robot was commercialized by Unimation Inc. Microprocessor technology was brought by INTEL in 1961. The real robot development process continued between 1968 and 1982 when various models of robots were developed by Design Analysis of a Remote Controlled "Pick and Place" Robotic Vehicle 58 leading robot scientists in different universities, national laboratories and different industrial houses in the USA, Japan, France, UK, and other European countries.

The research on robotics technology has done for implementing this system. The study goes on mechanical working principle of DC motors referred from K. S. Fu & R.C. Gonzalez & C.S.G. Lee, Robotics: Control, Sensing, Vision, and Intelligence (CAD/CAM, robotics, and computer vision). The study of working with DC motors includes the selection of a motor based on our requirement about the speed of the robot movement and weight to be carried and also power consumption. In our robotic system, the motors used are having high torque and low speed because of it needs to carry some more weight of pick and place arms with it

III. BASIC DESIGN OF THE SYSTEM

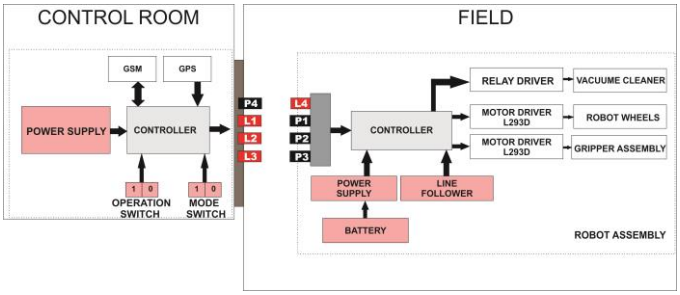

Figure 1: Block diagram of the overall system

IV. WORKING

At the control room, we are using GSM, GPS, and MODE & OPERATION SELECTION SWITCHES & LASER LEDS as light transmitter also a single photodiode as receiver. Mode selection is used to select robot to work in either automatic or manual mode (1- automatic mode & 0-Manual Mode). In automatic mode we can drive our robot through GSM to perform specific operations i.e. pick place or cleaning. Also in automatic mode GPS will receive the location & transmit it to users mobile. That means in automatic mode we can operate our robot from long distance also.

Now if mode switch is in manual mode i.e. 0, the robot will be manually operated to perform specified task. To define task we used operation switch. If operation switch is high then laser L2 will glow & respective photodiode P2 will receive signal & it will perform pick place operation. Also in same way if operation Switch is 0 then L3 will glow & P3 will detect the signal & robot will perform cleaning operation. That means manual mode is useful during certain area having restriction.

To drive the robot using DC Motors L293d Motor Driver is used. Also To turn on Vacuume cleaner Relay driver circuit is used.

When Robot is moving we are going to use Line Follower to move it through specific path. So using line follower we can stop our robot at fixed position.

DIMMER CIRCUIT

The internal variable resistor in the dimmer switch simply reduces the amount of voltage available for the bulb which in turn reduces its brightness. Note that LED bulbs are far more sensitive to voltage than conventional incandescent and halogen bulbs, and so small changes made to the dimmer switch setting have a much larger effect on bulb brightness. The new style of dimmer switch which turns the supply on and off cannot be used with 240V AC LED bulbs as it will seriously reduce their operational lifetime.

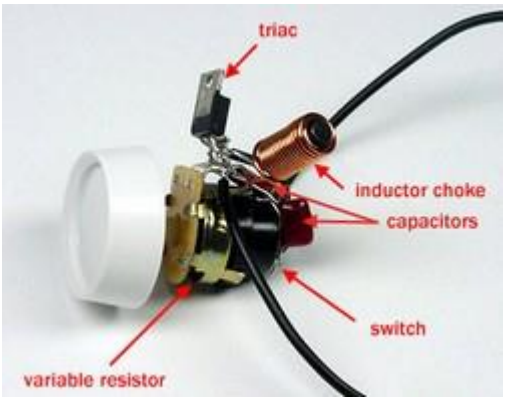

Figure 2

RELAY DRIVER

One of the serious problems in relay operated circuits is the relay clicking or chattering during the on/off of the relay driver transistor. This problem is severe if the input circuit is a light/temperature sensor. During the transition of light/temperature levels, the relay clicks which may cause sparking of contacts. By using a simple tip, this problem can be avoided. Below is the circuit of a relay driver using the NPN transistor BC 548. The relay is connected between the positive rail and the collector of the transistor. When the input signal passes through the I K resistor to the base of the transistor, it conducts and pulls the relay.

By adding a 470 uF electrolytic capacitor at the base of the relay driver transistor, a short lag can be induced so that the transistor switches on only if the input signal is persisting. Again,even if the input signal ceases, the transistor remains conducting till the capacitor discharges completely. This avoids relay clicking and the offers clean switching of the relay.

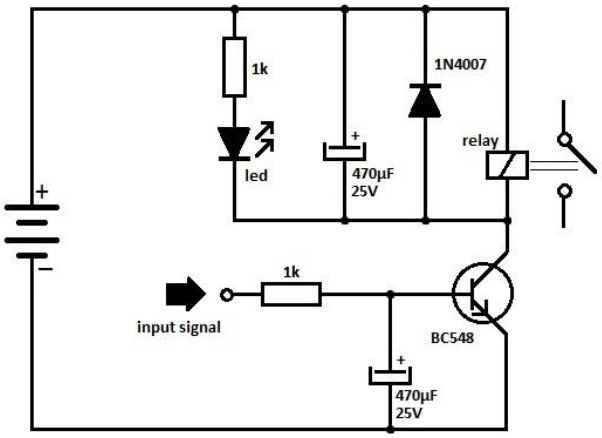

Figure 3

MOTOR DRIVE

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction.

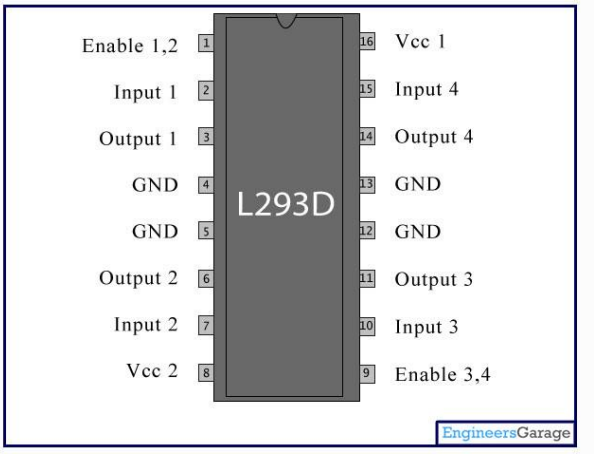

Figure 4

ROBOT GRIPPER

A robotic gripper is developed for universal use of gripping small objects. This robotic gripper is a two-jointed three fingered grasper. Its three fingers have synchronous mobility as driven by the sole DC motor. The upper joint of each finger is driven by the lower joint by purely mechanism; no extra actuator is required. This gripper is designed as driven by only one actuator at the palm. It is non-back drivable but programmable.

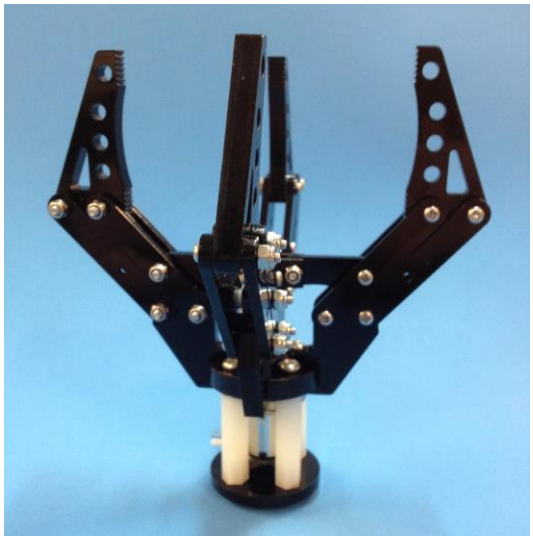

Figure 5

POWER SUPPLY

There are variety ways of building 3.3V power supply, such as using voltage divider, voltage regulator and DC-DC convertor. This application note will discuss how to build a 3.3V power supply circuit using different voltage regulators. A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. Depending on the design, it may be used to regulate one or more AC or DC voltages.

V. CONCLUSION

The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. The unique physical properties of light promise to deliver very densely-packed high-speed network connections resulting in orders of magnitude improved user data rates. Based on these very promising results, it seems that Li-Fi is rapidly emerging as a powerful wireless networking solution to the looming RF spectrum crisis, and an enabling technology for the future Internet-of-Everything. This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless isn‘t allowed such as aircraft or hospitals.

REFERENCES

[1] Of com, ―Study on the future UK spectrum demand for terrestrial mobile broadband applications, ‖ report, real wireless (June 2013).
[2] [2] Cisco Visual Networking Index, ―Global Mobile Data Traffic Forecast Update, 2012-2017, ‖ White (Feb2013).
[3] [3] Tsonev, D., Sinanovi´c, S., and Haas, H., ―Novel Unipolar Orthogonal Frequency Division Multiplexing (U-OFDM) for Optical Wireless,‖ in [Proc. of the Vehicular Technology Conference (VTC Spring)], IEEE, IEEE, Yokohama, Japan (May 6–9 2012)
[4] [4] Khalid, A. M., Cossu, G., Corsini, R., Choudhury, P., and Ciaramella, E., ―1-Gb/s Transmission Over a Phosphorescent White LED by Using Rate-Adaptive Discrete Multitone Modulation,‖ IEEE Photonics Journal 4, 1465–1473 (Oct. 2012).
[5] [5] Cossu, G., Khalid, A. M., Choudhury, P., Corsini, R., and Ciaramella, E., ―3.4 Gbit/s Visible Optical Wireless Transmission Based on RGB LED, ‖ Optics Express 20, B501–B506 (2012).
[6] [6] Azhar, A., Tran, T., and O‘Brien, D., ―A Gigabit/s Indoor Wireless Transmission Using MIMO-OFDM Visible-Light Communications, ‖ IEEE Photonics Technology Letters 25, 171–174 (Jan.15 2013).
[7] [7] Tsonev, D., Chun, H., Rajbhandari, S., McKendry, J. J. D., Videv, S., Gu, E., Haji, M., Watson, S., Kelly, A., Faulkner, G., Dawson, M. D., Haas, H., and OBrien, D., ―A 3-Gb/s Single-LED OFDM-based Wireless VLC Link Using a Gallium Nitride LED,‖ Photonics Technology Letter 99(99), to appear (2014).
[8] [8] Dimitrov, S. and Haas, H., ―Information rate of ofdm-based optical wireless communication systems with nonlinear distortion, ‖ Journal of Lightwave Technology 31(6), 918–929 (2013).
[9] [9] Tsonev, D., Sinanovic, S., and Haas, H., ―Complete modeling of nonlinear distortion in ofdm-based optical wireless communication, ‖ Journal of Lightwave Technology 31(18), 3064–3076 (2013)
[10] [10] Elgala, H., Mesleh, R., and Haas, H., ―Indoor Optical Wireless Communication: Potential and State-of-the- Art, ‖ IEEE Commun. Mag. 49, 56–62 (Sept. 2011). ISSN: 0163-6804.
[11] http://teleinfobd.blogspot.in/2012/01/what-is-lifi.htm