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LIFI Based Automation of Toll Gate Using Micro Controller

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Abstract: **Li-Fi is transmission of data through illumination by taking the fiber out of fiber optics by sending data through a LED light bulb 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. The term was first used in this context by Harald Haas in his TED Global talk on Visible Light Communication. At the heart of this technology is a new generation of high brightness light-emitting diodes, says Harald Haas from the University of Edinburgh, UK, Very simply, if the LED is on, you transmit a digital 1, if it's off you transmit a 0,Haas says, They can be switched on and off very quickly, which gives nice opportunities for transmitted data The Automation of Toll Gate Systems working model can be explained, by taking Toll Gate Model, as follows: The Toll Gate Office is having a Personal Computer, which is connected with the receiver and the software to run Automation of Toll Gate System. To implement this System every vehicle must be fitted with remote transmitter, hidden behind the Number Plate of the Vehicle. The job of this transmitter is to transmit continuously the Number of Vehicle on which it is mounted, in coded form. When any vehicle enters the zone of Toll Office, the sensors fitted either side of the road, senses and sends the signal to the Toll Office Control Unit. This Micro-controller based Control Unit activates the Number Plate Sensor, which in result receives the Number of the entering vehicle [capturing the signal sent by vehicles remote transmitter] and sends it to computer. The computer scans its centralized database and displays the details of that vehicle with the current time and date. The details are: Registration Number and Model Number with vehicles body color, Owners Name and Address, Date of Registration, Current status Clear or is in black list of any department etc. If the vehicle records show its Current Status is Clear, then the gate will be opened automatically. Otherwise, the gate will not open and the vehicle owner will be called for further enquiry. The Regional Transport Office or RTOs can use this System to watch the unregistered vehicles or trace the other state vehicles. The Cargo Companies can intimate their on-road vehicles about the latest development in the delivery plan and give the next delivery address. The Public Transports can keep the details of each vehicles check-in and check-out times with number of rotations it makes in a day. The Police Department can easily stop the wanted vehicle, by posting the Vehicles Register Number on its Data Base. As the Toll Gate MC checks this Data Base and founds the Current Status as wanted, it does not open the gate and immediately alerts the concerned authority.**

I. INTRODUCTION

LiFi is transmission of data through illumination by taking the fiber out of fiber optics by sending data through a LED light bulb 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. The term was first used in this context by Harald Haas in his TED Global talk on Visible

Light Communication. At the heart of this technology is a new generation of high brightness light-emitting diodes, says Harald Haas from the University of Edinburgh, UK,Very simply, if the LED is on, you transmit a digital 1, if its off you transmit a 0,Haas says, They can be switched on and off very quickly, which gives nice opportunities for transmitted data.It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s.The LED intensity is modulated so rapidly that human eye cannot notice, so the output appears constant. More sophisticated techniques could dramatically increase VLC data rate. Terms at the University of Oxford and the University of Edingburgh are focusing on parallel data transmission using array of LEDs, where each LED transmits a different data stream. Other group are using mixtures of red, green and blue LEDs to alter the light frequency encoding a different data channel.Li-Fi, as it has been dubbed, has already achieved blisteringly high speed in the lab. Researchers at the Heinrich Hertz Institute in Berlin,Germany,have reached data rates of over 500 megabytes per second using a standard white-light LED. The technology was demonstrated at the 2012 Consumer Electronics Show in Las Vegas using a pair of Casio smart phones to exchange data using light of varying intensity given off from their screens, detectable at a distance of up to ten metres. The Toll Gate Office is having a Personal Computer, which is connected with the receiver and the software to run Automation of Toll Gate System. To imple-ment this System every vehicle must be fitted with remote transmitter, hidden behind the Number Plate of the Vehicle. The job of this transmitter is to transmit continuously the Number of Vehicle on which it is mounted, in coded form. When any vehicle enters the zone of Toll Office, the sensors fitted either side of

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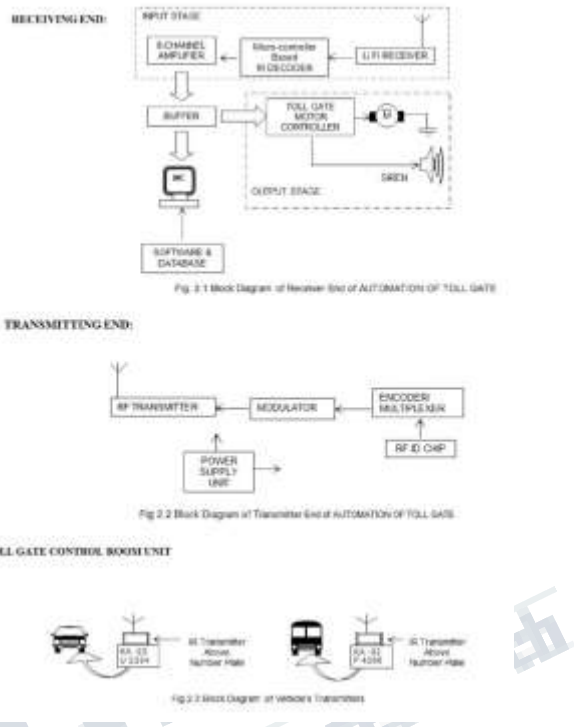
A. Main Features Of The Project

1 Effective in implementation. 2 Low power consumption, and compact size. 3 Remote signalling lights can be monitored using only one Receiver. 4 High reliability, due to the usage of power semiconductor devices. 5 Greater control range due the usage of Frequency Modulation and Li Fi Wavelengths with a MC. 6 Vehicles monitored from a remote area (no need of 'line-of-sight arrangement).

II. BLOCK DIAGRAM



III. BLOCK DIAGRAM EXPLANATION

A. Power supply unit

This section needs two voltages viz., +12 V and +5 V, as working voltages. Hence specially designed power supply is constructed to get regulated power supplies

B. Micro controller

The Atmel AT89 series is an Intel 8051-compatible family of 8 bit microcontrollers (Cs) manufactured by the Atmel Corporation. Based on the Intel 8051 core, the AT89 series remains very popular as general purpose microcontrollers, due to their industry standard instruction set, and low unit cost. This allows a great amount of legacy code to be reused without modification in new applications. While considerably less powerful than the newer AT90 series of AVR RISC microcontrollers, new product development has continued with the AT89 series for the aforementioned advantages

C. RF transmitter

RF transmitters are electronic devices that create continu-ously varying electric current, encode sine waves, and broad-cast radio waves. RF transmitters use oscillators to create sine waves, the simplest and smoothest form of

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continuously varying waves, which contain information such as audio and video. Modulators encode these sign wives and antennas broadcast them as radio signals. There are several ways to encode or modulate this information, including amplitude modulation (AM) and frequency modulation (FM). Radio techniques limit localized interference and noise.

D. RF receiver

RF receivers are electronic devices that separate radio signals from one another and convert specific signals into audio, video, or data formats. RF receivers use an antenna to receive transmitted radio signals and a tuner to separate a specific signal from all of the other signals that the antenna receives. Detectors or demodulators then extract information that was encoded before transmission. There are several ways to decode or modulate this information, including amplitude modulation (AM) and frequency modulation (FM). Radio techniques limit localized interference and noise

E. IR Transmitter and Receiver

Infrared (IR) transmitters and receivers are present in many different devices, though they are most commonly found in consumer electronics. The way this technology works is that one component flashes an infrared light in a particular pattern, which another component can pick up and translate into an instruction. These transmitters and receivers are found in remote controls and all different types of devices, such as televisions and DVD players. Peripheral devices that include this technology can also allow a computer to control various other consumer electronics. Since infrared remotes are limited to line of sight operation,

F. Pre amplifier

A preamplifier (preamp) is an electronic amplifier that prepares a small electrical signal for further amplification or processing. A preamplifier is often placed close to the sensor to reduce the effects of noise and interference. It is used to boost the signal strength to drive the cable to the main instrument without significantly degrading the signal-to-noise ratio (SNR)

G. Power amplifier

An audio power amplifier is an electronic amplifier that amplifies low-power audio signals (signals composed primar-ily of frequencies between 20 - 20 000 Hz, the human range of hearing) to a level suitable for driving loudspeakers. It is the final electronic stage in a typical audio playback chain

H. Li-Fi transmitter and receiver

Li-Fi is implemented using white LED light bulbs at downlink transmitter. These devices are used for illumination only by applying a constant current. By fast and subtle variations of the current, optical output can be made to vary at extremely high speeds. This variation is used to carry high speed data

I. Buffers

Buffers do not affect the logical state of a digital signal (i.e. a logic 1 input results in a logic 1 output whereas logic 0 input results in a logic 0 output). Buffers are normally used to provide extra current drive at the output but can also be used to regularize the logic present at an interface

J. Drivers

This section is used to drive the relay where the output is complement of input which is applied to the drive but current will be amplified

K. Relays

It is a electromagnetic device which is used to drive the load connected across the relay and the o/p of relay can be connected to controller or load for further processing.

IV. METHODOLOGY

So to overcome such problems, Global Positioning System [GPS] was introduced. In this system, vehicles are tracked using Low Earth Orbit Satellites continuously. Not only this, the vehicle owner can see the road map of the location on which he is heading towards or weather report / forecast of his locality or whether the heading road is clear or traffic-jammed and if road is blocked which is the alternative way to reach the destination etc. The Project is not about the GPS, but about the Automation of Toll Gate system. This system is intended to help the RTO, Police Department, Public Transport and Cargo Companies to track the vehicles.

A. Power Supply Unit

The circuit needs two different voltages, +5V and +12V, to work. These dual voltages are supplied by this specially designed power supply. The power supply, unsung hero of every electronic circuit, plays very important role in smooth running of the connected circuit. The main object of this power supply is, as the name itself implies, to deliver the

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required amount of stabilized and pure power to the circuit. Every typical power supply contains the following sections:

B. 1. Step-down Transformer

The conventional supply, which is generally available to the user, is 230V AC. It is necessary to step down the mains supply to the desired level. This is achieved by using suitably rated step-down transformer. While designing the power supply, it is necessary to go for little higher rating transformer than the required one. The reason for this is, for proper working of the regulator IC (say KIA 7805) it needs at least 2.5V more than the expected output voltage

C. 2. Rectifier stage

Then the step-downed Alternating Current is converted into Direct Current. This rectification is achieved by using passive components such as diodes. If the power supply is designed for low voltage/current drawing loads/circuits (say +5V), it is sufficient to employ full-wave rectifier with centre-tap transformer as a power source. While choosing the diodes the PIV rating is taken into consideration

D. 3. Filter stage

But this rectified output contains some percentage of superimposed a.c. ripples. So to filter these a.c. components filter stage is built around the rectifier stage. The cheap, reliable, simple and effective filtering for low current drawing loads (say upto 50 mA) is done by using shunt capacitors. This electrolytic capacitor has polarities, take care while connecting the circuit.

E. BUFFER and DRIVER

When the user programs the schedule for the automation using GUI [Graphical User Interface] software, it actually sends 5-bit control signals to the circuit. The present cir-cuit provides interfacing with the Microcontroller and the controlling circuitry. This circuit takes the 5-bit control signal, isolates the CONTROLLER from this circuitry, boosts control signals for required level and finally fed to the driver section to actuate relay. These five relays in turn sends RC5 coded commands with respect to their relay position.

F. Power Supply

This section provides the clean and harmonic free power to IC to function properly. The output of the full wave rectifier section, which is built using two rectifier diodes, is given to filter capacitor. The electrolytic capacitor C1 filters the pulsating dc into pure dc and given to Vin pin-1 of regulator IC 7805.This three terminal IC regulates the rectified pulsating dc to constant +5 volts. C2 and C3 provides ground path to harmonic signals present in the inputted voltage. The Vout pin-3 gives constant, regulated and spikes free +5 volts to the mother board. The allocation of the pins of the 89C51 follows a U-shape distribution. The top left hand corner is Pin 1 and down to bottom left hand corner is Pin 20. And the bottom right hand corner is Pin 21 and up to the top right hand corner is Pin 40. The Supply Voltage pin Vcc is 40 and ground pin Vss is 20.

V. APPLICATIONS AND FUTURE ENHANCEMENT

A. Applications

1. The project is used to secure and avoid the road accidents. 2. It can be used as part for automation of Toll Gates or Public Transportation. 3. This system is used to trace the culprit vehicles by police persons. 4. This project can also be used by Cargo Companies to intimate their on-road vehicles about the next delivery spot or assignment. 5. This system can be used to time keeping purpose in public transportation, such as departure and arrival timings, number of rotations each vehicle turned etc.

B. 8.2 Future Enhancement

The possibilities are numerous and can be explored further. If this technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wire-less data and we will proceed toward the cleaner, greener, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, since with this enhanced technology, a growing number of people and their many devices access wireless internet, on one way, transmit data at higher rates and on the other it is very cheap as compared with Wi-Fi

VI. ADVANTAGES AND DISADVANTAGES

A. ADVANTAGES

1. Harmless for the human body. 2. Data transmission by sockets of existing light fixtures. 3. Alleviation of problems associated with the radio frequency (RF) communication system. 4. Less energy consumption. 5. Increased security. 6. Compact integration of sensors through small dimensions. 7. Huge number of channels available without interfering with other sources. 8. Simple electronics as drive for the LEDs. 9. No influence to other sensitive equipment through radio waves

B. DISADVANTAGES

1. To transmit the data it should be in the line of sight.

VII. CONCLUSION

The possibilities are numerous and can be explored further. If his technology can be put into practical use, we will proceed toward the cleaner, greener, safer and brighter future. 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. This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless isnt allowed such as aircraft or hospitals. One of the shortcomings however is that it only work in direct line of sight. As this project is based on micro-controller(89C51), RF transmitter and receiver, and output. This project involves authentication of the vehicle and remaining all procedures of the tollgate will be done remotely.

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