

# A Smart Toll Collection System using Embedded Linux Environment

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**Abstract:** The main objective of this system is to develop a smart communication by using visible lights. Visible Light Communication (VLC) refers to the communication technology which utilizes the visible light source as signal transmitter which provides high data transmission up to 10Gbps can be achieved. The concept of LI-FI in data communication on fast flickering of light which is focused on photo detector and converts the on-off state into binary digital data. It is known that the traffic is still a drawback in the toll booth system. There is no other substitute to eliminate this drawback. The systems proposed by others are not implemented because of its major drawback and logical errors.

So we propose this concept of traffic eliminating system in toll booth section using Li-Fi technology. An RFID based tolling system is carried out at present. The elimination of the queuing system is not perfectly done as it takes time for RFID receiver to receive and analyses data. Also a human operation is required to monitor the driver's details and open the toll. Next to that they use QR code for toll gate but it also takes time for scanning process add to that it can be misused by placing others. QR code will reduce money for different person.

**Keywords:** Visible Light Communication (VLC), LI-FI, binary digital data.

## 1. Introduction

The concept of Li-Fi in data communication on fast flickering of light which is not detected by human but is focused on photo detector which converts the on-off state into binary digital data. It has gained a huge popularity in two years of its invention. Such technology has brought not only greener but safer and cheaper future of communication.

## 2. Objective

Using LI-FI (Light Fidelity) system we develop a smart communication in toll collection system through visible lights.

## 3. Literature survey

R.Shanmugha sundaram , S.Prasanna Vadanam designed Light Fidelity (Li-Fi) is a form of bi-directional Visible Light Communication (VLC) in which light is modulated at greater speed and can be used to implement Vehicle to Vehicle (V2V) communication. In this system the traffic signal receives an alert regarding an emergency vehicle, the traffic signal would immediately turn green which decreases the waiting time in

traffic dense lanes. Kasturi Shah<sup>1</sup>, Prajakta Joshi<sup>2</sup>, Dishaa Garg<sup>3</sup> proposed the toll gates on highways are congested and use manual toll collection system causing long queues of vehicles. To avoid such problems camera are used for capturing the QR code mounted on front side of the vehicle and sent for decoding process, as the amount will be deducted the toll booth opens automatically.

P. M. d'Orey and M. Ferreira designed the Visible Light Communication VLC system uses modulation schemes, such as on-off keying, so that the digital HIGHs and LOWs are representations of the binary code to be transmitted. Acknowledgement lights incorporated in the receiver are also utilized to make multicasting possible, and to signal the transmission.

R. Colella, L. Catarinucci, P. Coppola, proposed his paper which deals with the synthesis and design of reader antenna for (RFID)-based dedicated short-ranged communication (DSRC) system. Micro strip technology is chosen for its advantage of being light, simple, inexpensive, and easy to manufacture.

M. A. S. Kamal, S. Taguchi, and T. Yoshimura proposed RFID system transmits a particular ID code as soon as it reaches near the toll station. On receiving the code, processor checks the received code and compares it with the stored code, if the code matches the gate opens else they remain closed and prohibits the vehicle. This paper focuses on using (RFID) technology for electronic toll collection system.

## 4. Block diagram

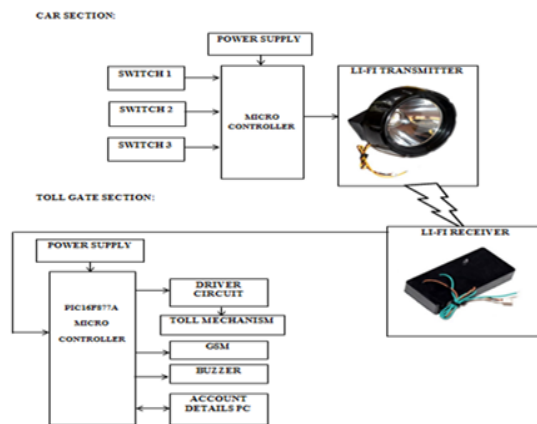


Fig. 1. Block diagram

## 5. Methodology

The system consists of three car based prototype consisting of three Li-Fi data in the controller and data of that car is transmitted using Li-Fi. The transmitted data is received by the Li-Fi receiver placed at the toll section. The toll section, after the receiving the data provides it to the controller. The controller checks whether the person has money for paying the toll. If there is enough money in user's account, then he will be permitted to pass through. If the balance is not enough to pay the toll, then the vehicle is restricted to pass through and the message will be send to the user.

### A. Components

#### 1) Pic16f877a

The term PIC, or Peripheral Interface Controller, is the name given by Microchip Technologies to its single – chip microcontrollers. PIC micros have grown to become the most widely used microcontrollers in the 8- bit microcontroller segment.

#### 2) Lifi module

Light Fidelity (Li-Fi) is a bidirectional, high-speed and fully networked wireless communication technology. Visible light communication and a subset of optical wireless communications could be a complement to communication.

#### 3) Power supply

Step-down transformer is used to convert the 230v ac into 12v ac. Rectifier will convert 12v ac into 12v dc. Regulator is used for 12v dc into 5v dc by IC 7805.

#### 4) Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric.

#### 5) Driver circuit

A driver is an electrical circuit or an electronic component used to control another circuit or component, such as a high-power transistor, liquid crystal display (LCD), and numerous others.

#### 6) Toggle switches

A toggle switch is a class of electrical switches that are manually actuated by mechanical lever, handle, or rocking mechanism.

#### 7) LCD

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580.

#### 8) GSM modem

GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem.

#### 9) DC motors

A DC motor is designed to run on DC electric power in our project we are using brushed DC Motor, which will operate in the ratings of 12v DC 0.6A which will drive the flywheels in order to make the robot move.

### B. Future scope

This system does not need any human operation and wireless data transmission can be made faster un mind of distance.

### C. Li-fi module



Fig. 2. Lifi module

## 6. Conclusion

It has been successfully proven through the prototype theory and concept for LI-FI technology works perfectly.

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