

Toll Collection using Li-Fi

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Abstract: This paper focuses on faster data transmit at toll plaza by using Li-Fi module which will reduce the problems that arise in ETC. Li-Fi has the advantage of being able to be used in sensitive area such as in Aircraft and other transportation without causing interference. The Li-Fi mechanism is implemented in every vehicle (four wheelers) and at toll plaza. At the toll plaza, once the vehicle's Li-Fi transmitter is paired with the Li-Fi receiver, the system at toll plaza automatically identifies the vehicle details. This paper is based on Li-Fi technology; the Li-Fi system uses Li-Fi which collects information of vehicle passing through the toll plaza and automatically debits the toll amount from prepaid account of vehicle owner, which in return reduces the traffic congestion and human errors. The vehicle owner has to register his vehicle with Li-Fi, creating a rechargeable account. When the vehicle will pass through toll gate the amount of toll will automatically be reduced from its account and give deduction message to vehicle owner. This OWC technology uses light from Light-Emitting Diodes (LEDs). The light received by photodiode is converted to binary data and is fed to the microcontroller. The microcontroller is connected to the serial port of the PC. The basic advantages of the system is travelling time is decreased, congestion free network, less emissions in toll area and no infrastructure cost is required. This gives a win condition for both toll authorities and toll customers.

Keywords: Li-Fi (Light Fidelity), LED, Transmitter, Photodiode.

I. INTRODUCTION

The growth in number of vehicles, we need for expansive roads catering to thousands of vehicles moving across India has become inevitable. However, considering the present situation of the current toll system has several drawbacks. Due to the limited number of toll booths and manually collection process, the average waiting time per vehicle is 10-15 minutes. This results in loses worth thousands of crores of Rupees in terms of fuel wastage. This long wait time often results in drivers getting irritated and in verbal spats and physical fights among people and the toll attendants. This paper finds a solution to problems which regarding manually toll payment with the help of Li-Fi module. Automatic toll payment system uses li-fi technology which is constitutes a unique id and a Li-Fi module with user details, which is placed in the mobile. When the car crosses the toll booth it acts as a Li-Fi transmitter, while the toll booth acts as a receiver and receives details and payment. The OWC technology uses light from Light-Emitting Diodes (LEDs) as a medium to deliver networked, mobile, high-speed communication. Li-Fi is a bidirectional, high speed and fully networked wireless communications system similar to Wi-Fi. It uses visible light communication. Li-Fi could lead to the Internet of Things with LED lights on the electronics being used as Li-Fi internet access points.

II. TECHNOLOGY USED

A. Li-Fi :

Li-Fi stands for Light-Fidelity. Li-Fi technology, proposed by the German physicist—Harald Haas, it provides for transmission of data through illumination by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. This paper focuses on How to developing a Li-Fi based system and analyzes its performance with respect to existing technology? Wi-Fi is great for general wireless coverage within buildings, whereas Li-Fi is ideal for high density wireless data coverage in confined area. Li-Fi provides better bandwidth, efficiency, availability and security than Wi-Fi. Li-Fi has already achieved by list erringly high speed in the lab. The low cost of LEDs and lighting units there are many opportunities to exploit this medium.[2]

B. Transmitter:

When the vehicle approaches the toll gate, initially the IR sensors placed on either side of the toll booth for detect the arrival of a vehicle as it interrupts the IR waves passing. This point of time, the gate gets closed and the vehicle's position is in such a way that the Li-Fi transeiver in the vehicle door. The Li- Fi receiver at the toll booth communicate where the former transmits the vehicle details stored in the microcontroller and the latter receives.[3]

C. LED (Light Emitting Diodes)/ Photodiode:

The OWC technology uses light from light-emitting diodes (LEDs) as a medium to deliver networked, mobile, high-speed communication. Li-Fi could lead to the Internet of Things with LED lights on the electronics being used as Li-Fi internet access points. LED and photodiode are the major components of Li-Fi circuit. LED are used to transmit the data at transmitting end. At receiving end a photodiode is connected to PC which senses the transmitted data. Transmitted data feed to the PC. A PIC microcontroller can be used for toggling of LED at transmitting end. At receiving end also one has to use a PIC microcontroller connected to output of photodiode.[2]

III. EXISTING SYSTEM

In the existing system, the toll payment is with manually is linked to a prepaid account from which the applicable toll amount is deducted. A manual lane can process approximately 400 vehicles per hour in comparison to a free flow free way lane, with capacity approaching 2,000 vehicles per hour. To overcome from this problem we can proposed new system toll using Li-Fi.

IV. PROPOSED SYSTEM

In the existing time, all vehicles which get manufactured are initially registered by their manufacturing company with the government authority. The registered vehicles display a vehicle registration plate and carry a vehicle registration certificate. This certificate is different from vehicle licensing and road worthiness certification. These details get stored into the microcontroller embedded within the vehicle which is the actual data which gets transferred through Li-Fi to the toll plaza. At the time of police verification these details may be transferred at a stretch with ease.

When the vehicle approaches the toll gate, initially the IR sensors placed on either side of the toll booth detect. The arrival of a vehicle as it interrupts the IR waves passing. This point of time, the gate closed and the vehicle's position is in such a way that the Li-Fi transceiver in the vehicle door and the Li-Fi receiver at the toll booth communicate where the former transmits the vehicle details stored in the microcontroller and the latter receives.

The Li-Fi receiver at toll booth updates the contents in the server and the database. Hence the vehicle details gets stored and the fare amount (toll) gets deducted from the prepaid account of the user which is also notified to the user via SMS. This payment procedure is done the vehicle is free to move out of the toll plaza. All this happens within few seconds as Li-Fi is very fast in transmission. An additional feature to our idea is the Li-Fi transmitter attached to the vehicle key. Which when matched with the unique id of the Li-Fi transceiver in the vehicle door gets the door opened else doesn't get opened. This is to enhance our idea in terms of security.[4]

ADVANTAGES OF PROPOSED SYSTEM

The proposed system uses the Li-Fi modules, it possesses several advantages mentioned below:

- 1. Capacity :** Li-Fi spectrum is 10,000 times greater.
- 2.Availability:** Light waves are available everywhere.
- 3.Efficiency:** Highly efficient as LED bulbs consume very less energy.
- 4. Security:** Highly secure as light waves cannot penetrate through walls.

EASE OF USE

The paper mainly motives to reduce the manual paper work and to save time, effort, and man power through processing the toll payment automatically. It would be useful in finding out how many times a vehicle is passing through the toll gate in a day as it stores all details in database.

V. CONCLUSION AND FUTURE USE

The use of Li-Fi technology along with Wi-Fi in automatic toll payment will be more efficient. This idea not only reduces the time for the users but also reduces the manual paper work that is being done at the present. Thus the use of Li-Fi will increase the speed of data transfer and also it is accessible in many banned places. And our paper can be extended with Gi-Fi technology which can be a replacement to Wi-Fi. Now Wi-Fi is getting overloaded and it used for short-range high-data rate links, it useful to offload the excess demand to Li-Fi. The idea of Li-Fi technology is currently attracting us and it offers tremendous scope for future research and innovation. As light is everywhere and free to use possibilities increases to a great extent to the use of Li-Fi technology.[5]

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