AUTOMATIC TOLL PAYMENT WITH VOCATUS DETECTION 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 by RFID tags. The Li-Fi mechanism is implemented in every vehicle (four wheelers) and at toll plaza. Alcohol sensor is attached to every vehicle in-order to identify the drunken driver. 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 and alcohol consumption details for fine payment along with toll fare. Incase if person is drunk then the information is sent to the nearby police station using k-NN algorithm and the image captured at the toll plaza is also sent for tracking the vehicle easily. If user with insufficient balance approaches the toll plaza, his/her prepaid bank balance would go to negative to a certain limit and this information is stored in the main server. Next time when the vehicle arrives at the same toll plaza, a notification is sent to the concerned authorities and henceforth the vehicle could be trapped.

IndexTerms — Li-Fi(Light Fidelity), Vocatus detection(alcohol detection), k-NN algorithm.

I. INTRODUCTION

With the growth in the number of vehicles, the need for expansive roads catering to thousands of vehicles moving across India has become inevitable. However, considering the present situation the current toll system has several drawbacks. Due to the limited number of toll booths and slow collection process, the average waiting time per vehicle is 10 minutes. This results in loses worth thousands of cores of Rupees in terms of fuel wastage. This long wait time often results in drivers getting irritated resulting in verbal spats and physical fights among people and the toll attendants. Later Electronic Toll Payment (ETC) by using RFID came into existence. Due to some issues in reading the RFID reader, makes the user to pay in cash. Thus this paper finds a solution to the above problems through automatic toll payment with the help of Li-Fi module and also paves way for detecting drunken driver using alcohol sensor .To enhance security measure every vehicle's key is attached with Li-Fi transmitter, so that the vehicle door opens only when the unique Id gets matched.

TECHNOLOGY AND COMPONENTS USED

A. Li-Fi

Li-Fi stands for Light-Fidelity. Li-Fi technology, proposed by the German physicist—Harald Haas, provides 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 developing a Li-Fi based system and analyzes its performance with respect to existing technology.

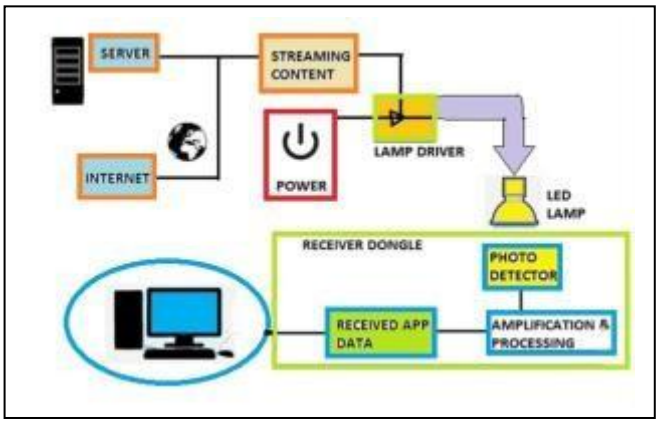

Fig 1.1 Working of Li-Fi

Wi-Fi is great for general wireless coverage within buildings, whereas Li-Fi is ideal for high density wireless data coverage in confined area and for relieving radio interference issues. Li-Fi provides better bandwidth, efficiency, availability and security than Wi-Fi and has already achieved blisteringly high speed in the lab. By leveraging the low cost nature of LEDs and lighting units there are many opportunities to exploit this medium, from public internet access through street lamps to auto-piloted cars that communicate through their headlights. Haas envisions a future where data for laptops, smart phones, and tablets will be transmitted through the light in a room.

B. Alcohol Sensor(MQ-6)

The alcohol sensor (MQ-6) is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration when consumed by the person. It operates at 5V which as the capacity to produce output in both digital and analog form.

C. Infrared Sensor

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. In short Infrared sensors detect the obstacle detected in its radiation which is also capable of measuring the heat being emitted by an object and detecting motion.

D. Microcontroller(PIC16f877A)

It is an 8 bit microcontroller which is used to execute 200 instructions per nanoseconds. The PIC16F877A features 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

E. K-NN Algorithm

This algorithm is generally a non parametric one which is used for classification and regression. It may determine the nearest neighbor with respect to the factor k. Euclidean distance is an important parameter used in deciding the nearest neighbor.

II. LITERATURE ON EXISTING SYSTEM

In the existing the automatic toll payment is with Radio- frequency Identification (RFID) technology and is affixed on the vehicle's windscreen after the tag account is active where ETC (electronic toll collection) pass is linked to a prepaid account from which the applicable toll amount is deducted.

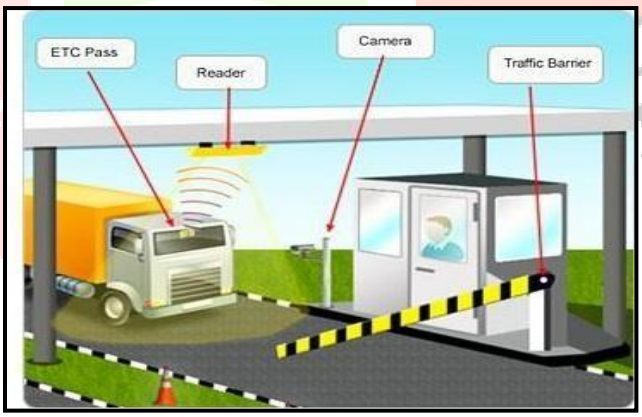

Fig 1.2 Existing System toll payment

DRAWBACKS OF EXISTING SYSTEM

The existing system which comprises of an ETC pass linked to a prepaid account from which the applicable toll amount is deducted with the help of a tag employing Radio-frequency Identification (RFID) technology affixed on the vehicle's windscreen after the tag account is active poses several disadvantages which are as follows:

1. The system is not always as fast as one would want to be. On top of that, the transceiver location is not always constant.
2. Some toll booths have it located few meters ahead of boom barrier, while some has it next to boom barrier.
3. In booths where transceiver is located well ahead of the booth, there is a good chance that your tag may not be read since you would have crossed the same before it was able to detect the tag.
4. In this case, you will have to reverse the car, which may not be feasible in case there are vehicle behind you.

III. PROPOSED SYSTEM

In the existing time, all vehicles which get manufactured are initially registered by their manufacturing company with the government authority. Only the registered vehicles display a vehicle registration plate and carry a vehicle registration certificate. This certificate is different from vehicle licensing and roadworthiness 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. As a result at the time of police verification these details may be transferred at a stretch with ease. Now 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 .At this point of time, the gate gets 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 it. During this process the information regarding the alcohol consumption of the vehicle driver also gets detected using the alcohol sensor and is stored in the microcontroller and gets transferred.

The Li-Fi receiver at the toll booth updates the contents in the server and the database and 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 . In case the driver is drunk fine amount is deducted from the user's account and his details along with vehicle details are sent to the nearest police squad using k-NN algorithm. Now when 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.

IV. BLOCK DIAGRAM

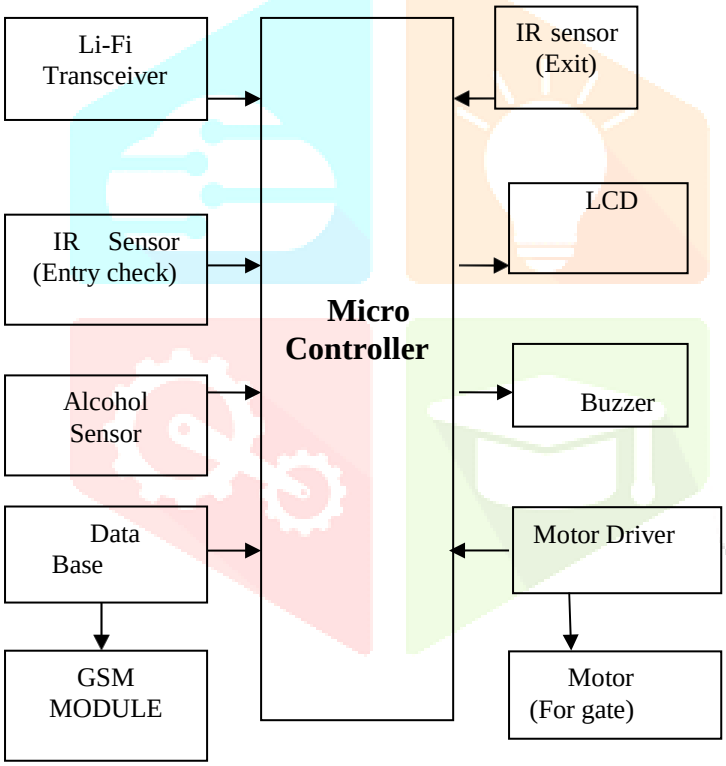

Fig 1.3 Functional Units of Proposed System

ADVANTAGES OF PROPOSED SYSTEM

As the proposed system uses the Li-Fi modules, it possesses several advantages over the existing one which are mentioned below:

1. ***Capacit* :** Li-Fi spectrum is 10,000 times greater than that of radio frequency.
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.

V. 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. Then to identify the person who is drunk during driving and inform to the police nearby. 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

VI. CONCLUSION AND FUTURE ENHANCEMENT

Now Wi-Fi is getting overloaded and so for short-range high-data rate links, it seems useful to offload the excess demand to Li-Fi. The idea of Li-Fi technology is currently attracting us and thus 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. 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.

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