Indian J.Sci.Res. 17(2): 243 - 246, 2018 ISSN: 0976-2876 (Print)
ISSN: 2250-0138(Online)

SMART RFID BASED TOLL E-PAYMENT SYSTEM

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Abstract-In now a day's transportation is one of the important issues in our country. For maintaining vehicles our country introduces electronic toll collection. In this Toll collection booths need an amount of operations like stopping the vehicle, lowering the casement, ruling the accurate coinage or convincing card earlier than travelers can carry on their journey. This research manuscript proposes the electronic toll collection system depends on RFID card. At this time RFID card identifies user's vehicle details and all others. After identifying user's details ZigBee module communicates both users and toll collection. Then users pay the bill amount automatically and collect the bill. When compared to traditional method, this method is very easy and also reduces the user's wastage of time.

Keywords **–** Raspberry pi, USB Camera, DC motor, Zigbee, RFID Module, LCD, Linux OS.

I. Introduction

Transportation is the backbone of any country's economy. Improvement in transportation systems result into the good lifestyle in which we achieve extraordinary freedom for movement, immense trade in manufactured goods and services, as well as higher rate of employment levels and social mobility. In fact, the economic condition of a nation has been closely related to efficient ways of transportation. Increasing number of vehicles on the road, result into number of problems such as congestion, accident rate, air pollution and many other. All economic activities for different tasks use different methods of transportation. For this reason, increasing transportation is an immediate impact on productivity of nation and the economy. Reducing the cost of transporting resource at production sites and transport completed goods to markets is one of the important key factors in economic competition. Nowadays, increasing traffic causes congestions at the toll plaza. Therefore a new technique is required to solve the problem of congestions. Automated toll collection is one of the best methods to solve this problem. The automated system is composed of several subsystems.

The SMART CARD technology, power supply, Database, microcontroller, GSM interface, and the two-way deduction system.

Automated system will save time and reducing human worker. The SMART tag and RFID reader are contained in SMART CARD technology. Toll tax collection systems in India are based on manual cash transactions. The operator at the toll booth manually collects toll amount according to vehicle type, in form cash bills. He hands the receipt for same. This modus operandi is time consuming. Due to such systems bottleneck is created in the high speed highways. There are chances of error, time wastage, and longer queues leading to fuel wastage. The Raspberry Pi based toll collection system works on the client-server architecture. There is a centralized server which stores database of users. A client Raspberry Pi at every toll booth is connected to the server via internet. Raspberry Pi controls hardware i.e. displays, RFID reader, motor and simultaneously it communicates with the server with the queries regarding user account. Due to this dual role of Raspberry Pi, separate need of microcontroller is eliminated. This results in a cost effective implementation of the system.

II. Existing System

There are two methods of collecting tax presently used they are First is the traditional manual method where one person collects money and issues a receipt. The other one is the Smart Card method where the person needs to show the smart card to the system installed at the toll tax department to open the Gate.

Drawbacks of Existing System

Both the above mentioned method for collecting tax is time consuming method. Chances of escaping the payment of tax are there. It leads to queuing up of following vehicles.

III. Proposed System

The base idea behind implementing RFID Based Toll System is to automate the toll collection process and their by reducing manual operation in toll booths and the long queues at toll booths using RFID tags installed on the vehicles. In addition to we can not only help the vehicle owners and system administrators from vehicle theft detection.

Here we are going to see some points regarding to purpose behind choosing this topic & what is the requirement of this type of paper in our day to day life.

- Avoid the fuel loss.
- Saving of time in collecting toll.

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- Avoid financial loss.
- To monitor the traffic.

According to the survey of Karnataka Government, in Sept.2012 they have proposed to get the annual toll collection about 2500 crores/year .But in the present situation they are able to collect only 900 crores of the toll value. Means there is loss of 600 crores due to human errors. So, in this situation we have to control this leakage. Now the present system we have with us on the high ways takes 1 minute to complete the toll collection process for one vehicle. With this automatic process, it will take just less than a minute to complete the whole process. As there is reduction in time for completion of the process so indirectly there will be no traffic as such & as there is no traffic so no fuel wastage takes place & the purpose of designing the highways is achieved i.e. reduction in journey time & also the money loss will be reduced.

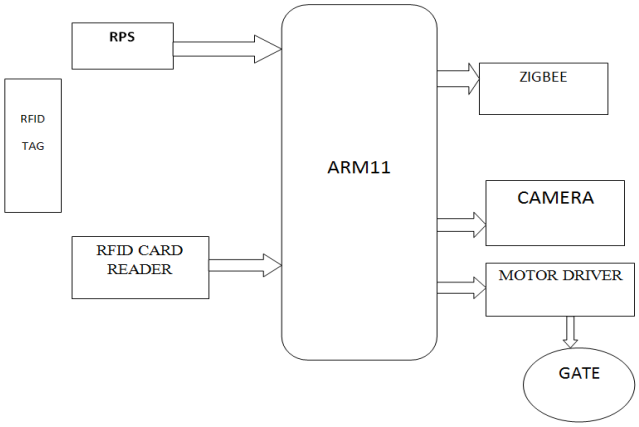

Fig.1 (a): Vehicle section

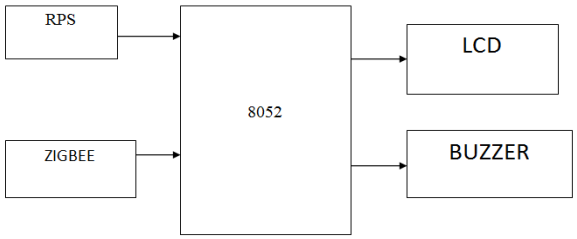

Fig.1 (b): Monitoring section

A. Raspberry Pi

Raspberry pi B is a portable, powerful and minicomputer. Programmable PC that runs in open-source Robot operating system. The board consists of Video Core IV graphics processing unit (GPU), ARMv7-compatible quad-core one, 512 MB of RAM. It has a Micro SD to boot media and for persistent storage. One powerful feature of the Raspberry Pi is the row of GPIO -General Purpose Input/output pins along the edge of the board (refer Fig.1.1). These pins are a physical interface between the Pi and the outside world. At the simplest level, these are called as switches. Seventeen of the 26 pins are GPIO pins; the others are power or ground pins.

B.USB Camera

The type of camera used here is an USB camera which has recording function built-in and can thus record directly to any standard storage media, such as SD cards, NAS (network-attached storage) or a PC/server. The camera feeds or streams its image in real time to a computer or a mobile using network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via Wi-Fi. When sent to a receiver side, the video stream is saved in cloud.

C. DC Motor

The DC motor is connected to a set of four wheels and is responsible for the movement of robot. A DC motor is a class of electrical machine that converts direct current electrical power into mechanical power. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

D. Liquid Crystal Display (LCD)

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

E. Zigbee

ZigBee is a specification for a suite of high level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee is based on an IEEE 802.15 standard. Though low-powered, ZigBee devices often transmit data over longer distances by passing data through intermediate devices to reach more distant ones, creating a mesh network; i.e., a network with no centralized control or high-power transmitter/receiver able to reach all of the networked devices. The decentralized nature of such wireless ad hoc networks make them suitable for applications where a central node can't be relied upon.

F. RFID Module

Radio frequency identification is a powerful emerging technology that enables companies to achieve

total business visibility. By knowing the identity, location and conditions of assets, tools, inventory, people and more, companies can optimize business processes and reduce operational costs. Radio frequency identification (RFID) is a generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves.

G. LINUX Operating system

Linux or GNU/Linux is a free and open source programming working framework for PCs. The working framework is a gathering of the fundamental guidelines that tell the electronic parts of the PC what to do and how to function. Free and open source programming (FOSS) implies that everybody has the flexibility to utilize it, perceive how it works, and changes it.

H. QT Embedded Frame Work

Qt is a cross-stage application system that is generally utilized for creating application programming with a graphical UI (GUI) (in which cases Qt is delegated a widget toolbox), and furthermore utilized for creating non-GUI projects such as command-line devices and consoles for servers. Qt utilizes standard C++ however makes broad utilization of an uncommon code generator (called the Meta Object Compiler, or moc) together with a few macros to advance the dialect.

IV. Working Principle

In this paper, we are giving the complete description on the proposed system architecture. Here we are using Raspberry Pi board as our platform. It has an ARM-11 SOC with integrated peripherals like USB, Ethernet and serial etc. On this board we are installing Linux operating system with necessary drivers for all peripheral devices and user level software stack which includes a light weight GUI based on XServer, V4L2 API for interacting with video devices like cameras, TCP/IP stack to communicate with network devices and some standard system libraries for system level general IO operations. The Raspberry Pi board equipped with the above software stack is connected to the outside network and a camera is connected to the Raspberry Pi through USB bus.

The architecture of the web server has the following layers.

- In the lower level the web server has the physical hosting interfaces used for storing and maintaining the data related to the server.
- Above the Physical hosting interface the server has HTTP server software and other web server components for bypass the direct interaction with the physical interaction with the lower levels.
- The final layer has the tools and services for interacting with the video streams which includes the Image codec and storing interfaces, connection managers and session control interfaces etc.

After connecting all the devices power up the device. When the device starts booting from flash, it first load the linux to the device and initialize all the drivers and the core kernel. After initialization of the kernel it first check weather all the devices are working properly or not. After that it loads the file system and start the startup scripts for running necessary processes and daemons. Finally it starts the main application.

When our application starts running it first check all the devices and resources which it needs are available or not. After that it check the connection with the devices and gives control to the user.

The board continuously reads data from the camera and at the same time it reads the data from the sensors. The scheduler is monitoring the process dedicated for camera reading and sensor reading. The camera read image and sensor values with scheduler information will send to the web server. There the user in front of the web server will monitor the priorities and the sensor and camera data. Whenever the user wants to change the priorities of the processes then using the web interface he can change the priorities. When ever change is occurred then the web server send the modified signals to board. Whenever the board got the modification, it will send the scheduler to change the priorities

ADVANTAGES:

- Low support cost,
- Easy to Implement
- Time Saving
- Reduce Manpower

APPLICATIONS:

- Airports
- Shopping Malls
- Industries

V. Future Scope

The cost of ARM11 is more that's why in future we can implement this system using ARM CORTEX A8, Beagle bone etc as well as updated processors with high frequencies will work fine.

As the storage space is also less in future we can also record these live streaming data by connecting external memory storage. We can complete our paper using wireless technology. In future we can provide more

security to data by using encryption, decryption techniques.

VI. Conclusion

The proposed system was fully developed and tested to demonstrate its feasibility and effectiveness. RFID based toll collection system is used as a technology for fast and efficient collection of toll at the toll booths. This is possible for the vehicles passing through the toll plaza need not stop to pay toll and the payment automatically is deducted from the account of the driver. The electronic toll lanes are setup with special antennas that will send out signals continuously. These signals are used to identify the vehicles that travel through them. To use the electronic toll facility the drivers need to setup an electronic transponder (tag) fixed in the vehicle. These transponders (tags) are fitted on the windshield of the vehicle . The tags have all the information regarding the users account. The antennas continuously send radio frequency pulses which returns only when hits a tag. These pulses are returned back from the tag and are received by the antenna. These reflected pulses from the tags contain information about the driver number, drivers account, balance etc. After encrypting the contents of this pulse the unit uses cellular modems or wireless transmitters to send it off to a central location where computers use the unique identification number to identify the account from which the cost of the toll should be deducted.

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