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Automatic Toll Payment with Tracking of Theft Vehicles

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Abstract: **Millions of drivers passing through Toll Gate Stations every day. The conventional way of collecting the toll from the vehicle drivers is to stop the car by the Toll Gate Stations and then pay the amount to the toll collector standing (or perhaps sitting!) by the side of the toll booth, after which the gate is opened either mechanically or electronically for the driver to get through the toll station. An efficient utilization of communication link between RF Modems over a wireless channel to facilitate vehicle monitoring, vehicle authentication and automated toll collection on the highways is proposed. The system is implemented to automatically collecting the toll and more convenient way of traffic management. The implementation is divided into the design of three modules, Vehicle Module, Tollgate station and Central PC End. The three modules communicate via RF Data modem connected to each module.**

I. INTRODUCTION

Automatic toll collection is considered as one of the intelligent transport systems. It is aimed at making toll taxation more efficient, reliable, and safe and environment friendly. In the past, customer would have to wait at the toll booth to pay the collector, creating traffic congestion, pollution and of course of a lot of frustration. Here we are using three modules for the automatic toll payment. That is vehicle module, toll gate station, and central PC. These three modules communicate via a RF data modem. So the basic function of this project is that to facilitate vehicle monitoring, vehicle authentication, and automatic collection of toll. Our project automatic toll payment with tracking of theft vehicles is originated from searching on net. Almost all the projects based on this topic is done by RFID technology. Then we were in a thinking to do this project which is useful to common people with less expensive and without complications. From that we introduce a RF data modem, which is a transceiver. There will be three modules, which are vehicle module, toll gate station, and central PC. These three modules communicate via RF data modem. When vehicle reaches the tollgate station a signal is passed from Tollgate station to the vehicle. Once the signal received the toll cash is automatically deducted from the user's account. Also a message to the user's mobile will be send after the successful payment. The toll gate will automatically open after the successful payment. The account details are synchronized with the Central PC End. If the account has not enough money to pay the toll, then there is a facility to pay the amount via keypad at the toll end. If the vehicle is a theft vehicle, user can send a "STOP VEHICLE" message to the Vehicle end after receiving the toll payment message.

A. Literature Survey

Three systems of toll roads existing, open (with mainline barrier toll plazas), closed (with entry/exit tolls), and all-electronic toll collection (no toll booths, only electronic toll collection gantries at entrances and exits or at strategic locations on the mainline of the road).On an open toll system, all vehicles stop at various locations along the highway to pay a toll. While this may save money from the lack of need to construct tolls at every exit, it can cause traffic congestion, and drivers may be able to avoid tolls by exiting and re-entering the highway. With a closed system, vehicles collect a ticket when entering the highway. In some cases, the ticket displays the toll to be paid on exit. Upon exit, the driver must pay the amount listed for the given exit. Should the ticket be lost, a driver must typically pay the maximum amount possible for travel on that highway. Short toll roads with no intermediate entries or exits may have only one toll plaza at one end, with motorists traveling in either direction paying a flat fee either when they enter or when they exit the toll road. In a variant of the closed toll system, mainline barriers are present at the two endpoints of the toll road, and each interchange has a ramp toll that is paid upon exit or entry. In this case, a motorist pays a flat fee at the ramp toll and another flat fee at the end of the toll road; no ticket is necessary.

In an all-electronic system no cash toll collection takes place, tolls are usually collected with the use of a transponder placed before the Gate as soon as the vehicle reaches near the Transponder the amount is deducted and the gate will be opened customer account which is debited for each use of the toll road. On some roads

automobiles and light trucks without transponders are permitted to use the road a bill for the toll due is then sent to the registered owner of the vehicle by mail; by contrast, some toll ways require all vehicles to be equipped with a transponder. Modern toll roads often use a combination of the three, with various entry and exit tolls supplemented by occasional mainline tolls. Open Road Tolling (ORT), with all-electronic toll collection, is now the preferred practice, being more efficient, environmentally friendly, and safer than manual toll collection.

B. Drawbacks of existing system

The above mentioned method for collecting toll tax is time consuming method. Chances of escaping the payment of toll tax are there. It leads to queuing up of following vehicles. Suppose the manual toll collection system is very efficient then for one vehicle to stop and pay taxes total time taken is 50 seconds. And suppose 200 vehicles cross the toll plaza. Then, time taken by 1 vehicle with 60 second average stop in a month is 50x30= 1500 seconds. Yearly total time taken is 1500x12 = 18000seconds = 5.0 hours On average each vehicle that passes through the toll plaza has to wait 5.0 hours in engine start condition yearly. The figure is staggering if on an average we take 200 vehicles pass through the toll plaza each day, then yearly 72000 vehicles pass through the toll plaza. And each year 72000 vehicles just stand still for 5.0 hours in engine start condition thereby aiding pollution and wasting fuel and money.

This study is if the system is very efficient but what if the vehicle has to wait for 5 minutes? This is a figure considering one toll plaza. If considering 50 toll systems the above figure will drastically increase and the wastage of fuel, money will increase and pollution will also increase. And each year 72000 vehicles just stand still for 5.0 hours in engine start condition thereby aiding pollution and wasting fuel and money.

C. Proposed system

In this paper three modules are there. Which communicate via RF data modem . There will be three block diagram for each unit. The vehicle end consists of GSM modem and RF data modem. When the vehicle reaches at the toll end the RF data modem transmits the signals to the micro controller. Then speed of the motor is reduced. Check the balance in the vehicle for toll payment. If the balance is enough, then a message like payment details sent to the user by GSM modem. And it displayed in the LCD. If there is no balance, then motor is just stopped. By using the keypad in toll end we have to recharge the required amount. And toll payment will be done and again sent a message to the user. In the case theft vehicle we can easily track the vehicle by using this system. That is when the message sent to the user, user can send back a message that stop car. Then car is locked at the toll end. There are three circuits for automatic toll payment with tracking of theft vehicles. That means there exist a circuit diagram for vehicle end, toll gate station, and central PC unit. The basic circuit of the microcontroller consists of a power supply unit, External Crystal oscillator and a reset circuitry. The power supply consist of a voltage regulator which is used to regulate the voltage to a fixed voltage of 5v .Normally 7805 voltage regulators are used for this purpose. Normally the crystal oscillator provided with the microcontrollers is of 16MHz and to 22pf capacitors are used with the microcontroller as decoupling capacitors for decreasing the noise.

The reset circuitry used here consist of a switch and a resistor normally a HIGH signal is present in the mCLR pin of the microcontroller when the switch is pressed a LOW presents at the pin and microcontroller gets reset and as there is a resistor provided in circuit the Vcc and Ground never get direct short while resetting. The microcontroller consists of an internal ADC module this ADC module is used to convert the ADC reading from the sensor to a digital value. The ADC provided with microcontroller is of 10 bit resolution. This reads value from 0-1023.The Devices which output the analog variation can communicate with controller using this module. The LCD is an external module used to display the details to the user.

The LCD communicates with the microcontroller using parallel communication of the data. The data lines are connected to a port of the microcontroller and the control lines RS (register select),E(enable),R/W (read /write),are connected to the corresponding pins .GSM is One of the most important conclusions from the early tests of the new GSM technology was that the new standard should employ Time Division Multiple Access (TDMA) technology. This ensured the support of major corporate players like Nokia, Ericsson and Siemens, and the flexibility of having access to a broad range of suppliers and the potential to get product faster into the marketplace. After a series of tests, the GSM digital standard was proven to work in 1988.

With global coverage goals in mind, being compatible with GSM from day one is a prerequisite for any new system that would add functionality to GSM. As with other 2G systems, GSM handles voice efficiently, but the support for data and Internet applications is limited.

A data connection is established in just the same way as for a regular voice call; the user dials in and a circuit-switched connection continues during the entire

session. If the user disconnects and wants to re-connect, the dial-in sequence has to be repeated. This issue, coupled with the limitation that users are billed for the time that they are connected, creates a need for packet data for GSM. The digital nature of GSM allows the transmission of data (both synchronous and asynchronous) to or from ISDN terminals, although the most basic service support by GSM is telephony.17 Speech, which is inherently analog, has to be digitized. The method employed by ISDN, and by current telephone systems for multiplexing voice lines over high-speed trunks and optical fiber lines, is Pulse Coded Modulation (PCM).

The GSM modem is connected to the microcontroller via UART communication protocol. The RX pin of microcontroller is connected to the TX pin of GSM modem and vice versa. In the same manner, the RF data modem is also interfaced with the microcontroller The PWM output from, the microcontroller is used to control the speed of the vehicle motor. An L293D motor driver is used to control the toll motor. Two digital pins are interfaced with the L293D input. In this manner the direction of the motor can be controlled.

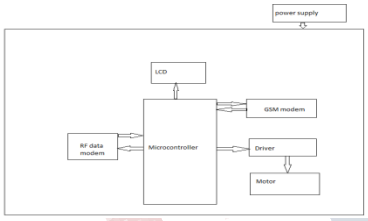

Fig: 1.1 Block diagram for vehicle end

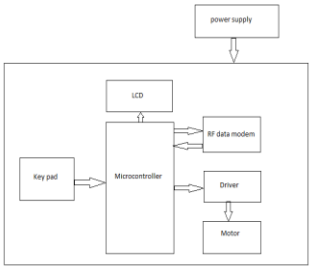

Fig: 1.2 Block diagram for toll end

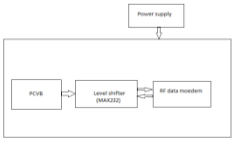

Fig: 1.3 Block diagram for PC end

D. Circuit diagram

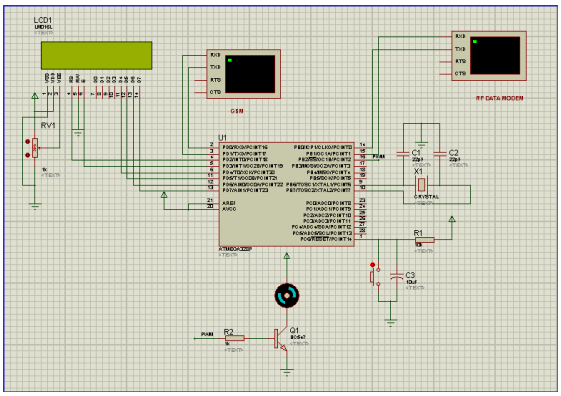

Fig: 1.4 Vehicle end

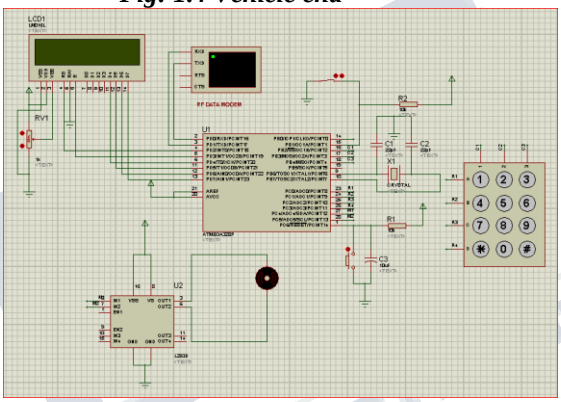

Fig: 1.5 Toll end

There will be three modules. We introduced the RF data modem, which is a transceiver .That means it can transmit and receive signals. Also there are vehicle module, tollgate station, and the central PC. These three modules communicate via RF data modem

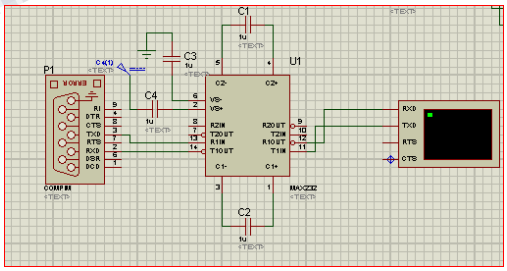

Fig: 1.6 PC end

II. RESULTS AND DISCUSSIONS

By doing automation of toll plaza we can have the best solution over money loss at toll plaza by reducing the man power required for collection of money and also can reduce the traffic indirectly resulting in reduction of time at toll plaza.The load cell plate, which is introduced for weighing the vehicles so as to classify them in different categories as light and heavy vehicles. The RF transceiver is used for detecting the presence of vehicle at different locations which will act as the gate pass to the toll plaza. By effectively utilizing these three

techniques at different stages of our project we are able to represent the automation in toll plaza which will reduce the complete processing time by few seconds which is very important as well as helps to reduce money leakage in a very cost effective manner. Also our project describes an additional application identification of theft vehicles by using GSM.

III. CONCLUSION

By doing automation of toll plaza we can have the best solution over money loss at toll plaza by reducing the man power required for collection of money and also can reduce the traffic indirectly resulting in reduction of time at toll plaza. By effectively utilizing this techniques in our project we are able to represent the automation in toll plaza which will reduce the complete processing time by few seconds which is very important as well as helps to reduce money leakage in very cost effective manner. It reduces human effort. Our project describes an additional application, identification of theft vehicles by using GSM. Therefore our project has many advantages that it can reduce human effort, avoids financial loss, avoid fuel loss, avoid chances of escaping from toll payment, avoid the traffic problems, and also helps to tracking of theft vehicles.

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