

Design of Automated Toll Gate System With UHF RFID

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Abstract: This paper describes the UHF RFID based automatic toll-tax collection system for toll gate. Most of the toll collection systems commonly used in India is manual transaction. Now a days, streams of traffic are increased and toll gate on highways are congested. It will cause the traffic jam and waste time. The objective of this project is to transform manual transaction to automated toll collection with the help of UHF RFID technology. There are three portions in toll collection system. They are RFID system, balance deduction system in host computer and toll gate control system. For the RFID system, 867MHz passive RFID reader and tag pairs are used. The 8051 microcontroller is also used to control the dc motor to communicate with toll gate. 8051 microcontroller can check the character A in the Zigbee which is received from the PC when the UHF RFID tag detects and the code is written on Labview with the database on PC. The amount of tag detects will also update simultaneously at the two database of the toll gate because of Zigbee network. By using this system, it will save time, i.e. by avoiding long queue as no need to stop the vehicle and no need of manual transaction at the toll gate.

Index Terms- UHF RFID, 8051 MICRO CONTROLLER, Dc Motor, Database

I. INTRODUCTION

UHF RFID stand for ultra high frequency radio frequency identification is use of radio waves that detects the tag wirelessly which is attached to the objects and gets the information. Since then, RFID has significantly advanced and experienced a tremendous growth due to developments in integrated circuits and radios and increased interest from retail industries and universities. In a passive UHF RFID system, the reader alternates between transmitting continuous wave (CW) and modulated RF commands to the tag. The tag chip gets powered wirelessly, similar to energy transmission in inductive contactless systems. The chip sends back information by varying its input impedance and thus modulating the signal backscattered to the reader, which receives it while simultaneously continuing to transmit CW to provide power to the tag. RFID products (readers, printers, and tags) are now used for a wide variety of applications and environments.

Nowadays, increasing traffic volume causes congestions commonly around the toll gate of highway. Therefore, the new technique is urgently required to reform the problem of congestions. UHF RFID Based Automatic toll –tax collection system is one of the methods to solve the above conditions. The automated system is composed of several subsystems. The RFID technology, computer database, Lab view, power supply, 8051 microcontroller, DC motor and inferred device

are included. Automated system can bring the several sectors for toll gates as saving time and reducing the human workers. Develop the prototype model, which reproduces the operation states of various toll gate systems: passing time and waiting time. The RFID tag and RFID reader are contained in RFID technology.

RFID means Radio Frequency Identification that consists of the tags which can be either active or passive tag. Passive tag do not have own power supply, much cheaper to manufacture and small coil antenna is used. On the other hand, active tag must have own power supply. It has longer range and larger memories. It can store additional information sent the RFID reader. RFID reader is an interrogator. It is placed at the toll gate on every single row where vehicles are passed. The reader contains an RF module, which acts as both transmitter and receiver of radio frequency signals. The reader generates the signal to receive the data from tag. The received signals send to the computer system which contains Graphical User Interface (GUI) and the database of all users. The computer and RFID reader are connected with USB cable. The code to detect the tag is written in labview and the Zigbee which is connected to the PC through USB is assigned character A when tag detects and transmit to the other Zigbee which is connected with 8051 micro controller and controller opens the toll gate when IR sensor gets the interrupt and close the toll gate when interrupt off.

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II. BASIC CONCEPT

This system allows the vehicle drivers to pass the toll tax booths without stopping at the toll booths. The toll amount is deducted from the RFID card. This RFID card is rechargeable

and account is stored on the records. This system will have two benefits. First benefit is that movement of traffic will be much faster as user will not wait to give the money because, driver has to just show the RFID card in-front of the card reader. Second benefit is that driver doesn't have to carry the money each time. He will just recharge the RFID card by certain amount and will use this card each time he travels. This is little bit similar to using credit cards. Most of the toll collection systems commonly used in India is manual transaction. Nowadays, streams of traffic are increased and toll gate on highways are congested. It will cause the traffic jam and waste time. The objective of this projects is to transform manual transaction to automated toll collection with the help of RFID.

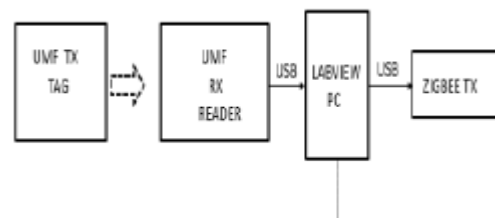
A. Applications

- 1) Faster toll collection system
- 2) Less manpower needed
- 3) Fuel saving
- 4) Low cost and easy to implement
- 5) Financial leakage control
- 6) Vehicle tracking
- 7) Pay parking system



Fig 1: General RFID based toll tax image

III. PROPOSED METHODOLOGY



The block diagram of automated toll gate system using UHF RFID is shown above in figure. It consists of UHF RFID, Zigbee, 5V power supply, max232 IC, L293D IC, DC Motor. Here the UHF RFID range is 10 meters, to detect the tag the UHF RFID reader is connected to the pc through USB cable and to communicate the graphical code is written in Labview is shown below in the figure

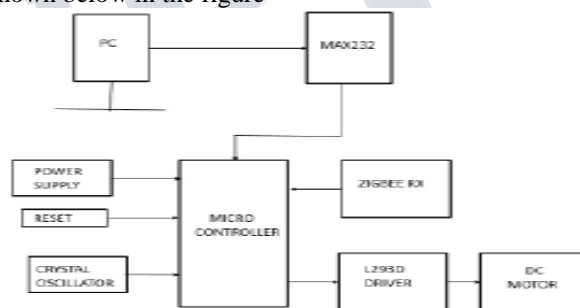


Fig 2: Block Diagram of the System.

The first block is visa open, to communicate first we should open the visa, the second block is serial communication block where we can set the Baud rate as per the requirements it will communicate serially through. To read the data from the tag to reader we have visa read block where can mention bytes of the data and the buffer it will display the data of the tag. Final block is visa close where it will close the serial communication. We can detect multiple number of tags, for that we should have the database of all the tag id, it will compare the any of the tag detects and the XOR gate is high then goes to the case structure where in case structure first it will open visa to communicate with Zigbee through USB port, second block is visa serial to communicate serially with Zigbee, third block is visa write, when case structure becomes active means when the tag detects the character A is write to the Zigbee and the final block is visa close where it will close the serial communication. From one Zigbee which is connected assigned A character will send to the other Zigbee which is connected to the microcontroller, when tag comes

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under range the data detects in the labview and that time A character is assigned to the Zigbee which is connected to the PC through USB and from that Zigbee transmit to the other Zigbee which is connected to the 8051 micro controller. The code is written in such a way that when the character is A is received and IR sensor gets the interrupt then open the gate and the vehicle moves the IR sensor see no interrupt then after few delay seconds it will close the gate.

The 8051 micro controller is connected to the PC through UART 9-pin connector which supports -13/3 volts. But 8051 microcontroller supports 5V so, for that we need max232 voltage level converter IC which converts -13/3 volts to 5V so data from PC to micro controller is transmitted and received through max232 IC. The code dumped in 8051 micro controller using the boot loader hence the module can be place in the toll gate.

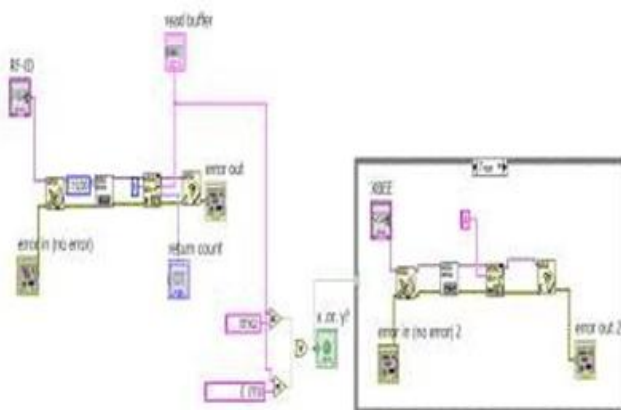


Fig 3: Labview code to detect the tag and send the data wirelessly from transmitter Zigbee to receiver Zigbee

IV. EXPECTED RESULTS



Fig 4: Labview Front Panel

The above result is obtained in the Labview window. The above result is data from the tag is detected and displayed in the labview window and the code in Labview is shown above in the proposed methodology. The RFID reader is connected to the PC through USB and also Zigbee is connected to the PC through USB. First the tag detects and the character A is assigned to Zigbee which is connected to the PC and the character A is transmitted to the receiver Zigbee when character A is received in the Zigbee which is connected to the controller and when character A is received in Zigbee the controller opens the toll gate with DC motor when IR sensor gets the interrupt and vehicle moves. The toll gate closes when the IR sensor interrupt is off with few seconds delay.



Fig 5: Proposed Model

V. 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. This system mainly reviewed the research and development work for toll collection at the toll gate on highway with the help of passive UHF RFID technology. By developing this system, the knowledge of RFID system, 8051 microcontroller, the MAX232, L395D and USB connection between PC and RFID reader with Labview. For this system, passive tags are better than the active tags because of low cost, low power consumption and also radio signals environmental factors. By using RFID based automated toll collection system, the vehicle can check for security with the passing time, save the time for toll collection and reduce traffic congestion at the toll plaza. Therefore, the RFID based Automatic toll-tax collection system is the best way for toll collection at the toll plaza

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