

Toll-Collection made Automation using Zig-Bee

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Abstract –There are more numbers of vehicles passing through Toll Gate every day and the numbers goes on increasing. At present the method of collecting the toll from the vehicles is to stop the car by the Toll Gate Stations and then pay the amount to the toll collector 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. This is a time consuming process during peak hours. In order to save time an efficient new technology is adopted in this paper for an effective method of toll collection by using communication link between RF Modems over a wireless channel to monitor the vehicle authentication and also automated toll collection on the highways by using Zig-Bee technology. Automatic Toll Collection is done by Zig-Bee transmitter fixed in the vehicle and a Zig-Bee receiver which is fixed in the toll station roadway. The method consists of Vehicle Unit, Tollgate Station unit. The Zig-Bee transmitter sends the signals from 10- 20mts to the tollgate station, then Zig-Bee Receiver detects the signal and the information to Central database, if information is matched an acknowledgement send to Tollgate station ,amount will be detected. Then automatically gate will be open.

Index Terms – Zig-Bee, IR sensor, Electronic Toll, Traffic Jam, Toll Plaza.

I. INTRODUCTION

In recent times, rapid development of the embedded technology and its product is governing the global IT industry development. The embedded system has been combined in people's life and the work increasingly in various forms. Zig-Bee is one new wireless network technology, developing in high speed with high reliable, high cost performance and low power. We assume that vehicles have 16-bit identification numbers. The RFID [3] tags to readers read the signal and information about vehicle owners. These RF signals are received by an RF receiver at the toll plaza, which send data to a computer's parallel port.

A software program running on the computer retrieves vehicle details from its vehicle database. Depending on this information, appropriate toll tax is deducted from the pre-paid account of the vehicle owners [8]. The owner receives an SMS message on his/her mobile about the details of the payment [1]. If the balance in the owners account is low or if the vehicle is not equipped with an RF system, the toll gate remains close. Next method proposes a very simple method for enhancing the performance of infrared electronic-toll-collection systems, in such a case, the vehicle owner will have to pay the toll tax in case and collect the receipt, We need a system for

handling violation and acknowledgement when a vehicle does not have an RFID module installed, a vehicle's ID number is not found in the database, or a driver has insufficient funds to pay toll [9]. If an acknowledgement is not received in a predefined time from the database, the toll plaza gate remains closed.

Existing automatic toll collection techniques incur power loss since the receiver is continuously turned on, even when no vehicle arrived at a toll plaza [2]. In our technique, only the IR sensor is turned on to detect the arrival of vehicles. Only when a vehicle is detected, RFID Tag to RFID reader reads the data. These characteristics make it be applied in the entire world market such as civil, commercial, public utilities as well as industry. With the expansion of the times, people get higher and higher request for the environment's intelligence. In this paper, we joined the embedded technology with the Zig-Bee wireless communication technology and have become conscious an intellectualized.

Block Diagram

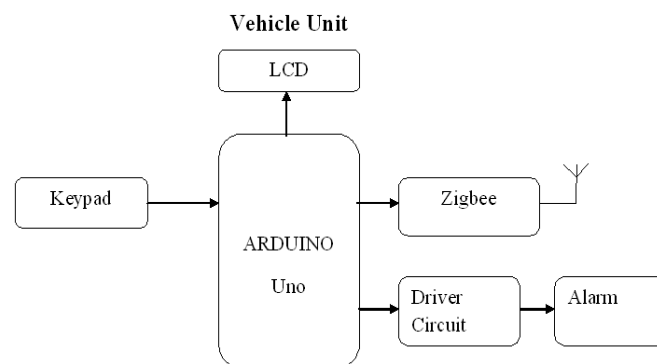


Fig.1 Transmitter section in the vehicle

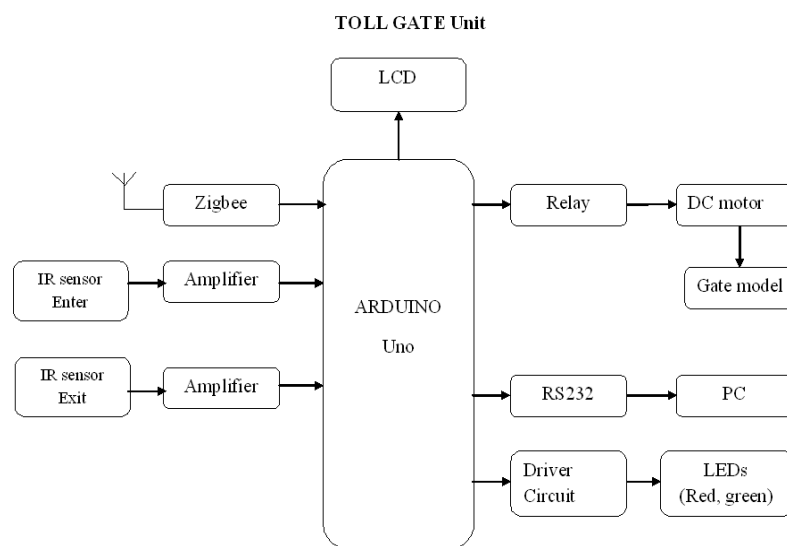


Fig. 2 Receiver section in the Toll Plaza

II. OVERALL OPERATION

Zig-Bee transmitter is static in the vehicle and highway enthusiast device whereas Zig-Bee receiver is fixed in the toll station's roadway. It consists of Vehicle Unit, Tollgate Location unit. The Zig-Bee transmitter sends the signals from 10- 20mts to the tollgate location, then Zig-Bee Receiver detects the signal and the information to Central database, if information is matched an acknowledgement send to Tollgate station, amount will be detected. Then automatically gate will be open.

III. MICROCONTROLLER

Arduino Uno:

Arduino/Genuino Uno is a microcontroller panel based on the ATmega328P . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP pass and a reset button. It surrounds everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC converter or battery to get started.

IV. ZIG-BEE

Zig-Bee is a two way wireless communication device. The Zig-Bee measured the range of frequency is 2.4GHZ. It is accomplished of connecting 255 devices per network. It transmits and receives the signals from 10-20mts.

V. DC MOTOR

The dc generators and dc motors make sure the same general production. An electric motor is a machine which converts an electrical energy into mechanical energy.

VI. IR SENSOR

InfraRed sensor (IR sensor) is an electronic device that processes infrared (IR) light radiating from substances in its field of vision. Apparent indication is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, such as a wall.

Entirely substances produce what is known as black body radiation. It is usually infrared radiation that is too small to see to the human eye but can be detected by electronic devices designed for such a purpose.

VII. RELAY

A relay is an electrically activated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw switches. Relays tolerate one circuit to switch a second circuit which can be absolutely isolated from the first. For illustration a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a moderately large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to activate from lower voltages. Most ICs cannot withdraw this current and a transistor is usually used to amplify the small IC current to the larger value essential for the relay coil. The maximum output current for the widely held 555 timer IC is 200mA so these devices can supply relay coils directly short of amplification.

VIII. OVERALL OPERATION



Fig. 3 Experimental Setup

Zig-Bee transmitter is fixed in the vehicle and highway crown device although Zig-Bee receiver is secure in the toll location's roadway. It consists of Vehicle Unit, Tollgate Post unit. The Zig-Bee transmitter sends the signals from 10- 20mts to the tollgate station, then Zig-Bee Receiver detects the signal and the material to Central catalog, if information is matched an acknowledgement send to Tollgate station ,quantity will be detected. Then automatically gate will be open.

IX. POWER SUPPLY

Power quantity circuit is used to high voltage ac to low voltage dc converter. The ac voltage, classically 220V rms, is associated to a transformer, which steps that ac voltage downhearted to the level of the desired dc output

A watchdog circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage parameter is usually obtained using one of the prevalent voltage regulator IC units.

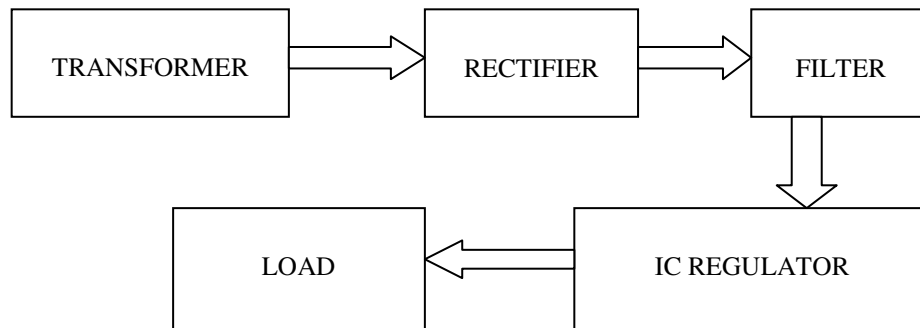


Fig. 4 Power supply diagram.

Advantages

- It consumes less power.
- It moderates the man power.

X. APPLICATIONS

- Spontaneous toll gate
- It can be used in parking place

XI. CONCLUSION

In this Paper, the concept of automated toll ticketing scheme we have used an advanced methodology where a traveling worker will be able to pay the toll while in motion using ZIG-BEE communication technology. Through this process of toll collection will save time, effort, and man power. How many vehicles transient through the toll gate is kept in the database. We can also find out a vehicle how many times passing through the toll gate in a day. The upgrading can be done to develop a multi vehicle amount deducted and send a message at a time multi vehicle. The principle of the development of science is that “nothing is impossible”. So we shall look forward to a bright & sophisticated world.

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