FABRICATION OF MOTORIZED TOLL GATE FOR HIGHWAY

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Abstract

The proposed project is intended as a solution to the traditional way of manual toll gate reduction system by designing and implementing an automatic toll gate using DC Motor. In this toll gate, there will be no manual work like pushing or pulling through human hand power. Here we will make complete system motorized so that a person who will verify any person or vehicle will operate this toll using switch. There will be a switch which can operate in both direction i.e. clockwise and anticlockwise for opening and closing of toll gate. The growth in the population of cars has increased a lot and is predicted to burst through in the coming years. All of this introduces more traffic, more pollution and more cost to people. We cannot control the growth in the population of cars but can do a thing or two by tweaking some functionalities in some of the systems used by these cars. One such system is a Toll system and we could change the traditional way of a Toll system working into a modern way by utilizing the technology available to us. Here we introduce a new way of functioning of Toll System making use of Geofencing and real-time database, which greatly reduces the efforts taken at the toll and helps both the human and nature.

Introduction

With the increase in the number of vehicles on road, the task of traffic management becomes more complex. It is hard to keep & maintain the details of the each vehicle, which is running on the road. Also in case of hit –and-run or carrying of illegal goods over inter-state cross boarder or road-robbery cases, the police may not trace the culprits very easily, as the vehicle details are not monitored continuously. Suppose The Cargo Company wants to send a message to its On-road vehicle to stop delivering the goods to customer, policeman want to stop a vehicle which is smuggling some illegal goods or city transports want to track each buses details such as departure and arrival time on bus terminal, number of round trips it has undergone in a single day. All this is possible by the use of automated toll gates. This system is intended to help the RTO, Police Department, Public Transport and Cargo Companies to open & close tollgate automatically. The main issue in toll plazas is the unending queue and the resultant traffic congestion. This queue occurs mainly because the arriving rate of vehicles is much higher than the servicing rate. The congestion is caused due to the vehicles stopping completely at toll booths for toll payment. This leads to an insane waste of time, easily avoidable fuel consumption and air pollution caused by vehicle exhausts.

Problem statement: Time and efficiency is the major priority of present day toll gates. They require vehicles to stop or slow down, manual toll collection wastes time and increase vehicle operating time. Criticisms of toll roads include the time taken to stop and pay the toll and the cost of the toll booth operators up to about one third of revenue in some cases. Automated toll paying systems help minimize both of these issues. The managing entities, whether public or private, may not correctly account for the overall social costs which may also lead to lose of money.

Literature survey

Abhishek Singh et.al [1] studied has proposed a geof ence is a virtual perimeter for a real-world geographic area. A geo fence could be dynamically generated—as in a radius around a point location, or a geofence can be a predefined set of boundaries (such as school zones or neighborhood boundaries).The use of a geo fence is called geo fencingChunnu Khawas et.al [2] explains the application of Firebase with Android. It also gives detailed information about its concepts, related terminologies, advantages, and limitations. The paper also tries to demonstrate some of the features of Firebase by developing an Android app. Firebase is a relatively new technology for handling large

amount of unstructured data.D. Suganthi et.al [3] details the concept of geofencing.It also presents Vehicle Tracking which is an application of geofencing. Geofence is basically a set boundary area which alerts you when a vehicle enters or exits the area. The drivers can just get right down to business. GPS tracking devices coupled with geofence alerts gives your equipment much more security.lrich Baret et.al [4] introduces geofencing and background tracking. It also demonstrates how location-based recommender systems work. It is shown that the upcoming generation of LBS will be determined by background tracking and geofencing applications.Lakshmi K, Megha et.al [5] proposes a system which includes RFID. It matches the gps data with the one at the toll and deducts the amount from the users account . As it makes use of RFID tag it does take part in hardware . The paper aims in designing a system, which automatically identifies the vehicle that advance towards the toll plazas and observes the vehicle number and the time of arrival.Likhita M et.al [6] explains An IoT module is used in this paper, which does the task of sending a confirmation message to the user. All the transactions are done online because there is no chance of errors in any of the transactions. Online transactions also make the process speed up. But the system requires a hardware module, which is not the case with our system.Manav Singhal et.al [7]outlines the challenges encountered by conventional toll collection systems in India and brings out the need for having an automated toll collection system such as FASTag; a program rolled out by the National Highways Authority of India (NHAI) for Electronic Toll Collection on National Highways.Navnath Dahifale et.al [8]explains This paper also makes use of the hardware-based technique, which is the RFID tag. Along with this, it includes the AVR microcontroller, which is used to control the DC motor and the GUI display. This system does the work but does include hardware a lot which is the thing we do not want to involve The amount of deposits will also update simultaneously at the two database of the toll gate because of XBee 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.Neena Sidhu et.al [9] proposes a system is proposed which includes automatic toll collection, anti-theft system. The components used in this system are radio frequency identification(RFID), Arduino Uno microcontroller, GSM SIM 800, Em 18 reader and a computer host. A system uses radio frequency identification (RFID), Arduino Uno microcontroller, GSM SIM 800, EM 18 reader and a computer host. Passive RFIDs are widely popular for its applications in the field of transportation and they are extensively used in motor vehicles for automated toll collection.Parita Danole et.al [10] proposes the use of an android application for toll payment. This system is quite similar to our in terms of not including the hardware but in this system the user has to decide the path in advance due to which the user cannot change his mind afterwards causing lost.

Methodology

The system design includes both the creation of the system and an explanation of how the system can interact with other components during the process of creating a smart toll gate system that makes use of RFID . The various hardware and software components used in this work. In addition to being a low-cost Linux computer, the Raspberry Pi features a set of GPIO (general purpose input/output) pins that can be used to connect and control a wide variety of sensors, gadgets, and electronic components for use in physical computing and the study of the Internet of Things (IoT). Ultrasonic sensors are connected to the Raspberry Pi to detect the vehicle at the entry gate and exit gate. Stepper motors are used for gate implementation. An RFID reader is also connected to the Raspberry Pi for retrieving owner details linked to vehicles. A database management system implemented on the cloud is connected to Pi for storing all activities related to vehicles at toll plazas. All these components are communicating with each other through various Python scripts.The various steps involved in toll fee collection are depicted in the entry gate is initially closed. If any vehicles are found at the entry gate and the exit gate is closed, the entry gate will open for vehicles to pass through the RFID reader. Pi will retrieve all the required data from the database using the RFID number attached to the vehicle. If the required data are found and the account has a sufficient balance, then the code will deduct the amount based on the type of vehicle and send the open signal to the exit gate. The exit gate is open until the vehicle crosses the gate, once it crosses the gate, the exit gate will be closed for the next

vehicle. In case of invalid details and insufficient balance, it will not send the open signal to the exit gate.
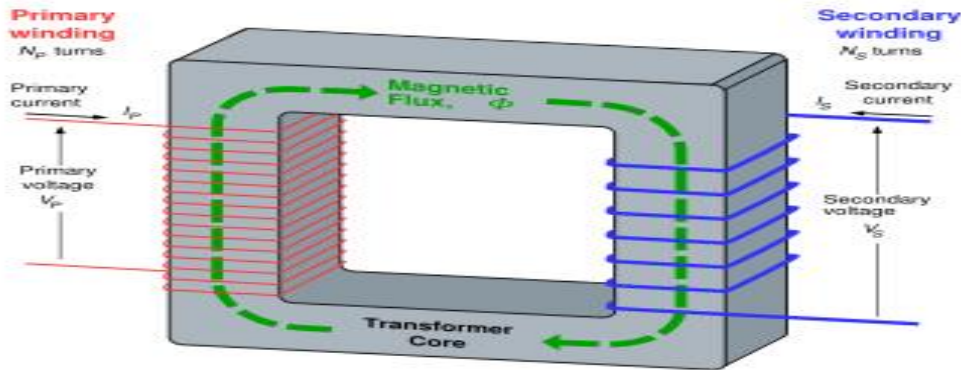
Operating Principle:

Figure -1 operating principle of Transformer

The transformer is based on two principles: first, that an electric current can produce a magnetic field (electromagnetism)and second that a changing magnetic field within a coil of wire induces a voltage across the ends of the coil (electromagnetic induction). Changing the current in the primary coil changes the magnetic flux that is developed. The changing magnetic flux induces a voltage in the secondary coil.Just as in the case of the PN junction diode, the N material comprising the two end sections of the NPN transistor contains a number of free electrons, while the center P section contains an excess number of holes. The action at each junction between these sections is the same as that previously described for the diode; that is, depletion regions develop and the junction barrier appears. To use the transistor as an amplifier, each of these junctions must be modified by some external bias voltage. For the transistor to function in this capacity, the first PN junction (emitter-base junction) is biased in the forward, or low-resistance, direction. At the same time the second PN junction (base-collector junction) is biased in the reverse, or high-resistance, direction.

A simple way to remember how to properly bias a transistor is to observe the NPN or PNP elements that make up the transistor.
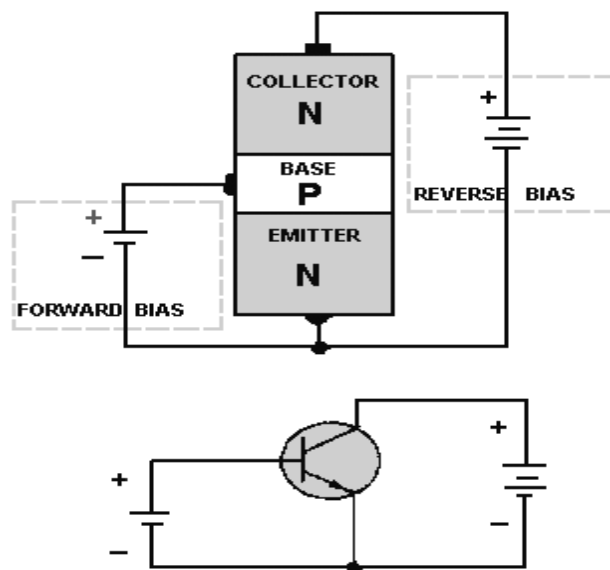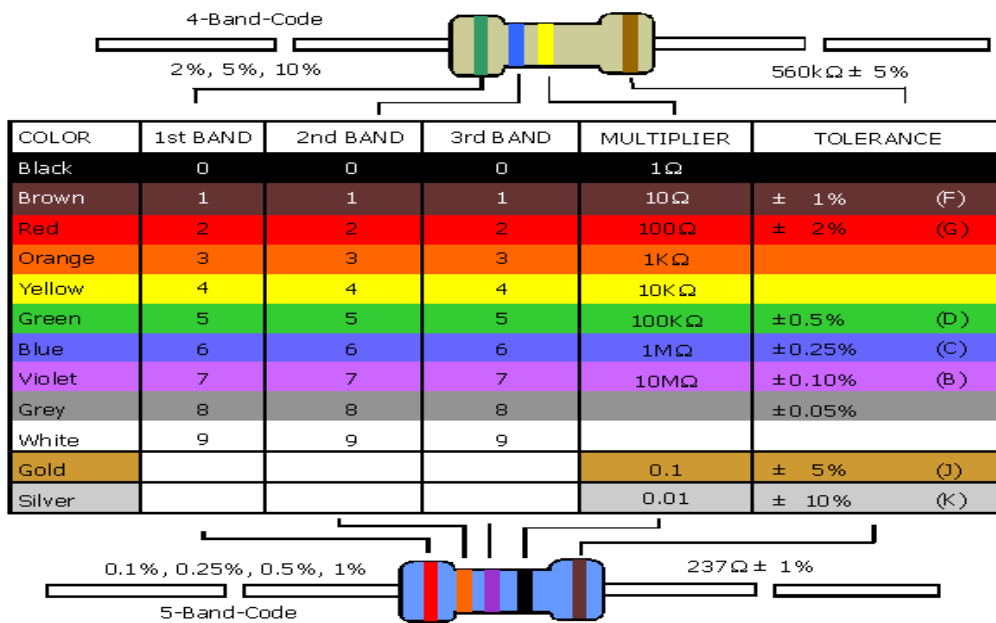

Fig.2:Npn Transistor

Fig.2: Colour coding technique of resistor

Working principle

The systems use a small radio transponder mounted in or on a customer's vehicle to deduct toll fares from a pre-paid account as the vehicle passes through the toll barrier. This reduces manpower at toll booths and increases traffic flow and fuel efficiency by reducing the need for complete stops to pay tolls at these locations. By designing a toll gate specifically for electronic collection, it is possible to carry out open-road tolling, where the customer does not need to slow at all when passing through the toll gate.

Result

The automated toll collection system significantly improves the user experience by eliminating the need for physical tollbooths. Drivers experience reduced waiting times and smoother traffic flow, resulting in enhanced overall roadway efficiency. The convenience of virtual account management allows drivers to seamlessly make toll payments without the need for cash transactions, reducing complexities and improving satisfaction levels. The system consistently collects and processes GPS data, calculates toll amounts, and deducts funds from virtual accounts without major disruptions or errors. The design allows for scalability, enabling potential expansion to cover additional road segments or integration with existing toll collection infrastructure.

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