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IOT BASED UNMANNED TOLLBOOTHMONITORING SYSTEM

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ABSTRACT
Managing multiple toll booths is a very complicated task. The system here is a smart Card based tollbooth system that is monitored using IoT. The Internet server maintains all the data of user accounts and also their balance. All vehicle owners would possess an RFID (Radio Frequency Identification) based card that stores their RFID number. The system at toll booths will monitor the cards scanned when a car arrives at the tollbooth. The system then connects to the online server to check if the card is valid and if valid what is the balance. If user balance is sufficient, the toll amount is deducted online and web system sends signal back to the card scanner system that the user has beenbilled. On receiving this signal the system operates a motor to open the toll gate for that car. The system is controlled by a microcontroller to achieve this purpose. The microcontroller uses Wi-Fi connection to connect to the internet through which system interacts with web server to perform the online verification process. Also system allows to store data of all the vehicles passed at particular time intervals for later reference and surveillance. This system thus automates the entire tollbooth billing and monitoring process with ease using RFID plus IoT based system.

1. INTRODUCTION
An embedded system is a system which is going to do a predefined specified task is the embedded system and is even defined as combination of both software and hardware. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious. All embedded systems are including computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer. The very simplest embedded systems are

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capable of performing only a single function or set of functions to meet a single predetermined purpose. In more complex systems an application program that enables the embedded system to be used for a particular purpose in a specific application determines the functioning of the embedded system.

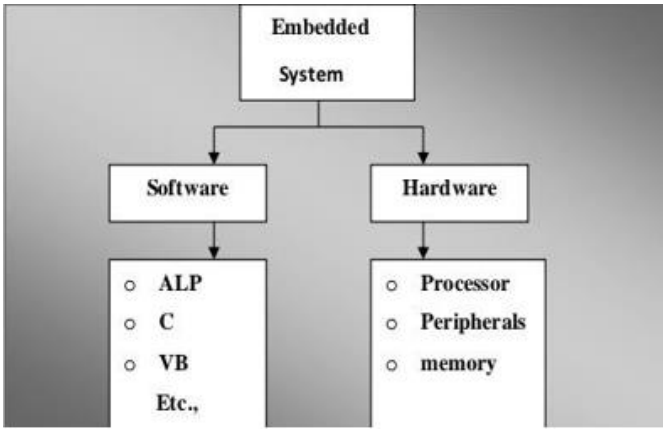

Figure:1.1 Block diagram of embedded system

1.1 The Full Wave Bridge Rectifier

Another type of circuit that produces the same output waveform as the full wave rectifier circuit above is that of the Full Wave Bridge Rectifier. This type of single phase rectifier uses four individual rectifying diodes connected in a closed loop "bridge" configuration to produce the desired output. The main advantage of this bridge circuit is that it does not require a special centre tapped transformer, thereby reducing its size and cost. The single secondary winding is connected to one side of the diode bridge network and the load to the other side as shown below.

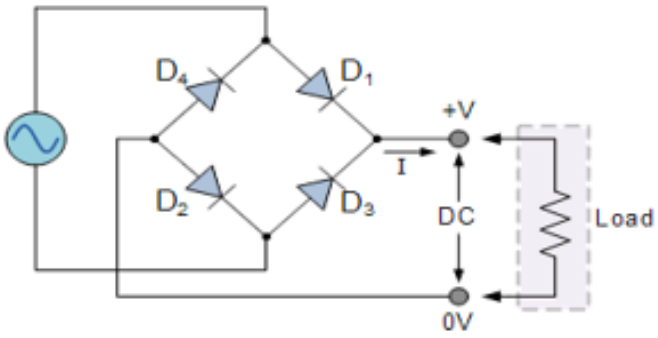

Figure:1.2. The Diode Bridge Rectifier

1.2 Capacitor Filter

The capacitor-input filter, also called "Pi" filter due to its shape that looks like the Greek letter pi, is a type of electronic filter. Filter circuits are used to remove unwanted or undesired frequencies from a signal.

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A typical capacitor input filter consists of a filter capacitor C1, connected across the rectifier output, an inductor L, in series and another filter capacitor connected across the load.

1. The capacitor C1 offers low reactance to the AC component of the rectifier output while it offers infinite reactance to the DC component. As a result the capacitor shunts an appreciable amount of the AC component while the DC component continues its journey to the inductor L
2. The inductor L offers high reactance to the AC component but it offers almost zero reactance to the DC component. As a result the DC component flows through the inductor while the AC component is blocked.

2. LITERATURE SURVEY

2.1 Existing System

Radio-frequency identification (RFID) is method for Automatic Identification and Data Capture. It uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically-stored information. Generally the tags are classified as active tags and passive tags.

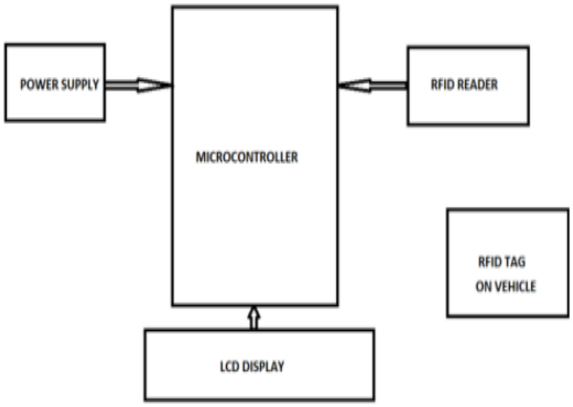

Figure:2.1. block diagram of existing system

3. CIRCUIT DESCRIPTION

In the developing countries we have seen a lot of crime happening at the bridges and highways. Specially, during evening and midnight many occurrence like- hijacks, murders etc. are commonly taking place. However, those criminals easily get escaped from the crime zone and victims lose their valuable assets including cars, jewelries etc. Although the presence of police, sometimes it gets difficult for them to identify the right vehicle and stop it for the checking. Most of the cases those vehicles pass the toll booth area by giving toll amount and no one can identify the criminals. To avoid those problems we have built an advanced security system which is integrated with the automated RFID based tolling system. This system will not let the criminals pass the toll booth

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area even after paying the toll amount. Thus, the crime rates at highways and bridges can be reduced. The overall system is user friendly, fast responsive and convenient for the developing countries. By implementing this system in the highways and bridges, primary steps can be taken to resist a criminal or any sort of crime. As the data of each vehicle owner should be recorded in the database previously, so when any information of that vehicle owner is needed by the authority or police, it can be easily found from the database to ease the investigation process.

3.1 LCD 16×2

It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

Figure:3.1. 16x2 LCD

3.2 8051 Microcontroller

The microcontroller like 8051 was designed in the year 1981 by Intel. The microcontroller is one kind of integrated circuit that includes 40-pins with dual inline package or DIP, RAM-128 bytes, ROM-4kb & 16-bit timers–2. Based on the requirement, it includes addressable & programmable 4 – parallel 8-bit ports. In the 8051-microcontroller architecture, the system bus plays a key role to connect all the devices to the central processing unit. This bus includes a data bus- an 8-bit, an address bus-16-bit & bus control signals. Other devices can also be interfaced throughout the system bus like ports, memory, interrupt control, serial interface, the CPU, timers.

Features of microcontroller

The main features of the 8051-microcontroller architecture include the following.

- 8-bit CPU through two Registers A & B.
- 8K Bytes – Internal ROM and it is a flash memory that supports while programming the system.
- 256 Bytes – Internal RAM where the first RAM with 128 Bytes from 00H to 7FH is once more separated into four banks through 8 registers in every bank, addressable registers -16 bit & general-purpose registers – 80.
- The remaining 128 bytes of the RAM from 80H to FFH include Special Function Registers (SFRs). These registers control various peripherals such as Serial Port, Timers, all I/O Ports, etc.

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- Interrupts like External-2 & Internal-3.

3.3 DC Motor

A DC motor is defined as a class of electrical motors that convert direct current electrical energy into mechanical energy.From the above definition, we can conclude that any electric motor that is operated using direct current or DC is called a DC motor. We will understand the DC motor construction and how a DC motor converts the supplied DC electrical energy into mechanical energy in the next few sections.

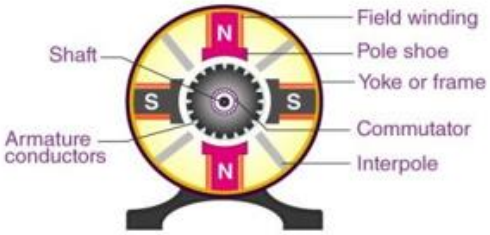

Figure:3.2. DC Motor Construction parts

3.4 Applications

RFID reader applications are the same as those for RFID tags, since one is useless without the other. Some common applications include those listed below.

- Encrypted readers are employed in scenarios where the RFID is directly linked to a credit or banking account. These readers will sometimes feature a keypad, so the user can enter a PIN and supplementary info.
- In asset tracking, fixed readers are placed at access points so tags can be automatically scanned as it passes. This includes factories and warehouses, as well as retail stores which utilize electronic article surveillance.

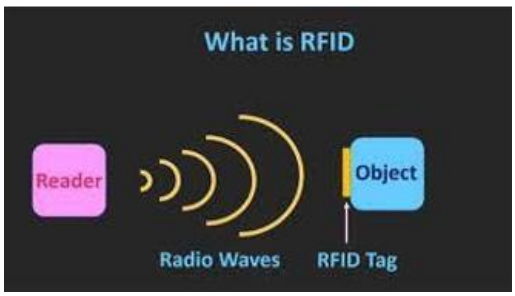

Figure:3.3. Transmission of radio waves

4. SOFTWARE USED

SOFTWARE EXPLANATION:

Software Requirements

- Keil software
- Proteus simulation

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- Programming language

4.1 Keil Software

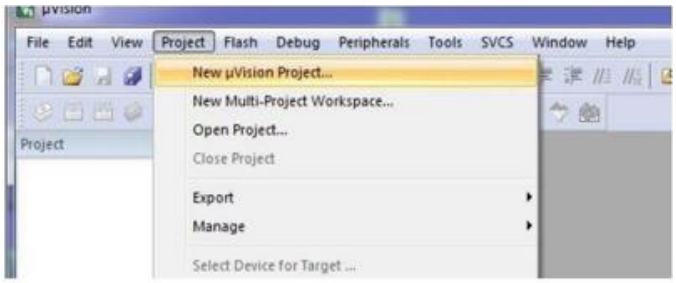
Keil development tools for the 8051 Microcontroller Architecture support every level of software developer from the professional applications engineer to the student just learning about embedded software development. The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, Real-time Kernels, Single-board Computers, and Emulators support all 8051 derivatives and help you get your projects completed on schedule.

4.2 Programming Using Keil µVision IDE

Step 1: Downloading Keil µVision IDE

Please click on the C51 icon to download 8051 development tools (above Figure) . and download your Windows Executable.

Step 2: Creating a 8051/8052 Project Using Keil Uvision IDE



After you have installed the Keil uVision tools for 8051, Double click on the Keil icon on your Windows Desktop to launch the IDE. To create a new 8051 project using Keil IDE, Click on the ' Project ' item on the IDE Menu bar and select ' New uVision Project... 'as shown in the above image. Now create a Folder to store your project and give a name to your Project files (*.uvproj), for eg Test (Test.uvproj).

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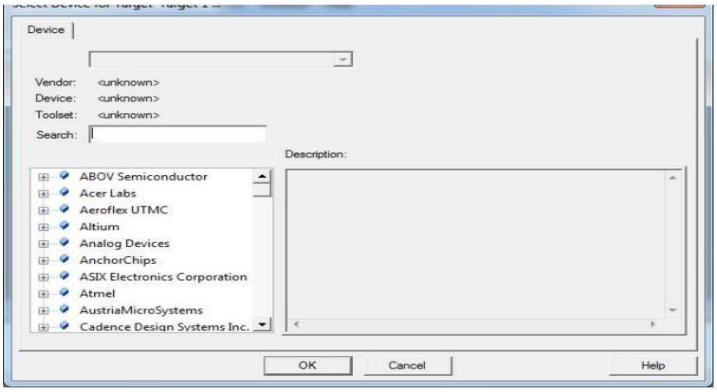
Step 3: Selecting an 8051 Device in Keil



You will then be taken to the device selection dialog, where you can select the 8051 derivative for which you want to develop software.

Step 4: Click yes to copy 'STARTUP.A51'

After selecting your 8051 derivative
You will get another dialog as shown Above.Asking to copy STARTUP.A51 Click "Yes"

4.3 MC Programming Language: Embedded C

This is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements. Embedded C is perhaps the most popular languages among Embedded Programmers for programming Embedded Systems. There are many popular programming languages like Assembly, BASIC, C++ etc. that are often used for developing Embedded Systems but Embedded C remains popular due to its efficiency, less development time and portability.

5. METHODOLOGY

Radio Frequency Identification (RFID) Card Readers provide a low-cost solution to read passive RFID transponder tags up to 2 inches away. The RFID Card Readers can be used in a wide variety of hobbyist and commercial applications, including access control, automatic identification,

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robotics navigation, inventory tracking, payment systems, and car immobilization. The RFID card reader read the RFID tag in range and outputs unique identification code of the RFID tag. The RFID reader can interface to microcontroller or PC and the unique identification code of the RFID tag received by the RFID reader is send through serial at baud rate of 9600. This project is built on 8051 micro controller; the project consists of RFID reader, LCD, motor and a motor driver. When the vehicle approaches the toll gate, the user has to show the RFID card to the reader. Then the system will automatically deducts the predefined amount from the users account and the remaining amount is shown on the LCD, at the same time, a motor will be rotated to open the gate, with some delay the gate will be closed. This process continues until the amount in the users account exudes. In this project, 7805 is a regulator and it avoids noise spikes in power supply. RFID modem is connected microcontroller through serial port. These RFID modem works under 9600 or 4800 baud rates. 16X2 LCD connected to microcontroller through digital I/O lines.

6. RESULT

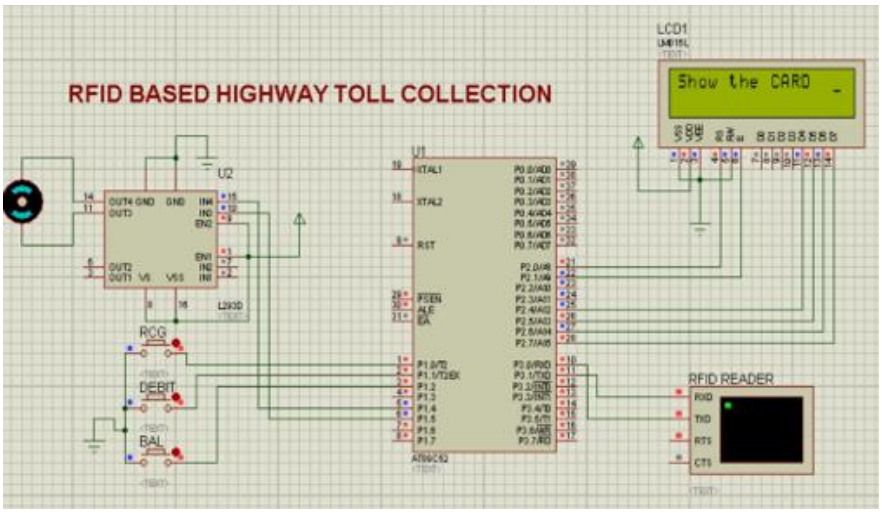

Figure:6.1. Initially the user need to show the authorized card

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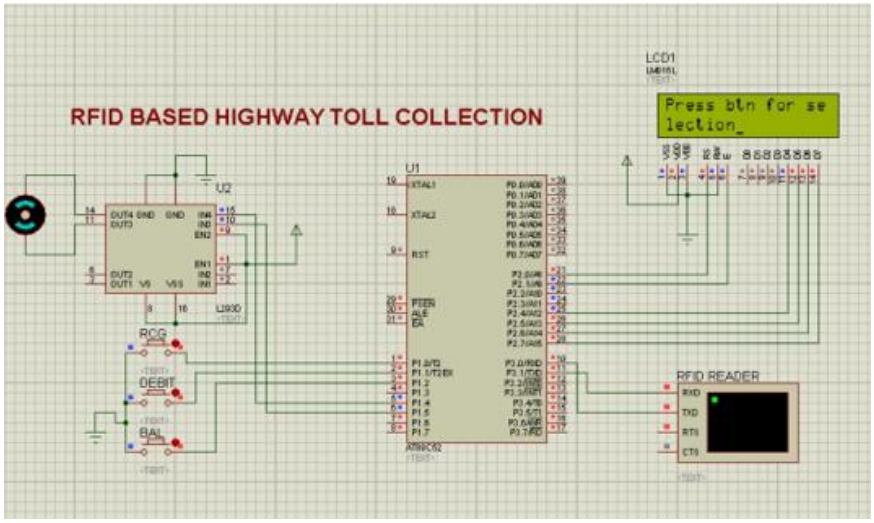

Figure:6.2. The user need to select one among the three buttons

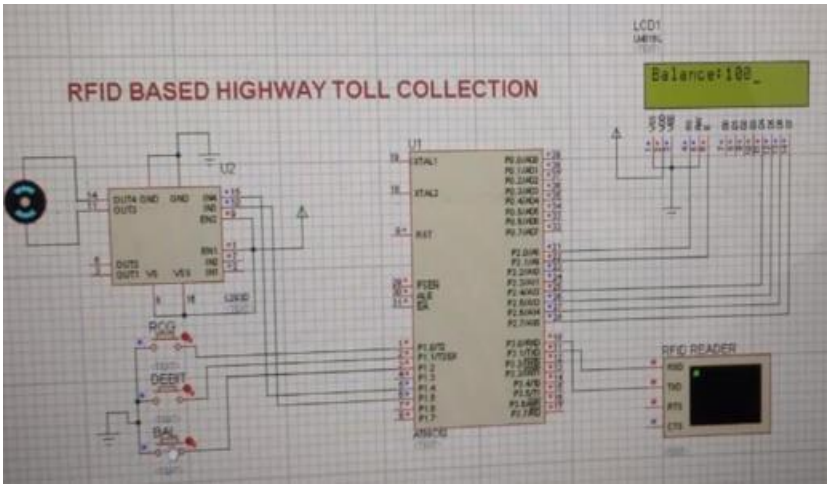

Figure:6.3. The output we get when we select the balance button

7. CONCLUSION AND FUTURE SCOPE

7.1 CONCLUSION

The "IOT Based Toll Booth Management System" is a prototype of the toll system using RFID which supports the vehicle to pass across the toll with ease and hassle free. The system aims in making the toll booths free of long queue and also eliminates the clumsy manual work. The proposed solution also sends the user transaction details; this makes the transaction open which is free from all corruptions. The information such as the vehicle No, toll gate no and the timings at which the vehicle pass are recorded in the cloud which helps in analysis for the future unforeseen reason. The easy availability of real time total toll revenue collection data figures over IoT cloud platform will also help the government to collect road tax properly. The combination of RFID system and Adafruit IoT platform appeared effective to detect stolen vehicles, informing the

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respective authority about their whereabouts and prevent their trespassing across states, districts, borders. Thus the existing toll management system can be completely implemented with this technology so that the transaction will be digital without any burden to carry the cash and also the journey becomes ease at the toll. Since most of the fuel is wasted by keeping the engine idle in the toll.

7.2 FUTURE SCOPE

In this paper, we have presented the implementation of IoT technology in the application of Toll Tax Collection. This method at toll collection stations allow the traffic to flow continuously and vehicle having been avoided stopping and starting again. The reduced fuel consumption has positive effect on environment which means pollution created will be minimum. Furthermore, the system also increases safety, as bottlenecks and long queues are avoided. Society and business community also benefits from the system because of its results in faster transportation. This system is cost-effective, time saving and easy to install which benefits the operator as well as user. IoT based toll booth monitoring system is a Arduino based toll collection system. The results obtained from working have shown that the system performance is quite reliable. The system has successfully overcome the shortcomings of the existing system by reducing the manpower at the toll booth. It provides easy way of toll collection and maintenance of the information.

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