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SMART TOLL GATE CONTROL SYSTEM BY NUMBER PLATE DETECTION USING ARDUINO

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Abstract:

An Automated Toll Collection System used for collecting tax automatically. In this we do the identification with the help of radio frequency. A vehicle will hold an RFID tag. This tag is nothing but unique identification number assigned. This will be assigned by RTO or traffic governing authority. In accordance with this number we will store, all basic information as well as the amount he has paid in advance for the TOLL collection. Reader will be strategically placed at toll collection Centre. Whenever the vehicle passes the toll Naka, the tax amount will be deducted from his prepaid balance. New balance will be updated. In case if one has insufficient balance, his updated balance will be negative one. To tackle this problem, we are alarming a sound, which will alert the authority that this vehicle doesn't have sufficient balance and that particular vehicle can be trapped. As vehicles don't have to stop in a queue, it assures time saving, fuel conservation and also contributing in

INTRODUCTION

An embedded system is a special-purpose computer system designed to perform one or a few dedicated functions, sometimes with real-time computing constraints. It is usually embedded as part of a complete device including hardware and mechanical parts. In contrast, a general-purpose computer, such as a personal computer, can do many different tasks depending on programming. Embedded systems have become very important today as they control many of the common devices we use.

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BLOCK DIAGRAM

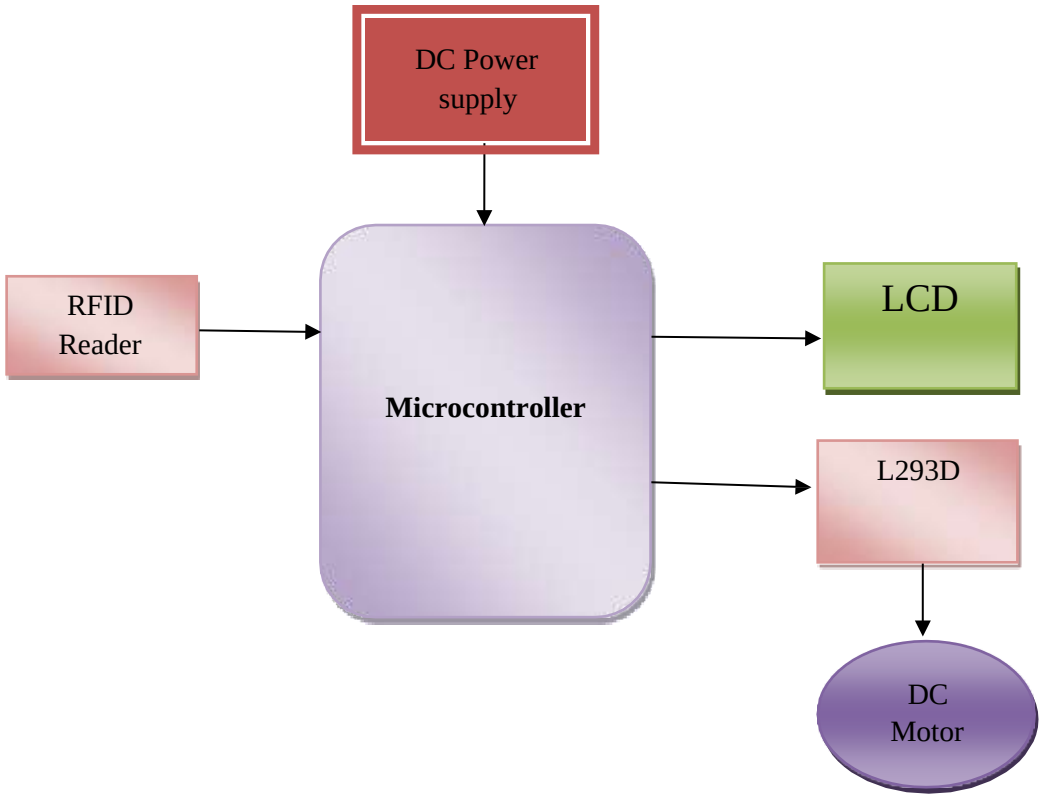

Figure.2.1. Block Diagram of Smart Toll Gate Control System by Number Plate Detection using Arduino

WORKING

ATCS is an Automated Toll Collection System used for collecting tax automatically. In this we do the identification with the help of radio frequency. A vehicle will hold an RFID tag. This tag is nothing, but unique identification number assigned. This will be assigned by RTO or traffic governing authority. In accordance with this number we will store, all basic information as well as the amount he has paid in advance for the TOLL collection. Reader will be strategically placed at toll collection center. Whenever the vehicle passes the toll Naka, the tax amount will be deducted from his prepaid balance.

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Internal Block Digram

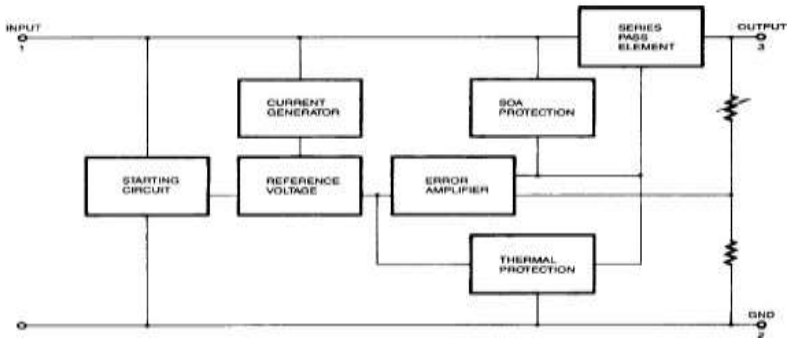

Figure: Block Diagram of voltage Regulator

Version	Family
ARMv1	ARM1
ARMv2	ARM2, ARM3
ARMv3	ARM6, ARM7
ARMv4	Strong ARM, ARM7TDMI, ARM9TDMI
ARMv5	ARM7EJ, ARM9E,ARM10XE
ARMv6	ARM11
ARMv7	Cortex

Table: Different version of ARM Family

ARM architecture

ARM is predicated on reducing instruction set pc architecture; it suggests that the core cannot directly operate with the memory. All operations should be done by registers with the knowledge that is found within the memory. The operation of information and storing the worth back to the memory. ARM consists of 37 register sets, 31 general purpose registers and 6 are standing registers. The ARM uses 7 handing out modes that are used to track the user task

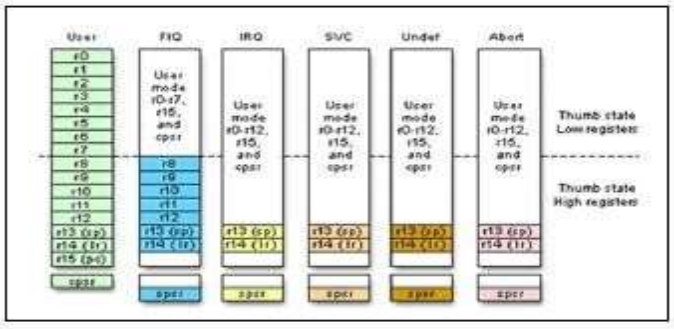

Fig:2.9. Block Diagram of ARM architecture

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- USER mode
- FIQ mode
- IRQ mode
- SVC mode
- UNDEFINED mode
- ABORT mode
- THUMB mode

User mode:

The user mode could be a traditional mode; that has least variety of registers. It doesn't have SPSR and restricted access to the CPSR.

Supervisor mode: The Supervisor mode is that the package interrupt mode of the processor to start out up or reset.

Undefined mode

The undefined mode traps illegitimate directions are dead. The ARM core consists of 32-bit knowledge bus and quicker knowledge flow.

THUMB mode

In THUMB mode the 32-bit of information divided into 16-bits and will increase the process speed. Some of the registers are reserved in every mode for specific use by the core. The reserved registers are.

- SP (stack pointer).
- LR (link register).
- Computer (program counter).
- CPSR (current program standing register).
- SPSR (saved program standing register

2.1. ARM 7 LPC2148

The raise 16/32-bit ARM7TDMI-S microcontroller coaching board is specifically Designed to assist students to master the desired skills within the space of embedded systems. The kit is designed in such means that each one the potential options of the microcontroller are going to be simply used by the scholars.

LPC2148 Chip Features

- 16-bit/32-bit ARM7TDMI-S microcontroller in an exceedingly small LQFP64

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package.

- 8 KB to forty KB of on-chip static RAM and thirty-two KB to 512 KB of on-chip non-volatile storage.
- 128-bit wide interface/accelerator allows high-speed sixty megacycle operation.
- In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot
- Loader code Single flash sector or full chip erase in four hundred ms and programming of 256 bytes in one Ms.
- Embedded ICE RT and Embedded Trace interfaces supply period debugging with the
- on-chip Real Monitor code and high-speed tracing of execution.
- USB 2.0 Full-speed compliant device controller with two KB of end RAMS.
- Single 10-bit DAC provides variable analog output (LPC2142/44/46/48 only).
- Two 32-bit timers/external event counters (with four capture and 4 compare channels each), PWM unit (six outputs) and watchdog.
- Low power period Clock (RTC) with freelance power and thirty-two kilocycles per second clock input.
- Multiple serial interfaces together with 2 UARTs (16C550), 2 quick I2C-bus (400 Kbit/s),
- SPI and SSP with buffering and variable knowledge length capabilities.

ANTENNA

The antenna emits radio signals to activate the tag and read and write data to it. Antennas are the conduits between the tag and the transceiver, which controls the system's data acquisition and communication. Antennas are available in a variety of shapes and sizes; they can be built into a door frame to receive tag data from persons or things passing through the door or mounted on an interstate tollbooth to monitor traffic passing by on a freeway. The electromagnetic field produced by an antenna can be constantly present when multiple tags are expected continually.

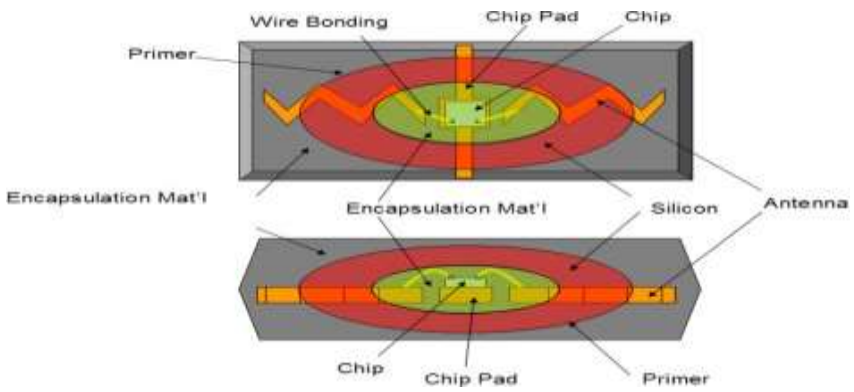

Figure:2.13. Block Diagram of Antenna working

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TAGS (Transponders)

An RFID tag is comprised of a microchip containing identifying information and an antenna that transmits this data wirelessly to a reader. At its most basic, the chip will contain a serialized identifier, or license plate number, that uniquely identifies that item, like the way many bar codes are used today. A key difference, however, is that RFID tags have a higher data capacity than their bar code counterparts.

Figure: 2.14. Circuit Diagram of RFID TAGS

Data capacity

The amount of data storage on a tag can vary, ranging from 16 bits on the low end to as much as several thousand bits on the high end. Of course, the greater the storage capacity, the higher the price per tag.

Form factor

The tag and antenna structure can come in a variety of physical form factors and can either be self-contained or embedded as part of a traditional label structure (i.e., the tag is inside what looks like a regular bar code label—this is termed a 'Smart Label') companies must choose the appropriate form factors for the tag very carefully and should expect to use multiple.

Passive versus active

“Passive” tags have no battery and "broadcast" their data only when energized by a reader. That means they must be actively polled to send information.

Frequencies

Like all wireless communications, there are a variety of frequencies or spectra through which RFID tags can communicate with readers. Again, there are trade-offs among cost, performance, and application requirements. For instance, low-frequency tags are cheaper.

EPC Tags

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EPC refers to "electronic product code," an emerging specification for RFID tags, readers and business applications first developed at the Auto-ID Center at the Massachusetts Institute of Technology.

RF Transceiver

The RF transceiver is the source of the RF energy used to activate and power the passive RFID tags. The RF transceiver may be enclosed in the same cabinet as the reader, or it may be a separate piece of equipment. When provided as a separate piece of equipment, the transceiver is commonly referred to as an RF module.

Typical Applications for RFID

- Automatic Vehicle identification
- Inventory Management
- Work-in-Process
- Container/ Yard Management
- Document/ Jewelers tracking
- Patient Monitoring

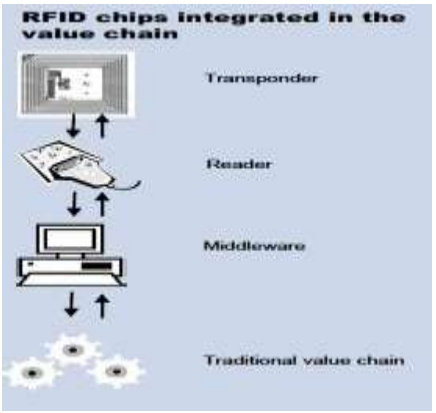

Figure:2.15. RFID integrated Chips

HARDWARE COMPONENTS

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4.1. POWER SUPPLY

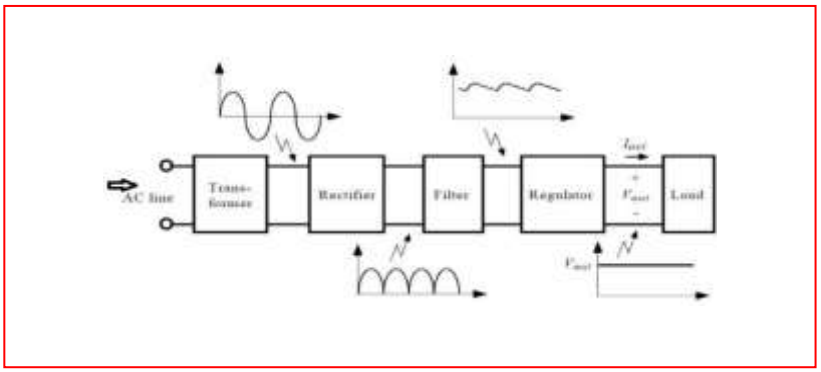


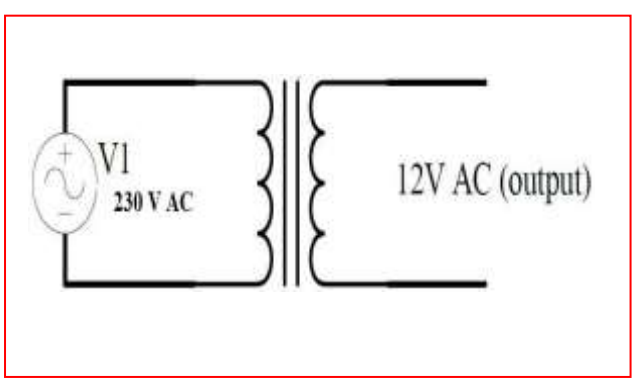
Figure.4.1. power supply

4.1.1. Transformer

Transformer is a static device used to convert the voltage from one level to another level without change its frequency. There are two types of transformers.

1. Step-up transformer
2. Step-down transformer

Step-up transformer converts low voltage level into high voltage level without change its frequency. Step-down transformer converts high voltage level into low voltage level without change its frequency. In this project we are using step-down transformer which converts 230V AC to 12V AC [or] 230V AC to 5V as shown below.



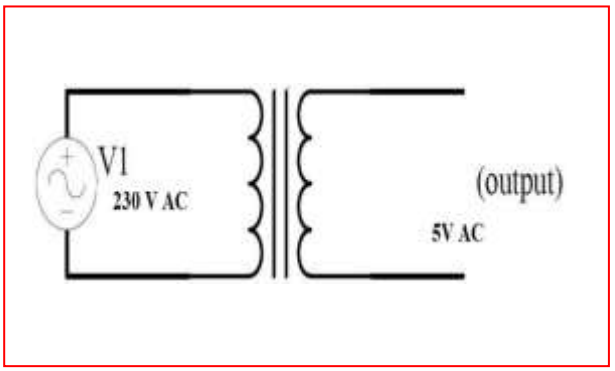


Figure. Transformers

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Diodes

Diodes allow electricity to flow in only one direction. The arrow of the circuit symbol shows the direction in which the current can flow. Diodes are the electrical version of a valve and early diodes were called valves.

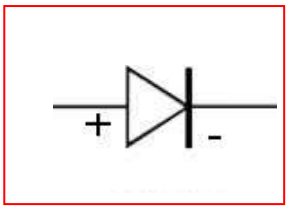

Figure.4.3. Diode Symbol

A **diode** is a device which only allows current to flow through it in one direction. In this direction, the diode is said to be 'forward biased' and the only effect on the signal is that there will be a voltage loss of around 0.7V. In the opposite direction, the diode is said to be 'reverse-biased' and no current will flow through it.

Rectifier

The purpose of a rectifier is to convert an AC waveform into a DC waveform (OR) Rectifier converts AC current or voltages into DC current or voltage. There are two different rectification circuits, known as **'half-wave'** and **'full wave' rectifiers**. Both use components called **diodes** to convert **AC into DC**.

The Half-wave Rectifier

The half-wave rectifier is the simplest type of rectifier since it only uses one diode, as shown in figure.

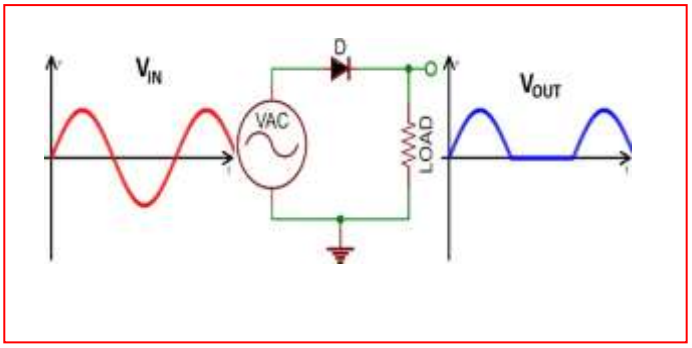

Figure.4.4. Half Wave Rectifier

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Figure 2 shows the AC input waveform to this circuit and the resulting output. As you can see, when the AC input is positive, the diode is forward-biased and lets the current through. When the AC input is negative, the diode is reverse-biased and the diode does not let any current through, meaning the output is 0V. Because there is a 0.7V voltage loss across the diode, the peak output voltage will be 0.7V less than Vs.

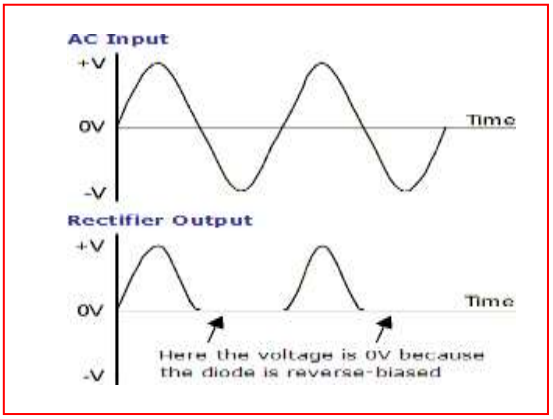

Figure.4.5. Half-Wave Rectification

While the output of the half-wave rectifier is DC (it is all positive), it would not be suitable as a power supply for a circuit. Firstly, the output voltage continually varies between 0V and Vs-0.7V, and secondly, for half the time there is no output at all.

The Full-wave Bridge Rectifier

The circuit in figure 3 addresses the second of these problems since at no time is the output voltage 0V. This time four diodes are arranged so that both the positive and negative parts of the AC waveform are converted to DC. The resulting waveform is shown in figure 4.

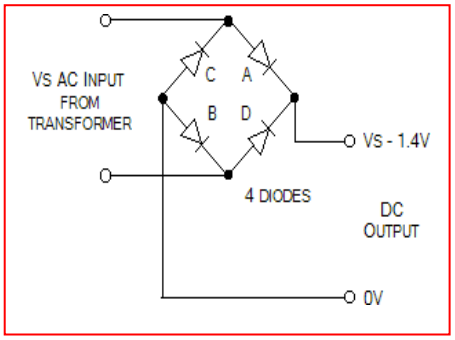

Figure. Full-Wave Rectifier

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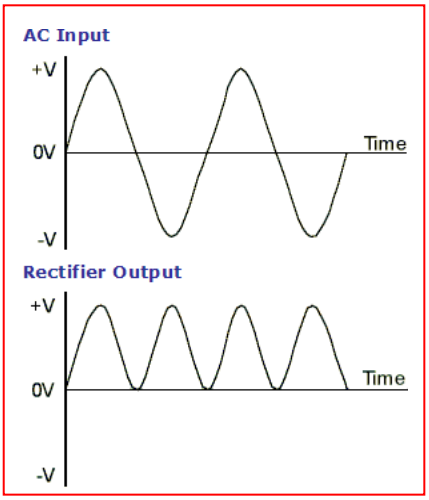

Figure. Full-Wave Rectification

Results:

The following figure provides the experimental setup of the system which is proposed inthis paper. The proposed system utilizes two RFID card i.e., one is valid card and another oneis Invalid card. The toll gate will be open when valid card is swiped & it will remain in closedstate upon swiping invalid card. The proposed system in this paper eliminates the long queues of the vehicles at toll plaza by making it fully automatic by utilizing Arduino UNO controller, which is the heart of project, GSM (Global System for Mobile communication) for sending messages, RFID card and reader modules, servo motor, Buzzer, 16X2 LCD display, LED, Buzzer, Node MCU ESP8266 Wi-Fi module and L293D motor driver IC.

The proposed system provides automation is toll collection system by providing Rechargeable RFID cards that acts as unique cards for every driver, whenever the driver arrives at the toll plaza, he/she must swipe the respected RFID card in front of the RFID reader and the required amount at the toll plaza will be automatically deducted by the Arduino UNO processor. The message of deduction amount and the available amount in the drivers account will be sent over web server with the help of ESP8266 Node MCU module and to the registered mobile number with the help of GSM module. The proposed system also incorporates 16X2 LCD, buzzer and on-board power supply circuitry.

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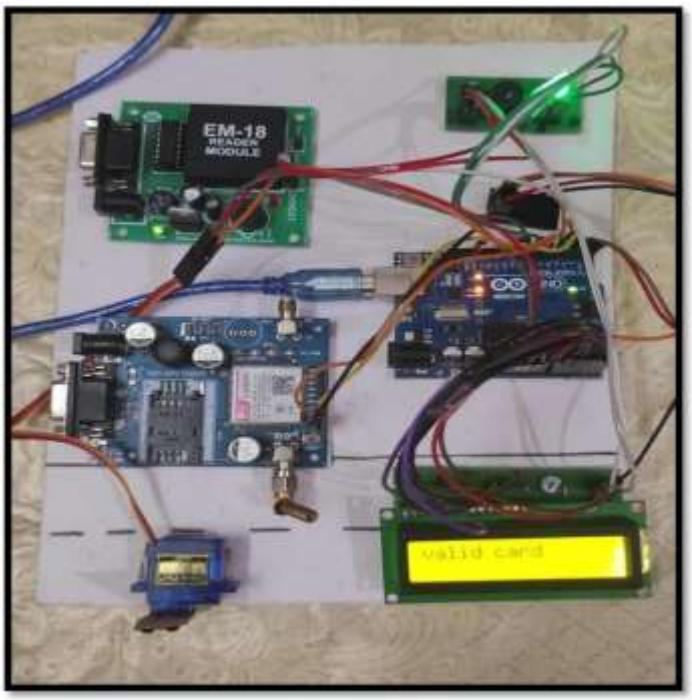

Fig.. Experimental setup of Smart Toll Tax System

CONCLUSION

In ANPR system, the picture of vehicle number plate is taken with the camera and the license number of the vehicle is perceived with the goal that the data and information of the vehicle owner can be obtained. In our proposed system, we have performed a technique in which the picture of the vehicle plate is taken. At that point, the noise diminishment is performed on it to show signs of enhancement come about. After this, segmentation and binarization is performed. We make a matrix dataset of characters and train it on neural network then identification of characters is done using trained neural network.

FUTURE SCOPE

In future, Image capturing system will install. Camera will place on door, when car will arrive camera capture picture of front of car then localizes the number plate and do further recognition process. If number plate is authorized, then door will open otherwise an alarm will ring.

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