Sudan University of science and technology

College of Engineering

Electronics Engineering Department

Vehicle's Automatic Speed Control Using RFID

التحكم التلقائي في سرعة السيارات باستخدام تقنية ال RFID

A Research Submitted in Partial fulfillment for the Requirements of the Degree of B.Sc. (Honors) in Electronics Engineering

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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

قال تعالى :

(وَمَا تَكُونُ فِي شَأْنٍ وَمَا تَتْلُو مِنْهُ مِن قُرْآنٍ وَلَا تَعْمَلُونَ مِنْ عَمَلٍ إِلَّا كُنَّا عَلَيْكُمْ شُهُودًا إِذْ تُفِيضُونَ فِيهِ ۚ وَمَا يَعْزُبُ عَن رَّبِّكَ مِن مِّثْقَالِ ذَرَّةٍ فِي الْأَرْضِ وَلَا فِي السَّمَاءِ وَلَا أَصْغَرَ مِن ذَٰلِكَ وَلَا أَكْبَرَ إِلَّا فِي كِتَابٍ مُّبِينٍ)

صدق الله العظيم

آية (61) سورة يونس

إهداء

إلى سبب وجودنا في الحياة ..

أمي و أبي

يا من تعجز الحروف عن إرضائكم

....

لكم كل الحب والاحترام

Acknowledgement

First, Praise be to Allah that by His grace Good works completed, we thank Allah that for help us to accomplish this project and give us the ability to develop it and all the knowledge we have gained during making this project.

Our appreciation to our colleagues, teachers, brothers and sisters, the authors also would like to thank *Dr.Abuagla Mohammed* for their constant guidance and support.

College of Engineering We have learned from you that the success have value and meaning... and you learned us how to be a dedicated and sincerity to work with you... and we have learned that not impossible, for the sake of creativity ... so you must honored with wreaths of flowers.

Our beloved Moms and Dads thank you for your efforts… but thanks phrases ashamed of you because you are higher than it, you have turned failure to success rises in the peaks.

Abstract

This project aims at automatically controlling vehicles at speed restricted areas such as schools, hospital zones etc.

Nowadays the drivers drive vehicles at high speed even in speed limited areas without considering the safety of the public, the traffic police are not able to control them with full effect. Also it is not practical to monitor these areas throughout. This project paves way for controlling the speed of the vehicles within certain limit in restricted zones without interruption of the drivers. An RFID is used for this purpose. The RFID reader is attached along with the vehicle and the RFID tag with these zones. These tags are programmed to send a coded signal when the reader comes in proximity.

Whenever the vehicles enter into these zones their receivers will receive this code and the speed of the vehicles is controlled automatically with the help of the Arduino unit present inside the vehicle. The tags are placed at the beginning and the end of the regions for which the speed should be reduced.

المستخلص

يهدف هذا المشروع إلى التحكم تلقائياً فى سرعة المركبات عند المناطق محددة السرعة مثل المدارس المستشفيات الخ .

في الوقت الحاضر نجد أغلب السائقين يقودون بتهور وبسرعات عالية حتى في المناطق محددة السرعة دون النظر لسلامة المواطنين، ولا تستطيع شرطة المرور مراقبة و ضبط كل تلك المناطق بفعالية تامة ، كما أنه ليس من العملي رصد هذه المناطق طوال الوقت

فى هذا المشروع نمهد الطريق للتحكم فى سرعة المركبات فى المناطق محدودة السرعة دون تدخل السائقين ، حيث قمنا بإستخدام تقنية التعرف على الموجات الراديوية، وذلك تثبيت المستقبل على المركبة بينما الرقاقات توضع عند بداية ونهاية المناطق المراد تقليل السرعة عندها ،هذه الرقاقات مبرمجة على إرسال إشارة مشفرة عند إقتراب المركبة من تلك المناطق .

عند دخول المركبة المنطقة المحددة يلتقط جهاز الإستقبال الموجود في المركبة إشارة الشفرة الصادرة من تلك الرقاقة ويتم التحكم في سرعة المركبات تلقائيا بمساعدة وحدة اردوينو المدمجة داخل السيارة.

يتم وضع علامات في بداية ونهاية للمناطق التي ينبغي خفض السرعة لها.

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Abbreviations

3G	Third Generations
DC	Direct Current
ECU	Electronic Control Unit
EDC	Electronic Display Controller
ETCS	Electronic Throttle Control System
GND	Ground
GPRS	General Packet Radio Services
GPS	Global positioning system
GSM	Global System of Mobile
I2C	Interface to Communicate
ICSP	In-Circuit Serial Programming
IDE	Integrated Development Environment
IR	Infrared
KHz	kilohertz
LCD	Liquid Crystal Diode
LDR	Light Dependent Resisters

LED	Lighting Emitting Diode
PC	Personal Computer
PIN	Personal Identification Number
PROM	Programmable Read Only Memory
PWM	Pulse width Modulation
R3	Rev3
R3	Rev3
RAM	Read All Memory
RF	Radio frequency
RF	Radio Frequency
RFID	Radio Frequency Identification
RFID	Radio Frequency Identification
ROM	Read Only Memory
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver/Transmitter
WIFI	Wireless Fidelity

Chapter one

Introduction

Chapter One

Introduction

1.1 Preface

Most of the road accidents occur due to over speed and rash driving of vehicles on public roads. The rate of accidents has increased as more vehicles come on to ground. Usually the drivers drive the vehicles at high speed without considering the public in speed limited areas too. Even though the traffic police control them we cannot achieve full response from them. Also it is not possible to monitor those areas at all time to regulate their speed Research on fully and partially automated roadway systems is being conducted in most developed countries. The major technologies are unlikely to be introduced before the end of the century and some are unlikely to be implemented within two decades. These systems offer excellent opportunities to control vehicle speeds and movements in order to avoid accidents but they rely, of course, on sophisticated features built into the roadway and vehicle. Progress with these systems should be monitored but they are unlikely to offer any significant short term solutions. But various types of accident are occurred on express highway road, highway road, off road just because of small uncertain activities. Rash driving, system failure, collision due to obstacles, exiting speed control limit etc. are just some causes of accidents. For prevention of this accident, government made some rules. Such as helmet, seat belt compulsion etc. Speed control at particular type of road is also necessary to avoid accidents. For this, there is no any system to control the speed of vehicle. That's why, there is need to invent such system which control the speed of vehicle automatically at given limit at particular limiting distance. If this concept methodology system is possible, the problems related to traffic as well as accidents due to collision will be controlled. Now it is possible to control or set the speed of vehicle at a given limit on the roads like highways, school zones, hospital zones...etc express high ways and any area where the speed limit is desired by the technique suggested in methodology described in this project. In our country mostly 60 km/hr. limit for high ways and below 80km/hr. limit for express highways. Thus this project paves way for controlling the speed of the vehicles within certain limit in those restricted zones without the interruption of the drivers. This developed system is applicable for any speed limit which can be set or controlled as per the roads. In this project, the proposed methodology is suggested that one such kind of speed control system based on radio frequency detection for highway and restricted zones. [7]

1.2 Problem statement

Nowadays people are driving very fast; accidents are occurring frequently, we lost our valuable life by making small mistake while driving (school zone, hospital zones, hills area, and highways). So in order to avoid such kind of accidents and to alert the drivers and to control their vehicle speed in such kind of places the highway department have placed the signboards. But sometimes it may not possible to view that kind of signboards and there is a chance for accident. Thus, the existences of an automatic regulation of vehicle near by the critical zones are highly required.

1.3 Proposed Solution

The proposed solution for this topic is to prepare a model which will show the experimental view of this project covering the theoretical as well as practical areas related to this project this model will also show the practical implementation of the device which could be fitted in to the vehicles for safety purposes.

We should come with a model which will show the experimental view of Smart Display and control device through which the Idea of automated speed control concept to prevent the accident and control traffic would be more clearly understood. We are actually presenting the layout of the project on which we will be working.

1.4 Objective

The main objective is to design Electronic control unit meant for vehicle's speed control and monitors the zones, which can run on an embedded system. Electronic control unit (ECU) can be custom designed to fit into a vehicle's dashboard, and displays information on the vehicle.

And to intimate the driver about the zones and the speed limit automatically.

1.5 Methodology

It consists of an RFID system which gives the reference speed to the ECU (Electronic control unit). The actual speed of the vehicle is measured using a sensor and is given as another input to ECU. The RFID reader and ECU part resides in the vehicle whereas the RFID tag is connected to speed limit signs on roads. The output of the electronic control unit is used to manage the speed of the vehicle.

During speed limited situation, the tags are detected by the reader present in the vehicles. Reader produces an output which is again an input to the electronic control unit. On basis of an algorithm, the ECU analyses and produces an output signal. When the accelerator pedal is moved to increment the speed, microcontroller calculates the speed that would be reached on the new pedal position. If the speed is greater than the maximum speed limit then it denies excess speed and gives appropriate signal to the ECU.

1.6 Thesis outline

Chapter 2 - Literature review is representing a huge amount of researches that have been done.

Chapter 3 - System design describe all the work steps.

Chapter 4 - Results & Discussion

Chapter 5 - Conclusion & Recommendations

Chapter Two

Literature Review

Chapter two

Literature Review

2.1Theoritical Background

Up until the late 1980s, most cars had a fairly straight forward throttle control. You stepped on the accelerator pedal, the throttle opened by pushing the mechanical throttle cable between the driver's foot and the engine throttle body and air flowed into the engine, where it mixed with gasoline and burned. This burning gas powered the car's wheels, getting you down the road. If you wanted to go faster, all you had to do was step down harder the throttle would open wider, giving the car more power.

But electronic throttle control, which is sometimes called drive-by-wire, uses electronic, instead of mechanical, signals to control the throttle. That means that when you step on your car's gas pedal, instead of opening the throttle, you're activating an accelerator pedal module, which converts the pressure you put on the pedal into an electric signal. That signal is then sent to an electronic control unit, which takes your inputs into account, as well as outside variables, to open the throttle for optimum efficiency and performance.

It's a complex system, but one that has a lot of benefits for engine wear, performance and efficiency.[8]

2.2 Electronic throttle control system

ETCS which changes the operation of the accelerator pedal into electrical signal by using ECU (electronic control unit) for controlling the opening and closing the throttle valve by moving the motor in accordance with driving conditions as shown in Figure (2-1) .

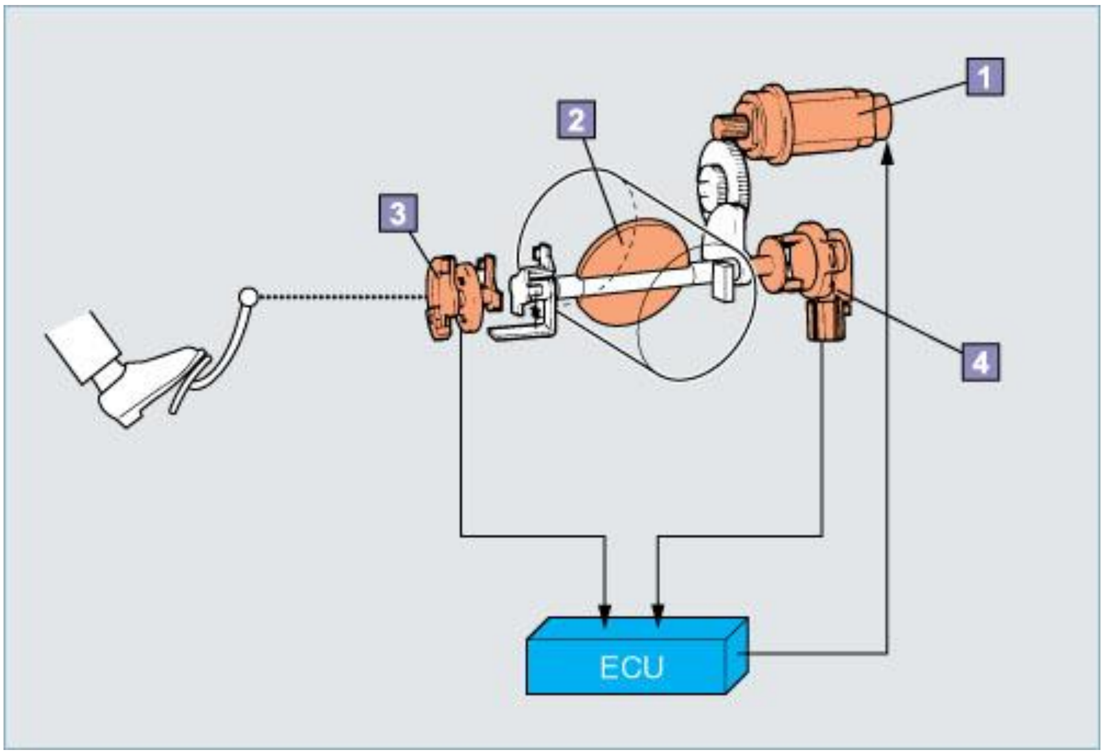


Figure 2-1: Electronic throttle control system in normal automobiles

1. Motor control

2. Throttle valve

3. Accelerator pedal sensor

4. Throttle position sensor

2.2.1 Motor Control

The module sends a command to the electric motor on the throttle body to open the throttle a certain amount, the throttle motor opens or closes the actual throttle blade, which increases or decreases the power output of the engine.[9]

2.2.2 Throttle Valve

It consists of cylinder centered by circular plat which rotates via the motor, this rotation open or close the throttle that controls the air flow into the engine.

2.2.3 Accelerator Pedal Sensor

When the gas pedal is depressed, the electrical resistances of the potentiometers inside the pedal sensors change. The control module notes the change in position and assumes the driver wants to go faster. The module then looks at other sensor inputs and calculates how much throttle opening is needed.

2.2.4 Throttle Position Sensor

In our system, a throttle pedal sensor sends data to an electronic throttle control computer, which evaluates and relays the throttle request to a specialized electronic throttle motor on the engine throttle body.

In our project we use Arduino Uno Rev3 as enhancement for ECU because the ECU has no method to control the vehicles automatically in critical zones, and we use potentiometer to simulate the operation of position sensor.

2.3 Related Works

2.3.1 RFID Technology

Radio Frequency Identification (RFID) technology shows a continuous growth in various application fields, like logistics, medical science, security, access control etc. The RFID system is a three component system consisting of: tag, reader and database. The access control, specifically, is detection of IDs entry to or exit from the range area of the RFID reader. Transponders (Tags) must have the circuitry needed to harvest power from the electromagnetic fields generated by the interrogator, the necessary memory elements, as well as the different control circuits. The simplest transponders contain only read-only memory (ROM), while more sophisticated transponders also include random access memory (RAM) and nonvolatile programmable read-only memory (PROM) or electrically erasable programmable read-only memory (EEPROM). ROM usually contains the identification string for the transponder and instructions for its operating system. The advantage of RFID is its low cost for tags and can be attached to the traffic signals easily.[10]

2.3.1.1 Main Working

The main objective is to replace road signs with RFID tags, and use in-vehicle RFID Reader-enabled modules to sense them, and provide useful information to the driver and design Electronic Display Controller meant for vehicle’s speed control which is an embedded system. The RF tag can be placed on an existing road sign to transmit the information provided by signals placed on the road to adapt the vehicle’s speed. Once the information is received from the RF tags, the vehicle’s Electronic Display

Controller automatically warns the driver, to reduce the speed according to the traffic sign indicated by the tag. It waits for few seconds for the driver's response to the information received; otherwise vehicle's EDC unit automatically reduces the speed.

The author (Chavan, D.B) Described how the Zone between two tags where the speed is controlled or reduced is called as Sensitive Zone. This process can be used not only to indicate Sensitive zones but also provide additional information to the drivers. Along with the primary objective of road safety, a plethora of other information can be provided to the commuter. Tags could disseminate additional information such as locations of nearby hospitals, fuel stations and food centers, by serving as Navigator. If there is road work or a construction in progress in a locality, installment of a tag a few km before the distressed area can be used to suggest suitable detours, thereby averting potential traffic jams and blockades. The possibilities are numerous; Care should be taken to provide the alerts on a priority basis **[1]**.

The system is shown in Figures (2-2) and (2-3).

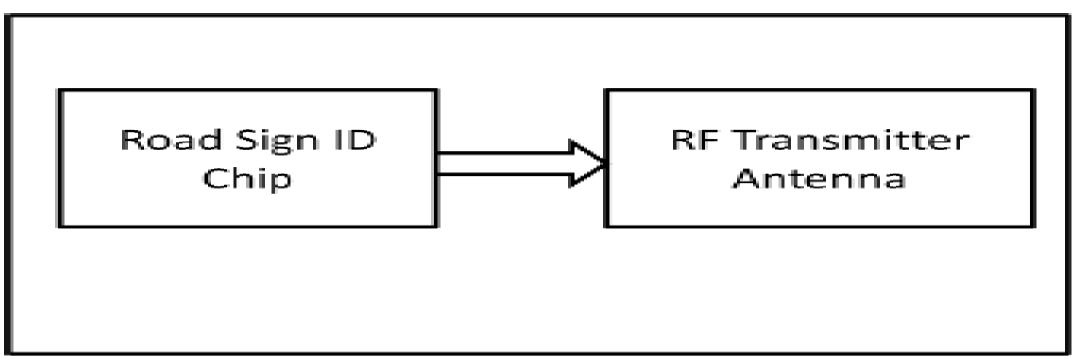


Figure 2-2: Passive RF Tag

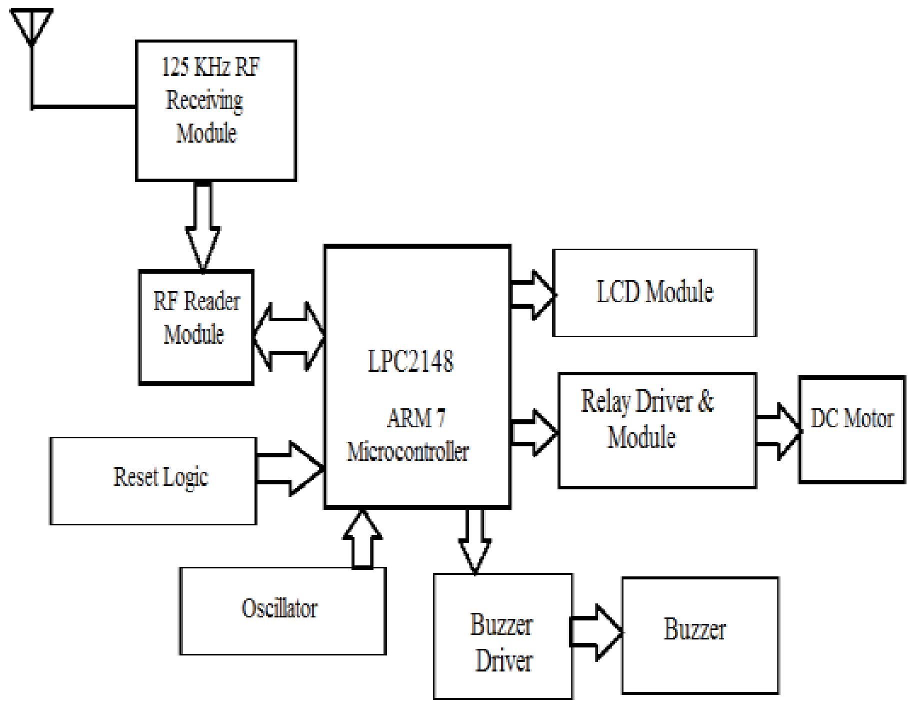


Figure 2-3: Electronic Controller and Display unit embedded in automobile

The authors (Thirukkovulur, A.K.,H.Nandagopal,and V.Parivallal) Represent an RFID system which gives the reference speed to the ECU (Electronic control unit). The actual speed of the vehicle is measured using a sensor and is given as another input to ECU. The output of the electronic control unit is used to manage the speed of the vehicle**[2]**.

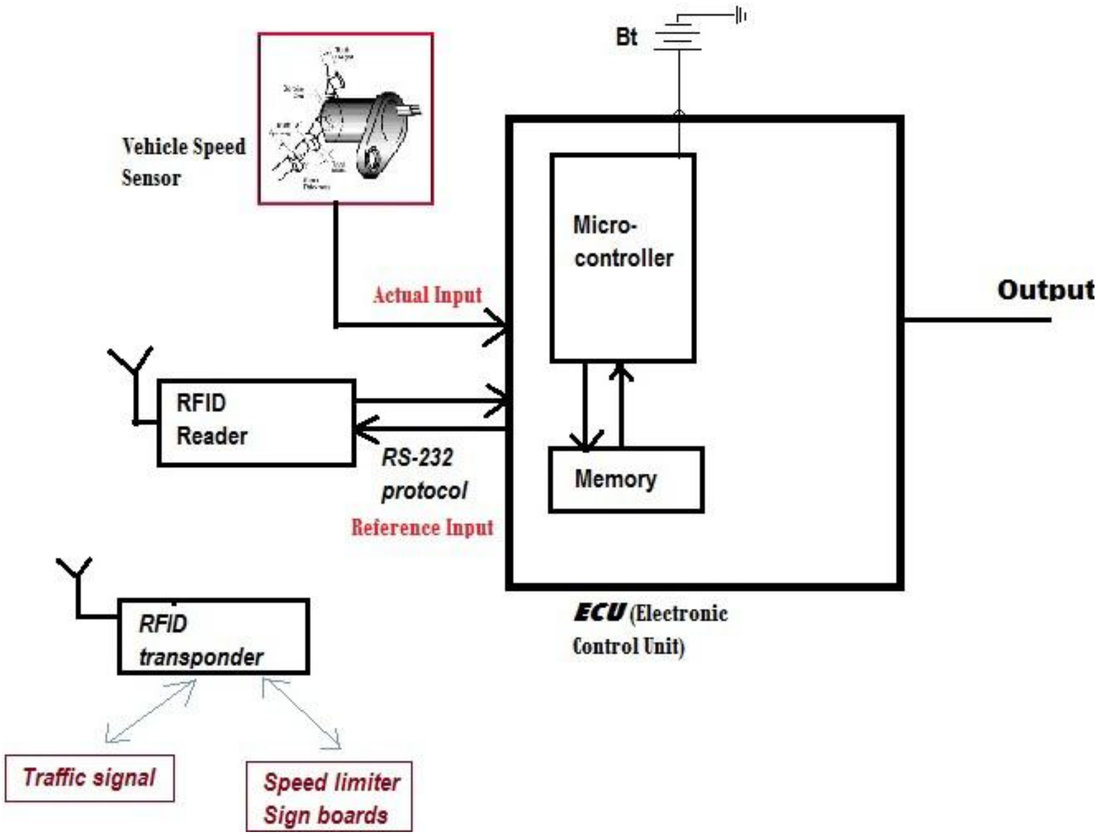


Figure 2-4: Block diagram of proposed System

The output is given to the electro proportional pilot. Meanwhile this same output turns on the dc motor, which pumps the braking fluid from the container upwards. The limiter present will set a constant pressure flow and send it to the electro proportional valve. On the basis of the output provided by the ECU, the valve sends only the necessary pressure to be applied on wheels.[2]

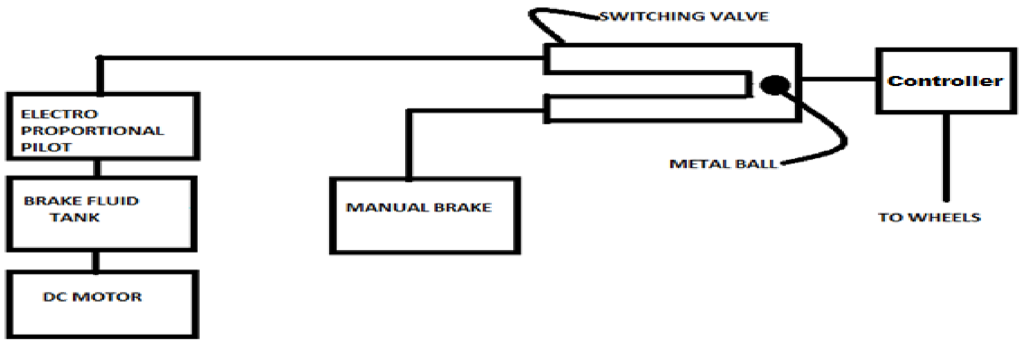


Figure 2-5: Diagram of Electro-Hydraulic Braking System

The same authors as in [2] described how electronic fuel pump driving system can control; the fuel system provides the injector with the fuel at constant rate and quantity with certain optimum pressure. The ECU we use here controls the timing and quantity of the fuel entering into the injector. The ECU get the input, analyses it and based on the requirement it provides the output. Figure (2-6) explains how the electronic fuel pump is controlled by the electronic control unit. After giving the reference and the test input to the ECU, the ECU unit analyses the data according to the micro controller program fed and produces the output. This output is used to control the fuel pump by varying the pulse width. From the fuel pump after passing through the filter it enters the injector which supplies the fuel to the engine. After the reference speed obtained to control the vehicle speed, the ECU will produce an output so as to reduce the pulse width which will delay the fuel pump rate to the injector and so the engine is provided with very less amount of fuel.

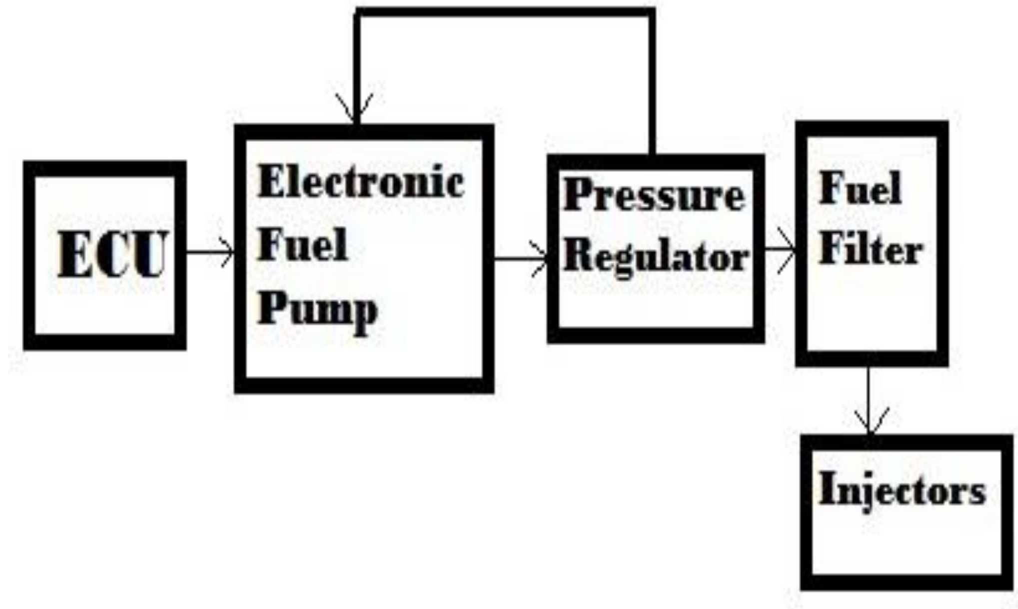


Figure 2-6: Electronic Fuel Pump Driving System

The author (Rao, S.V) Represent modules with RF transmitter and receiver for establishing wireless communication, DC motors for the movement controller, IR sensor for Obstacle detection. The controlling device of the whole system is a Microcontroller to which RF receiver module; DC motors are interfaced through a motor driver. The Microcontroller checks the data with the program embedded in it and performs appropriate actions on the electric DC motors. The Microcontroller is programmed using Embedded C language. Whenever the vehicle is within the transmitter zone, the vehicle speed is controlled by receiving the signal, i.e.., every time the vehicle speed is decreased by some cutoff and kept constant until the vehicle moves out of the transmitter zone, and then the vehicle can get accelerated by itself. The IR sensor detects if any Obstacles occurs and send information to Micro controller. Micro controller interacts with motors through driver IC to take appropriate directions to prevent accidents**[3]**.

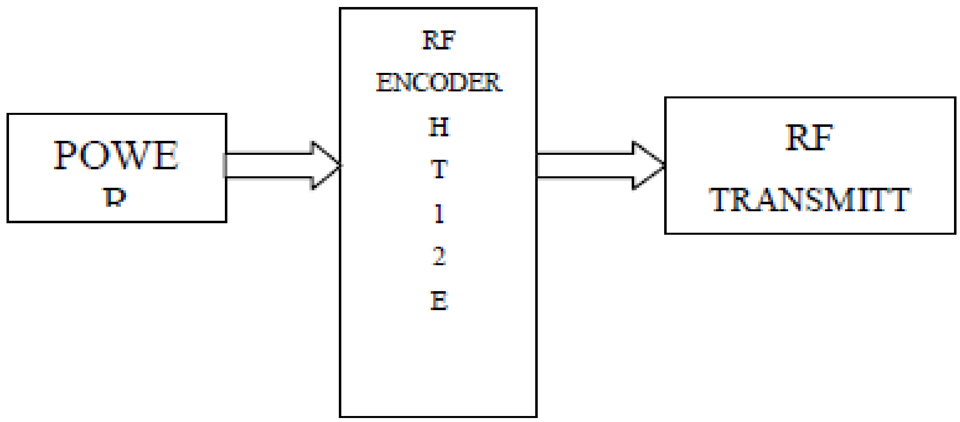


Figure 2-7: Transmitter

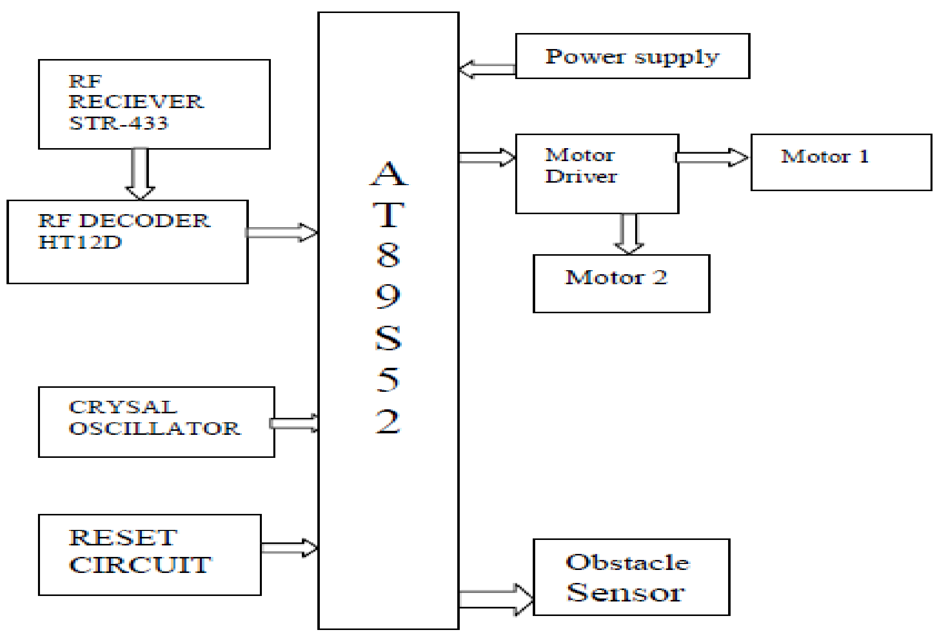


Figure 2-8: Receiver

2.3.2 Wireless Technology

The author (Govindaraju, K.) Proposed a system has an alerting, recording and reporting system for over speed violation management. The Zigbee transmitter sends the speed limit of the particular lane entered by the vehicle and also gives alerts like “road works”, “steep slopes”, “school zone” in the form of acoustical messages and also in LCD. The receiver unit placed in the vehicle receives the message and sends to the microcontroller. When speed of the vehicle nears the speed limit it displays the warning and if exceeds the limit, the microcontroller records the violated speed and time. The LCD displays the lane speed limit and shows the number of times, speed was violated. A GSM module sends message to the nearest traffic personnel immediately after a violation occurs. An authenticated device is also provided, which can be operated only by the traffic police in whom he can retrieve the data stored at any time. Increase in the count of violation increases the penalty amount which can be collected in toll gates located nearby**[4]**.

In [5] the authors Described a real-time online safety prototype that controls the vehicle speed under driver fatigue. The purpose of such a model is to advance a system to detect fatigue symptoms in drivers and control the speed of vehicle to avoid accidents. The main components of the system consist of number of real time sensors like gas, eye blink, alcohol, fuel, impact sensors and a software interface with GPS and Google Maps APIs for location.

In [6] Achieved with the help of “AARS using GPRS 3G TECHNOLOGY”. Through this, we can provide a smooth flow for the ambulance by controlling the traffic light according to the ambulance location to reach the hospital. The location of the ambulance can be easily identified with the help of the GPS unit installed in it. A controller in the traffic junction can automatically control the traffic flow and thus reduces the time delay taken by ambulance to the hospitals. The traffic junction band the ambulance will have GPRS 3G modem to communicate between them. The chances of misusing the ambulance can overcome with the help of an RFID tag given to the doctor's in the respective hospitals so that the security can be attained.. This scheme is helpful for the Traffic police to control the traffic thereby helping the patients who are facing emergency.

2.3.3 RF Technology

2.3.3.1 Main Working

The arrangement at vehicle side is a receiver which receives the RF signal when the transmitter frequency is interacting. The data available from receiver is in terms of serial this data has to be converted back in terms of parallel through a decoder which decodes the data and it is in the form of parallel. The decoded data is interfaced to microcontroller and the controller is so programmed that it now driving system drives the signal to a suitable level that which controls the action of vehicle engine. The speed is reduced when the RF frequency is interacting with receiver.

Authors (Chavan, D.B) they use a transmitter which is tuned at a frequency of 433MHZ are mounted as these transmitters continuously radiate a RF signal for some particular area. As the vehicle come within this radiation the receiver in the vehicle gets activate. Moreover that they implement more component for the detection of humps and any obstacle on the roads which are IR LED and photo diode technique which acts as a proximity sensor when the IR signals transmitted from LED depending upon the distance of the obstacle or humps there is reflection of IR beam from that, material the circuit provides the signal to the microcontroller and with the same process of fuel reduction technique the vehicle fuel has been reduce and reduce the speed of the vehicle and prevents the accidents. The vehicle can be further avoided with accidents by alerting driver when the driver feels drowsiness during long driving or night driving. A three dimensional IR led and photo diode are arranged so that whenever an abstraction takes place between triggers the photodiode which generate a buzzer sound to alert the vehicle driver. Within certain area across the schools, hospitals the transmitter will be keep, if the vehicle passes from that area the receiver kept in the vehicle receives the signal from that transmitter and that signal is fed to the controller and with the help of switching circuit the horn of the vehicle is controlled. Headlights of the vehicle are controlled with the help of LDR (light dependent resistor). When the head lights focus of the vehicle coming in front is more, then the LDR sensor in the vehicle senses that signal and the light beam of headlight goes low. As soon as that vehicle passes, the light beam of headlight goes high**[1]**.

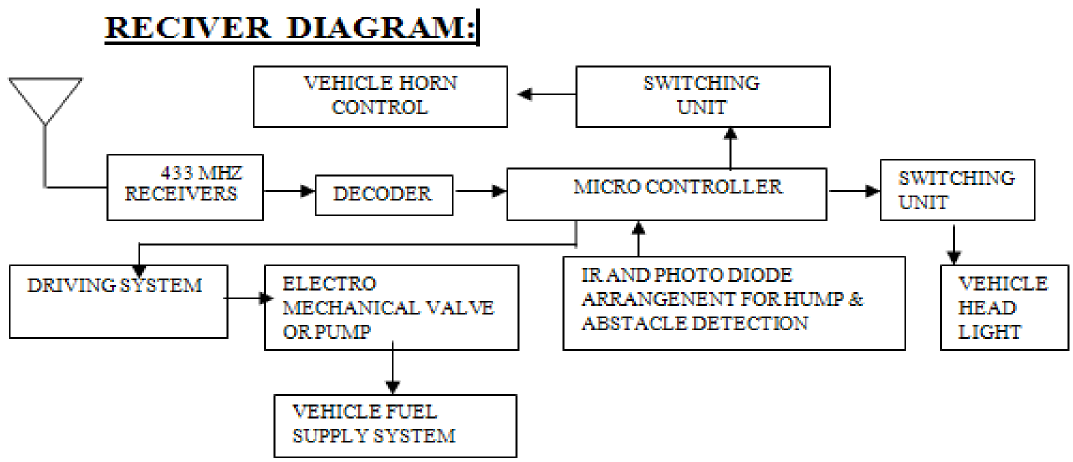


Figure 2-9: System Receiver

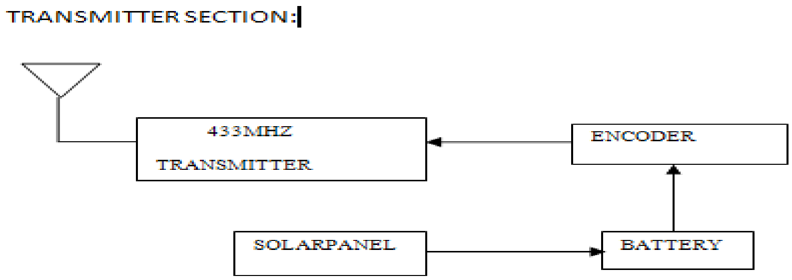


Figure 2-10: System Transmitter

2.4 From the review

It's clear that the studies are quite similar to each other and on a broader comparison, the study [2] , presented a system that controls the vehicle's speed automatically which makes it unique and complex among the rest papers. Further [4] the other study used a different technology for communication between units that is Zigbee wireless protocol which makes it unlike the other introduced systems that are all based on RFID technology. Moreover, [6] developed a system with different concept to manage the traffic by monitoring the traffic jam in real time and update users through SMS or web page via RFID and GPRS technologies. Study [1] , designed a system that not only manages speed violation, it also detect crashes which hasn't been discussed by any other referred papers.

Eventually, among all researches and different system, system [3], proposed a system that is excessively similar to the presented project in some aspects, since it utilizes Radio Frequency Identification (RFID) technology. However, the presented system will utilize longer range RFID readers with extra characteristic that is an Obstacle Sensor which hasn't been used by any of the previous paper.

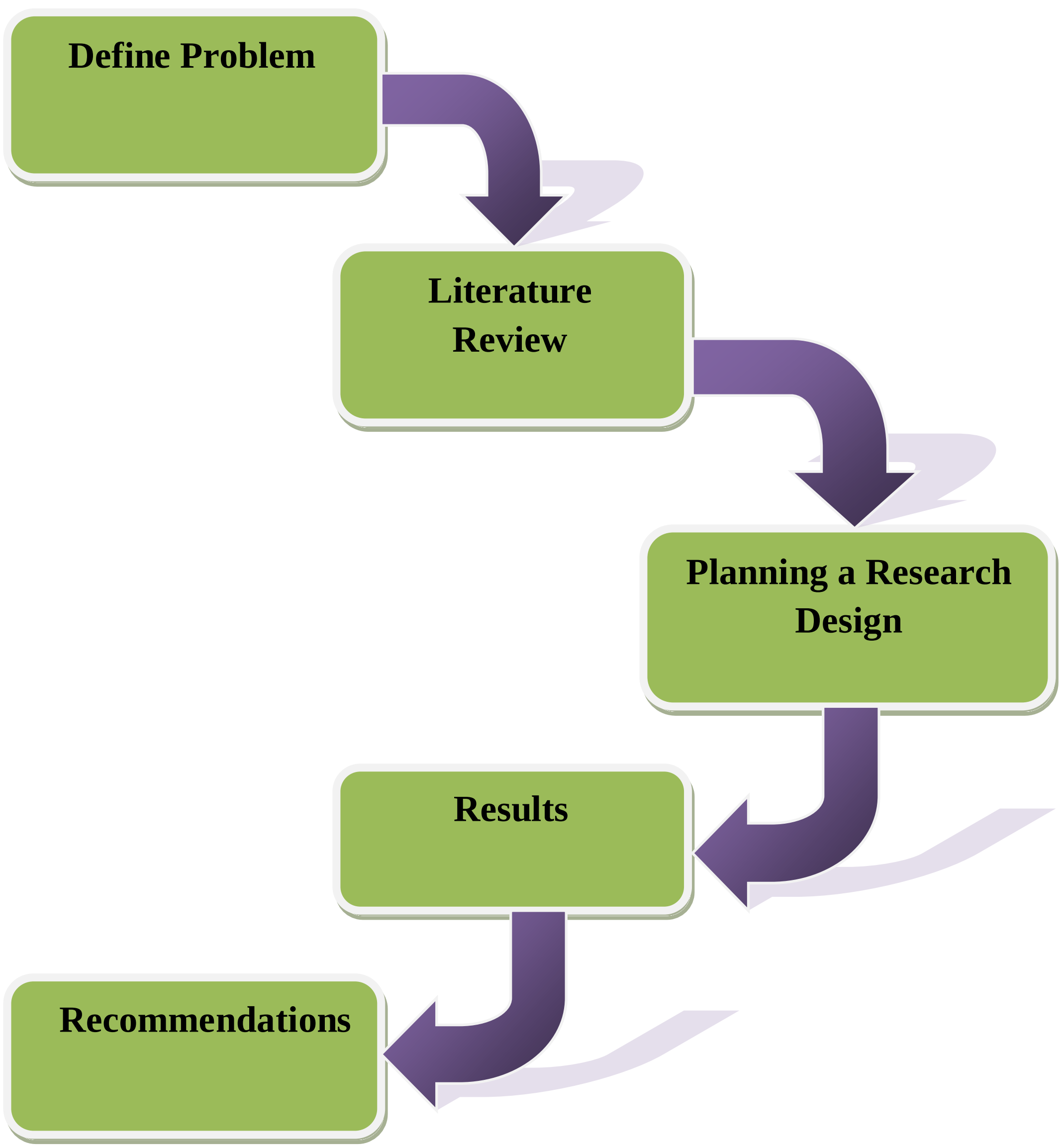
Chapter Three

System Design

Chapter Three

System Design

3.1 Research Framework



3.2 The System Block Diagram

The Figure (3-1) show the block diagram of implemented circuit in our proposed system.

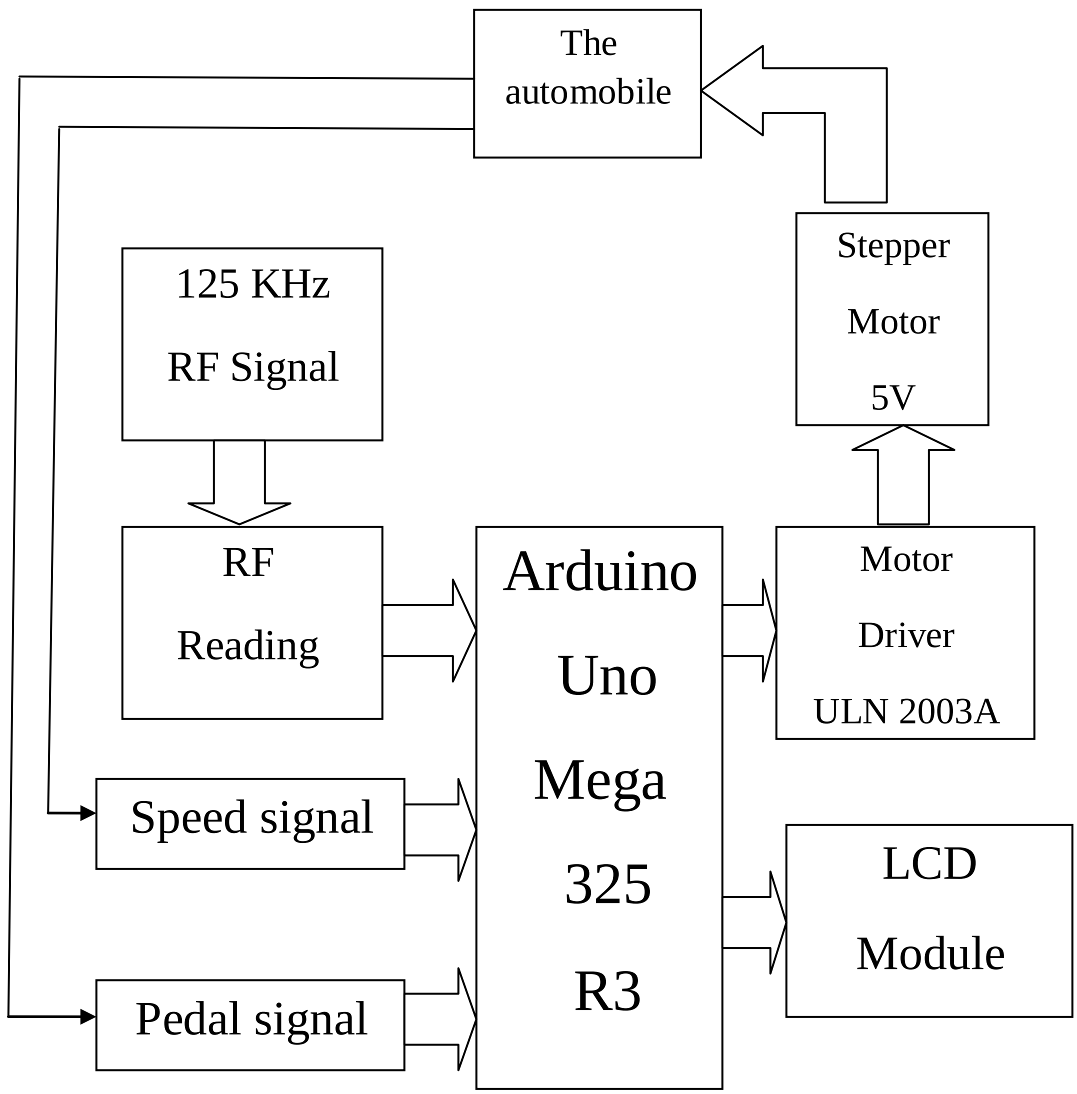


Figure 3-1 : Hard scheme of automobile in our proposed Design

3.3 Operation Mode

In Active mode of operation arduino unit continuously studies the speed of the vehicle. To control the speed of the vehicle according to the limits we have developed.

If the speed of the vehicle is above the Maximum speed limit, then it sends the digital signal to the ECU such that speed of the automobile will be decreased. When the accelerator pedal is moved to increment the speed, arduino calculates the speed that would be reached on the new pedal position. If the speed is greater than the maximum speed limit then it denies excess speed and gives appropriate signal to the ECU. See figure (3-2) for flow chart in active model.

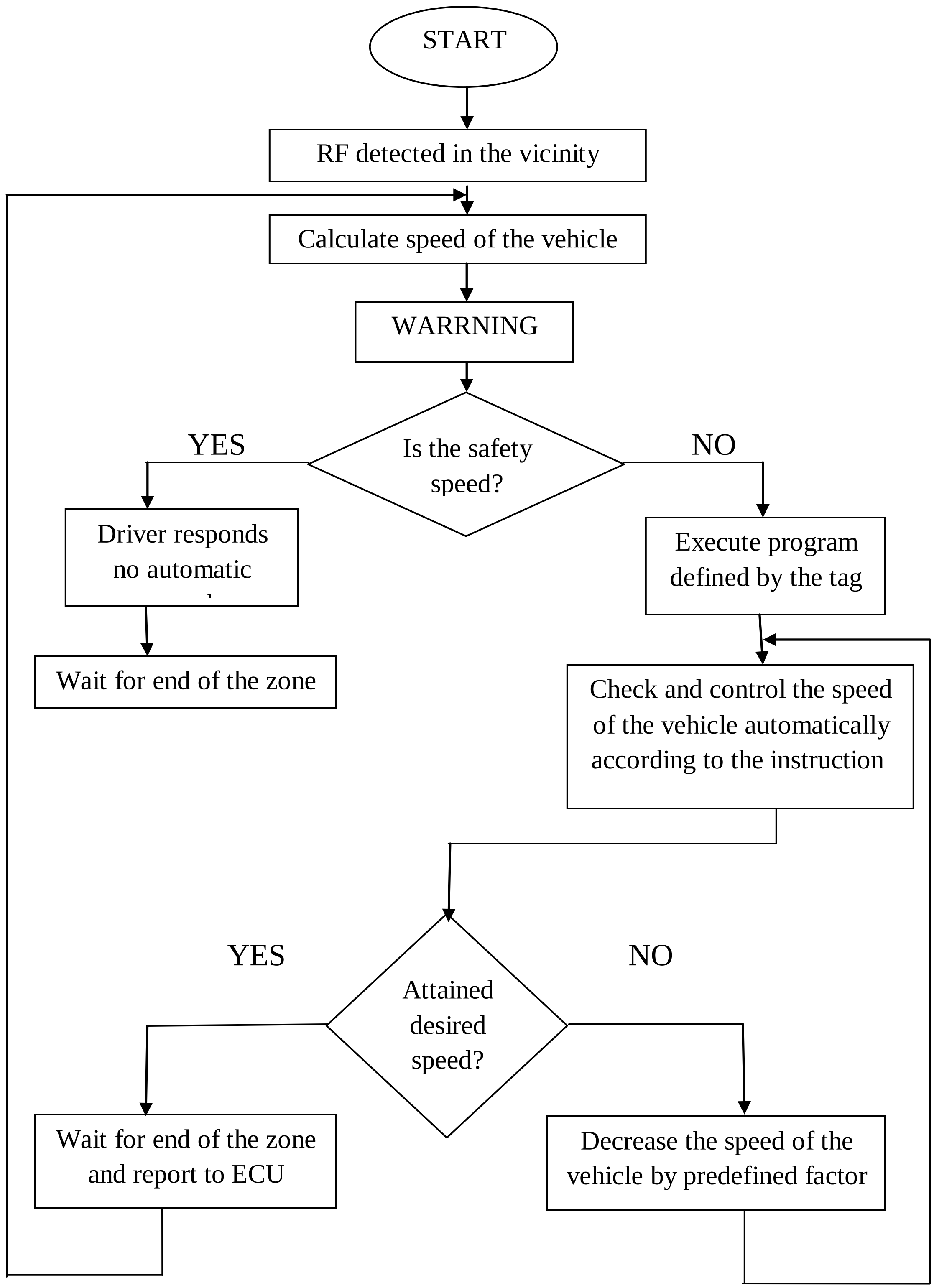


Figure 3-2: Flowchart schematic of operation in Active mode

3.4 The Implemented Hardware circuit:

The Figure (3-1) show the implemented hardware that will fitted into vehcile.

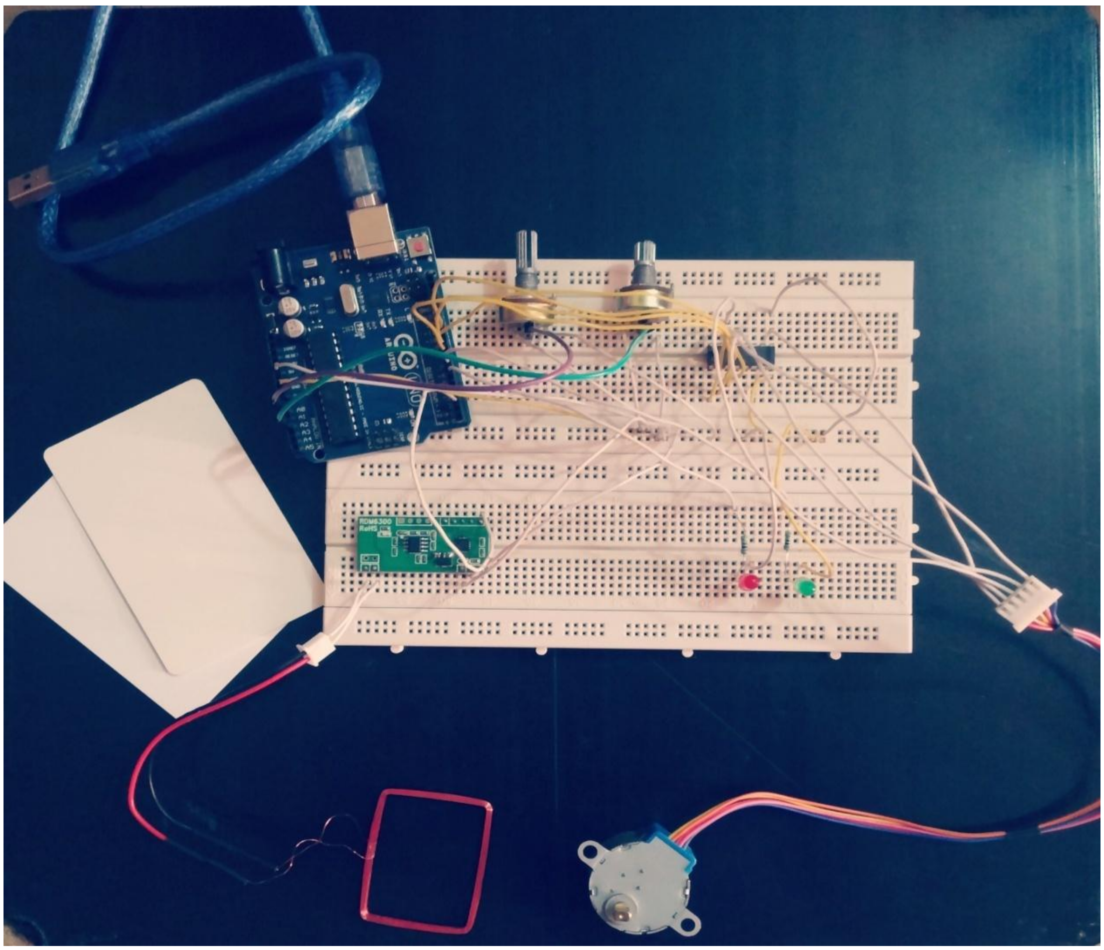


Figure 3-3: The Hardware Circuit

3.4.1 Connecting the RFID reader with Arduino

This reader (RDM6300) works and communicates with the Arduino. We used Arduino Uno and compatible Breadboard, three jumper wires, the RFID reader package and two RFID tags, we insert the RFID reader into a breadboard as shown in figure 3-3. Then we use jumper wires to connect the second and third pins at the top-left of the RFID board to Arduino 5V and GND respectively. The RFID coil connects to the two pins on the top-right (they can go either way), this coil is very sensitive. Finally, we connect a jumper wire from the bottom-left pin of the RFID board to Arduino digital pin 2 as shown on figure 3-3.

3.4.2 Connecting the Stepper Motor and ULN2003A to Arduino

The simplest way of interfacing a unipolar stepper to Arduino is to use a breakout for ULN2003A transistor array chip. The ULN2003A contains seven Darlington transistor drivers and is somewhat like having seven TIP120 transistors all in one package. The ULN2003A can pass up to 500 mA per channel and has an internal voltage drop of about 1V when on. It also contains internal clamp diodes to dissipate voltage spikes when driving inductive loads.

ULN2003A is placed between Arduino and motor, that means the input pins of ULN2003A are connected to Arduino in digital pins with four pins, IN1 connected to pin 8, IN2 connected to pin9, IN3connected to pin 10 and IN4 connected pin11, and output pins of ULN2003A are connected to The unipolar stepper motor with five wires connected to ULN2003A output pins, the blue connected to out1, the red with common, the pink connected to out2, yellow connected to out3 and the orange connected to out4.

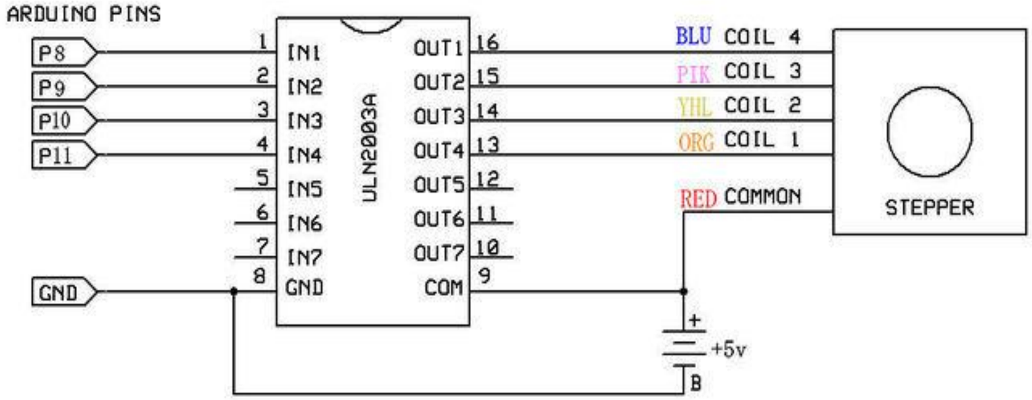


Figure 3-4: connect stepper and ULN2003A to Arduino

3.4.3 Connecting the Potentiometers

We use two Potentiometers, one as position sensor and the second as speedometer. These Potentiometers are 10k Ohm with three edges, the middle is variable side and the two other sides one to the dc power and the other to ground.

The middle pin of speedometer is connected to the analog input A2 and the middle pin of the position sensor is connected to analog input A0.

3.4.4 Connecting the Arduino to PC

Finally we connect the Arduino to PC by plug it straight into a computer's USB port and registered on the computer as a virtual serial port. [11]

3.4.5 Reading The tags

We through the tag parallel over the antenna, the antenna read the tag and sends a digital code from 16 digits and from those readings the Arduino unit takes the actions[12] Here we use two tags.

3.5 System Model

The system model for our project consists of following Hardware Modules.

3.5.1 Arduino

The Arduino board actually is a specially designed circuit board for programming and prototyping with Atmel microcontrollers. The nice thing about the Arduino board is that it is relatively cheap, plugs straight into a computer's USB port, and it is dead-simple to setup and use (compared to other development boards).[13]

Some of the key features of the Arduino Uno include: an open source design. The advantage of it being open source is that it has a large community of people using and troubleshooting it. This makes it easy to find someone to help you debug your projects, and an easy USB interface. The chip on the board plugs straight into your USB port and registers on your computer as a virtual serial port. This allows you to interface with it as through it were a serial device. The benefit of this setup is that serial communication is an extremely easy (and time-tested) protocol, and USB makes connecting it to modern computers really convenient.[14]

Very convenient power management and built-in voltage regulation, you can connect an external power source of up to 12v and it will regulate it to both 5v and 3.3v. It also can be powered directly off of a USB port without any external power.

An easy-to-find, and dirt cheap, microcontroller "brain" The ATmega328 chip has countless number of nice hardware features like timers, PWM pins, external and internal interrupts and multiple sleep modes.

A 16 MHz clock this makes it not the speediest microcontroller around, but fast enough for most applications, 32 KB of flash memory for storing your code, 13 digital pins and 6 analog pins. These pins allow you to connect external hardware to your Arduino. These pins are keys for extending the computing capability of the Arduino into the real world. Simply plug your devices and sensors into the sockets that correspond to each of these pins and you are good to go.[15]

An ICSP connector for bypassing the USB port and interfacing the Arduino directly as a serial device, this port is necessary to re-boatload your chip if it corrupts and can no longer talk to your computer. An on-board LED attached to digital pin 13 for fast an easy debugging of code.

And last, but not least, a button to reset the program on the chip.

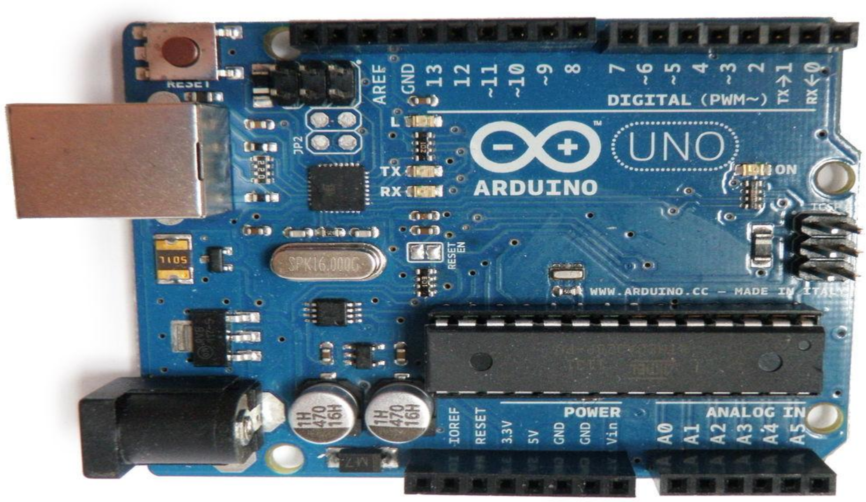


Figure 3-5: Arduino UNO Rev3 Unit

The circuit work on the voltage ranges between 6-20 volts, but if we have secured less than 7 volts voltage to output controlling pin 5v may not be able to secure the voltage output of the 5 volts required and may lead to instability of the circuit.

But if we have provided the circuit voltage higher than 12 volts, it may affect the voltage regulation element and lead to a rise in temperature resulting in damage to the board.

Before we can start doing anything with the Arduino, we need to download and install the Arduino IDE.[16]

From this point on we will be referring to the Arduino IDE as the Arduino Programmer and the Arduino Programmer is based on the Processing IDE and uses a variation of the C and C++ programming languages.[17]

3.5.1.1 Analog signal

Analog input reflects the changing signals such as product voltage of a particular sensor due to changes in a specific factor we can use this phenomenon to measure any particular factor environment, using suitable sensors that measure the environmental factor, and converted to electric analog signal measurable.[17]

3.5.2 Wireless Module

3.5.2.1 RFID Reader

RFID reader connected to a wire antenna which demodulates the Manchester RF 32/64 bit signal and decodes it automatically. The data retrieved from the transponder is ready to be processed inside the device or to be sent over I2C/ UART / SPI or custom protocols. The user can control chip/module with an external device such as microcontroller, PC and here we controlled by Arduino.

3.5.2.2 RF Tag

RF identification is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for identifying and tracking tags attached to objects. A Passive Clamp shell type tag is used for transmitting the road-sign which consists of memory chip and antenna. [12]

3.5.2.3 Reading RFID Tags

We'll be using the RDM3600 to perform the task of reading an RFID tag. At a minimum, it requires +5V, ground, and a digital pin (on the Arduino) that we will utilize for serial communication. RDM3600 operates at 9600bps and has an LED output pin, and Less than 100ms decoding time.

This LED output is great! We can use this to verify if the RDM3600 is reading the tag even before it is connected to the Arduino!

All of RDM3600 readers read at a frequency of 125 kHz. Any 125 kHz RFID tag will do.[2]

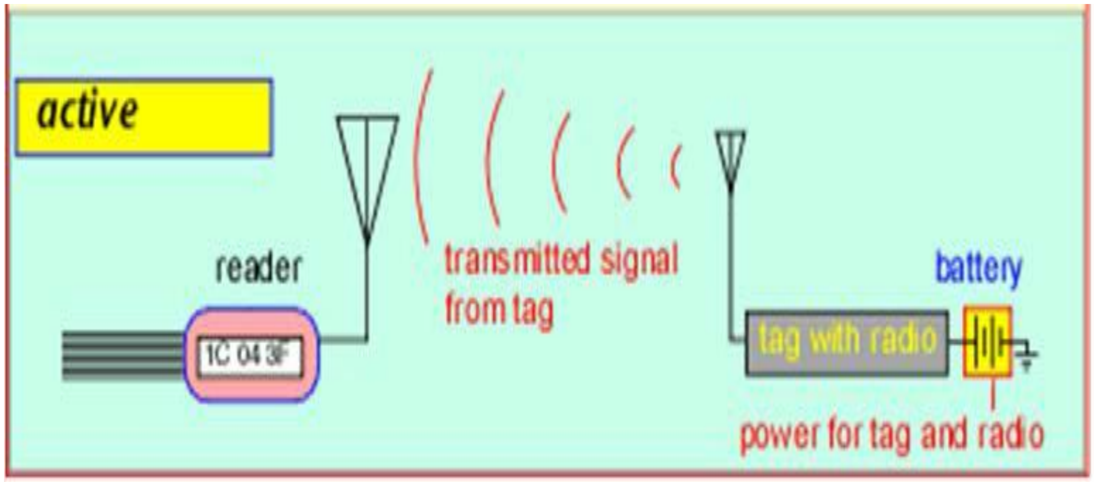


Figure 3-6: Working of Active RFID tag

3.5.3 Stepper Motor

A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied. One of the most significant advantages of a stepper motor is its ability to be accurately controlled in an open loop system.

Stepper motors differ from normal DC motors in that, rather than just spinning in one direction or another, they move in small increments in a given direction. These small increments are called steps. We can tell a stepper to go one or more steps in one particular direction. They are not necessarily fast, but they have high precision and quite some torque.

There are two common types of stepper motors: Bipolar and Unipolar.

The difference between the two types is the voltage levels. A unipolar stepper motor only operates with positive voltage, so the high and low voltages applied to the electromagnetic coils would be something like 5V and 0V. A bipolar stepper motor has two polarities, positive and negative, so it's high and low voltages would be something like 2.5V and -2.5V.

Taking these electrical differences into account, the physical difference between these two styles is that the unipolar configuration requires an extra wire in the middle of each coil to allow current to flow through either to one end of the coil or the other. These two opposite directions produce the two polarities of the magnetic field, effectively mimicking the positive and negative voltage capabilities of the bipolar stepper motor.

The bipolar stepper motor will actually have more torque because current flows to the entire coil, producing a stronger magnetic field to induce the shaft to rotate to the appropriate angle. On the other hand, unipolar stepper motors only utilize half of the coil length due to the extra wire in the middle of the coil, so less torque is available to magnetically hold the shaft in place[18]

To control the stepper, apply voltage to each of the coils in a specific sequence as shown in Table (3-1).

Table 3-1: Switching Sequence

Lead Wire Color	---> CW Direction (1-2 Phase)							
	1	2	3	4	5	6	7	8
4 ORG	-	-						-
3 YEL		-	-	-				
2 PIK				-	-	-		
1 BLU						-	-	-

3.5.4 Motor Driver ULN2003A

ULN2003A is a circuit comprised of a number of switches that can safely drive a stepper motor.

These switches can be relays or (most commonly) transistors. The transistor is a solid state switch that can be closed by sending a small current (signal) to one of its pins. Unlike single transistors which only allow you to control the speed of a motor, ULN2003A allow you to also control the direction in which the motor spins. It does this by opening different switches (the transistors) to allow the current to flow in different directions and thus changing the polarity on the motor.[19]

3.6 Concept of Automatic Vehicle Speed Controller

In general, the speed of the automobile is varied according to the accelerator's Pedal position. The variation in the Pedal position is fed to the Electronic Control Unit (ECU) .ECU determines the position of the throttle based on the accelerators pedal position and the inputs received from the other sensors.

Adjustment of throttle position causes the change in the variation of automobiles speed. Such type of hardware scheme is shown in figure 3-7, whereas in the proposed automatic vehicle speed controller model accelerator pedal position is given to the arduino unit and then it is fed to the Electronic Control Unit. If the automobile is in the active mode, arduino transfers the manipulated pedal position to the ECU that will not increase the automobile speed greater than the maximum speed specified in the identification tag. [2]

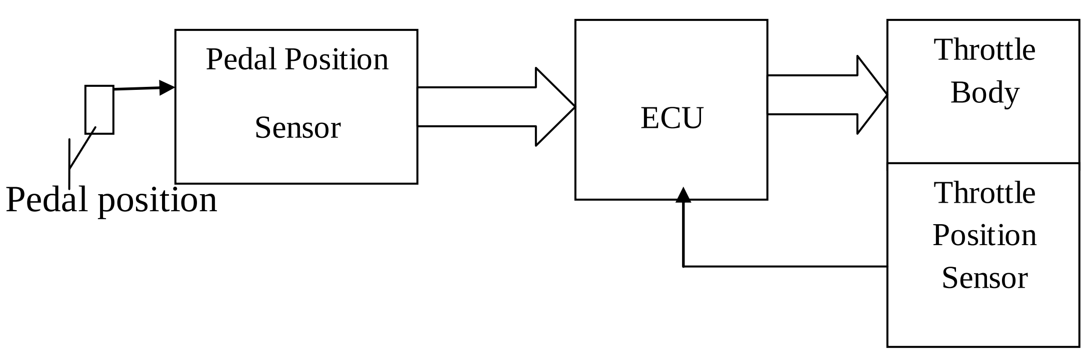


Figure 3-7: Hardware scheme in normal automobiles

3.7 Test Environment

Figure 3-8: snap of critical area near Sudan University College of Engineering

The experimental tests have been performed in an Imaginary work in public driving circuit near Sudan University of Science and Technology College of engineering.

Three signals were used for the tests, each signal was configured to detect different target speeds, the first one to warn the driver for the critical zone, the second to reduce the speed of the vehicle automatically, and the third for end of the critical zone as described.

RFID tags were attached to the traffic signals plate at a height of 2.00m over the ground or higher than that, for safety from people, see figure 3-8, while the readers were in one side of the vehicle.

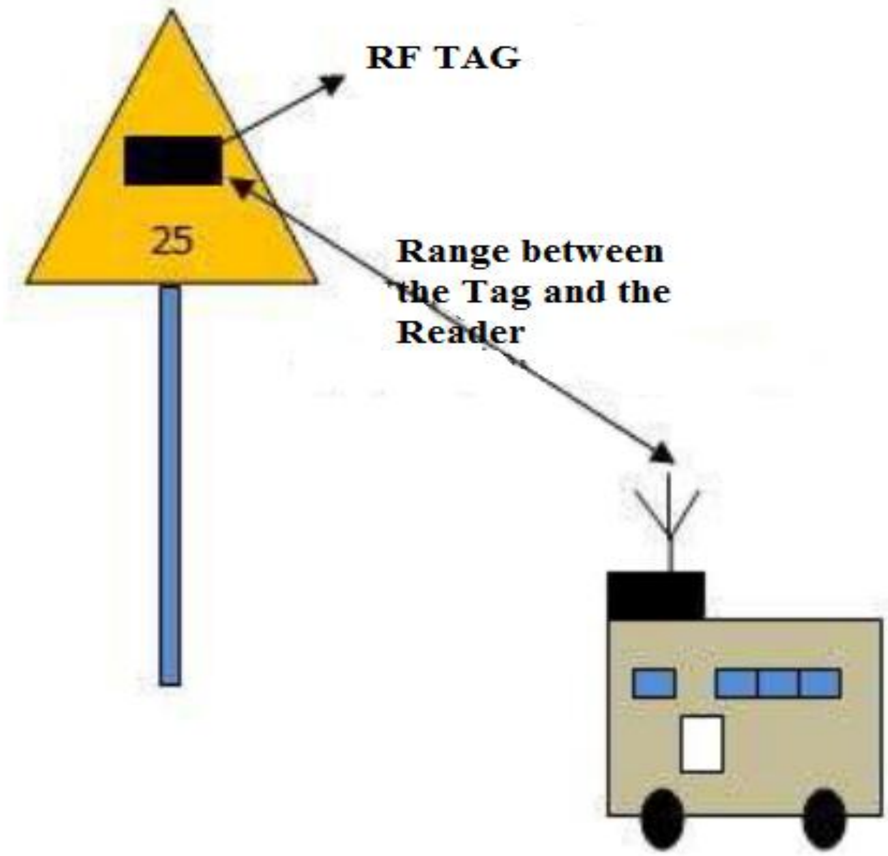


Figure 3-9: Traffic Signal posts equipped with RF tag (left side) Automobile equipped with the RFID reader (right side)

Chapter four

Results

and

Discussions

Chapter four

Results and Discussions

4.1 Results

4.1.1 Reading the Initial Tag

Since the vehicle entered the critical zone RFID reader read the controlling tag, the Arduino read the speed of vehicle from potentiometer (speedometer sensor) and compare it to reference speed in the Arduino code (30 km/h).

If the speed is over the limited speed, automatically the motor closed the throttle, thus the vehicle started Deceleration and speed was decreasing to specific speed within critical zone.

Here we have made a test and the measured speedometer value when enter the critical area was (99 km/h), the LCD displaying WARRNING message show " Critical area , Slow down " and continually display that message until speed reach (30 km/h) it displayed " stay in speed limit ".

During that the driver interrupted and can't be able to increase the speed because the throttle pedal was disconnected until the speed is become less than (30 km/h). The driver will be able to controls if they do not exceed (30 km/h).

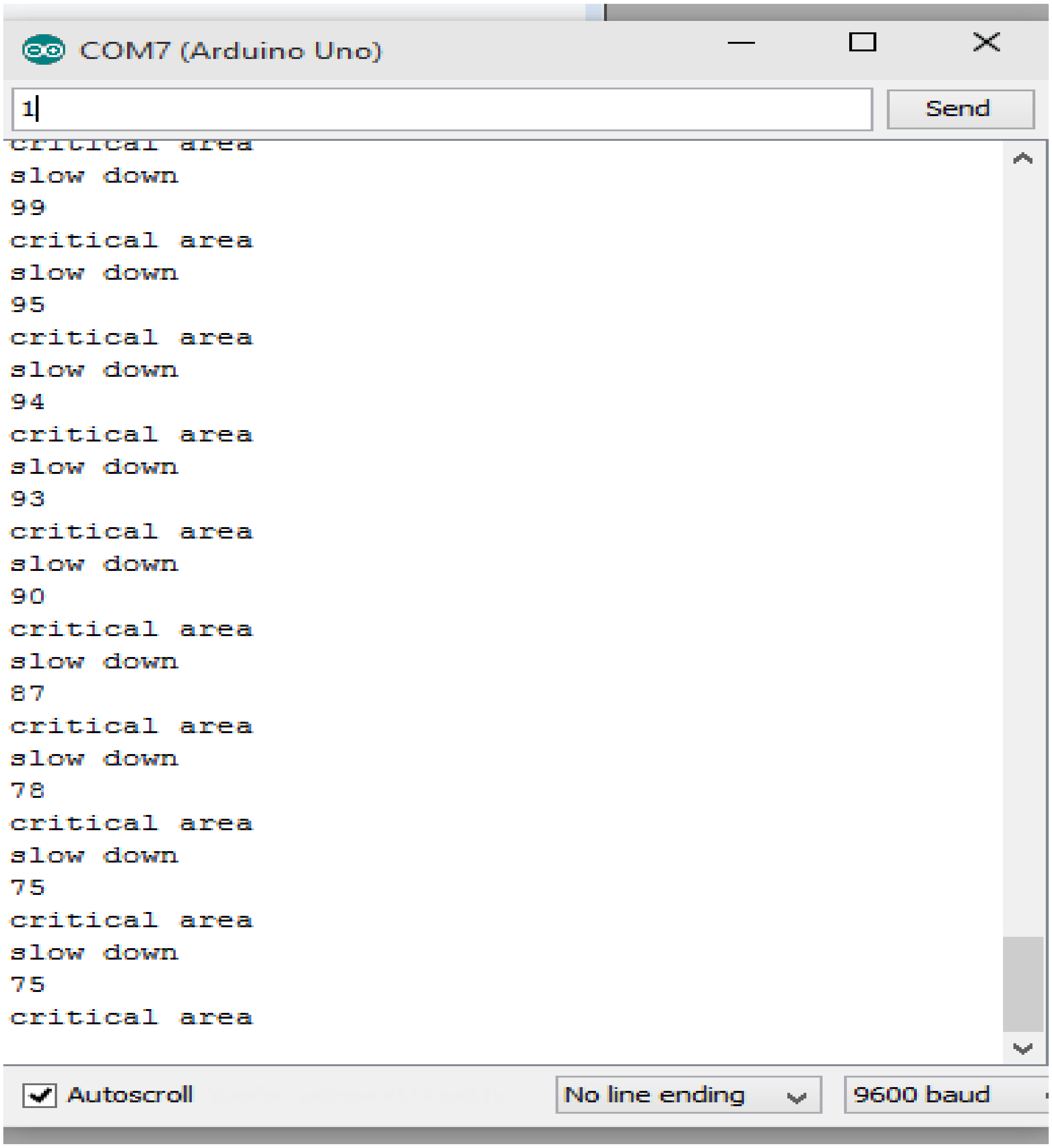


Figure 4-1: The Readings of Initial Tag in violated speed

If the speed is equal or less than the limited speed, Here the driver will be able to control the speed if they do not exceed (30 km/h), and if the driver exceed (30 km/h) Automatically the motor closed the throttle, thus the vehicle started Deceleration and speed was decreasing to specific speed within critical zone, and that will repeated continually until the vehicle exit from the critical zone.

Here we have made a test and the measured speedometer value was (28 km/h), the LCD displaying message show " speed controlled = 28 km/h" and continually display that message until the vehicle exit from the critical zone.

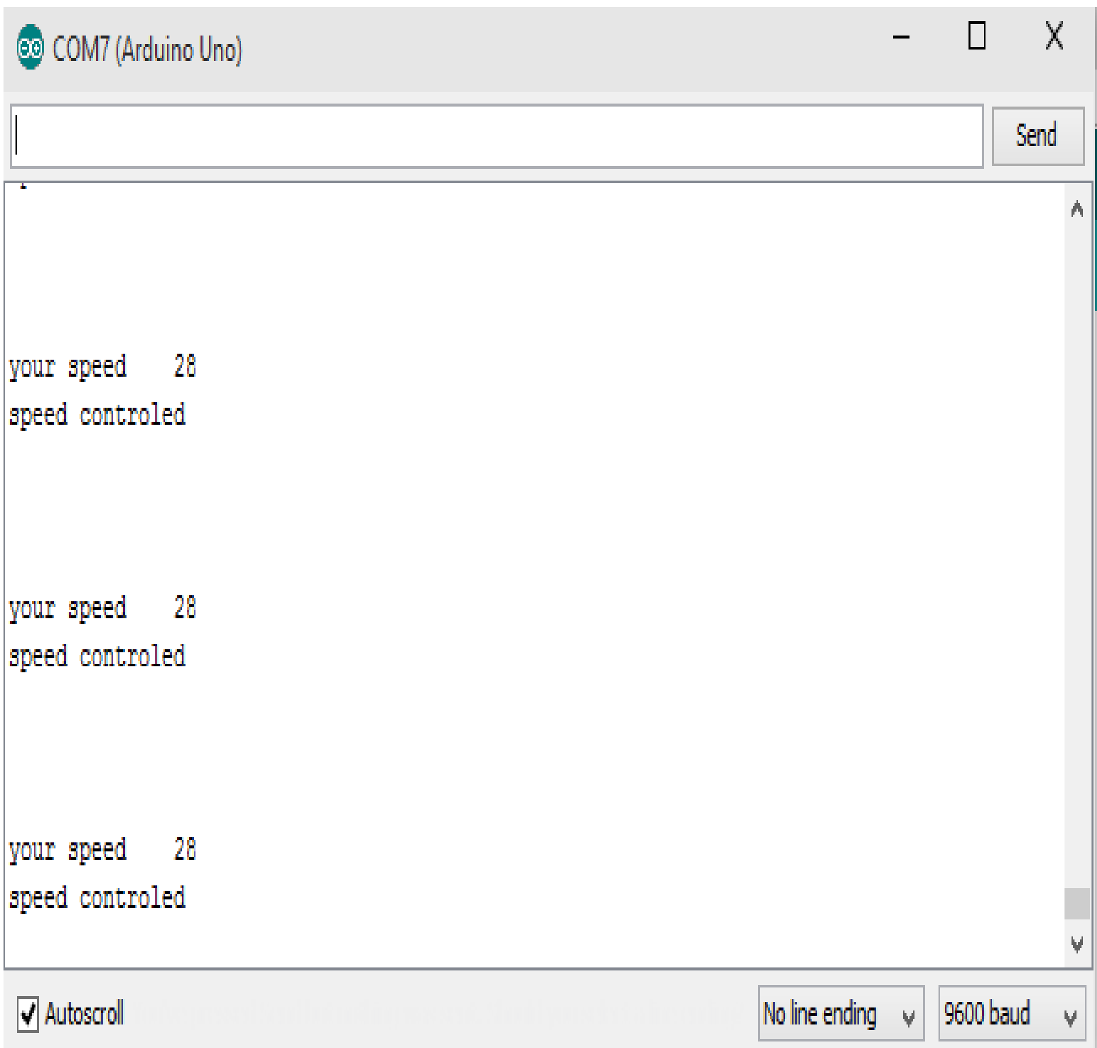


Figure 4-2: The Readings of the Initial Tag with limited speed

4.1.2 Reading the End Tag

When the RFID reader read the end tag, the vehicle exit from critical zone, and the LCD displaying message show "you are out drive safe", thus the driver will be free and started control the vehicle completely.

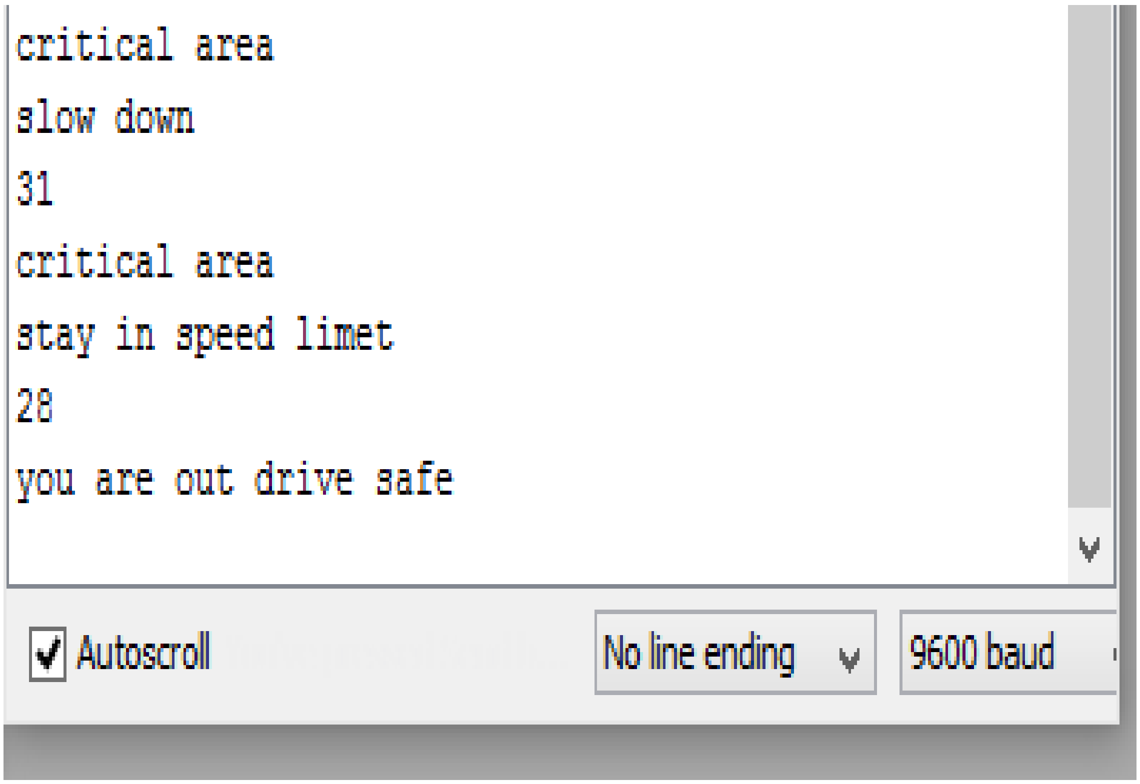


Figure 4-3: The Readings of End Tag

4.2 Features of the System

- This system is easy to implement on present system which ensures maximum safety for drivers, passengers and pedestrians.
- The driver can get the information without any kind of distraction.
- This prototype works even in bad weather conditions while the technology of artificial vision-based recognition of traffic signals might

fail if visibility is poor and GPS Navigation system may not work due to the sheer distance of satellites or weak signals Radio Frequency signals might still be transmitted reliably through all the conditions.

- The system consuming the fuel.
- The system can be more effectively used for heavy duty locomotives and automobiles, which are the main cause for accidents.
- The cost of the system is very less expense.

4.3 Discussions

In our project we use throttle because it's the best way to control the speed of vehicle, this modifications given for the throttle are very small and simple, and if we use the breaking may cause accidents and harm the driver life, We used the low voltage battery which is safe to operate and easy to charge, practically the system operates from the vehicle ECU.

Chapter five

Conclusion

and

Recommendations

Chapter five

Conclusion and Recommendations

5.1 Conclusion

The focus of this thesis is to control the vehicles speed in restricted zones such as hospital, schools and other congested places. It represents vehicles to infrastructure communication model, when cars reach restricted zone the system will release the control from the driver and try to adapt the speed of the vehicle according to the allowed speed.

This project has been implemented practically and successfully in all parts of the project except the integration with the vehicle engine in another words we can say that all of the electronics part as an embedded system has been complete successful.

The outcomes of this implementation are reducing the traffic accidents.

Speedometer has been used to monitor the speed of the vehicle and throttle unit to control the speed, the speed of the vehicle can be maintained in the limited speed without the intervention of the driver. This project is very effective and helpful to police traffic since it can controls rash driving behavior in addition to controlling over speeding in the speed limited zones, thus saving the lives of our country's people.

5.2 Recommendations

Although, the obtained results of this project are satisfied and quite enough according to the prescribed scope of work however, further enhancement can be summarized for future researchers such as for in old or manual vehicles there is some mechanical moderation must be done in the throttle and pedal.

This project may be enhanced further by establishing vehicle to vehicle communication through Radio frequency so as to avoid vehicle collisions and to prevent deaths.

To smooth the process of speed control for over speed drivers, a geographical distribution of card readers in addition to the formulation of mathematical models are required.

We recommended the authority of traffic that this system is to be bounded for vehicles.

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Appendixes

```
#include <Stepper.h<

#include <SoftwareSerial.h<

 *****/for stepper/*****

 //change this to the number of steps on your motor

#define  STEPSREV    2047    // 64(fullsteps) * 64 (reduction ratio(

#define  COIL1      11

#define  COIL2      9

#define  COIL3      10

#define  COIL4      8

#define  POT        0

#define  POT2        2

#define  ENER       13

#define  TIMEOUT    3000

 //create an instance of the stepper class, specifying

 //the number of steps per revolution and pins atached to motor coils.

Stepper myStepper(STEPSREV, COIL1, COIL2, COIL3, COIL4؛(
```

```
int PotVal؛

int PotVal2؛

int LastPotVal= 0 ;          // To implement a software Low-Pass-Filter

int LastPotVal2= 0 ;          // To implement a software Low-Pass-Filter

int pos = 0;              // stepper position(0-4096)->(0-360°(

int pos2 = 0؛

int pos3 = 0 ؛

unsigned long stamp = 0;  // last move time stamped.

unsigned long stamp2 = 0;  // last move time stamped.

 *****/for RFID/*****

SoftwareSerial RFID(2, 3); // RX and TX

int data1 = 0؛

int ok = -1؛

int yes = 7؛

int no = 6؛

int tag1[14] ={2,48,52,49,50,66,54,51,54,56,69,49,56,3؛{

int tag2[14] = {2,48,49,48,48,52,56,56,67,68,55,49,50,3؛{

int newtag[14] = { 0,0,0,0,0,0,0,0,0,0,0,0,0,0}; // used for read comparisons

void setup()
```

```
}
  myStepper.setSpeed(10);  // set the motor speed to 10 RPM
  pinMode(ENER, OUTPUT);  // status led (coils energized.(
  //Serial.begin(9600);   //for debuging.
RFID.begin(9600); // start serial to RFID reader
Serial.begin(9600); // start serial to PC
pinMode(yes, OUTPUT); // for status LEDs
pinMode(no, OUTPUT؛(
{
/*************************************************/
boolean comparetag(int aa[14], int bb[14([
}
boolean ff = false؛
int fg = 0؛
for (int cc = 0 ; cc < 14 ; cc(++
}
if (aa[cc] == bb[cc([
}
fg؛++
```

```
{{
if (fg == 14(
}
ff = true؛
{
return ff؛
{
/***************************************************/
void outread()
}
Serial.println("you are out drive safe؛("
digitalWrite(no, HIGH؛(
delay(1000؛(
digitalWrite(no, LOW؛(
int count2=0؛
for (pos3; pos3>0; pos3(--
}
  count2؛++
{
```

```
 myStepper.step(-count2؛(

pos3=count2؛

 count2=0؛

  myStepper.step(pos3؛(

ok = -1؛

{

/**************************************************/

void speedcontrol()

}

 PotVal2 = analogRead(POT2)/10.23;       // Potentiometer value range 0-
100

 int count=0؛

  if(PotVal2 < 30(

}

  Serial.println("critical area؛("

   digitalWrite(yes, HIGH؛(

   delay(1000؛(

   digitalWrite(yes, LOW؛(
```

```
 for (pos3 ; pos3 > 0 ; pos3(--
}
  myStepper.step(1؛(
{
  Serial.println("stay in speed limet؛("
   Serial.println(PotVal2؛(
  delay(500؛(
 ok=-1 ؛
{
  if(PotVal2 > 30(
}
Serial.println("critical area؛("
   digitalWrite(yes, HIGH؛(
   delay(1000؛(
   digitalWrite(yes, LOW؛(
   for (pos2 ; pos2 > 0 ; pos2(--
}
  count؛++
{
```

```
  mySteppper.step(-count؛(
 Serial.println("slow down؛("
  Serial.println(PotVal2؛(
  delay(500؛(
{
{
/*****************************************************/
void enterread()
 }
speedcontrol؛()
{
/*****************************************************/
void fullcontrol() // normal setuation
}
  readTags؛()
   PotVal = analogRead(POT);       // Potentiometer value range 0-1023
  PotVal= map(PotVal,0,1023,0,514);      // Map pot range in the stepper
range.
  PotVal= PotVal * 0.1 + LastPotVal * 0.9 ;  // Filtering to reduce noise.
```

```
 LastPotVal= PotVal؛
 if(abs(PotVal - pos)> 4){             //if diference is greater than 4 steps.
    if((PotVal - pos)> 0}(
       digitalWrite(ENER, HIGH);   //Motor energized     .
       myStepper.step(1);          // move one step to the right.
       pos؛++
{
    if((PotVal - pos)< 0}(
       digitalWrite(ENER, HIGH);   //Motor energized.
       myStepper.step(-1);          // move one step to the left.
       pos؛--
{
        pos2=pos؛
        pos3=pos؛
    stamp = millis();              // stamp actual time.
{
 else     }
    if((millis() - stamp) > TIMEOUT){   //Turn Off coils after TIMEOUT.
       digitalWrite(COIL1, LOW؛(
```

```
        digitalWrite(COIL2, LOW؛(
        digitalWrite(COIL3, LOW؛(
        digitalWrite(COIL4, LOW؛(
        digitalWrite(ENER, LOW);    //Motor de-energized.
    {
{
{
/****************************************************/
void checkmytags() // compares each tag against the tag just read
}
ok = 0; // this variable helps decision-making،
 //if it is 1 we enter the area, zero for out tag،
 1- //is no read attempt made
if (comparetag(newtag, tag1) == true(
}
ok؛++
{
if (comparetag(newtag, tag2) == true(
}
```

```
ok=0؛
{
{
/*************************************************/
void readTags()
}
if (RFID.available() > 0 (
}
 //read tag numbers
delay(100); // needed to allow time for the data to come in from the serial buffer.
for (int z = 0 ; z < 14 ; z++) // read the rest of the tag
}
data1 = RFID.read؛()
newtag[z] = data1؛
{
RFID.flush(); // stops multiple reads
 //do the tags match up؟
checkmytags؛()
```

```
{
 //now do something based on tag type
if (ok > 0) // if we enter the area
}
enterread؛()
//ok = -1؛
{
else if (ok == 0) // if we are out
}
outread؛()
{
{
/***************************************************/
void loop()
}
fullcontrol؛()
}
```