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External Adaptive Cruise Control System For Lawbreakers and For Desired Zones

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Abstract
Accidents are increasing day by day because of many reasons. According to surveys, it is said that over speed is the main reason for 90 percent of road accidents. In each zone, there is a permitted speed (limited speed) but in each and everyone's busy life nobody is ready to obey the rules. The main aim of my project is to control the speed of a vehicle if its speed is more than the permitted speed. There are many existing systems and methods to control the speed of the vehicle but because of the cost and the difficulty level of implementation, the existing methods are not that efficient. The Adaptive Cruise Control System is there to control the speed of a vehicle but it is only with fully automatic vehicles and if we want to activate the Adaptive Cruise Control System the drivers should set the speed and on the button then only it will work automatically. If a driver fails to do that or if he is not setting the speed properly it is not going to make any change. Considering all these existing problems this paper proposes an external adaptive cruise control system that is not placed inside the vehicle but it can be placed in any kind of zones where we want to control the speed of vehicles. This proposed system consists of a RF transmitter, RF receiver, and a webpage to set the speed. The RF transmitter is placed in particular zones where all we want to control the speed of a vehicle and it transmits RF signals in 2km coverage. The transmitted signal is received by RF signals which is placed inside the vehicle and the speed is controlled automatically. Using the created webpage we can set the speed of vehicles. The main aim of my project is to control the speed of vehicles and to help the police officers to catch the law breakers.

Keywords: *Adaptive Cruise Control System,NodeMCU, RF transmitter, RF receiver, Engine Control Unit, Arduino IDE.*

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I. INTRODUCTION

Nowadays each and everyone is driving very fast and accidents are occurring very frequently. Because of over speed somany people are losing their precious lives. We have a permitted speed in particular zones but people who are driving the vehicles are not ready to obey the rules. As we all know over speed kills and this project is all about controlling the speed of vehicles and reducing the number of accidents.

The main aim of this project is to help the police officers to catch thieves, smugglers, or anyone who committed a crime and escapes using a vehicle. After committing a crime if they are using a vehicle to escape they will drive the vehicle at a maximum speed so if we control the speed of the vehicle automatically then police officers can easily catch them. This project also concentrates on controlling the speed of a vehicle if the speed of the vehicle is more than the permitted speed. So we areintroducing an external adaptive speed controlling system. It is used to control thespeed of the automobile at a remote place for a fixed time.

It is known that roadaccidents are increasing day by day because of the over speed of the vehicles in restricted areas and even where sharp turning and hairpins exist. So the primestep that is needed to be taken is to reduce the high speed of the vehicles and it should be done automatically in speed-restricted areas.Many ideas have been put in place to prevent accidents caused by over speed. One of them is the cruise control system and which was the first system designed to control the speed of cars but the problem is the speed is maintained by the driver and if he is not ready to control the speed then the speed of the car is not reduced. To overcome this problem a new version has been introduced which is Adaptive Cruise Control(ACC) the main aim of this is to keep the vehicle at a safer distance from the other vehicles and it is applicable only in a fully automatic vehicle and the driver should also aware of new technologies.

Here in this paper, I am proposing an External Adaptive Cruise Control System where the system willcontrolthe speed of vehicles according to the data transmitted by the RF transmitter located somewhere where we want to control speed. The transmission signal is received by the RF receiver that is placed inside the vehicle which is entering the area where speed exceeding is not allowable and controlling the vehicle speed to the permitted speed automatically. Inthis system, the speed of certain areas can be set by the official by sitting in his or her office via the IoT network while the new speed is updated to the signal.

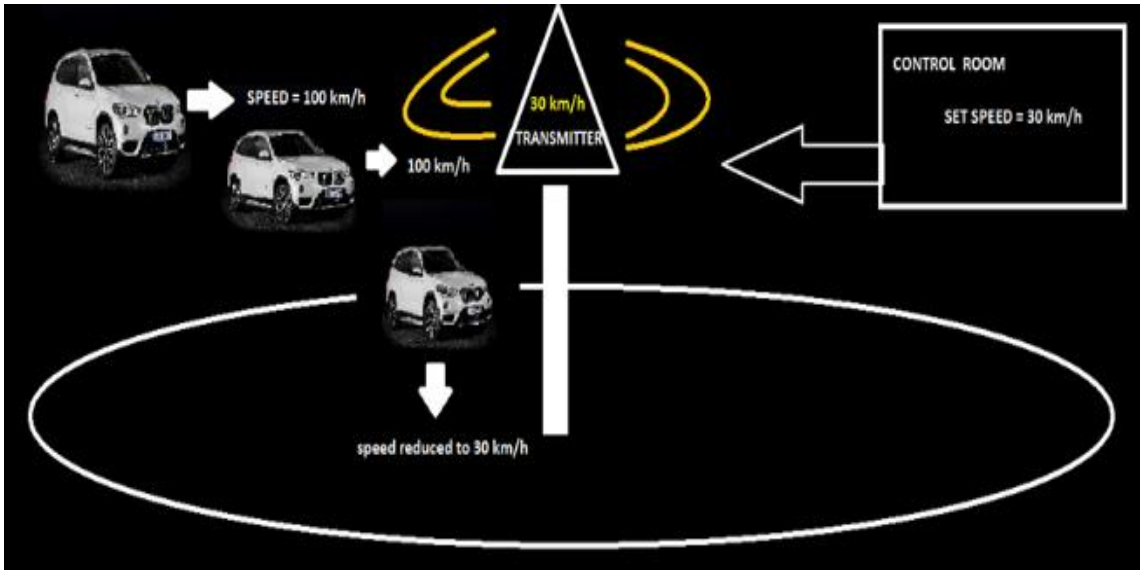

Figure1:Over-speeding vehicleapproachingspeed limit zone

The aim of the project, entitled "An External Adaptive Cruise Control System for lawbreakers and for desired zone," is to:

• If the speed of the vehicle exceeds the allowable speed, the external adaptive cruise control system reduces the vehicle speed to the permitted speed.
• Automatically control vehicle speed in speed-restricted areas.
• Local speed can be set by an official sitting in his office and operating on the IoT network. The new speed is updated on the signal.
• Lawbreaker car speed is automatically controlled within speed limits.
• Reduce the risk of accidents, improve traffic flow, and help to catch criminals.

II. METHODOLOGY

Every state or country has some roads and particular areas with heavy traffic. Therefore, certain speed limits are required on these roads for the vehicle to drive comfortably. So I decided to make these important places a special safety zone for children and adults. This safety zone guarantees the vehicle a specific speed limit. This forces these vehicles to drive within or below the minimum speed limit whenever they are in this area. The system I have proposed also helps police officers to catch law violators, thieves, or those who drive away after committing a crime. If you use the vehicle to commit a crime and escape, you will not drive the vehicle at a restricted speed, and when you enter the special economic zone, the vehicle will automatically slow down and be easily caught by police agents. The RF transmitting circuit consists of an RF transmission module and an RF receiving module. I used a virtualwire library that doesn't require an encoder.

The voltage regulator circuit is powered by a 12 volt (1A) battery, supplying the motor with untuned 12-volt power, and the Arduino, motor driver, and receiver module receive tuned 5-volt power. DC motors are connected via a motor driver. When the RF transmitter is turned on, the user-configured dataset is encrypted and sent to the receiver module.The receiver module decodes the data and sends it to the Arduino to compare the embedded data. If the speed of the DC motor is lower than the restricted zone, the Arduino will instruct the motor driver not to take any action and the speed of the DC motor will remain the same.When the speed exceeds the set speed limit, the Arduino will instruct the motor driver to limit the speed according to the zone to avoid an accident. Now you can use the transmitter to steer your car to where you want it.The transmitter sends a data frame containing a field containing the maximum speed and at that time this speed limit is applied.With this system, the speed of a particular zone can be adjusted by officers sitting in the office via the IoT network.The new setspeed will be updated with a signal.

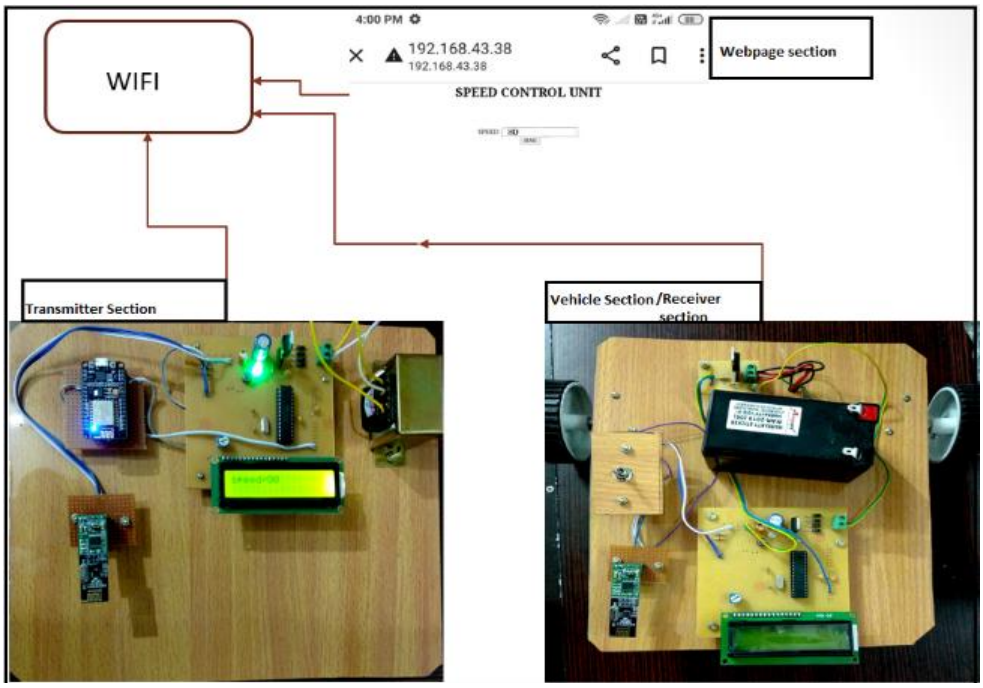

Figure 2. Proposed System

2.1 Module Description

An external adaptive cruise control system is used to adjust the speed of the vehicle. If the vehicle is moving faster than the permissible speed, the speed of the vehicle will be adjusted automatically. This is done using three modules: RF transmitter, RF receiver, and web page. Web pages are used to set the speed.

2.2.1 Transmitter Section

In the proposed system, the transmitter section consists of RF transmitters, node MCUs, and microcontrollers.The RF transmitter receives serial data from the website when you set the speed and send the data. The transmitted data from the RF transmitter is received by an RF receiver operating at the same frequency as the transmitter. The speed value is set on the web page and sent to the transmitter section where the node MCU receives the data. This value is sent to the microcontroller and received from the microcontroller by the RF transmitter, which is wireless communication. Then it is transmitted from the RF transmitter to the vehicle in which the RF receiver is installed.

2.2.2 Receiver Section

When the RF wave leaves the transmitting antenna, it moves to another antenna connected to the receiver, which is the last component of the radio medium. The receiver receives the signal and converts the modulated signal and transfers it for processing. The receiver section mainly contains RF receivers, microcontrollers, and LCD displays. The RF receiver receives the RF signal transmitted by the RF transmitter. It is then passed to the microcontroller, which eventually slows down the vehicle.

2.2.3 Web Page Section

The mobile phone used to open the web page, transmitter section, and receiver section all are connected to the same WiFi connection. For simplicity, we use node MCU because it has more storage capacity and it supports WiFi connection. To create a website, first, establish a connection. Next, a web page for the same network is created. Then connect your mobile phone to the same network so that you can access the same web page. The speed value is sent via the web page and received by the RF transmitter. The value is then sent from the RF transmitter to the RF receiver located in the vehicle, and finally, the vehicle slows down.

2.2 External Adaptive Cruise Framework

The purpose of this project is automatic cruise control of vehicles in speed limit areas. In certain zones, a special type of transmitter is tuned to the frequency. These transmitters continuously emit RF signals. When the vehicle enters this radiation, the vehicle's receiver becomes active. Whenever the vehicle is in the zone, the vehicle speed is controlled by receiving a signal. Each time the vehicle speed drops to a certain limit and

remains constant until the vehicle leaves the zone, the vehicle can accelerate on its own. In this paper, we will introduce a new design for controlling the speed of a car for a certain period of time.

In general, the throttle position of a car is controlled by an electronic control unit (ECU) mainly according to the input received from the accelerator pedal position sensor. However, in the proposed model, instead of the ECU, another microcontroller unit receives the pedal position from the sensor and the microcontroller unit sends it to the ECU. The microcontroller unit is also connected to a wireless module that can detect other transceivers. Now you can guide the car to the destination with a transmitter that sends a data frame containing a field containing the maximum speed and the time this speed limit is applied. In this system, the speed of each zone can be adjusted by the officer sitting in his office. The new set speed will be updated with a signal over the IoT network.

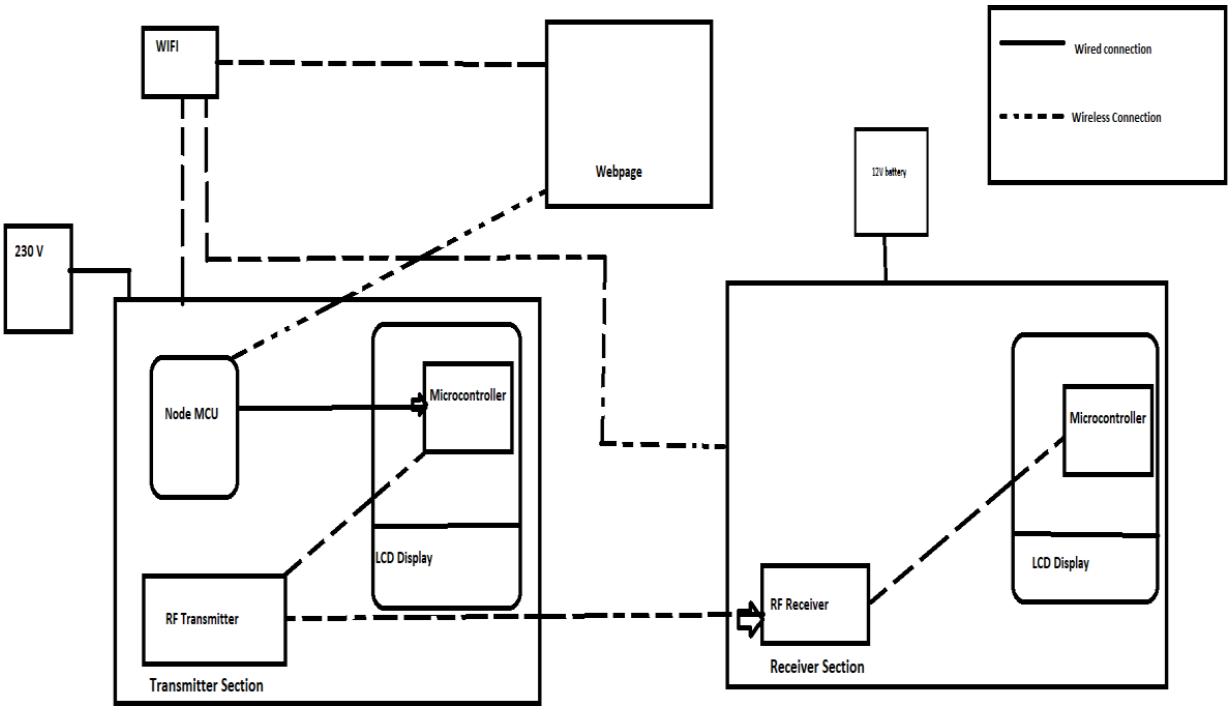

Fig 3: External Adaptive Cruise Control Framework

The framework consists of three steps: setting and sending a value on a web page, receiving a value in the transmitter section and sending the value to the receiver section, and controlling the speed of the vehicle. All three modules are connected to a common WLAN. The speed value is set on the web page and sent to the transmitter section where the node MCU receives the data. This value is sent to the microcontroller and received from the microcontrollerby the RF transmitter, which is a wireless communication. It is transmitted from the RF transmitter to the vehicle in which the RF receiver is installed.The receiver receives the signal from the antenna, converts the modulated signal and transfers it for processing. In the receiver section, there are mainly RF receivers, microcontrollers and LCD displays.

The RF receiver receives the RF signal transmitted by the RF transmitter. It is then passed to the microcontroller, which eventually slows down the vehicle. The transmitter and receiver parts are all connected to the same WiFi connection, which makes the node MCU easier to use and it also has more storage capacity. To create a website, first establish a connection. Next, a web page for the same network is created. Then connect your mobile phone tosame network so that you can access the same web page. The speed value is sent via the web page and received by the RF transmitter. The value is then sent from the RF transmitter to the RF receiver located in the vehicle, slowing down the target vehicle.

III. SYSTEM SPECIFICATION

3.1 Hardware requirements

3.1.1 RF Module (RF transmitter andreceiver)

An RF (radio frequency) module is a small electronic device used to send and receive radio signals between two devices. In embedded systems, it is often used to communicate wirelessly with another device. This wireless communication can be achieved via optical or radio frequency (RF) communication. RF is the medium of choice because many applications do not require a line of sight. RF communication includes

transmittersand receivers**.**

3.1.2 Arduino

One of the easiest and cheapest ways to implement wireless communication is to use an RF (Radio Frequency Module) module. The Arduino, on the other hand, is a low-cost solution for microcontroller applications that use open-source hardware and software. Arduino can be used in many small to real-time applications with simple programming and hardware components. By combining the two objects, communication can be donewirelessly with Arduino, you can create a variety of applications such as remotecontrol cars, wireless robots, home automation, the transmission of data, andmany more.

3.1.3 Microcontroller

Here we are usingATmega328P microcontroller. The ATmega328P is a high-performance, low-power 8-bit AVR microcontroller andit has advanced RISC architecture. It is commonlyfound as a processor for Arduino boards such as Arduino Fio and Arduino Uno.

The ATmega328P is supported by a complete suite of program and system development tools, including a C compiler, macro assembler, program debugger/ simulator, in-circuit emulator, and evaluation kit.

3.1.4 Other Hardware Components

Other hardware components used in thisproject are wheel 4ps, L293D IC, Bread Board, Jumper wire, Lithiumpolymer battery, and sensors.

3.2 Software Requirements

3.2.1 Arduino IDE

The Arduino IDE is open source software used to write code and upload it to your Arduino board. IDE applications are suitable for a variety of operating systems such as Windows, Mac OS X, and Linux. It also supports programming languages C and C ++. Full form of IDE is Integrated Development Environment. Programs or code written in the Arduino IDE are often referred to as sketches. To upload sketches written in the Arduino IDE software, you need to connect the Genuino and Arduino boards to the IDE. Sketches are saved with the extension ". With O."

3.2.2 Proteus Design Suite

This software is primarily used by electrical device designers and engineers to create schematics and electronic prints for PCB manufacturing.

3.2.3 Circuit Wizard Software

Circuit Wizard is an innovative new system that combines circuit design, PCB design, simulation and CAD / CAM manufacturing in one complete package.

IV. IMPLEMENTATION RESULT

Several experiments were performed to evaluate theperformance of the proposed framework. It is known that traffic accidents are increasing day by day. Many of these traffic accidents are caused by cars driving at high speeds, even in areas with sharp turns and intersections. Driving a car in these places is the main cause of an accident. Reducing thenumber of such accidents is the most important step that needs to be taken. The main modules of the project we use are: To control the movement of the vehicle using RF transmitters, RF receivers, and DC motors to build wireless communications. The control unit for the entire system is a microcontroller in which the RF receiver module and the DC motor are connected via a motor driver. In the field of sensor technology, sensors are installed in vehicles andinfrastructureto provide intelligent cruise control.

Some components and the working model is givenbelow:

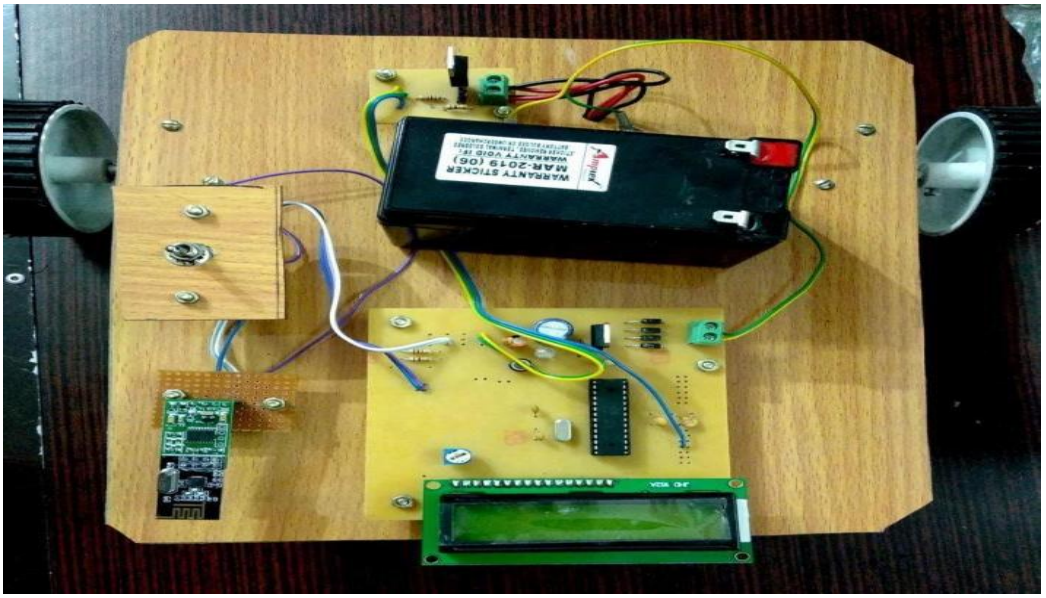

Figure 4: Vehicle Section

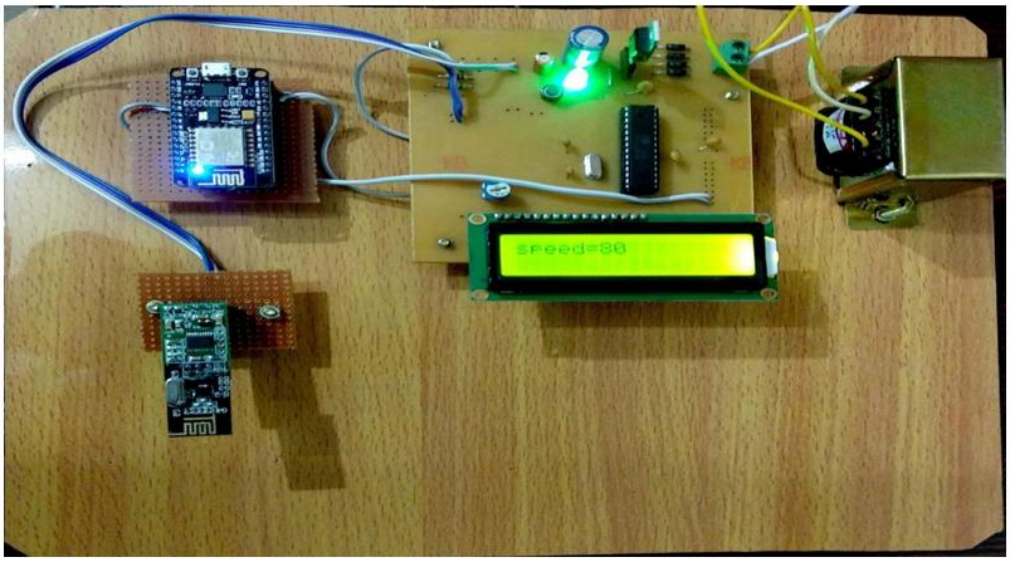

Figure 5: Signal Section

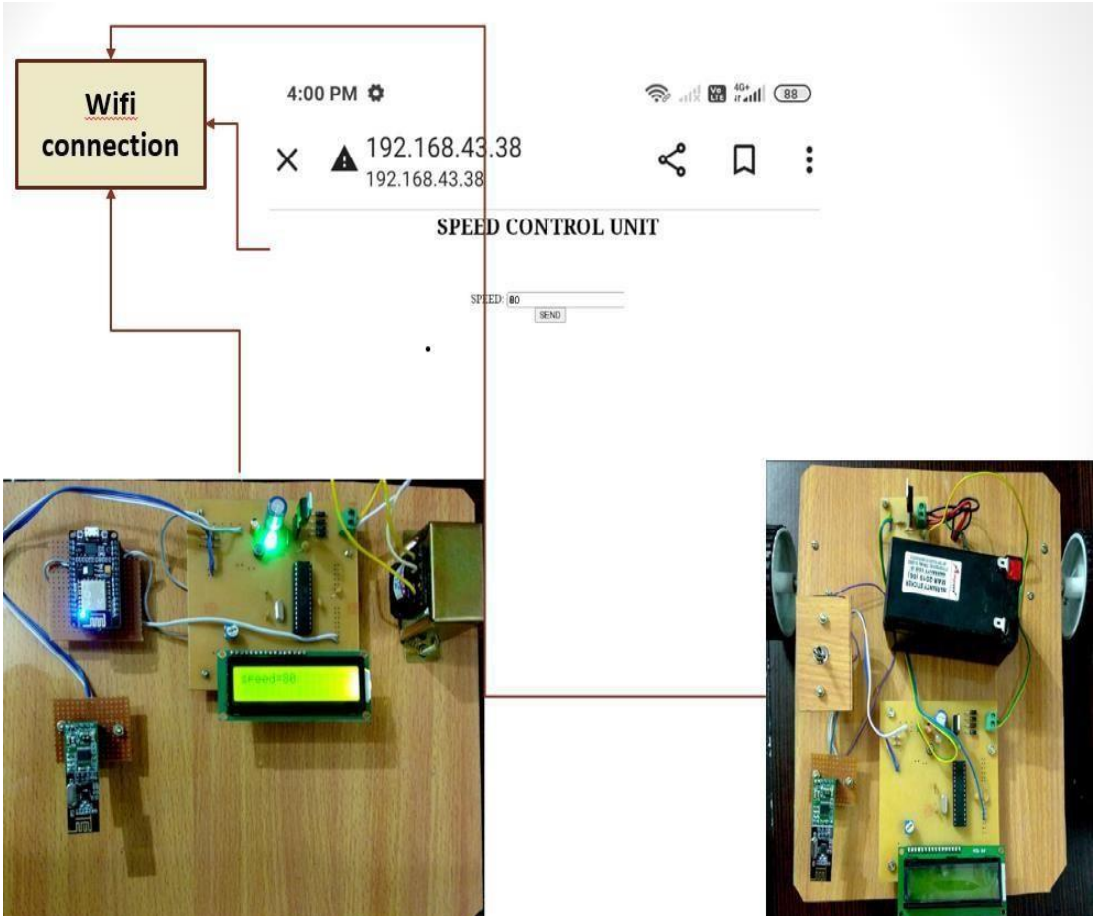

Figure 6: Screenshot of the prototype

V. PERFORMANCE ANALYSIS

Over speed of vehicles are controlled using RF transmitter and RF receivers. A web page is also created to set the speed. In the proposed work we are introducing an external adaptive cruise control system where RF transmitter will be obtaining data from the webpage when an agent set the speed and send the value. The FR transmitter will receive the value from the webpage and that value is sent to the RF receiver which is there within the vehicle. The RF receiver receives the value and the speed of the vehicle is controlled to the permitted speed.

NO:	VEHICLE SPEED	SET SPEED	ACCURACY
1	50	30	89%
2	60	40	91%
3	70	50	95%
4	90	30	98%
5	100	40	100%

Figure 7: Evaluation Table

a. Time delay for receiving signal = 30 to 60 seconds
b. Time taken by vehicle to reduce to the desired speed =10seconds
c. Time to connect hotspot =nearly 30seconds
d. Accuracy of the system =99%

VI. CONCLUSION

Reducing the number of accidents isa very challenging task nowadays. There are many existing methods and techniques to control the speed of the over-speed vehicle because of its cost, complicated technologiesand many other reasons it's not that effective. So this project proposes a proper solutionto this problem by introducing an external adaptive cruise control system for police officers and for lawbreakers. In my project, it is done by with the help of RF transmitters and RF receivers.

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