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Semi-Automatic Control of Electric Cars Using Mobile Handset

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ABSTRACT: Electric vehicles (EVs) are considered as the likely replacement of IC engine vehicles.An electric car is an automobile that is propelled by one or more electric motors, using energy stored in rechargeable batteries. New technologies in communication and robotics have given rise to the concept of autonomous vehicle technology which aims to reduce crashes, energy consumption, pollution, and traffic while at the same time increasing transport accessibility. In this paper, it proposes control of speed,acceleration,braking,etc. of an electric car from a mobile handset along with a provision for the prevention of forward collision. It is achieved withsensors, which senses the obstacle ahead andapplies braking when the threshold range is reached.

KEYWORDS: Electric Vehicles, Autonomous Vehicle Technology, Forward Collision

I.INTRODUCTION

Electric Vehicles (EVs) are the upcoming trend in automobile industry. With the advent of autonomous technology in EVs, problems related to traffic congestion, parking, theft etc. can be reduced up to a certain limit. Along with this EVs are ecofriendly and helps in reducing the energy scarcity and pollution. Along with all these benefits they possess some challenges in interacting with other vehicles in same route and also in clearing the government regulations. Unlike the conventional vehicles an electric vehicle or car is powered by an electric motor rather than a gasoline engine. The electric motor gets its power from a controller. The controller is powered from an array of rechargeable batteries or using solar power with the help of solar panels.

Electric cars can use AC as well as DC motors.DC motors run on a voltage ranging between 96 to 192 volts. Another feature of DC motors is that they can be overdriven for short periods of time. In that case, BLDC motor will be a wise choice as it has compact size, high operating speed, and high efficiency and only requires less maintenance. Lithium ion batteries are used to power the vehicle. The controller takes power from the batteries and delivers it to the motor. As mentioned earlier, solar power can also be used as backup supply power supply. Solar panels are attached to the roofs generate electricity and can be used to power auxiliary functions such as light,horn,etc.

In this paper, it proposes an efficient semi- automatic control mechanism for controlling speed, acceleration, braking, light and horn. The controlling is achieved via a mobile handset. The user can give directions to the vehicle with the help of an application installed in the mobile phone. A Bluetooth module acts as an interface between the user and vehicle. The control signals are carried over the Bluetooth network and they are received by an Arduino platform. There it is processed and it controls the motor correspondingly. The speed, acceleration and braking are controlled with a stepper motor. In order to avoid any collision with the vehicle ahead, a forward collision prevention mechanism is employed making use of the sensors.Cruise control is also enabled in the vehicle which helps in reducing the fatigue of the driver from continuous driving.

II.OVERVIEW

The proposed vehicle employs a semi-autonomous control technology. The control system comprises of an Arduino platform, Bluetooth module and a user platform like smartphone. The vehicle holds a stepper motor, IC LN298, relays and an arduino board while the smartphone have an application from which the user/owner can give commands to the vehicle regarding the control purpose. The Bluetooth module acts as an interface for the communication between the person and vehicle.

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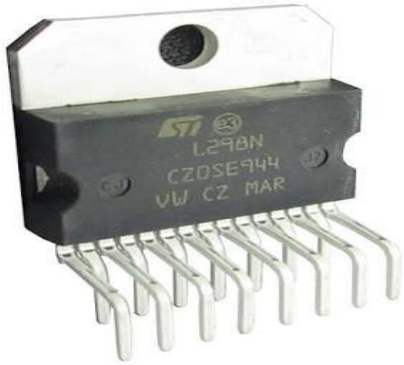
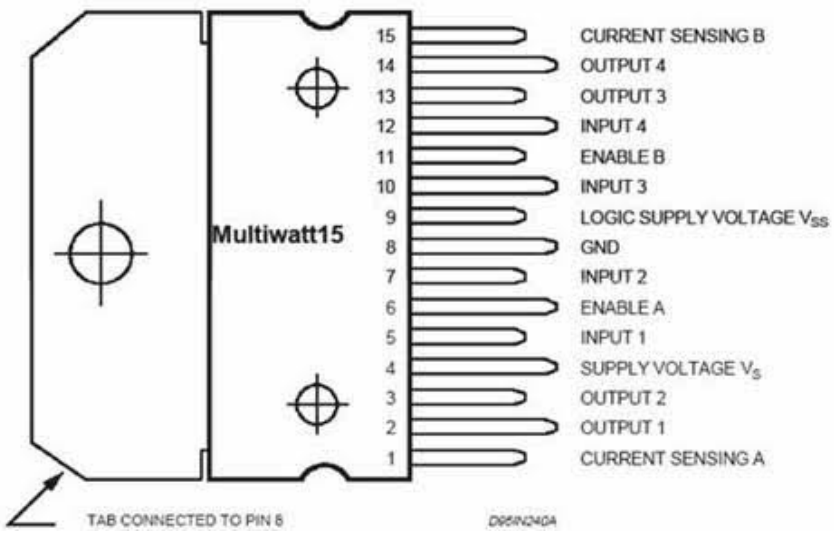
Stepper Motor:
Due to their unique design it can be controlled to high degree of accuracy without any feedback mechanism. The shaft of a stepper motor, mounted with a series of magnets, is controlled by a series of electromagnetic coils that are charged positively and negatively in a specific sequence moving at forward or backward in small steps. The stepper motor is controlled by digital pins 8, 9, 10 & 11 of the arduino board. The stepper in turn controls the speed of the vehicle.

ICLN298:
ICLN298 is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals.ICLN298 is used in order to step up the voltage to suit the working voltage of the stepper motor.



Arduino board:
It is an open source hardware used to design a variety of microprocessors & controllers. It is equipped with sets of digital and analog input/output pins. An Arduino board is installed in the vehicle preprogrammed for control operations. It enables the communication between owner and vehicle and take actions corresponding to the control signals.



The schematic representation of the control system is as shown in fig 2.1.The operator gives commands to from his android phone using the application. The android phone is connected with Bluetooth module, which helps to establish a communication with the vehicle. When the control signals are received by the Arduino, the information is processed and necessary control mechanism is employed.

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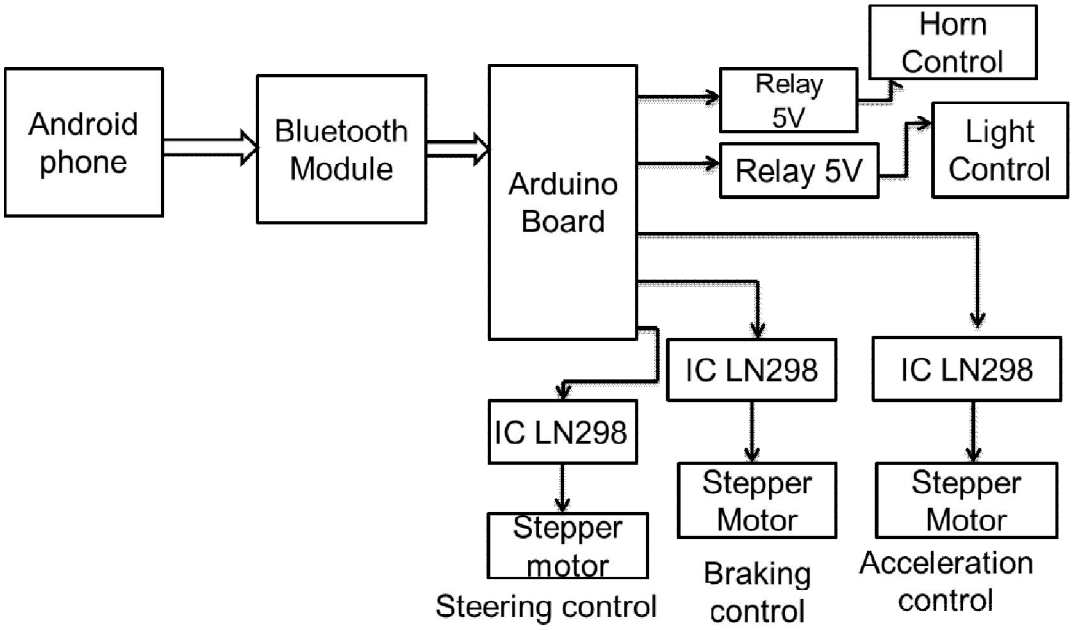

Fig 2.1

III.CONTROL OPERATIONS

Employing semi-autonomous control technology, the various control operations proposed in this paper includes:
1. Steering control
2. Braking control
3. Acceleration control
4. Cruise control
5. Forward collision avoidance
6. Control of light, horn, etc.

STEERING CONTROL

Here we are controlling the car steering using an android app. Fig 2.2 shows the software application developed for the control purposes.

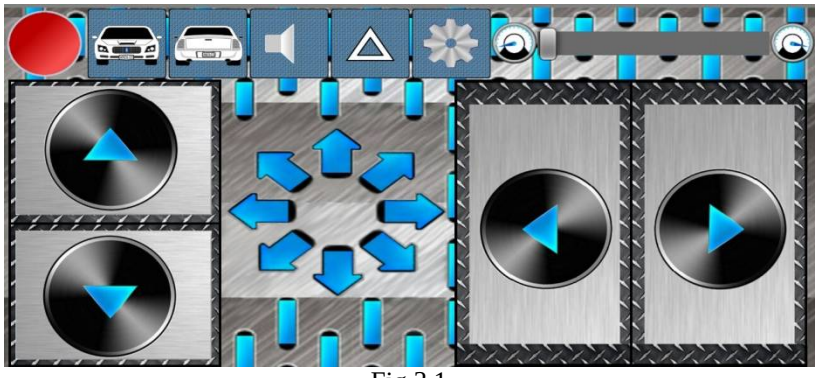

Fig 3.1

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From the application the steering is controlled by pressing arrowscorresponding to different directions thus altering the vehicle direction. When arrow is pressed, the bluetooth module sends data to the arduino board. Arduino is connected to motor through IC LN298, and the motor in turn is connected to the steering via gear box.

BRAKING CONTROL

The braking system employs a piston-cylinder mechanism. The stepper motor is connected to the piston by which the pressure of the fluid is controlled. Stepper motor acts according to the control signals received from arduino.

ACCELERATION CONTROL

Acceleration of the vehicle is controlled by varying the voltage using the analog pins of arduino. The voltage is given to the motor controller.

CRUISE CONTROL

Cruise control is a system that automatically controls the speed of a vehicle. The system is a servomechanism that helps to maintain a steady speed as set by the driver.The driver must bring the vehicle up to speed manually and use a slide bar in the application to set the cruise control to the current speed. The cruise control system is capable of being turned off automatically when the driver depresses the brake, and often also the clutch. The cruise control is helpful in long drives reducing driver fatigue and improving the comfort.

IV.FORWARD COLLISION AVOIDANCE SYSTEM (FCAS)

According to National Highway Traffic Safety Administration (NHTSA), about 40000 people are killed each year in automobile collisions. In this paper it proposes a system to prevent automobile collisions. In the system Lidars are used to sense the obstacles ahead of the host vehicle and when it crosses the threshold distance braking is applied automatically. A pictorial representation of the FCAS is shown in Fig 3.1.

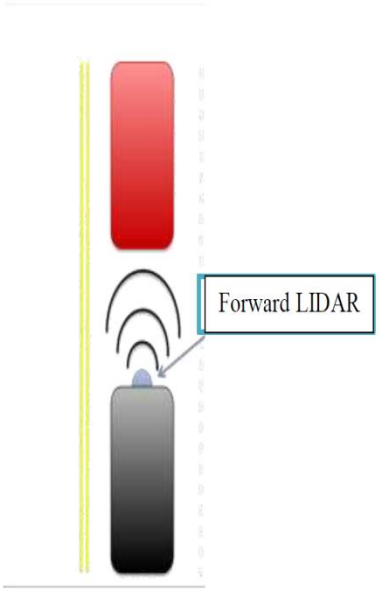

Fig 3.1

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Preconditions:

There is another vehicle or non-vehicle obstacle in the direct path of the host vehicle.

Flow of events:

1. The vehicle is moving forward .
2. FCAS continuously senses the distance between the host vehicle and the obstacle.
3. When the obstacle crosses the threshold distance(say, 1 meter), braking control system is activated.
4. Vehicle stops.
5. The FCAS determines that a collision is no longer possible.
6. The braking control system deactivates.

Post-conditions:

1. Forward collision is not possible.
2. The vehicle can run freely.

V.ALGORITHM

1. Check whether serial data is available
2. Check which key is pressed
3. If horn and lights pressed- digital pins 3,4,5 made high.
4. If acceleration key is pressed - analog pin A1 increased
5. when cruise control is set- output of analog pin is set to corresponding voltage
6. If keys for steering control pressed - motor rotated in corresponding direction using the library function for specific number of steps
7. If braking pressed - motor rotated in corresponding direction

VI.CHALLENGES

1. Bluetooth range is limited - controlling beyond this limit is difficult - incorporating wifi systems can be a solution
2. If vehicle is stationary the steering movement using motor is difficult

VII.CONCLUSION

This paper discusses about the various semi-autonomous control operations employed in an electric car. It will reduce the accidents and in case of accidents there is no harm for the driver. It provides efficient driving as well as passengers can smoothly travel. The autonomous control technology helps in establishing efficient communication between the user and vehicle.

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