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Self-Driving RC-Car

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ABSTRACT

Our project is a Self-Driving RC Car, which is designed to give human driver relaxed driving. In the field of automobile various aspects have been considered which makes a vehicle automated. In this project we have focused on application of automated car, in which the car will detect obstacle, traffic signal and stop signs. It also drives itself on the track and monitoring and surveillance the environment with the help of Ultrasonic sensors, IR sensors. Arduino, Raspberry pi which is used to collect all the input data from sensors and cameras. The other application is automated driving during the heavy traffic jam, hence relaxing driver from continuously pushing break, accelerator or clutch. Since taking intelligent decision in the traffic is also an issue for the automated vehicle so this aspect has been also under consideration in this paper.

Index Terms — GPS, Ultrasonic Sensors, IR Sensors, Arduino, Raspberry pi, Voice Recognition.

I. INTRODUCTION

An autonomous car (also known as a driverless car, self-driving car, robotic car[1]) is a robotic vehicle that is designed to travel between destinations without any human intervention.

About 1.24 million People are killed in roads every year throughout the world. According to BUET accident research centre the death toll every year is 10-12 thousand and countless number of people are injured or become disabled destroying so many lives and families.

Autonomous system is a solution of this problem. Here are some ways through which driverless car will change the world as follows:

1. Safety - No matter what we like to believe, humans are no good at driving. The 1.24 million people killed every year on roads worldwide are proof of that. Unlike us, driverless cars will never drive drunk and will not be able to speed, take reckless chances or race their mates

away from traffic lights. They will never doze off, lose concentration or send a text message at the wheel. They will never get angry, frustrated or competitive. In short, they will be a lot, lot safer than we are.

2. Congestion – There are more people and cars on this little island than ever before, and they're all in a traffic jam between where you are and where you need to be. Driverless cars can travel in convoys, inches apart, without any needless dabs of the brake pedal to filter backwards through traffic and create mysterious, pointless hold-ups.

3. Cost – Buying, insuring and maintaining a car is expensive. So why not let someone else do it? The future of driverless cars is likely to include sharing schemes, smart taxi firms and affordable leasing options – cars will be more productive, more of the time, rather than spending 99 per cent of their lives motionless outside your house.

4. Parking - No longer will it be our problem to find a space – our car will handle it. Once we arrive at our destination we will hop out at the front door and leave the car to slink away and wait for us to summon it later with our Smartphone. No more parking tickets, no more dented bumpers, no more endlessly driving in circles waiting for a neighbor to leave. This will free up urban road space for wider pavements.

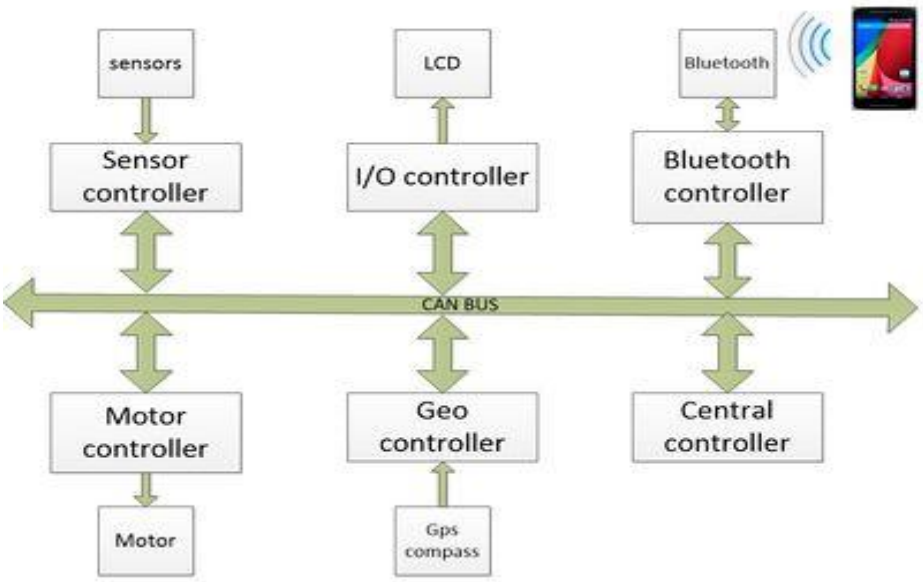

Fig. 1 working of self driving RC car.

RC car to handle three tasks: self-driving on the track, stop sign and traffic light detection, and front collision avoidance. The system consists of three subsystems: input unit (camera, ultrasonic sensor), processing unit (computer) and RC car control unit. These all task are completed by using the Global positioning system for source to destination.

1. **System Design:** The system consists of three subsystems: input unit (camera, ultrasonic sensor), processing unit (computer) and RC car control unit.

2. **Input unit:-** A Raspberry Pi board (model B+), attached with a pi camera module and an HC-SR04 ultrasonic sensor is used to collect input data. Two client programs run on Raspberry Pi for streaming color video and ultrasonic sensor data to the computer via local connection.

3. **Processing unit:-** The processing unit (computer) handles multiple tasks: receiving data from Raspberry Pi, neural network training and prediction(steering), object detection(stop sign and traffic light), distance measurement monocular vision), and sending instructions to Arduino through USB connection.

4. **Control unit:** The RC car used in this project has an on/off switch type controller. Thus, an Arduino board is used to simulate button-press actions. Four Arduino pins are chosen to connect four chip pins on the controller, corresponding to forward, reverse, left and right actions respectively. Arduino pins sending LOW signal indicates grounding the chip pins of the controller; on the other hand sending HIGH signal. The Arduino is connected to the computer via USB. The computer outputs commands to Arduino using serial interface, and then the Arduino reads the commands and writes out LOW or HIGH signals, simulating actions to drive the RC car.

Hardware and Software Require

A pre-built four wheel drive (4WD) chassis is used as a base on which following hardware components are :-

1. Raspberry Pi and Arduino, Motor shield (for GPU and CPU computations)
2. Sensors: - Ultrasonic and IR sensor are used for Obstacle detection.
3. Pi camera: - Pi Camera are used to capture the image.
4. Bluetooth Module:- Bluetooth Module are used for the voice recognition.

Hardware and software Description.

1. **Raspberry Pi:-** The Raspberry Pi is a credit card-sized single-board computer. There are currently five Raspberry Pi models in market i.e. the Model B+, the Model A+, the Model B, the Model A, and the Compute Module (currently only available as part of the Compute Module development kit). All models use the same SoC (System on Chip - combined CPU & GPU), the BCM2835, but other hardware features differ.

2. Bluetooth Module:- Bluetooth module allows the Arduino Mega to easily communicate with the mobile phone. Whatever is being sent via a serial connection to the Bluetooth module is being transmitted wirelessly to whichever device is currently connected to the Bluetooth module. On the HC-05, there is also a pin that indicates whether there is an active connection at the moment, which we utilize in order to fetch and transmit data from the Arduino, only when that is necessary.

3. **Ultrasonic Sensors:-** Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively [1]. In this project, they are used to detect the distance of obstacles from the car [1].

4. **Pi Camera:-** It is the camera shipped along with Raspberry Pi [18]. Pi camera module is also available to which can be used to take high-definition videos as well as still photographs [18].

II.LITERATURE SURVEY

1. **Title**: Involved in solving a challenge to build autonomous cars.

2. **Description:**

First autonomous car was demonstrated. It was radio -controlled driverless by name "Linrrican Wonder" It travelled on New York City streets, from Broadway down to Fifth Avenue. In 1926 Lihrrican Wonder used Radio antennas for sending radio impulses, those radio impulses were caught by the antennae. The antennae introduced the signals to circuit-breakers which operated small electric motors that direct every movement of the car..

In 1953 RCA LABS in USA build first device to control the cars on highways. But first actual self-sufficient and truly autonomous cars were developed in the 1980s with the help of Carnegie Mellon University and ALV projects in 1984 and afterwards in 1987 by Bedewed University Munich's EUREKA Prometheus Project and Mercedes-Benz

1. **Title**: Developed unmanned vehicle prototypes in which they have worked on the obstacle avoidance and path planning

2. Description:

In the pre-computer days of the 1930s, the driverless cars were only the science fiction things. But the development of the digital computer made possible to dream of self-driven vehicles outside the fiction.

By the passing years, the car is developed and equipped with multiple sensors, radars, lasers, Global Positioning System (GPS), it uses heavily detailed maps, and many other things to safely drive and navigate itself with no human interaction. The car can not only drive it but it can be parked on its own, it can go on freeways, Cameras are used to find and detect objects that are then processed by the computer within the car.

1. **Title:** Autonomous Car Using Full Mapping GPS System"

2. **Description:**

"Autonomous Car Using Full Mapping GPS System" is submitted to the Department of Electrical and Electronic Engineering of BRAC University in partial fulfillment of the Bachelor of Science in Electrical and Electronic Engineering.

Autonomous Car using full mapping GPS, which is based on a Laptop computer to generate the path coordinates and an Android phone to obtain the GPS data and used the mobile camera as the obstacle detection image processing unit. An Arduino is used as the brain of the system.

The car which we made features electric motor driving of each of the two front wheels via independent controllers and has full drive-by-wire control of the throttle, steering and braking system. Nowadays the traffic has increased by quite a huge number.

1. **Title**: Design and Implementation of Autonomous Car using Raspberry Pi

2. **Description:**

The project aims to build a monocular vision autonomous car prototype using Raspberry Pi as a processing chip. An HD camera along with an ultrasonic sensor is used to provide necessary data from the real world to the car. The car is capable of reaching the given destination safely and intelligently thus avoiding the risk of human errors. Many existing algorithms like lane detection, obstacle detection are combined together to provide the necessary control to the car.

1. **Title**: Self-Driving and Driver Relaxing Vehicle

2. **Description:** Vehicle moving on its way to some destination, while the following vehicle (at back) is getting GPS location of the front vehicle and moving towards it by getting directions and instructions from Google Maps using Google Maps API. Blue line route experimenting the self driving mechanism Experiments during turns Shows the route taken by the Front vehicle while the Red colored line shows the route taken by the Following vehicle after getting instructions from Google Maps. By testing the vehicle in real time, we have also observed that

even if the target vehicle takes the wrong route, the following vehicle will follow the right route because it is connected to Google Maps. As it is a prototype and vehicle is very small, hence it is very slow but if the system is implemented in real vehicles then this could help in solving the discussed issues in real time.

III. MOTIVATION

1. Currently the leading causes of automobile deaths are distracted drivers, drunk drivers and drivers who speed.
2. .People with vision problems and other physical limitations that keep them from driving may be able to get around again

IV.OBJECTIVE AND GOALS

1. The main goal of self driving RC car is to avoid accidents.
2. Increasing roadway capacity by reducing the distances between cars
3. People are free to concentrate on other tasks or to rest during their journeys.
4. The current location of vehicle can be determined using GPS

V.PROPOSED SYSTEM

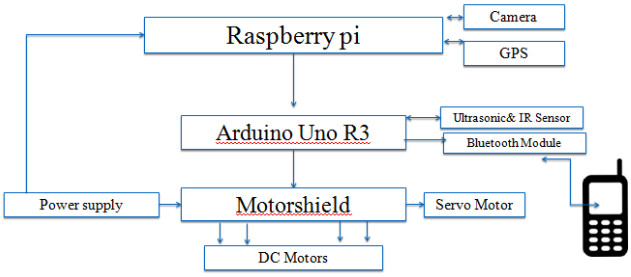

Fig 2.proposed system

The proposed system design attribute-based different function such as obstacle detection, voice recognition etc and image processing etc. This all task are complete by using the different software and hardware components.

The system contains four modules,

1) Obstacle detection.
2) Image processing.
3) Voice recognition.
4) GPS system

1. Obstacle detection.-

This proposed system are used for the two type of sensors first is ultrasonic sensor used for the obstacle detection another one is IR sensor used for motion detection, Human detection and smoke detection.

2. Image processing:-

In this system Raspberry pi used for the image processing. Image capturing camera, Raspberry Pi board to run image recognition programs on it. DVI compatible monitors also connected with this system during initial stages to

preview the captured images and give the user indication and Also having self-driving on the track, stop sign and traffic light detection.

3. Voice recognition:-

Voice recognition is the process of taking the spoken word as an input to a computer program. This is important to virtual reality because it provides a fairly natural and intuitive way of controlling the simulation while allowing the user's hands to remain free.

4. GPS system:-

When global positioning system is used to the current location of vehicle can be determined. Also find path from source to destination.

Actual working:

Our main focus was on Following Vehicle, which detects and avoids obstacles, coordinate with Google Maps API, get route and follow the route. For another application, it checks vehicles around and automatically moves slowly behind the traffic until it gets out of traffic jam situation. The function of the Target vehicle is just to provide the coordinates to Following Vehicle, which is also not static as the Target vehicle is moving towards its destination. The Target vehicle fetches its existing location coordinates through GPS and sends to Arduino then these coordinates in the form of the message has been sent to following vehicle after every certain time of interval.

The app is in such a way that it converts the voice command to text and transfer the text to the connected Bluetooth device. The Bluetooth connected on the Arduino board receives text from the Android app as characters and stored them as string to the assigned String. There are words pre-programmed (forward, reverse, right, left and stop) to the Arduino, whenever the received text matches with the pre-programmed words, the Arduino executes the command that assigned to the words.

Advantages of Proposed System:

1. Managing traffic flow to increase road capacity.
2. Reliving vehicle occupants from driving allowing them to concentrate on other task during their journey.
3. To avoid accidents.
4. Increase the road way capacity by reducing the distances between cars.
5. The current location of vehicle can be determined using the Global positioning system.

VI .FUTURE WORK

In the future we might be able to text, talk on the phone, eat breakfast, read emails and surf all of our beloved social media sites, all while on the way to work

To obtain precise and accurate results LASER sensors are required. These kinds of sensors are pretty much expensive. In future works, if the laser sensors named “LIDAR” is used; surely the results will have very less errors.

VII. FEASIBILITY

There are many challenges in making self driving cars reality in India. There are several assumptions that go in while building machine learning algorithms behind self driving cars.

For example

1. There is clear marking of lanes.
2. All the vehicles and pedestrians follow traffic rules at least to maximum extent
3. There are clean sign board indications.

Economic Impact

1. $1.3 trillion in annual savings to the economy
2. $158 billion in annual fuel cost savings.
3. $488 billion in annual accident cost reduction savings
4. $138 billion in annual productivity savings from less congestion.

VIII .CONCLUSION

The driver less car's technologies improves vehicle's stability helps to loss of control. Driver less cars are designed to minimize accidents by addressing the main cause of collisions: driving error, distraction and drowsiness.

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