Semi Autonomous Vehicle To Prevent Accident

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ABSTRACT: The design and development of semi-autonomous vehicle to prevent accident and to provide safety to the passenger as well as to the surrounding. Obstacle avoidance system where the human driver has full control of the vehicle until the system detects that the vehicle is headed for a collision or is too close to an obstacle for safety. When hazard is detected, the system will take control of the vehicle, alters the movement and then hand over the control back to driver. We monitor the distance between the obstacle and the vehicle to identify occurrence of abnormality, it also allows the driver to follow traffic rules like if the signal glows red the vehicle has to stop, the cameras placed in the vehicle senses the signal color and alters the vehicle mobility. The proposed system is implemented with the help of ultrasonic sensor, camera module and raspberry pi.

Keywords: Raspberry Pi, Camera Module, Ultrasonic Sensor, L293DNE Motor Controller

I INTRODUCTION

Initially vehicles are invented to minimize strain on human and to increase the productivity, as the population increases many advancements where made in the vehicle in order give comfort to the people who travel in it. In the present scenario production of vehicles have increased enormously so as the user which thereby leads to heavy traffic. One of the major reasons for the accidents is disobeying of traffic rules such as using mobile while driving, over speed and carelessness So to reduce accidents we have come out with an idea of semi-autonomous vehicle to prevent accident using Raspberry Pi in which car will be automatically controlled during emergency situation, this car alters the direction of the vehicle whenever the driver is not aware of the driving situation and will avoid collision. This semi-autonomous vehicle consists of Raspberry Pi interfaced with Camera module, Ultrasonic sensor and DC Motor. This system is executed with the python programming. Raspberry Pi is used for both manual and automatic toll processing unit in which it is interfaced with the RF Transceiver, WIFI USB Dongle, Camera and Stepper Motor, in this system camera captures the license plate number and then it is received by the Raspberry Pi which is connected to the internet will read the characters and transmits number of server for matching and toll from users account [8]. Ultrasonic range estimation is the method uses a wideband frequency-hop spread spectrum ultrasonic signal to increase robustness to noise and reverberation. The method applies cross-correlation with earliest peak search and a novel minimum variance search technique to correct the error in the cross-correlation time-of-flight estimate to within one wavelength of the carrier before applying a phase-shift technique for sub wavelength range refinement [10]. The properties of infrared light and magnetic fields have already been exploited for position localization in distances of several centimeters. Ultrasonic waves and laser light can be used for longer distance estimation if the system is capable of accurately measuring the time of flight of the reflected signals. The proposed approach intends to cover a distance of several meters without requiring high accuracy measurements and sensors of increased precision. The area covered can be increased by a factor between 20% and 100% depending on the allowed range overlapping of the transmitting devices. [14]. Low cost autonomous vehicle for obstacle avoidance is taken in which ultrasonic sensor is used to measure the distance between the vehicle and obstacle, this is also a low cost which is one of the key features which is used to reduce the accidents during heavy traffic and also while driving in highway.[15]. Traffic surveillance incident detection system which is capable of Sign Board detection, signal detection and speed control integrated digital recording of 25/30 frames per second per camera. All camera images are permanently stored in separate buffers. A ring-buffer enables access to past events and keeps live images from each camera. The buffer capacity is freely configurable within the storage capacity [17].

II SEMI AUTONOMOUS VEHICLE MODEL

Semi-autonomous vehicle consists of a Hardware assembly which has Raspberry Pi, Camera Module, Ultrasonic Sensor and DC Motor. These components are connected in order to form a vehicle to prevent accident.

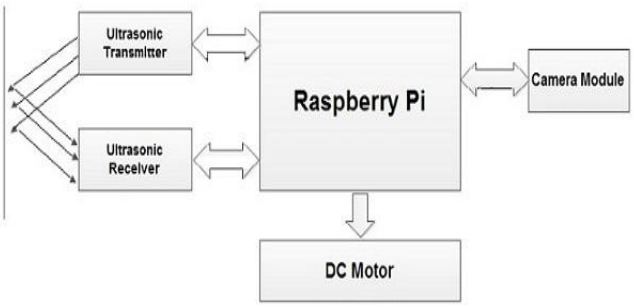

Figure 1 Semi Autonomous Vehicle Model

The basic requirement for this model is Raspberry Pi, Camera module, Ultrasonic sensor and DC Motor. Raspberry Pi is the processing unit which is interfaced with the ultrasonic sensor which consists of a transmitter and receiver. Ultrasonic sensor transmits eight continuous pulses of 40 KHz which will hit the obstacle and the reflected pulses are received by the receiver which is used to measure the distance between the obstacle and the vehicle. This distance is analyzed by the processing unit to alter the direction of vehicle. When the distance between the obstacle and vehicle is less than the threshold distance, altering the direction of the vehicle is done by DC Motor. Camera module is interfaced with the processing unit for the signal detection which will detect the color of signal and

alter the mobility of vehicle. Raspberry Pi is a credit-card sized single board computer developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi is a small, powerful and lightweight ARM based computer which can do many of the things a desktop PC can do. The powerful graphics capabilities and HDMI video output make it ideal for multimedia applications such as media centers and narrowcasting solutions. Raspberry Pi Model B has 512Mb RAM, 2USB ports and an Ethernet port. It has a Broadcom BCM2835 system on a chip which includes an ARM1176JZF-S 700 MHz processor, video core IV GPU, and an SD card. It has a fast 3D core accessed using the supplied openGL ES2.0 and openVG libraries. GPIO (general purpose I/O) signals on the 2x13 header pins include SPI, I2C, serial UART, 3V3 and 5V power. These interfaces are not "plug and play" and require care to avoid miswiring. The pins use a 3V3 logic level and are not tolerant of 5V levels, such as you might find on a 5V powered Arduino. General Purpose Input/ Output is a generic pin on a chip whose behavior including whether it is an input or output pin can be controlled through software. Raspberry Pi has a 26-pin 2.54mm marked as P1 arranged in a 2*13 strip. GPIO voltage levels are 3.3V and are not 5V tolerant. There is no over-voltage protection on the board. Ultrasonic sensors are also known as transceivers when they both send and receive, but more generally called transducers, they work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively.

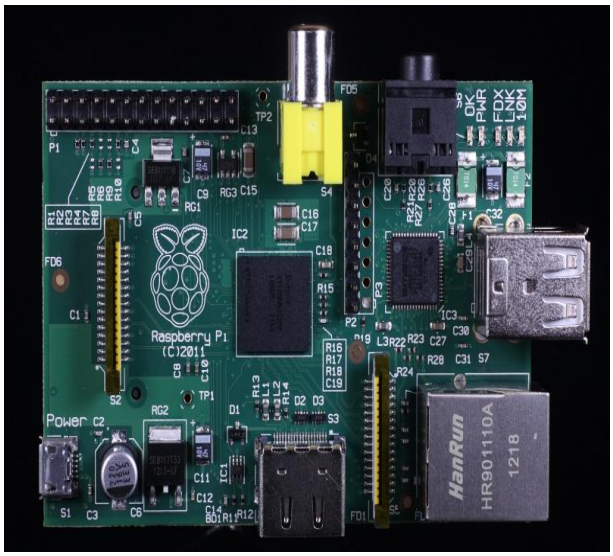

Figure 2 Raspberry Pi Model B

Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. A Camera module is an Image sensor integrated with control electronics and an interface like CSI, Ethernet or plain raw LVDS. The Raspberry Pi camera board contains a 5MPixel sensor, and connects via a ribbon cable to the CSI connector on the Raspberry Pi. A Guide describes setup and use. The video and still image quality is better than a USB webcam of similar price. With no IR filter, it can see near-IR wavelengths (700 - 1000 nm) like a security camera, with the tradeoff of poor color rendition. It is otherwise the same and uses the same software as the normal Pi camera. It is an extremely fast connection, which on the Raspberry Pi is capable of sending 1080p sized images (1920x1 080 x1 0bpp) at 30 frames per second, or lower resolution at even higher frame rates. A DC motor relies on the facts that like magnet poles repel and unlike magnetic poles attract each other. A coil of wire with a current running through it generates a electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnet field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°.This DC Motor is controlled by H-bridge which consists of L293DNE motor driver. L293DNE works on the concept of H-bridge is a circuit which allows the voltage to be flown in either direction. An H-bridge is an electronic circuit which enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications to allow DC motors to run.

IV.SYSTEM ARCHITECTURE OF PROPOSED SEMI AUTONOMOUS VEHICLE

System Architecture consists of three essential components they are, Raspberry Pi, Camera Module and L293DNE Motor Controller

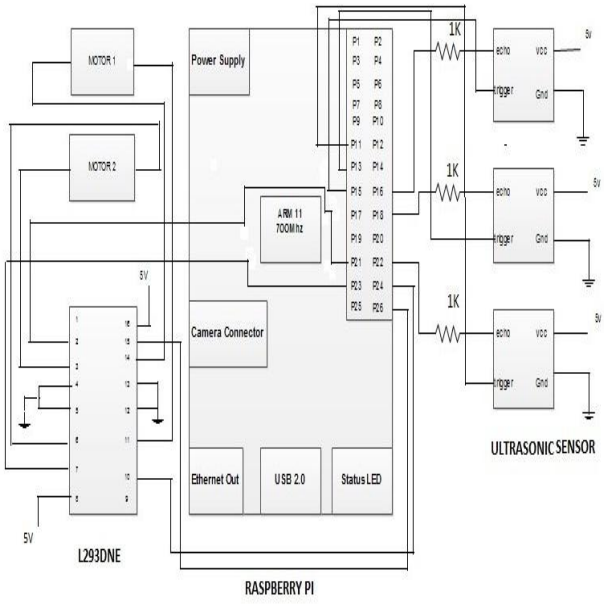

Figure 3 System Architecture of Proposed System

Raspberry pi is the processing unit used to control DC Motor with respect to the distance measured by the ultrasonic sensors attached to the vehicle and the data obtained from camera. Raspberry Pi is provided with a 5V power supply which can be provided with an adapter or a battery at (pin 2). Three ultrasonic sensors are connected to the front of the vehicle, the sensors consist of four pin they are VCC, ECHO, TRIGGER and GROUND. The VCC of three sensors are connected to battery and ground connection is provided accordingly. Trigger of the three

sensors are connected to the pin 11, 13, 15 and echo is connected to the pins 12, 16, 18 respectively. A 1Kohm resistor is connected between the echo and Raspberry Pi pins as the received pulse may produce voltage higher than 5V which has the possibility to damage the pins so this resistor acts as filter. Since DC motor cannot be connected directly to pins of raspberry pi because the voltage output at port 1 may not be 5V all the time which may be less than that some time so in order to produce a constant voltage IC L293 DNE H-bridge is used. Pin 21 and 23 of raspberry pi is connected to pin 2,7 of motor controller, then pin 24,26 of raspberry pi is connected to pin 10,15 of motor controller finally motor 1 and 2 are connected to 3,6,14,11 respectively. Motor controller L293DNE is capable of providing constant 5V to the motor so just by varying the voltage at the pins movement/rotation of motor can be altered. Male Female jumper wires are used to establish connection. For Processing Image raspberry pi camera module (5MP) is used which can be connected to the port provided for camera separately.

V RESULTS

The measured distance between the obstacle and vehicle by the three ultrasonic sensors

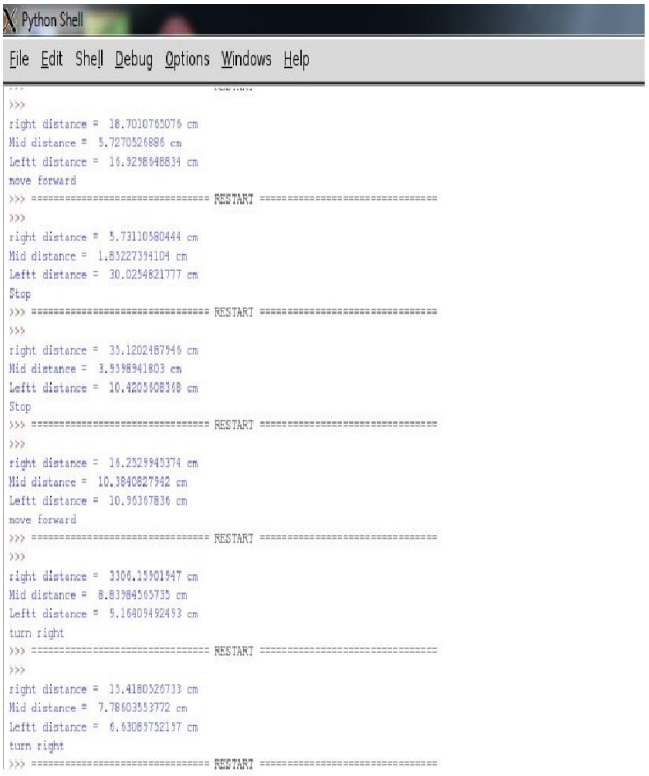

Figure 4 Sensor Output

Detecting red color by camera module

Figure 5 Color Identification Output

Hardware assembly of Raspberry pi, Camera Module, Ultrasonic Sensor and DC Motor

Figure 6 Hardware Assembly Of Semi Autonomous Vehicle

The proposed system will be useful for drivers for safe driving which will also prevent accidents which takes place every day with the reduced cost.

VI CONCLUSION

By implementing this project a safe and intelligent vehicle at low cost is provided. This is achieved by using Raspberry Pi as the main computational engine where as in existing systems the use of full-fledged general purpose computer which would increase the cost. This model projects the idea of preventing accident at low cost with the implementation of Raspberry pi which is a credit card size PC. Thus our project helps the society in reducing accidents. In future work this vehicle can be further extended for much better driving experience currently we have created a module for

estimating distance between vehicle and obstacle then altering the movement accordingly and detecting the color of the signal, further it be used to detect the sign board and caution board in the driving path which requires pattern detection and analyzing the detected data when implemented ensures more safety to the vehicle users for more accuracy LIDAR and DISTRONIC sensors can be used which is of high cost.

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