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VOICE GUIDED DRIVER ASSISTANCE SYSTEM BASED ON RASPBERRY-Pi

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ABSTRACT

The use of embedded technology has proved to be very beneficial in present driver assistance systems. It helps to reduce the complexity for the drivers during parking and reversing the vehicles making the drivers aware of the static/ dynamic obstacles. To ensure safety of user and vehicle it is important to develop a system which will continuously guide the driver. In proposed method a driver assistance system using Raspberry pi an on board computer is developed which acts as a guide for the driver. The work identifies obstacles and related distance from the vehicle using ultrasonic and infra-red sensors interfaced with raspberry pi and provide indications to the driver in terms of distance of obstacle from the vehicle and various guiding instructions through display as well as voice via speaker.

KEYWORDS: Raspberri-pi, infrared (IR) sensors, ultrasonic sensors.

INTRODUCTION

Nowadays parking of vehicles is not an easy task especially in urban areas. There is a need of parking assist for drivers which can convey them about blind spots. These blind spots can be small animals, pedestrians, milestones, wall or other vehicles also. Due to presence of such blind spots sometimes small accidents can occur or damages to vehicle. Therefore an automated parking assistant system is required to make the driver aware of any obstacles and visibility of those blind spots.

Parallel and reverse vehicle parking is complex job especially for drivers due to presence of blind spots. An automated parking assistant system is essential to make driver aware of any static/dynamic obstacle and visibility of those blind spots. To overcome the issue , method is proposed to construct an automated system that uses Raspberry-Pi with ultrasonic Sensors(US) and Infra-red (IR) sensors for obstacle detection. Also an audio module is interfaced to raspberry pi such that voice output provides guidance to driver in terms of distance from obstacle. LED indicators are also used for displaying presence or absence of obstacles. The work can be implemented on an actual vehicle.

Automatic Guided Vehicle (AGV) nothing but vehicle guideline provided by capturing images of the road. In the paper by Anup et al. design of an embedded surveillance and safety systems is proposed [4]. The system also provides full driver assistance by determining the distance between two vehicles. The lane departure is an improved techhnique in which lane boundaries are analyzed continuously and reported to the user as soon asvehicle moves outside lane or road.

Intelligent driver assistance system provide the full assistance to driver while driving car on road considering traffic intensity & white lane detection [3]. System consist of the camera module used to take continuous video streaming. This stream video store into SD card first & process this video by writing the script in python.Lane detection is done from the video by using the Hough transform algorithm & hough lines.

IPS (Intelligent parking system) is an advanced automatic driving system that consists of car parking guidance and car damage notification[1].IPS has some interesting functionalities that ensure an easy parking without damages, parking within less time in any suitable spots and getting a notification if the parked car has been scratched or damaged while the

driver is not in the car. During the parking process, the driver is alerted by visual and sound signals. The IPS system provides a path planning image that is displayed on the on-board computer system to indicate the directions for the wheels. The damage notification system consists of car-camera shock sensors placed in the front and rear of the vehicle .

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MATERIALS AND METHODS

Design and Implementation

Figure 1 shows block diagram containing two ultrasonic sensors, two IR sensors & display are interfaced with Raspberry Pi such that each ultrasonic sensor is on left and right side of the vehicle & two IR sensors are at the back. All sensors are connected as inputs to Raspberry pi 2 B to GPIO (General purpose Input Output) pins.Display is connected as output to Raspberry Pi 2 B for displaying distance. Voice module or speaker give voice commands to the driver according to sensors inputs.

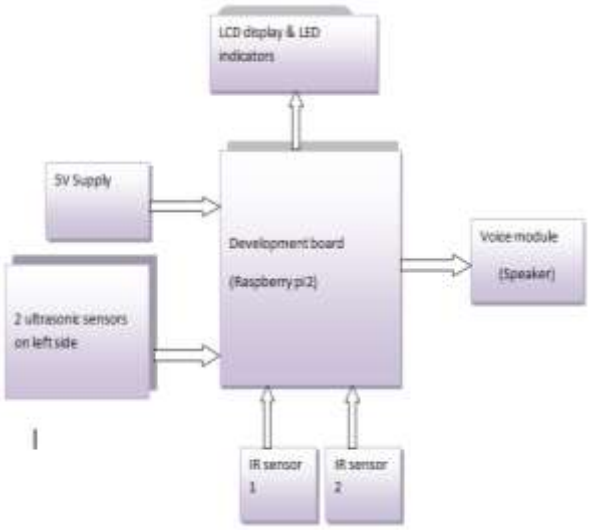

Figure1: Block Diagram of the system

Calculation of the Distance

The two ultrasonic sensors are fixed on both sides of the vehicle which calculate distance of object and displays on LCD and also a voice output guides the driver through speaker. Two IR sensors are placed on back of vehicle which indicate presence of obstacle. If an obstacle is present in specified range, for example less than 50cm, then voice command is given to stop the vehicle immediately.

LCD display, voice module and LED indication panel is on front of the driver for providing proper guidance in terms of distance.Ultrasound reflection is used to measure the object proximity or range in an ultrasonic sensor. It has various applications in Robotics, Vehicle parking, Public security etc. There are one or more transmitters, control circuits and a receiver in an ultrasonic sensor. A high frequency i.e. of 40 KHz ultrasonic sound is emitted by the transmitter which falls on any nearby object.Figure 2 shows communication of ultrasonic sensors with Raspberri pi.

The module automatically sends 40 kHz square wave eight pukses and automatically detects returning pulse signal. It has four pins i.e. ground (GND), echo pulse output (ECHO), trigger pulse input (TRIG) and V supply Vcc. If returning signal exists means ultrasonic has transmitted.

The raspberry pi sends an input pulse to TRIG and ECHO is zero volts until the sensor is triggered. The return pulse sets ECHO to V for complete pulse duration. The pulse duration is actually time between receivers detecting pulse and sensor providing the output pulse. Therefore for calculating distance , pulse duration must be measured first. The two ultrasonic sensors are fixed on both sides of vehicle and calculate distance of object and it is displayed on LCD and also a voice output guides driver through the speaker.

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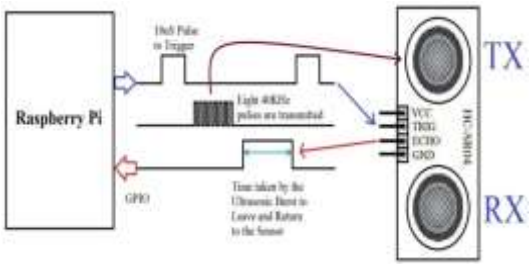

Figure2:Communication of ultrasonic sensor with Raspberri pi

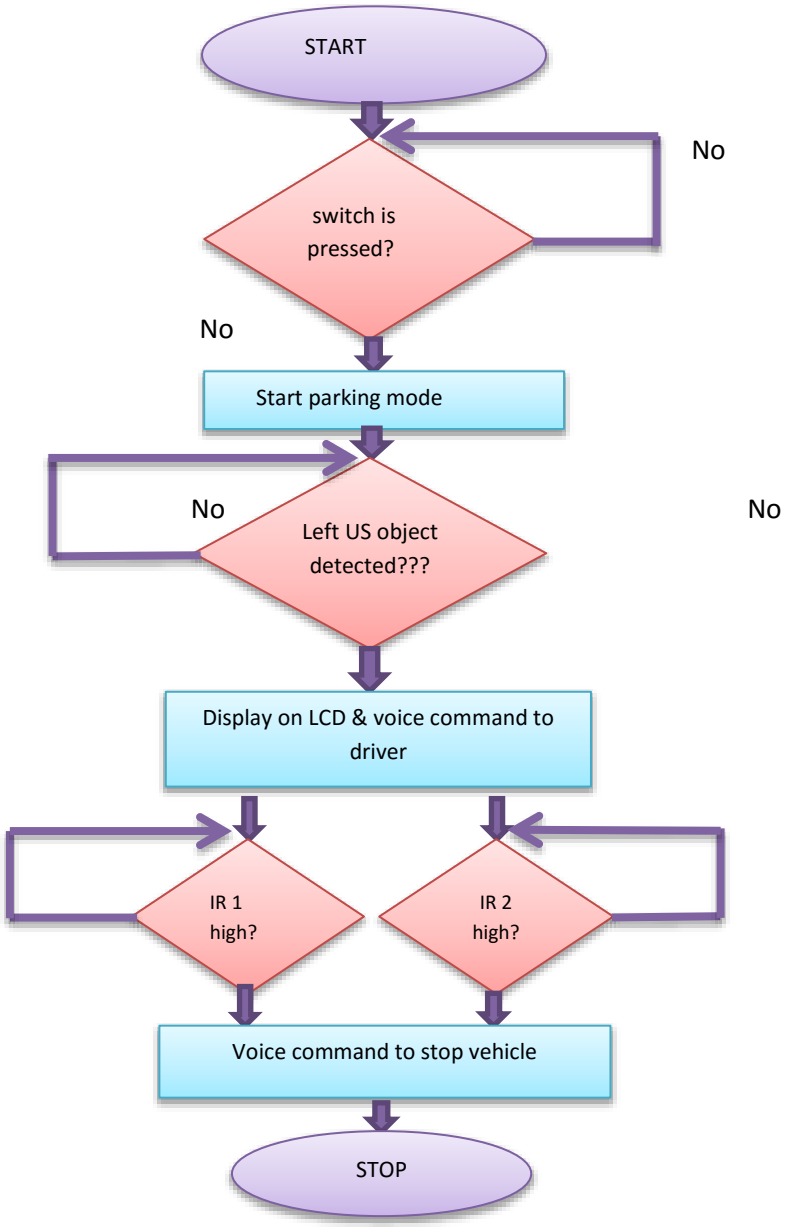

Figure.3: Flow chart of the system

Algorithm Flow Description

According to the flow chart shown in Figure 3, following steps are implemented.

1. If switch of system is pressed then system turns on and parking mode starts else it remains off.

2. If ultrasonic sensors (HC-SR04) of either side detects any obstacle then distance of obstacle from vehicle is displayed on LCD screen and voice command is given in terms of distance.
3. At the same time if IR sensors placed at the back side of vehicle generates high output activating voice commands is given to stop the vehicle.
4. The safe limit for minimum distance is set to the 0.3 meters However for distance less than 0.3m , a voice alert "stop the car immediately" is given to the driver.

Fig.4 Top view of the system

The figure 4 shows the top view for actual representation of the system with all the components placed.

Implementation steps

1. First the Raspbian OS is installed in Raspberry pi using SD vehicled.
2. The raspberry pi is connected to laptop using Putty and VNC softwares for programming.
3. Ultrasonic sensors are interfaced with raspberry pi for obstacle distance measurement with 4 pin connection i.e GND, ECO, TRIGG and VCC to respective GPIO headers.
4. After interfacing ultrasonic sensors ,the LCD display is interfaced with raspberry pi using I2C with 4 pin connections that is GND, SDA,SCL and VCC.
5. The IR sensors are also interfaced with raspberry pi .
6. After interfacing all the modules connect speakers to the audio jack of Raspberry pi.
7. A python code for all these modules is coded and saved in raspberry pi.
8. After running python code , distance of obstacle is displayed on LCD screen and also the warnings is given through the voice module by speaker.

RESULTS AND DISCUSSION

The overall system with hardware and software works as a perfect guide for driver. The ultrasonic sensors provide range up to 5m, therefore obstacles up to 5m are detected by the ultrasonic sensors from both sides of vehicle i.e. on left and right. The distance of obstacles is displayed on LCD screen and at the same time voice commands are given to the driver from the speaker of the vehicle. The IR sensors at back side of the vehicle detects any obstacle at back side and if the object is very near to vehicle say at distance 12 cm or less than that then immediately a command is given to stop the vehicle.s

A GPS module can be added to the circuit to periodically notify user status when in problem to nearest control room. The proposed system can be accessed by internet on Raspberry pi or it can be connected to other IOT based systems

CONCLUSION

The raspberry pi development board is basically designed for real-time applications. The system works with accuracy and can fulfill the operations satisfactorily required for the driver assistance system. In future GPS module can be added to the circuit to periodically notify the user status. The driver assistance system has broad sense of application and the work implements a system which helps the driver essentially during reversing the vehicle only .

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