Autonomous Vehicle

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***Abstract*— Car accidents is a very serious issue arising nowadays. Around 2.6 million people are injured in vehicle accident every year. Considering this issue we propose a system which is self paced that is automatic. In this paper, we concentrate on development of a self driven vehicle which is based on image processing concepts such as Canny Edge Detection, Hough Transform. In contrast to current systems that deploy huge and bulky sensors, our system uses less bulky and efficient in operation(ultrasonic sensor). The vehicle follows path which provided by GPS. Camera is used for colour and lane detection, whereas for obstacle detection ultrasonic sensor is used. Our testing results show that our system is accurate and efficient and provides real time results.**

Keywords— Raspberry Pi, Camera, Lane detection, Obstacle detection, Colour detection, GPS.

I. INTRODUCTION

Most of us use cars for accomplishing daily tasks which involve completing the to-do lists, daily errands etc. Thus cars are more preferably used as a public and private transport vehicle. But the current issues of car accidents indicates the need of unmanned vehicle which is completely dedicated to follow the rules and regulations and reach its destination safely. The proposed system aims to develop a driverless vehicle which will reduce rash driving and human errors, which is the current main cause of car accidents. The vehicle uses predefined image processing algorithms namely Canny Edge Detection and Hough Transform for Lane Detection.

In order to detect the on road obstacles, Ultrasonic Sensor is used and is capable of estimating the distance between two objects itself. Traffic signals present on the road are detected by using colour detection concept. The camera is used for providing the on road inputs or real time inputs to the system. LCD is used for displaying the distance between two vehicles or object detected. Raspberry pi 3B model is used as this model is capable of processing such complex image processing. algorithms. The pi is programmed to process this real time images and provides output based on the algorithms used.

II. LITERATURE SURVEY

The table no 1.1 mentioned below describes different methodologies which were previously implemented. In this table comparison of different papers which were published by various authors have been studied and compared.

Table 1.1: Comparison of different techniques

Name of Author	Title	Year of Publication	Information
Gurjashan Singh Pannu, Mohammad Dawud Ansari, Pritha Gupta	Design and Implementation of Autonomous car using Raspberry Pi	IJCA March 2015	The system is implemented using Raspberry Pi, HD camera sensor to provide necessary details from real world to car.
Quidsa Memon, Muzamil Ahmed, Shahzeb al	Self driving and driver relaxing vehicle	IEEE 2016	This system implements a vehicle that route itself within the guidance of the other vehicle moving ahead to same destinations
Chan Yee Low, Hairi Zamzuri, Saiful Amri Mazlan	Simple Robust Lane detection algorithm	IEEE 2014	The system uses robust lane detection algorithm to detect the lane marks. Hough transform and Canny edge detection is used for lane detection.
Chandrasekar, G. Durga	Implementation of Hough Transform for image processing	IEEE 2014	The system uses generalized Hough transform on an image, feature extraction is also possible
Jeffrey L.	Increasing	IEEE	The

Binangkit, Dwi H. Widyantoro	accuracy of traffic light Colour Detection and recognition using machine learning	2016	system uses HSV colour representation and extracts features based on area of pixels.

III. PROPOSED SYSTEM

Existing vs. Proposed system

The Existing system involves LIDAR sensor for detection of object and estimating distance between vehicle and object while the proposed one is automated system with ultrasonic sensor, along with this the system uses relatively less expensive sensors which helps to reduce the cost of the system. Few disadvantages of the existing system are:

- Sensor immunity towards environmental conditions.
- High cost.
- More number of sensor arrays required.

The proposed system overcomes above disadvantages and has below merits.

- Automated system requires less number of sensors.
- Computations required are less.
- Sensors are immune to environmental conditions.

A. BLOCK DIAGRAM

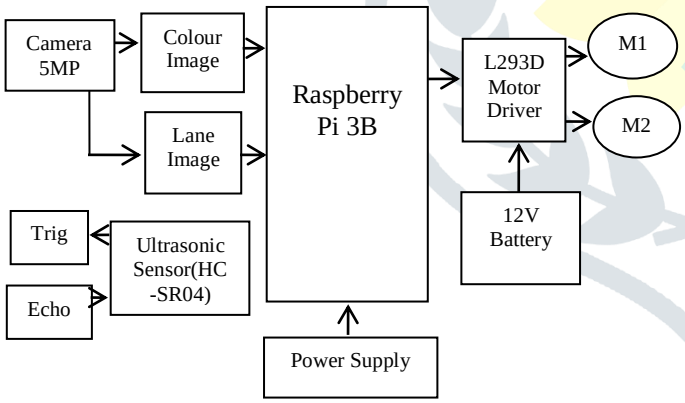


Figure 1.2: System block diagram

- Power Supply:

This component is used to power the Raspberry pi. The power requirement for pi model 3B is 5.1v and 2.5A. Thus a power supply capable of providing above requirements is used.

- Raspberry Pi 3B:

The raspberry Pi, a series of small single-board computers is developed in the United Kingdom by the Raspberry Pi Foundation. The foundation provides a linux based distribution namely Raspbian, for download as well as for third party Ubuntu, Windows 10 IOT core, RISC OS and specialised media center distributions. Pi 3 is the third generation Raspberry Pi. It is a powerful credit card sized single board computer that can be used for many applications and supersedes the original Raspberry Pi Models. Some features of Raspberry Pi 3B include:

- Broadcom BCM2837 SOC with a 1.2GHz 64 bit quad core ARM Cortex-A53 processor.
- 512KB shared L2 cache.
- 80% faster than its previous versions.
- Additionally it adds wireless LAN and Bluetooth connectivity making it ideal solution for powerful connected designs.
- Ultrasonic Sensor (HC-SR04):

Ultrasonic sensors offer contact less range detection by using sonar technique to find distance to an object like bats, dolphins etc. They offer high accuracy and stable reading in a user friendly package ranging from 2cm to 400cm or 1" to 13 feet. These sensors do not get affected by sun rays or any other solid objects like sharp range finders. In order to function, these sensors emit short duration, high-frequency pulses at periodic intervals from the trigger pin. These pulses propagate through the air at the velocity of sound. While travelling, if they strike an object, they get reflected back as echo signals to the sensor. Depending on the time-period between emitting the trigger

pulse and receiving the signal back (i.e echo), the distance is calculated by the sensor.

- USB Camera:

The camera is used for taking real time road snaps for detecting lane simultaneously with colour for traffic signal detection. Both the lane and colour detection is performed in parallel fashion. The viewing angle of this camera is 200 degree with a resolution of 5 Mega Pixels.

- Colour image:

Colour information is used for signal detection. Colour vision can be processed using RGB colour space or Hue space. The HSV model determine colour similarly to how human eye identifies colour. RGB determines colour in terms of a coalition of primary colors, where as, HSV describes colour using more familiar comparison such as colour, vibrancy and brightness. Thus in situations where colour description plays a important role, this model is frequently used over RGB model.

The values used for colour estimation using HSV model are as follows:

Class	Colour Range		
	Hue	Saturation	Value
Red	1-15 and 170-180	128-255	128-255
Green	40-95	128-255	128-255
Yellow	16-40	100-255	128-255

Table 1.2 HSV values

- Lane image:

The real time lane information is given to pi through camera. The pi processes the lane information using image processing algorithms namely Canny Edge Detection and Hough Transform to detect the edges present on the road.

The procedure of Canny Edge detection is broken into certain steps as shown:

- To remove the noise from image Gaussian filter is used.
- Obtaining the intensity gradients of the image.
- To reduce false response to edge detection non maximum suppression is used.
- To find potential edges double threshold used.

- Track edge by hysteresis.
- Weak edges are suppressed and stronger edges are thus obtained.

Hough Transform:

To obtain the required features from an image, a feature extraction technique known as Hough Transform is used. The aim of this method is to find incomplete instances of objects in a specific class of shapes. Hough Line Transform is used to detect single straight lines. Edge detection is carried out before application of Hough Transform.

The Hough Line transform is implemented as follows:

- Obtain all the lines in the image by using any suitable line detection scheme.
- Quantize the (m,c) space into a two-dimensional matrix with proper quantization levels.
- Initialize the matrix to zero.
- Each element of the matrix that corresponds to the line is increased by 1. The result is histogram corresponding to (m,c) values.
- The histogram contains elements of higher values. These elements corresponds to lines in the camera image.

- DC Motor:

DC motor is a rotary electrical machine that transforms direct current energy into mechanical energy. The working mechanism depends on the force developed by magnetic fields. All the DC motors have electromechanical or electronic internal mechanism to change the current flow direction in the motor at periodic time intervals. Two DC motors each of 45 rpm each are used to control the wheels.

- L293D Motor Driver:

A motor driver is an integrated circuit used to control motors in robots. Motor driver is a bridge between the processors and the motor in the robot. The frequently used driver IC's belong to the L293 series which contains L293D, L293E, L293NE, L293DNE etc. These IC's are manufactured to control 2 DC motors simultaneously. L293D driver contains two H-bridge circuits. These circuits are simple circuits and used for heading a low current motor.

B. METHODOLOGY

Flowchart

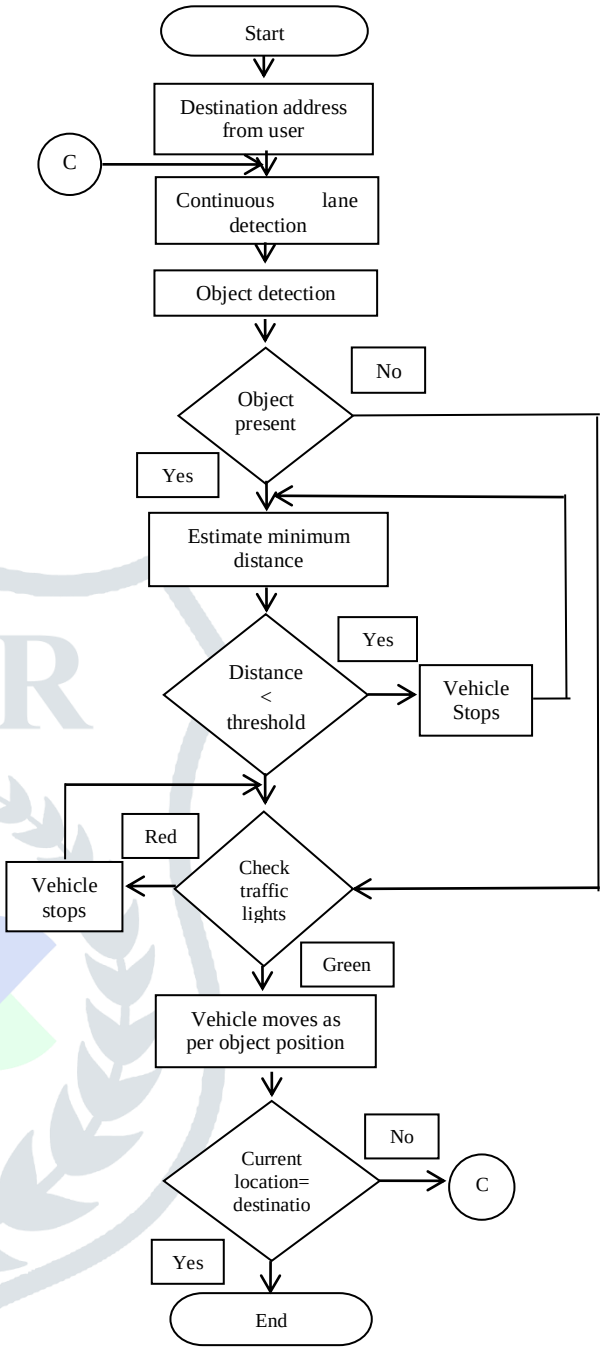
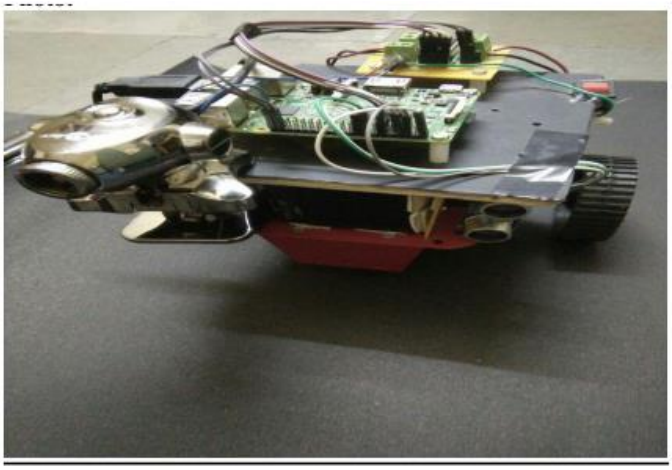


Figure 1.3: System flowchart

C. WORKING MODULE



CONCLUSION

- Vehicle accidents are on rise today. Most of these accidents take place due to human faults, such as rash driving or over speeding.
- Man is a mistake making machine but in automated and programmed machines, the chances of error are reduced largely.
- Automated vehicle is mainly designed to provide safe and relaxed drive experience for users.
- Risk of accidents is eliminated.
- This system will reduce human intervention for controlling vehicle and saves lot of time.
- Thus this system serves as a important part of the transport system.

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