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Self Driving Car

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***Abstract*— An autonomous vehicle system with lane detection using Raspberry Pi is presented in this paper. The autonomous car or the driverless car can be referred to as a robotic car in simple language. This car is capable of sensing the environment, navigating, and fulfilling the human transportation capabilities without any human input. It is a big step in advancing future technology. It highlights the idea to develop an automated car which can be driven from anywhere using the internet over a secured server. This car will also have limited automation features like RTO sign detection, obstacle avoidance system and lane detection system so that it can drive itself safely in case of connectivity failure. The main goal here is to minimize the risk of human life and ensure highest safety during driving. At the sametime the car will assure comfort and convenience to the controller. A miniature car including the above features has been developed which showed optimum performance in a simulated environment. The system mainly consists of a Raspberry Pi, a Pi camera, a sonar module, a web interface, and internet modem. The Raspberry Pi was mainly used for the Computer Vision algorithms and for streaming video through the internet. The proposed system is very cheap and very efficient in terms of automation.**

***Keywords*—Raspberry Pi, Transportation Capabilities, Pi camera, Computer Vision.**

I. INTRODUCTION

Internet of Things refers to a connection of billions of complex devices like electronics, sensors, gateways, actuators, andplatform hubs. These tangible devices connect and interact with each other over a wireless network. Connected objects (or things) share data with each other and operate without any intervention by humans.

Things have evolved due to the convergence of multiple technologies, real-time analytics, machine learning, ubiquitous computing, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", including devicesand appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers. The IoT can also be used in healthcare systems. And this is a level 4 heading: It is recommended to write your text in a separate document and then add it to this template once it's complete. When copying text into the template from another document, make sure that the with the ever-growing technological advancement, human civilization is looking for automation in every sphere of life. Automated cars are one of the latest trends which has been massively recognized by people all around the world as they want maximum security andcomfort during driving. Nowadays, road accidents are one of the prime concerns for the people. It became very frequent and uncertain. Most of the road accidents occur due to lack of abidance of the traffic rules. Most of the time, the drivers become drowsy or distracted during driving and eventually hit objects ahead of them. If the driving process can be handled with the aid of Computer Vision and efficient sensors then the risk of human mistakes can be highly reduced. Besides, sometimes it becomes necessary to access the car from a remote location in order to reduce hassles. In this case, it would be a lot more convenient if the car could be viewed from a remote computer and driven by interaction through the computer keyboard. This could be as easy as playing a computer game.Our work is based on Internet of Things technology and Computer Vision to remotely control our vehicle and automation features. Various lane detection techniques have been observed. Lane detection techniques using OpenCV based on Receiver n d Operating Characteristic curve and Detection Error Trade-off curve and using perspective images have already been worked on. In this paper lane detection is done using canny edge algorithm and Hough line transformation which has shown good rate of success in the working condition. So far many related works are done involving remote controlling an autonomous car using Bluetooth with android or iPhone.

II. LITERATURE SURVEY

Self-Driving Car concept including Computer Vision, Sensor Fusion, Deep Learning, Path Planning, Actuator, Localization. Computer vision is an interdisciplinary field that deals with how computers can be made for gaining high-level understanding from digital images or videos. From the perspective of engineering, it seeks to automate tasks that the human visual system can do. [1][2]

Sensor fusion is combining of sensory data or data derived from disparate sources such that the resulting information has less uncertainty than would be possible when these sources were used individually. The term uncertainty reduction in this case can mean more accurate, more complete, or more dependable, or refer to the result of an emerging view, such as stereoscopic vision (calculation of depth information by combining two-dimensional images from two cameras at slightly different viewpoints). [3][4]

Deep learning is part of a broader family of machine learning methods based on learning data representations, as opposed to task-specific algorithms. Learning can be supervised, partially supervised or unsupervised. [5][6]

Edge detection includes a variety of mathematical methods that aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. Edge detection is a fundamental tool in image processing, machine vision and computer vision, particularly in the areas of feature detection and feature extraction [7].

The purpose of detecting sharp changes in image brightness is to capture important events and changes in properties of the world. It can be shown that under rather general assumptions for an image formation model, discontinuities in image brightness are likely to correspond to discontinuities in depth, discontinuities in surface orientation, changes in material properties and variations in scene illumination [8][9].

Edges extracted from non-trivial images are often hampered by fragmentation, meaning that the edge curves are not connected, missing edge segments as well as false edges not corresponding to interesting phenomena in the image – thus complicating the subsequent task of interpreting the image data [10]. Edge detection is one of the fundamental steps in image processing, image analysis, image pattern recognition, and computer vision techniques.

METHODOLOGY

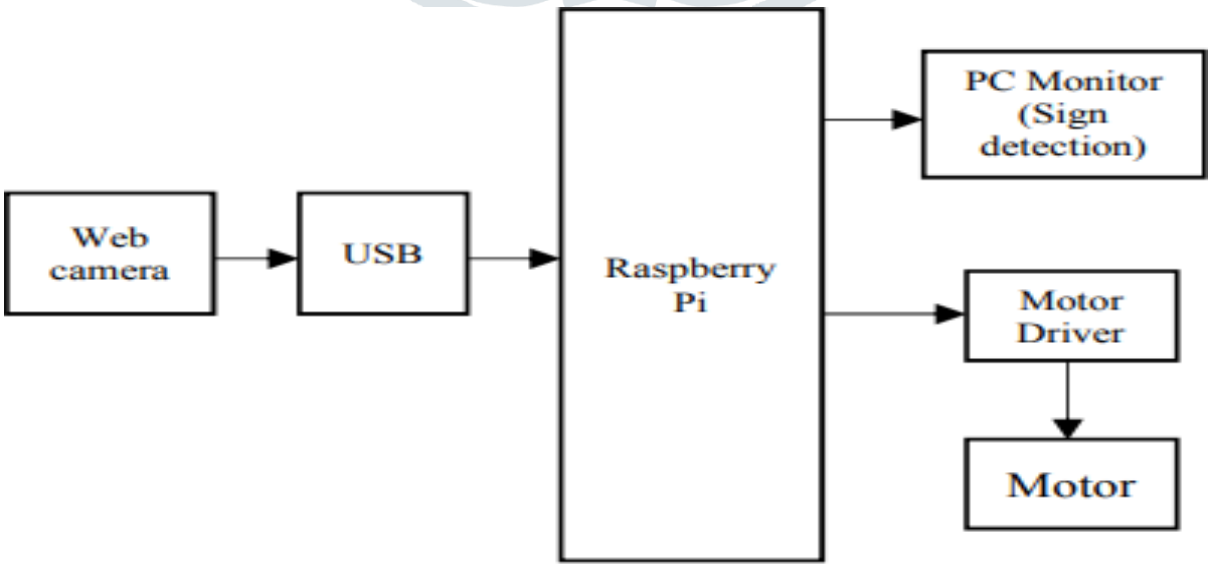

Fig 1.1 Block Diagram of Self Driving Car

A. Block Diagram Description-

The paper aims to build an 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.

B. System Description-

Firstly, the car can be remotely controlled through the Internet using a web browser. In case of connectivity failure it can act autonomously in a good weather condition. The proposal consists of complex Computer Vision algorithms and video transmission with the Internet. Raspberry pi and Arduino are the main devices to implement the prototype. The Raspberry Pi streams the video to the internet. A user can access the streaming using a web browser. It takes a lot of processing power for simultaneously working on video streaming and running Computer Vision. The Raspberry Pi 2 model B is a single-board computer with a powerful processing unit and serial and camera interface (CSI). The Raspberry Pi camera module can be used to take high-definition video. It can be accessed through the V4L (Video for Linux) APIs, and there are numerous third-party libraries built for it, including the Picamera Python library which will be beneficial to the live streaming purpose. Apache is a popular web server application that was installed on the Raspberry Pi to allow it to serve web pages. Apache can serve HTML files over HTTP, and with additional modules can serve dynamic web pages using scripting languages such as python. A web page was hosted that shows the video streaming sent from the Picamera. To access the web page one only needs to know the IP address of the Raspberry Pi and a username and password to log in. From the web page the car can be fully driven.

For the connectivity failure the car needs to work on its own. It needs to keep itself safe from collisions and abide by the traffic rules. The Arduino controls the motor driver circuit. It is connected with sonar, an ultrasonic sensor which evaluates the attributes of a target by interpreting the echoes from radio waves. It is used to detect the distance of obstacles from the car. If an obstacle is detected then the Arduino stops the motor from running operation. Meanwhile the Raspberry Pi uses computer vision algorithms to detect the lane and traffic light signals. Python Open Source Computer Vision (OpenCV) is a library of programming functions mainly aimed at real-time computer vision. It has over 2500 optimized algorithms which can be used for image processing, detection, object identification, classification of actions, traces and other functions. The Raspberry Pi is interfaced with the Arduino with serial communication. It controls the Arduino to run the car accordingly.

III. RESULTS

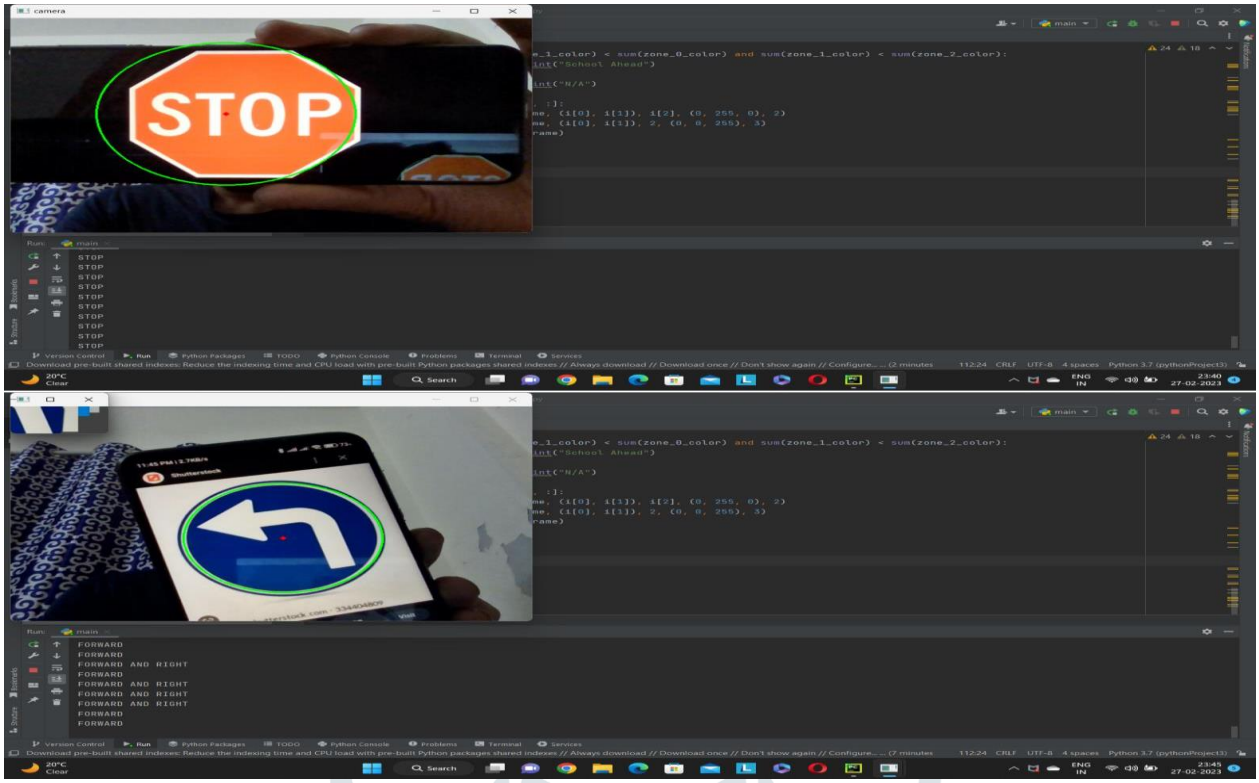

Fig 1.2 Simulation result

The Pi Camera detects the sign in front of it and give the signal to the Raspberry Pi. The Raspberry Pi process the signal input into the code and we get our simulation result.

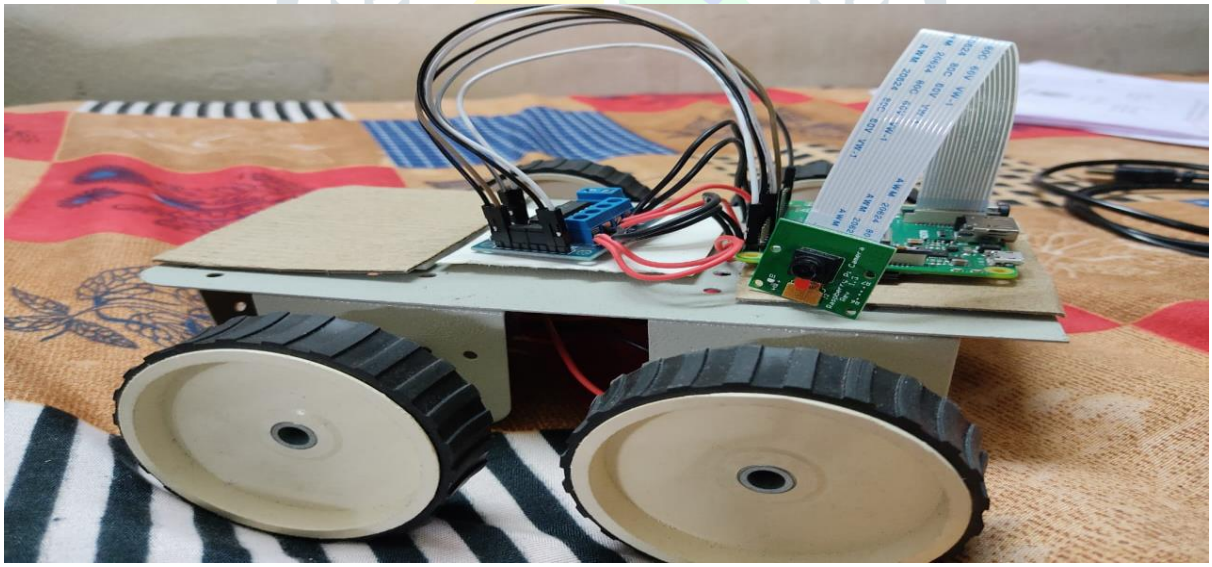

Fig 1.3 Self driving Car

This is the figure of our self driving car after assembling all the hardware to the right position. The Pi Camera is connected to the Raspberry Pi board. The four DC motor is connected to every wheels of the car. The DC motor is connected to Motor Driver which is used to control multiple DC motor at the same time. Motor Driver is connected to the Raspberry Pi through Jumper Wires.

IV. Conclusions

The driver helping system has been presented in this paper. The basic idea is to recognize and classify the traffic signs from an input image. The image processing technique used in this system is based on the SURF algorithm. Finally, the recognition and classification of these potential road signs is done according to a database of road sign patterns and controls the speed according to it. The performance of this idea depends on the quality of the input image, in relation to its size, contrast and the way the signs appear in the image. This system is fully based on automation process whichreplaces the existing manual operation. Automation process, in turn decreases the human error, increases the accuracy, processing speed and reliability. In this report, a method to make a self-responding robot car is represented Working of different hardware components are described. A way to find the stop signs board and red signals have been defined and also way to detect the obstacles. All methods and algorithm mentioned in this paper are successfully implemented in a robot car of chassis having two wheels. For future enhancement, more advanced resolution camera and advanced processors can be used in order to detect the sign perfectly and quickly. A System should be developedto monitor the rear end vehicle during the turnings so that the automation process will ensure more safety. To enhance it more in the future machine learning algorithms can be used so it can be able to determine each object. The current performance is good but to make it more efficient it is necessary to implement it using machine learning and other algorithms so it will understand more things. So, in future to make it more advance it.

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