VISION-DRIVE: VISION BASED SELF DRIVING ROBOTIC CAR THAT DOES LANE TRACKING, OBSTACLE DETECTION, TRAFFIC SIGNAL RECOGNITION, DRIVERLESS PARKING, REVERSE PEDESTRIAN DETECTION, THEFT PREVENTION AND HAS SMARTPHONE CONNECTIVITY – A ROBOTIC IMPLEMENTATION

Arun Revanth.A[1], Ms.Saranya .G[2]
[1]UG student, [2]Assitant Professor
Electronics and Communication Engineering, KCG College of Technology
Karapakkam, Chennai

Abstract

A major number of vehicle accidents are caused by human driver errors for reasons including distracted driving or aggressive driving. The main factor behind all this is that the human reaction time is limited and hence these incidents are inherently unavoidable. At present car manufacturers are coming up with partially automated cars such as ADAS to assist the human drivers. As such, a fully autonomous car is still a distance away. But the industry is now advanced to such an extent that both camera sensor technologies and high performance processing technologies are beginning to exceed the requirements that is needed to build a fully based autonomous cars. Our solution is to construct a fully self driving robotic car that is capable of sensing its environment using an advanced vision sensor and navigates itself intelligently and autonomously without human input. Several image processing and sensor fusion techniques are used to do this. The project uses an advanced camera sensor, ultrasonic and motion sensors and a cortex-m4f microcontroller. The microcontroller unit handles multiple tasks such as reading the image from the camera, doing vision processing and sensor fusion, communicating with smart phone and controlling the robotic car.

Keywords: ADS, Intelligently, camera sensor, Cortex- m4f microcontroller.

Introduction:

An Embedded system is a computer system designed for specific control functions within a larger system, often with real time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a Personal Computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems contain processing cores that are either microcontrollers or Digital Signal Processors (DSP). A processor is an important unit in the embedded system hardware. It is the heart of the embedded system. The key characteristic, however, is being dedicated to handle a particular task. Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale. Physically, embedded systems range from portable devices such as digital watches and MPEG (Motion Picture Experts Group) Layer-3 Sound File (MP3) players, to large stationary installations like traffic lights and factory controllers. Complexity varies from low, with a single microcontroller chip, to very high with multiple

units, peripherals and networks mounted inside a large chassis or enclosure.

I. RELATED WORK

A. Existing System

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B. Proposed System

Our solution is to construct a fully self driving robotic car that is capable of sensing its environment using an advanced vision sensor and navigates itself intelligently and autonomously without human input. Several image processing and sensor fusion techniques are used to do this.

. The microcontroller unit handles multiple tasks such as reading the image from the camera, doing vision processing and sensor fusion, communicating with smartphone and controlling the robotic car.

II. WORKING

A. METHODOLOGY

The project uses an advanced camera sensor, ultrasonic and motion sensors and a cortex-m4f microcontroller. The microcontroller unit handles multiple tasks such as reading the image from the camera, doing vision processing and sensor fusion, communicating with smartphone and controlling the robotic car.

The robotic vehicle is capable of doing the following list of tasks on its own.

1) **Lane tracking** – Lane tracking algorithm detects lane boundaries and continuously controls the vehicle to keep the vehicle in the lane centre.
2) **Obstacle detection** – Obstacle detection algorithm detects another vehicle or any other obstacle along the path and automatically applies braking to mitigate the collision.
3) **Traffic signal recognition** – The system can recognize and interpret the traffic signal lights and intelligently takes the decision to obey the traffic rules.
4) **Driverless parking** – Automated parking is an essential requisite for a driverless car. The system can automatically look for a parking space, and upon finding one, parks itself by moving into the found space. It also includes a self retrieving feature. This demo involves both camera and ultrasonic sensors.
5) **Reverse pedestrian detection** – When the vehicle is reversing, it is important to not hurt walking or standing pedestrians, and the pedestrian detection functionality is carried out using a rear camera helps this cause. An ultrasonic sensor assists this process.
6) **Theft prevention alert** – When the vehicle is parked, the system continuously monitors the surrounding space for unwanted intruder motion using a vision sensor and also looks for abnormal motion using vehicle movement sensors. This feature is automatically activated as long as the car is parked. Here the system sends an alert message or ringtone to the user mobile if it detects one.

   A set of common vision processing algorithms such as colour recognition, edge detection and image comparison are used to extract information from the captured camera images.

B .Camera module

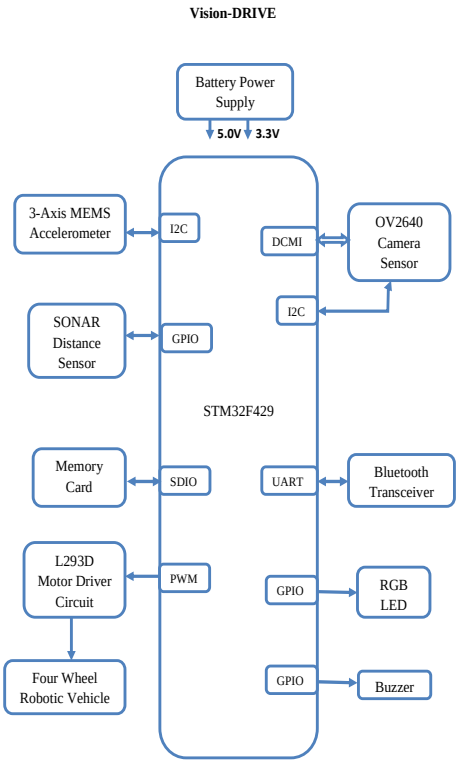
OV2640 camera image sensor is used as the primary vision sensor in this project. It can output images at resolutions ranging from QQVGA upto SVGA. The system should be capable of processing atleast 5 frames per second to achieve a good performance on a moving vehicle. Here, low resolution images will be used to achieve the fast vision processing needs in this project.

The system is able to communicate with a smartphone app via Bluetooth. This allows the

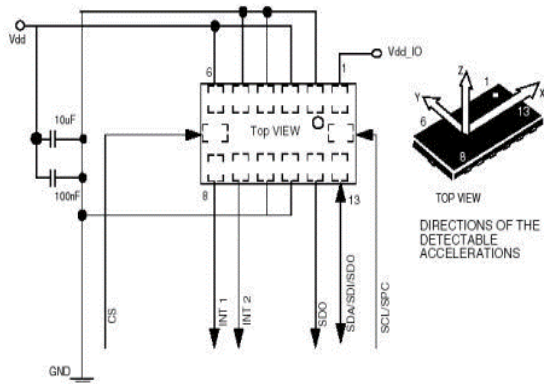
user to send control commands from a handheld smartphone and operate the robotic vehicle

C. Hardware Module

Hardware design it gives physical appearance to the embedded system depending upon the application requirements. It's like microcontroller, peripherals, timer, memory, external panel for physical look and application required components for designing.



Circuit diagram



Software design

The Atollic TrueSTUDIO® IDE provides a modern and highly integrated development environment which directly supports the use of advanced workflow tools such as version control, bug tracking, code review, and code analysis and distributed task-based development, along with tailored control for project and build control and a fully integrated debugger. The Atollic TrueSTUDIO® IDE comes in a variety of packages enabling customers to select the features/price model best suited to their development needs. As the underlying compiler tool chain is based on the GNU C/C++ compiler, there is no worry about a 'proprietary' tool chain becoming out of date, or unavailable. The same goes for the Atollic TrueSTUDIO® IDE, as it is based on the open Eclipse framework.

III.CONCLUSION

This project is an effort to show off and improve our embedded system skills and thus the robotic car is built to run within indoors using a mock road and not on real roads. There are significant works to be done to make this system to become a true end product that could run on a real road in real world conditions. As such, this is our first step towards that vision of accident free roads based on self driving vehicles.

IV.FUTURE SCOPE

We could hope for the future with more efficient systems in size at same time available at reasonable rate. There are significant works to be done to make this system to become a true end product that could run on a real road in real world conditions. For the luxury of humans with best secure way of transportation by reducing the accidents levels. Thus in future there will be implementation more sensors so that it will be tested and implemented for the future implementation efficiently

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