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Design of semi-autonomous vehicle

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ABSTRACT

A web-controlled and partially autonomous vehicle system is presented in this paper. It highlights the idea to develop a remote-controlled car which can be driven from anywhere using the Internet over a secured server. This car will also have automation features like 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 the highest safety during driving. At the same time, 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.

Keywords— *ARM-LPC 2148, Semi-autonomous driving, Collision detection, Internet, Instruction, Web-server, Robotics, Embedded systems*

1. INTRODUCTION

The technological world advancements are ever-growing. Humankind is looking for automation in every form of life. The automated car is one of the latest trends which have been massively recognized by people all around the world as they want maximum security and comfort 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 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. This system consists of ARM-LPC 2148, Collision detection sensors, Battery power supply and a Dedicated Web-server to send Instruction to the vehicle which is stored in the server to make it efficient and cheap in terms of automation.

The field of autonomous automation is of interest to researchers, and much has been accomplished in this area, of which this paper presents a detailed chronology. This paper can help one understand the trends in autonomous vehicle technology for the past, present and future. We see a drastic change in autonomous vehicle technology since the 1920s when the first radio controlled vehicles were designed. In the subsequent decades, we see fairly autonomous electric cars powered by embedded circuits in the roads. By 1960s, autonomous cars having similar electronic guide systems came into the picture. The 1980s saw vision-guided autonomous vehicles, which was a major milestone in technology and till date, we use similar or modified forms of vision and radio-guided technologies. Various semi-autonomous features introduced in modern cars such as lane keeping, automatic braking and adaptive cruise control are based on such systems. Extensive network guided systems in conjunction with vision-guided features are the future of autonomous vehicles. It is predicted that most companies will launch fully autonomous vehicles by the advent of the next decade. The future of autonomous vehicles is an ambitious era of safe and comfortable transportation.

Since 1920 the research for vehicle automation has been conducted on, although first promising trails took place around the 1950s. During 1980 with Carnegie Mellon University's Navlab and ALV, The first ever autonomous car has been seen. This has paved the way for the companies to work on autonomous vehicle research. In July 2013, Vislab demonstrated BRAIVE a vehicle that moved autonomously on a mixed traffic route. Countries like Belgium, France, Italy and the UK are planning to operate transport systems for driverless cars.

Society of Automotive Engineers (SAE) has classified automated vehicles into six categories from level-0(No-Automation) to level-5. In this paper, we have worked with level-3(Conditional automation). In this level, the driver can safely turn their attention in a familiar place and good weather condition. This is by far the most secure driving system as we cannot put confidence into fully automated vehicles yet. Besides the cost behind Google car and Tesla wheels are supposed to be out of reach for most people.

A sonar sensor (HC-SR04) has been used for this purpose. It emits very high frequency (40 KHz) of sound. It has two transducers–a transmitter and a receiver. The "Transmit" transducer sends out a short burst of (8 cycles) of the pulse train.

Whenever an obstacle was placed in front of the car it reduced its speed and stopped. Some echoes were overlapped and gave back garbage values for a very few time. For better performance multiple-sonar can be used. For a real-life application, much efficient and powerful sensor can certainly minimize the hassle.

In this paper, a method to implement some automation feature in a regular car is described. Utilizing this small prototype is designed and built. The Implemented model is a level-3 automated car. However, if it to be provided with level-5 automation a lot more work is to be done. It cannot navigate its way to a given location.

Consumers all around the whole world are enthusiastic about the advent of autonomous cars for the public. An autonomous car can operate without human control and does not require any human intervention. Campbell et al. stated that modern autonomous vehicles can sense their local environment, classify different kinds of objects that they detect, can interpret sensory information to identify appropriate navigation paths whilst obeying transportation rules. Considerable advancements have been made in giving an appropriate response to unanticipated circumstances where either a backlash can occur in the vehicular systems or some medium in the external environment may not behave as predicted by internal prototypes. To carry out successful autonomous navigation in such situations, combining a variety of technologies from different disciplines that span computer science, mechanical engineering, electronics engineering, electrical engineering, and control engineering, etc. In this project the vehicle is controlled in different directions using IOT modem and it can be controlled using the mobile phone and it is easy to control and reliable.

2. EXISTING SYSTEM

The existing automobile companies keep coming up with newer autonomous features in their recent models. Technological advancements have seen every day in areas like information technology, communication, data analysis and storage etc. are not exclusive to these areas alone. The realm of autonomous cars is progressing at a rapid rate these days. Segway Incorporated and General Motors jointly developed a 2 seat electric car, basically designed for urban environments and which could be driven normally or operated autonomously. Known as GM's EN-V (General Motor's Electric Networked Vehicle), it was first unveiled from 1st May through 31st October 2010 at the joint GM & SAIC pavilion at the Expo 2010 in Shanghai. EN-V was further divided into three different vehicle types: Jiao (Pride), Miao (Magic), and Xiao (Laugh). EN-V exhibits autonomous features such as self-parking/retrieval, vehicle platoons and collision avoidance. GM's ENV became an important advancement towards paving the way in realizing a higher grade of vehicle connectivity, vehicle interfaces, motion control algorithms, and connected autonomous driving architecture

3. PROPOSED SYSTEM

The motor driver circuit is used to control the autonomous vehicle direction and speed using pulse width modulation. The ultrasonic sensor is used to avoid obstacles. The IR sensor is used to track follower which operates in a straight direction. The sensors are controlled using ARM-LPC 2148 and the status of the vehicle is updated to the cloud using IoT module. The autonomous vehicle can also be controlled using IoT. In the existing method, there is no autonomous vehicle with a vision system with any security and in the existing system is difficult to monitor the vehicle.

In our proposed system we are going to monitor the status of a vehicle which operates autonomously with human commands through the internet.

In this project the vehicle is controlled in different directions using IOT modem and it can be controlled using the mobile phone and it is easy to control and reliable.

3.1 Block diagram

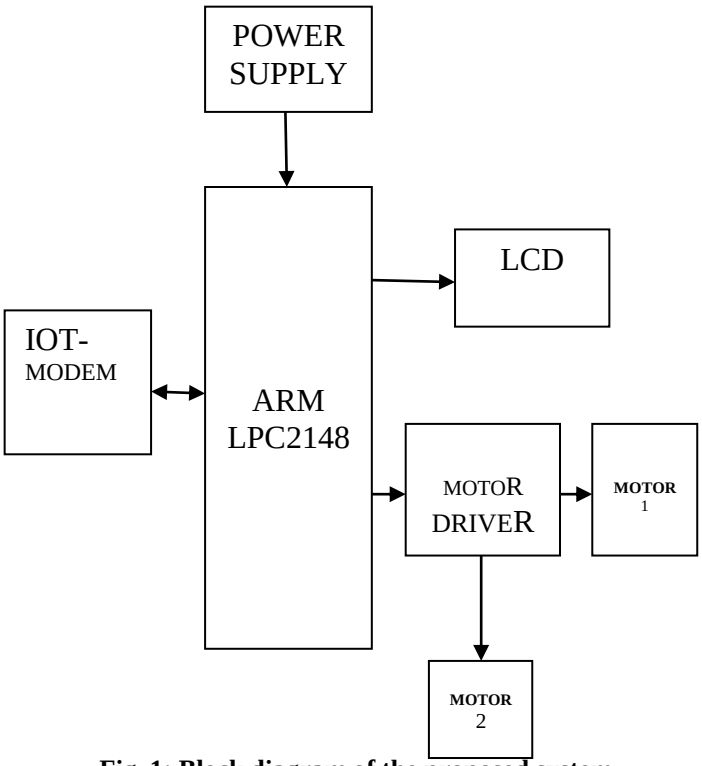


Fig. 1: Block diagram of the proposed system

3.2 Hardware and software used

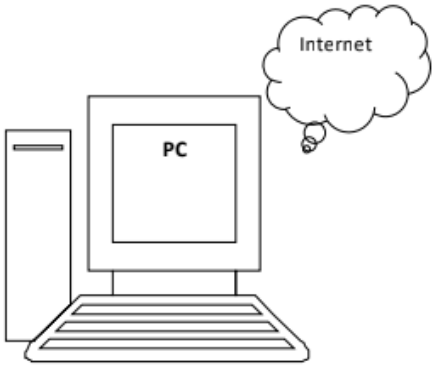
The hardware that is required for the model is ARM-LPC 2148, IR sensor, Ultrasonic sensor, Robotic chase which is the body of the vehicle, a Motor driver with DC motor, a web server and IoT module. The software required to complete the module is ARM- LPC2148 and Embedded C language.

3.3 Existing vs. proposed system

Table 1: Comparison of existing and proposed system

Existing System	Proposed System
➢ In existing method, there is no autonomous vehicle with vision system with no security.	➢ In our proposed system we are going to monitor the status of vehicle which operates autonomously with human commands through internet
Drawbacks of existing system ➢ Difficult to monitor the vehicle	Advantages of proposed system ➢ Fast response & Easier ➢ Secured Authorization

3.4 Monitoring Section



The monitoring section is where the instructions are sent from. A computer which has a browser acts as the client and instructions which are stored in the web server is retrieved and sent to the ARM-LPC 2148 using the IoT module while the computer is connected to the Internet.

4. GOOGLE'S AUTONOMOUS VEHICLE WAYMO

Fig. 2: WAYMO vehicle

"Autonomous vehicles still need help from distant humans."
"For all the talk of cars without drivers, the deployment of autonomous vehicles might still require humans controlling them from a distance. Most major AV companies are testing or planning to incorporate remote control or Teleoperations in their robot-driven cars."

"Computers are great at saying, let's keep between the lanes and manage the speed. But making a judgment call on whether now is a good time to pass is really hard. It only gets worse in disorganized environments like truck yards."

5. CONCLUSION

In this project, the vehicle is controlled in different directions using IOT modem and it can be controlled using the mobile phone and it is easy to control and reliable and most importantly this model brings secured connection between the microcontroller and the server. Hence only the authorized owner of the vehicle can access this server-based semi-autonomous vehicle.

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