Voice Activated Intelligent Vehicle for the Handicapped

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1 Abstract

This poster describes the design of a low cost control system of a vehicle that can be used by for drivers who are unable to use their arms nor legs to drive a vehicle. In this control system, the data acquisition and processing platform are provided by the human sensors and brain. The control signal, generated by the *human brain*, is conveyed to the vehicle using *voice commands*. Safety sensors and camera are also included as part of the control system to ensure obstacle avoidance, lane keeping, smooth turns, and prevention of hitting other vehicles on the road as well as colliding other vehicles.

2 Introduction

Today automobiles, whether a car, truck, van or bus are designed for disabled people by using automotive adaptive devices where one can control the entire vehicle from the steering by pushing buttons or by using a joystick. For a driver with no hands, there are mechanical foot steering systems where a disk is placed near the acceleration and brake pedal to control the vehicle using legs.

The above technologies require the driver to have either arms or legs. If a person lost both of their legs and arms, then the driving controls should have mechanisms such as zero effort steering, high-tech driving controls for gas and brake.

This poster attempts to provide a technology of vehicle driving without using legs nor arms using *voice recognition*. Hands are replaced by using stepper motor for steering (Artificial arms) and the legs are replaced by using linear actuators to control acceleration and brake (Artificial Legs) as shown in Fig 1. The driver sends the voice commands and the microcontroller gets input from voice and the sensors to decide the turn and movement. Furthermore, camera is used for lane keeping in order to take smooth turns and safety.

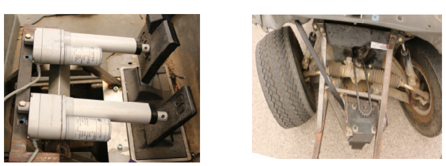

Fig.1 Actuators (Artificial legs) and Stepper Motor (Artificial Arms)

3 Methods

Design of the control system:

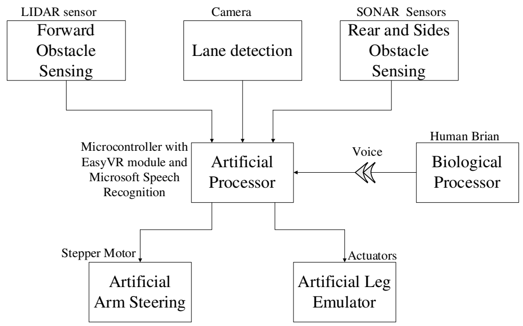

Fig.2 Design of control system

Voice recognition:
EasyVR voice recognition module is used to provide voice commands which is a speaker dependent system that requires training of user words. In order to improve efficiency, Microsoft speech recognition (Cortana, a speaker independent system) is used in combination shown in Fig 3 to have high accuracy of speech recognition that communication with microcontroller using serial communication.

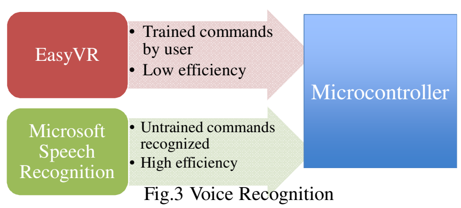

Fig.3 Voice Recognition

Obstacle Detection:
Considering the safety as primary consideration, the vehicle is mounted with LIDAR sensor at the front and SONAR sensors at rear and sides of the vehicle as shown in Fig 4. When the driver provides a command to turn the vehicle where there is an obstacle, the vehicle doesn't turn and provides alert to the driver.

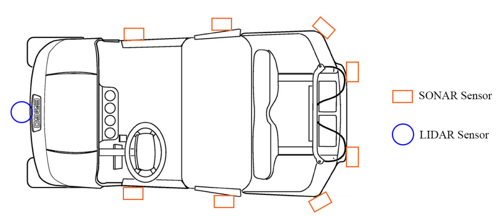

Fig.4 Sensors mounted around vehicle

Lane keeping:
A camera is placed in the front the vehicle and by using OpenCV software, the code is written to see the lanes which provides the distance of the lanes from the vehicle using Hough line detection algorithm. The method used for lane keeping is shown in Fig 5.

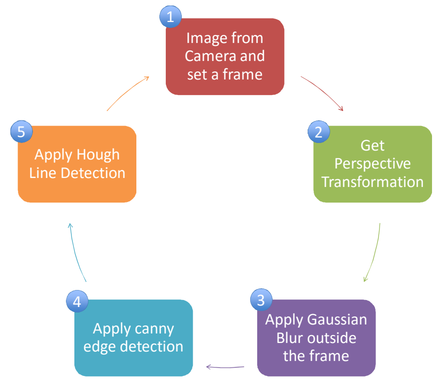

Fig.5 Lane Detection

Lane detection:

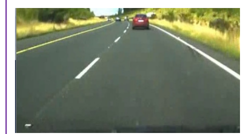

Fig.7a Original image

Fig.7b Canny edge detection after Gaussian Blur

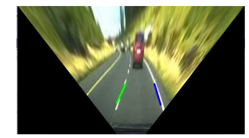

Fig.7c Hough Line Detection

4 Results

Obstacle Detection:
When obstacle is detected by the sensors, the vehicle turns automatically to the other side.

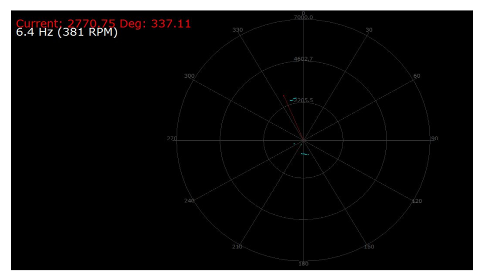

Fig.6a Obstacle sensed on Left

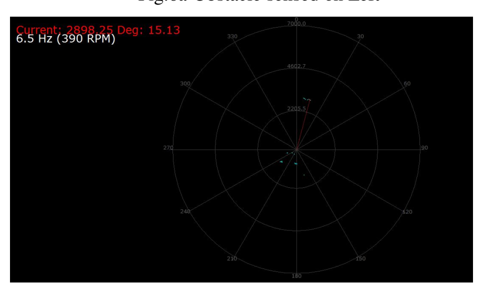

Fig.6b Obstacle sensed on Right

5 Conclusions

- A voice activated intelligent vehicle is implemented and tested that can be driven by the handicapped people.
- When voice command is given as left and obstacle is found on left, the vehicle doesn't turn and alert the driver.
- The vehicle stays in the lane during its path as long as there are no obstacles.

6 References

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- F. Bounini, D. Gingras, V. Lapointe and H. Pollart, "*Autonomous Vehicle and Real Time Road Lanes Detection and Tracking,*" 2015 IEEE Vehicle Power and Propulsion Conference (VPPC), Montreal, QC, 2015, pp. 1-6.

7 Acknowledgement of support

- I would like to thank my advisor Dr. Ali T. Alouani for his continuous mentoring and support.
- I would also thank the capstone teams for helping out in the hardware implementation of the vehicle.

8 Future work

- Implementing the navigation on the vehicle so that vehicle goes to user defined location automatically.
- Reducing the interference of sunlight on LIDAR sensor during bright sunlight.