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Advanced Driving Stake System for Physically-Challenged People

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Abstract: This paper proposes Advanced Driver Stake System (ADSS) for physically challenged people to assist them in driving the four-wheeler vehicles such as car. The present technologies concentrate on improving the advanced driving systems to avoid accidents and automatic systems for this purpose, but these were limited in interfacing the android systems. This paper was designed to improve this technology for interfacing mobile android applications, car driving systems to work with vocal instructions. The GPS is also enabled so that the registered users gets SMS alert in case of an emergency. The car motion can also be captured using GPS and can be followed by authenticated user. If the car founds any obstacle at a maximum distance of 3cm at the front then the car stops immediately with an alert message to the driver. The car gets slowed down if the obstacle was found at a distance less than 10cm in the front. If the obstacle is found at a distance of 10cm in any other directions such as left, right or behind then the car gives an alert message to the driver indicating the obstacle on the respective direction.

Keywords: Arduino, IR sensor, Microcontroller, Ultrasonic sensor, Voice control.

I. Introduction

Compassion towards the physically challenged people who cannot move around and subvent a wheelchair to move is inarticulate. They cannot travel anywhere without the support of any other person even in the case of an emergency. Nowadays many old aged people had to live separately from their children and there is no chance of any human assistance for such people along the whole day. Some of the recent inventions aim at assisting such people in many ways but deserve some limitations in any part of the assistance. The car or any vehicle proposed get slows down when it detects an obstacle nearby at a distance of 5cm [2]. This uses sensors to detect the obstacles nearby and processes them using the control system in the vehicle. An algorithm was proposed to detect such static and dynamic obstacles and do the statistical analysis for those images using image processing. Depending on the distance at which the obstacle is present the car works and stops immediately. But the present proposed ADSS can detect obstacles at a minimum distance of 3cm and stops the car when it detects the obstacle even at more distance. This works better when some vehicle or obstacle moves faster and reaches the nearest point range of the vehicle to detect it and operate accordingly and immediately with the help of highly precise sensors. A wheelchair was proposed in [5] which is controlled with the hand gestures of the person. It moves around in all the directions with the sensors detecting the hand gestures of the user. These signals were given to a microcontroller which controls the wheelchair. Hand and vision gesture-based driving wheelchair were also proposed [7] which work based on the movement of hands in all directions at certain angles and also with the movement of eyeballs in all sides along the eye with image detection. These works can be improvised with the help of present model for better usage and implementation. In assisting those people to travel individually without the help of any other people some voice controlled cars were designed so that those cars can be controlled using voice commands. This paper Advanced Driver Stake System helps to control the car through voice commands received via android application.

A wearable head-mounted sensor-based apparatus for eye tracking applications is explained in [9]. It helps in human-computer interfacing which helps in tracking with simple eye glasses. The advantages can be helped in our project in sensing the objects near by the vehicle and update the system to alert the driver. Ultrasonic devices transmit short burst of ultrasonic sound towards the target, and the sound gets reflected to the sensor when it hits any object, its applications can be understood

from [11]. All these sensors can be interfaced with controllers through some instructions [13-14].

II. System Configuration

The automated system consists of many functional modules associated to the Arduino and microprocessor which can be classically called as a CPU. The functional association of all the modules is shown in the Fig. 1. Android application can be operated using any smartphone or tab in which an app "Bluetooth RC Controller" has to be installed. Voice commands can be given to this application from microphone of the smartphone or the tab which was used for executing the android application. The control unit is integrated with Bluetooth device to capture the voice commands and read them aloud as a buzzer. Then the ADSS operates as per android application commands. The android based Smartphone / tab with an android OS can be used for android application. This provides good interactive GUI which makes the driver to control the vehicle easily. The transmitter uses android application to transmit the data. The receiver reads these commands and interprets them into ADSS.

The android device generates commands to make the vehicle move in backward, forward, left and right directions. After receiving the commands, the microcontroller operates the motors to move the vehicle in four directions. The data between receiver and the android device is sent as serial data communication. The microcontroller program is designed to move the motor through a motor driver IC.

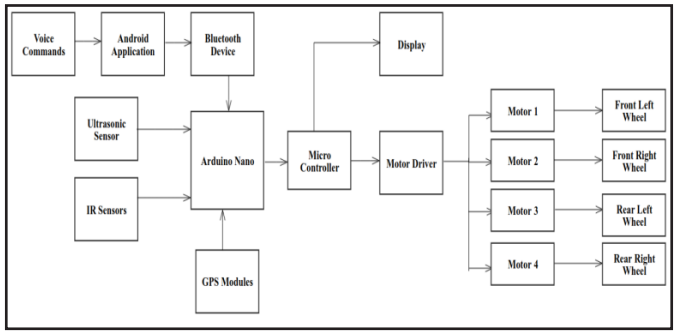

Fig. 1: Block Diagram of the Functionality of ADAS

It has GPS tracking for detecting any accidents or emergency and will sends the message. This car also has ultrasonic sensor in the front part for sensing vehicles in the front direction and gives commands to the ADSS to stop the car if the obstacle is so closer of 3cm distance. Similarly both sides (left, right) of the car and back of the car has IR sensors to avoid collision with other vehicles by giving the buzzer indicating the driver to give safe command to the car.

The modules arrangement and relation between each module with the other modules can be understood from Fig. 1 and also working dependencies of each module over the other was indicated.

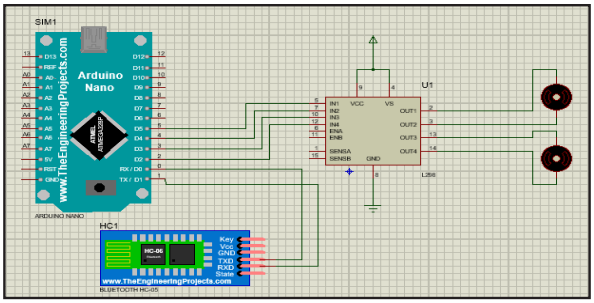

Fig. 2: System Configuration of Arduino Connected with Bluetooth and Motor Driver

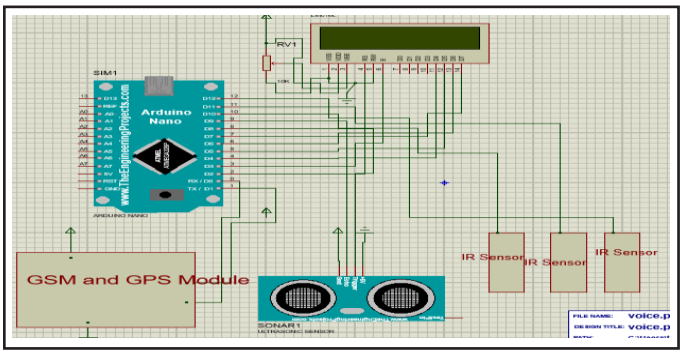

Fig. 3: Driving System Configuration with the Modules Connected to the Control System

The Arduino connection with the Bluetooth device and the motor driver is shown in Fig. 2 which acts as a medium between those two devices and functionalities. Arduino processes the received wireless signals and operates the wheels with the help of motor driver. The configurations done by the control system or ADSS with all the modules is shown in Fig. 3. System collaborates all the modules and based on the requirement they work accordingly.

III. System Implementation

The car runs with all the normal features along with this add-on assisted driving feature. The voice commands will be given to the car with the help of the android based device. ADSS is operated using a programmed Arduino FTDI which connects all the modules and affiliate them with interfaces. This Bluetooth is connected to the Arduino which processes the signals. These signals are given to the Low Power AVR 8-bit microcontroller using the transmitter and the signals are received by a receiver in the microcontroller to make it all work wirelessly. The microcontroller having advanced RISC architecture is programmed to process these commands and give the signals to the motor driver with much faster and accurate performances. This motor driver coordinates and operates the four motors which were connected to the wheels of the car. These wheels move based on these signals given to the motor driver by microcontroller.

The Ultrasonic and IR sensors were also connected to the system which sense the traffic and then gives the signals to the control system which in turn slows down the vehicle if the obstacle is beside or behind the vehicle, or in front of the vehicle at a distance of 10-15cm or even less. The vehicle stops automatically if the obstacle is found in front of the vehicle at a maximum distance of 3cm.

Motors are connected to the Arduino through a motor driver which were in turn connected to the wheels. Four motors are connected to the Arduino or the control system to operate four wheels according to the instructions given by the driver. When the vehicle senses an obstacle nearby, then the motors will be given a low or high inputs and according to them directions of the wheels changes and hence the car gets rotated accordingly.

IR and Ultrasonic sensors were placed to sense the obstacle or traffic nearby the car. The SONAR 1 Ultrasonic sensor was placed at the front of the car which can sense any obstacle at a minimum distance of 3cm and gives a buzzer mentioning that the obstacle is found and also sends the signals to the motor to stop the car so that the car stops immediately.

If any obstacle is found more than a distance of 10cm then the sensor gives a buzzer alerting the driver about the obstacle at the front. IR sensors were placed in all the remaining sides of the car which can sense the obstacles and gives a buzzer to the driver. If the obstacle is present on the right side it says "you have right side passing take care" and if the obstacle is on the left side of the car it says "you have left side passing to take care". If the car detects the traffic on the back side then it buzzers as "you have back traffic take care at your both sides and take a good command".

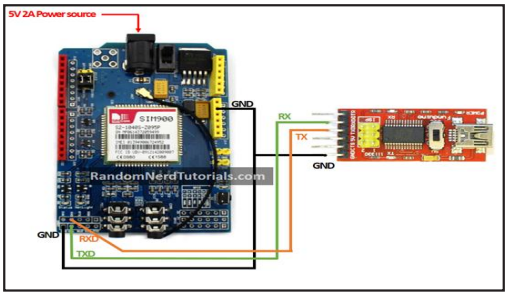

Fig. 4: FTDI Programmer Connected with GSM Shield

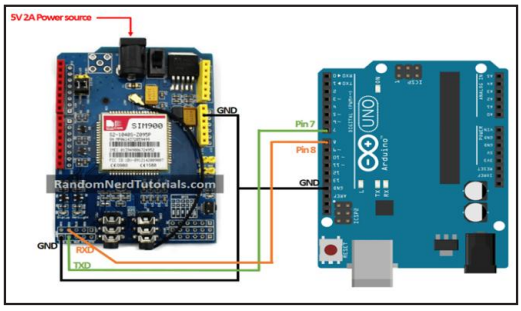

Fig. 5: The FTDI Programmer is Connected with the Arduino for Control Using Android Application

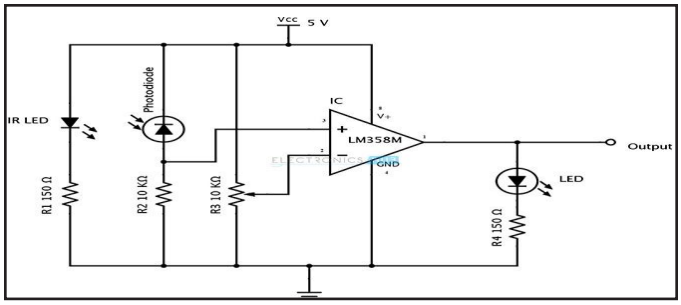

Fig. 6: IR Sensing Circuit Implementation

The transmitter and receiver pins of the FTDI programmer were connected to the GSM shield Fig. 4 which detects the latitude and longitude position of the car and sends SMS to the prescribed users immediately in case of any emergency like an accident. Same pins were connected to pin 7 and 8 of Arduino Fig. 5 which helps in serial data transmission. Serial data helps in sending and working according to the commands given by the user. The IR sensing circuit is shown in Fig. 6 and IR LED or transmitter sends the infrared light and a receiver receives the reflected light waves from the obstacle. The indirect incidence technique is used for detecting the obstacle using IR sensor. In order to avoid reflections from surrounding objects other than the obstacle, both the IR transmitter and the IR receiver must be enclosed properly using a plastic coated with black color.

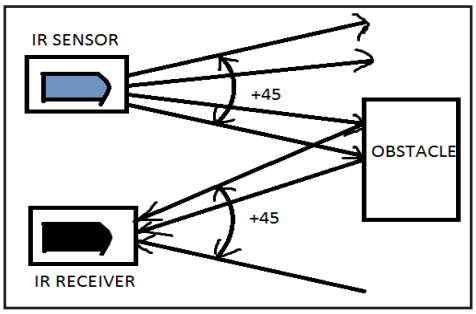

Fig. 7: IR Sensing Circuit Directivity with the Object or Any Obstacle

IV. Results and Discussion

The Arduino is observed with the help of an Arduino IDE which displays a screen as shown in the Fig. 8. The SIM900 GSM GPRS shield is used as serial monitor and hence its default baud rate 19200 is to be maintained with the Arduino. The baud rate is set to 19200 using a command AT+IPR=19200. The command reply "OK" in the Arduino IDE indicates that the Arduino is working perfectly. ADSS front view Fig. 9 contains the Ultrasonic sensor and LED display which displays the command given to it and the details of any obstacle that comes across in any direction. The distance at which the obstacle is present is also shown on the display. The ADSS system configuration shown in Fig. 10 contains the connections and hardware required for implementing ADSS functionality.

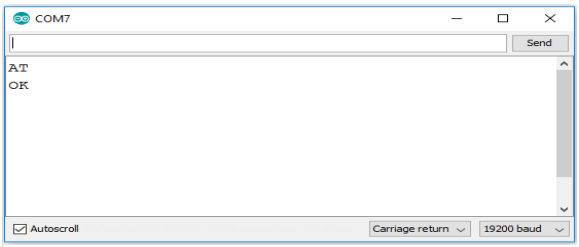

Fig. 8: Arduino IDE Showing the Arduino Module is Functioning Correctly

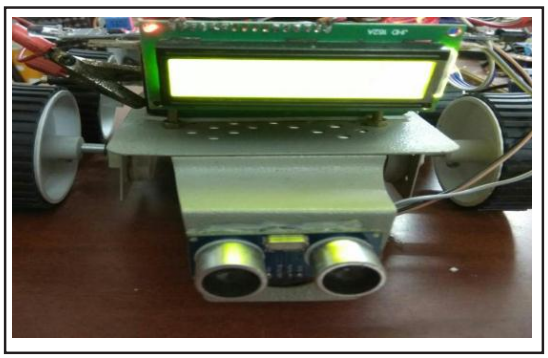

Fig. 9: ADSS Front View with Ultrasonic Sensor and LED Display to Detect the Vehicles in Front Direction

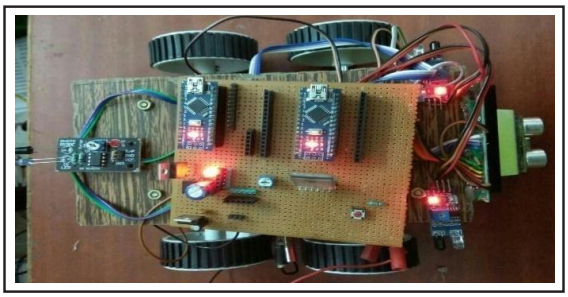

Fig. 10: Android Application Displaying the Commands Displayed to Verify the System Status

The obstacle is detected by the sensors on all sides and the buzzers get activated indicating the obstacle. ADSS functionality was tested and observed when some obstacles were placed while the car was moving while distance and direction of the obstacle was shown on the display which matches with the actual values.

V. Summary and Future Scope

An interface was created between android application and microcontroller with Bluetooth module which helps in accurate and fast implementation wirelessly. We also incorporated GPS to send notification to the registered person upon emergency. This car also detects and stops the vehicle when it comes across any obstacle at the front with in a distance of 3cm. Our system uses simple instructions through voice commands given by the user and performs with immediate action. This can be further extended with many other gestures and different types of inputs that differently disabled persons can also use them.

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