Multi sensor based autonomous car for visually impaired people

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Abstract:-

Autonomous driving is currently a very active research area with virtually all automotive manufacturers competing to bring the first autonomous car to the market. This race leads to billions of dollars being invested in the development of novel sensors.

In this project, we explore the synergies between the challenges in self-driving technology and development of navigation aids for blind people. We aim to leverage the recently emerged methods for self-driving cars, and use it to develop assistive technology for the visually impaired which makes use of the multiple sensors for detection, recognition and processing of objects that hinders the path. Ultrasonic& IR sensors detect and measure the distance of obstacle and depending on the obstacle present in its path it decides the movement of vehicle.

Keywords:-
AT mega 328 microcontroller, Ultrasonic sensors, Motor drivers, GSM, Motors

I. Introduction

Humans rely strongly on vision, our primary sense used for perception of surroundings. Our daily life independence is closely connected to the ability to explore new environments and detect obstacles in a safe way. Navigation in an unknown setting is therefore a very difficult task for visually impaired people, often limiting their independence [3].

According to W.H.O (World Health Organization), there are approximately 285 million people who are visually impaired out of which 39 million are blind and 246 million have low vision about 90% of the world's visually impaired have low income[6]. There is a constant need of an self-driving vehicle for them.

In this work we present a road terrain estimation method that uses an obstacle detection technique. It detects the obstacles in the path and avoids it and resumes its running.

There are some famous methods for navigation like wall-following, edge detection, line following. One of the commercial systems uses wall following method on a floor cleaning robot for long hallways. The most commonly employed method for obstacle avoidance is based on edge detection [2]. By using of this edge detection method it detects an obstacle and stop the vehicle in order to avoid a collision, using some sophisticated algorithms that enable the robot to detour obstacles. The latter algorithms are more complex, since they involve detection of an obstacle as well as some kind of quantitative measurements concerning the obstacle's dimensions. Once these have been determined, the obstacle avoidance algorithm needs to steer the robot around the obstacle and resume motion toward the original target.

II. Existing system

In simple robot, steering algorithm is used for robotic actions in which driver or a human being is controlling the robot using remote. Here driver is present, who can see the obstacle and navigate robot accordingly. But it is not applicable for visually impaired people.

III. Proposed system

Our proposed project puts forward an obstacle avoider robotic vehicle that uses

ultrasonic sensors for this purpose. The system uses AT mega 328 microcontroller to achieve this functionality.

The robotic vehicle is designed to first track and avoid any kind of obstacles that comes it's way. The vehicle achieves this smart functionality with the help of sensors coupled with a microcontroller and motors. The entire system combined gives the vehicle an intelligent object detection and obstacle avoidance scheme.

This system allows the vehicle to guide itself in case it encounters any obstacle. The obstacle detection is done using the different sensors. This is detected and a signal is passed on to the microcontroller.

On receiving the signal it guides the vehicle in another direction by actuating the motors through the motor driver IC.

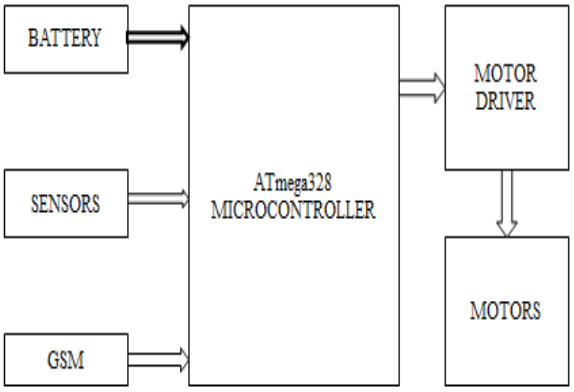

Fig 1: **Block diagram**

1) *ATmega328 Microcontroller:*The Atmel 8-bit AVR RISC-based microcontroller combines 32kB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

2) sensors: The main goal of sensors is to perceive the environment, and thus they are a critical part of the system: we simply cannot avoid obstacles that we can't sense. There is no sensor modality that is capable, by itself, to perceive all possible challenges in all environments, therefore a self driving car must combine sensors from multiple modalities.lot of sensors are available for obstacle detection such as ultrasonic sensor, infrared sensor, PIR, camera and LIDAR (laser based sensor system), which has been considered as one of the most accurate schemes for generating spatial information about the shape and surface characteristics of any object.

IR sensor is used to improve the overallvision system of mobile robot. IR sensors are widely used for measuring distances, so they can be used in robotics for obstacles avoidance. IR sensors are also faster in response time than ultrasonic sensors. In addition, the power consumption of IR sensor is lower than ultrasonic sensors. Active Infrared (IR) sensors can be an emitter and detector, which operate at the same wavelength. It is also known as photoelectric sensor working with reflective surfaces. IR sensor can be categorized as retro-reflective sensors and diffuse reflection sensors. Retro-reflective sensors are proper for harsh environment conditions and have much larger detection range than the diffuse reflective sensor. IR sensors use a specific light sensor that can detect a selective light wavelength in the IR spectrum. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor as shown in Figure-2.

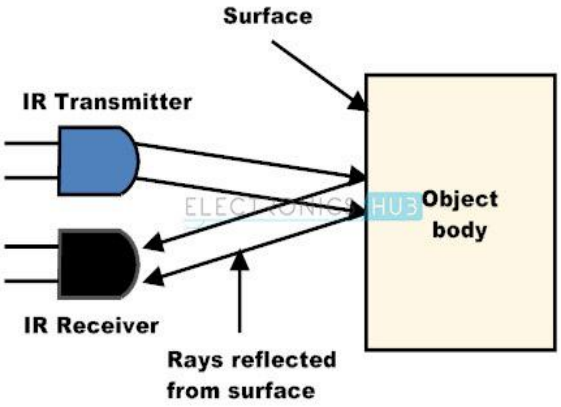

Fig 2: IR Sensor object detection

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view.

An individual PIR sensor detects changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor.When an object, such as a human, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature, and then back again. The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage, and this triggers the detection. Objects of similar temperature but different surface characteristics may also have a different infrared emission pattern, and thus moving them with respect to the background may trigger the detector as well.

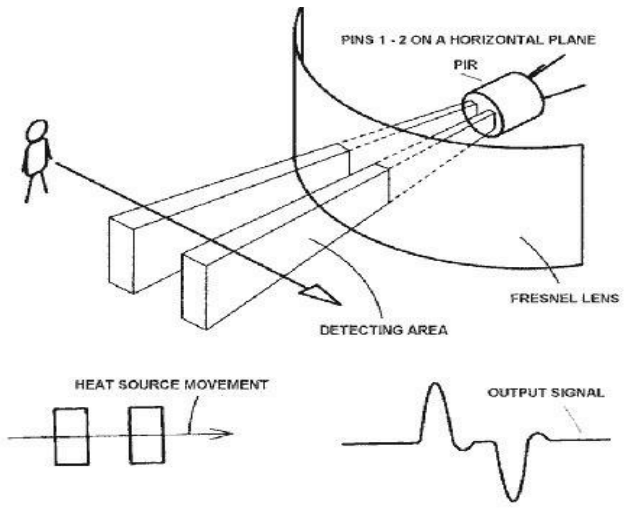

Fig 3: **PIR Sensor object detection**

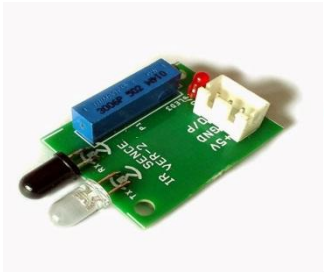

Fig 4: IR sensor

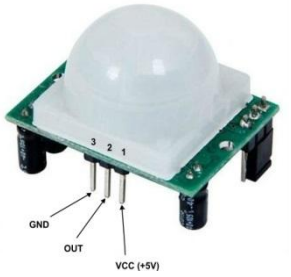

Fig 5: PIR sensor

3) Motor driver: Motor driver L293D (H-bridge) is used to control the motors and decides which motor will be moved or stopped in accordance to the incoming signal from the microcontroller ATmega32.

4) GSM: Here we use GSM and GPS technology to track a vehicle. This vehicle tracking system can also be used for accident detection alert system, soldier tracking system and many more. In this accelerometer and tilt sensor is used. Accelerometer detects the sudden change in the axes of vehicle, Tilt sensor detects the position of the vehicle and GSM module sends the alert message on your Mobile Phone with the location of the accident. Location of accident is sent in the form of Google Map link, derived from the latitude and longitude from GPS module. It sends the person location to the nearby police station and send SMS to family members.

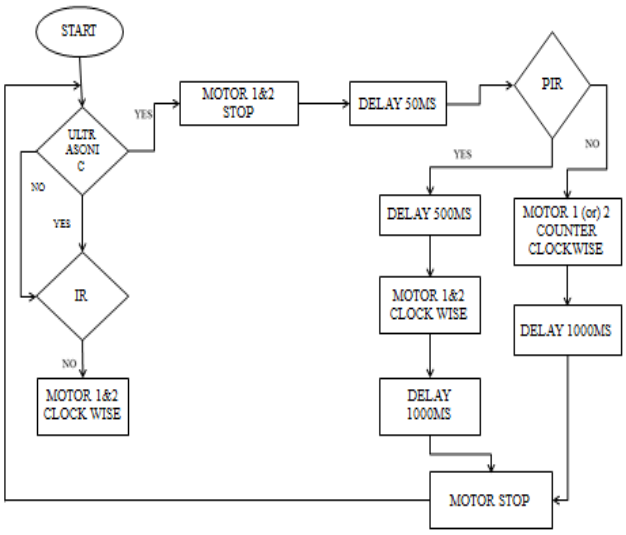

Fig 6: Flow chart of the obstacle avoidance autonomous car

Experiment Setup

Circuit diagram of the obstacle avoiding robot is given in Figure 6. The hardware developed consists of Microcontroller Atmel ATMEGA 328, IR sensor, two DC motors as differential driving system, PIR (Passive Infra-Red) sensor and motor driver L293D. The microcontroller ATMEGA 328 is the central brain of the autonomous car. The IR detector (rear) is connected to PD6 of ATMEGA328. If any object is located at the rear part of the robot frame, the IR sensor output will alert the microcontroller that an obstacle is detected. The IR sensor used as shown in Figure 4. Ultra sonic sensor is used to detect the obstacles by using ultra sonic waves. It transmits the ultrasonic waves from its sensor head and again receives the ultrasonic waves reflected from an object. PIR sensor (front) is connected to PD7 I/O pins. If any object is moving in front of the vehicle, the PIR sensor output will alert the microcontroller that an obstacle is detected. Motion sensor has 90 degrees field of view and it will be triggered when a warm object moves across the area it is facing. It is very sensitive and will trigger with just a hand movement. PIR motion sensor is shown in Figure 5.

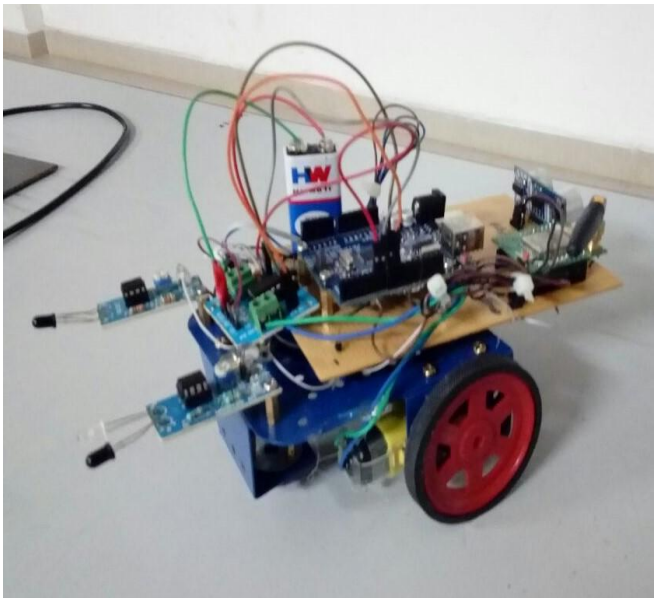

Fig 6: Experimental setup for autonomous car

Conclusion

In this project we propose theautonomous cars into assistive technology for blind and visually impaired people.Vehiclecan move in different directions like Forward, Backward, Left, and Right. Based on the object present in front of the vehicle .if it is living object then it waits for the obstacle status and ifnon-living objects are present in its path then it changes the direction of vehicle direction. Vehicle tracking system is also used to detect the location of the vehicle and also for accident detection.

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