Development of Smart Car system for Accident Prevention

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Abstract-

In today's world ROBOTICS is a fast growing and interesting field. SMART CAR has sufficient intelligence to cover the maximum area of provided space. Introduces the design and implementation of an autonomous obstacle - avoiding Smart Car using ultrasonic wave sensor in this thesis. The project is design to build an obstacle avoidance Smart Car vehicle using ultrasonic sensors for its movement. A microcontroller (ATmega328) is used to achieve the desired operation. A Smart Car is a machine that can perform task automatically or with guidance. The project proposes Smart Car vehicle that has an intelligence built in it such that it directs itself whenever an obstacle comes in its path. This Smart Car vehicle is built, using a micro-controller of AT mega 328 family. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the micro-controller. Depending on the input signal received, the micro-controller redirects the Smart Car to move in an alternate direction by actuating the motors which are interfaced to it through a motor driver By sending pulses, the obstacle avoidance distance can be measured. At the same time, we can control steering gear to realize the obstacle avoidance function. The Smart Car uses front axle steering, rear wheel drive arrangement. Two drive tires are driven by two DC motors with gear reduction mechanisms. Using Arduino MCU chip as the control core of the Smart Car. Through the design of the hardware and software system, we build the Smart Car car platform and obtain good experimental effect.

Keywords: Smart car , accidents detection , alcohol sensor , ultrasonic sensor etc.

1. Introduction

This SMART CAR has sufficient intelligence to cover the maximum area of provided space. It has a ultrasonic sensor which are used to sense the obstacles coming in between the path of SMART CAR. It will move in a particular direction and avoid the obstacle which is coming in its path. We have used two D.C motors to give motion to the SMART CAR. The construction of the SMART CAR circuit is easy and small .The electronics parts used in the SMART CAR circuits are easily available and cheap too. Obstacle avoidance Smart Car is designed in order to navigate the Smart Car in unknown environment by avoiding collisions. Obstacle avoiding Smart Car senses obstacles in the path, avoid it and resumes its running. There are some very popular methods for Smart Car navigation like wall-following, edge detection, line following and many more. A more general and commonly employed method for obstacle avoidance is based on edge detection. A disadvantage with obstacle avoidance based on edge detecting is the need of the Smart Car to stop in

front of an obstacle in order to provide a more accurate measurement.

All mobile Smart Cars feature some kind of collision avoidance, ranging from primitive algorithms that detect an obstacle and stop the Smart Car in order to avoid a collision, using some sophisticated algorithms that enable the Smart Car 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 Smart Car around the obstacle and resume motion toward the original target. The steering algorithm ensures that the Smart Car does not have to stop in front of an obstacle during its navigation. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the micro-controller [10] Hence the Smart Cars may overcome some of the problems during navigation, which are discussed above and it can navigate smoothly during its operation avoiding the collisions. if we were

use the IR sensor Infrared sensors detect the object's distance with infrared radiation.

2. Objectives

The main objectives of the project are comprehended as follows:

• The obstacle avoidance Smart Car is able to move around in an unknown environment without colliding with surrounding objects.

• The Smart Car would have the capacity to detect obstacles in its path based on a predetermined threshold distance.

• After obstacle detection, the Smart Car would change its course to a relatively open path by making autonomous decision.

• It would require no external control during its operation.

• It can measure the distance between itself and the surrounding objects in real-time.

• It would be able to operate effectively in unknown environment.

• Obstacle avoiding Smart Cars can be used in almost all mobile Smart Car navigation systems

• They can be used for household work like automatic vacuum cleaning.

• They can also be used in dangerous environments, where human penetration could be fatal.

3. Literature Survey

We reviewed different obstacle detecting Smart Car mechanisms that have been built by a lot of students and other practitioners that are in existence. For an autonomous mobile Smart Car performing a navigation-based task in a vague environment, to detect and to avoid encountered obstacles is an important issue and a key function for the Smart Car body safety as well as for the task continuity. Obstacle detection and avoidance in a real world environment that appears so easy to humans is a rather difficult task for autonomous mobile Smart Cars and is still a well researched topic in robotics. In many previous works, a wide range of sensors and various methods for detecting and avoiding obstacles for mobile robot purpose have been proposed. Good references related to the developed sensor systems and proposed detection and avoidance algorithms can be found.

Based on these developed sensor systems, various approaches related to this work can be grouped.

"line follower and obstacle avoidance bot using arduino" has been designed and developed by Aamir attar, Aadilansari, Abhishekdesai, Shahid khan, Dipashrisonawale to create an autonomous Smart Car which intelligently detects the obstacle in its path and navigates according to the actions that user set for it. So this system provides an alternate way to the existing system by replacing skilled labor with robotic machinery, which in turn can handle more patients in less time with better accuracy and a lower per capita cost [1].

"Obstacle-avoiding robot with IR and PIR motion Sensors" has been designed and developed by Aniket D. Adhvaryu et al has proposed that developed robot platform was not designed for specific task but as a general wheeled autonomous platform. It can therefore be used for educational, research or industrial implementation. Students can use it to learn the microcontroller programming using C++, Arduino Uno 1.6.5 compiler, IR and PIR sensors characteristics, motor driving circuit and signal condition circuit design. Research on obstacle avoidance robot at the polytechnic level can help students to develop communication, technical skills and teamwork. The design of such robot is very flexible and various methods can be adapted for another implementation. It shows that PIR sensors are more sensitive compared to IR sensors while detecting human being [2].

"Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor, Android and Bluetooth for Obstacle Detection" has been designed and developed by Vaghela et.al has mentioned that enormous amount of work has been done on wireless gesture controlling of robots. Various methodologies have been analyzed and reviewed with their merits and demerits under various operational and functional strategies. Thus, it can be concluded that features like user friendly interface, light weight and portability of android OS based smart phone has overtaken the sophistication of technologies like programmable glove, static cameras etc., making them obsolete. Although recent researches in this field have made wireless gesture controlling a ubiquitous phenomenon, it needs to acquire more focus in relevant areas of applications like home appliances, wheelchairs, artificial nurses, table top screens etc. in a collaborative manner [3].

"Obstacle Avoidance Robot" has been designed and developed by Paul Kinsky,Quan Zhou mentioned

that robot with a few mechanical components to add two more functions to the main body, namely the laptop holder and the camera holder. AT89S52 development board is designed, developed and tested in a large scale, which was used to control the motors smoothly. the cameras with relatively low cost are fixed and adjusted on the camera holder for good calibration of the computer vision.Users establish the serial communication method between the upper laptop and the lower development board with USB port. The laptop will send out a signal of the motor condition to the development board [4].

"Obstacle avoidance car" has been designed and developed by Faiza Tabassum, et.al has mentioned that Obstacle Avoidance Car successfully detects and avoids obstacles. Simple algorithms used to steer and reducing the turning radius, successfully navigated the vehicle. In conclusion, the group successfully interfaced every component that was originally planned. Timer interrupts for IR pulse generation. Obstacle detection using IR transceiver. Servo mechanism using PWM. Steering system using Lego and Servo. [5].

4. Project Methodology
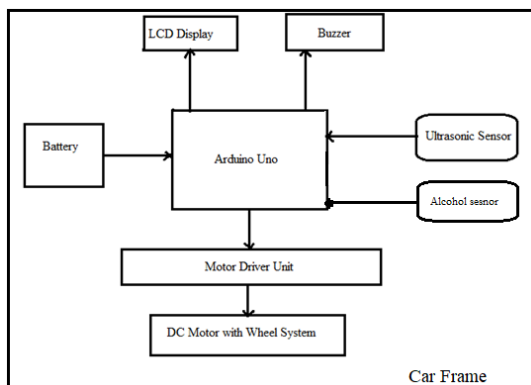### 4.1. Block Diagram

Fig. 1. Block Diagram

4.2. Working

The project is designed to build an obstacle avoidance Smart Car vehicle using ultrasonic sensors for its movement. An Arduino uno is used to achieve the desired operation. A Smart Car is a machine that can perform task automatically. Robotics is generally a combination of computational intelligence and physical machines (motors). Computational intelligence involves the programmed instructions. The project proposes Smart Car vehicle that has an intelligence built in it such

that it guides itself whenever an obstacle comes ahead of it. This Smart Car vehicle is built, using an Arduino uno. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the Arduino. In today's world robotics is a fast growing and interesting field. Smart Car has sufficient intelligence to cover the maximum area of provided space. Autonomous Intelligent Smart Cars are robots that can perform desired tasks in unstructured environments without continuous human guidance. The obstacle detection is primary requirement of this autonomous Smart Car. The Smart Car gets the information from surrounding area through mounted sensors on the Smart Car.

5. Calculation
1. ***Selection of electric motor***
A) 30 RPM DC motor SPEED = 30
B) RPM VOLTAGE = 12 VOLT
C) WATTS = 18 WATT

2. ***Torque of the motor***
A) Torque = (P X 60) / (2 X 3.14 X N)
B) Torque = (18X 60) / (2 X 3.14 X 30)
C) Torque = 5.72 Nm Torque = 5.72 x 10^3 N-m
D) The shaft is made of MS and its allowable shear stress = 42 MPa
E) Torque = 3.14 x fs x d^3 / 16   5.72 x 10^3 = 3.14 x 42 x d^3 / 16   D = 8.85 mm
F) The nearest standard size is d = 9 mm.

3. ***Electrical (electric) power equation***
A) Power P = I × V Where V = 12 W = 18 I=18/12=1.5
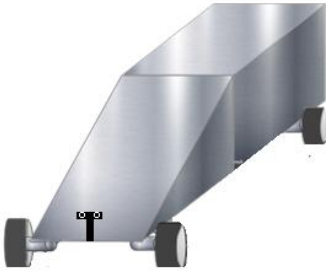B) A H.P = .02414

4. ***Battery calculation***
A) BAH /CI = 8 ah/420ma = 19 hrs
B) To find the Current Watt = 18 w
C) Volt = 12v Current =?
P= V x I 18 =12 x I   I = 18/12 = 1.5
D) AMPS battery usage with 1.5 AMPS
BAH /I 8/1.5 = 5.3 hrs.

6. Applications

This device has application in surveying different landscapes and mapping them. It can also be used in commercial devices like,

☐ Automated lawn mover

☐ Smart room cleaner etc

☐ Obstacle avoiding Smart Cars can be used in almost all mobile Smart Car navigation systems.

☐ They can also be used in dangerous environments, where human penetration could be fatal.

☐ Unmanned vehicle driving

☐ Mining Vehicle that uses Obstacle Detection

7. Advantages

- Collision control.
- It provides Safe Navigation.
- This is the basic of all Smart Car and has a wide scope of extensions.
- Drink and driving and thus avoiding accidents
- Protect the human life

8. Limitations

- The performance of this Smart Car mainly depends on the sensors and number of sensors.
- The ultrasonic sensor used here is of commercial application so it may easily undergo interference.

9. Result

The above Arduino controller and ultrasonic sensor were studied and the HcSR-04 ultrasonic sensor was selected, as the controlling result are satisfying for its use in the automobile prototype system bring developed. It was used to sense the obstacle and avoidance them. On successful implementation of obstacle avoidance algorithm was successfully carried out too with minimal errors, by coding the algorithm in python. Obstacle avoidance is a very good application to be used in vehicle preventing many accidents and loss of life.

This project developed an obstacle avoiding Smart Car to detect and avoid obstacles in its path. The Smart Car is built on the Arduino platform for data processing and its software counterpart helped to communicate with the Smart Car to send parameters for guiding movement. For obstacle detection three ultrasonic distance sensors were used that provided a wider field of detection. The Smart Car is fully autonomous and after the initial loading of the code, it requires no user intervention during its operation. When placed in unknown environment with obstacles, it moved while avoiding all obstacles with considerable accuracy. In order to optimize the movement of the Smart Car, we have many considerations for improvement. However, most of these ideas will cost more money and time as well. ₁In future cameras can be used to detect the obstacle however, it is better to get CCD or industrial use ones to get clear and fast pictures. Even the ones we mentioned in the camera holder part will be better because of the special software.
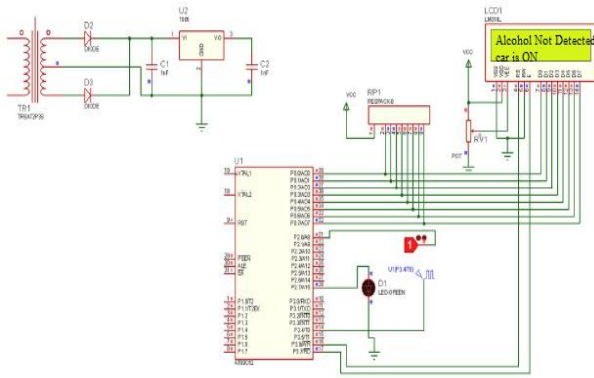
In this project we have developed a real time model that can automatically shut off the engine automatically. Tests found that this system is highly effective and it's efficient in testing the alcohol percentage of the Human beings and if it crossed the threshold value the dc motor will stop working. By fitting this alcohol sensor into the car. We can save the life of the driver and also the remaining passenger.

The result is obtained for obstacle avoidance Smart Car using Arduino, if the Smart Car moves forward if any obstacle detect it check for other directions and moves where there is no obstacles it moves in forward direction, to sense the obstacle ultrasonic sensor is used. We used servo motor to rotate the ultrasonic sensor.

Case 1: Without Alcohol Consumption

If person did not found Alcoholic, Alcohol sensor send the signal to the microcontroller and microcontroller reults its output to LCD display : Alcohol is not detected , Car is ON.
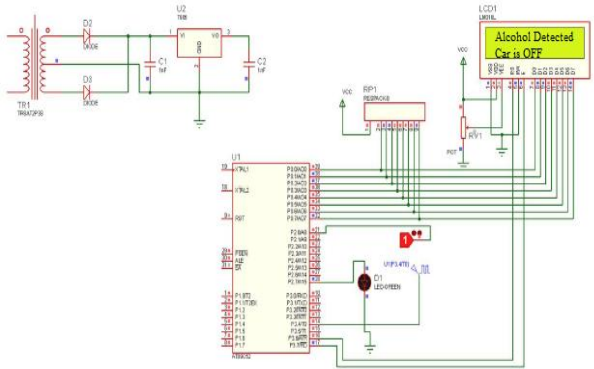
Also Buzzer is silent and relay board is active the DC motor.

Case 2: With Alcohol Consumption

If person is alcoholic alcohol sensor detect the alcohol, it gives signal to the microcontroller. Lcd display shows the output : Alcohol detected , Car is Off.

Buzzer start siren and relay board is active and stops DC motor rotation

The result is obtained for obstacle avoidance robot using Arduino, if the robot moves forward if any obstacle detect it check for other directions and moves where there is no obstacles it moves in forward direction, to sense the obstacle ultrasonic sensor is used. We used servo motor to rotate the ultrasonic sensor.

10. Conclusion

Today we are in the world of robotics. Knowingly or unknowingly, we have been using different types of Smart Cars in our daily life. The project is "obstacle detection and the avoidance Smart Car" is practically proved by using the Ultrasonic sensor for sensing the Smart Car, Motor Shield Driver for the driving the dc motors, dc motor is used for the movement of the Smart Car with the help of the Arduino Microcontroller. A lot of factors determined the accuracy of the Smart Car we

designed. These factors were the environmental phenomenon in which the Smart Car was tested, the number of obstacles present making the test space crowded or relatively less crowded the type and shape of the obstacle (the Smart Car is designed for a uniform shaped obstacle). These factors majorly affected the sensors. The accuracy of the Smart Car is dependent on the sensors used. Thus, the nature of the sensor and its accuracy defined the accuracy of my Smart Car.

11. Future Works

To enable Smart Cars to be able to adapt to its environment is an important domain of robotics research.

- Whether this environment be underwater, on land, underground, in the air or in space.
- A fully autonomous Smart Car has the ability to Work for an extended period of time without intervention from human or a need for power supply.
- Avoid situations that are harmful.

The most effective method to increase the accuracy of my Smart Car is the inclusion of better sensors, although the project cost might increase but the accuracy will definitely increase as well as the problem space where the Smart Car can be used. Better actuators will result in a faster and more efficient Smart Car.

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