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VOICE CONTROLLED ROBOT WITH REAL TIME BARRIER DETECTION AND AVERTING

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Abstract – *The main aim of the robot is to scan the voice input and process it for required operation and to evacuate the human presence over specified area by controlling the robotic vehicle via voice command. The voice control technique consists of an Android app which communicates with the robot via Bluetooth module. Additionally the robot will also have the proficiency to detect the obstacle and notifies the user to avoid the obstacle by choosing different path with the help of Ultrasonic sensor.*

Key Words: voice command, obstacle, Bluetooth module.

1. INTRODUCTION:

1.1 History of Robotics:

Robots are the combination of electrical, mechanical and automated systems that are used to perform specific and complex tasks that are given by humans. Robot's growth from scratch has been tremendous over the years. The concept of developing a robot originated when people begun to think that their work has to be done in a given period of time without any human help. Turning ideas into reality they developed remotely operated robots with wiring system, and then they developed as wireless robot in the form of antenna which covers over a certain distance only. Around 10th century BC the mechanical automated robot was built that could sing and dance. It was built by an artisan named Yan Shi and the machine had lifelike organs like muscles, joints and bones. The ancient Chinese built the clock towers that automatically ring the bell for every hour.

1.2 Voice Control:

The robots may be remote controlled, voice controlled or fully automated. To get high interaction with the robot voice controlled is recommended. Voice controlled robots uses speech recognition to obtain the data from the user. Here the speech is converted into bits by using the sampling technique, based upon the binary values the robot takes the required action.

1.3 Components Description of the Project:

A robot needs a standard controller which acts as a brain for it. As arduino is platform free and user friendly, it can be used. The smart phones are used to get the input data from the user. The communication between the smart phone and the controller of the robot is done by using the Bluetooth module. The use of Bluetooth module is highly efficient over the given range and also Bluetooth is very easy to get the communication with the smart phone and arduino. The robot must move accordingly with respect to the objects that are present nearby the robot. The obstacles are detected by using various sensors like capacitive sensors, magnetic sensors, photoelectric sensors, and ultrasonic sensors. Here ultrasonic sensor is used to detect the obstacles. The ultrasonic waves are generated by using the piezo electric crystal, where the electric signals are converted into mechanical vibrations (ultrasonic waves). The ultrasonic waves are transmitted at the transmitter end, if there is any object within the given limit; the ultrasonic waves strike the object and get received at the receiver end of the sensor. Based upon the time taken for the transmitting and receiving the distance between the robot and the obstacle is calculated. The robot stops or move further based upon the values that we give. Thus, the robots increase the quality of living of the humans in this world.

1.4 Overview of Our Work:

Our project voice controlled obstacle avoiding robot can cover up more distance than wireless antenna robots due to the fact that we have used Bluetooth module which is more efficient than the wireless antenna's as it transfers our speech input data from android app to the brain of the robot (Arduino UNO). Ultrasonic sensor used in this project helps to detect the obstacles present in front of the robot. In the presence of obstacle the robot stops. Then, the robot waits for the user to provide next command regarding in which direction it needs to move. Our robot is a semi-automated robot, in future our robot can be upgraded from chassis structure to prototype humanoid robot with addition of motorized hands and legs.

1.5 Task of the Robot:

1. When the robot gets power supply, the robot starts to move.
2. When the obstacle comes in front of robot, it senses the obstacle and stops.
3. Then the robot waits for the user to provide the next command.
4. The command of the user are "go ahead", "go back", "turn left" and "turn right".
5. Depending upon the command given by the user, the robot works according to it.

Table -1: Tasks of the robot.

INPUT (User speaks)	OUTPUT (Robot does)
GO AHEAD	Moves forward
GO BACK	moves back
TURN RIGHT	turns right
TURN LEFT	turns left

2. METHODOLOGY:

2.1 Block Diagram:

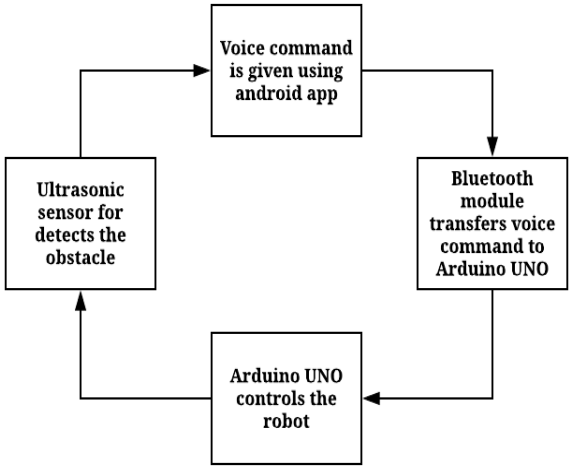

Fig -1: Block diagram

Initially the command is given using android app. The command is in the form of voice using Google voice search method. The given voice input transmits to Arduino UNO via Bluetooth module HC-05. Then Ultrasonic sensor starts to work with the information provided by the Arduino UNO from android app.Then, the Ultrasonic sensor transmits sound waves and if the sound waves hits any object, it then return back and the Ultrasonic sensor receives the sound waves and detect where the obstacle within the given limit with the help of servo motor. After identifying the obstacle the robot stops immediately and wait for the command from the user to move further.

2.2 Project Flow:

The robot is constructed using chassis and android application is used as a software initialization here. Bluetooth module, Arduino UNO, ultrasonic sensor and motor driver are the components used here.The overall flow of the voice controlled obstacle avoiding robot is explained below,

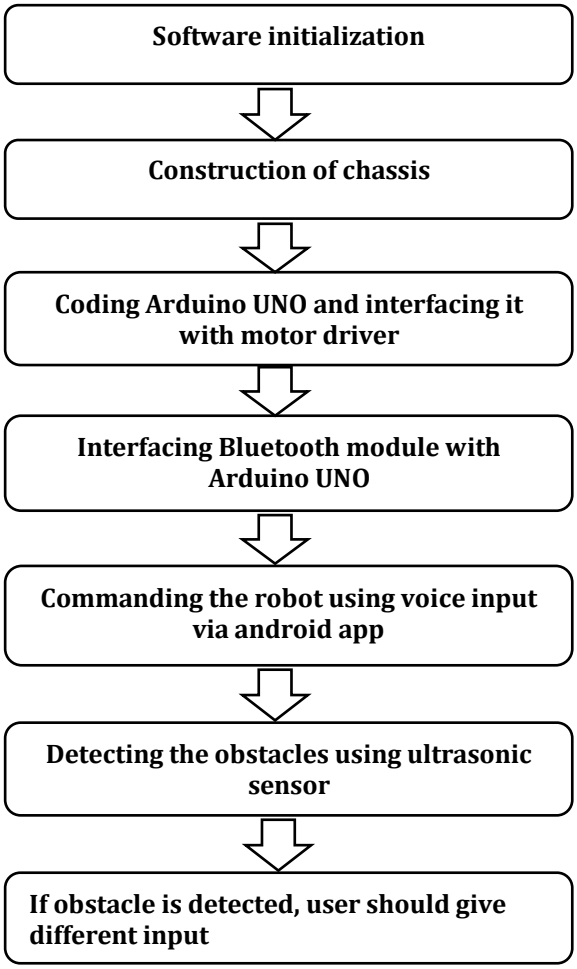

Fig -2: Project Flow

3. HARDWARE IMPLEMENTATION:

3.1 Arduino UNO:

The Arduino UNO is a microcontroller which has both analog and digital pins. The motor driver shield is mounted on the Arduino UNO. Then, the program is uploaded to Arduino UNO via data cable needed for controlling the robot. Arduino UNO is also cheap, easy to use and acquire less space so that all the components can be placed on the chassis.

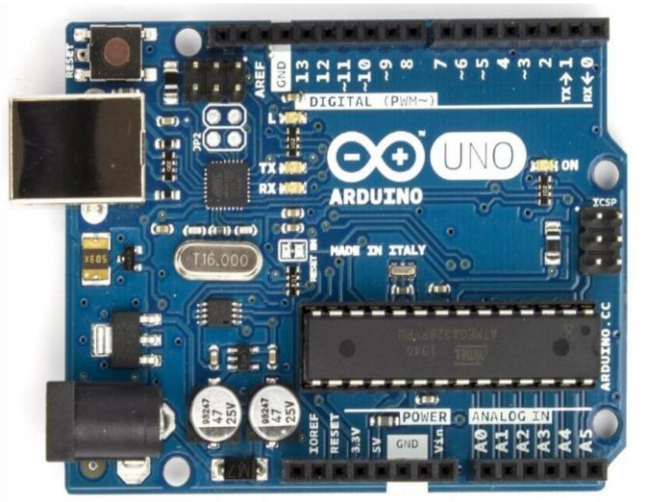

Fig -3: Arduino UNO

3.2. Ultrasonic Sensor:

Ultrasonic sensor which emits ultrasonic waves is defined as waves having a frequency over 20KHZ which is beyond the human hearing. Transmitter and receiver part is present in Ultrasonic sensor.

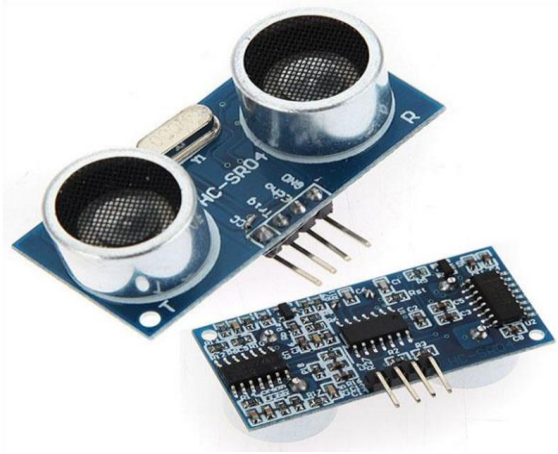

Fig -4: Ultrasonic Sensor

Ultrasonic waves are transmitted and received which are used to detect the obstacles and it can determine the distance from which the location of the obstacle is also detected. The piezo electric material convert's electrical energy into sound waves (mechanical energy).The piezo electric material will generate Ultrasonic waves for detecting the obstacle.

3.3 L293D Motor Driver:

The DC motor drives in both forward and reverse direction with the help of L293D. Two H-bridges are located in L293D circuit. In L293D, pin 2, 7 are input pins which is located in the left side of the L293D and pin 15, 10 are also input pins which are located in the right side of L293D.

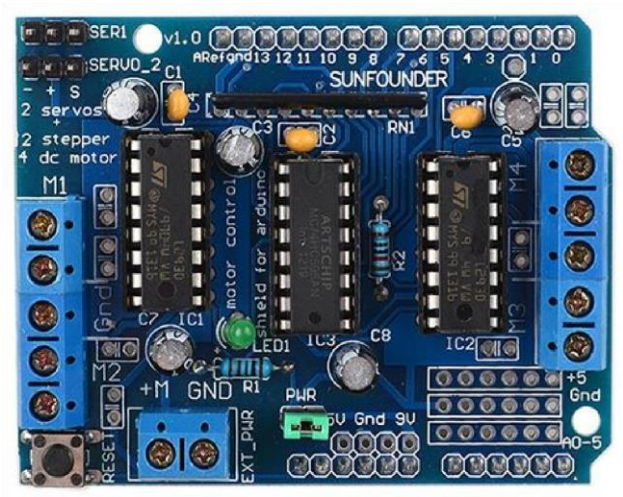

Fig -5: L293D Motor Driver

Table -2: Logic table of L293D motor driver

S.NO	PIN 2	PIN 7	OPERATION
1.	1	0	CLOCK WISE DIRECTION
2.	0	1	ANTI CLOCK WISE DIRECTION
3.	0	0	IDLE[NO ROTATION]
4.	1	1	IDLE[NO ROTATION]

3.4 Bluetooth Module:

Here the wireless connection between the user and the robot is established using the Bluetooth module HC-05. Bluetooth module makes contact with the microcontroller using serial communication method. HC-05 Bluetooth module operates on the basis of master and slave mode as it is used for either transmitting or receiving the data.

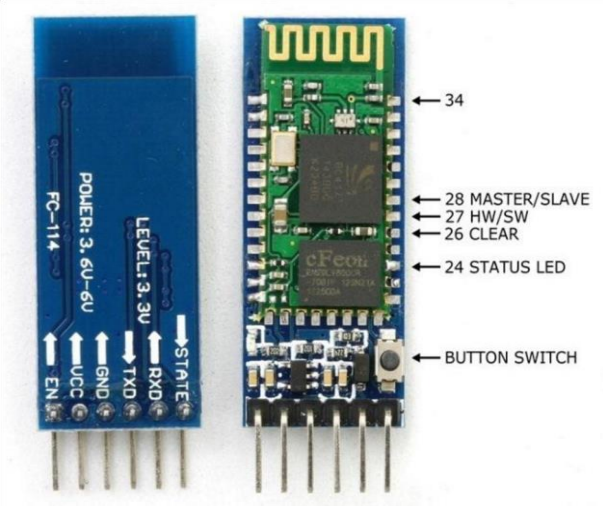

Fig -6: Bluetooth Module

3.5 Hardware Implementation of the Robot:

The hardware implementation of the robot is successfully designed and it is given below,

Fig -7: Hardware setup of the robot

4. SOFTWARE IMPLEMENTATION

4.1 Android App:

The voice commands to the robot are processed via android application and then transmitted via Bluetooth. A decision to use an Android OS interface as the speech processing platform was made, due to its flexibility and numerous features. Also it allows an easy and reliable connection with the Google Speech processing libraries for smooth and accurate speech recognition. For controlling of robot BT voice control app is used. It involves several steps for accessing the robot.

Fig -8: Android App

4.2 Steps to connect Bluetooth module with Android app

Step 1: Download the BT voice control App and open the app.Connect with Bluetooth module which is interfaced with arduino.

Fig -9: View of Android App

Step 2:

The voice command for controlling the robot is given by clicking the voice button in the app.For the command **go ahead**, the operations are given below,

Table -3: "Go ahead" operation of robot

Command : GO AHEAD	
Robot action:	Moves forward
Left side wheel:	Rotates in forward direction
Right side wheel:	Rotates in forward direction

Fig -10: Go ahead command

Step 3:

For the command **go back**, the operations are given below,

Table -4: "Go back" operation of robot

Command : GO BACK	
Robot action:	Moves backward
Left side wheel:	Rotates in backward direction
Right side wheel:	Rotates in backward direction

Fig -11: Go back command

Step 4:

For the command **turn right**, the operations are given below,

Table -5: "turn right" operation of robot

Command : TURN RIGHT	
Robot action:	Moves right side
Left side wheel:	Rotates in clockwise direction
Right side wheel:	Does not rotates

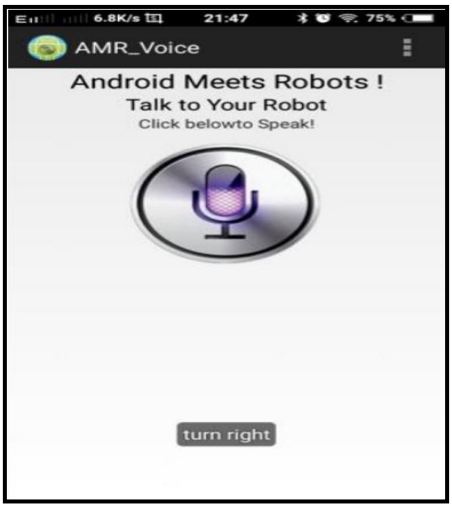

Fig -12: Turn right command

Step 5:

For the command **turn left**, the operations are given below,

Table -6: "turn left" operation of robot

Command : TURN LEFT	
Robot action:	Moves left side
Left side wheel:	Does not rotates
Right side wheel:	Rotates in anti-clockwise direction

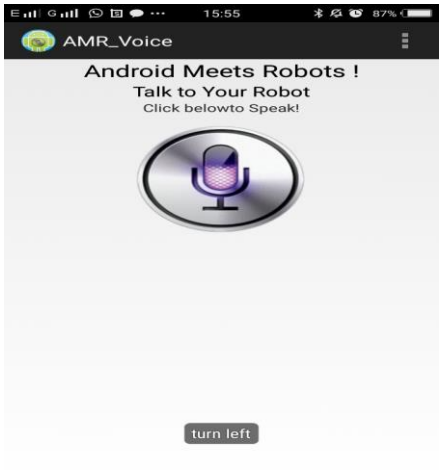

Fig -13: Turn left command

5. ALGORITHM:

The algorithm behind the operation of voice controlled obstacle avoiding robot is simple and understandable.

Steps:

1. The program first reads voice input of the user and it reads the sensor output as distance.
2. Then, it checks whether the distance is less than 50.If the condition satisfies the robot stops and if the condition fails the code checks next condition.
3. If the user input is high, it satisfies the condition and execute the output and if the user input doesn't satisfy the condition, it moves to the top of the code.

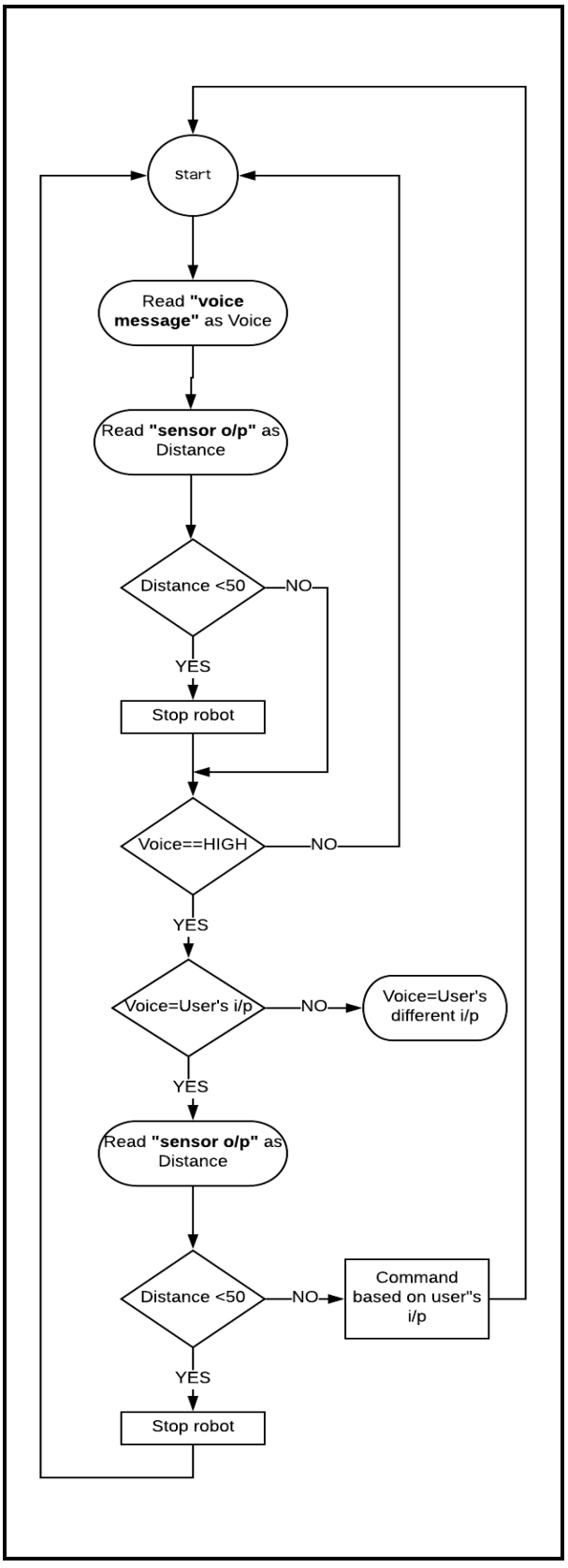

Fig -14: Algorithm

6. DISADVANTAGES OF THE PROJECT:

1. If voice command is given as input, any external noise or unwanted noise when interacts around the surroundings, then the clarity of voice input disturbs and error occurs.

2. The voice input should be given near to the phone, if voice input is given far away from the phone, then the error occurs.

3. The main disadvantage is that, it has no security protection. Anyone can access by speaking to give the voice input, the app only checks the equivalent voice commands. It will not check the types of voice given by the user.

4. Since it is a prototype, the robot can communicate with the android app using Bluetooth module only to a certain extend.

7. RESULTS:

Thus, our voice controlled obstacle avoiding robot is able to detect the obstacles and make the movement to the required direction by using the user's voice command. Our project has a good accuracy as Bluetooth module which is used for communication is very efficient within the short range as the robot is able to move within two seconds for the given input.

As ultrasonic sensor is insensitive to light, smoke, dust, mist and vapour as compared with IR sensor and so ultrasonic sensor is preferred over it. Voice command is used to get high interaction with the robot using android app. Hence a good efficiency is achieved in this project.

Table -7: Controlling parameters of robot

S.No	Conditions	Presence of Obstacles	Possible voice command
1	Distance<50cm	Yes	"go back" "turn left" "turn right"
2	Distance>50cm	Yes	"go ahead" "go back" "turn left" "turn right"
		No	

1. When the Distance<50cm and obstacle is presents the possible voice commands are given as "go back", "turn left" and "turns right".
2. When the Distance>50cm and whether the obstacle is present or not the possible voice commends are given as "go ahead", "go back", "turn left" and "turn right".

8. CONCLUSION AND FUTURE SCOPE:

Thus, the voice controlled obstacle avoiding robot is successfully designed and it is concluded that voice controlled robots are undeniably going to be a future market for many industrial applications and domestic purposes related to automation in daily activities. These robots is most suitable for the industries as firefighting robots, as automated plant watering robots. It is also useful for military purposes and many military soldiers can save their lives. Further this project can be developed as a fully automated humanoid robot which is used to detect the enemies in war field and shot them.

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