Acoustic Robot using Arduino

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Abstract: **The Acoustic robot using arduino system is about a voice controlled robot that can be operated by giving user specified voice commands through the microphone. This system makes use of the speech recognition system for giving and processing the speech commands. The use of robots in various working sectors has increased the need for having healthy interface between humans and robots. The speech recognition system can recognize up to 20 voice commands and allows fast data input operations. This system also has a camera mounted on the top and an obstacle detection module so it is capable to avoid obstacle collisions. The system is used in places where it is difficult for humans to reach but human voice reaches and can be used for many other applications.**

Keywords: Arduino , Speech Recognition System, Obstacle detector.

I. INTRODUCTION

Rapid and concurrent progress in technology has been made in robotics, have lead to the situation where interaction between robots and humans is no longer a science fiction[1]. The concept of social interactive based robotics is important to the Artificial intelligence and Robotics community. Artificial intelligence is a term which is used together with the different concepts of robotics[4][7]. Over the past few decades the need for healthy interaction between human and robots has risen. There are number of ways to have communication between humans and robots. Robots operations can be broadly classified into two modes : Computer mode, Speech mode. An endeavour in providing human-machine communication led to development of the keyboard, joy stick, mouse ,etc which are used in computer mode of operation. However, none of these devices provided the ease as speech, which has been the common form of communication between humans. For humans, speech represents the most ideal way of communication thus, an advanced technology called Speech Recognition System has been developed in order to make Human-Robot Interaction (HRI) more efficient.

The security concern is important factor of every nation and technology plays a vital role in it. So we are developing a robot which can be controlled by speech and can work in such areas where it is difficult for humans to reach. They can work in hazardous environments[2]. Initially the system is designed to recognize human words. Speech Recognition System allows the user to provide with the input voice command. Just like typing the input on keyboard , pressing the key on mouse , the Speech Recognition System accepts input in the form of speech[3]. The system can be programmed and controlled by input voice commands. It is easy for humans to recognize familiar voice however it is difficult for a computer to distinguish a particular voice among others. Large numbers of similar sounding words make it difficult for the computer to recognize voice, thus uncertainty is a major issue in such system.

Special feature of this system is the wireless camera mounted on the top which is used to provide visual feedback to the user and a feedback recorder is also available at the user end. Along with this another important feature is ability to avoid obstacle which is achieved by using an obstacle detection module.

II. LITERATURE SURVEY

The idea of using speech commands to operate a system is not new to us. We have come across many such events in movies and novels. However with the advent of technologies this idea came into existence. Improvements have already being realized in various parts of this system.

Biraja Nalini Rout, , Abhijeet Das, Sasi Rekha Sankar have introduced the design and implementation of Speech Recognition System for Robotic Control and Movement by using microcontroller and HM2007 Speech Recognition System which is a single chip CMOS speech recognition LSI circuit with the on-chip analog front end, Voice analysis and system control functions[6].

Jayesh Chopade, Dattatray Barmade, Swapnil Tonde proposed that robot can be controlled either through voice commands or computer commands. They implemented the Spy Robot by using zigbee transmitter and receiver along with the HM2007 Speech Recognition System[2].

Satrio Halim and Widodo Budiharto proposed the implementation of robot control using TIGAL SmartVR Voice Recognition System. Their experimental testing was carried out by varying the distance of microphone from the user while considering the rate of recognition in low noise and high noise and the result were obtained with pretty good accuracy[4].

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III. SPEECH RECOGNITION SYSTEM

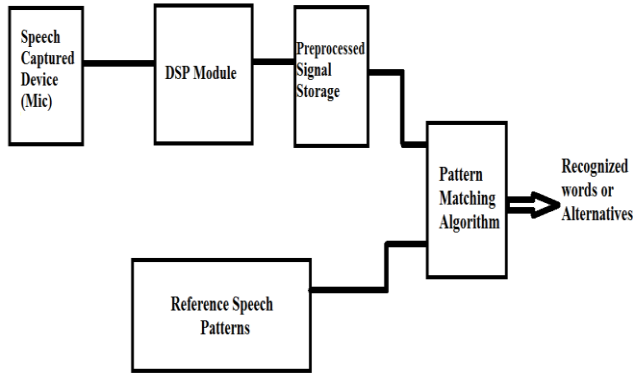The speech recognition system shown in Fig.1 depends on various factors as follows:

Fig 1: Speech Recognition System

a) User Speech pattern :

Speaker dependent system approach is the one in which individual user will operate the system . The drawback to this approach is the system responds to only the individual who has trained the system . Speaker independent system can work for large number of users. Speaker adaptive systems are the systems that customize their operation according to the users.

b) Homonyms:

Homonyms are the words that sound alike such as cat, bat, fat, etc. Because of their similar sounding nature the speech recognition system can get confused. However this problem can be reduced by avoiding homonyms.

c) The Voice with Stress and Excitement :

The accuracy of the systems is affected due to the stress and excitement in ones voice. To achieve high accuracy in word recognition, the user should consider these factors while programming the circuit.

d) Recognition Style:

Isolated words - In this mode the words spoken by the user are separated and isolated . Connected words - This mode is halfway between isolated mode and continuous mode . It allows the user to speak multiple words at a time. Continuous words- This mode allows user to give conversational speech , but it is extremely difficult for the system to recognize.

e) Features of Speech Recognition System:

Self- contained stand alone system
User programmable
Multi- lingual
Non- volatile memory back up with 3V battery onboard.

IV. BLOCK SCHEMATICS

The block diagram of acoustic robot control shown in "Fig 2",basically works on the principle of speech recognition system.
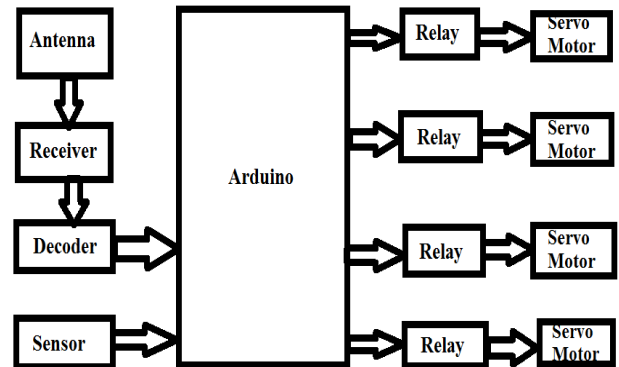

Fig 2: Block diagram of Acoustic Robot

The system includes arduino, microphone, speech recognition module and servo motors. Initially the voice from the user will be analyzed and processed by the speech recognition system and will be given to the arduino , which in turn will control the motion of the robot.

The speech recognition process is done by using MATLAB. After recognition, the desired command is send to the arduino. The arduino accept the input from sensors like camera, microphone, obstacle detector. If the user gives the command to move in forward direction then the output is in such a way that all servo motors will move in same direction. Thus the motion of motor will change according to the input signal provided. The input from the wireless camera provides the visual feedback to the user . It basically provides live telecast of the region where the robot is being used. The obstacle detector module is used to detect obstacle, thus whenever the arduino gets a signal from the obstacle detector module , the arduino stops the motion of robot by turning off all the servo motor to avoid obstacle.

The flowchart of the above system is shown in Fig.3.

The basic commands used to control the robot are as follows :

a) *Forward :* This command is used to move the robot in forward direction.

b)*Backward :* This command is used to move the robot in backward direction.

c)*Left :* This command is used to move the robot in left direction.

d)*Right :* This command is used to move the robot in right direction.

e)*Stop :* This command is used to stop all the motion of the robot.

f)*Load :* This command is used to lift the load.

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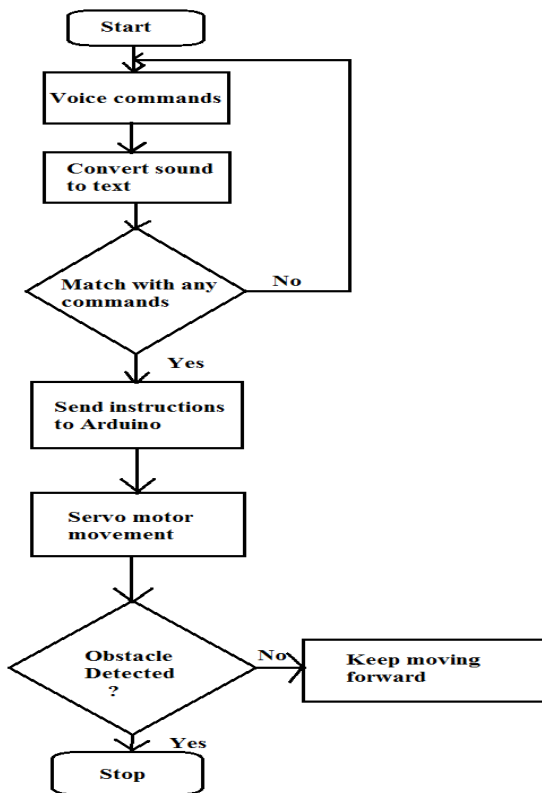**ICIATE - 2017 Conference Proceedings**

Fig 3 : Robot System flow chart

V. EXPECTED RESULTS

In this system, a robot will be developed which can be controlled by giving speech commands. On which experimental testing will be conducted by giving voice commands from varying distance of the microphone and the robot so as to obtain the rate of recognition of speech commands. Testing will be conducted to test the overall system and to achieve better speech recognition results. Hence it is expected to achieve high percent of accuracy in detection of speech commands.

VI. CONCLUSION

The Acoustic Robot control by using arduino has been achieved in this paper. The robot is controlled by arduino board containing microcontroller. It is found out that this system can be used in number of extreme sectors such as in war, dense areas where it is difficult for humans to reach. This system can be integrated so as to work in harsh areas thus it can be used in hazardous environment. This system provides live telecast of the remote working area of robot. The system is designed for use of particular sets of commands for better outcome. It is found that high memory level microcontrollers can be used for better performance.

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