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Artificial Intelligence based Voice Controlled Robot

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Abstract - *This paper introduces an artificial intelligence based voiced controlled robot. Presently, various ways are used to control one. The most user friendly one of them is controlling it by voice commands. And it is well known fact that disabled people face different difficulties regarding their physical movement. In such conditions, the robot whose operation is controlled by human voice command can provide a potential solution to their problem. Controlling the robot with voice commands along with visual feeds helps the robot to operate easily and more accurately. Artificial intelligence based voiced controlled robot help reducing the manual effort being put by human in their day to day tasks. The robot can perform different movement, turns, start/stop operation and relocate an object from one place to another as per the user commands. At first, the robot takes voice commands on which objects to grab and displace; then it finds the object using the object detection module. After detecting the object, sorting object takes place using color sorting module. And finally it grabs and displaces the object using the robotic gripper arm module.*

Key Words: Android based Smart device, Bluetooth, Control over voice, Object detection, Object Sorting Robotic arm

1. INTRODUCTION

Human have evolved in inventing new technologies for reducing human effort and saving human life. Physically challenged and elderly people face difficulties while handling objects and hence they need voice controlled robot for the same. Thus, if a robotic assistance is developed that can be operated using speech commands would be of immense use. Artificial intelligence based voice controlled robot can be controlled using speech commandis developed in this paper and it can be used in hospitals, homes, industries and Educational institute. It can mainly used for handicapped peoples.

The bluetooth connected on the arduino board recieves text from the android app as character, and stores them as string to the assigned string. There are some words pre-programmed words, the arduino perform the action as per commands. For example user says like “give me the bottle” then smartphones receive this command. Smartphones transmits this received data to arduino through bluetooth module. Then arduino will searching the bottle using RGB sensor. When the object will detect the arduino sends the command to robotic arm. Then robotic arm picks the object and robot will going back to user place. Finally robot will place the object or bottle at user place.

1.1 Block Diagram

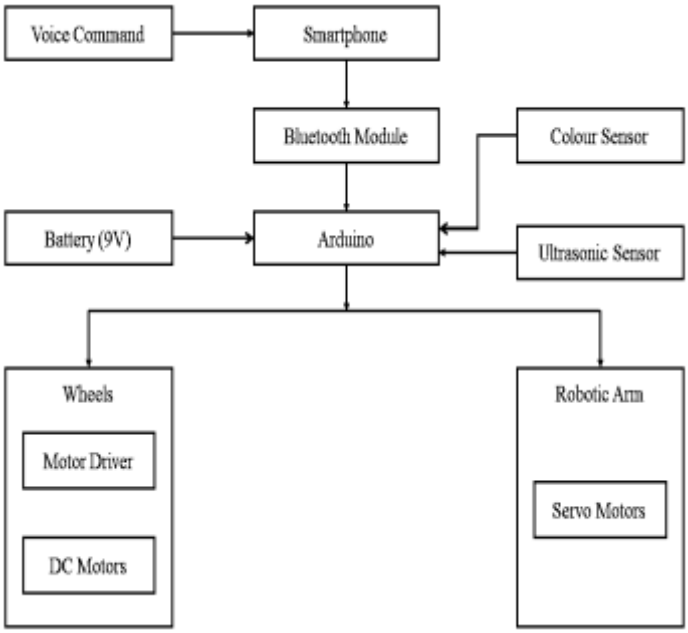

Fig -1: Block Diagram

2. HISTORY CONSTRUCTION DETAILS OF THE ROBOTIC ASSISTANT

The movement of the robot is controlled using speechcommands i.e. the movement of the (i) robot’s body, (ii) hands and (iii) the arm depend upon the voice command which are given. The voice commands are given to the robot using a smart mobile phone which is based on an Android OS based platform. The voice signal is then converted to the text form using an online cloud server, in real time. This text command is sent via Bluetooth network of the smart-phone to the Bluetooth module on the robot. The Bluetooth module on-board the robot receives the text signals and forwards it to the microcontroller on-board the robot’s body. The microcontroller again processes the signal and it controls the movement of the robot through the 4 DC motors. The schematic block diagram of the assistant robot is shown in Fig. 1

The hardware platform consists of a robotic arm built on the robot’s body that can move. The robotic arm consists of an arm the hands are used to hold and drop any object. It is just like human’s hands where the robotic arm acts same like our arm and the robotic hands act like our hands.

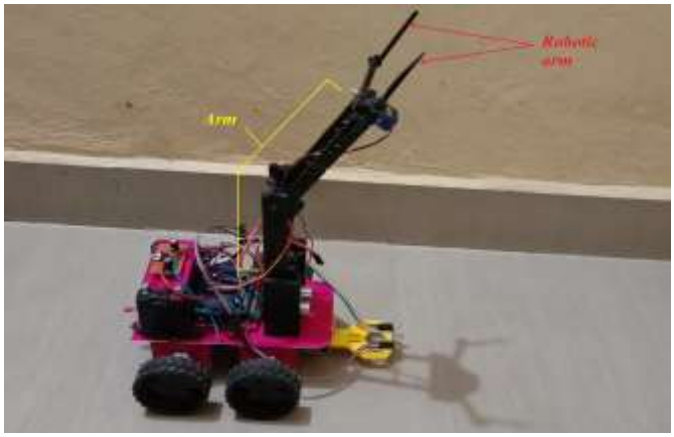

Fig-2(a): Side view of the robot with 'robotic hands' open

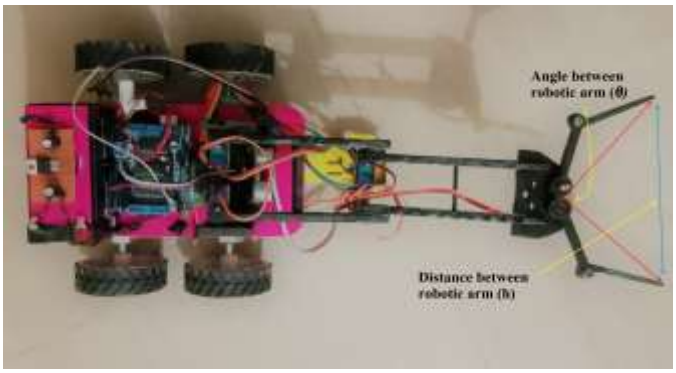

Fig -2(b): Top View of the robot with 'robotic hands' open

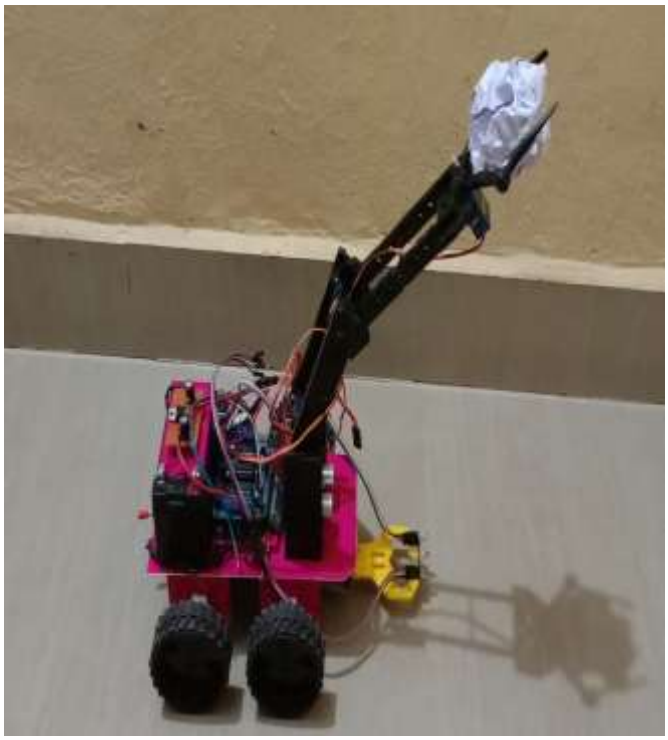

Fig -2(c): Side View of the robot holding an object ('robotic hands' closed)

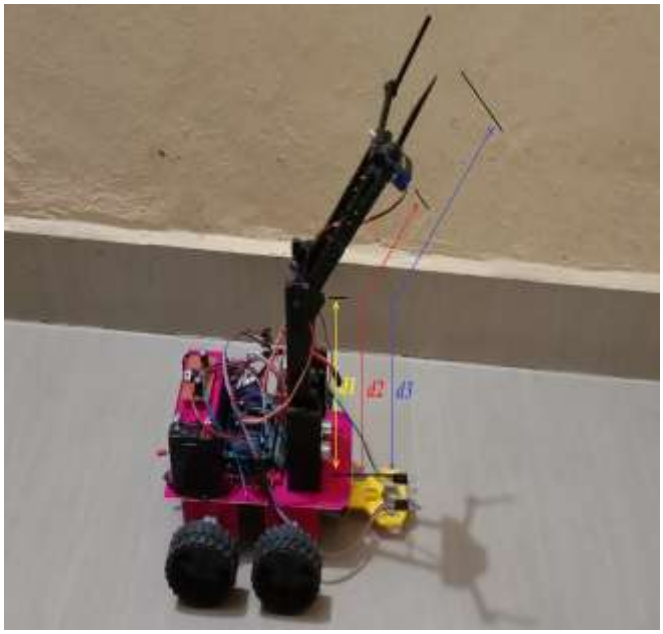

Fig- 2(d): Figure of the 'robotic arm' with Free body diagram

Two DC motors are used to control the movement of the robot's body. Another two DC motors are used to control the movement of the robotic arm and the robotic hands. Motor driver IC is used to control the movement of DC motor. A single motor driver (L293D) IC can control two DC motors.

3. FLOWCHART

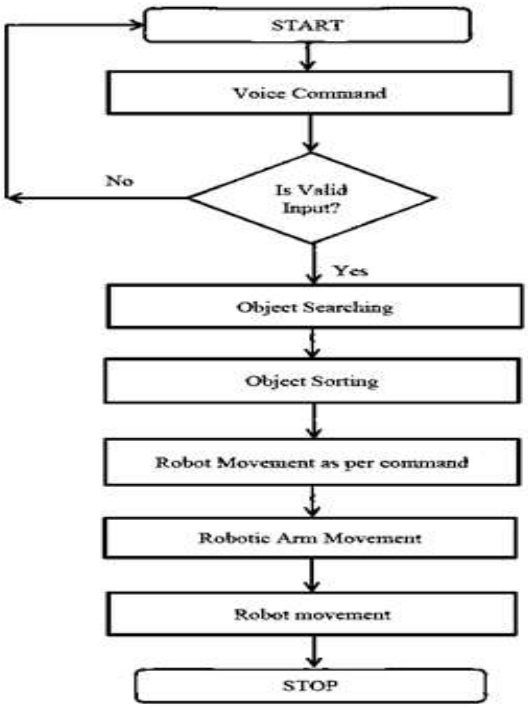

Fig-3: Block Diagram

4. VOICE CONTROL OVER BLUETOOTH

The Android application converts the input voice command given on the smart phone to the text form. Then this signal which is in the text form is transmitted to the Bluetooth module present on the robot which intern sends the signal to the microcontroller. The micro-controller then would process the signal and moves the robot accordingly. The block diagram of the operation of the assistant robot is shown in Fig. 1. Communication is done to the robot using the smart phone. The movements of the robot's body, the robotic hands and the robot's arm can be controlled simultaneously as different motors are used for the different parts of the robot.

5. OBJECT DETECTION OVER ULTRASONIC SENSOR

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2cm to 400cm or 1" to 13 feet.

The operation is not affected by sunlight or back material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module.

6. OBJECT SORTING OVER COLOUR SENSOR

This section is used for detecting the colour of the objects to be sorted. There are many colour sensing ICs available today. In different ICs the properties vary such as colour differentiating ability, output format, price, speed, resolution etc. in this project TCS3200 is selected.

The TCS3200 is a programmable light-to-frequency converter that combines configurable silicon photodiodes and a current to frequency converter on a single monolithic CMOS integrated circuit. The output is square wave (50% duty cycle) with frequency directly proportional to light intensity.

The full-scale output frequency can be easily scaled by one of three values via two control input pins. Digital inputs and digital outputs allow direct interface to a microcontroller or other logic circuitry. Output enable places the output in the high impedance state for multiple-unit sharing of a microcontroller input line. In TCS3200, the light-to-frequency converter reads an 8x8 array of photodiodes. Sixteen photodiodes have blue filters, sixteen photodiodes have green filters, sixteen photodiodes have red filters and sixteen photodiodes are clear with no filters.

Table-1: Selectable Options

S0	S1	Output Frequency Scaling (fo)
L	L	Power down
L	H	2%
H	L	20%
H	H	100%

S2	S3	Photodiode Type
L	L	Red
L	H	Blue
H	L	Clear (No Filter)
H	H	Green

The four types of photodiodes are interdigitiated to minimize the effect of non-uniformity of incident irradiance. All photodiodes of the same colour are connected in parallel. Pins S2 and S3 are used to select the group of photodiodes (Red, green, blue, clear) are active.

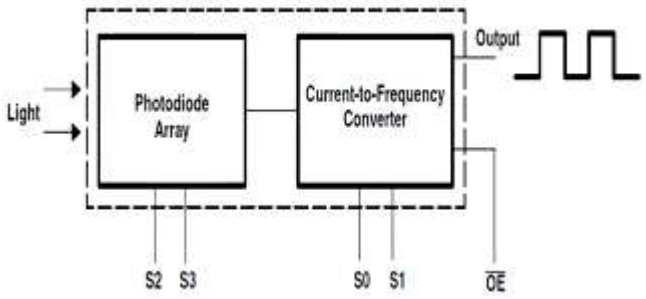

Fig-5: Block diagram of colour detector TCS3200

Photodiodes are 110µm x110µm in size and are on 134µm centres. Output frequency scaling is controlled by two logic input, S0 and S1. The internal light-to-frequency converter generates a fixed-pulse width train. Scaling is accomplished by internally connecting the pulse-train output of the converter to a series of frequency dividers. Divided outputs are 50% duty cycle square waves with relative frequency values of 100%, 20% and 2%. Because division of the output frequency is accomplished by counting pulses of the principal internal frequency, the final output period represents an average of the multiple periods of the principle frequency.

7. APPLICATION OF ASSISTANT ROBOT

The assistant robot can be used for various purposes as listed below:

(i) In homes and for daily needs: People may need robot to reduce their manual effort, which may be mostly needed in the case of physically handicapped people or the old-aged people. Artificial Intelligence based Voice Controlled Robot can be used by physically challenged people or the old-aged

people as it helps them to place an object from one place to another which would be difficult for them in general. The robot can move around quickly and also can be controlled easily by voice commands and can be used to obtain the desired result in a quicker span of time and much easily.

(ii) In chemical industries: In chemical industry, people cannot handle the chemicals which might be having high temperature. Thus, industrial robot is a vital development towards improving the safety standards in industries. In such hazardous situations, the robot can be used to hold the chemicals and carry them from one place to another without human interference. Also, there might be places in the industries where humans cannot go and work, in all such cases this robot can be controlled by the voice commands and can be directed to go and work in that place. It can also be used to carry small objects in the industry within a certain distance to reduce the time and the manual labour. Artificial intelligence based voice controlled robot can also be used in manufacturing sector for different re-positioning operations.

(iii) In hospitals: This robot can be used extensively in the hospitals where it can be used in surgical operations. Robotic arm has been used in various surgeries across hospitals. Furthermore, if it can be guided by the voice commands and carry out the specified task, efficiency can be increased thus also causing the human labour to reduce.

8. DETAILS OF SYSTEM

Paper presents the design, development and construction of an artificial intelligence based voice controlled robot, which can detect, sort, pick and place the objects of different colour. The mechanical structure of the robotic arm was assembled using wooden blocks which helped to reduce the weight without losing the mechanical strength. The aim of the project was to perform the day-to-day tasks of handicapped peoples. In various sunlight conditions has the color sensor IC TCS3200 response show almost stable.

The system is working with open loop. A better resolution can be achieved if closed loop control is incorporated. The system responses are a little bit slower than expected. It can be improved by using a more advanced colour sensor and microcontroller. User interfaces also can be provided as a modification which will enable the on demand reconfiguration of the movement in a better way.

10. CONCLUSION

Artificial intelligence based voice controlled robot is developed in this paper. Voice commands, given at the user end, are converted to text form using smartphone. Speech commands converted to text commands are then transmitted to the robotthe Bluetooth network of an Android based smart phone. The text commands transmitted by the smart phone are received by a Bluetooth module on-board the robot which in turn sends the signal to the arduino-uno board. The voice controlled robot then performs the various actions as per the speech commands received.

Various performance parameters of the robot are studied. Analysis of rate of separation between the robotic hands, angular velocity of the robotic arm and power consumption by the robot is done through experiments conducted on the prototype. Computed and practical values are compared. Also, reasons for deviation of the robot from ideal behaviour are also discussed.

The effects of the distance between the mouth and the Smartphone on the performance of the robot, effect of noise on the speech to text conversion are some of the areas that can be explored. Using renewable source of energy for the functioning of the robot would not only improve upon the cost of the robot but would also prove to be eco-friendly. Solar cells can be a possible source of energy that can be used. The prototype designed has an operating range of 90-100 m, which can be increased using Wi-Fi modules. The weight carrying capacity of the robot can be increased by using a stronger metal of the arms and the motors with high torque.

The robot developed has potential applications ranging from chemical industries to comfortable scenario inside homes. This paper should be helpful in showcasing a signal processing application in developing a voice-controlled robot.

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BIOGRAPHIES

Description Dr. Rashmi A. Jain working as an Assistant Professor at E&TC Department in Dr.D.Y.Patil Institute of Technology, Pimpri, Pune. And completed Ph.D. in Electronics in August 2018