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Utilitarian Arm For The Physically Disabled Using Speech Recognition And Live Streaming

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Abstract—A Speech controlled robotic arm mounted on wheels is designed and constructed to meet the needs of physically challenged patients with higher level of immobility. The arm combines the features of vocal recognition and image processing thereby increasing the independency of the patient. With 5 Degree of Freedom (DOF) and usage of acrylic material the arm tends to be a low cost robotic arm and reduces the weight of the whole system. The object is recognized using image processing and is picked efficiently by speech command signals. The main objective behind this project is to provide a user-friendly assistive arm by object detection and the implementation of the trio. A wireless camera module is used to capture the objects image which improves the accuracy of requirements.

Keywords—Vocal recognition;image processing;object detector; Assistive robotic arm;Arduino

I. INTRODUCTION

An assistive Robotic arm with 5 degrees of freedom is designed according to the needs and requirements of the patient. Paralysis is the loss of ability to move in part or most of the parts as a result of illness or injury. It is an inability to act or function properly. Speech controlled robotic arms already exist in assisting the disabled but this limits the patients requirements to a closed area.[1]Gnu octave tecnique is used to deetermine colour and shape of the object.sorting is done using RGBcolur and shape[2]Here the whole prosses depends upon the precaptured image if there is fault in the present captured image we cannot proceed furthur[3]Quadbot is used only 10 voices can be used for processing[4]They depend on environmental situations,theyare bilateralcommunication[5]Theyhave3 degree of freedom(dof) workspace limited[6]They have two stages automation and android systems , its installed in smart phones but can be access seperately only[7]Obstracle avoider is is implemented using ultrasonic sensor[8]Here wifi is used for robotic control[9]Real timeimage processing is used[10]Speech recognition only one user at a time.In our paper we use image processing and features of Bluetooth which enhances the arm's capabilities to help the patient in a much more effective way. In the existing technology, the arm is controlled only using speech commands from the patient. These commands are received by a microphone embedded on a voice recognition module kept on the robot. This module is essential to recognize the voice of an individual patient and hence does not work for any other person's voice commands. This technique highly limits the applications for which the arm can be used. Additionally, tilt sensing is done using gravity sensors present in an android mobile by connecting it with an android application. Gravity sensors are used to control the body of the arm and the voice recognition module is used to control the movements of the claws and the arm joints. The combination of both speech processing and tilt sensing using an android phone is now being used. But this technology has certain restrictions as it is not suitable to everyone and it has a lot of limitations keeping in mind the highly disabled people with extreme immobility of the limbs. There are robotic arms using image processing techniques but they are only used for some particular application and cannot be used by everyone.

II. PROPOSED TECHNOLOGY

The technology proposed is a combination of speech processing, image processing and a 5 DOF robotic arm. Speech processing techniques are used to receive input from the paralytic patient. A Bluetooth module is used in the robot to receive the speech commands after converting them to text in an android applications developed by Android Meets Robot (AMR). These commands are then sent to the controller which performs the predefined programs or tasks of picking the required object. This is where Image processing techniques are used. Open Computer Vision (CV) software is used for the image processing applications. This software receives the frames captured by the webcam fixed on the robot. The open CV software will then compare each of the captured image with the already stored images and if the image matches with the command given by the patient, then the arm will pick the object and will give it to the patient by returning back to the original position from where it started.

In Chapter I the basic introduction about a robotic arm and the proposed system is devised. Chapter II is an overview of the proposed

model in comparison with the previous models. Chapter III explains the technologies used in the proposed model – Robotic arm, Speech processing and Image processing. Chapter IV and V gives an in depth detail of the hardwares and the softwares incorporated in the system. The working operation of the proposed model is briefed in chapter VI.

III. THE TRIO

The trio here represents the following: the robotic arm, speech processing and image processing. We use the combination of all three technologies to create an efficient method of assisting the disabled in their day to day lives without depending much on others. Speech processing is used to receive speech commands from the user and convert it into text. The speech processing here is essentially a speech to text converter. The text commands are then transmitted to the Arduino board via the Bluetooth module. The speech processing application is constructed using the app inventor developed by Massachusetts Institute of Technology (MIT).This software contains certain predefined modules which can be used according to our requirement. This platform works using the googlesearch engine. This platform has been used to build the speech processing application. This application is built on a pc or laptop and then is converted to an Android application package (APK) file and downloaded in android device suitable to the user. This android device is used to receive the speech commands which is then used to control the robotic arm according to the patient's needs. As the speech command is given to the device, the HC-05 Bluetooth module receives the signal which is interfaced with the Arduinoand performs the corresponding action. Image processing is used to identify which object is to be picked by the arm. The images of the required objects are captured and stored in the system. Whenever an object is to be picked, a voice command is given by the user and this triggers the arm. The arm when triggered starts moving and looking for obstacles. An obstacle detector system is implemented for this purpose. Whenever an obstacle is detected, the arm considers it to be an object and captures the image. It will then compare it with the already stored objects and will pick the object if the images match. If the images don't match then the arm will not pick the object and moves further turning left or right till the next obstacle is detected and this process continues till the required object is picked and is given to the user. The arm is programmed in such a way that it returns to the original position..

A. Robotic Arm

Figure 1 represents the developed model of the robotic arm used in the proposed system. The proposed arm has a 5 degree of freedom design. It consists of a base servo motor and two additional links terminating at the gripper.Each link is powered with a servo that enables bending of the arm for a range of 0'-180'.The gripper or claw itself has the ability to open and close up to an angle of 60'.This gives the arm a very efficient design to pick and place any object even if it is not in the defined neighborhood.The arm as a whole is made of acrylic material which reduces the weight and the corresponding cost by at least 20% when compared to the conventional metallic arm.

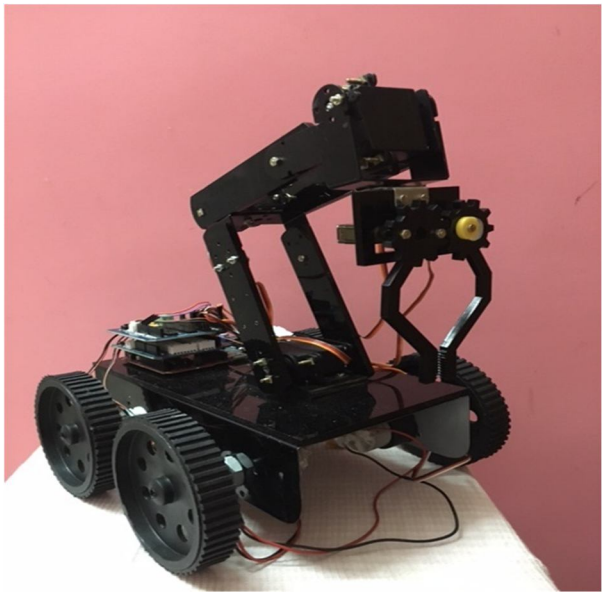

Figure 1 Design of the proposed Arm

B. Speech Processing

Figure 2 represents the HC-05 bluetooth module which is used to receive the speech signal from the patient. An application for BT Voice control developed by AMR is used for speech to text conversion. This application is supported by all android devices and it is connected to the Bluetooth module and in turn to the Arduino. The HC-05 Bluetooth module receives the text message and sends it to the controller which then implements the required action that is preprogrammed into it. This method can be used to detect speech commands from any user and hence does not differentiate the voice which is an added advantage as it can be used by more number of users.

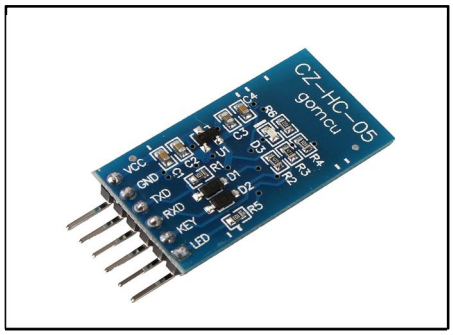

Figure 2 HC-05 Bluetooth module

C. Image Processing

Image processing is implemented using webcams that are attached to the robotic arm.When an object is to be picked by the arm the patient just has to say the ID of that particular object into his android device and the arm starts scanning all the available object in the space.It will then compare each of the objects image with the images that were already stored and whenever the captured image matches with the image required it will pick the object and will come back to the initial position and hence giving it to the patient.This mechanism is very essential as the patient does not have to keep giving commands to pick the objects. The patient only needs to say the required command and the arm brings it for the patient.

IV. HARDWARE SPECIFICATIONS

The hardware components used in this proposed model are Arduino board, Auton Shield, Servo Shield, Voltage regulator, HC-05 Bluetooth module, Basic geared motors, Servo motors, LiPoBattery, Acrylicmaterial, metal chassis and wheels.

A. Arduino

You can tell your board what to do by sending a set of instructions to the microcontrolleron the board .To do soarduino programming language is used.

B. Auton Shield

The shield is great for autonomous robots with sensor port,on board regulators,L293D(dual motor drive) and ports for interfacing line array. They are used to connect 2 motors,6analog and 12 digital sensors.

C. Servo Shield

This is used to drive upto 6 servos at a time.The power given to the board are equally splitted and servos are controlled.

D. Voltage Regulator

It fixes the output voltage of present magnitude that remains constant regardness of changes to its input voltage or load conditions.

E. Bluetooth Module

The module has a transmitter and receiver in it. It is used for wireless transmission or communication. It is used for the range for about 10 meters.

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F. Basic Geared Motor

Basic geared motor is nothing butnormaldcmotor. They are used here to drive the motion of the wheels .They are responsible for the robotic movements in ground level.

G. Servo Motor

Two types of servo motors are used here, they are metal geared and plastic geared servo motors. Metal gear motors can handle high torque and plastic gear motors can tolerate only less amount of torque.

H. Lipo Battery

Lithium polymer batteries are used in this system as they can give a voltage of upto 12V which is essential to run the servo motors.They are rechargeable batteries.

V. SOFTWARES INCORPORATED

The software's implemented in the proposed system are Arduino 0022, AMR Voice and Open CV for Robotic arm, Voice recognition and image processing respectively.

A. Arduino 0022

The board used here is Arduino Uno which consists of microcontroller ATmega328.It consists of 14 digital I/O pins and 6 analog I/O pins which can further be converted to digital pins using Analog to Digital Converters' (ADC).It consists of a 16MHz quartz crystal which denotes the clock speed, a USB port, power jack and a reset button. It requires an operating voltage of 5V and input voltage from 7 to 12V can be given. It has 32Kb memory space and an 8 bit processor.It weighs around 25 gms.It is programmed using the Arduino software Integrated Development Environment (IDE).

B. AMR VOICE

This application uses the voice recognition in the android device. It is connected to the Bluetooth module in the robot. It converts the voice input to text commands and sends it to the Bluetooth reciever.The Bluetooth receiver then sends the data received to the controller and hence the corresponding action is implemented.This application is supported by all android devices and a similar application like SIRI can be used in iOS

C. OPEN CV:

Open source Computer Vision is the most commonly used software for processing images. A web cam is used to capture the images of all the objects required and is stored in the memory with a predefined name or ID.Whenever an image is captured by the web cam, it sends the frames to the Open CV software. This is used to detect the co-ordinates of the centre of the image. This can further be used to compare the captured image with the already stored images.

VI. WORKING OPERATION

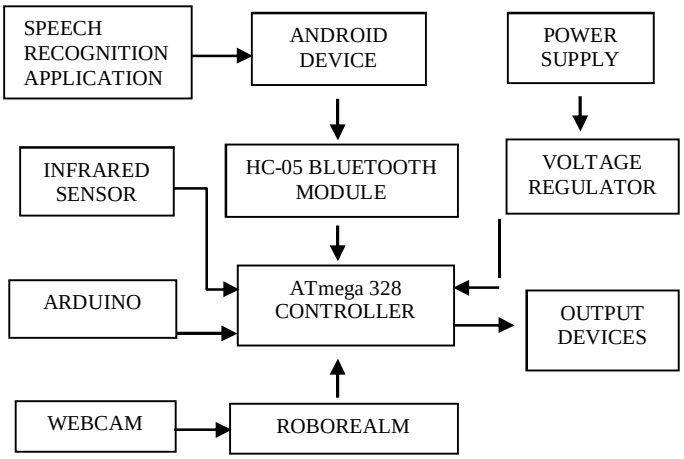

Figure 3 The proposed model

The overall working of the arm can be explained in 3steps.The speech command is first given into the android device which converts the speech to text commands.The signals are then received by the Bluetooth module which is kept on the robotic arm and this also triggers the webcam implanted on it.

As this process starts, the robot starts moving and searching for the required object.If the image of any object matches with the image already stored, then it will pick the object and come back to the initial position.

VII. CONCLUSION

A. Utilitarian Robotic Arm Is Designed And Implemented To Aid

The disabled and help them to lead an independent life. The automated robotic arm can be utilized in real time applications in the daily routine of a paralytic patient. The arm isconstructed in such a way that it is accustomed to the needs of the patient in the most effective way. Assignment of the trio in the arm has provided a better platform for the patient to acquire his necessities. Image processing software is used to make the operation much more automated than the previous technologies. This makes it so much more easier for the arm to be operated by a paralytic patient. The arm is controlled by speech commands given by the paralytic patient. The usage of acrylic material has added to the reduced cost and weight of the arm although the arm has bandwidth constraints in real time applications.This is not a big disadvantage as this arm is being used only by the patient in short ranges .Thereby, the utilitarian arm provides the best of its assistance by making use of speech recognition and image processing techniques.

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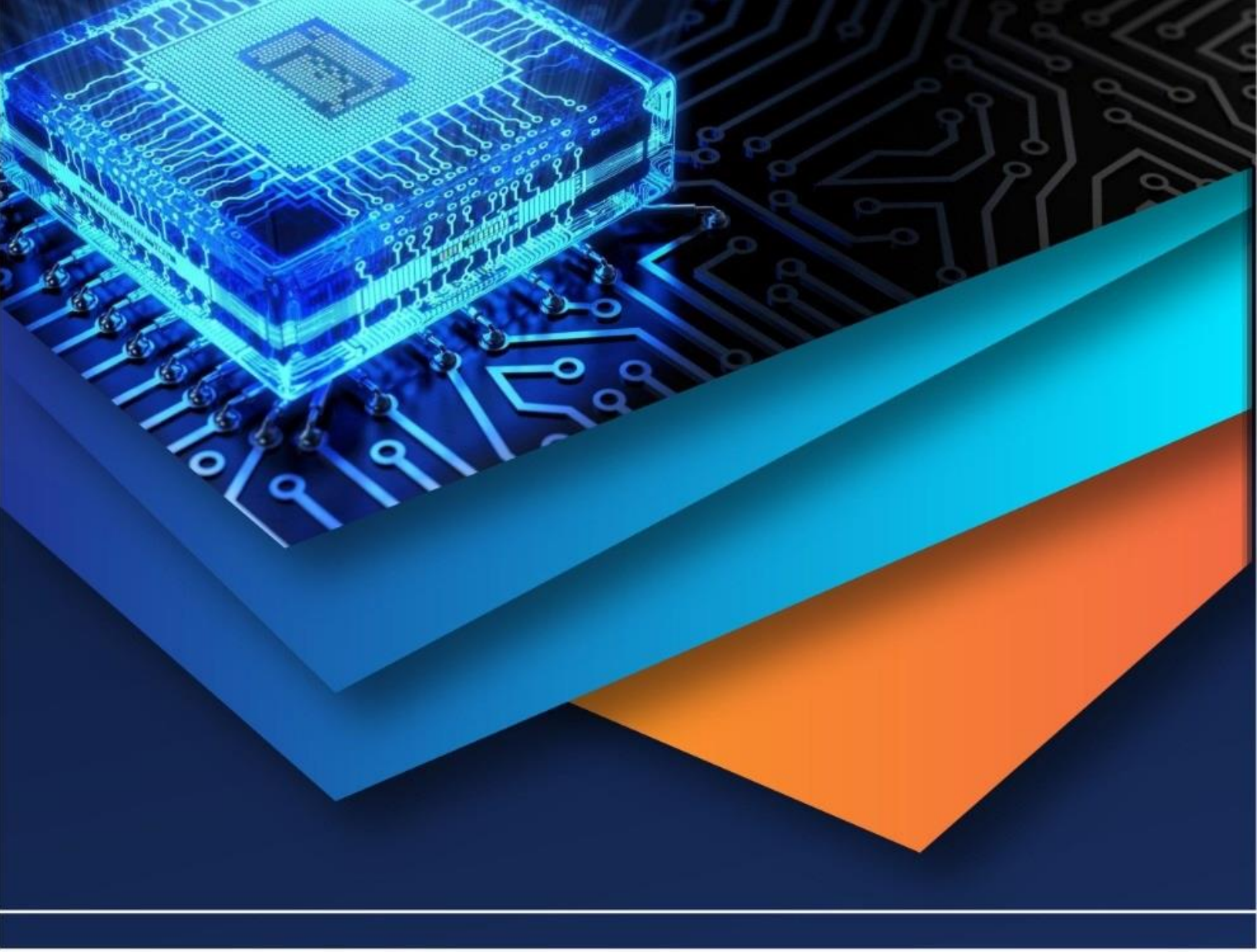

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