Speech Recognition System Based Robotics for Bio-Medical Applications Controlled By Regional Language

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Abstract— This paper describes about the implementation of speech recognition system on a robotic module which controls the movement of the module. We make use of a Regional language to control the robotic module. Any Regional language can be used based on the region where the robot is being used. In this paper we are using languages like Kannada and Hindi as they are the prominent languages used in the region of Karnataka. Speech is being used as it is significant and primarily a convenient way to communicate with the module and also with fellow humans. Speech recognition plays a vital role in the usage of any technology, as it renders the great task of usage more friendly. The Robotic module is precisely designed to use in Bio medical field. As the robot can be a replacement for paramedical staffs and can monitor and act according to the commands of Doctor. A user interface has been designed to communicate with the robotic module.

Key words: Speech Recognition System, Zigbee Serial Communication Regional Language, Robot

I. INTRODUCTION

Speech is the most critical medium of communication with any subject, the power of speech has taken man to the levels he is today. Although, words can move mountains, man has often found control by his words and failure for the lack of it, the feature envisioned in this paper surely renders man to control the technology to move mountains. This paper envisages a vision of enabling speech recognition into robotics, empowering mankind with the capacity to control, operate their functions with a word from the mouth. The entry of Robotics into various fields of life is prolific, with speech recognition, robotics can be taken to different levels, robots can be controlled by talking to it, by using regular words of everyday speech, words that are used normally in our regional dialects. Medical society requires a lot of assistance in the work environment, as activities and chores of service to handle the cases of people is vital. A simple task of picking up a scissor in an act of surgery is significant to a doctor, needless to say the paramedical staff is ever on the duty to cater the needs of medical professionals, the advent of robotics has changed the world. Robotics can be used to deal with tasks effectively, it is often an apt companion for herculean tasks, as they are functional in all environments, efficient and consistent in effect. Certain tasks require robots only, and they can be replaced instead of humans for laborious work. But, controlling these robots in real life situations poses a threat, these robots can be controlled by a voice command and even can recognize speech and respond likewise. This paper envisions a technology that enables the feature of speech in robotics, to help the biomedical world miles more in keeping the world healthy. Zigbee is used as this wireless technology is more prominent in connectivity wirelessly when compared to other wireless technologies. Zigbee enforces the process of transmitting and receiving the speech command between laptop computer - robot and robot - laptop computer because of its wide range of connectivity wirelessly. Robot can be controlled by speech commands with the help of an external microphone or manually by using Laptop computer. The commands are being adapted in regional language Kannada. A Speech user-interface is designed for interfacing with the Robotic module.

II. RELATED WORK

According to the survey on Robotics the use of robotics in was up by 19% in 2002. In first half of 2005, the orders for the robots for the industrial were up by 17% which was an highest level ever recorded. The forecast in the year 2003-2006 tells the use of robotic was increased by an average annual rate of about 6.97%. Over 5 Million robots are used in household in the next few years. From the UNECE issues in 2004 World Robotics survey we can easily realize that household (service) robots getting popular. This gives the researcher more interest to work with service robots to make it more user friendly to the social context. Speech Recognition technology gives the researcher the opportunity to add Natural language communication with robot in natural. So the robot that behave more similar to humans is starting to become a reality .REX is the first fully bionic human robot. It can walk, talk and even has a beating heart just like humans.

A walking frame or walker is a tool for disabled or elderly people who need additional support to maintain balance or stability while walking [1]. We designed a walking frame incorporating both robotic technology and speech recognition, which enables the user control the walker's navigation and speed using speech commands. The materials used were wood, Bluetooth Robot Controller, continuous rotation servos, 6 AA batteries and peripheral cables for connections. The Robot Controlled Bluetooth was configured with different speech commands using the Builder Robot Control Software. Speech recognition tests were carried out on the robotic walker in both quiet and noisy environments [2]. A multipurpose human assistance robotic dog is designed to guide the visually impaired and elderly people to some predefined destination avoiding obstacles and traffic. It is also designed to act as an advanced multipurpose human assistance. A robot is designed in order to recognize the words spoken by the user, talk to them and take action according to the spoken voice command. The Voice commands are recognized by an android Smartphone and the information is transferred to the main MCU using a Bluetooth serial port that runs Bluetooth SPP protocol stack [3].

III. PROPOSED SYSTEM

The proposed system basically has three modules. One is speech recognition unit and the other is communication unit the final module is of control unit of robot. The entire module setup is as shown in figure 1.

Speech command is given by the speech recogniser through microphone. Once the speech is recognized, it is transmitted through zigbee protocol to controller unit for further action. Microcontroller will decode the input once it is received from zigbee receiver and generates a unicode to do particular action.

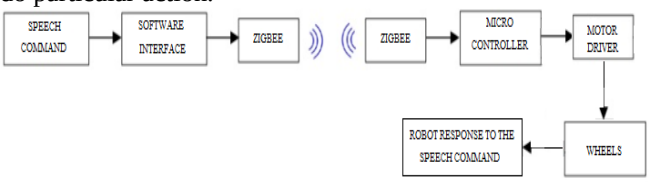

Fig. 1: Block Diagram of Robot Control System Using Voice Commands

A. *Module1: Speech Recognition Unit:*

The Speech commands are given to the robotic module through external microphone. The Input Speech command is searched and is compared with the data present within the program

B. *Module2: Communication Unit:*

ZigBee is a high-level communication protocol used to create personal area networks built from small, low-power digital radios. It has a low power consumption and limits transmission distances to 10–100 meters. ZigBee is based on an IEEE 802.15.4 standard. ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. ZigBee is best suited for intermittent data transmissions from a input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range low-rate wireless data transfer. Once the input speech is recognized from speech database, a signal is transmitted to the robotic module from recognition unit. For the process of transmission and receiving, a new communication technology is used i.e. Zigbee. This technology is used because of its high range of connectivity wirelessly. Another Zigbee is present within the module for receiving.

C. *Module3: Robot Control Unit:*

The received signal is given to the microcontroller for controlling the robot to do particular action. Once the recognized signal matches with database the microcontroller will generate a Unicode to do particular action.

COMMANDS	RESPONSE
MUNDHAE	MOVES FRONT
HINDAE	MOVES BACK
EDA	ARM MOVES LEFT
BALA	ARM MOVES RIGHT
MHELE	ARM MOVES UP
KELAGE	ARM MOVES DOWN
HEDEE	ARM GRIPS THE OBJECT LIKE KNIFE OR SCISSOR
BEDU	ARM RELEASES THE OBJECT
NILLU	ROBOT STOPS

Table 1:

IV. ALGORITHM

Speech command is given to Module 1, speech recognition unit through microphone. The voice command is compared with predefined set of database stored in memory and check whether it matches the list present in database. If the speech matches the dataset based on the recognised command further action is taken by controller unit to move the robotic module. Otherwise the voice command is given again by the user for next speech command. The algorithm is shown below.

1) STEP 1: Start.
2) STEP 2: Speech command is given to speech recognition unit through microphone
3) STEP 3: The speech command is compared with the set of commands which are predefined.
4) STEP 4: Checking if the speech command matches with the predefined command.
5) STEP 5: If the speech command matches, the robotic module acts according to the command.
6) STEP 6: If the command doesnot matches, Repeat STEP 2 untill the match is found.
7) STEP 7: Stop.

V. PERFORMANCE ANALYSIS

Performance Analysis is done in order to check how efficient the robot is to the input speech commands. Five trials are done for each command and the response of the robot is noted down. The efficiency for each command is calculated based on the results of these five trials of each command. After going through all these commands, it is seen that the efficiency of robot is 88.89% overall. The efficiency for some of the commands is as shown below:

COMMANDS	ITTERATION	RESULT	EFFICIENCY (%)
MUNDHAE	1	MOVES	100
	2	MOVES	
	3	MOVES	
	4	MOVES	
	5	MOVES	
BEDU	1	RELEASES	60
	2	DOESNOT RELEASES	
	3	RELEASES	
	4	RELEASES	
	5	DOESNOT RELEASES	

Table 2:

VI. SPEECH PANEL AND ROBOTIC MODULE

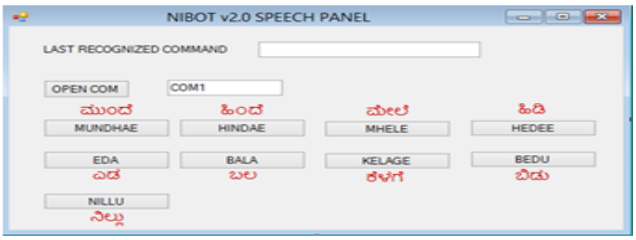

Fig. 3: Speech Recognition Panel

Fig. 4: Robot Module

VII. CONCLUSION

A system for reliable recognition of speech in regional language has been designed and developed. This system can be made highly efficient and effective if the demanding environmental conditions are maintained. By incorporating robotic technology and speech control technology, it has made easier for the Doctors to communicate with the robot in their regional language during surgeries and operation. An efficiency of 88.89% is achieved for the speech commands overall.

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