ABSTRACT - In today’s world, in almost all sectors, most of
the work is done by robots or robotic arm having different
number of degree of freedoms (DOF’s) as per the
requirement. This paper deals with the Design and
Implementation of a “Voice Controlled Robotic Arm”. The
system design is divided into 3 parts namely: Voice
recognition module, Robotic Arm and Platform. Arm with
Voice Recognition is to create a wireless voice controlled arm
which can be operated through a range of 10 to 50 meters
using ZIGBEE transmitter and receiver. Voice recognition is
"the technology by which sounds, words or phrases spoken by
humans are converted into electrical signals, and these signals
are transformed into coding patterns to which meaning has
been assigned". The different motions performed by robotic
arm are: PICK and PLACE / DROP, RAISING and
LOWERING the objects. Also, the motions performed by the
platform are: FORWARD, BACKWARD, RIGHT and
LEFT.

Keywords: Voice recognition, DOF, zigbee Module, Gripper,
stepper motor

I. INTRODUCTION

A robot may define as an electro-mechanical device, which
is capable of sensing its surrounding and taking its decision
(command).In general, robot must be able to move (by
mechanical movement), it must be able to sense (by transducer)
and it should be take decision (by remote
control or artificial intelligence). A robotic arm is a robot
manipulator, which can perform similar functions to a
human arm.

Robotics arm is vital role of industrial application. Most
robotics arm perform the task such as welding, trimming,
picking, placing and painting etc.,

Moreover the biggest advantage of these arms is that it can
work in hazardous areas and also in the areas which cannot
be accessed by human

Few variants are Keypad Controlled, Voice Control,
Gesture Control, etc. However, most of the industrial
robots are still programmed using the typical teaching

process which is still a tedious and time-consuming task
that requires technical expertise. Therefore, there is a need
for new and easier ways for programming the robots. The
prime aim of this project is the platform started with
movement as soon as the voice command receive by
operator. if the voice is not audible then the alternative
method is remote control accessing Robot

The goal of this paper is to develop methodologies that
help users to control and program a robot, with a high-level
of abstraction from the robot specific language i.e. to
simplify the robot programming

II. RELATED WORK

In the robotics field, several research efforts have been
directed towards recognizing human gestures.

Few popular systems are:

2.1 VISION-BASED GESTURE RECOGNITION

This Recognition system basically worked in the field of
Service Robotics and the researchers finally designed a
Robot performing the cleaning task. They designed a
gesture-based interface to control a mobile robot equipped
with a manipulator. The interface uses a camera to track a
person and recognize gestures involving arm motion. A
fast, adaptive tracking algorithm enables the robot to track
and follow a person reliably through office environments
with changing lighting conditions. Two gesture recognition
methods i.e. a template based approach and a neural based
approach were compared and combined with the Viterbi
algorithm for the recognition of gestures defined through
arm motion. It results in an interactive clean-up task, where
the user guides the robot to go to the specific locations that
need to be cleaned and also instructs the robot to pick up
trash.

2.2 MOTION CAPTURE SENSOR RECOGNITION

This recognition technique made it possible to implement
an accelerometer based system to communicate with an
industrial robotic arm wirelessly. In this particular project
the robotic arm is powered with ARM7 based LPC1768 core. MEMS is a three dimensional accelerometer sensor which captures gestures of human-arm and produces three different analog output voltages in three dimensional axes. And two flex sensors are used to control the gripper movement.

2.3 FINGER GESTURE RECOGNITION SYSTEM BASED ON ACTIVE TRACKING MECHANISMS

The prime aim of the system (based on the above mentioned recognition methodology) proposed by the author is to make it feasible to interact with a portable device or a computer through the recognition of finger gestures.

Apart from the gestures, speech can also be other mode of interaction because of which this system can form part of a so-called Perceptual User Interface (PUI). The system could be used for Virtual Reality or Augmented Reality systems.

2.4 ACCELEROMETER BASED GESTURE RECOGNITION

This Gesture Recognition methodology has become increasingly popular in a very short span of time. The low-moderate cost and relative small size of the accelerometers are the two factors that makes it an effective tool to detect and recognize human body gestures.

Several studies have been conducted on the recognition of gestures from acceleration data using Artificial Neural Networks (ANNs)

III. TECHNICAL REQUIREMENTS

The technical requirements chosen as a basis for the efficient functioning of the system are as follows:

3.1 MICROCONTROLLER

PIC microcontroller is used as the hardware platform. It is the controlling unit, to which all other components (Voice recognition, Motors, RF modules etc.) are interfaced. Two such microcontrollers are used in this project, one at the Transmitting end and one at the Receiving end.

3.2 ZIGBEE MODULE

ZigBee is a specification for a suite of high-level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee is based on an IEEE 802.15 standard though its low power consumption limits transmission distances to 10–100 meters line-of-sight depending on power output and environmental characteristics, 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 typically used in low data rate applications that require long battery life and secure networking (ZigBee networks are secured by 128 bit symmetric encryption keys.) ZigBee has a defined rate of 250 Kbit/s, best suited for intermittent data transmissions from a sensor or input device. That we used CC2500 transceiver module

APPLICATIONS

- Home Entertainment and Control
- Wireless sensor networks
- Industrial control
- Embedded sensing
- Medical data collection
- Smoke and intruder warning
- Building automation
3.3 VOICE RECOGNITION

Speech recognition is the process of converting an acoustic signal, captured by microphone or a telephone, to a set of words. There are two important parts of speech recognition:

- Recognize the series of sound and
- Identify the word from the sound.

The most popular and dominated technique in the last two decades is Hidden Markov Models. There are other techniques also used for SR systems – Artificial Neural Network (ANN), Back Propagation Algorithm (BPA), Fast Fourier Transform (FFT), Learn Vector Quantization (LVQ), Neural Network (NN).

Hardware module includes:
- Voice Extreme Module
- HM2007 - Speech Recognition Chip
- OKI VPR6679 – Voice Recognition Processor
- Speech Commander - Verbex Voice Systems

The Spoken Language interface should be in English Language:

- The robot should understand the task from the dialogue.
- The system should be speaker independent.
- The robot should have some user feedback; such as, if the robot doesn’t understand the user commands, it gives the user feedback - “I don’t understand”
- The robot should understand the dialogue.

<table>
<thead>
<tr>
<th>SENTENCE</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward</td>
<td>Move in forward direction</td>
</tr>
<tr>
<td>Backward</td>
<td>Move in backward direction</td>
</tr>
<tr>
<td>Right</td>
<td>Turn right</td>
</tr>
<tr>
<td>Left</td>
<td>Turn left</td>
</tr>
<tr>
<td>Upward</td>
<td>Move arm in upward direction</td>
</tr>
<tr>
<td>Downward</td>
<td>Move arm in downward direction</td>
</tr>
<tr>
<td>Pick</td>
<td>Arm gripper pick the object</td>
</tr>
<tr>
<td>Drop</td>
<td>Arm gripper drop/place the object</td>
</tr>
</tbody>
</table>
IV. OVERALL DESIGN OF THE SYSTEM

In this paper, a robotic arm with three degrees of freedom is designed, which is able to pick the desired object and place them at the desired location. Based on functionality, the system has been categorized into the following parts:

- Robotic arm
- Platform
- Communication system

[2] ROBOTIC ARM

This is the vital part of the system as it is this part which does the Pick and Drop task of the project. The robotic arm is equipped with a Gripper (for picking and placing the objects) and an Arm (for raising and lowering the objects). Both the Arm and Gripper are equipped with Servo Motor to control the movement. These movements are synchronized with the voice commands of the user, operating the Robotic Arm. Also, the different voice commands, shown in Figure 4, are described below:

- Downward: To Lower the Arm
- Upward: To Raise the Arm
- Pick: To close the Gripper Mouth so that it can pick the object
- Drop: To open the Gripper Mouth so that it can place / drop the object

4.2 PLATFORM (ROBOTIC MOVEMENT)

Platform is nothing but that part of the project onto which the Robotic Arm is mounted. The platform is fitted with Stepper Motors and its movement is synchronized with the voice command of the user, operating the Robotic Arm. It is this part of the project which takes the entire project from one place to another.

- Forward: To make the platform move in Forward direction
- Backward: To make the platform move in Backward direction
- Right: To make the platform take a turn towards Right
- Left: To make the platform take a turn towards Left

4.3 COMMUNICATION SYSTEM (VOICE RECOGNIZATION & ZIGBEE TRANSCEIVER)

This part is the heart of the entire project. Without an effective and reliable communication system, no system
Human-Robot interaction is an important, attractive and challenging area in HRI. The Service Robot popularity gives the researcher more interest to work with user interface for robots to make it more user friendly to the social context. Speech Recognition (SR) technology gives the researcher the opportunity to add Natural language (NL) communication with robot in natural and even way. The working domain of the Service Robot is in the society -to help the people in every day’s life and so it should be controlled by the human. Our future work will focus on introducing more complex activities and sentence to the system and also introducing the non-speech sound recognition, like footsteps (close), footsteps (distant) etc. Humans normally use gestures such as pointing to an object or a direction with the spoken language, i.e., when the human speaks with another human about a close object or location, they normally point at the object/location by using their fingers. This interface called multi-modal communication interface

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REFERENCE


