Voice Based Self Assisting Robot Using Firebird V

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ABSTRACT

This paper presents a substantial design of a robotic system. Robotics is a automation field of technology which includes mechanical, electrical, and computing package of systems. Robot is a machine which can be programmed by a computer, it can be guided by an external control or controlled by the embedded system. In order to access the required information for an individual who is unfamiliar with a new surrounding or lack of knowledge about a particular information, this robot can make a huge impact in guiding such people. This project proposes a strategy which is helpful in controlling a robot through connected speech input. It also helps in placing the objects at the desired positions. Android phone is used to communicate with the robot via Bluetooth Connectivity and Arduino Nano is used for baud rate conversion. The proposed system is more robust than the existing one.

Keywords – Robotics, Firebird v, Bluetooth, Android phone, Arduino, Gripper, Arduino voice control application, X-bee.

I. INTRODUCTION

Over the years, humans have evolved in inventing new technologies for reducing human efforts. The design of a robotic system can dramatically impact its work efficiency and cost. Robots are one among them which are a package of systems which include mechanical, electrical, computing and automation fields of technology which is used to perform various tasks in industrial and domestic use. A best way to accomplish such is to control a robot via voice command.

The proposed setup, gives an open approach on using all available open source software and implementing using available limited hardware sources. This allows the users to free up their hands and work on other tasks. Firebird V is a state of art research platform designed to get acquainted with the world of robotics and Embedded systems. It provides an excellent environment for experimentations, algorithm development and testing.

Its modular architecture allows controlling of robot using multiple processors such as 8051, AVR Core Processors and ARM processors. Firebird V robot is controlled by ATMEGA2560 microcontroller which is based on ATMEL's AVR 8-bit architecture modelled on ATMEGA8 microcontroller. Firebird V robot is driven by two powerful geared dc motors having separate motor drivers equipped with position encoders. It has 16 x 2 characters LCD for displaying messages on it. It has 32 channels ADC and equipped with three white line sensors, one IR sharp sensor and eight proximity sensors. It supports various

communication modes such as USB, RS232, USART and X-Bee 2.4GHz wireless.

Some basic applications of robots utilizing voice recognition are to support people with disability, executing preset commands etc. To process the voice commands a simple and efficient method is to use a Android phone or using microphone. Android phones are powerful devices that are capable of performing many functions similar to a computer. One of the major features that we shall make use of is the Bluetooth module and the X-bee module which allows the phone to communicate with the robot. Several Operating Systems are used for android phones but the most common one is the Android OS. Its flexibility and ease of use make it an ideal interface for robotic application. These android related systems are very efficient for developing applications throughout the world. Arduino IDE is the software used for programming the robot to communicate with the users. The Arduino voice control app is used for giving voice commands to the robot. Grippers are the mechanical arms of the robots used for carrying objects and placing it at the desired location which is also voice controlled.

II. LITERATURE SURVEY

The literature survey referred by us presented the usage of human voice wherein speech recognition module is not used and instead an android application is used to take human voice and converted into text. The purpose of [2] is to provide simpler robot hardware architecture but with powerful computational platforms.
This has potential applications in homes and chemical industries. It was developed for individuals with motor impairment. It was developed on AT89S52 microcontroller which makes it highly efficient and cost effective solution to many embedded control systems. The disadvantage in the referred paper is that we have to give directions to the robot to turn or to move forward and backward i.e.,

the final destination is not specified and the user has to give the path directions himself. This added to the disadvantage that there should always be a person assisting the robot.

In [1] an assistant robot is used to realise smart living and more specifically home lightning system using Bluetooth technology where in the consumer can control their home remotely and wirelessly. Personal robotic assistants help reducing the manual efforts being put by humans in their day-to-day task. Voice commands given at the user end are converted into text form using the speech processing. Speech commands converted into text form are then transmitted to the robotic assistant. It is developed on a microprocessor based platform. The Bluetooth network in android phones is used for this purpose. The assistant robot then performs the actions according to the given commands. In [3] the robot uses its vision system to identify round objects inside a basket which are picked and placed using a gripper. In all the papers referred the robots were used for sole purposes. This robot can find applications in the field of agriculture as well as industries with better capabilities than human beings.

III. METHODOLOGY

The proposed robot mainly has two functionalities one is guiding people to their destination and other is the pick and place of an object at the desired place. Any user who wants to make use of the robot first has to pair up his phone's Bluetooth with the robot's Bluetooth HC-05. After the pairing is done the user has to give voice commands to the robot using the Arduino voice control application by pressing the mic button present in it. The voice commands are the destinations he intends to go. Communication between the user and robot takes place via the Bluetooth module. The voice inputs are converted into text form which will be displayed on the 16 x 2 characters LCD display of the Firebird V robot. After

the command is received by the robot it displays the message "COMMAND RECEIVED" on the LCD screen and moves to the required destination as path to it is pre-programmed. The user has to follow the robot to reach the destination. The message "DESTINATION REACHED" will be displayed on the LCD screen on reaching the destination. Once the destination is reached the robot moves back to its original place.

Voice input

Communication with robot using Bluetooth

Speech to text conversion

A/ C to assisting command

Firebird v

A/ C to pick command

Path assisting application

Pick and place application

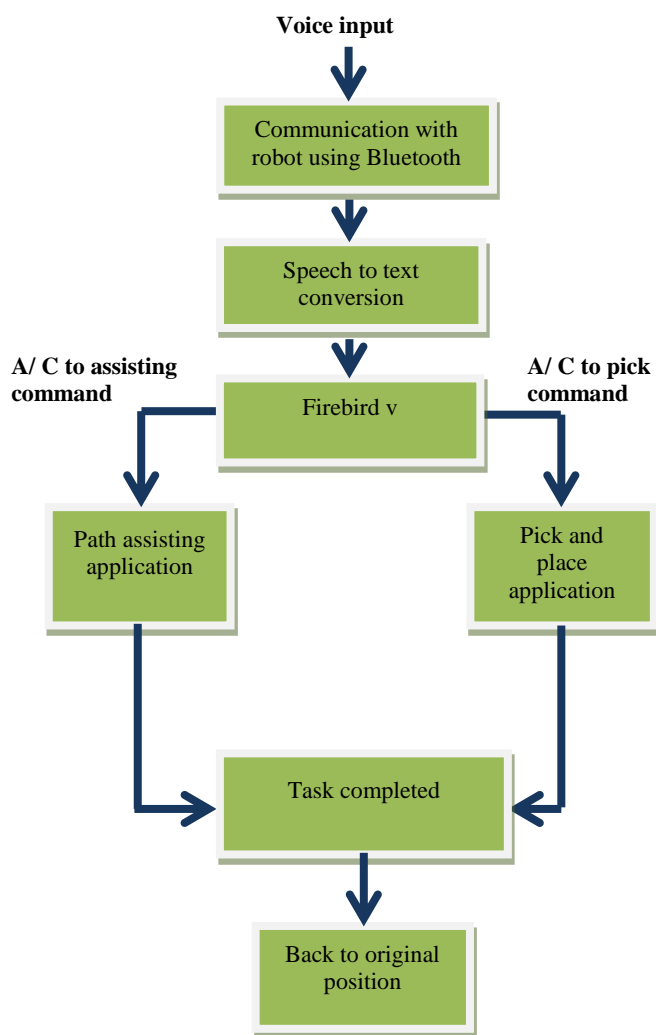Task completed

Back to original position

Figure 1: Block diagram of proposed method

In the same way to pick the objects and place it at the desired location the user has to give commands to the robot as "TAKE" and "DROP". When the command "TAKE" is given, the robot's gripper picks the object and places it at the destination specified by the user on giving the command "DROP". On completing its task the robot then moves back to its original place.

The robot is programmed using the Arduino IDE software using embedded C programming. After programming, the hex file is created and it is loaded to the robot using the Boot loader. After the user is done with his job he has to unpair his device from the robot's Bluetooth so that other people can connect to it and make use of it.

1. **FIREBIRD V ROBOT**

Figure 2: Firebird V robot

The Firebird V robot has Atmel ATMEGA2560 master microcontroller and Atmel ATMEGA8 slave controller. It has 3 white line sensors and 5 sharp IR range sensors. It has 16x2 characters LCD for displaying sensor data or any other information, also with indicator LEDs and buzzer. It has a 9.6V, 2100mAh nickel metal hydride rechargeable battery of lifetime 2 hours. It is easy to interface with PC using wired and wireless communication. It provides wireless communication via X-bee (2.4 GHz), USB communication and RS232 serial communication. It has 2 DC geared motors with position encoders having a top speed of 24cm/second.

2. **HC-05 BLUETOOTH MODULE**

It is a Bluetooth module designed for wireless communication which can be used in both master and slave configuration and has a range of about 10m. It has a red LED to indicate the connection status which blinks continuously before connecting and the blinking slows down after the connection is established. It is used for communication between the user and the robot. Its operating voltage is about 4-6V

and operating current being around 30mV. It works with serial communication (USART) and it can be easily interface with laptop or mobile phones.

3. ARDUINO NANO

It is a small, complete and bread-board friendly module similar to Arduino UNO. It is used for the Baud rate conversion of Bluetooth with 9600 baud rate to X-bee baud rate of 115200 which is compatible for the Firebird V robot communication. It has an operating voltage of 5V. It has 14 digital I/O pins and 8 analog input pins. It has a flash memory of 32 KB. It has Microcontroller ATmega328.

4. GRIPPER
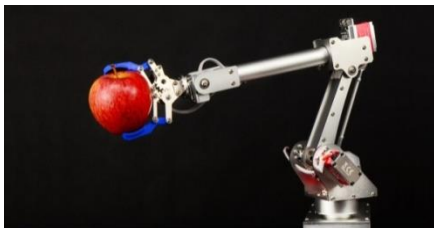
It is the mechanical arm of the robot. Different types of grippers are available for different applications. The parallel gripper assembly can grip objects with size up to 33mm with the force of 250gms. It has rubber pads to get a firm grip. It has 2 servo motors for twisting and gripping action. It is used to pick and place the objects.

5. X-bee

The X-bee modules are the embedded solutions which provide wireless end-point connectivity to devices. The X-bee transmits and receives the data at the same time.

6. ARDUINO VOICE CONTROL APPLICATION

It is an application which is freely available in the Google play store. It is used to send voice commands via Bluetooth. The application displays the word's given by the user and sends data strings for the Arduino to process.

7. ARDUINO IDE

It is an open source platform which can be used with any Arduino board for building the electronic projects which makes it easy to write the code and upload it to the board.

IV. RESULTS AND DISCUSSIONS

The user has to pair his phone's Bluetooth with the robot's Bluetooth module. At a time only one person can pair his device and communicate with the robot. The process of converting spoken words into written texts is known as speech recognition or speech to text conversion. A number of applications are available for this purpose in the Google play store and one among them is the Arduino voice control application. Using the Arduino voice control application, the voice input has to be given to the robot.
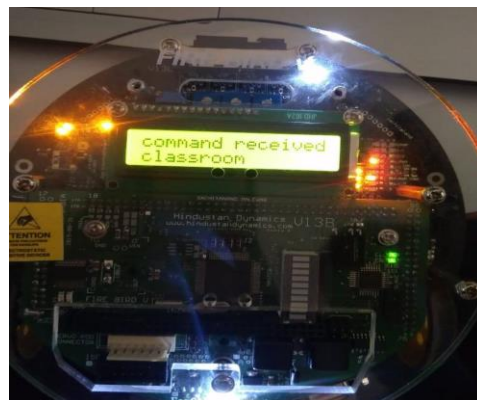
Figure 3: Robot with voice command received

The voice input will be in the form of keywords which are already specified in the program. These

keywords which are recognised by the robot will be processed and displayed in text form on the LCD display and this being the first result of the experiment. After displaying the destination on the LCD, the robot moves to the desired location as given by the user. This pattern is already programmed and loaded to the robot. The user has to follow the robot to the destination. Upon reaching the destination the robot gives a beep sound to intimate that the user is at the destination and it moves back to its original position and is ready to pair up with the next device. This being the second output of the experiment.

Figure 4: Robot moving towards the destination

The gripper is attached to the robot for pick and place of the objects. The gripper arm angles are varied within 180 degrees in order to achieve the grasping and releasing of the objects being the final result of the experiment.

Figure 5: Firebird V with Gripper

V. CONCLUSION

The voice based self-assisting robot in the indoor navigation assistance for individuals is very important when they visit a new environment. The proposed method for the robot plays a very big role in such situations by taking voice commands and guiding people. It can also be implemented in places such as schools, colleges, big factories and other similar surroundings. In hazardous places such as chemical industries the robot can be useful to pick and place the objects. Our proposed system is a good solution for indoor assistance with voice-aid when compared to the existing methods.

VI. REFERENCES

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