

Course Project Documentation
CS308 Project

Speech Based Servant Bot

TEAM : 11

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INTRODUCTION:

The idea is to make the bot work at a remote location on the command of the user.

Now-a-days many have android phones.

There is also speech processing library for android.

The bot also has many modules for remote communication like bluetooth module and zigbee module.

This is the motivation for this project, that we can make the bot work remotely.

PROBLEM STATEMENT:

The main aim of the project is to develop a "Speech based servant bot" which does tasks from a remote distance as specified by the user.

The user talks to the android phone. The speech recognising library identifies the speech.

This message is transmitted to the bot via bluetooth and the bot performs the necessary actions.

In our project, the application is such that the bot moves on a grid to the coordinates specified by the user on the phone. The grid has white lines on black background.

The bot should also be able to avoid obstacles on the grid, that is, it should find a different path when it faces obstacles.

REQUIREMENTS:

A) Hardware requirements :

1. Firebird V : which does the tasks specified by the user
2. Android phone : in which the user speaks the commands
3. Bluetooth : for communication between the bot and the android
4. Proximity sensors : to check for obstacles
5. White line sensors : to follow the white line

B) Software requirements :

1. AVR Studio : to program the code for the bot
2. AVR Boot loader : to burn the code into the bot
3. Android SDK, eclipse: for android app development
4. Pocket sphinx library : speech recognition library for android

IMPLEMENTATION:

A) Speech Recognition :

Speech recognition is done on the android phone using pocket sphinx library. This speech is then converted into the message to be sent to the bot using an xml file as dictionary to map the words to corresponding messages.

B) Communication between the bot and the android phone :

The communication between the bot and android happens via Bluetooth. Initially, as soon as the app starts, it asks for connecting to a device. Then the user selects to connect to the bot. And after speech recognition is completed, that command is sent to the bot via Bluetooth. When a command is received at the bot, that command if corresponds to coordinates, then it is stored in a list of destination coordinates.

C) Reaching the destination :

The destination coordinates are stored when they are received. The bot moves to these coordinates in the order in which they are received. The bot first tries to clear the x-coordinate and then the y-coordinate.

D) Avoiding obstacles :

There might be obstacles in the grid while the bot is moving to the current destination coordinates. In this situation, the bot tries to find a different path by doing a search on the available paths. When the bot finds obstacle on a particular edge, that edge is marked as unavailable. The bot might again come and check if it is available or not.

THE PROCESS:

A) Speech recognition :

The user can talk into the android phone. The speech gets recognized, converted into appropriate message and then sent to the bot via Bluetooth

B) Bot receiving signals :

When the bot receives signals from the android phone, the coordinates are stored.

C) Bot reaches a junction :

When the bot reaches a junction, the current coordinates are updated based on the current direction. If the bot has cleared all the x-coordinate of the destination, then it may have to take a turn to clear the y-coordinate.

When it takes a turn the direction is updated according to the present direction and the direction of the turn (left or right). If the bot has cleared both x and y-coordinates, it has reached the destination.

D) Bot finds an obstacle :

There might be an obstacle when the bot is moving to the destination.

Then this edge where the bot found an obstacle will be marked as edge with an obstacle. Then a path is searched to the current destination from the current position based on the available edges. Then the bot tries to move along that path.

E) Bot reaches current destination:

When bot reaches the current destination, if any other destinations are left to go, then the current destination is updated, and the bot tries to go to that destination.

DISCUSSION OF THE SYSTEM:

A) What worked as per plan?

1. Android speech recognition:

Speech recognition is the main part of the project. The speech was recognized using the pocket sphinx library for android. The noise from the other sources may be a hindrance to the recognition.

2. Movement of the bot to the specified coordinates:

The bot moves to the destination coordinates. We can give as many destinations we want and we can give them even before the bot reaches its current destination.

B) What we added more than we discussed in the SRS?

1. Obstacle detection and avoidance:

The bot can identify the obstacles in its path to goal.

Then the bot tries to find a path to the goal and moves along that path.

C) Changes made in the plan:

1. Bot code in Embedded C:

Initially we thought of doing the bot side code in RTOS. But we faced many problems while working with RTOS. The first thing is that RTOS licence was expired in the laptops provided. We tried to do it in our laptops, but there were a lot of error, many functions which worked in the embedded C were not working in RTOS. We tried to debug but we could not print on the LCD. So we had to switch to Embedded C.

FUTURE WORK:

The bot moving to destination coordinates is just an application to demonstrate our project. This speech processing in android and communicating through Bluetooth can be easily extended to other applications. A camera can be mounted to the bot so that it can take pictures on command and send to the android phone.

CONCLUSIONS:

Our project can be generalized as "speech + action". The action depends on the application and the speech depends on the actions to be performed in the application. The user need not be in the location, but can still do the work with the help of the bot.

REFERENCES:

1. Android app development : <http://developer.android.com>
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<http://cmusphinx.sourceforge.net/2011/05/building-pocketsphinx-on-android/>