MATLAB HARDWARE CHALLENGE

2K16

(INDIA)

Project Details:

- **Name:** Voice Controlled Robot (VCR)
- **Dependency :** Speaker Independent system
- **Principle used** : Digital Audio Processing (MATLAB) and Robotic Locomotion (ARDUINO)
- **Matlab used** : MATLAB Version: 8.1.0.604 (R2013a)
- **MATLAB License Number:** 724504
- **Hardware used :** Arduino/ Genuino Uno R3
- **Communication media ;** Radio Wave (Rf, 433Mhz ,ASK wireless comm.)
- **Locomotion:** DC geared Motor controlling via Motor Driver IC (L293D)
- **Audio processing :** LPC (linear predictive coding)

Introduction :

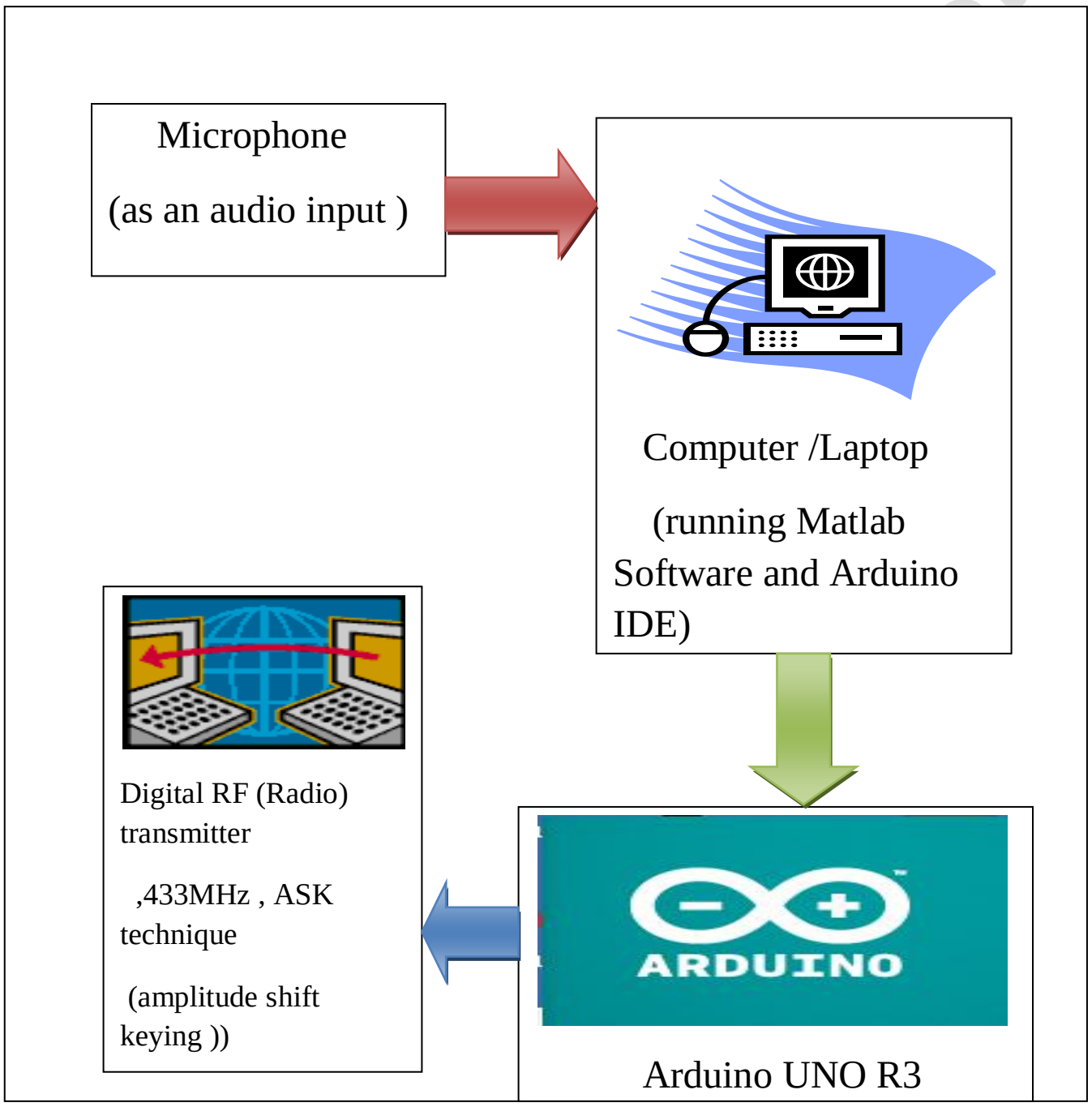
As the project name "**voice controlled Robot**", gives the idea about what it could be.

It is basically controlling the locomotion of four wheeler robot by audio commands wirelessly. The main motto of making this project is to explore the matlab interfacing with hardware.

Matlab have various tools in-build in it, like DSP (digital signal processing).by using one of its tool (audio processing) and interfacing with hardware ,one can make more interactive projects based on these aspects, that what I did in this project.

Hardware description :

➢ Transmitter side:

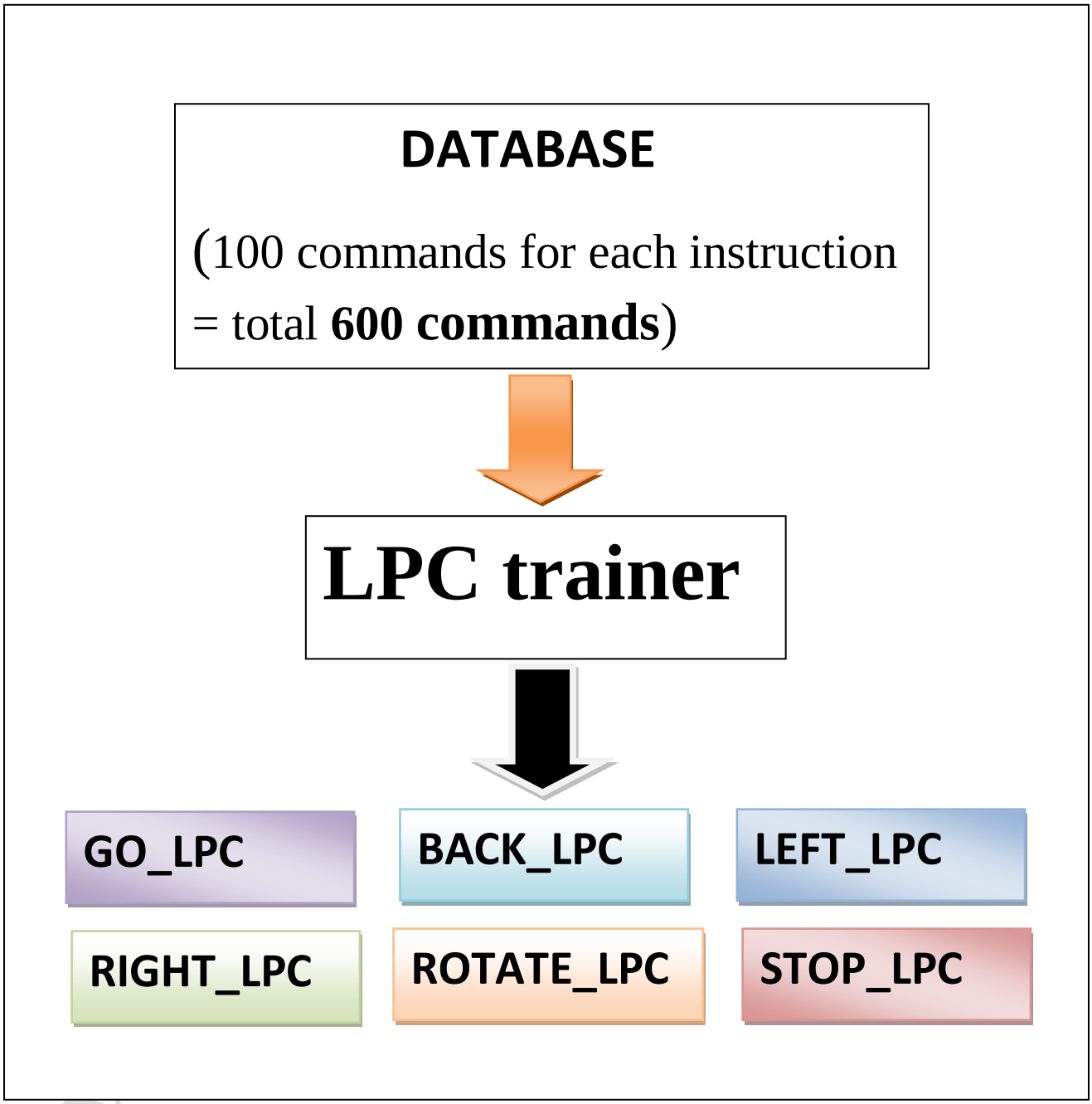


- The transmitter part mainly consist of a microphone ,PC/Laptop having matlab and arduino IDE installed ,arduino uno R3 and Rf transmitter.
- First, an Audio command is given to matlab via speaking in microphone at a **sampling frequency 44500Hz**. there are only **six instructions** for which the robot is commanded **(i.e. GO ,BACK,LEFT, RIGHT,ROTATE and STOP)**
- the spoken audio is then captured by matlab software. After capturing, Matlab performs Speech Recognition.
- The principle for speech synthesis used here is LPC (**linear Predictive Coding**) and which is used in two modes.

  [1] Training mode

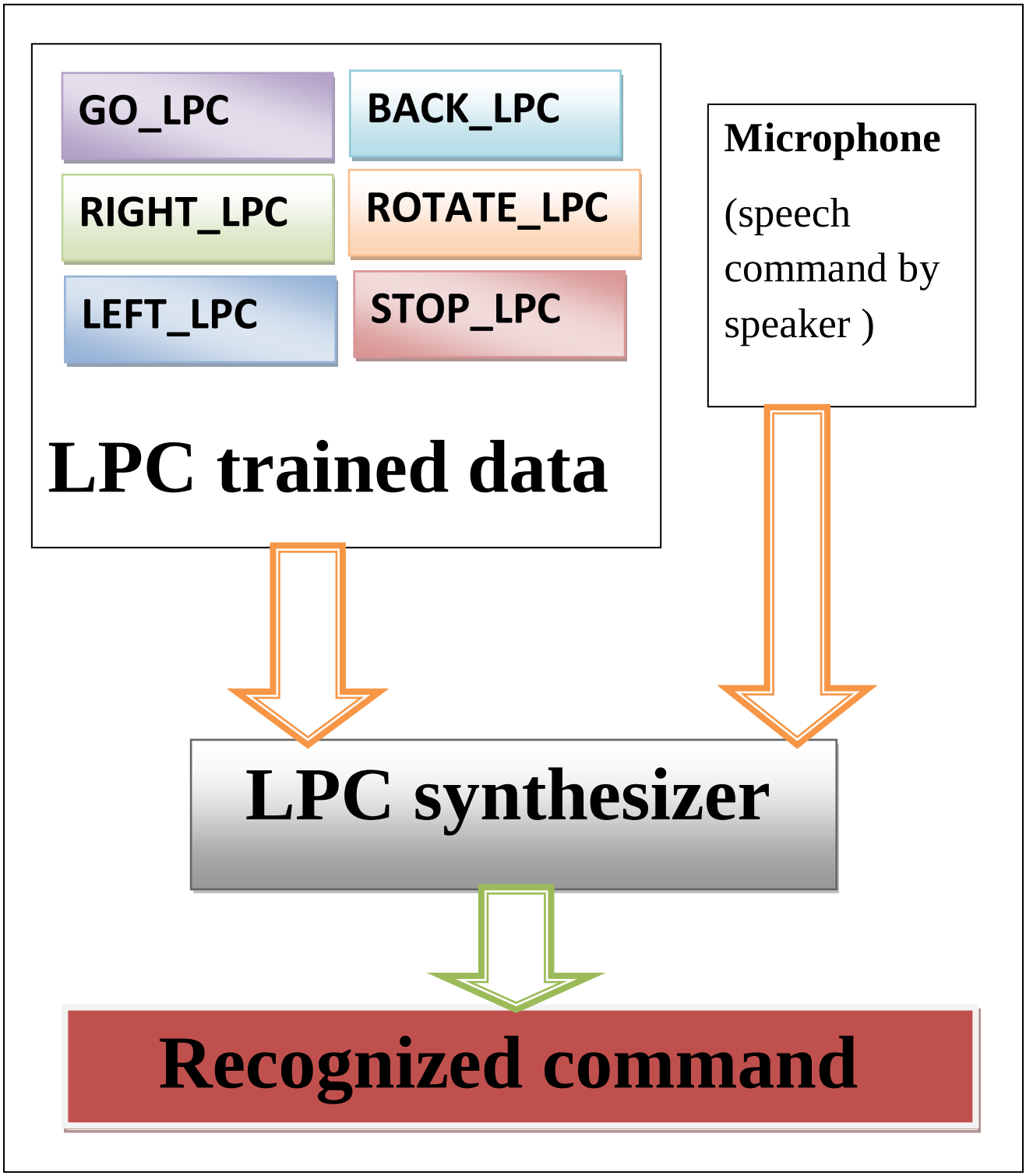
  [2] Synthesizing mode

➢ Training mode :



- The database consists of audio files compressed in a single file .(*ex. for all 100* ***go.mat*** *file ,a single file called* ***go_all.mat*** *is used and similarly for all the commands)*
- An LPC trainer is used to convert the database commands into it's equivalent LPC coefficients
- It first extracts the commands from database one -by-one.
- Then perform **LPC** ,(*an coefficient in which information of audio is stored* ***like pitch, loudness, intensity , amplitude*** *etc*)
- Thus it will do for all the commands for specific instruction and calculate its average and store in single mat file (*ex,* **GO_LPC, BACK_LPC***…and so on)* and store which is then use for recognizing the speech.

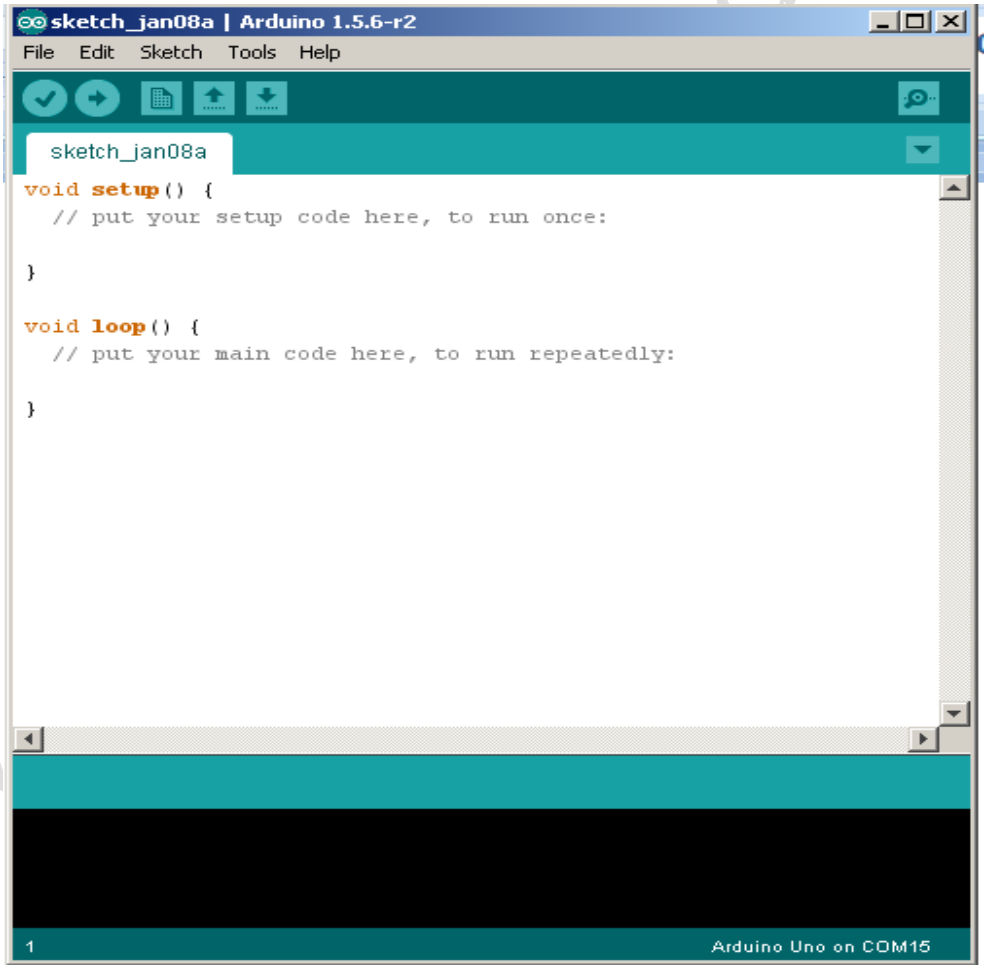
➢ Synthesizing mode:



- In the synthesis, first the user is requested to give command which is recorded via microphone.
- LPC synthesizer, will then perform LPC on the command to convert into its coefficient (ex. **INPUT_LPC**)
- The synthesizer then, compares (subtracts) this input coefficient to the database coefficients .
- It will find the minimum distance which gives the ***recognized latter*** .

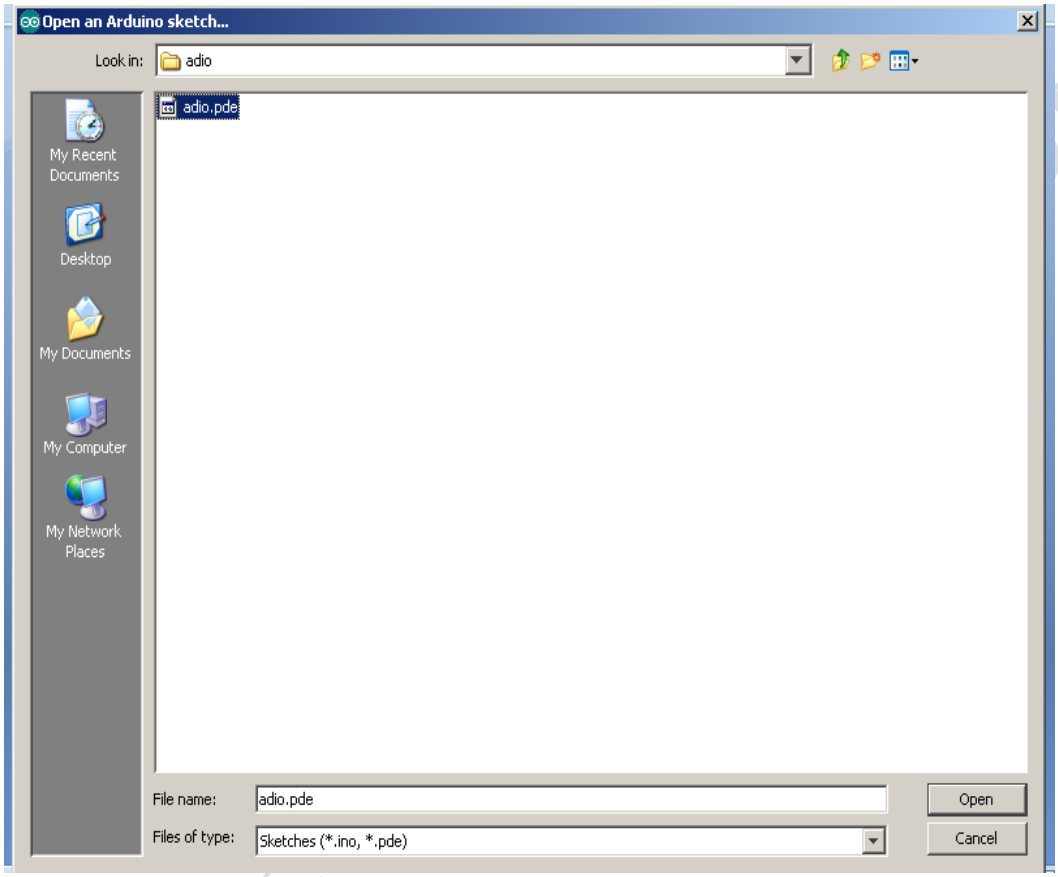
- After recognizing the latter now it's time to interface the system with matlab.
- Following steps used for interfacing the Arduino with matlab.

1. Download "**.pde"** files from internet and open Arduino IDE

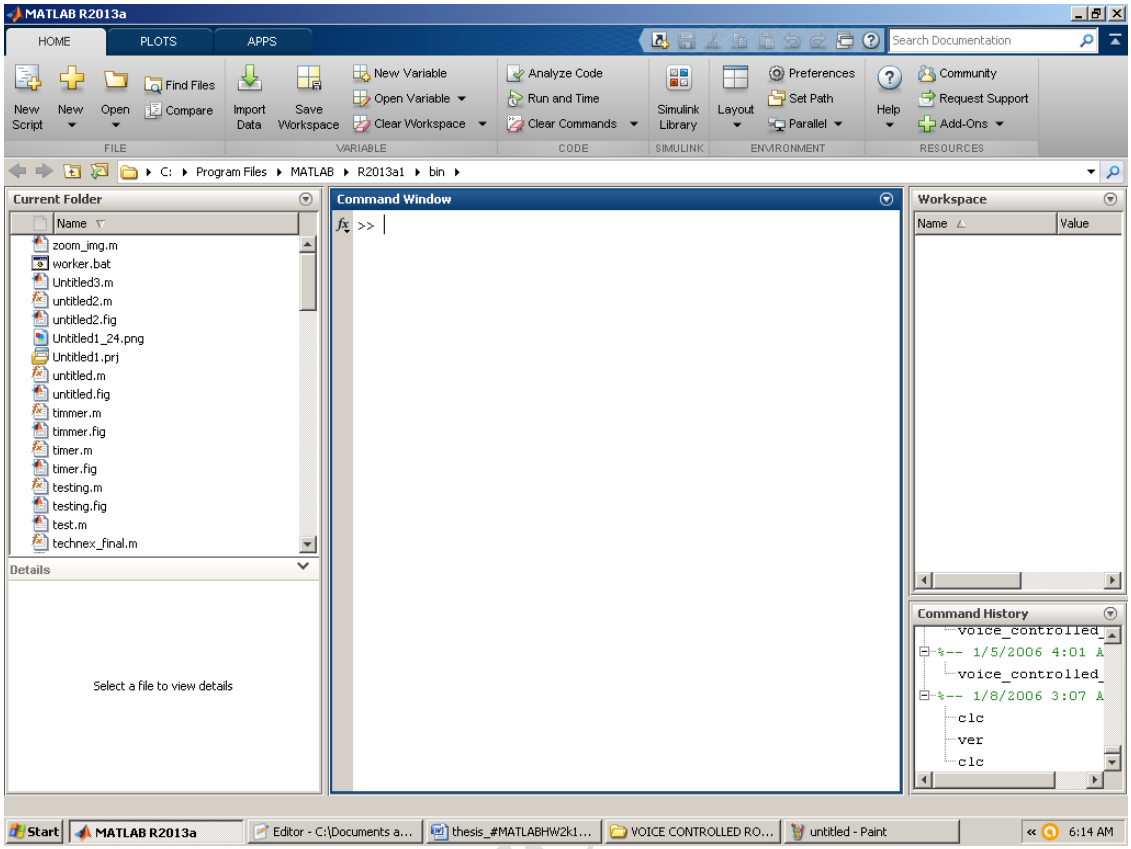


2. Connect arduino uno to the computer via USB cable.

3. Open "**adio.pde** "file in IDE and upload the code on Arduino.

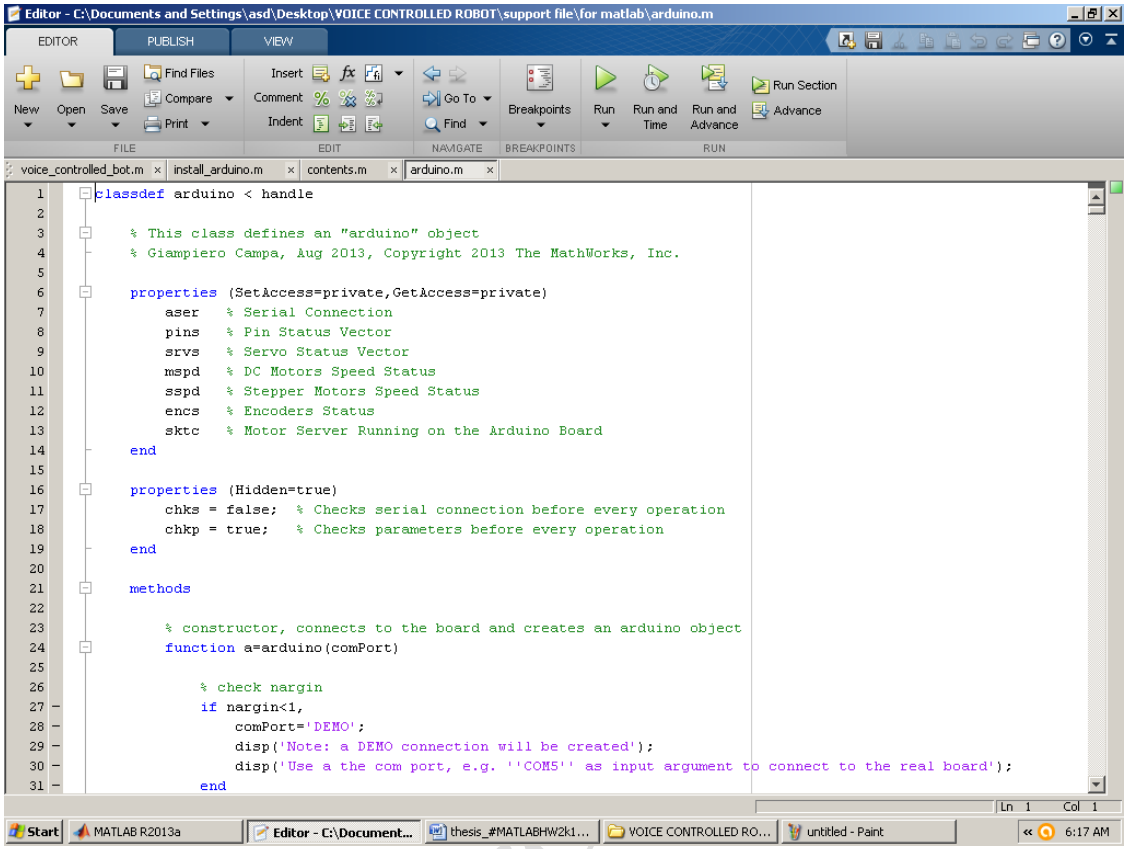


4. Close the IDE and open MATLAB software .

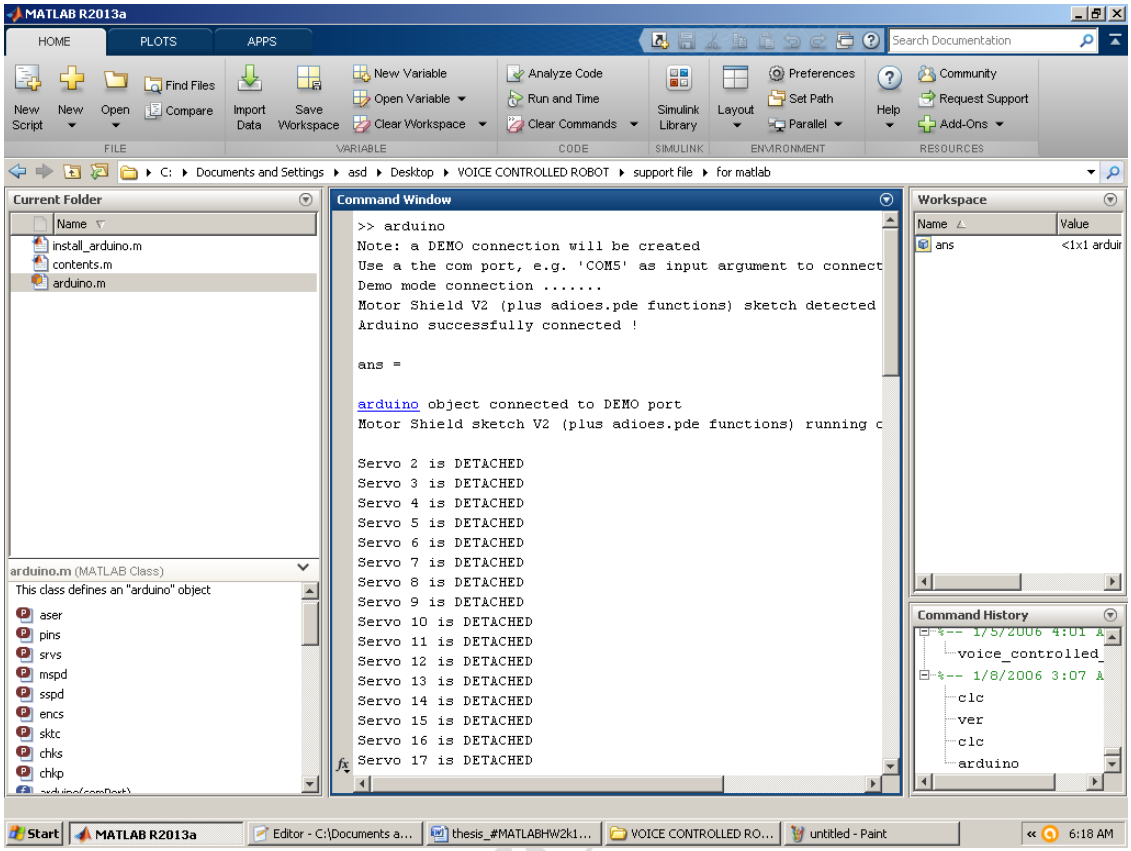


5. Download three .m files from internet as [1]**content.m** , [2] **Install Arduino.m** and [3] **Arduino.m** files

6. Run these files on MATLAB (this will take fewer minutes ..)



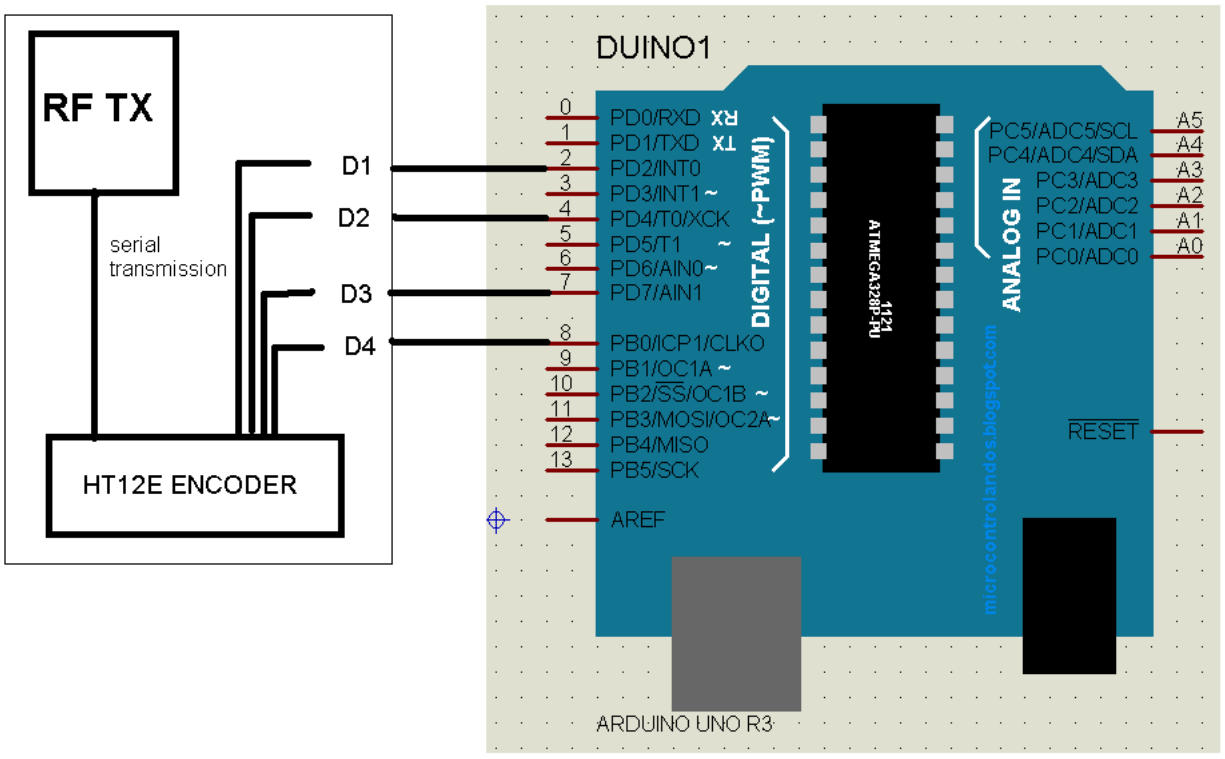
7. After showing the text “ARDUINO successfully installed ..!”,the Arduino is now interfaced with matlab.



Transmission :

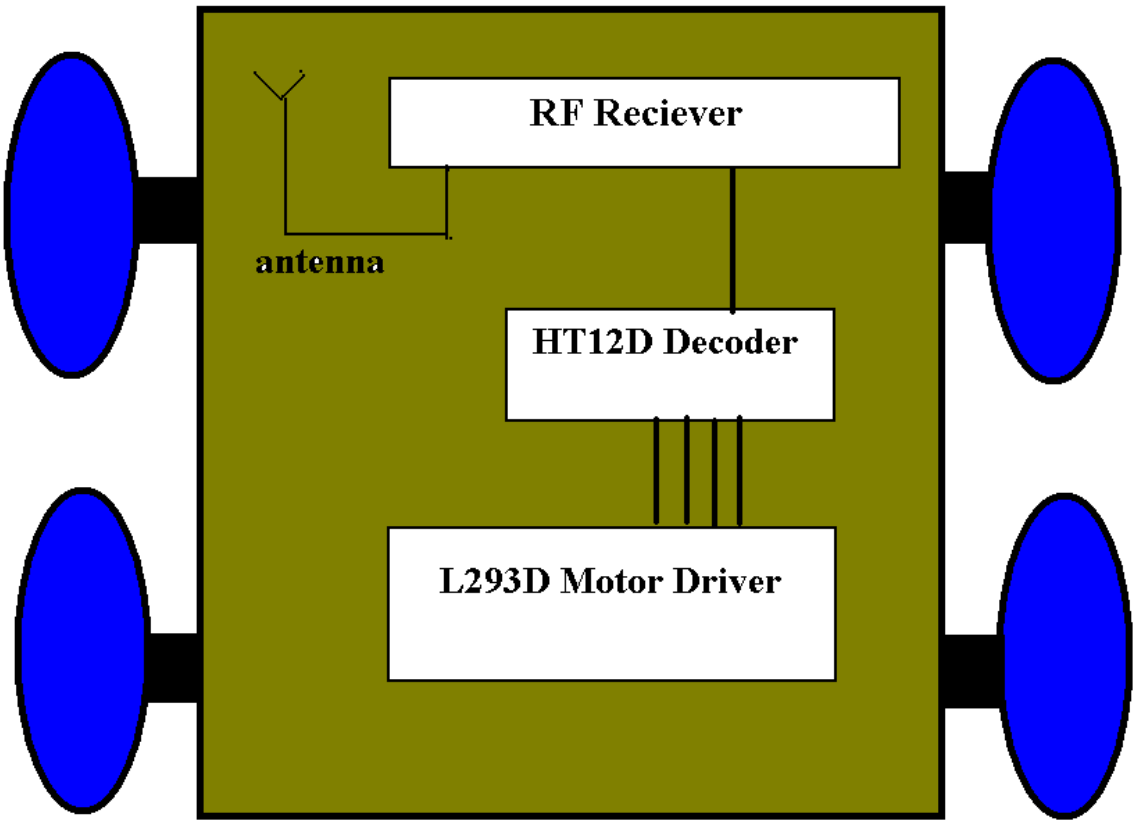
- Transmitting the command by an digital bits(4 bit code via matlab) to the transmitter
- Arduino is use to transforming the data from matlab to transmitter

- The four digital pins of Arduino is connected to the transmitter's digital pins (D1 to D4)
- In this way ,the signal is transmitted serially via an serial bit encode HT12E IC.



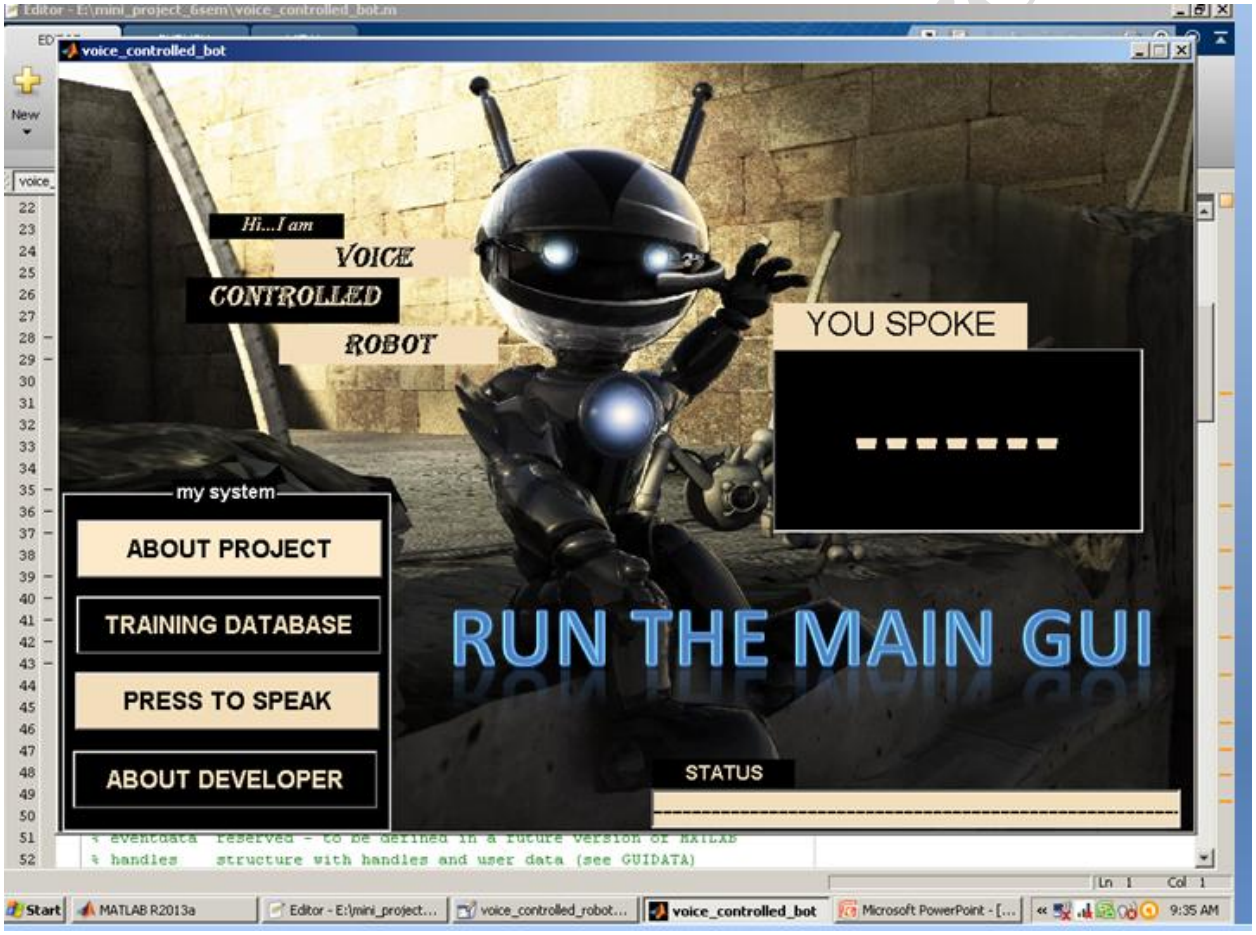
Reception :

- It consist of an RF receiver , decoder and a driver .
- RF receiver ,receives the data serially and send it to the decoder
- HT12D decoder then converts the data into Parallel form.
- Then ,it is feed to the motor driver IC L293D which drives the motors accordingly .



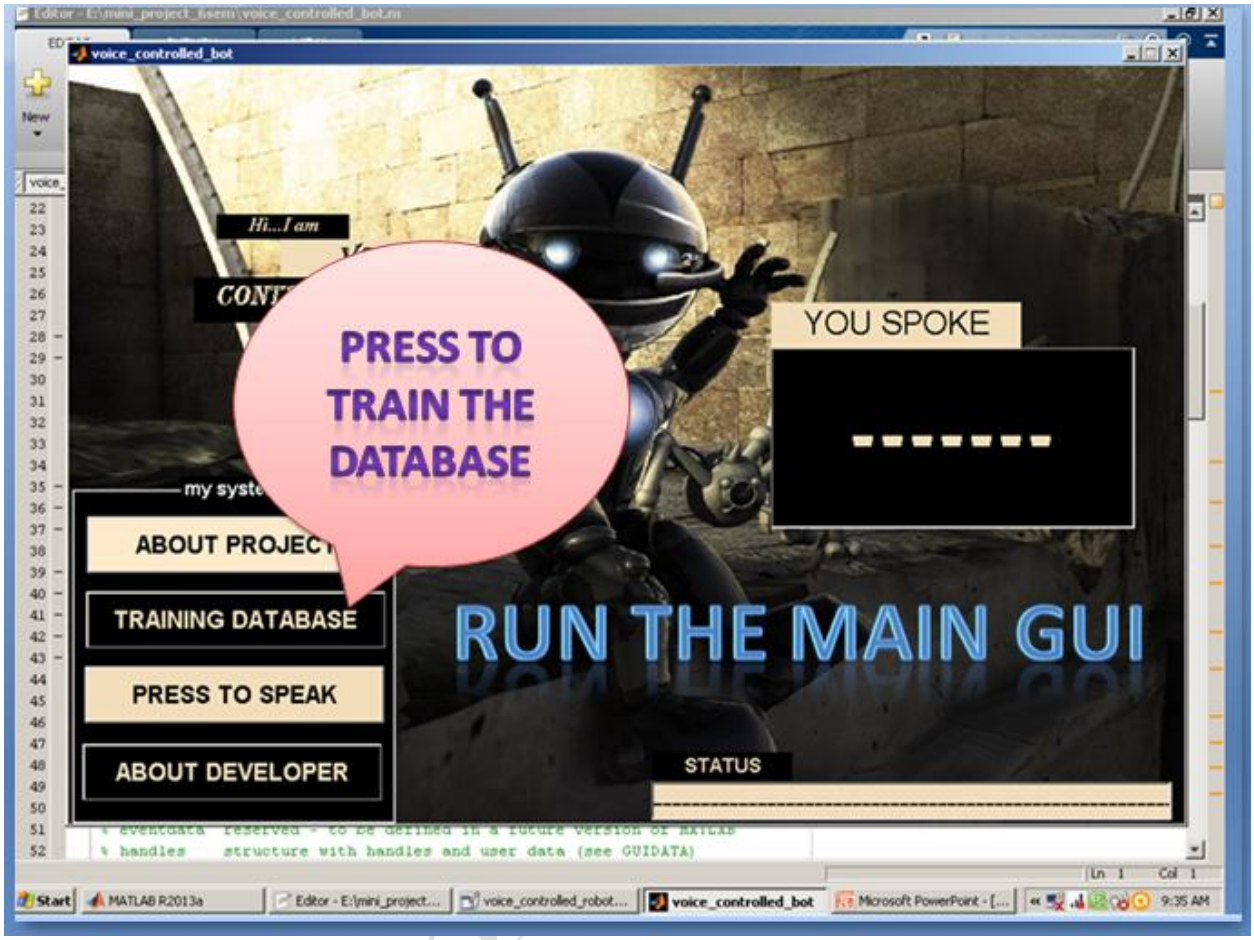
Software description :

- The complete system is developed in matlab using a GUI (graphical user interface) guide.
- For running the voice controlled robot system ,one need to run the GUI and then through the GUI robot can be controlled.

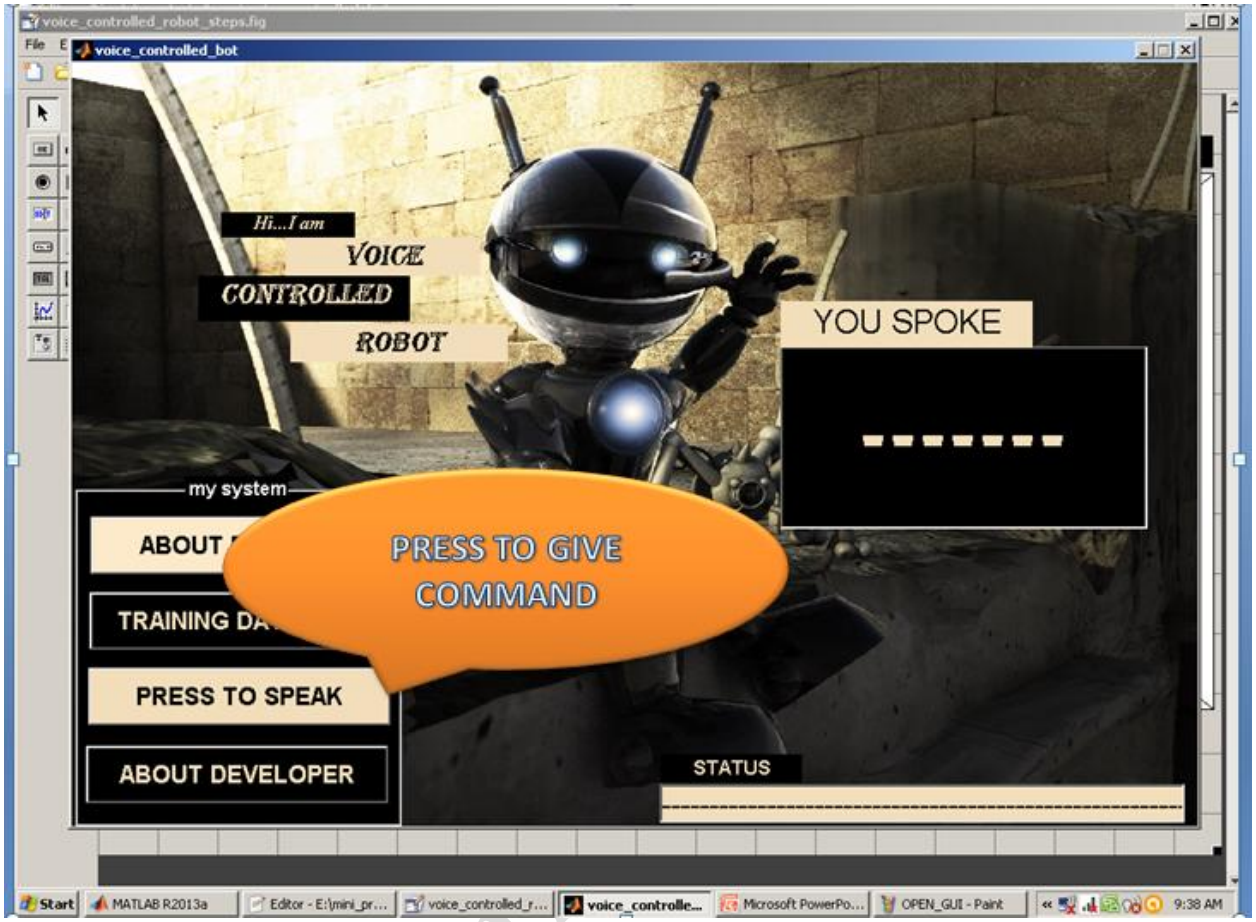


- The following steps to follow to run the system on matlab GUI.

[1] run the main GUI



[3] press the indicated button to train the database and wait for some time until it finished .



[3] press the button to speak in mic. (command the robot via this button)

[4] the output will show on the window as shown above and simultaneously the robot will move..

THAT'S IT FROM THE PROJECT ….

Thank you!!!!!

****

by: Manishkumar Bante

electronics and telecomm. Engineer

bante_manish@rediffmail.com