

Voice Controlled Obstacle Avoiding Robot

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Objective

- ❖ Develop a two wheeled robot that is able to respond in real time to voice commands as well as avoid obstacles in its intended path of travel.
- ❖ Create a smartphone application in which controls the robot via Bluetooth

Background

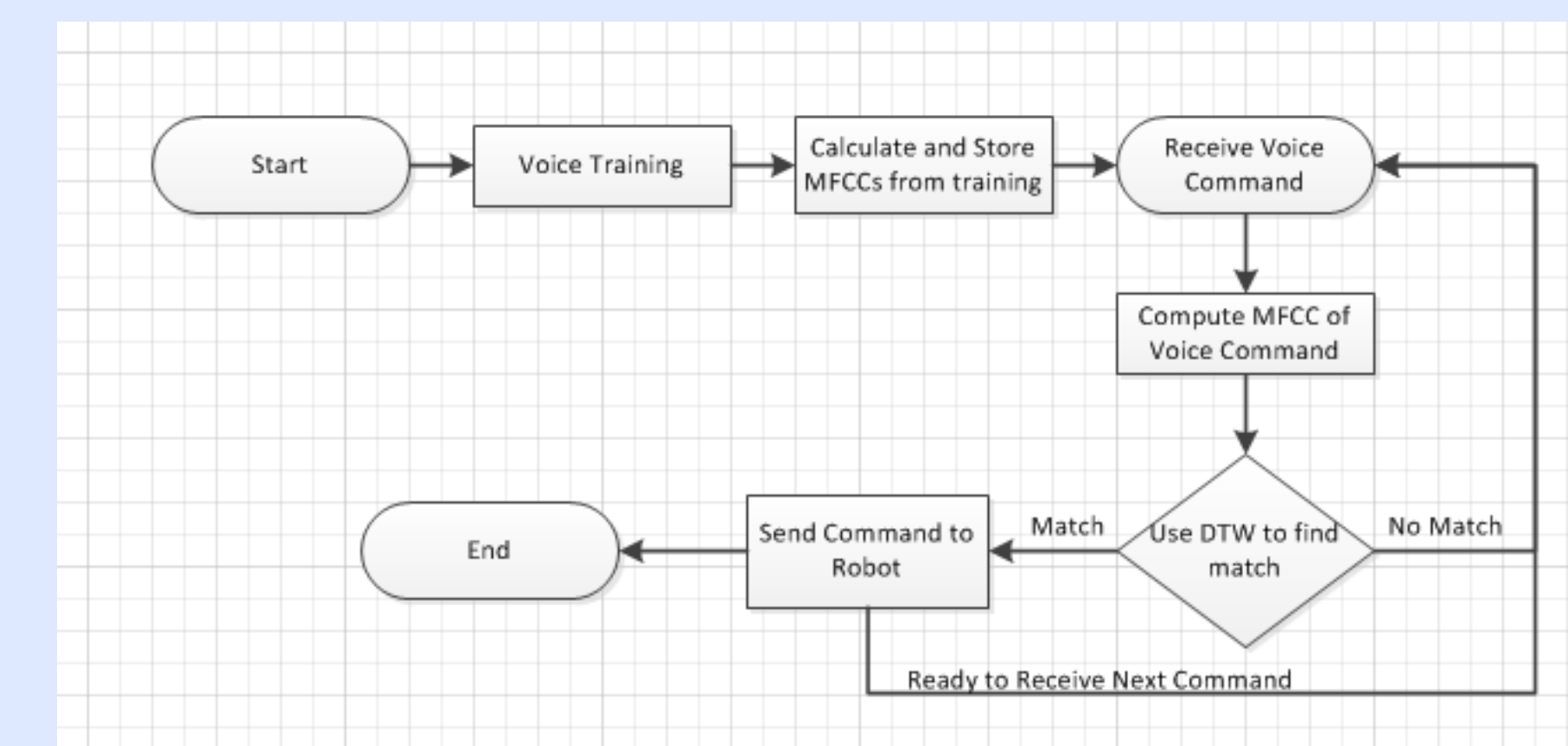
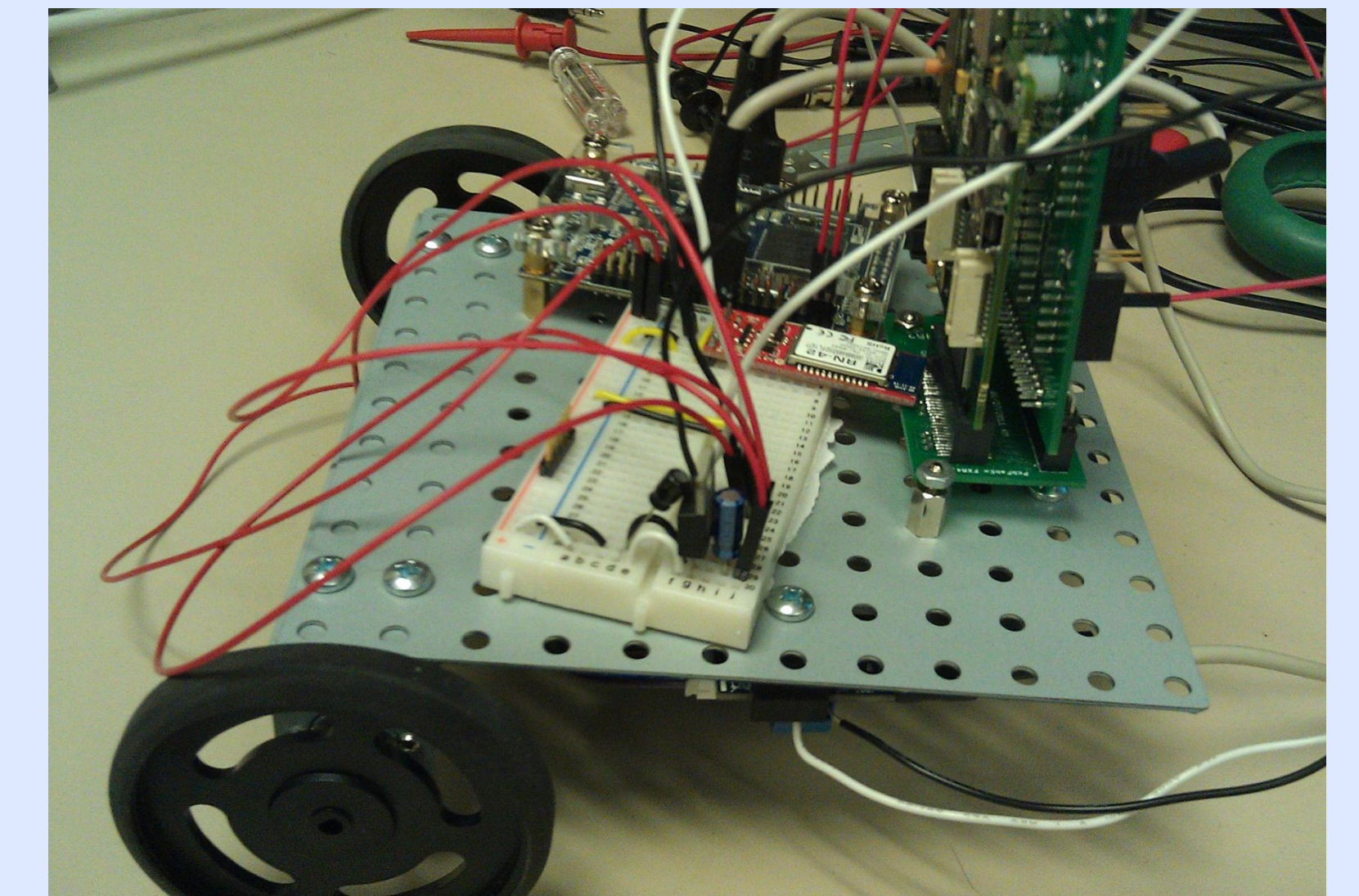
- ❖ Modern vehicles are becoming more autonomous with the introduction of new systems such as an adaptive cruise control and collision avoidance.
- ❖ Vehicles now offer voice recognition systems to control peripherals (navigations systems, media players, etc...) so the driver is not distracted while driving.

Methods Investigated

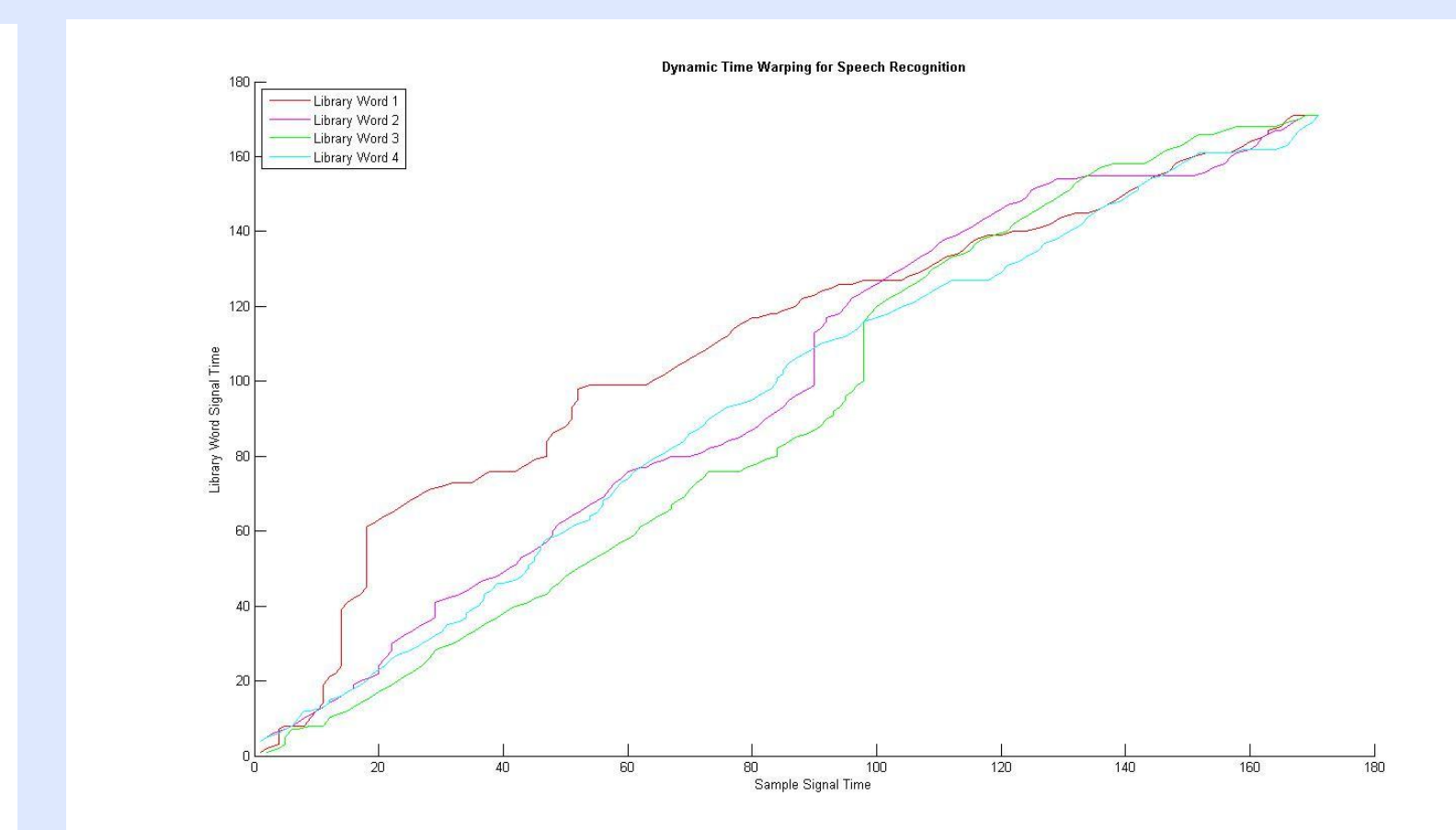
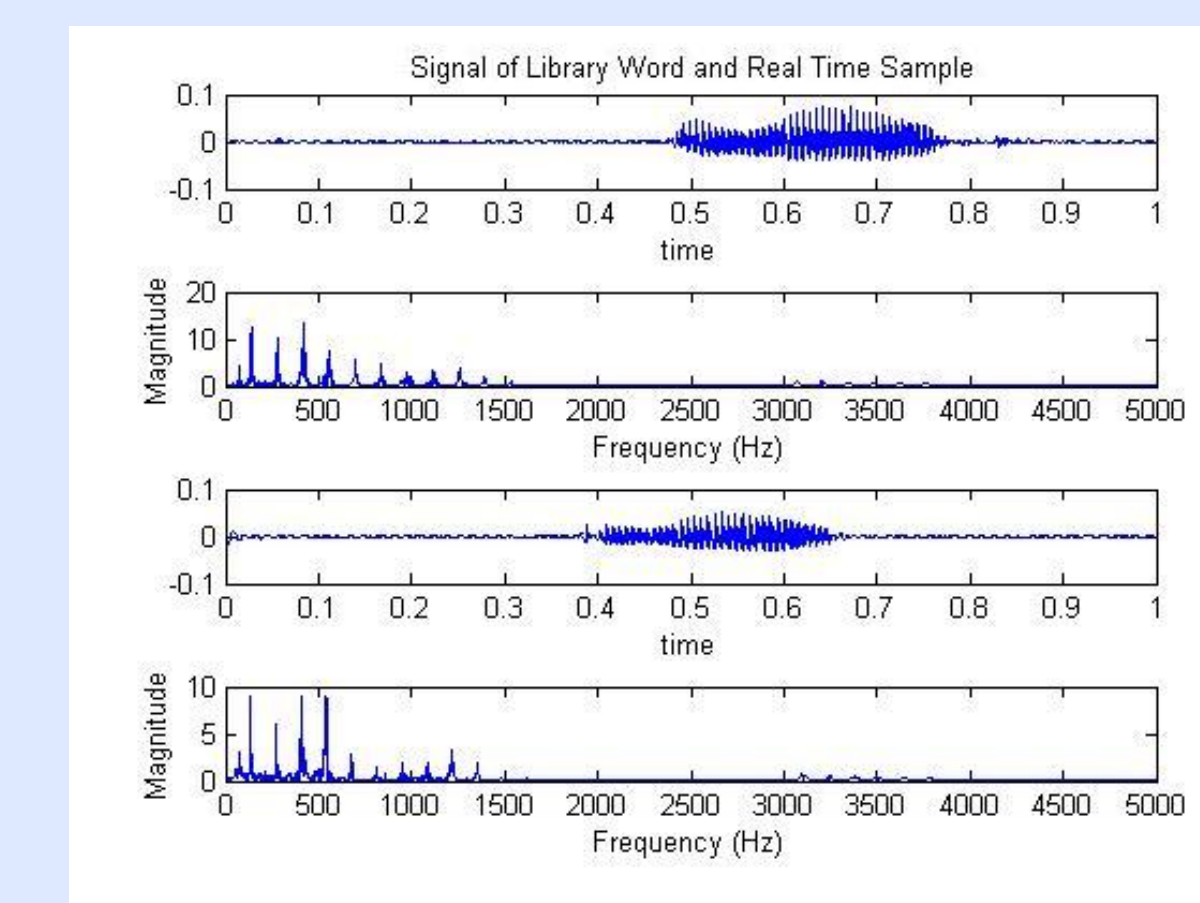
- ❖ Speech Recognition
 - ❖ Hidden Markov Model
 - ❖ Most predominant method for speech recognition
 - ❖ Used for systems with dictionaries of +1000 words
 - ❖ A statistical model in which the system is presumed to be a Markov process with unobserved states
 - ❖ Mel Frequency Cepstral Coefficients and Dynamic Time Warping
 - ❖ MFCC is a method which uses the mel scale to approximate voice signals more closely than linearly spaced frequency bands, leading to better audio feature extraction.
 - ❖ Algorithm for measuring the similarity between two signals that vary in time and speed
- ❖ Obstacle Avoidance
 - ❖ Gradient Decent and Laser Striper
 - ❖ This system will project a laser line into the surrounding objects.
 - ❖ A mounted camera will then see the line and process the distances of the objects based off of light intensity
 - ❖ This method is similar to laser range finders used on golf courses, but instead of just giving a distance in one direction, it will be able to give a larger field of view.
 - ❖ This approach uses weighted vectors to drive the robot in a desired direction while avoiding the objects closest to the robot
- ❖ Smartphone Application
 - ❖ Android based application

Results

- ❖ Robot
 - ❖ Hardware
 - ❖ Digilent Robot Base
 - ❖ Nano FPGA Board
 - ❖ C5515 DSP Processor
 - ❖ BlueSmirf Bluetooth
 - ❖ Ultrasonic Sensors
- ❖ Object Avoidance
 - ❖ Using ultrasonic sensors to determine the distance to near by objects
 - ❖ Use weighted vectors from distances to avoid objects
- ❖ Speech Recognition
 - ❖ Algorithm



- ❖ Dynamic Time Warping
 - ❖ Train algorithm by creating a library of stored recordings
 - ❖ Result is the library word closest to real time sample computed by dynamic time warping and least cost analysis



Acknowledgements

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