

Robotic Arm Controlled by Speech

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ABSTRACT

Diseases affect people all across the world. Diseases such as ALS (is a specific disease which causes the death of neurons controlling voluntary muscles). People affected with ALS can move difficult so they can't grab things easily too. I had an idea to help people affected by ALS grab things for them. My idea was to build a robotic arm controlled by speech. The project had two elements. Hardware: The robotic arm has four joints it can turn left-right, forward-backward. Software: To control something by voice, we need to have data storage because we need to use AI (Artificial Intelligence). In contrast to the natural, I hadn't used python before and did not know AI at all. So I start the project by using Googles AI or "Cloud Speech API" for education. The project is still in voice recognition phase. After the project was made I feel like it should be improved, so I work on the project in the next trimester. I changed my hotword detection from Cloud Speech API to Snowboy which is free software and can detect the Thai language and can be used offline. I also assembled a new robotic arm and tested it with a new function to brew tea. The robot can brew tea nicely.

Keywords

AI; Python; Google Voice; Snowboy; Raspberry Pi;

2. PROJECT DESCRIPTION

2.1 Project Overview

My project is a robotic arm controlled by voice as seen in Figure 1. My project was done by using Raspberry Pi3 B+ (Raspberry Pi is a small computer that we can program with Python as a microcontroller. Since it's a computer it can store data) with the Google AIY Voice Kit (It is a kit made by AIY made for doing projects about controlling by speech/voice) and the Cloud Speech API (It is an AI made by Google can recognize speech/voice, but it needs to connect to the cloud currently 300\$ per year). Using Python to program the AI to recognize speech and control the Robotic Arm. The commands that are available is Forward, Backward, Center, Left, Right, Front, Up, Down, Reset, Grab, Drop. Currently, because I'm using Google's AI, it's limited that it needs to connect to the internet to use.



Figure 1: Robotic Arm Controlled by Speech

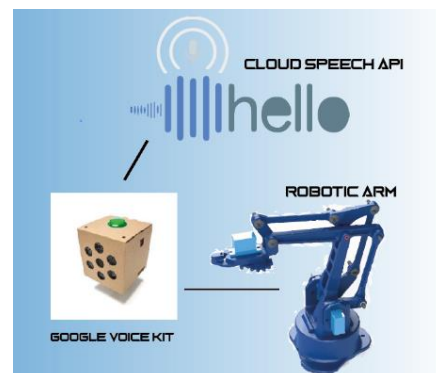


Figure 2: Project Diagram

On the second trimester, I used Raspberry Pi3 B+ with Snowboy which can detect any language and can be used offline. However is more difficult to use compared with Google API. I tried using Snowboy with simple functions such as saying the word “Sawasdee” (Hello in Thai) and then make Raspberry Pi responds with a BB8 voice (A famous robot in the Starwars film). After trying experiments several times with Snowboy, I started assembling a new robotic arm with higher quality and added a new function to brew a cup of tea. The brew tea function has two commands that are Cha Keaw (Green tea in Thai) and Earl Grey. The robotic arm will move to grab the tea bag and put it in the glass, shake it, and finally grab the tea bag in the waste box which is used to collect used tea bags. See how it works at the URL: https://www.youtube.com/watch?v=QPgksJ_jodw&t=20s

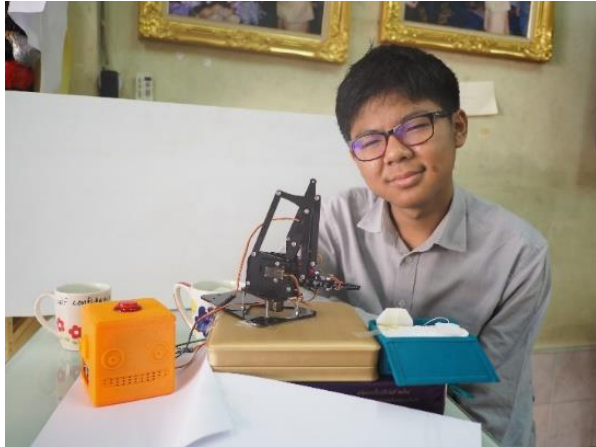


Figure 3: Robotic Arm Controlled by Speech V.2



Figure 4: Communication between the user and the robotic arm

2.3 Lessons Learned

From this project

- I learned how to use Snowboy.
- I learned Python.
- I learned more about designing and how to use Rhinoceros 6 to try making my robotic arm.
- I learned about inside the servo and how a servo works, which is very important to understand how it can move the robot arm
- I learned more about how to use the hand tools properly.

3. BIOS

Pannawish Boonto was born in Hamburg, Germany on 4 November 2004. I finish my Grade 1 from Grundschule Kerschensteinerstrasser. I moved back to Thailand when I was seven years old, and now I am studying in grade 7 at Darunsikkhalai School for Innovative Learning Thailand. I have done many projects in Fablab since I was in Grade 4. My previous project was Micro:Bit Child Tracker, LED pad for Speech-Impaired People to Talk with Others, and The Royal Boardgame. I like working in Fablab because it has many tools and easy to use; also I can get advice from the Fablab teachers.