INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

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wake word

FORGET "HEY SIRI"

Context

Aim :
Implement the Offline Speech Recognition technique in Teensy 4.0 as a smart home device

- Improve the quality of daily life.

Wake word detected : Wait for commands to run programs for different functions

- Switch on the LED
- Playing a song

Amazon Echo Dot 5

Proposition

Implementation :

- **Speech Recognition** : Frequency Detection
  - Study the frequencies for wake word and different commands
- **Adjust frequency range** : Assure the stability and response rate
- **Configure the functions** : Switch on LED on Teensy 4.0

Hardware :

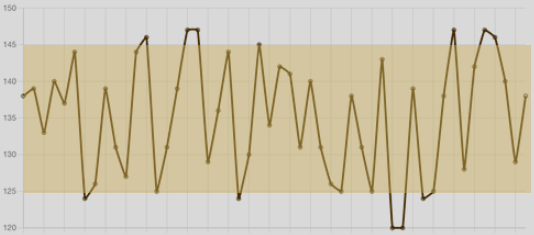
- Teensy 4.0
- Teensy Audio Shield
- Headset with microphone

Teensy 4.0

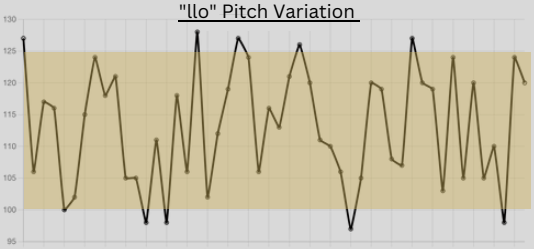
Results

Wake Word : Hallo

"Ha" Pitch Variation



"llo" Pitch Variation



Frequency range :

- "Ha" : >125 Hz & <145 Hz
- "llo" : >100 Hz & <125 Hz

Wake Word detected success rate : 90 %

Same application for the **commands detection**

Wake Word detected success rate

Source of errors :

- Accent
- Emotion
- Noise interference
- Health conditions

Frequency detection Speech Recognition

- **Benefits**
  1. Flexibility : Different languages and dialects
  2. Speed : Real-time processing
  3. Accuracy : Reliable and efficient
- **Disadvantages**
  1. Limited vocabulary : Complex words and phrases
  2. Speaker dependence : Age & Gender
  3. Limited context understanding : Homophones

See

Sea

Perspective and conclusion

Microcontrollers :
Perfect domestic IoT device

- ultra power-efficiency
- no external RAM

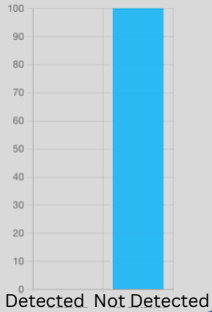
Frequency detection :
High dependency on the user

- Customisation
- Security

Extension :

- Controller for every home appliances

Wake Word detected success rate by non-user



Reference

[1] P. Setiawan and R. Yusuf. "IoT Device Control with Offline Automatic Speech Recognition on Edge Device". In: 12th (ICSET). Oct. 2022

[2] Fan-Gang Zeng et al. "Speech recognition with amplitude and frequency modulations" In: PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES Vol. 102 | No. 7. 15 Feb. 2005

Special Thanks:
Romain Michon
Tanguy Risset