Project Idea

### Overview

The Mimi-box party friendly game device is designed under the focus of a score-based fun for all ages game where each user has to try and imitate your fellow players voice given a turn-based rule set. Being the best mimic in a round will award a point in various game modes the point victory count and the pre-recorded speaker that will interchange between various situations to maintain entertainment, through the spontaneity and creativity with your voice utilizing accents, tongue twisters and any assortment of sounds the player can muster to through the opponent off, with the primary intention of inducing unique, ridiculous game play with high replay ability.

### Motivation

The reasoning behind the choice of the Mimi box is to have normalization of household party games for family and friends to enjoy and due to the given circumstances that Australia is in.

At the current time with "Social distancing and lack of a vaccine" people have be unable to be together let alone most entertainment being a form of online media gaming or movies. Found from the 2006 study that showed "the average 15 to 34-year-olds spends just under 3 hours with friends and 10 hours with their family each weekend". With this acknowledged and the given current situation COVID-19 brings we hope to facilitate the popularity of party games to support the demand for social interaction humans need, whilst introducing our product to a less populated market of modern gaming and be just as a standalone product within a global appeal based one functionality given language catering. This would function great for instant gratification and ideal for family fun nights or party with friends to promote social interaction among all members of any age and any number of players.

Melbourneinstitute.unimelb.edu.au. 2020. [online] Available at: <https://melbourneinstitute.unimelb.edu.au/\_\_data/assets/pdf\_file/0007/3376879/ri2020n08.pdf> [Accessed 20 October 2020].

Description (design, Gameplay)

The concept for the basic game loop is after starting the game with 2 or more players for the first user to input the number of players and then record a sound / message when prompted by the mimic box. When ready the player can press 'speak', this button will allow the user to record their input to be stored by the Mimi-box. Prior to the first input, each of the players will need to input their name so each user input can be identified then pressing skip will start the game which will first instruct the player of how the game works, with the recorded voice intention of being hard to repeat, after which the next and or all player/s will attempt to imitate what the first player sounded like which can be recalled by the player, and the individual with the highest accuracy will be considered the winner of the game/ round given the rule set you decide upon as a group.

A secondary game mode of the box to be called funny mode would provide a pre-stored sound effect which the players must aim to imitate collectively and whomever is closet wins said round/ game, these recorded inputs by players will have a timer to have the input be comparable so you as a player are on the clock to provide your statement, joke or accented sentence or whatever the player is capable of choosing within the frame of ten seconds,

The physical device is a raspberry pi that utilizes java and frontier series to compare the MEL-Frequency spectrum of a user input determined by contrasting the difference in frequency/ pitch, between the inputs to determine the most efficient match therefore a given winner of a set game of Mimi-Box, without any player input the game will pause and using the skip button is how to have the game continue between turns.

The physical design of the box is a 10cm x 10 cm case that closely resembles a hexagonal prism that can be seen (link here), holds the interior mechanisms audio and power within the casing with the boxes centre of mass being focused around the base, the device itself is generally expected to be utilized by children and or youth or perhaps adults that are inebriated, therefore, the device needs to be shock absorbent and liquid resistant so reduce direct damage to the functional hardware, the powering of the device will require 6xAA batteries that are found underneath the device in a screw bound compartment,

the box has majority of its user inputs taken on the faces at the top of the case consisting of five buttons, one power, two for volume(up/down) control, skip as a user’s continue button on one side and on the other speak, which behind the case there are small grated holes and the speak button is above when held will record clear and concise audio inputs,

and on the top an output speaker for the device to communicate the directions and next instruction.

(Mel frequencies)

Docs.nvidia.com. 2020. Audio Spectrogram — NVIDIA DALI 0.26.0 Documentation. [online] Available at: <https://docs.nvidia.com/deeplearning/dali/user-guide/docs/examples/audio\_processing/spectrogram.html#:~:text=error%3A%200.00359%20dB-,Mel%20spectrogram,by%20humans%20as%20being%20equidistant.> [Accessed 20 October 2020].

### Tools and Technology

The technology at hand is a Raspberry Pi Zero that would be arranged to run the game through a java code program that would take the users inputs as a measurement in Hz, then you would have to make an excerpt of the given audio signal, then is the users input and take the frontier transform (a composition of a signal over time given as a function that is subsequently broken into its constituent expressions of frequencies, From there you have to map the powers of given powers in correlation to the Mel spectrum specifically utilizing Triangular overlapping windows which provides the pitch of the speech given decibels/ amplitude of a dictation.

This can be used to compare the user pitch of input and to do as said you need to take the log of the each of the recorded Mel frequency's then performing a discrete cosine transform with the list of Mel frequency logged powers.

That will be your resulting signal that the other players are intending to match with, this is a MFCC's, in order to have the box perform a comparison it will be necessary compare each of the recorded Mel frequency's as matrices with identical vector signal size hence 10 seconds each is consistent per turn to have each matrix line up for comparison more dynamically for Frontier transformations, where taking the two inputs as A & B and the proposed distance between them being C which would function as (CxA)= X and (CxB) =y ,(X/Y) = your distance between the two frequency MFCC's and this is called speaker adaptation, notably the first coefficient provided by the MFCC is an expression of loudness,

And should be disregarded when the intention of the device is the comparison of utterances.

The physical components of the case that are found primarily within the box are a Adafruit 12S MEMS Microphone for sound input as well an mini HAT, the Adafruit 12S 3W Stereo Speaker Bonnet mini Kit, using 12S digital sound to create clear crisp audio, with the intention of efficiency and Saving power, the Mimi-box uses 1 mono 40mm diameter 4 Ohm 3-watt speaker. The power is provided by a 6xAA battery pack connected via a universal battery eliminator circuit that is within the aforementioned bottom skew compartment for ease of battery change and safe use.

En.wikipedia.org. 2020. Fourier Transform. [online] Available at: <https://en.wikipedia.org/wiki/Fourier\_transform> [Accessed 20 October 2020].

En.wikipedia.org. 2020. Window Function. [online] Available at: <https://en.wikipedia.org/wiki/Window\_function#Triangular\_window> [Accessed 20 October 2020].

similarities, S., 2020. Speech Comparison Algorithm For Rating On Similarities. [online] Signal Processing Stack Exchange. Available at: <https://dsp.stackexchange.com/questions/7581/speech-comparison-algorithm-for-rating-on-similarities> [Accessed 20 October 2020].

## Skills Required

Given the Raspberry Pi is Linux base operating software, in this particular case will need to install and have the device run java using Open-JDK as one of the most efficient ways to achieve development of variable loops. And comparisons as well as have methods to be called by the physical inputs of the user as a discrete function which can then be compared against each other to determine the winner of a round or game and perform various while loops, as well as actively declaring the user’s inputs as variables that can be correlated to integer values to then be evaluated and compared based on intensity/ amplitude to see how accurate the repeat of a given sequence is. With that in mind array values will need to temporarily store the variables of the inputs to match and the recordings that are being compared against within a margin of error and loop back turn by turn.

The hardware challenges that we will need to individually solder the microphone and pins and heads of each component to the raspberry Pi but thankfully the components themselves can be purchased from Adafruit and Pi hardware and are available as a direct bulk purchase, and distribution batches yet individual assembly is still required per unit production as well as development and implementation of java code to function for the game which can be implemented in FFT to capture the input and have an active and a copy as to store one array, then to compare each active player against the first input and log each players score to display at the end of a round/game.

Linuxize.com. 2020. How To Install Java On Raspberry Pi. [online] Available at: <https://linuxize.com/post/install-java-on-raspberry-pi/> [Accessed 20 October 2020].

Web.archive.org. 2020. Java Implementation Of The FFT Algorithm — CMD-C && CMD-V. [online] Available at: <https://web.archive.org/web/20120312201547/http://blog.datasingularity.com/?p=53> [Accessed 20 October 2020].

### Outcome

Our projects intended proposed idea is a feasible and fun game for the family to enjoy on a causal basis as a way of inclusive and open to all game to play that would be great for a family or making new friends or playing with established friends to increase the fulfillment of social interaction that we all require. To expand upon the voice recognition industry under the guides of creating an entertainment system that promotes creative social interaction as a household party game it is its purpose to draw attention to our needs as people in a modern society and revitalize the party game category, using the innovation of the dynamic raspberry pi and supporting hardware and software to present to you the Mimi-Box.

~subject to edit and here are the original references to save time ;)

instant gratification Elliot Taylor Panek 2012, Immediate Media: How Instant Gratification, Self-Control, and the Expansion of Media Choice Affect our Everyday Lives, Dissertation, viewed 13 September 2020, https://deepblue.lib.umich.edu/bitstream/handle/2027.42/94069/elpanek\_1.pdf?sequen

speech recognition DevTeam.Space 2020, How To Make A Speech Recognition System - Devteam.Space, viewed 08 September https://www.devteam.space/blog/how-to-make-a-speech-recognition-system/ [Accessed 13 September 2020]. https://www.devteam.space/blog/how-to-make-a-speech-recognition-system/

board game interest increase Arizton 2019, Board Games Market - Global Outlook and Forecast 2019-2024, company report 4841529, Research and Markets, viewed 12 September 2020 https://www.reportlinker.com/p05482343/Board-Games-Market-Global-Outlook-and-Forecast.html

news article for tabletop games Marie Elizabeth Oliver 2018, ‘The Seattle Times’, Join the party: Board game popularity just keeps growing, blog post, 14 February, viewed 10 September 2020, https://www.seattletimes.com/explore/shop-northwest/join-the-party-board-game-popularity-just-keeps-growing/

2006 statistics on how Australians use their time: Australian Bureau of Statistics 2008, How Australians Use Their Time, 2006, cat. no. 4153.0, ABS, Canberra, viewed 11th September 2020, https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4153.0Main+Features12006?OpenDocument

Hardware for Project:

Raspberry Pi zero W https://www.raspberrypi.org/products/raspberry-pi-zero-w/

Microphone input https://www.adafruit.com/product/3421

Mini HAT https://www.adafruit.com/product/3346

Speaker output https://www.adafruit.com/product/3968

DIY Portable Raspberry Pi Power Supply https://www.makeuseof.com/tag/pi-go-x-ways-powering-raspberry-pi-portable-projects/