Objectives

- To create a functioning program that can use audio input as commands that will influence a circuit's operation,
- To design and develop a prototype that will execute said commands through the application of integrated circuits,
- To provide a voice-controlled solution to prevent related electric circuit incidents, and
- To provide people with disabilities a convenient way to access home appliances much easier.
- To be able to be an effective basis for future researchers.

Users or Beneficiaries

The researchers aimed to develop a Voice-Activated Control System that will benefit the following:

Entrepreneurs

Entrepreneurs can use this to their advantage by coming up with new products to offer and coping up in modern society. Voice control systems are sweeping the market, delivering a new level of convenience to households throughout the world. Voice control systems have always implicitly or explicitly addressed users with visuals sometimes disguised as a more general goal of enabling eyes-free/eyes-busy or handsfree/hands- busy access to circuits and other applications.

Clients

Homeowners have introduced smart technology into their houses to make their lives more comfortable and convenient. Either people with physical disabilities, pregnant women, or modern family use several means to acquire access to information

technology. The goal is to give the user a tool that can translate the user's words as well as a human interpreter could.

Future researchers

The findings of this study will be useful to subsequent researchers working in the same area. There will be serve as a resource, a manual, or a basis for future, more thorough research.

Scope and Delimitation

The general intent of this study is to develop voice activated control system for the students of Bachelor of Science in Computer Engineering Block B at Pangasinan State University, Urdaneta Campus. This study will be conducted through researchers House. This study will cover implementations of voice activated control system using miniature house, the miniature and source code of the system will be provided for the demonstration of the system.

The system is focus on how to develop a Voice Activated Control System can be helpful to the staff of the electricity companies, Civil Engineers, and their client. The system has accessibility to control the circuit and appliances even at the long distance, and lastly the main objective of this system is to manage the safety of the buildings and houses of the clients. This study limits its respondents only to the students of Bachelor of Science in Computer Engineering Block B at Pangasinan State University, Urdaneta City Campus.

This project doesn’t cover:

a) Significant changes to a hardware component. Each component has a role to play in the build and each component is expected to do their job properly so there will be no disassembling of a unit.

b) Voice Recognition Ai training. The program will use a speech recognition package that includes a recognizer class, this class is responsible for the process's audio recording and speech-to-text conversion.

c) Offline Voice Recognition. Recognizers differ on each package and currently, the offline recognizers from the packages pocket sphinx (live speech) and vosk (Kaldirecognizer) are inaccurate, use large space consuming models, and/or slow.

d) The system will not use GUI and Mobile system to run the system. The miniature and source code of the system will be provided for the demonstration of the system.

Definition of terms

PyCharm - Is a dedicated Python Integrated Development Environment (IDE) providing a wide range of essential tools for Python developers, tightly integrated to create a convenient environment for productive Python, web, and data science development.

Python - Is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built-in 0data structures, combined with dynamic typing and dynamic binding; make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together (python.org).

Raspberry Pi Pico – Is a micro control and heart of our project that we use to control the circuit.

HC-06 Module – it is a Bluetooth module that we use to receive a voice command data and transmit to the raspberry pi Pico.

PySerial – is used in project to give support to our Data transmitter-to-receiver connection.

Google's Online Speech Recognition API – is an online speech recognition library this help on our project to convert speech to text.

Universal asynchronous receiver-transmitter (UART) - A universal asynchronous receiver-transmitter is a computer hardware device for asynchronous serial

communication in which the data format and transmission speeds are configurable this help on our project to transmit the data from the voice command to raspberry pi Pico.

Pycharm - Is a dedicated Python Integrated Development Environment (IDE) providing a wide range of essential tools for Python developers. this is the IDE that we use to develop the code.

Python - Is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built-in 0data structures, combined with dynamic typing and dynamic binding; make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together (python.org).

Conceptual Framework

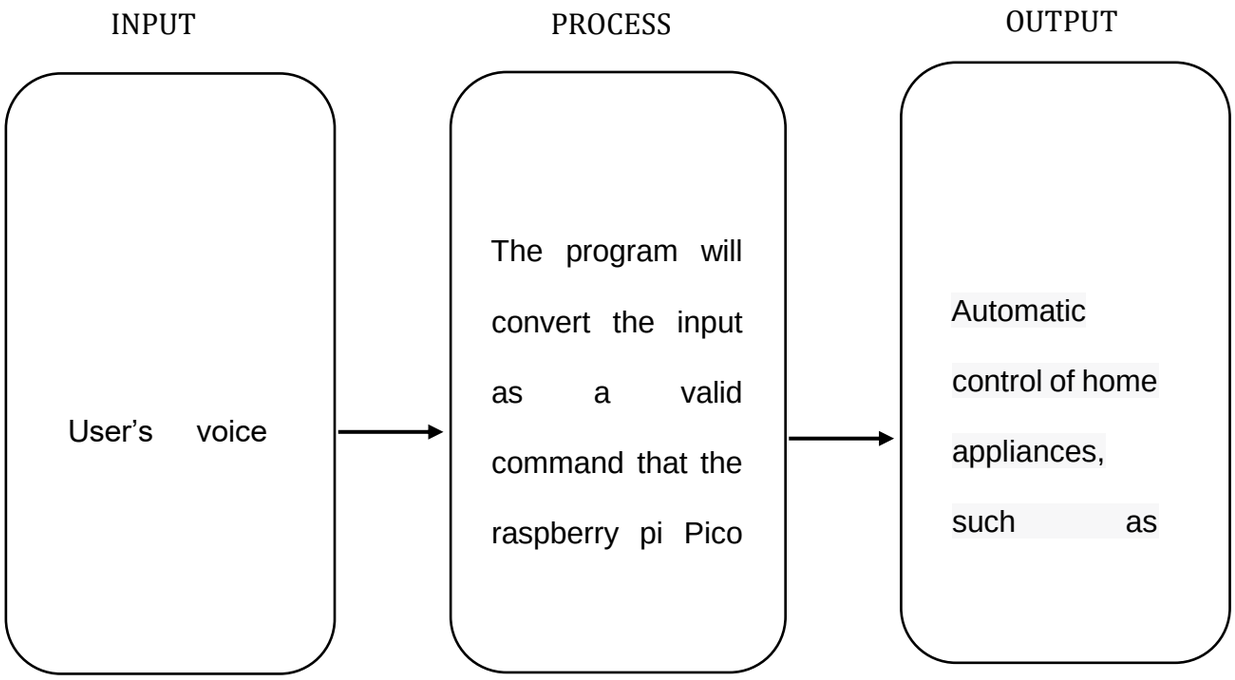


Figure 1. Conceptual Framework

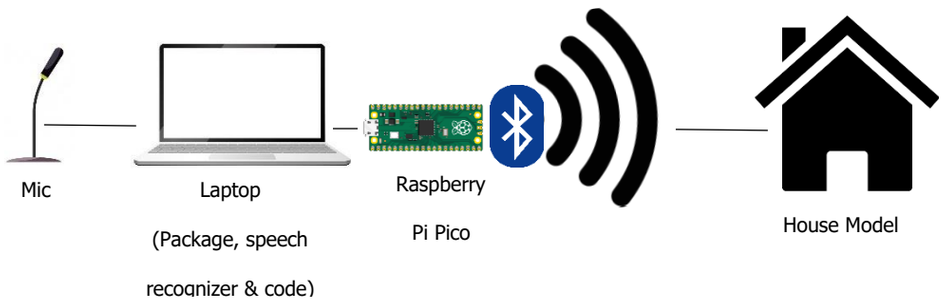
The conceptual framework of the study used an Input-Process-Output (IPO) model. This model is composed of three main components: Input, Process, and Output:

For input, using a microphone the user will give a specific voice command.

For the process, the speech recognition library in our program will listen to the voice input, and the input will then be converted into a string. If the string is a valid command, the program will send the data to the Bluetooth module then the module will transfer the data to raspberry pi Pico. The raspberry pi Pico will then relay or not relay current flow to the specific appliances connected to it around the house miniature.

For the output, specific appliances in the house miniature will be automatically controlled (such as automatically turning on and off) according to the voice commands that the user had given.

THEORETICAL FRAMEWORK

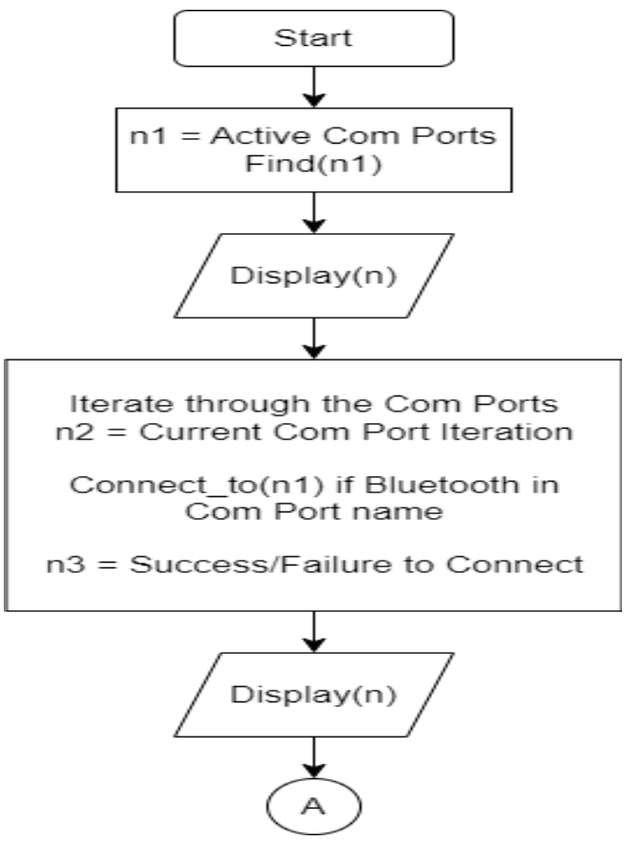


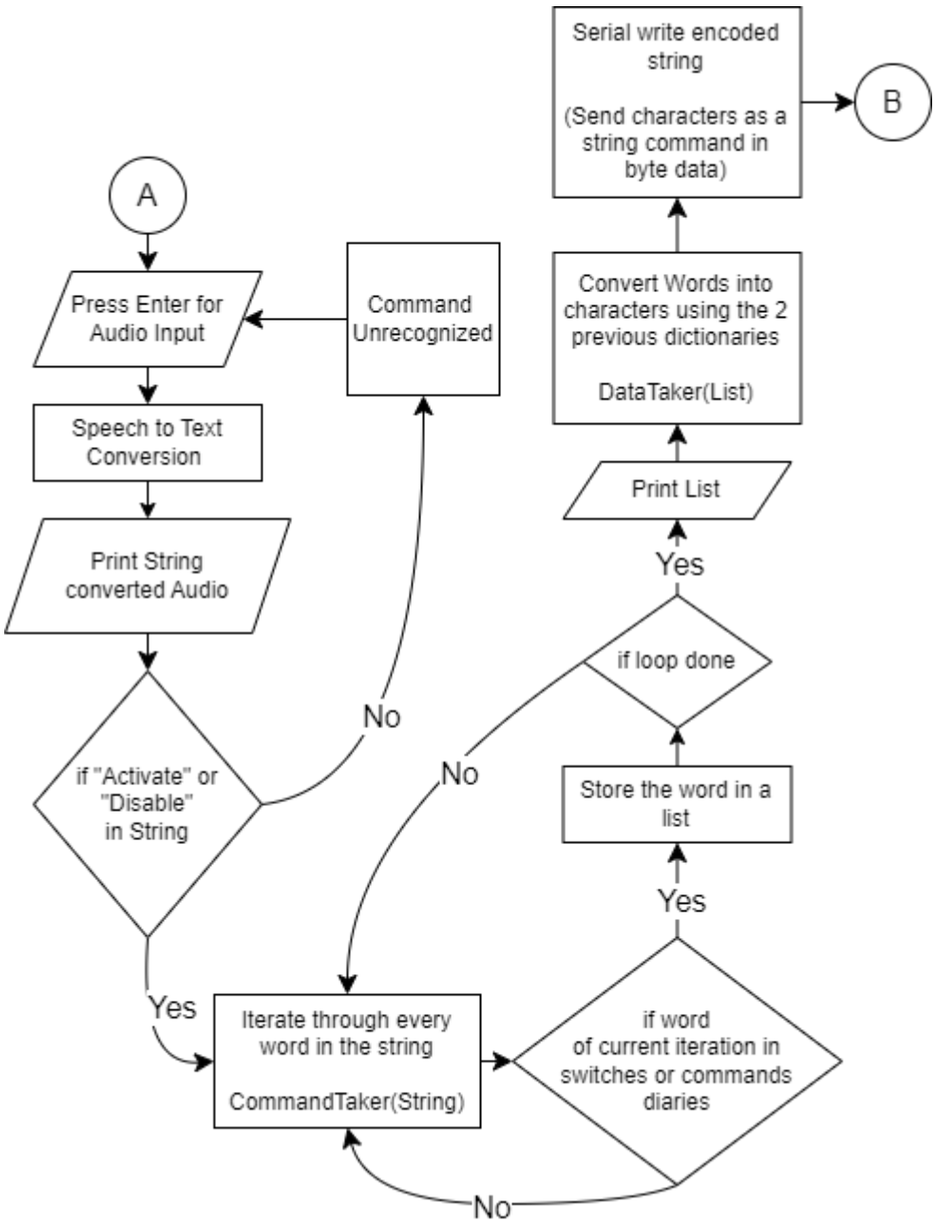
By using the package “PyBluez” or “PySerial”, this would connect two Python language programs in Bluetooth with the Raspberry Pi Pico. After the connection has been successfully linked, it can now receive speech input from the mic. To recognize the speech input of the mic, speech libraries are used to provide an easy way to work with the end-to-end speech recognition pipeline such as “Vosk”, “PocketSphinx”, or “Google Speech API”. With the mic and speech recognizer applied on the input, the code would process the speech library’s output data to a statement which would search for a match on the pre-determined commands. If the statement does match, the output would be done exactly as what the pre-determined commands are written to the house model.

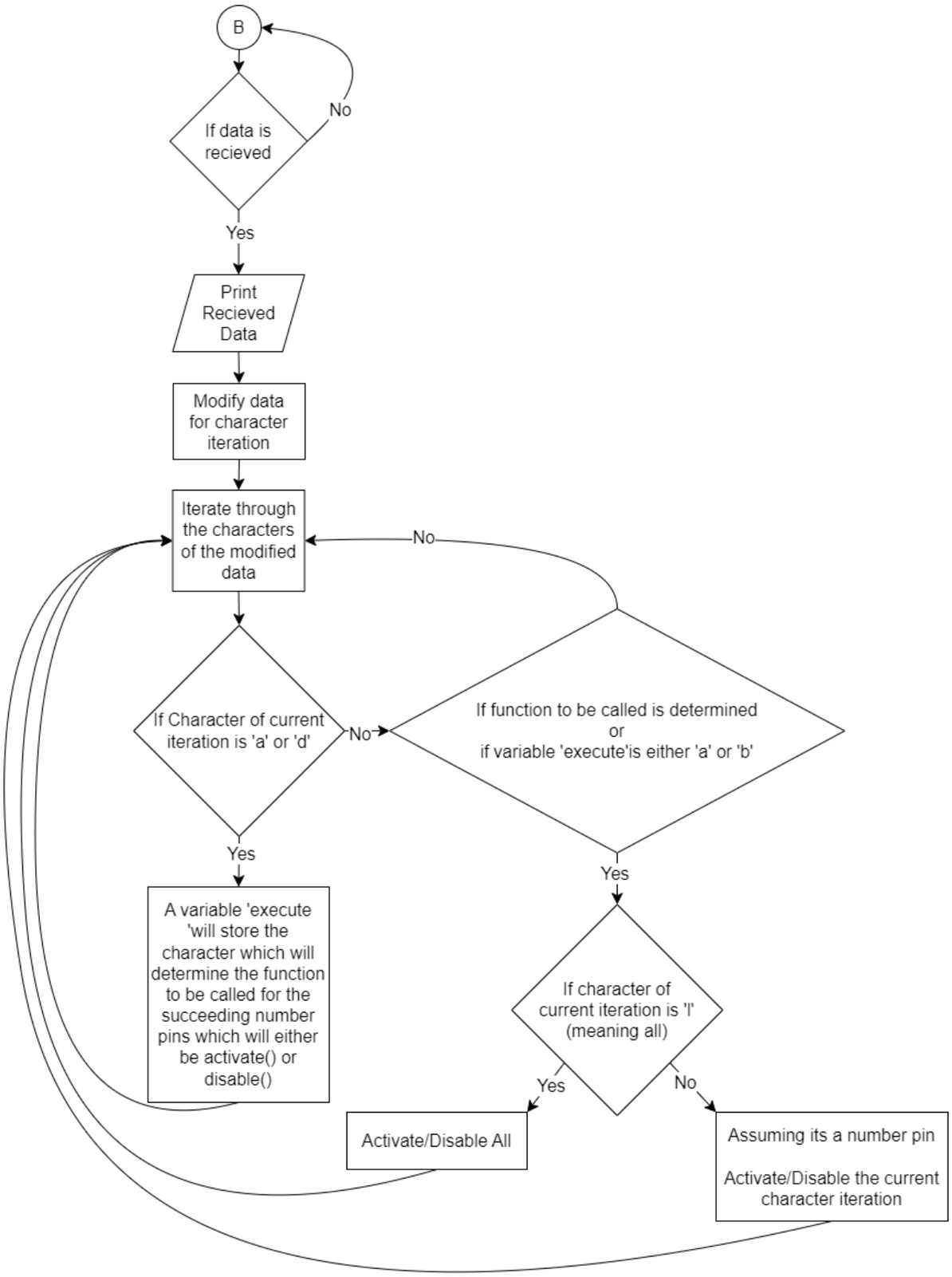
Methodology

The team worked together to discover packages, algorithms and research that is appropriate to the parts that make up our whole project. These being “Speech Recognition”, “Serial Connection” and “Hardware Builds”. Speech Recognition is created with a package of the same using a cloud speech API from google. This is a very powerful package that can recognize 100+ languages and has already built-in methods for microphone audio recording along with text conversion. Serial Connection is made using both the packages PySerial for the IDE program and UART for the raspberry pi Pico. The computer that runs the program and the micro-controller is connected by Bluetooth, this is done by both packages working on both ends with respective Bluetooth hardware modules, connecting to the correct communication port and matching each programs’ baud rates. Our hardware is made operational by 2 of our teammates enabling the distribution of electricity by activating the designated pins connected to different micro-devices.

The Flowchart that shows the flow of our project is displayed bellow:




A
Press Enter for Audio Input
Speech to Text Conversion
Print String converted Audio
if "Activate" or "Disable" in String
No
Command Unrecognized
Yes
Iterate through every word in the string
CommandTaker(String)
if word of current iteration in switches or commands diaries
No
Yes
Store the word in a list
if loop done
No
Yes
Print List
Convert Words into characters using the 2 previous dictionaries
DataTaker(List)
Serial write encoded string
(Send characters as a string command in byte data)
B


B
If data is recieved
No
Yes
Print Recieved Data
Modify data for character iteration
Iterate through the characters of the modified data
No
If Character of current iteration is 'a' or 'd'
No
If function to be called is determined or if variable 'execute'is either 'a' or 'b'
Yes
Yes
A variable 'execute 'will store the character which will determine the function to be called for the succeeding number pins which will either be activate() or disable()
If character of current iteration is 'I' (meaning all)
Yes
No
Activate/Disable All
Assuming its a number pin
Activate/Disable the current character iteration

Results and Discussion

The Project's final output includes a program from a phone connected wirelessly thru Bluetooth to an assembly of hardware(device) built by the project members. The program can record audio input from the microphone and translate it into a readable string, the program then checks the string and correlates with the possible executable commands. The commands are then sent via Bluetooth to the Bluetooth module within the device, this device is connected to several activatable components such as led lights and dc motors. Commands include the activation and deactivation of each or all components and will be executed immediately. After execution the program will then be waiting for another audio input a miniature model of a house was made mostly with cardboards and acrylic sheets bonded with glue stick. The Led lights served as light bulbs and dc motors served as fans, through voice commands, the fans and lights can be switched on/off at will by voice command. If this project could be developed and installed on households especially with those of disabilities, this could be a great help for them as they wouldn't bother to exert efforts in simply switching lights and fans. The developers plans on adding more features on the system by adding more appliances/switches that can be controlled. With the continuous ascend of technology, humans are keeping up by making this advance technology that helps people in living a convenient life.

https://avionmission.github.io/blog/convert-py-to-apk-using-python-and-buildozer/

https://realpython.com/python-speech-recognition/

https://singerlinks.com/2022/03/how-to-convert-microphone-speech-to-text-using-python-and-vosk/

https://www.geeksforgeeks.org/python-convert-speech-to-text-and-text-to-speech/

https://github.com/karulis/pybluez

https://www.verizon.com/articles/speech-recognition-technology/

https://www.speechly.com/blog/advantages-of-voice-user-interfaces

https://vilmate.com/blog/voice-user-interface-and-speech-recognition/

https://getaboutmobility.com.au/blogs/news/voice-recognition-help-people-with-disabilities

https://www.clickworker.com/customer-blog/speech-recognition-systems-for-disabled-persons/

https://www.w3.org/WAI/perspective-videos/voice/

https://www.kansai-td.co.jp/english/home/teiden-info/preparation/electrical-safety.html

Amount	Description
300	Raspberry Pi Pico - is the microcontroller used in the prototype for this project.
300	Hc-05 Bluetooth Module - used as the receiver, it receives data/program to the phone and transfers the data/program to Raspberry Pi Pico.
50	Breadboard is used to connect the jumper wire to the led light, micro motor and USB led lights.
40	Usb led lights is to represent the light bulb to this prototyping project.
30	Led lights constitute the light bulb for this prototyping endeavor.
50	Micro motor is the material used to depict the fan's motor in this prototype.
30	Pin male header 2.54mm pitch is used to put in Raspberry Pi Pico and it is used to connect the Raspberry Pi Pico to jumping wire.
50	Jumper wires (Female - Female) this material is utilized to link and transport data from the Hc-05 Bluetooth module.
90	Jumper wires (Male - Female) this material is used to connect between the Raspberry Pi Pico with Pin male header 2.54mm pitch to the breadboard

50	Propeller is the material used to simulate the fan in the micro motor.
190	Others include the cost of delivering the materials and other items that must be purchased in the future.
200	Color paint is the material that used to give appropriate design to the miniature
600	Card case, sticker paper and glue stick are the materials that need to assemble the miniature

Source Code:

Serial-Sr

```
import serial
import speech_recognition as sr
import serial.tools.list_ports

comdiary = {
    "activate":'a', "activity":'a',
    "disable":'d', "disabled":'d', "deactivate":'d'
}
numdiary = {
    "activate":'a', "activity":'a',
    "disable":'d', "disabled":'d', "deactivate":'d',
    "all":'l', "on":'l',
    "two":'2', "to":'2', "main":'2', "between":'2',
    "three":'3', "tree":'3', "girls":'3', "gals":'3', "gal":'3', "girl":'3',
    "four":'4',
    "for":'4',
    "boy":'4',
    "boys":'4',
    "voice":'4',
    "or":'4',
    "3/4":'34',
    "five":'5',
    "disco":'5',
    "christmas":'5',
    "front":'5',
    "door":'5',
    "coffee":'6',
    "relax":'6',
    "relaxing":'6',
    "kitchen":'7',
    "fan":'78',
    "pan":'78',
    "fans":'78',
    "pans":'78',
    "lights":'23456',
    "light":'23456',
    "indoor":'234',
    "indoors":'234',
    "outdoor":'56',
    "outdoors":'56',
    "living":'2',
    "leaving":'2',
    "ate":'8',
    "hate":'8',
    "last":'z'
}

def DataTaker(n):
```

```
    Data = ''
    for i in n:
        if i.isdigit():
            #Data.append(i)
            Data += i
        elif i in numdiary:
            #Data.append(numdiary.get(i))
            Data += numdiary.get(i)
    print('   Data to Encode:',Data)
    return f'{Data}'

def CommandTaker(n):
    Commands = []
    for x in n.split():
        if x.isdigit() and len(x) > 1:
            y = ' '.join(x)
            for i in y.split():
                Commands.append(i)
        else:
            Commands.append(x)
    print('   Commands:', Commands)
    return DataTaker(Commands)


ports = serial.tools.list_ports.comports()
print('Listing all Ports: (port: desc [hwid])')
for port, desc, hwid in sorted(ports):
        print(f" {port}: {desc} [{hwid}]")

global serialPort
#dic = {}
print('\nConnecting to HC-05')
connected = 0
while connected == 0:
    for portt, desc, hwid in sorted(ports):
        #dic[portt] = f'{desc} [{hwid}]'
        if 'Bluetooth' in desc:# and 'hc-05' in desc and 'out' in desc:
            print(f' Connecting to {portt}: {desc}')
            for i in range(3):
                try:
                    serialPort = serial.Serial(port=portt, baudrate=9600, timeout=0,
stopbits=1) # parity=None,
                    connected = 1
                    if connected == 1:
                        break
                except:
                    print('  Connection Failed')
#print(dic)
print('  Connection Successful\n')
```

```
r = sr.Recognizer()
gate = ''
waitcount = 0
while True:
    gate = input('Press Enter:')
    print('Please wait for "Speak"')
    if gate != None:
        try:
            with sr.Microphone() as source:
                print(" Adjusting for Ambience.")
                r.adjust_for_ambient_noise(source, duration=1) #pag wala to, it treats ambient noise as input,pinapabagal
                print("  Speak.",waitcount)
                waitcount += 1
                MyText = r.recognize_google(r.listen(source)).lower()
                print(f'   Mytext: {MyText}')
                if ("activate" in MyText or "disable" in MyText):
                    inp = ''.join(CommandTaker(MyText))
                    serialPort.write(inp.encode())
                    print(f'   Byte Encoded Data: {inp} \n')
                else:
                    print("   Command Unrecognized\n")
                gate = ''

        except sr.RequestError as e: #sadly dis api needs internet
            print('  Error Internet Connection Failed')
            gate = None

        except sr.UnknownValueError: # caused by no audio input or sometimes gibberish
            print("Unknown Value Error.\n")
            gate = None
            pass
```

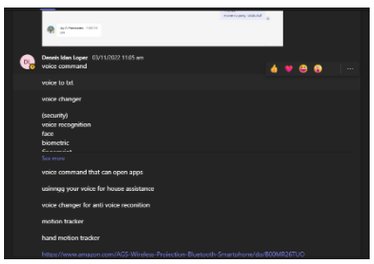
Raspi – final:

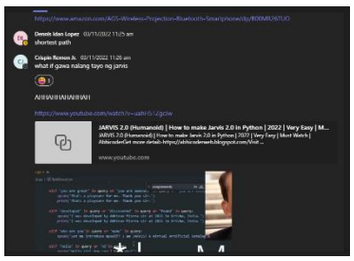
```
from machine import Pin, UART
from time import *
uart = UART(0, 9600)

execute = ''
command = ''

def activate(pin):
    if pin == 'l':
        for pins in range(2, 9):
            Pin(pins, Pin.OUT).value(1)
            print('Activated:', pins)
            sleep(1)
    elif pin == 'z':
        Pin(25, Pin.OUT).value(1)
```

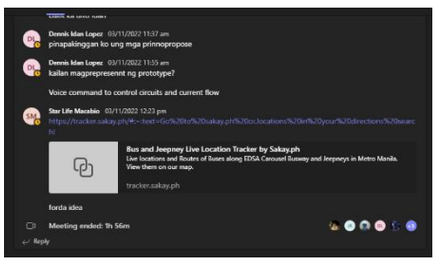
```
    elif pin.isdigit():
        Pin(int(pin), Pin.OUT).value(1)
    print('Activated:', pin)


def disable(pin):
    if pin == 'l':
        for pins in range(2, 9):
            Pin(pins, Pin.OUT).value(0)
            print('Disabled:', pins)
            sleep(1)
    elif pin == 'z':
        Pin(25, Pin.OUT).value(0)
    elif pin.isdigit():
        Pin(int(pin), Pin.OUT).value(0)
    print('Disabled:', pin)
while True:
    if uart.any():
        data = uart.read().lower() #readline()  # .lower()
        print('byte', data)
        temp = str(data)
        command = temp[2:-1]
        for i in command:
            if i == '1' or i == '0':
                continue
            elif i == 'a':
                execute = 'a'
            elif i == 'd':
                execute = 'd'
            elif execute == '':
                continue  # skip
            elif execute == 'a':
                activate(i)
            elif execute == 'd':
                disable(i)
            sleep(1)
        execute = ''
```

DOCUMENTATION:

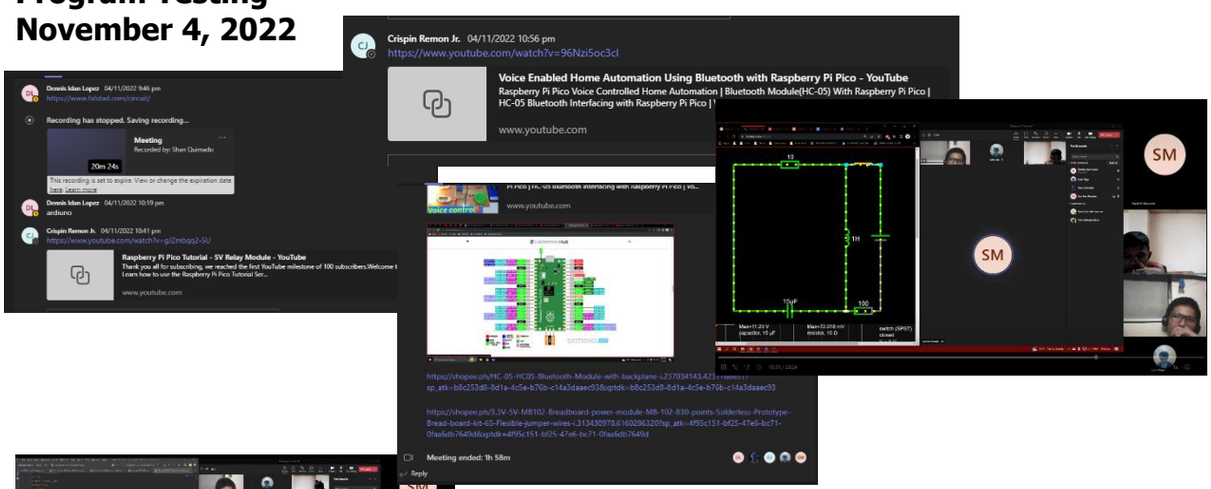
Planning for Title and Project Concept/Focus/Content
November 3, 2022

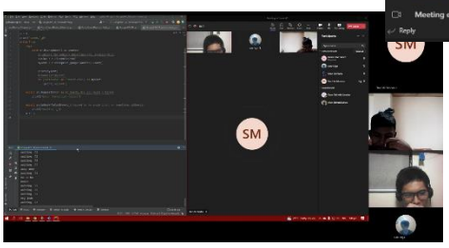




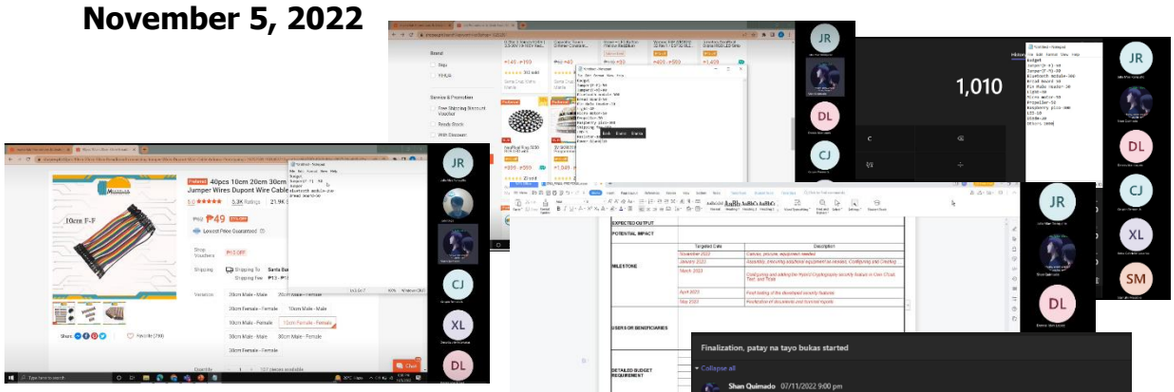


Program Testing
November 4, 2022

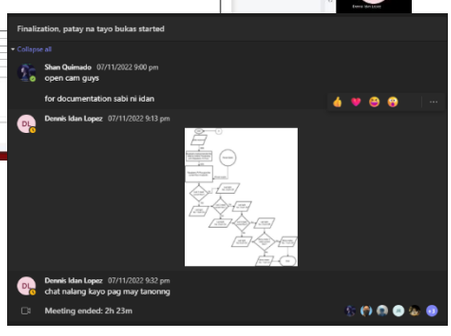




Planning for Materials, Finalized Title, Assigning Parts, and Preparation for the Checkup Defense
November 5, 2022

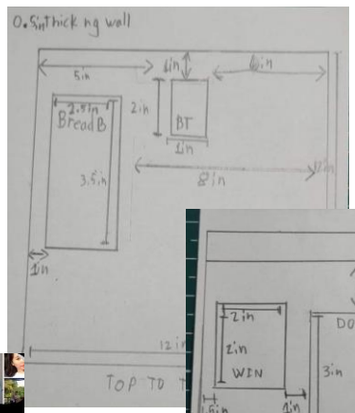


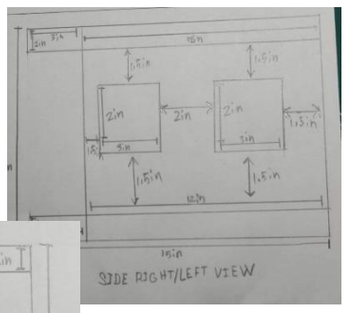
Before the day of the Check Up Defense (Supposed to be)
November 7, 2022

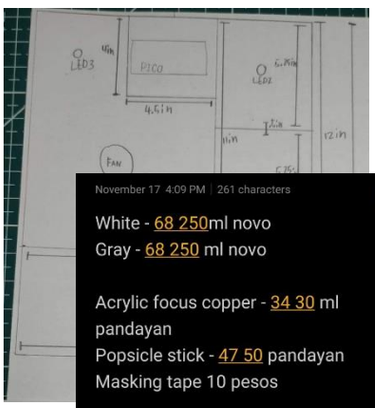


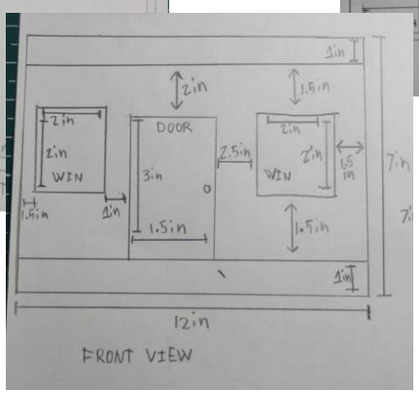
Title Defense
November 8, 2022

Floor Planning
November 10, 2022

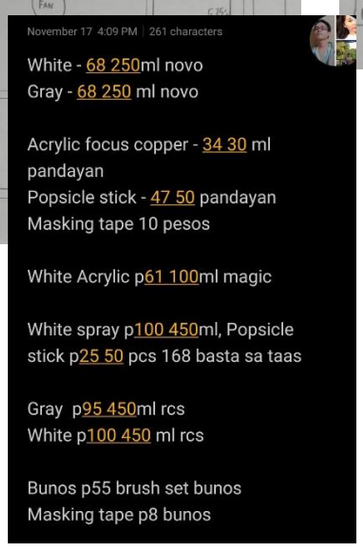






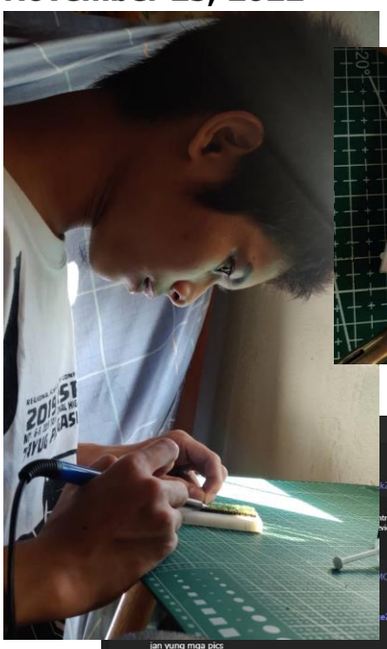


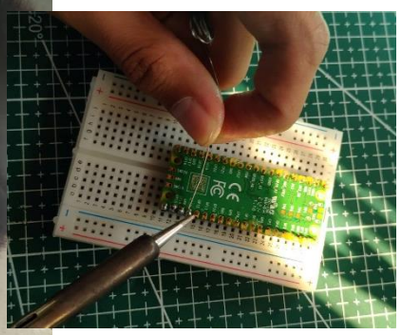
Canvassing Materials to be Used for the Miniature Model
November 17, 2022

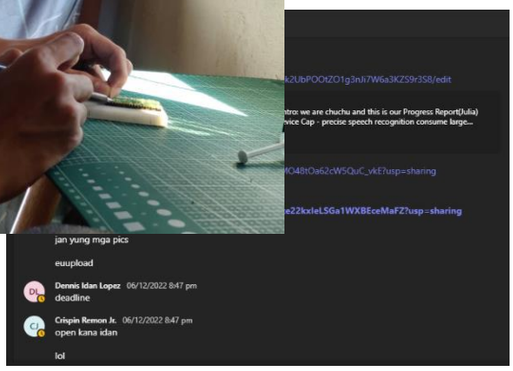


Soldering pi Pico and Testing the Raspberry with the Program

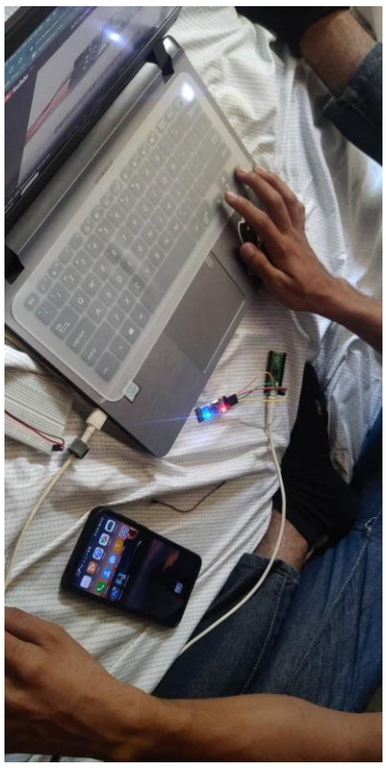
November 25, 2022



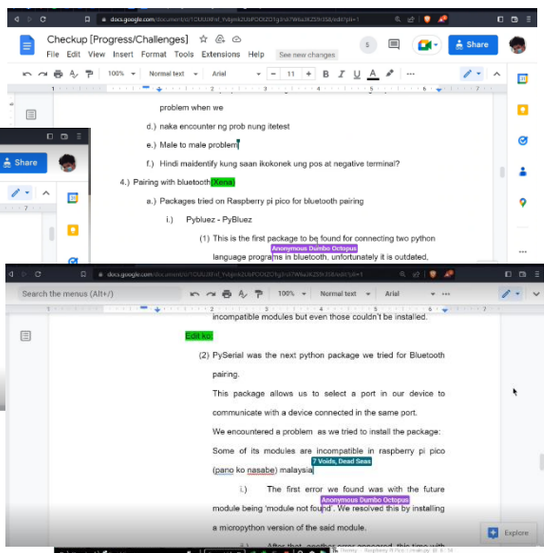


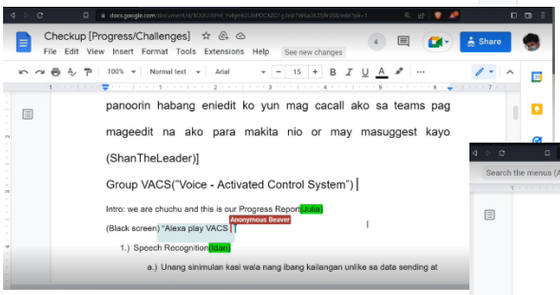


Sending links for the Check Up Progress and Documentation December 6, 2022

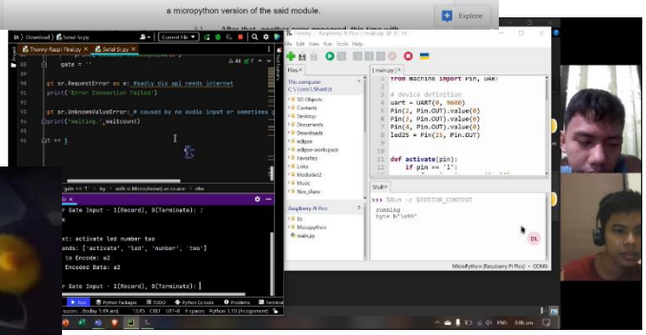


Editing the VACS Check-up Progress Report and Information to be Recorded December 7, 2022

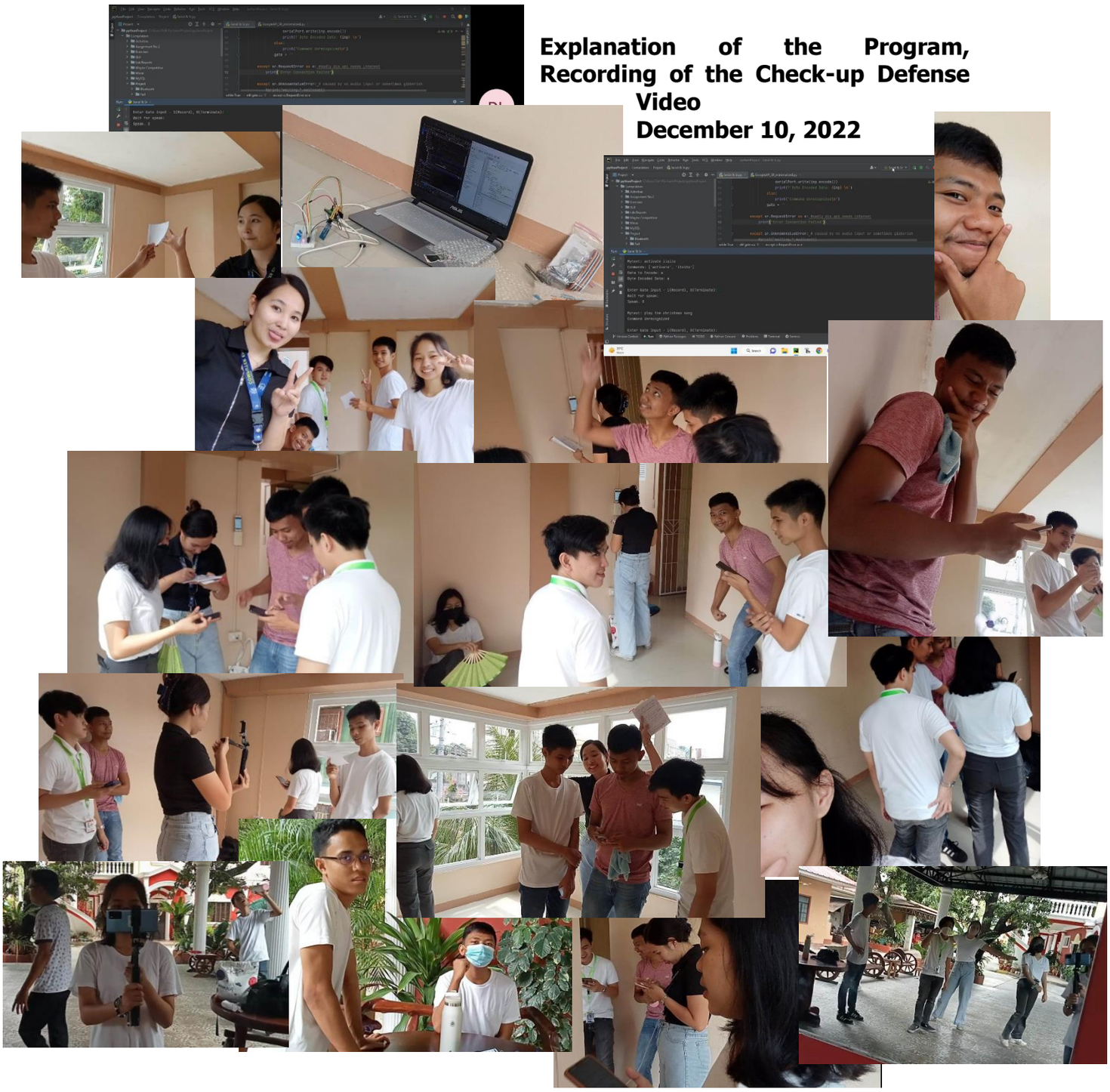


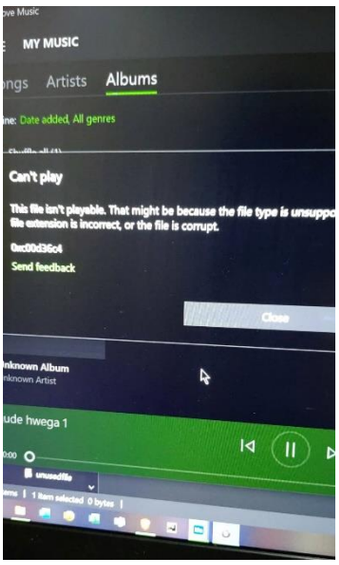


Testing the Program Again ft. lights and fan December 9, 2022



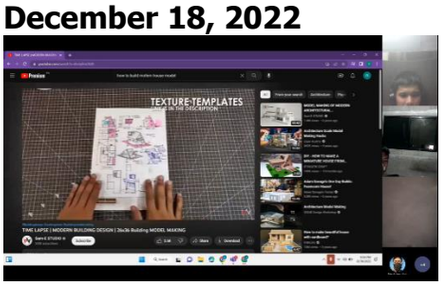
Explanation of the Program, Recording of the Check-up Defense Video
December 10, 2022





Editing of the Check-up Video
December 11, 2022

Meeting for the Floor Planning, watching tutorial videos for creating a miniature house and the procurement of materials to build.
December 18, 2022



Building the Miniature House Model
December 19, 2022 – January 15, 2023

CHAPTER VI: DOCUMENTATION