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Assignment Cover Letter

(Individual Work)

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Course Code	**: COMP6335**	**Course Name**	**: Introduction to Programming**
Class	**: L1AC**	**Name of Lecturer(s)**	: 1. Minaldi Loeis
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Title of Assignment (if any)	: Voice-controlled Actions		
Type of Assignment	**: Final Project**		
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Due Date	**: 20-11-2018**	**Submission Date**	**: 20-11-2018**

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“Voice-controlled Actions”

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1. Introduction

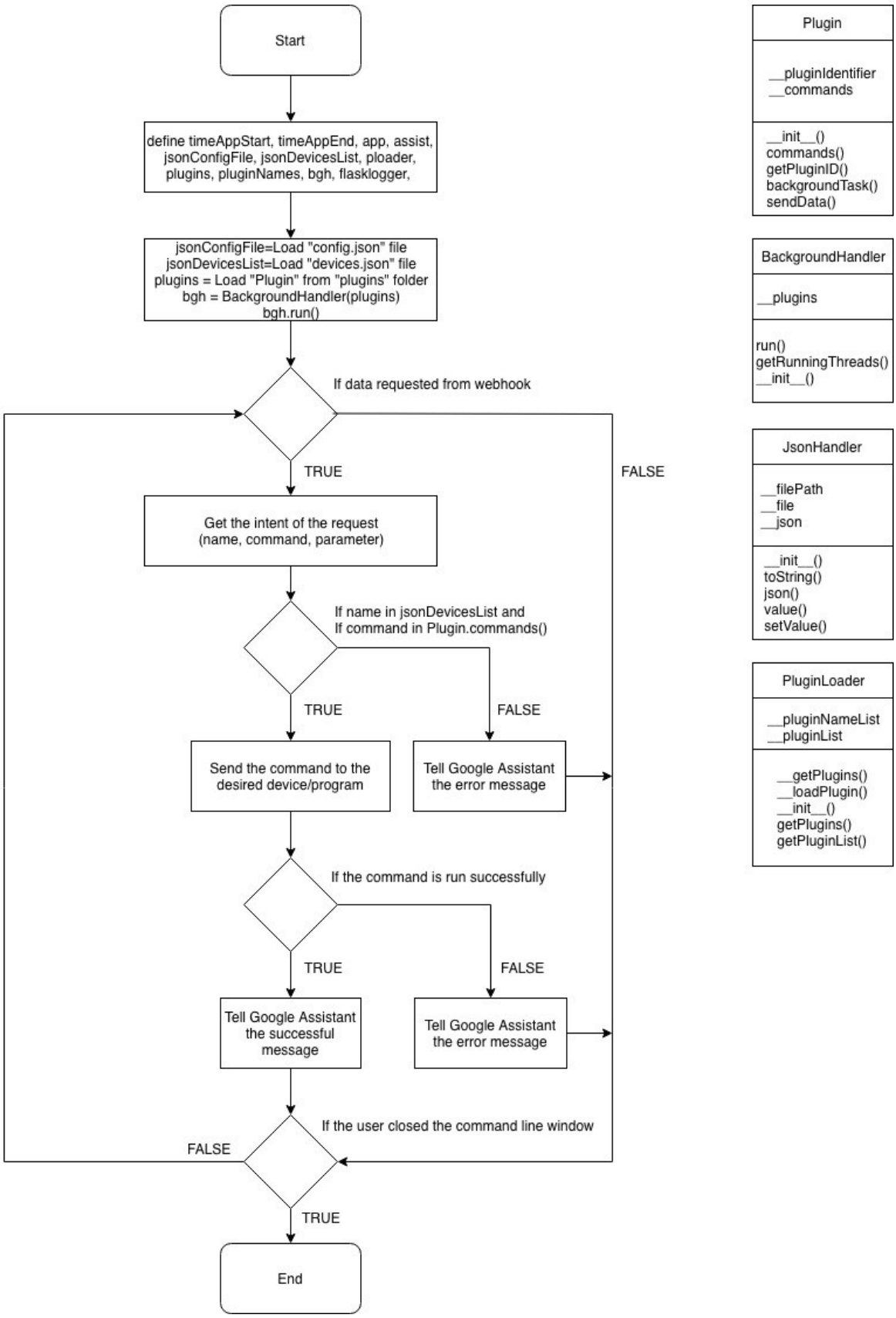
Concept

This program is designed to handle voice input from Google Assistant, and process it accordingly. It acts as a bridge for other programs, or even a microcontroller such as Arduino. It works by processing the user's input by voice. The program then processes what the user wanted to do, check if the action is set-up by the user and then sends the command to the program or device that the user intended to do.

Problem

Voice recognition and voice assistant technology are available for the past few years. But the technology is very underutilized. It had useful features already such as reminders, calendar management and many more. But there is no way to customize it fully by default. With this program, custom voice commands and actions are possible.

2. Design


Start
define timeAppStart, timeAppEnd, app, assist, jsonConfigFile, jsonDevicesList, ploader, plugins, pluginNames, bgh, flasklogger,
jsonConfigFile=Load "config.json" file
jsonDevicesList=Load "devices.json" file
plugins = Load "Plugin" from "plugins" folder
bgh = BackgroundHandler(plugins)
bgh.run()
If data requested from webhook
TRUE
FALSE
Get the intent of the request
(name, command, parameter)
If name in jsonDevicesList and
If command in Plugin.commands()
TRUE
FALSE
Send the command to the desired device/program
Tell Google Assistant the error message
If the command is run successfully
TRUE
FALSE
Tell Google Assistant the successful message
Tell Google Assistant the error message
If the user closed the command line window
FALSE
TRUE
End
Plugin
__pluginIdentifier
__commands
__init__()
commands()
getPluginID()
backgroundTask()
sendData()
BackgroundHandler
__plugins
run()
getRunningThreads()
__init__()
JsonHandler
__filePath
__file
__json
__init__()
toString()
json()
value()
setValue()
PluginLoader
__pluginNameList
__pluginList
__getPlugins()
__loadPlugin()
__init__()
getPlugins()
getPluginList()

3. Discussion

Implementation

To make this project possible, it uses API and external applications. This program depends on packages such as Flask, Flask-Assistant, paho-mqtt, and colorama. It also uses other applications nor services such as Dialogflow, Actions on Google, and ngrok.

Actions on Google is a service from Google for developers to connect Google Assistant with another service, Dialogflow. This is crucial to this project, as it uses Google's voice recognition services.

Colorama is a package that makes adding color easier on the command-line output. In this project, it is used to differentiate between different message easily. For example: info, errors, and warnings.

Dialogflow is a service that handles the input from Google Assistant and interprets the human language to something that computers can understand. This is used to determine what the user wanted to do and sends it to the program through a webhook request.

Flask is a web framework used to handle webhook requests from Dialogflow. Flask works with Flask-Assistant to parse the data from Dialogflow.

Ngrok is a program to forward local web servers to the internet. In this project, its used as an alternative for port-forwarding.

How it works

When the program starts, it will initialize the Flask framework first. The program then reads the "config.json" file which contains the configuration of the app and reads "devices.json" file which contains the things that can be controlled. When that's done, the program will load the modules stored in the "plugins" folder. Then the program will run "backgroundTask()" function from the loaded plugins. That function is running all the time, parallel with the main code. It handles actions that are needed to be done while the main code is still running. In this case, one of the plugins will check the connection to a device periodically. After all of this process, the program will wait for webhook requests from Dialogflow.

The plugin system works by having identical classes in different files within the same folder. The class has to have the same name (in this case the class name must be "Plugin"), core attributes (__pluginIdentifier, __commands), and core methods (commands, getPluginID, backgroundTask, and sendData). It is needed because the main program will call those methods. If another attributes or methods are needed, it needs to be called by one of those methods. The plugin files are loaded using a module built into Python called importlib. The function of importlib is to dynamically import modules, so it does not have to be hardcoded like "import plugin1", "import plugin2", etc.

When the program received a webhook request, it will first determine what's the intent of the request. Then it will run the processes needed for certain intent. It will check if the "name" on the webhook request is listed in jsonDeviceList. Then it will check id the plugin ID configured in the devices.json file exists. It will also check if the "command" on the webhook request is on the plugin's "command" attribute. If all of the conditions are true, the program will send the command to the desired device. If one of them is false, it will tell the

user that something is wrong. After the code runs, it will check if the command is sent successfully, by waiting for a message sent back from the device. If the message is received by the program, then we can assume that the command has been received and done successfully. If there is no response, it will tell the user that something went wrong.

Ngrok is used so the local web server can be accessed from the internet. It's used as an alternative for port forwarding which is not an option for some places like public Wi-Fi networks. This is mainly used for connecting between programs on a different network and can be used for webhook address for Dialogflow. But in this case, the program will be running on a virtual private server (with a static IP address), and the other program that's controlled are running on a PC, thus ngrok is used on the PC (which the IP address changes dynamically).

Code Explanation

main.py

```
13  import time
14  import logging
15  import json
16  from datetime import datetime as dt
17  from flask import Flask, request
18  from flask_assistant import Assistant, ask
19  from modules.consolelog import log
20  from modules.jsonhandler import JsonHandler as JSON
21  from modules.pluginloader import PluginLoader
22  from modules.backgroundhandler import BackgroundHandler
```

This part of the code is used to import the modules from the "modules" folder, and imports the packages needed for this program.

```
25  # ----- MAIN INITIALIZATION ----- #
26
27  timeAppStart = time.time()      # Gets the time that the app started
28  log("MAIN", 0, "Initalizing Flask and Flask-Assistant...")
29  app = Flask(__name__)
30  assist = Assistant(app, route='/')
31
32  # Load the JSON files
33  jsonConfigFile = JSON("config.json")
34  jsonDeviceList = JSON("devices.json")
35
36  # Load plugins
37  ploader = PluginLoader("plugins")
38  plugins = ploader.getPlugins()
39  pluginNames = ploader.getPluginList()
40
41  # Run background tasks for each plugin
42  log("MAIN", 0, "Running plugin background tasks...")
43  bgh = BackgroundHandler(plugins)
44  bgh.run()
45
46  # Disables or enables the flask command line output depending on what the user
47  # had already set on config.json file.
48  if jsonConfigFile.json()["flaskLogging"] == 0:
49      log("MAIN", 2,
50          "flaskLogging is set to 0. Will not show flask command line output.")
51      flasklogger = logging.getLogger('werkzeug')
52      flasklogger.setLevel(logging.ERROR)
53  elif jsonConfigFile.json()["flaskLogging"] == 1:
54      log("MAIN", 2,
55          "flaskLogging is set to 0. Will show flask command line output.")
56
57  timeAppEnd = time.time()        # Gets the time that the app finished loading.
58  log("MAIN", 0, "DONE in {}s".format(round((timeAppEnd - timeAppStart), 3)))
59
```

timeAppStart and timeAppEnd are used to count on how long it takes for the program to load everything. It's used for debugging purposes as it helps what changes made the program slower. The variable app = Flask(__name__) basically initializes Flask based on the QuickStart guide. assist = Assistant(app, route='/') initializes Flask-Assistant also based on the QuickStart guide. jsonConfigFile and jsonDeviceList are an object of a class "JsonHandler". It

reads the config.json file and devices.json file to be accessed later during runtime. bgh is an object of a class “BackgroundHandler”. It loads background tasks that from each plugin. The variable flasklogger is used to disable the command line output of flask, except for error messages.

```
61  # A function that handles data sending to a certain plugin that returns
62  # a boolean value
63  def sendData(plugin, id, value, param):
64      for i in range(len(pluginNames)):
65          if pluginNames[i].lower() == plugin.lower():
66              if plugins[i].sendData(id, value, param):
67                  return True
68      return False
69
70  # A function that handles data sending to a certain plugin that returns
71  # a string
72
73
74  def sendDataStr(plugin, id, value, param):
75      for i in range(len(pluginNames)):
76          if pluginNames[i].lower() == plugin.lower():
77              return plugins[i].sendData(id, value, param)
78      return False
79
80
81  # A function to log the HTTP request activities
82  def httpLogging(ip, path, method, time):
83      log("MAIN", 0, "{} {} \"{}\" at {}".format(ip, method, path, time))
84
```

The “sendData” function is used to call the “sendData()” function of the desired plugin and passes the information to it. It will return a Boolean value. On the other hand, “sendDataStr()” has the same function, but it will return a string. This is used when a plugin outputs a string. The “httpLogging()” function is there for debugging purposes. It prints the information when a HTTP request is made.

```
89  # ----- HTTP REQUEST HANDLING ----- #
90  # This part of the code is mainly used for debugging purposes. Some of it is
91  # used to communicate between programs via the internet
92
93  # Shows the message when user opened "/" in the web browser, indicating that
94  # the program is running successfully
95  @app.route("/")
96  def httpRoot():
97      time = dt.now().strftime("%Y/%m/%d %H:%M")
98      httpLogging(request.remote_addr, request.path, request.method, time)
99      return "If you see this message, the program is running."
100
101
102 # Shows the devices.json file when user opened "/devices.json"
103 @app.route("/devices.json")
104 def httpDevicesJson():
105     time = dt.now().strftime("%Y/%m/%d %H:%M")
106     httpLogging(request.remote_addr, request.path, request.method, time)
107     return jsonDeviceList.toString()
108
109
110 # Shows the config.json file when user opened "/config.json"
111 @app.route("/config.json")
112 def httpConfigJson():
113     time = dt.now().strftime("%Y/%m/%d %H:%M")
114     httpLogging(request.remote_addr, request.path, request.method, time)
115     return jsonConfigFile.toString()
116
117
118 # Shows the list of running threads when the user opened "/threads"
119 @app.route("/threads")
120 def httpThreadsList():
121     time = dt.now().strftime("%Y/%m/%d %H:%M")
122     httpLogging(request.remote_addr, request.path, request.method, time)
123     return str(bgh.getRunningThreads())
124
125
```

```
126  # This function is simillar to @app.route("/devices.json"), but it
127  # returns only specific JSON key requested (<deviceID>) when called
128  @app.route("/devices/<deviceID>")
129  def httpDeviceJson(deviceID):
130      time = dt.now().strftime("%Y/%m/%d %H:%M")
131      httpLogging(request.remote_addr, request.path, request.method, time)
132      try:
133          keyValue = str(jsonDeviceList.value(deviceID))
134      except (KeyError):
135          return '{"ERROR": "KeyError"}'
136      else:
137          return keyValue
138
139
140  # Sends command based on the device ID specified on the json file, and check
141  # if the plugin has the command or not. This can be used for debugging, or
142  # for another program to commmunicate with each other
143  @app.route("/devices/<deviceID>/<command>/<param>")
144  def sendCommand(deviceID, command, param):
145      time = dt.now().strftime("%Y/%m/%d %H:%M")
146      httpLogging(request.remote_addr, request.path, request.method, time)
147
148      # check if the deviceID is on the devices.json file
149      if deviceID in jsonDeviceList.json():
150          pluginType = jsonDeviceList.json()[deviceID]["type"]
151          pluginID = pluginNames.index(pluginType)
152
153          # if the command requested is on the commands list on each plugin
154          if command in plugins[pluginID].commands():
155              cmdList = plugins[pluginID].commands()
156              # check if the command is registered in the plugin's command list
157              for i in range(0, len(cmdList)):
158                  if command == cmdList[i]:
159                      if not plugins[pluginID].sendData(deviceID, command,
160                                                        param):
161                          return '{"return": "SendDataFalse"}'
162          else:
163              # fallback code
164              return '{"return": "UnknownCommandError"}'
165
166          return '{"return": "success"}'
167
168      else:
169          # if the key (deviceID) is not found
170          return '{"return": "KeyError"}'
171
```

This part of the code is used to handle HTTP requests through the web browser. It's mainly used for debugging purposes, but some are for communicating between programs. In this case, the WindowsControl plugin needs another program to send its address, so the other program will pass the address using the "sendCommand" function. The @ symbol at the "@app.route()" is a decorator function. It is used by flask to run certain steps when the user requested certain address.

```
#  ----- DIALOGFLOW INTENT HANDLING ----- #
# This part of the code handles the input from Google Assistant.

# Actions to do if "toggleOnOff" intent is triggered by voice or text
# via Google Assistant
@assist.action('toggleOnOff', mapping={'bool': 'boolean', 'obj': 'any'})
def dflowToggle(bool, obj):
    log("MAIN", 0, "Received \"toggleOnOff\" intent from Dialogflow.")
    keys = jsonDeviceList.json().keys()
    for i in keys:
        # Check if the device name that the user wanted to send command to\
        # exists in the devices.json
        if jsonDeviceList.json()[i]["name"].lower() == obj.lower():
            # If the data is sent successfully
            if sendData(jsonDeviceList.json()[i]["type"], i, bool, ""):
                log("toggleOnOff", 0, "Command sent successfully")
                speech = "Ok. the {} is {}".format(obj, bool)
                return ask(speech)
            else:
                log("toggleOnOff", 2, "Command not sent.")
                return ask(dflowErrMsg)
    log("toggleOnOff", 2, "Command not sent (UnknownDevice:{})".format(obj))
    return ask("Sorry, I don't know a device called {}".format(obj))

# Actions to do if "appOpen" intent is triggered by voice or text
# via Google Assistant
@assist.action('appOpen', mapping={'app': 'appName', 'action': 'action',
                                   'device': 'deviceName'})
def dflowOpenApp(app, action, device):
    log("MAIN", 0, "Received \"appOpen\" intent from Dialogflow.")
    keys = jsonDeviceList.json().keys()
    for i in keys:
        if jsonDeviceList.json()[i]["name"].lower() == device.lower():
            response = sendDataStr(jsonDeviceList.json()[i]["type"], i, action,
                                   app)
            try:
                responseJSON = json.loads(response)
            except Exception as e:
                log("appOpen", 1, "Failed to parse response: {}".format(e))
                return ask(dflowErrMsg)
            else:
                log("appOpen", 0, "Successfully parsed response.")
                # If the command ran successfully
                if responseJSON["return"] == "1":
                    log("appOpen", 0, "Action ran successfully.")
                    return ask("Ok.")
                else:
                    # This part handles the error message that will be told to
                    # the user when it encountered errors.
                    if responseJSON["msg"] == "ProcAlreadyRunning":
                        log("appOpen", 2, "Only one instance of {} is allowed"
                            .format(app))
                        return ask("I can't run multiple instances of {}."
                                   .format(app))
                    elif responseJSON["msg"] == "ProgNotFound":
                        log("appOpen", 2, "Unknown Program: {}".format(app))
                        return ask("I don't know a program called {}."
                                   .format(app))
                    elif responseJSON["msg"] == "InvalidAllowMultipleVal":
                        return ask("There's something wrong with your \
                        configuration file. Check the file and restart the\
                        Windows client, then try again.")
    # Shows the response from the plugin, to further investigate the error if
    # an error happened
    log("appOpen", 2, "Response: {}".format(response))
    log("appOpen", 2, "Action failed to run.")
    return ask("I can't do that action for some reason. Check \
    the console for more information.")
```

This part of the code handles the user input (from Google Assistant). @assist.action() is a decorator function used, so Flask-Assistant can do the actions we wanted to do.
@assist.action("appOpen", mapping={'app': 'appName', 'action': 'action', 'device': 'deviceName'})
"appOpen" is the intent specified on Dialogflow. The keys in "mapping" is used to map variables from Dialogflow webhook requests to Python variables (the key will be the Python variable; the value is the variable from Dialogflow).

modules/consolelog.py

```
from colorama import init, Fore, Style
init()


def log(moduleName, type, string):
    # Coloring for types of console logging
    if type == 0:
        t = "{}INFO{}".format(Fore.BLUE, Style.RESET_ALL)
    elif type == 1:
        t = "{} ERR{}".format(Fore.RED, Style.RESET_ALL)
    elif type == 2:
        t = "{}WARN{}".format(Fore.LIGHTYELLOW_EX, Style.RESET_ALL)

    n = "{}{}{}".format(Fore.LIGHTCYAN_EX, moduleName, Style.RESET_ALL)
    print("{} [{}] {}".format(t, n, string))
```

This module prints the command line output and adds color to differentiate between the message type. There are three different types of command line output defined by this code, which is info, error, and warning. Those three different types have its own color. The color is handled by a package called colorama.

modules/backgroundhandler.py

```
import threading
from modules.consolelog import log


class BackgroundHandler:
    # Initialize the object with a list that contains plugins.
    def __init__(self, plugins):
        log("BGHANDLER", 0, "Loaded {} plugins.".format(len(plugins)))
        self.__plugins = plugins

    # Runs all the plugins on the plugins list.
    def run(self):
        for plugin in self.__plugins:
            pName = plugin.getPluginID()
            log("BGHANDLER", 0, "Running {} background task...".format(pName))
            t = threading.Thread(target=plugin.backgroundTask,
                                 name=pName)
            t.start()

    # Gets the list of running threads
    def getRunningThreads(self):
        return threading.enumerate()
```

This module handles the running of the background tasks that each plugin has. It works by applying the concept of multithreading using the Threading module built into Python. “self.__plugins” is a list containing an object “Plugin”. The “run()” method will loop through the “self.__plugins” list and runs the “backgroundTask()” method that each plugin has. “getRunningThread()” method returns the current active threads.

modules/jsonhandler.py

```
12  import json
13  from modules.consolelog import log
14
15
16  class JsonHandler:
17      def __init__(self, path):
18          try:
19              self.__filePath = path
20              self.__file = open(path, "r").read()
21          except Exception as e:
22              log("JSON", 1, e)
23          else:
24              self.__json = json.loads(self.__file)
25              log("JSON", 0, "Loaded {}".format(self.__filePath))
26
27      def toString(self):
28          return json.dumps(self.__json)
29
30      def json(self):
31          return self.__json
32
33      def value(self, key):
34          return self.__json[key]
35
36      def setValue(self, key, value):
37          try:
38              self.__json[key] = value
39          except Exception as e:
40              log("JSON", 1, e)
41              return False
42          else:
43              return True
```

This module contains a class that is used to load JSON file and store it in the memory which will be used later when a program needs data from the JSON file. JSON itself is an abbreviation of “JavaScript Object Notation”. In this case, it is used for storing configuration files.

modules/pluginloader.py

```
13  import importlib
14  import os
15  from modules.consolelog import log
16
17
18  class PluginLoader:
19      # Gets the list of python files in the directory.
20      def __getPlugins(self, pluginDir):
21          for (dirpath, dirnames, filenames) in os.walk(pluginDir):
22              x = []
23              x.extend(filenames)
24              x = x[::-1]
25              xa = []
26              for i in range(0, len(x)):
27                  if ".py" in x[i]:
28                      x[i] = x[i].replace(".py", "")
29                      xa.append(x[i])
30              return xa
31
32      # A method to construct the plugin and put the plugins in a list
33      def __loadPlugin(self, pluginDir, pluginNameList):
34          plugins = []
35          for i in range(len(pluginNameList)):
36              log("MAIN", 0, "Loading plugin {}".format(pluginNameList[i]))
37              pluginFile = str(pluginDir) + "." + str(pluginNameList[i])
38              currentPlugin = importlib.import_module(pluginFile, ".")
39              plugins.append(currentPlugin.Plugin())
40          return plugins
```

```
41
42      def __init__(self, pluginDir):
43          self.__pluginNameList = self.__getPlugins(pluginDir)
44          self.__pluginList = self.__loadPlugin(pluginDir, self.__pluginNameList)
45
46      def getPlugins(self):
47          return self.__pluginList
48
49      def getPluginList(self):
50          return self.__pluginNameList
```

This module is the core of the modularity part of this program. This module is used for plugin related task. It loads plugins from the specified plugins directory. This is possible with a module built into Python called importlib. Importlib is a module that can import modules dynamically. Rather than having all modules imported manually (for example: import plugin1; import plugin2; etc.), it will look for python files in the plugins folder, then imports it automatically. The "__getPlugins()" method is used to get the list of Python files (.py) in the directory. The "__loadPlugin()" method is used to get the class inside the Python files and construct it into a list. Since the Python files has the same class inside of it which is "Plugin", It can just loop through the list of plugin files and construct the object and put it in a list. Those 2 functions then will be called when the class "PluginLoader" is initialized by the "__init__()" method. The other two methods "getPlugins()" and "getPluginList()" will be called in the main.py file.

plugins/powercontrol.py

```
15  from datetime import datetime as dt
16  import json
17  import threading
18  from modules.consolelog import log
19  # import paho.mqtt.client as mqtt
20  import paho.mqtt.publish as publish
21  import paho.mqtt.subscribe as subscribe
22
23
24  class Plugin:
25      # function to open the configuration file
26      def __openConfig(self):
27          try:
28              file = open("plugins/powercontrol/config.json", "r").read()
29          except (FileNotFoundError):
30              log("POWERCONTROL", 1, "Config file not found.")
31              exit()
32          else:
33              log("POWERCONTROL", 0, "Loaded config.json")
34              return json.loads(file)
35
36      # plugin initialzation
37      def __init__(self):
38          self.__pluginIdentifier = "powerControl"
39          self.__commands = ["on", "off", "toggle"]
40
41          # loads the config.json and set each keys to a variable
42          self.__configFile = self.__openConfig()
43          self.__MQTT_ADDRESS = self.__configFile["MQTT_ADDRESS"]
44          self.__MQTT_PORT = self.__configFile["MQTT_PORT"]
45          self.__MQTT_KEEPALIVE = self.__configFile["MQTT_KEEPALIVE"]
46          self.__MQTT_RESPONSE_TIMEOUT = self.__configFile[
47              "MQTT_RESPONSE_TIMEOUT"]
48
49          currentDT = dt.now().strftime("%Y/%m/%d %H:%M")
50          log("POWERCONTROL", 0, "PowerControl initialized at {}"
51              .format(currentDT))
52
53          # temporary variable for thread returns
54          self.__tempVerifyThread = []
55
56      def commands(self):
57          return self.__commands
58
59      def getPluginID(self):
60          return self.__pluginIdentifier
```

```
61
62      def getPluginType(self):
63          return self.__pluginType
64
65      def backgroundTask(self):
66          log("POWERCONTROL", 2, "No background task. Quitting thread...")
67
68      def __simpleSubscribe(self, topic):
69          msgRcv = subscribe.simple(topic, hostname=self.__MQTT_ADDRESS,
70                                    port=self.__MQTT_PORT,
71                                    keepalive=self.__MQTT_RESPONSE_TIMEOUT,
72                                    msg_count=1)
73          self.__tempVerifyThread.append(str(msgRcv.payload)[2:-1])
74
75      def sendData(self, id, val, param):
76          if val == "on":
77              value = 1
78          elif val == "off":
79              value = 0
80          elif val == "toggle":
81              value = 2
82
83          log("POWERCONTROL", 0, "Sending value '{}' in key '{}' to {}"
84              .format(value, id, self.__MQTT_ADDRESS))
85          try:
86              # Try publishing a message to the MQTT broker
87              self.__tempVerifyThread = [""]
88              publish.single(id, value, hostname=self.__MQTT_ADDRESS,
89                             port=self.__MQTT_PORT,
90                             keepalive=self.__MQTT_KEEPALIVE)
91          except Exception as e:
92              log("POWERCONTROL", 1, "{}".format(e))
93              return False
94          else:
95              log("POWERCONTROL", 0, "Successfully sent to MQTT broker.")
96              log("POWERCONTROL", 0, "Waiting for verification...")
97              try:
98                  # A thread used to wait for incoming message from the device
99                  # that it sent the message to. This is part of the
100                 # verification process
101                 verifyThread = threading.Thread(target=self.__simpleSubscribe,
102                                                 args=(id+"R",))
103                 verifyThread.start()
104                 verifyThread.join(timeout=self.__MQTT_RESPONSE_TIMEOUT)
105                 msgRcv = self.__tempVerifyThread.pop()
106             except Exception as e:
107                 log("POWERCONTROL", 1, e)
108                 return False
109             else:
110                 # If the message is sent and the verification message is
111                 # received
112                 if msgRcv == "MSGRCV {} {}".format(id, value):
113                     log("POWERCONTROL", 0,
114                         "Successfully received verification request.")
115                     return True
116                 else:
117                     log("POWERCONTROL", 1, "Request timed out.")
118                     return False
```

This plugin is made to forward what the user wants to do, to devices using the MQTT (Mosquitto) protocol, for example: lights, power sockets, etc. In this project, it is used to send data to an Arduino. Arduino is a microcontroller that can be programmed easily. When “sendData()” method gets the data (arguments) from the “sendData()” on the main.py file, it will try to connect to the MQTT broker (a program that handles MQTT message publishing and subscribing) and sends the message to the broker (line 88). The cons of using MQTT, there is no way to determine if the message is received by another device by default. To solve this problem, the other device has to send a message back to the program, so that the program knows that the message has been sent successfully. The program waits for message (line 101) until a certain timeout value stored on the powercontrol’s config.json file. If the program received a message, then it’s safe to say that the message went through, and vice versa.

plugins/windowscontrol.py

```python
from datetime import datetime as dt
from modules.consolelog import log
import json
import time
import urllib.request


class Plugin:
    # A method to open the configuration file.
    def __openConfig(self):
        try:
            file = open("plugins/windowscontrol/config.json", "r").read()
        except (FileNotFoundError):
            log("WINDOWSCONTROL", 1, "Config file not found.")
            exit()
        except Exception as e:
            log("WINDOWSCONTROL", 1, "Error: {}".format(e))
        else:
            log("WINDOWSCONTROL", 0, "Loaded config.json")
            return json.loads(file)

    def __init__(self):
        self.__pluginIdentifier = "windowsControl"
        self.__commands = ["run", "kill", "check", "setaddr"]

        self.__configFile = self.__openConfig()
        self.__isDynamicAddress = self.__configFile["isDynamicAddress"]
        self.__desktopAddress = self.__configFile["desktopAddress"]
        self.__pingInterval = self.__configFile["pingInterval"]

        currentDT = dt.now().strftime("%Y/%m/%d %H:%M")
        log("WINDOWSCONTROL", 0, "WindowsControl initialized at {}"
            .format(currentDT))

    def commands(self):
        return self.__commands

    def getPluginID(self):
        return self.__pluginIdentifier

    def getPluginType(self):
        return self.__pluginType

    def backgroundTask(self):
        # If the PC is using dynamic address
        if self.__isDynamicAddress == 1:
            isAddrFound = False
            self.__desktopAddress = ""
            log("WINDOWSCONTROL", 2, "Desktop IP address is set to Dynamic.")
            log("WINDOWSCONTROL", 2, "Waiting for address...")
            while not isAddrFound:
                # Wait until the windows client sends it's address
                if self.__desktopAddress != "":
                    log("WINDOWSCONTROL", 0,
                        "Address received. Running background task.")
                    isAddrFound = True

            url = "http://{}/{}".format(self.__desktopAddress, "ping")
            # Check the connection at X minutes. (Interval set on config.json)
            while True:
                url = url.replace(" ", "%20")
                log("WINDOWSCONTROL", 0, "Requesting ON status...")
                try:
                    response = urllib.request.urlopen(url).read()[2:-1]
                except Exception as e:
                    log("WINDOWSCONTROL", 1, "ERROR: {}".format(e))
                else:
                    log("WINDOWSCONTROL", 0, "Windows Client is connected.")
                    self.__desktopAddress = response
                    time.sleep(self.__pingInterval*60)

    def sendData(self, id, value, param):
        if value == "run" or value == "kill":
            url = "http://{addr}/{cmd}/{app}".format(addr=self.__desktopAddress,
                                                     cmd=value, app=param)
```

```
89              url = url.replace(" ", "%20")
90              # Requests response from the windows client app.
91              log("WINDOWSCONTROL", 0, "Requesting response from {}".format(url))
92              response = json.loads(str(urllib.request.urlopen(url).read())[2:-1])
93              return json.dumps(response)
94          elif value == "setaddr":
95              self.__desktopAddress = param
96              log("WINDOWSCONTROL", 0, "Received machine IP Address: {}"
97                  .format(param))
```

This plugin is made to communicate between this program and a client program running Windows. The purpose of this is to tell the client to run or kill certain process (application) on a computer running Windows. The system is more or less the same compared to powercontrol.py. But what makes it different is the way this two programs communicate. Rather than using MQTT, this plugin and the client communicates with HTTP requests.

4. Evidence

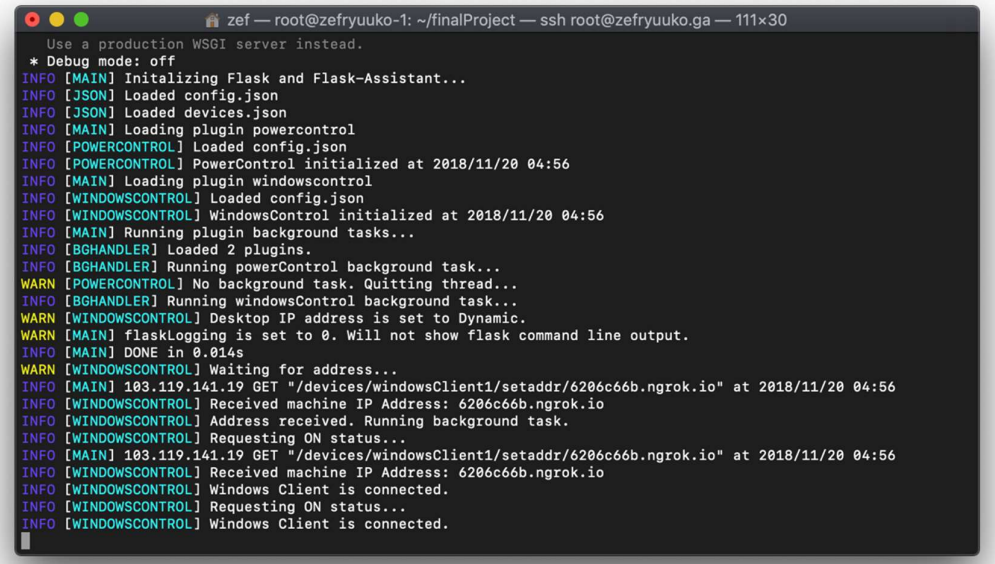


Figure 1: Application running on a virtual private server, and established connection with a Windows client program on another network.

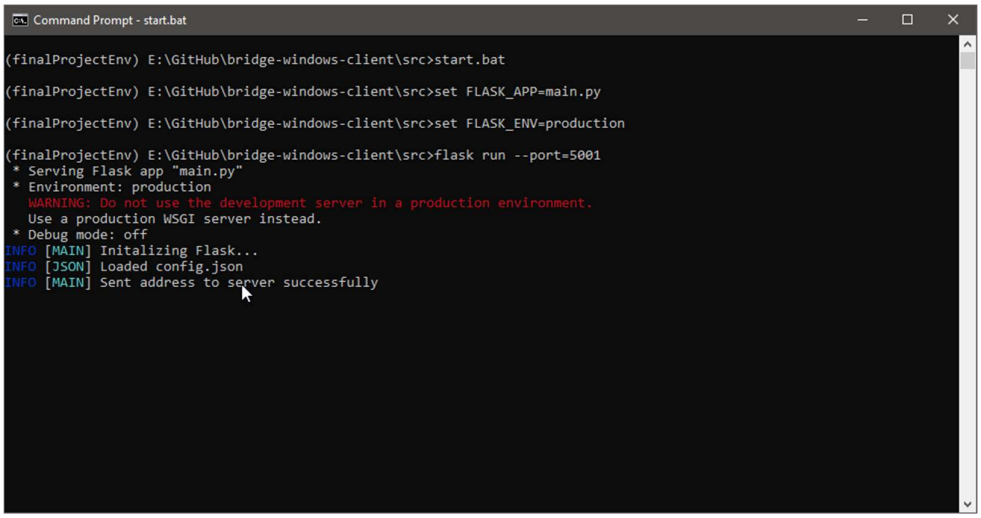


Figure 2: Windows client program sends it's address to the main program.

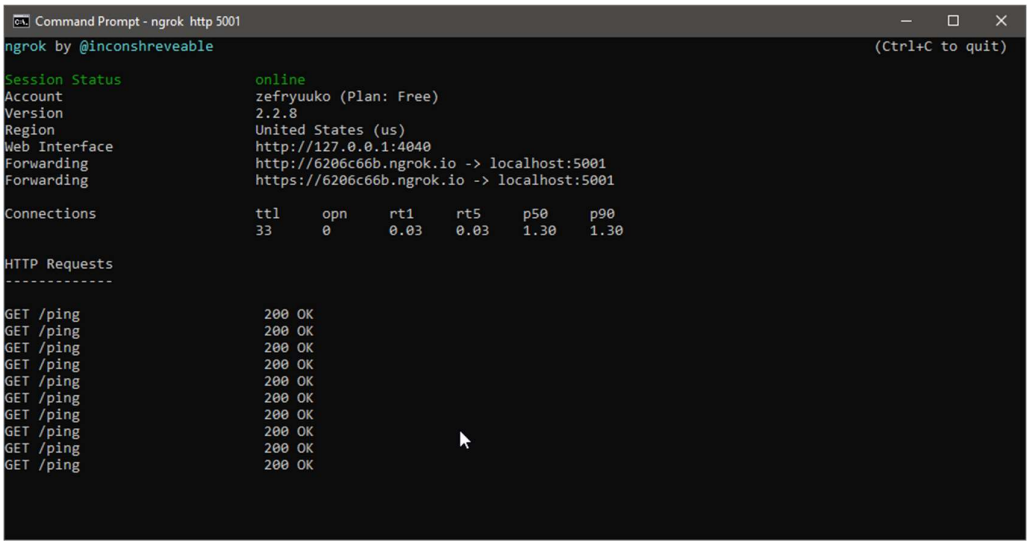


Figure 3: ngrok forwards local port 5001 to externally visible address on port 80 (HTTP)

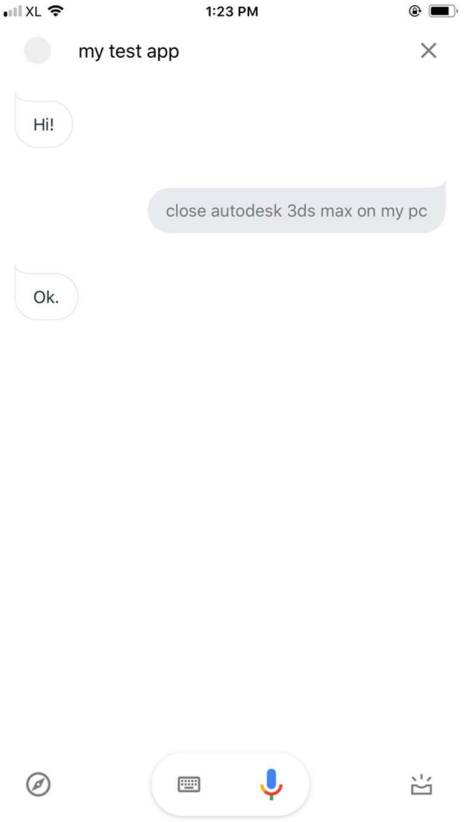


Figure 4: Google Assistant controlling a Windows PC.

5. **Sources**

Documentations:

- https://codelabs.developers.google.com/codelabs/actions-1/#0
- https://dialogflow.com/docs/getting-started
- https://docs.python.org/3/reference/index.html
- https://pypi.org/project/paho-mqtt/
- http://flask.pocoo.org/docs/1.0/
- https://flask-assistant.readthedocs.io/en/latest/
- https://pypi.org/project/colorama/
- https://dashboard.ngrok.com/get-started

Other sources (Stack Overflow, YouTube, etc.) is listed on

- https://github.com/zefryuuko/pdm-final-project/blob/master/references.txt
- https://github.com/zefryuuko/pdm-final-project/blob/master/src-windowsclient/references.txt
- https://github.com/zefryuuko/pdm-final-project/blob/master/src-arduino/references.txt