



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: VI Month of publication: June 2023

DOI: <https://doi.org/10.22214/ijraset.2023.54437>

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System Volume and Brightness Control Using Voice Commands

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Abstract: *This paper proposes a missing feature of windows voice assistant Cortana that voice assistants of android Operating Systems, iPhone Operating Systems. Android operating system has Google Assistant and IOS has Siri, which can adjust the system volume and brightness followed by user's voice commands, while Cortana can't adjust the system volume and brightness.*

Keywords: *Voice Recognition, Human-Computer Interaction, Voice Interaction, Volume Control, Brightness Control.*

I. INTRODUCTION

Voice communication is a convenient and accessible way for users to interact with computers. A voice assistant is an application, which listens to the user's voice and respond to their voice command whatever they instructed the system to do, but a voice assistant can't do whatever the user giving as command, every voice assistant will have some restrictions. In android and IOS the voice assistants Siri and Google Assistant, can listen to the user's voice command and respond accordingly, especially they can adjust the brightness and volume of the system with respect to user's voice commands. In windows also there is an inbuilt voice assistant called "Cortana", unlike other voice assistants like Siri and Google Assistant, it can't adjust the system volume and brightness. If we ask Cortana to adjust with system volume or brightness, it will simply say "I'm sorry, but I can't help with that.". So, we have proposed a windows application, which can adjust system volume and brightness by user's voice commands.

In our proposed prototype, Human-Computer Interaction will be done through voice communication, as user will give the input via voice and system will acknowledge the user about the output with voice. Our system will listen to the user's voice command and start responding to the voice command with adjustment in system volume or brightness when the user starts the services by saying 'start' or 'start services' to their computer through microphone. Why starting services because, this is a voice interaction prototype and needs to listen while the program is running and while running if the user has speaking to someone else the system will recognize and respond to their command. So if the user don't want to use the service but they want the program to run in background for future usage, they can pause the program and start again whenever they want.

Possible commands for adjustments can be stored and matched while user give their commands. After starting service, if the user gives a voice command, then the voice command will be matched with the desired action, and the desired action will be carried out. If none of the commands match in the dataset, then the similar commands to the given voice command will be fetched and showed and outputted by the system speaker to the user. The user can also pause the service by saying a command and can start again after a while. The user is also allowed to terminate the program using voice command, by saying voice commands like "exit", and a confirmation will be done with the user whether they want to terminate the program and after it will terminate the program.

II. METHODOLOGY

In Our proposed prototype, we are going to use python for controlling system sound and brightness, recognizing user's voice to text and voice output.

A. Voice Recognition

Using the microphone connected to the computer, user's voice commands will be recognized and converted into text using python's "speech-recognition" library. It is a library provided by google. The voice will be recorded for 3 seconds, and almost matching text to the voice will be chosen as text and output from this module.

B. Command Matching from Command Dataset

The text output from voice recognition module will be matched to the already created voice commands in the Command Dataset. Commands are separately created for operations such as Increase volume or brightness, decrease volume or brightness, mute or unmute volume, half the volume, half the brightness, setting maximum brightness or volume, setting minimum volume or

brightness. Most possible commands are stored in a python file as python lists. If the voice command from the user does not match the commands specified in the created dataset, then almost all matching commands will be fetched and output to the user.

C. Volume Control Module

If the user's command is for adjusting volume like increase, decrease, mute, unmute or setting to maximum level, this module will be called. Using "pycaw", "ctypes", "comtypes" python libraries, system volume is getting adjusted. System sound will be measured in "decibel", if the system volume is 0 decibel, then the system volume is at its maximum level, if the system volume is -65.25db (for the tested computer) then the volume is 0 (minimum level). This minimum level may vary for each computer, so we must find the minimum decibel volume and compute the adjustments accordingly. According to the user's command the system volume decibel is set, and the system volume will change accordingly.

D. Brightness Control Module

If the user's command is for adjusting brightness like increase, decrease, setting to maximum level, this module will be called. Using "screen_brightness_control" python library, screen brightness is controlled. Screen brightness will range from 0 to 100 percent, so according to the user's command the brightness level will set. If the user is instructed to increase the brightness, it will get increased by step-by-step increment.

E. Voice Output Module

For every action carried because of user's voice command will be output to the user via voice output via system speaker and the same text will be displayed on the screen. Instructions for the users will also be spoken via speaker. Using "pyttsx3" python library text input is converted into voice output.

III. REQUIREMENTS SPECIFICATION

A. Software Specifications

Windows operating system which supports Python3 and Python libraries which include Pyaudio, screen_brightness_control, Pyttsx3, speech_recognition, Ctypes, Comtypes, Pycaw.

B. Hardware Specifications

Microphone, 2 GB Ram minimum, 10 GB Hard disk space Minimum, Speaker, Active Internet.

IV. HIERARCHICAL TASK ANALYSIS

GOAL: Use voice commands to adjust system volume and brightness.

A. Steps involved in the HTA

- 1) Starting the application to make the microphone to listen for voice commands.
- 2) Then the user will give their voice commands.
- 3) Acknowledgement for their voice commands will be received through voice output.
- 4) If the user command matches volume adjustment, volume will get adjusted, else if the user command matches to brightness adjustment, brightness will get adjusted.
- 5) If the user command does not match with the commands stored, a similar command will be acknowledged to the user.
- 6) Termination of program after user says exit.

B. Diagrammatic representation of the HTA



Figure 1: diagrammatic representation of HTA

V. STATE TRANSITION NETWORK

A. Diagrammatic representation of STN

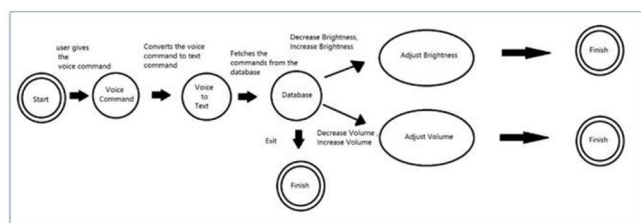


Figure 2: diagrammatic representation of STN

The user can terminate the program whenever they want, that is the reason behind three finish states in STN.

VI. LITERATURE SURVEY

A. Volume Control using Gesture [1]

This paper proposed a volume controller using hand gestures, which uses hand gestures as input to control the system, OpenCV module is basically used in this implementation to control the gestures. This the system consists of a high-resolution camera to recognize the gesture taken as input by the user. This type of hand gesture system provides a natural and innovative modern way of non-verbal communication.

B. Automatic Brightness control of the handheld device display with low illumination [2]

The paper addresses the problem of how to adjust the brightness of handheld device displays under low illumination conditions. The authors propose a new algorithm to automatically adjust the brightness of the display based on the ambient light level, the content displayed on the screen, and the user's visual acuity using front camera present in the smartphone. Overall, the paper provides a solution to the problem of adjusting the brightness of handheld device displays under low illumination conditions, which has implications for improving user comfort and productivity.

C. Interaction with Gaze, Gesture, and Speech in a Flexibly Configurable Augmented Reality System [3]

This paper focuses on the design and development of an interactive augmented reality (AR) system that allows users to interact with virtual objects using gaze, gesture, and speech. The system is designed to be flexible, allowing users to customize the interaction methods to suit their preferences and requirements. They also discuss the user interface and how the system handles the input from the user, particularly with respect to gaze, gesture, and speech. Overall, the paper demonstrates the potential of interactive AR systems that allow users to interact with virtual objects using multiple input modalities, and the importance of designing such systems to be flexible and customizable to meet the needs of different users.

D. Speech-to-text recognition for multilingual spoken data in language documentation [4]

The paper discusses the use of speech-to-text recognition technology for transcribing spoken data in endangered languages, which can help with language documentation and preservation efforts. The authors focus on the challenge of multilingual spoken data, which often involves code-switching and other linguistic complexities. The results of the experiment showed that the speech-to-text recognition technology was effective in transcribing multilingual spoken data, with an overall accuracy rate of 76%. Overall, the paper demonstrates the potential of speech-to-text recognition technology for language documentation and preservation efforts, particularly in the context of multilingual spoken data.

E. Free-hand gestures for music playback: deriving gestures with a user-centred process [5]

The paper presents a user-centered approach to deriving free-hand gestures for controlling music playback on mobile devices. The authors conducted a user study to collect and analyze gesture preferences and designed a gesture set based on the results. They then evaluated the proposed gestures in a second user study and found that many participants found the gesture set easy to learn and use. The paper concludes that user-centered design can help create intuitive and effective gesture interfaces for music playback on mobile devices.

VII. STAKEHOLDERS IDENTIFICATION

- 1) *Users*: People who will use our program for adjusting their system volume and brightness.
- 2) *Developers*: The group of people who build and keep the program running.

VIII. TESTING

A. Usability Testing

As our system is based on VUI (Voice User Interface), the test for usability is different from others. Here are some Usability Testing's for Voice Interaction platforms:

1) *Involve The Target Audience In The Development From The Beginning*

The targeted users for using our proposed system can be people who watch movies or videos for long time, people who read or watch videos while eating or doing other works simultaneously, so that they do not need to involve their hands for adjusting the system volume or brightness.

2) *Define the Test Tasks Precisely.*

Tasks are defined precisely as Adjusting system volume, adjusting system brightness, Knowing the current brightness, Knowing the current volume level.

3) *Choose your Testers and Questions Well*

Speech commands are chosen accordingly with questioning the targeted users.

4) *We should never expect users to do what we want them to do.*

Users don't need to memorize the commands, if they forgot about the exact command, they could give a Similar command and the system will suggest them the similar commands.

B. User Acceptance Testing

S.No	Test description	Expected Outcome	Observation	Result
1	Whether the Voice Recognition, recognizes voice to text properly	Exact match of voice to text	In the presence of lesser noise, inputted voice came as text output.	Pass
2	Whether the voice command input obtains the desired output.	Adjustment of volume or brightness with respect to voice command	Adjustment done successfully with respect to voice commands.	Pass
3	Whether feedback received for wrong commands	If command is not found, acknowledgment is needed for the user.	Acknowledgement received and similar commands outputted through voice.	Pass
4	Whether that pause and start services working fine.	If a program is paused, it should not do any actions if it receives commands until it starts again.	After program paused, it listens to the voice command and not responding until it receives start	Pass
5	Termination of program confirms the user, whether they want to terminate the program.	After 'exit' command received, it should ask confirmation until it receives 'no' or 'yes' commands.	After 'exit' command received, the system asks confirmation after confirmation, it terminates.	Pass

C. Testing of Response Time

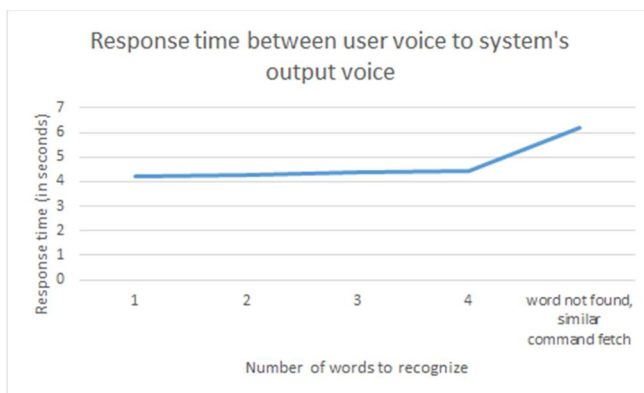


Figure 3: graphical notation of response time analysis

IX. APPLY OF NORMAN'S PRINCIPLES

- Visibility:** This program that shows how much time is left until a recording is complete. And shows the text which got converted from the voice command given by the user, So that user can confirm whether their desired action is done correctly, also there is voice output to inform the users that their query has been successfully executed.
- Feedback:** This is a sound that plays when the voice command is given and voice after the command gets matched with the database confirming that the action was successful or unsuccessful. If the voice command of the user is mismatch to the commands, there is also a voice output as a response, if the Command matches the database commands, then the system will voice output the similar commands.
- Constraints:** Until the user uses a voice “ start ” command the program won't start. Same with the commands after the program starts the user has to give voice commands to adjust the brightness and volume. If the user don't want to use the system for a while they can say “stop” or “pause” to pause the program for a while, where it recognize the text but won't do any actions. If the user say “start” again it will start again. If the user wants to terminate the program he can say “exit”, after confirming the user the program will terminate.
- Mapping:** This program lets the user know after the action such as adjustment of the volume or brightness. The user will have proper mapping of the control and the effects. And if the user says command to mute the volume, it will let the user know that system volume is going to get muted, because after mute, the voice output can't be heard by the user.
- Consistency:** Since this is a voice interaction program, it does not need any interface, but for user's acknowledgement, user can see the input output in the terminal, in which the python file is running. This program runs in a terminal which is being used by many users overall globally and which is universally same. The user won't be having any issue using the program. User's input will be displayed from the right side of the screen and the reply (the output) will be displayed in the left side of the screen, as like chat box's to achieve consistency.
- Affordance:** The program gives the user voice and text instructions on what must be done and what will happen after those controls.
- Mental Model:** The program is programmed in a way which the user can give his/her comfortable voice commands and the program matches it with relevant commands from the database, so the user won't have to memorize any new commands to adjust his/her brightness and volume of their system. If they say any relevant commands that do not match from the database of commands, it will say the matching commands, so that user can use that to fulfil the desired action.

X. ANALYSIS

A. KLM

User gives a command for adjusting volume/brightness.

- 1) Open the setup.exe file from the desktop
- 2) User gives the voice command
- 3) User gives exit command

a) Open the setup.exe file from the desktopRemarksOperations
 Moves hand to mouse H
 Point on the setup.exe file on the desktop PDDouble Click B B (left click)

b) User gives the voice command
 RemarksOperations
 Think and gives voice command "Start" to start the programM
 Think and gives command for either to adjust thevolume/brightness M
 Wait for operation to be executed M

c) User gives exit commandRemarksOperations
 Thinks and gives "Exit" command M
 Total time: (H P B B) + (M M M) + (M)
 : (0.12 +1.10+0.20+0.20) +(1.35+1.35+1.35) +
 (1.35)
 : 7.02 sec

XI. ACKNOWLEDGMENT

We would like to extend our sincere appreciation to everyone who helped get this project done. This job would not have been possible without their help. The following is acknowledged by us: Thank you to Dr. Swarnalatha P, our academic advisor, for your essential advice, knowledge, and ongoing assistance throughout the study process. The volunteers who contributed their time and ideas to the usability testing, without whom it would not have been feasible to conduct this study. Vellore Institute of Technology for making data and tools available that are necessary for carrying out the research. Friends who helped with programming, data analysis, and other technical facets of the project. Our research and our knowledge of the subject have been affected by earlier scholars and authors. The ethical and regulatory organizations that checked for compliance with rules and laws and approved our research. For their constant support, inspiration, and motivation throughout the study process, we thank our family and friends. Each team member brought their own special skill to the project as they worked together and contributed to various areas of it. Finally, we would like to extend our gratitude to all the authors and scholars whose work has served as a great source of information and inspiration for us. We deeply appreciate all of these people and groups for their essential contributions to this initiative and are appreciative of them all.

XII. CONCLUSION

As we have implemented speech recognition with Google's API, we can only record the speech and then recognize it. To make it effective, we need to implement real time speech recognition, which requires paid API but makes Human- Computer Interaction much faster and better.

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