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JNANASANGAMA, BELAGAVI - 590018



Python Project Report On

JustGest

Submitted in partial fulfillment for the award of degree of

**Bachelor of Engineering
in
COMPUTER SCIENCE AND ENGINEERING**

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CERTIFICATE

Certified that the Python project entitled **JustGest** carried out by Mr. **Chirag G Shetty** (USN: 1BG21CS022), Mr. **Ganesh Sharma** (USN: 1BG21CS034), Mr. **Karthik** (USN: 1BG21CS041) and Mr. **Pranav M** (USN: 1BG21CS054) bonafide students of IV Semester, BNM Institute of Technology in partial fulfillment for the award of Bachelor of Engineering in COMPUTER SCIENCE AND ENGINEERING of Visvesvaraya Technological University, Belagavi during the year 2022-23. It is certified that all corrections / suggestions indicated for Internal Assessment have been incorporated in the project report deposited in the departmental library. The Python project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

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ABSTRACT

JustGest is a desktop software application developed using python. The software application has features including Hand Mouse, Commands, Face detection, Game Play, Slang Code and Analysis. The project team conducted research, developed a blueprint, and implemented best practice in various functions of the software to ensure that the final software meets the project objectives and requirement. The software includes different python modules and libraries. It also includes Bard API key to develop the AI chat bot. The project showcases the team's skills in python modules and provides a valuable addition to their portfolio. Overall, the software is a desktop assistant which helps users to handle the desktop with minimum use of mouse and keyboard. User can interact with the system by either hand gesture or voice command. The application is face-lock protected to make it more secure.

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Chapter 1

Introduction

The following is a report on Just Gest (control using Just few Gestures), an innovative software solution leveraging computer vision and artificial intelligence to redefine the boundaries of human-computer interaction and enhance the digital experience.



Figure 1.1: Software Logo

In the digital age, human-computer interaction has transcended beyond the conventional modes of keyboards and pointing devices. The allure of controlling devices without physically touching them has been a pursuit of science fiction, now inching closer to reality with advancements in computer vision, artificial intelligence, and machine learning. The python project embodies this vision, aiming to revolutionize the user experience by enabling a more intuitive and inclusive form of computer interaction.

Image processing, a subset of computer vision, has emerged as a dominant force in achieving contactless control. While many have dabbled in this domain, especially with gesture-based controls, there remains a challenge in terms of user-friendliness and comprehensive application. Most solutions in the market are either too niche, focusing solely on specific tasks, or too cumbersome, demanding a steep learning curve from users. There's a gap in the market for a comprehensive, user-friendly software that not only facilitates control but also enhances security, amusement, and overall computer experience.

The project seeks to fill this void. The objective is clear: design an intelligent software system that seamlessly integrates with daily computing tasks, comprehends human movements, and reacts with precision. More than just motion-based commands, the software promises an ecosystem of features. From facial recognition ensuring security, head alignment for gameplay, to AI-driven coding assistance, the software endeavours to cater to diverse user needs. Furthermore, with the incorporation of data analytics via MongoDB Atlas, the platform aims

to continually evolve and tailor itself to individual user preferences, ensuring that the software is not just smart, but also learns and grows with time.

While the functionality of the software is extensive, project aspires to maintain compactness for easy portability, ensuring that users can incorporate it into their computing environment without hassle. Moreover, in acknowledging the diverse range of computer users, the project also emphasizes inclusivity. Amputees, or those with limited motor skills, often find traditional computer interactions challenging. It can potentially offer them a more accessible avenue to engage with digital platforms.

Furthermore, this python project isn't limited to pure utility. Features such as Gameplay and Slang Code add an element of entertainment and creativity, showcasing the team's commitment to ensuring a holistic computer experience. In essence, Just Gest isn't just another software tool; it's a vision of the future of human-computer interaction, a bridge to a more interactive, inclusive, and enriched digital era.

1.1 Problem Statement

The primary challenge is to design an intuitive, compact, and consumer-friendly software system that harnesses computer vision to enable contactless control, ensuring enhanced security, entertainment, and a richer computer experience.

In today's technologically-driven era, the interaction between humans and computers has remained largely limited to traditional input devices like keyboards and mice. This interaction poses inherent limitations, particularly in situations demanding a more organic, hands-free approach or for individuals with physical impairments. While there have been attempts to integrate gesture-based controls through image processing, many of these solutions lack consumer-friendly interfaces, thereby reducing their adoption. Moreover, there's a missed opportunity in harnessing these capabilities for other purposes like security or amusement. Therefore, the problem at hand is to develop a software, this python project that not only bridges the gap by allowing seamless contactless control through human movements but also enriches the overall user experience by integrating features like face recognition, head alignment for gameplay, and an intelligent AI bot for a range of tasks.

1.2 Objectives

In the evolving landscape of human-computer interaction, the "Just Gest" project is poised to set new benchmarks. The core ethos behind this initiative is to create an interface that is both intuitive and comprehensive, breaking free from the confines of traditional interaction mechanisms. These objectives not only address the immediate need for advanced, contactless control but also envision a holistic digital experience. Below is a detailed breakdown of the multifaceted objectives that guide the development and implementation of the software:

- Holistic Interaction: Develop software capable of observing, understanding, and responding to human movements accurately. Promote a hands-free and intuitive user experience.
- Security Enhancement: Incorporate face-recognition technology to verify users, ensuring an added layer of security during software access.
- Diverse Functionality: Integrate a head alignment measurer for gameplay, enabling users to control games like subway surfers and temple run through head movements. Facilitate quick commands for popular applications and tasks, enhancing productivity. Offer features surpassing traditional input devices, like a hand-gesture controlled mouse with additional functionalities.
- Innovative Coding Assistance: Design the "Slang Code" feature that allows users to describe a code segment, which the software then generates in the desired programming language.
- Intelligent Learning and Analysis: Link the software with an AI bot to cater to user queries. Integrate the system with MongoDB Atlas to store and analyse usage patterns. Present an analysis feature that visualizes the usage metrics of each functionality in the software.
- Accessibility and Automation: Provide speech-to-text and text-to-speech features to make the software more accessible and to automate tasks. Ensure the software assists individuals with physical impairments, promoting inclusivity.
- Compactness and Portability: Engineer the software to be as compact as possible, ensuring ease of transport and integration across various computing environments.

Consumer-Friendly Approach: Design a user interface that is intuitive and easy to navigate. Ensure that the software system remains consumer-centric, prioritizing user needs and feedback.

Chapter: 2

Literature Survey

The following literature helped in developing the proposed work with greater performance and implementing it in a way by overcoming the disadvantages of the existing systems

By Karan Kharbanda and Utsav Sachdeva in 2023 The development of intelligent machines and advancement of technology has made complex devices used in our daily lives smaller and more compact. These breakthroughs have led to the advent of Augmented and Virtual Reality (AR) and (VR), which make Human-Machine Interaction much simpler. This study proposes a method for creating a virtual mouse^[1] that uses hand gestures for human-computer interaction. The virtual mouse would be able to recognize hand gestures and carry out instructions based on the principle of gesture recognition. This could potentially make certain devices obsolete and represents a potential future of human computer interaction. Gesture recognition is a domain that involves machines using mathematical algorithms to interpret and understand human gestures. It is a subfield of computer vision. Gesture recognition involves using mathematical algorithms to interpret and understand human body movements and expressions, with a focus on facial expressions and hand gestures. This technology can recognize emotions through these forms of expression and allow users to control or interact with devices through simple gestures without physically touching them. In addition to interpreting sign language, gesture recognition also includes the identification and recognition of body posture, walking style, the study of personal space, and human behaviour.

By Mr. Dhanaraju, Dr. Sreenivas Mekala, A. Harsha Vardhan Rao, CH. Pavan Kumar, R. Lokesh in 2022, Moving the pointer along with the screen using a computer mouse or by moving one's finger has become fairly common in today's technology. Every movement of the mouse or finger is detected and mapped to the movement of the pointer by the system. Because their arms are not functioning, certain people, known as "amputees," will be unable to use present technology to use the mouse. If the amputee's eyeball and facial features, as well as the direction in which their eye is staring, can be recorded, the movement of the facial features may be transferred to the cursor, allowing the amputee to move the cursor at whim. An 'eye-tracking mouse' is a gadget that tracks the user's eye movements. The project relies on mapping facial traits to the cursor to recognize and capture them in video. When the camera is opened,

the application must extract all of the video's frames. Since the video's frame rate is typically around 30 frames per second, every frame will be processed in about 1/30th of a second. The application then goes through a series of steps to identify and map the characteristics of the video to the point. After the frame has been retrieved, the face areas must be identified. As a result, the frames will go through a set of image-processing routines to appropriately analyse the frame, allowing the algorithm to distinguish things like eyes, mouths, and noses.

By Shraddha Gaikwad¹, Devansh Rane, Shubham Gupta, Prof. Pranjali Gurnule in 2022 In our daily life, vision and gestures are important approaches for communication among human beings, and the same role is played by the mouse in Graphical User Interface (GUI) based computers. So, a combined methodology can be used to make a better interactive system for Human-Computer Interaction. Computer vision techniques can be an alternative way for the touch screen and create a virtual human-computer interaction device using a webcam. In this project, a finger tracking-based virtual mouse application will be designed and implemented using a regular webcam. To implement this, we will be using the object tracking concept of Artificial Intelligence and the OpenCV module of Python.

The Literature Survey for our project was performed in phases. The first being the research based on already existing articles and research papers which show us the scenario of the past and suggest improvements that can be made in the future.

Table 2.1 - Survey on hand gesture controlled virtual mouse

S. No.	Author	Title	Journal	Year
1.	Karan Kharbanda, Utsav Sachdeva	GESTURE CONTROLLED VIRTUAL MOUSE USING ARTIFICIAL INTELLIGENCE	International Research Journal of Modernization in Engineering Technology and Science	January 2023

Findings

- In the proposed system, MediaPipe and OpenCV have been used to further the advancement in interactions between humans and machines.
- The proposed system performs mouse functions via hand gestures by using Computer Vision techniques which is a shift from the existing wired and wireless models.
- The main gestures for using functionalities of this system are:
- Neutral Gesture: Used for stopping the ongoing gesture, Move Cursor: Using this gesture, the operator can navigate the cursor to the desired location. Speed of the

cursor's movement is proportional to the speed of moving hand,

- **Scrolling:** It is a dynamic gesture to scroll horizontally and vertically. The speed of scrolling is proportional to the distance by which the pinch gesture has moved from its starting point. Vertical and horizontal scrolling is performed by vertical and horizontal pinch movements respectively,
- **Volume Control:** This is a dynamic gesture for volume control. The rate of increase/decrease of volume changes in accordance with the distance moved by the pinch gesture from its starting point,
- **Brightness Control:** It is a dynamic gesture to control brightness. The rate of increase/decrease of brightness is proportional to the distance moved by the pinch gesture from its starting point.
- This model can be achieved with the help of an external or inbuilt webcam that processes a live video feed and recognizes hand signs to execute specific mouse functions

Table 2.2 - Survey on eye controlled virtual mouse

S. No.	Author	Title	Journal	Year
2.	Mr. Dhanaraju, Dr. Sreenivas Mekala, A. Harsha Vardhan Rao, CH. Pavan Kumar, R. Lokesh	Human-Eye Controlled Virtual Mouse	International Research Journal of Modernization in Engineering Technology and Science	June 2022

Findings

- The objective of our project is to make the work of 'amputees' (people who don't have their arms to be operational) easy. Amputees or quadriplegics can benefit from our project (people affected by paralysis of all four limbs) can use and operate the mouse using their facial features and actions of their eyes.
- To deliver a user-friendly human-computer interaction project, this project will design a system that will just require a camera to employ human eyes and facial characteristics as a pointing device for the computer system.
- The following are the main features: Eyes and face Detection, Eye end points extraction, develop an algorithm to calculate the point gaze based on eye features extracted, develop a GUI that shows a result, Develop a Calibration technique.

Table 2.3 - Survey on another hand gesture controlled virtual mouse

S. No.	Author	Title	Journal	Year
3.	AI Virtual Mouse using opencv	Shraddha Gaikwad, Devansh Rane, Shubham Gupta, Prof. Pranjali Gurnule.	International Research Journal of Modernization in Engineering Technology and Science	May 2022

Findings

- To develop a virtual mouse using python programming language which works using hand gestures.
- To create a system which won't require any hardware to operate mouse which will reduce the hardware cost.
- To find an alternative way to use at public places to reduce spread of virus through touch and will help people to return to normal routine after pandemic.

Limitations of overall literature survey

- The existing systems are our traditional hardware mouse devices either wired or wireless to control the cursor. This means the actual hardware device is required. Also, the touchpad in laptops and touch screen devices requires a user to touch the surface.
- Other existing virtual mouse control system consists of a simple mouse operation which uses colored tips like red, green, and blue color. These colored fingers act as an object that the web-cam senses to perform actions and then image processing techniques are applied to them.
- Some existing systems use number of fingers to perform the specific operations (for eg. 1 finger for left click, 2 fingers for right-click, 3 for double click). Such systems are more complex and difficult for the user to use.
- Eye-tracking technology might not be as accurate or precise as traditional input methods like a physical mouse or touchpad. This can lead to unintended cursor movements or difficulty in performing intricate tasks that require high precision.
- Eye-tracking systems often require precise calibration for each individual user, which

can be time-consuming and may not always result in perfect accuracy. Additionally, the setup process might be complex and require technical assistance.

- The system's accuracy and performance could depend on the quality of the camera and hardware being used, potentially limiting its accessibility to users with certain equipment.
- While hand gestures can be effective for certain tasks, they might not be suitable for all types of computer interactions, such as precise graphic design or gaming.

Overall, the literature survey highlights the exploration of eye-controlled virtual mice and AI-driven hand-tracking systems using OpenCV underscores both the potential and challenges of innovative human-computer interaction technologies. These systems offer promising avenues for enhancing accessibility and expanding the ways individuals interact with computers, particularly benefiting those with limited mobility or physical disabilities. However, a nuanced understanding of their limitations is essential for informed adoption and practical implementation. From accuracy and calibration intricacies to gesture complexity and hardware dependencies, each system presents its unique set of constraints that require consideration. As the field of assistive technology continues to evolve, addressing these limitations through ongoing research, advancements in computer vision, and user-centric design will be crucial in realizing the full potential of these alternative input methods and fostering a more inclusive digital environment.

Chapter: 3

System Requirement Specification

Just Gest is an innovative software system leveraging cutting-edge technologies in computer vision and artificial intelligence to revolutionize the landscape of human-computer interaction. This software seeks to provide a comprehensive and intuitive solution for controlling computer systems through gestures and facial recognition, aiming for enhanced user experience, security, amusement, and adaptability.

3.1. Core Software

- Operating System: The software is compatible with any operating system that supports Python 3.11. This flexibility ensures that users on different platforms, such as Windows, macOS, and various Linux distributions, can use the application without restrictions.
- Programming Language: Python 3.11 (latest version) is the core programming language for developing the software. Python is known for its simplicity and versatility, making it an ideal choice for this project.

3.2. Integrated Development Environment (IDE)

- IDE: The chosen Integrated Development Environment (IDE) for developing the software is PyCharm. PyCharm is a widely used and feature-rich IDE specifically designed for Python development. Its features, such as code completion, debugging, and project management, facilitate efficient development.

3.3. Database System

- Database: The software utilizes MongoDB Atlas as its database system. MongoDB Atlas is a cloud-based database service that offers scalability, high availability, and the ability to store and manage data. It is used for storing user preferences and data analytics related to the application's usage.

3.4. Key Python Modules

- pyautogui: This module provides functions to simulate keyboard key presses, mouse movements, and clicks. It's essential for creating the gestures and actions associated with user interaction.

- pynput: Used to manage keyboard and mouse input. It enables listening for and controlling keyboard events, facilitating the keyboard control functionalities of the software.
- smtplib: This module handles sending emails. In the software, it's employed to automate email communication, enabling notifications or alerts.
- opencv-python: OpenCV is a popular computer vision library. The "opencv-python" module provides tools for efficient image capturing, manipulation, and processing. It's crucial for various image-related tasks within the application.
- Mediapipe: A library that simplifies building applications involving real-time perception. In this project, it's employed for accurate and fast hand and facial movement detection, enhancing gesture-based interaction.
- speech-recognition: This module integrates with Google's speech recognition API, allowing the software to convert spoken language into text. It powers the speech-to-text functionality.
- tkinter: Python's standard GUI (Graphical User Interface) library. It's used to create the user interface elements like buttons, labels, and windows within the software.

Each of these software requirements and modules plays a critical role in the functionality and features of the project, enabling various forms of interaction, data management, and user interface components.

Chapter: 4

Methodology and Implementation

In this Chapter, we discuss the methodology followed to design the project and the implementation of ideas to develop it efficiently which fulfils all the objectives.

4.1 Methodology

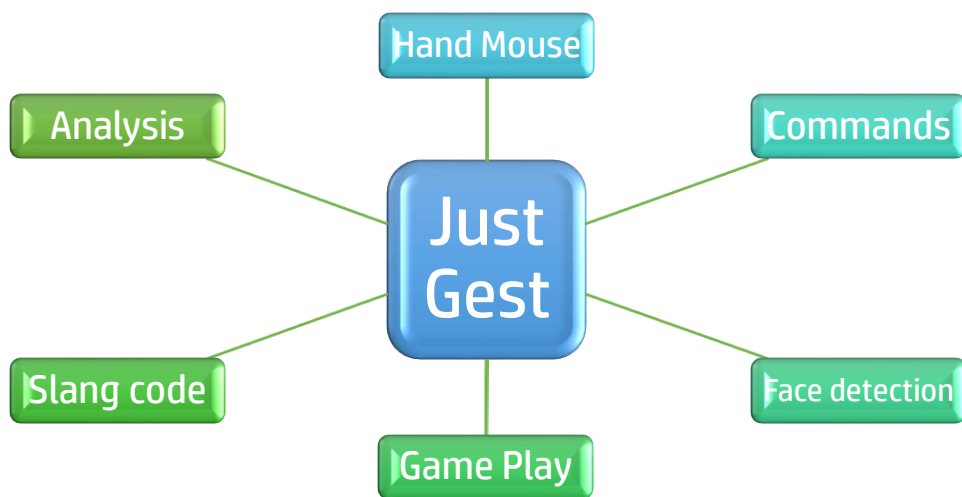


Figure 4.1.1: A block diagram succinctly captures the comprehensive features.

Steps undergone to accomplish the project

1. Requirement Gathering:

- Engage team members to outline the primary needs and objectives of the software.
- Define the technical and functional requirements, such as computer vision functionalities, user interfaces, and cloud database integration.

2. Research and Feasibility Study:

- Analyse available tools, technologies, and frameworks suitable for developing the application.
 - Study the feasibility of implementing features like face recognition^[2], gesture-based controls, and cloud-based storage with MongoDB Atlas.
3. Design and Prototyping:
- Draft an initial design of the software's architecture, ensuring modularity for each feature.
 - Create wireframes and prototypes for the tkinter GUI, including all interactive elements like buttons and feature interfaces.
4. Development:
- Start by setting up the basic structure of the application, focusing on user account creation and verification processes.
 - Implement facial recognition using suitable libraries or APIs, ensuring it aligns with the desired security standards.
 - Design the main GUI interface with tkinter, embedding features such as Hand mouse, Commands, Gameplay, Slang code, and Analysis.
 - Integrate MongoDB Atlas for account data storage and ongoing usage analysis.
5. Integration of Features:
- For each feature (like Hand mouse or Commands), develop the underlying logic and algorithms, ensuring they interact seamlessly with the main interface.
 - Incorporate the cloud-based OTP verification for new users and the synchronization of user data every time the software is initiated.
6. Testing and Quality Assurance:
- Conduct unit testing for individual features to ensure they function as intended.
 - Perform integration testing to guarantee cohesive performance between interconnected modules.
 - Conduct user acceptance testing to gather feedback from potential users.
7. Optimization:
- Fine-tune the software for performance, ensuring it runs efficiently even on standard systems.
 - Optimize for portability so that it works for all the Windows platforms.

8. Deployment:

- Prepare the software for release, packaging the community edition as open-source and the professional version with advanced features.
- Ensure the MongoDB Atlas connection is stable and secure, facilitating data storage and retrieval.

9. Documentation and Training:

- Produce comprehensive user manuals, guides, and technical documentation to aid users and potential developers.
- Develop a handbook to guide users through its various features.

10. Maintenance and Upgrades:

- Monitor user feedback and software performance to identify areas for improvement.
- Periodically release updates, enhancing features, patching any vulnerabilities and integrating new functionalities based on emerging tech trends and user needs.

Data Flow Diagram

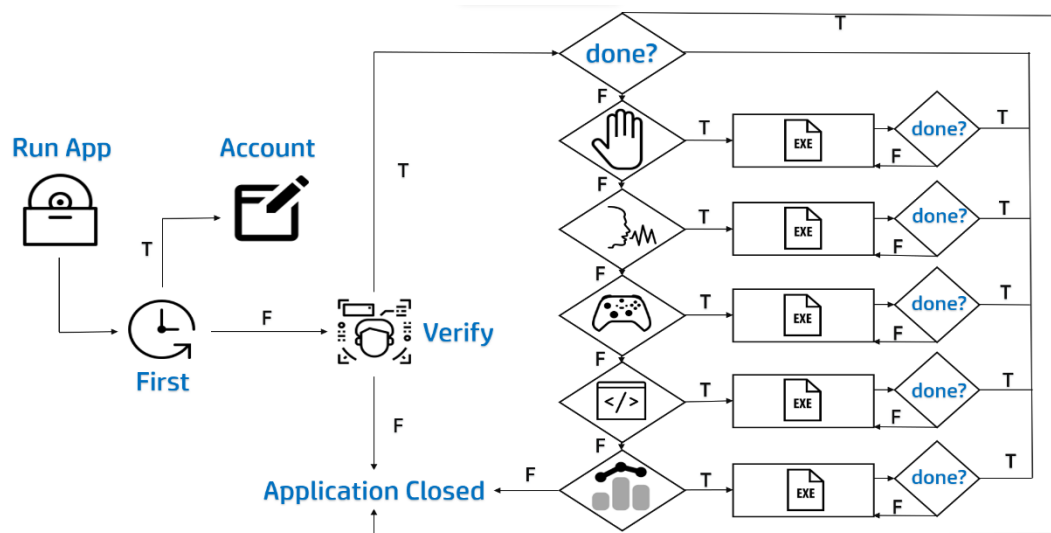


Figure 4.1.2: The project's entire flow is meticulously presented within a block diagram, showcasing traceable paths.

Algorithm for the software

1. Start the application.
2. Check if the user's account already exists.
 1. If not:
 1. Ask for the user's Gmail^[6].
 2. Send an OTP for confirmation.
 3. If OTP is valid:
 1. Store the user details in MongoDB Atlas.
 4. Else:
 1. Close the application.
 2. If yes:
 1. Perform face verification.
 2. If verification is successful:
 1. Display the window with options: Hand mouse, Commands, Gameplay, Slang code, Analysis.
 3. Else:
 1. Close the application.
3. Await user's choice among the provided options.
4. Run the chosen feature's underlying code.
5. Check for user input continuously:
 1. If "stop" button is clicked:
 1. End the feature's execution.
 2. Return to the main options window.
 2. If "exit" button is clicked:
 1. Close the application.
6. If the user exits:
 1. Update the user's interaction details in MongoDB Atlas.
7. End.

Algorithms for all the features

Hand Mouse

1. Select hand mouse.
2. Open the camera.
3. The hand will be sensed and the landmarks will be processed.
4. According to movements the actions will be carried.
5. Functions such as minimizing, zoom- in & out and shortcuts etc.
6. Once you complete your tasks, go back to menu and explore other functions of just gest.

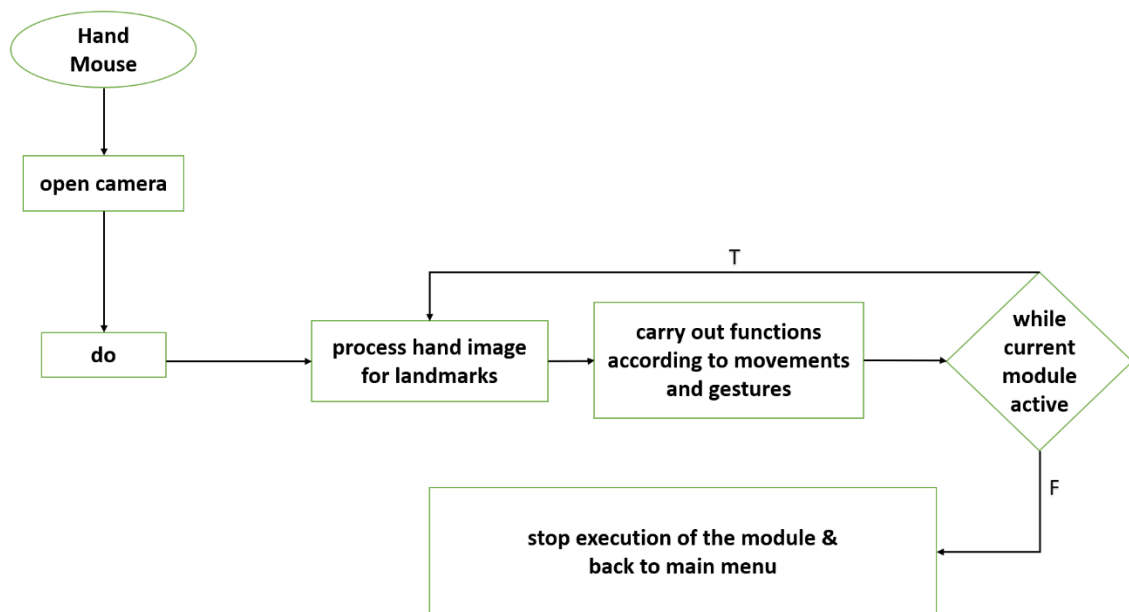


Figure 4.1.2: Block diagram that visually delineates both the functionality and data flow of the Hand Mouse.

Commands

1. Select the voice assistant.
2. Enable your microphone.
3. Access internet, shortcuts and any apps.
4. Chrome can be accessed using specific keyword.
5. Once you complete your tasks, go back to menu and explore other functions of just gest.

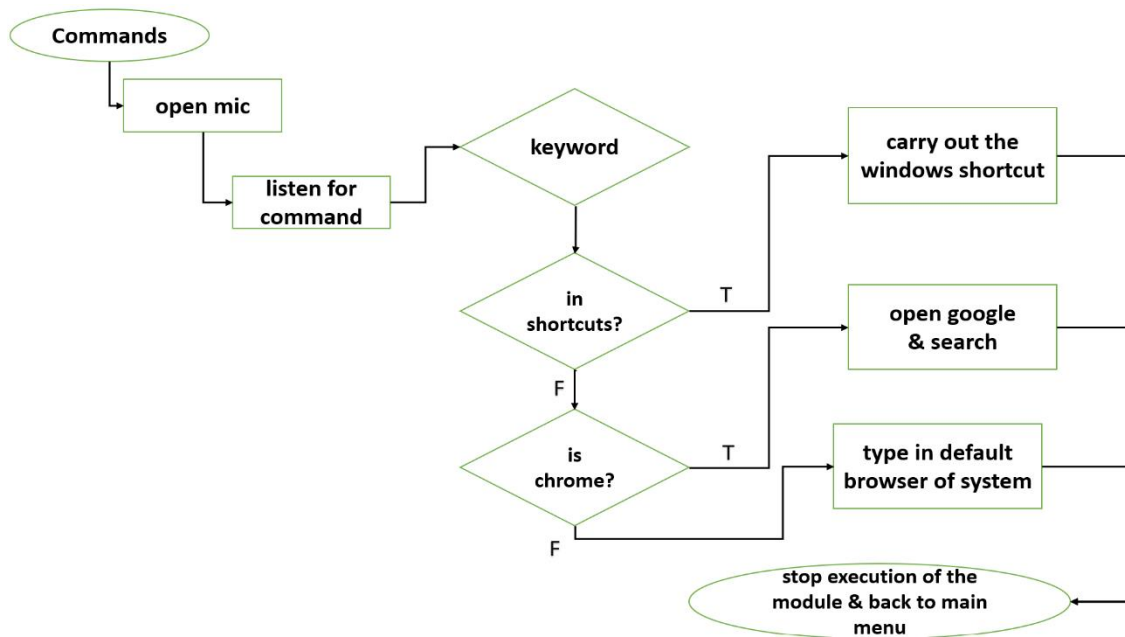


Figure 3.1.4: The block diagram effectively illustrates the integration of a microphone using keywords and the implementation of shortcuts for enhanced functionality.

Gameplay

1. Select the game play.
2. Enable your camera.
3. Once the landmarks are matched after processing of face.
4. Through our microphone assistant you can open the game.
5. Comfortable movements such as up, down and sideways.
6. Time limit as of now is 3min.
7. Once you complete your tasks, go back to menu and explore other functions of just gest.

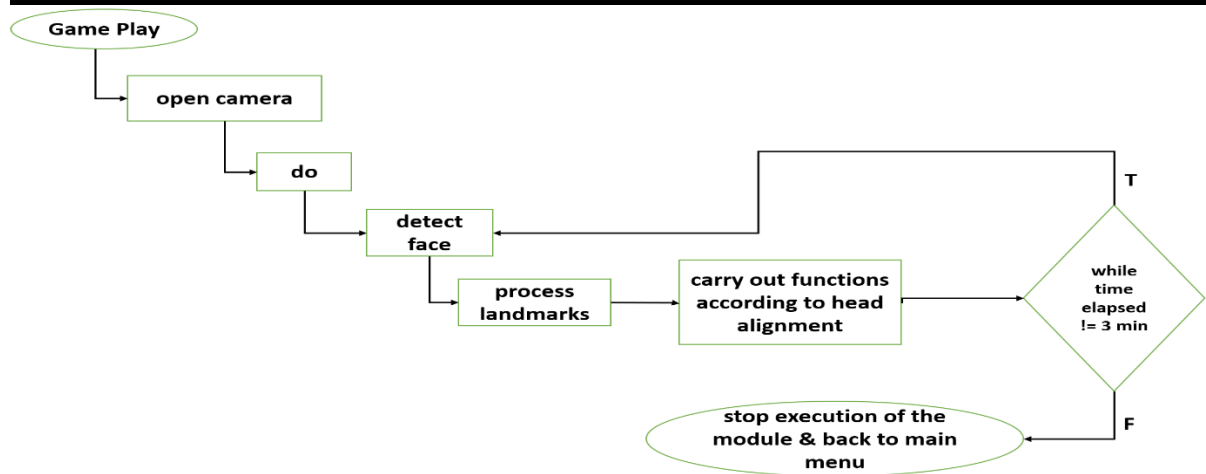


Figure 4.1.5: The block diagram visually outlines an elevated gaming experience achieved through detecting face movements, and seamless execution of associated functions.

Slang Code

1. Select the slang code.
2. Enable your microphone.
3. This feature enables to enhance the coding level.
4. Ask a program.
5. Internally the code is processed using a ai bot.
6. After processing is done the code is typed on code editor.
7. Once you complete your tasks, Go back to menu and explore other functions of just gest.

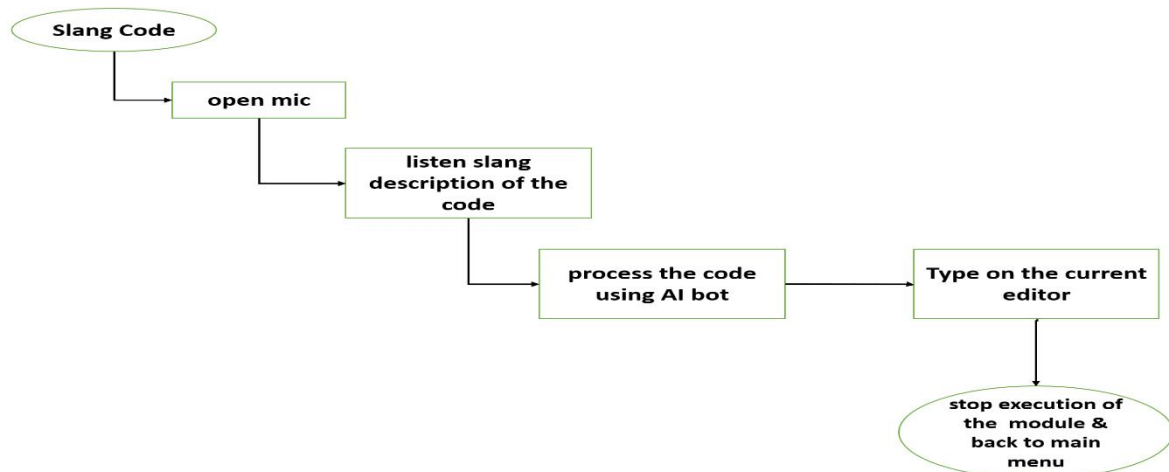


Figure 4.1.6: Diagram shows the feature of slang code by accessing the voice command and enhances the coding experience.

Analysis

1. After the successful login select the analysis.
2. User data is collected and processed.
3. Through this user can see his time spent on specific feature of just gest.
4. By bar graph its graphically represented.
5. Once you complete your tasks, go back to menu and explore other functions of just gest.

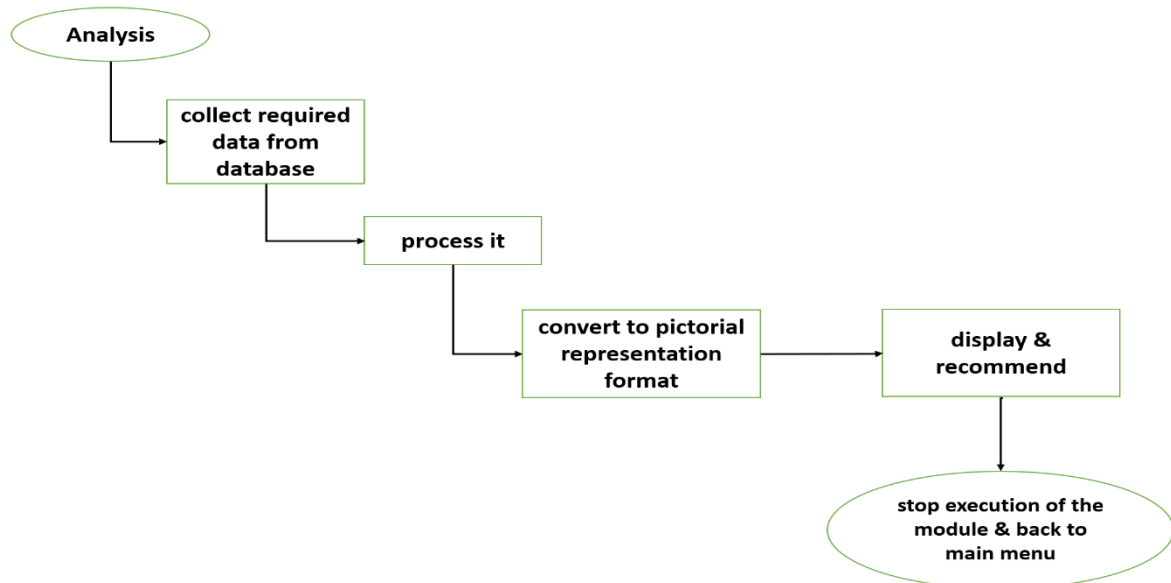


Figure 4.1.7: The diagram illustrates user analysis via data collection and graphical representation.

By adhering to this methodology, the project can ensure a systematic, efficient, and user-centred development process, resulting in a software solution that is both innovative and highly functional.

4.2 Implementation

A detailed description of implementation of the project using Python and MongoDB Atlas is given:

1. Welcome page: The first stage is to develop the user interface where all the menu bar buttons will be present and corresponding functions. There will be 5 options that are available to the user- commands, slang code, gameplay, hand mouse and analysis. The user can choose any of the functions he wants to try out by clicking on the menu bar buttons. Accordingly, the respective functions

will start executing and user can start using them.

2. Commands: We will take a look on to the first function- commands which basically converts speech to text^[4] and perform the actions required by the user.

```
def hand_mouse_click():
    speak('Show me your hand')
    try:
        td.start_new_thread(hm.the_h_mouse, ())
    except:
        speak('Oops!There was a glitch, please try again')

def commands_click():
    global t_cmd
    t1=time.time()
    import Cmds as cd
    try:
        cd.quick_actions()
    except: speak('Please check your internet connection')
    t_cmd+=(time.time()-t1)

def slang_code_click():
    global t_sd
    t1=time.time()
    import SlangCode as sd
    try:
        sd.type_em(sd.return_code(sd.return_query()))
    except: speak('Oops!There was a glitch, please try again')
    t_sd+=(time.time()-t1)

def gameplay_click():
    global t_gp
    speak("Let's Play")
    speak("Please adjust your head for neutral alignment to have an enjoyable time playing")
    t1=time.time()
    import GamePlay
    t_gp+=(time.time()-t1)
    speak("Gameplay stopped. If you want to play for unlimited time, upgrade to professional version")
def requests_click():
```

Figure 4.2.1: Menu bar buttons and corresponding functions

In this the user speech is being analysed using the speech recognition module Under this function the user can open the windows apps or search anything on Google or your default browser.

```
def quick_actions():
    query = ''
    import speech_recognition as sr
    r = sr.Recognizer()
    with sr.Microphone() as source:
        r.adjust_for_ambient_noise(source)
        speak('Go ahead')
        audio = r.listen(source, phrase_time_limit=4)
        try:
            query = r.recognize_google(audio).lower()
        except sr.exceptions.UnknownValueError:
            pass
    if len(query):
        speak('Command accepted')
        map_to_key(query)
```

Figure 4.2.2: Speech to Text

3. Slangcode: In this function whatever code the user wants can be executed. For this function we have made use of the bardapi module which allows the user to ask a program using mic and then send the program to google bard and after the processing is done, the code will be typed on your corresponding editor using the pyautogui module.

```
def return_code(query):
    from bardapi import Bard
    import os
    os.environ['_BARD_API_KEY']='ZgjUjZ7_pW9cigpRMPz2haHN1IW--iATcD06Wg4M5aRxUrrzsbZ-NBHNu7TbLA80N6U8aA.'
    query+='\n\nThe first line code snippet should be this comment - 'ProgByBard'
    query+='\n\nThe last line code snippet should be this comment - 'ProgByBard'
    query+='\n\nThe code should not contain other comments or any description of any function'
    query+='\n\nPlease give only the code snippet without any explanation'
    speak('Coding the program')
    code=Bard().get_answer(query)['content']
    code=code.split('ProgByBard')
    return code[1][:-4]

1 usage
def final_typer(s):
    import pyautogui
    speak('Here you go')
    for i in s:
        pyautogui.typewrite(i)
```

Figure 4.2.3: Sending code to google bard and then receiving the code

4. **GamePlay:** In this function the user can play a game using the movement of your head. So basically, the camera will detect your face and retrieve all the landmarks. The user must identify his stationary position before playing the game so as to ensure that it will be convenient while playing.

```
def doer():
    import _thread
    global enabled
    d = {196: 0, 197: 0, 50: 0, 132: 0, 352: 0, 323: 0, 212: 0, 214: 0}
    success, img = cap.read()
    img = cv.flip(img, 1)
    imgRGB = cv.cvtColor(img, cv.COLOR_BGR2RGB)
    results = face_mesh.process(imgRGB)

    if results.multi_face_landmarks:
        for faceLms in results.multi_face_landmarks:
            mpDraw.draw_landmarks(img, faceLms, mpFaceMesh.FACEMESH_CONTOURS,
                                   mpDraw.DrawingSpec(color=(0, 255, 0), thickness=1, circle_radius=1),
                                   )

            for id, lm in enumerate(faceLms.landmark):
                ih, iw, ic = img.shape
                x, y = int(lm.x * iw), int(lm.y * ih)
                if id in (196, 197, 50, 132, 323, 352):
```

Figure 4.2.4: Face detection and retrieval of landmarks

5. **Hand mouse:** This function allows the user to use his hands to perform the mouse functions. The main module which is being used here is the OpenCV. Before executing the camera will detect your hands and retrieve the landmarks of your hand. After this the user can perform various operations like changing tabs, performing the clicks, moving the cursor etc.

```
def the_h_mouse():
    cap = cv.VideoCapture(0, cv.CAP_DSHOW)
    cap.set(3, 640)
    cap.set(4, 480)
    mpHands = mp.solutions.hands
    hands = mpHands.Hands(max_num_hands=1)
    mpDraw = mp.solutions.drawing_utils

    global id_points, mouse_in_action, left_click_var, click_allowed, scroll_allowed, task_allowed, zoom_allowed, others_allowed, t_a, s_w, s_h, smoothening, plocX, plocY, clocX, clocY, time_allowed, close_allowed

    try:
        while mouse_in_action:
            if time_allowed:
                t.start_new_thread(timer, ())
            success, img = cap.read()
            imgRGB = cv.cvtColor(img, cv.COLOR_BGR2RGB)
            results = hands.process(imgRGB)
            if results.multi_hand_landmarks:
                for handLms in results.multi_hand_landmarks:
                    mpDraw.draw_landmarks(img, handLms, mpHands.HAND_CONNECTIONS)
                    for id, lm in enumerate(handLms.landmark):
                        h, w, _ = img.shape
                        cx, cy = int(lm.x * w), int(lm.y * h)
```

Figure 4.2.5 Hand detection and retrieval of landmarks

6. Mailer: In this part of code, we will be creating a login interface where the user has to mention his email address and an OTP will be sent to his corresponding email and after the verification of the OTP the user will be able to log in. This is done to provide authentication to the users.

```
def mailer(client):  
    global em,my_pass,my_mail,otp  
    em['To']=client  
    context = ssl.create_default_context()  
    with smtplib.SMTP_SSL('smtp.gmail.com',465,context=context) as smtp:  
        smtp.login(my_mail,my_pass)  
        smtp.send_message(em)  
    return otp
```

Figure 4.2.6: Mailing the OTP

7. Analysis: In this part of code, we will be able to determine the duration the user has spent for each of the function. This can be done by storing the information in the MongoDB Atlas cloud database and after retrieving the data from the database and a graph will be plotted which will indicate the duration of the features.

```

def stat():
    uri=client=db=collection=0
    try:
        from params import gmail
        uri = "mongodb+srv://CGSMongo:gIWkRYRpnQBnCxET@mongocluster.zo5lmgp.mongodb.net/?retryWrites=true&w=majority"
        client = MongoClient(uri, server_api=ServerApi('1'))
        db = client['JustGest']
        collection = db['Users']
        _doc = collection.find_one({'gmail': gmail})
        data = _doc['l_t']
        plt.title('Your usage')
        plt.xlabel('Features →')
        plt.ylabel('Duration →')
        plt.ylim(0,int(max(data)*1.5))
        plt.xticks(range(4),['Hand Mouse', 'Commands', 'Slang Code', 'Gameplay'])
        bars = plt.bar(range(4),data)
        for bar in bars:
            yval = bar.get_height()
            plt.text(bar.get_x() + bar.get_width() / 2, yval, round(yval, 2), ha='center', va='bottom')
        manager = plt.get_current_fig_manager()
        manager.window.geometry('+550+120')
        manager.window.title('Stats')

```

Figure 4.2.7: Retrieve data from database and plot the graph

8. Verification: The OTP verification is done in this part and once the OTP is verified the user will be able to explore the features of our project and carry out the database operations.

```

if (get_otp() == otp):
    ffp = open('params.py', 'w')
    ffp.writelines(["gmail="+""+credentials['gmail']+""","\n\nl_t = [0,0,0,0]"])
    ffp.close()
    pass_w = credentials['password']
    enc_pass_w=''
    for i in pass_w:
        enc_pass_w+=chr(ord(i)*5-5)
    collection.insert_one(
        {'gmail': credentials['gmail'], 'pass': enc_pass_w, 'time_s': time.ctime(),
        'otp': otp,'l_t':[0,0,0,0]})
    messagebox.showinfo('Validation Success', 'Go ahead and explore!')
    try:
        speak('Welcome to Just Gest')
        menu_bar()
        putter()
    except: speak('Oops!There was a glitch, please try again')

```

Figure 4.2.8: Verify OTP and carry out database operations

Chapter: 5

Testing and Validation

The "Just Gest" project, due to its multifaceted nature, demands rigorous testing and validation processes to ensure accuracy, reliability, and robustness. Implementing a thorough testing methodology is crucial not only for the project's functionality but also for user safety and security. Here's a detailed outline of the potential testing and validation procedures:

1. Unit Testing

Each component of the system should be tested individually to ensure it functions correctly.

- Face Recognition: Test the system with various faces, under different lighting conditions, and using different angles to ensure accurate recognition.

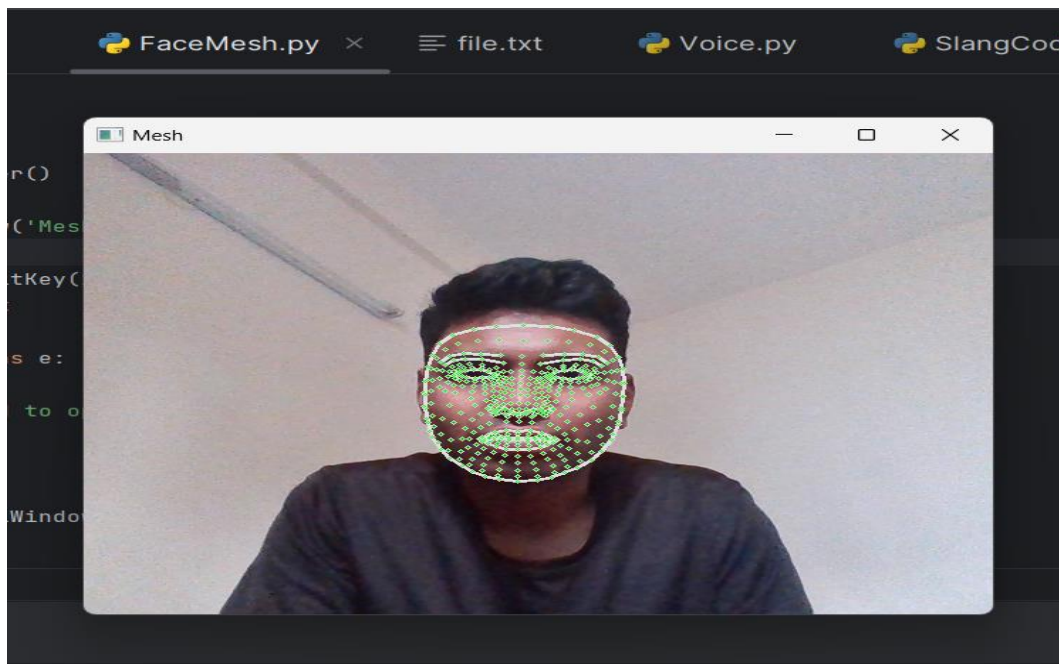


Figure: 5.1 Face landmark identification

- Voice Commands: Test with various accents, speech speeds, and background noise levels to ensure commands are accurately recognized.

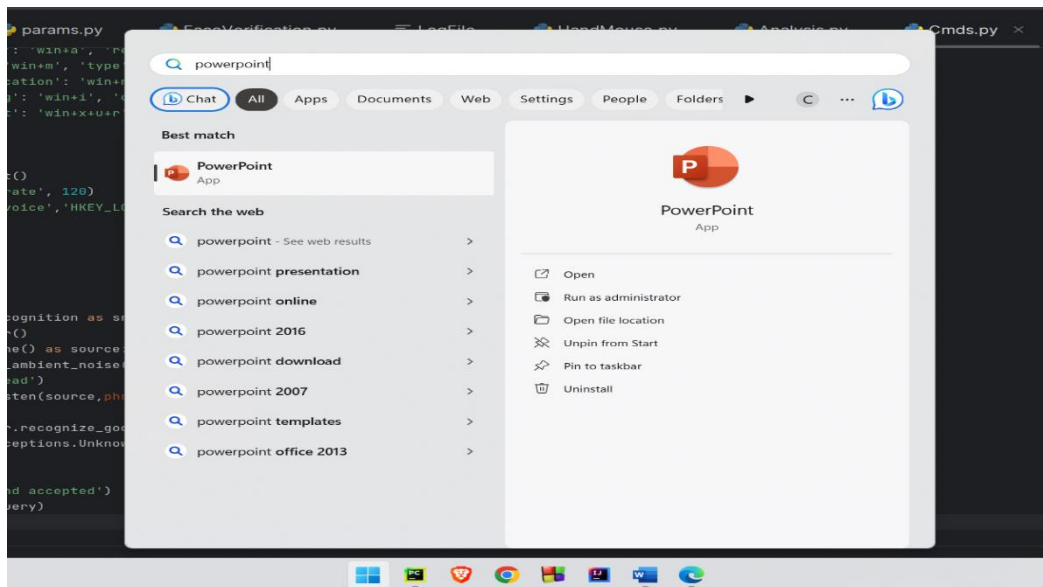


Figure:5.2 Opening the app present in the pc

2. Integration Testing

After individual components are validated, the next step is to ensure they work seamlessly when integrated.

- System Flow: From face recognition login to navigating through the different features using gestures or voice, the entire flow should be smooth and free of glitches.
- Database Integration: Ensure that data is correctly stored in and retrieved from MongoDB, especially for the "Analysis" feature.

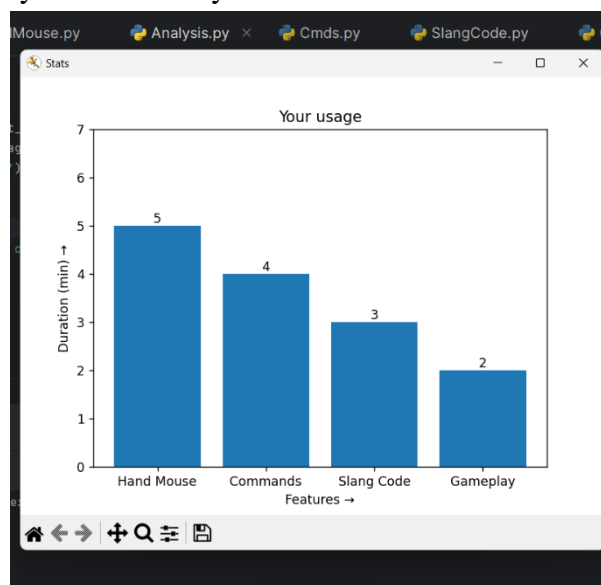


Figure: 5.3 Graph plotted for sample data

3. Usability Testing

Engage real users to test the software in real-world scenarios.

- **User Feedback:** Obtain feedback about the intuitiveness of the software, any challenges faced, and areas of improvement.
- **Accessibility Testing:** Engage differently-abled users, especially amputees, to understand if the software truly caters to their needs.

4. Stress Testing

Assess the software's performance under extreme conditions.

- **Multiple Users:** If more than one user tries to interact with the software simultaneously, it should either handle the input gracefully or queue the processes efficiently.
- **Extended Use:** Test how the software performs when run for prolonged periods. This helps identify any potential memory leaks or overheating issues.

5. Security Testing

Given the use of facial recognition and potentially voice data, security is paramount.

- **Data Encryption:** Ensure that user data, especially facial data, stored in MongoDB is encrypted and cannot be easily hacked.
- **False Positives and Negatives:** For face recognition, test against potential spoofing attempts using photos, videos, or masks.

6. Performance Testing

Evaluate the software's efficiency.

- **Response Time:** The time taken from when a gesture is made or a command is given to when the system responds should be minimal.
- **Resource Utilization:** Monitor CPU, memory, and GPU utilization to ensure the software is optimized and does not hog system resources.

3. Usability Testing

Engage real users to test the software in real-world scenarios.

- User Feedback: Obtain feedback about the intuitiveness of the software, any challenges faced, and areas of improvement.

4. Stress

Assess

5. Security

Given t

6. Performance

Evaluate the software's efficiency.

- Response Time: The time taken from when a gesture is made or a command is given to when the system responds should be minimal.

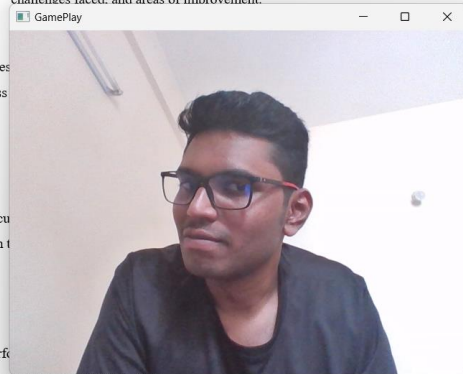


Figure: 5.4 Performing left arrow action on a word document

7. Regression Testing

Every time a new feature is added or an existing one is modified, it's essential to test the entire software again to ensure no previously working functionality is broken.

```

Run SlangCode x
E:\Coding\Python\JustGest\Scripts\python.exe E:\Coding\Python\JustGest\SlangCode.py

import java.util.ArrayList;

public class MultiplyIndices {

    public static void main(String[] args) {
        ArrayList<Integer> arraylist = new ArrayList<Integer>();
        arraylist.add(1);
        arraylist.add(2);
        arraylist.add(3);
        arraylist.add(4);
        arraylist.add(5);

        // Multiply the odd indices with -1
        for (int i = 0; i < arraylist.size(); i++) {
            if (i % 2 == 1) {
                arraylist.set(i, arraylist.get(i) * -1);
            }
        }

        // Multiply the even indices with 10
        for (int i = 0; i < arraylist.size(); i++) {
            if (i % 2 == 0) {
                arraylist.set(i, arraylist.get(i) * 10);
            }
        }
    }
}

```

Figure: 5.5 Receiving the answer for query and printing on the console

8. Edge Case Testing

- **Uncommon Scenarios:** Test scenarios that might not be frequent but are possible, such as rapid, consecutive commands or uncommon hand gestures.

9. Validation

Finally, after all the testing phases:

- **Comparison with Objectives:** The project's functionality and performance should be compared with the stated objectives to ensure alignment.
- **Continuous Feedback Loop:** Even after launch, continuous feedback should be taken from users and should be integrated into future iterations of the software.



Figure: 5.6 Trial of sending OTP using Gmail

In conclusion, the project's testing and validation will play a crucial role in its success. Ensuring each feature works flawlessly, the system is secure, and the user experience is unparalleled will determine the project's adoption and effectiveness in real-world scenarios

Chapter: 6

Results and Discussions

6.1 Results

The results of the python project were promising, as it successfully implemented the proposed features and addressed the idea of almost contactless computer control.

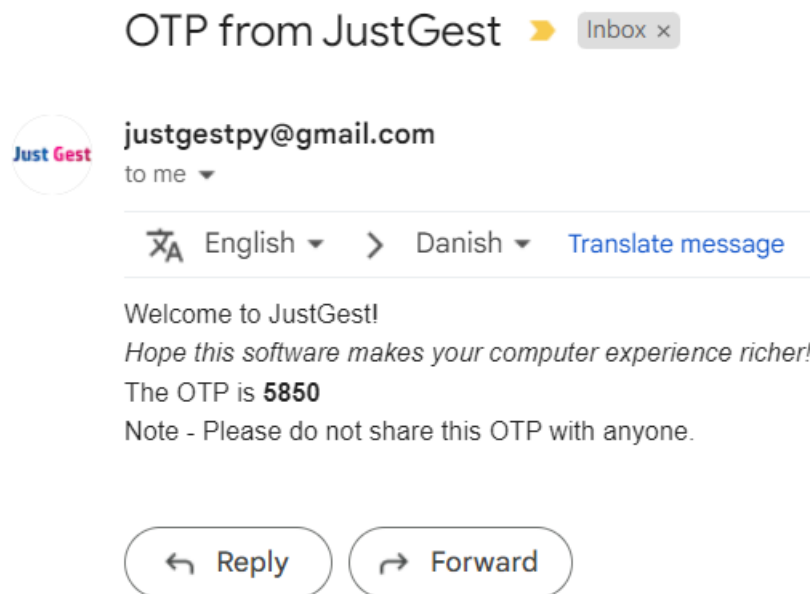


Figure:6.1.1 Mail when the user signs up

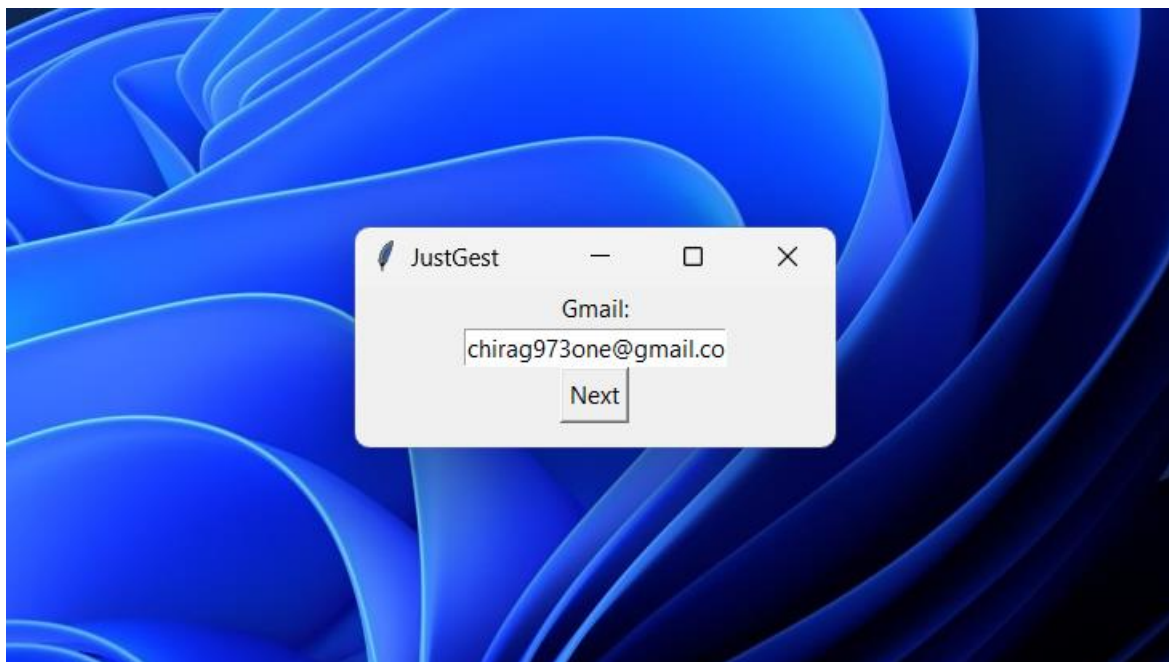


Figure:6.1.2 User entering Gmail id when signing up



Figure:6.1.3 User entering OTP for validation

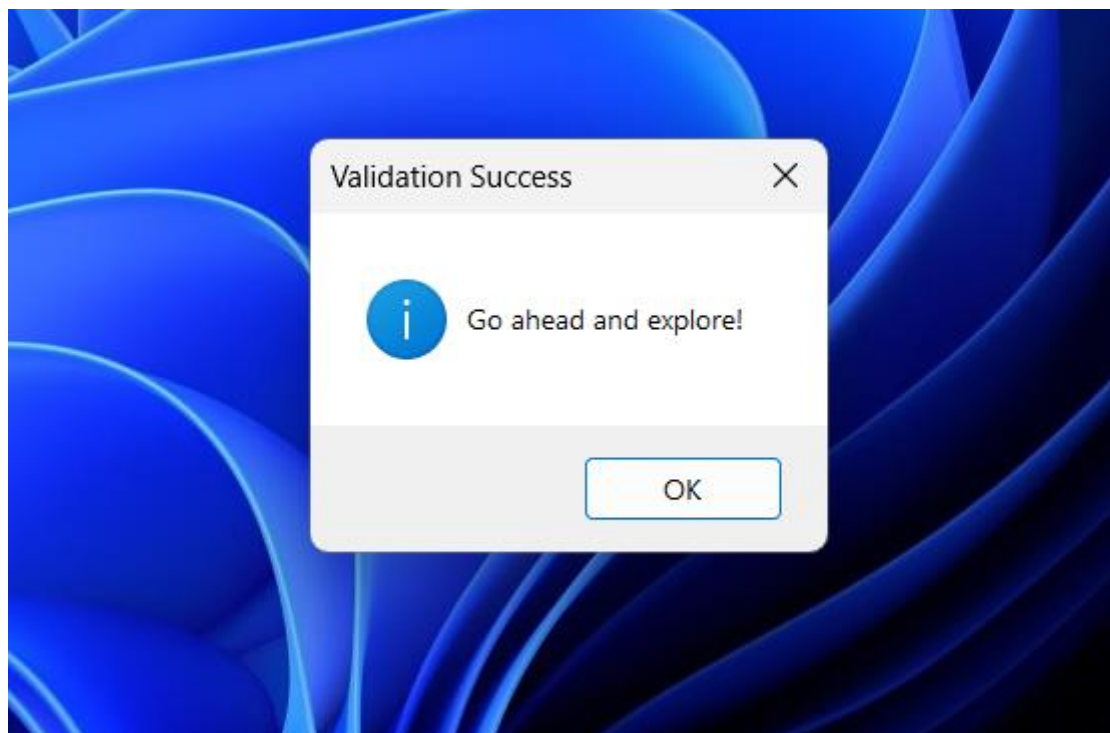


Figure: 6.1.4 Pop up window if the OTP is verified and after the face has been registered

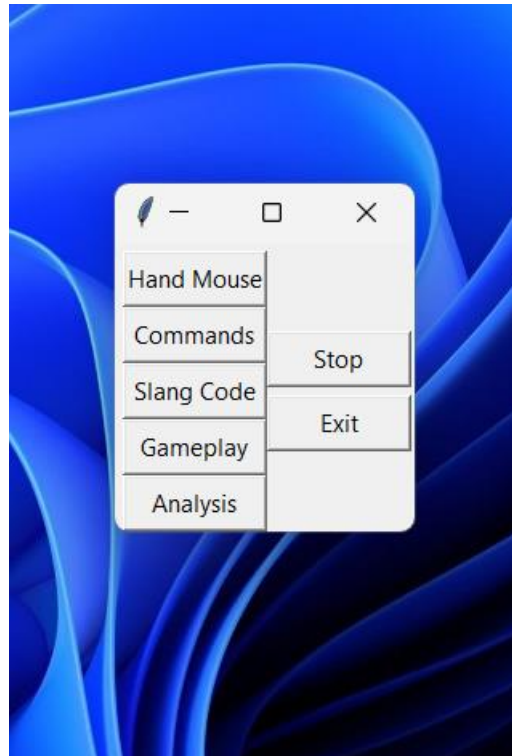


Figure:6.1.5 Menu Bar

1. Enhanced User Interaction

- **Hand Mouse:** This feature has the potential to drastically change how users interact with their computers. Not only does it offer a novel way to control the mouse, but it also introduces features that are absent in traditional mice. Users can expect a more intuitive and fluid experience, especially in situations where hands-free operation is needed.

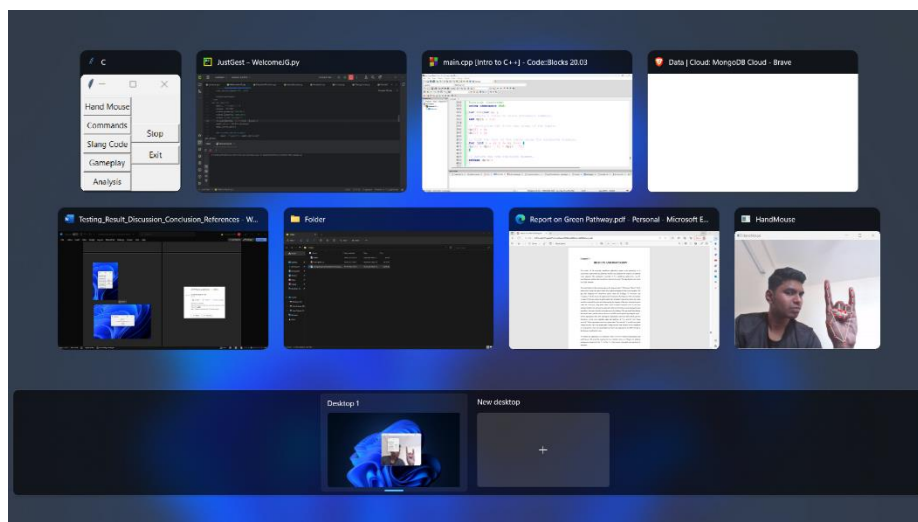


Figure: 6.1.6 Viewing all tabs

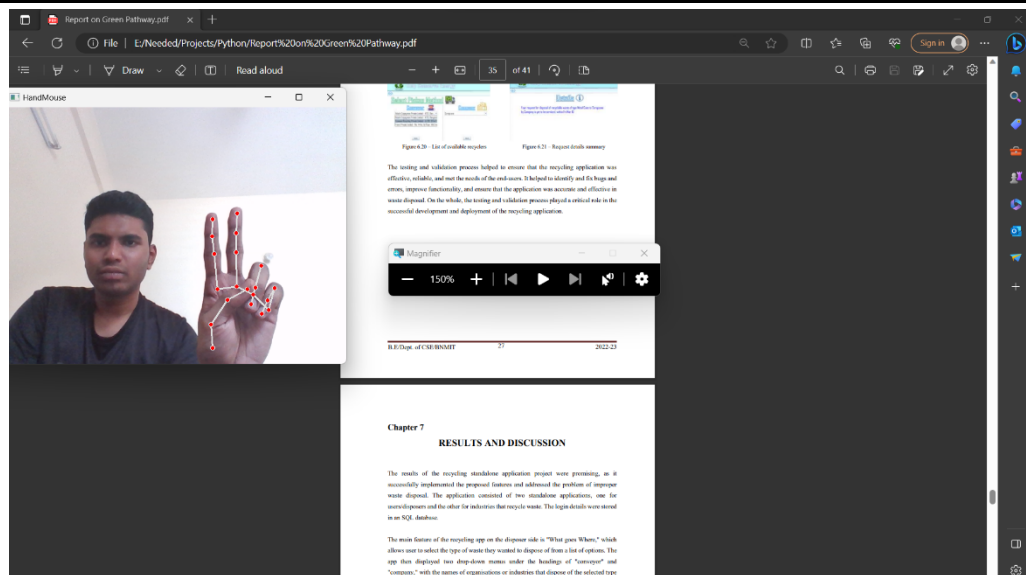


Figure:6.1.7 Zooming (in)

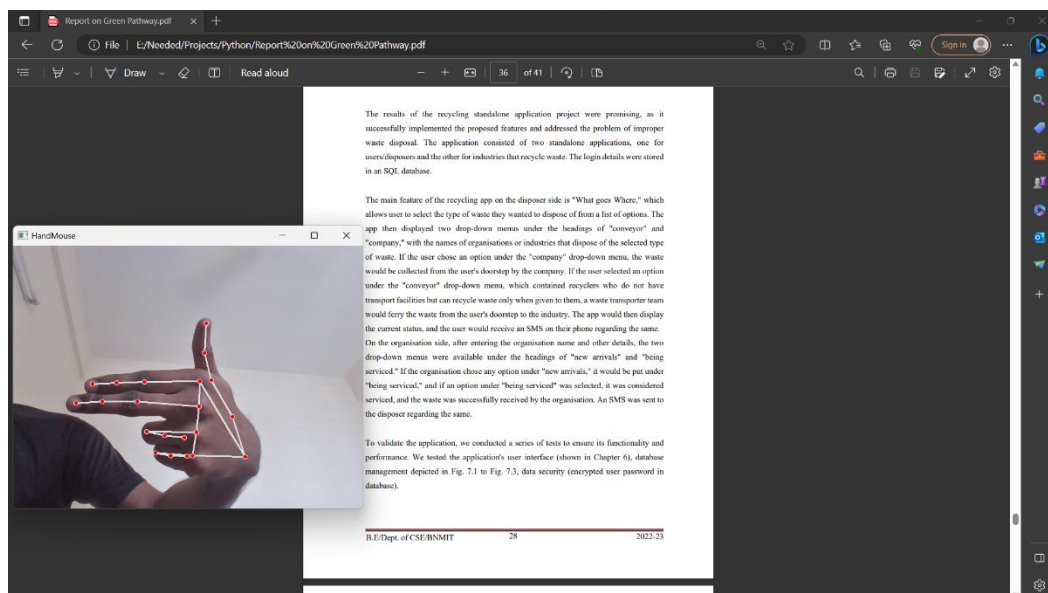


Figure:6.1.8 Scrolling the pdf (upwards)



Figure:6.1.9 Opening taskbar applications (4)

- **Commands:** By listening to quick commands, the system is expected to improve multitasking. Whether it's quickly launching apps, taking screenshots, or locking the system, users can do so without diverting their attention or relying on manual input methods.

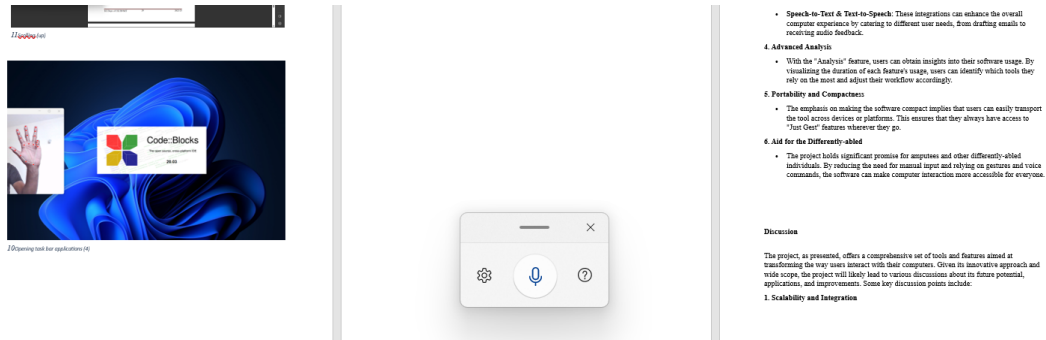


Figure:6.1.10 Opening the listen and type feature

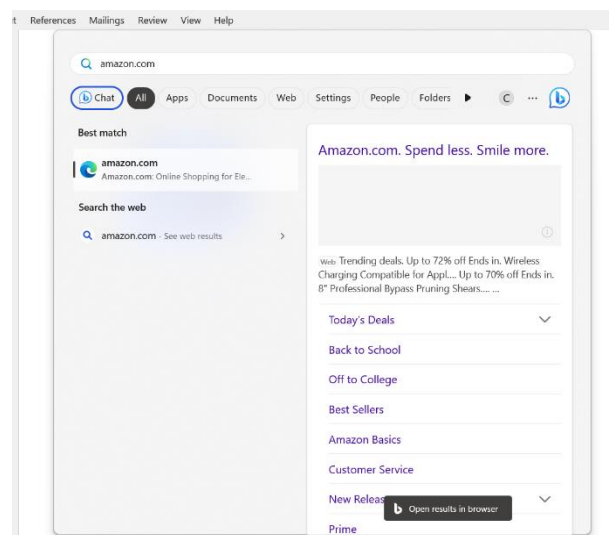


Figure:6.1.11 Browsing websites on the system's default browser

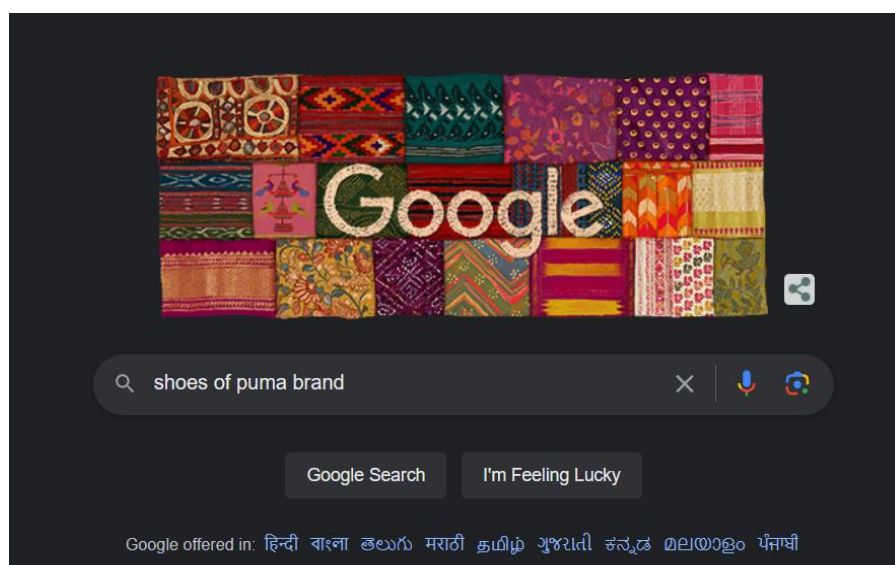


Figure:6.1.12 Searching the voice command on Google

- **Gameplay:** The integration of head alignment as a game controller provides an innovative method for game interaction. Games like Subway Surfers and Temple Run, which rely heavily on directional cues, can be played more immersively.



Figure: 6.1.13 Subway surfers Gameplay (jump movement by lifting head)



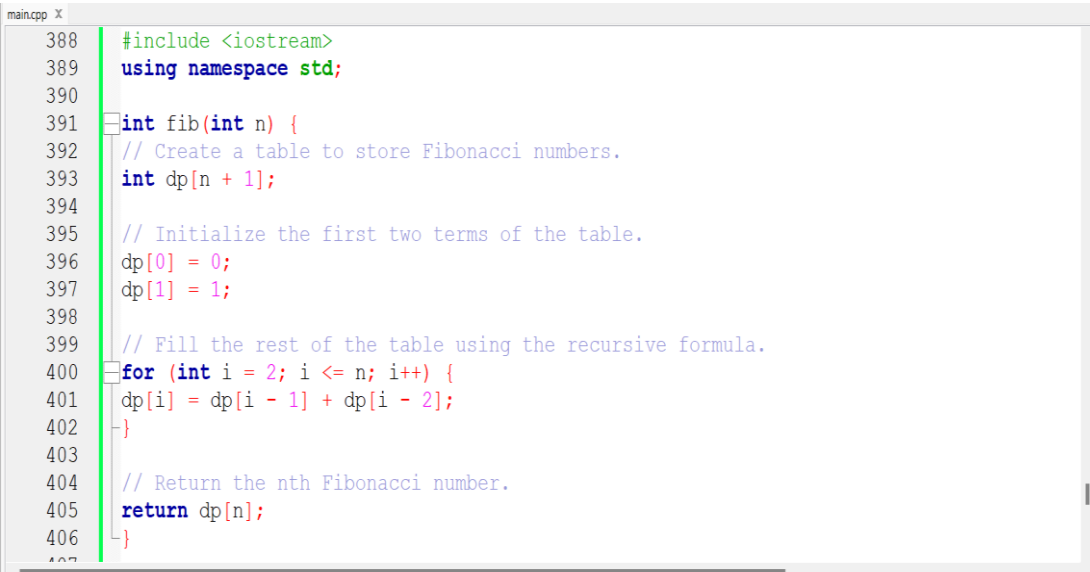
Figure:6.1.14 (left movement by turning left)

2. Improved Security

- The face recognition feature ensures that unauthorized users cannot access the software, thereby adding an extra layer of security. In scenarios where password compromise is a concern, "Just Gest" provides a safer alternative.

3. Increased Automation^[3] and Efficiency

- **Slang Code:** This is potentially a groundbreaking feature for developers. By merely

A screenshot of a code editor window titled 'main.cpp'. The code is a C++ implementation of a Fibonacci function using dynamic programming. It includes headers for iostream and std, defines a dp array, initializes the first two terms, and uses a for loop to fill the rest of the table. The code is as follows:

```
388 #include <iostream>
389 using namespace std;
390
391 int fib(int n) {
392     // Create a table to store Fibonacci numbers.
393     int dp[n + 1];
394
395     // Initialize the first two terms of the table.
396     dp[0] = 0;
397     dp[1] = 1;
398
399     // Fill the rest of the table using the recursive formula.
400     for (int i = 2; i <= n; i++) {
401         dp[i] = dp[i - 1] + dp[i - 2];
402     }
403
404     // Return the nth Fibonacci number.
405     return dp[n];
406 }
```

Figure:6.1.15 C++ code typed on the editor as per description provided by speech

describing a piece of code verbally, the system can generate the required code in any programming language. This not only speeds up the coding process but also aids those who may not be proficient in a particular language.

- **Speech-to-Text & Text-to-Speech:** These integrations can enhance the overall computer experience by catering to different user needs, from drafting emails to receiving audio feedback.

4. Advanced Analysis

- With the "Analysis" feature, users can obtain insights into their software usage. By visualizing the duration of each feature's usage, users can identify which tools they rely on the most and adjust their workflow accordingly.

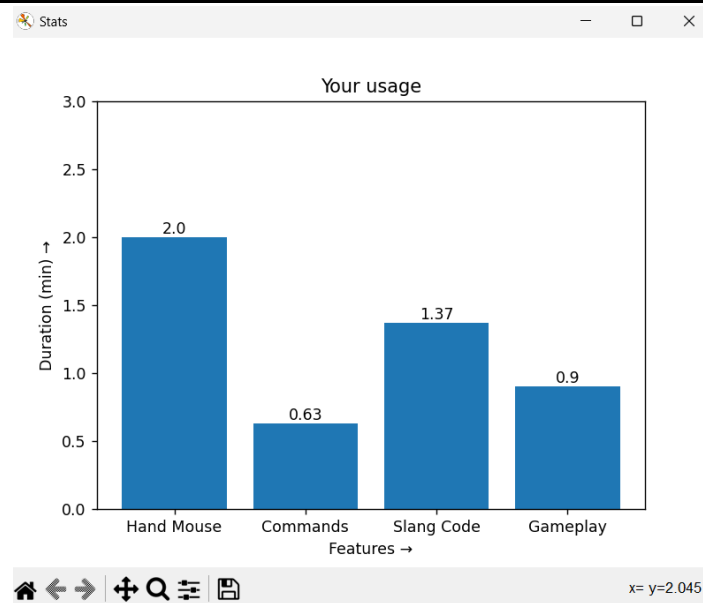


Figure:6.1.16 Bar graphs for analysis for a user

5. Portability and Compactness

- The emphasis on making the software compact implies that users can easily transport the tool across devices or platforms. This ensures that they always have access to "Just Gest" features wherever they go.

6. Aid for the Differently-abled

- The project holds significant promise for amputees and other differently-abled individuals. By reducing the need for manual input and relying on gestures and voice commands, the software can make computer interaction more accessible for everyone.

```

_id: ObjectId('64db1dde52edc8a6b4ce489d')
gmail: "chirag973one@gmail.com"
time_s: "Tue Aug 15 12:10:30 2023"
otp: "4909"
l_t: Array
  0: 2
  1: 0.63
  2: 1.37
  3: 0.9

```

Figure:6.1.17 The collection of data of one user in cloud

6.2 Discussions

The project, as presented, offers a comprehensive set of tools and features aimed at transforming the way users interact with their computers. Given its innovative approach and wide scope, the project will likely lead to various discussions about its future potential, applications, and improvements. Some key discussion points include:

1. Scalability and Integration

- **Multi-platform Support:** How can the project be scaled to support various operating systems and platforms? Discussion around making "Just Gest" compatible with macOS, Linux, and even mobile platforms like Android and iOS will be essential.
- **Integration with Other Applications:** How can "Just Gest" be integrated seamlessly into popular software suites, like Microsoft Office, Adobe Creative Suite, and others, to make those applications more gesture-friendly?

2. Enhancing Security Features

- **Advanced Face Recognition:** With the evolving world of deepfakes and biometric hacking, there may be discussions on enhancing the face-recognition feature using multi-point recognition or integrating other biometric parameters.
- **Behavioral Patterns:** Exploring how the software could learn and adapt to the unique gesture and voice command patterns of its primary user, adding an additional layer of security.

3. Feature Expansions

- **Gesture Customization:** Will users be able to customize and define their gestures for specific actions?
- **Language Support for Slang Code:** Expansion of the Slang Code feature to support more programming languages and understand developer lingo from various cultures and regions.
- **Enhanced Gaming Experience:** Beyond controlling arrow keys, what other gaming integrations and experiences can be explored using gestures?

4. Addressing Potential Challenges

- **Physical Strain:** Prolonged use of gestures might lead to physical strain or discomfort. Discussions around introducing ergonomic guidelines or adaptive rest periods could be beneficial.
- **Environmental Factors:** How will "Just Gest" adapt to different lighting conditions or backgrounds, ensuring consistent performance?

5. Augmented Reality (AR) and Virtual Reality (VR) Integration

- With the rise of AR and VR, how can "Just Gest" be integrated into these platforms to offer gesture-controlled immersive experiences?

6. Continuous Learning & Adaptation

- How will the software adapt to the learning curve of users? As users become more accustomed to using gestures, will "Just Gest" adapt and refine its responsiveness over time?
- Discussions on integrating machine learning models that help the software become more intuitive with prolonged use.

7. Outreach and Community Development

- Building a community around "Just Gest" where users can share custom gestures, slang code definitions, and other personalized settings.
- Offering SDKs or APIs for developers to integrate "Just Gest" features into third-party applications.

The future discussions for this python project will revolve around its scalability, feature enhancements, addressing challenges, and exploring new technological integrations. It's a project with vast potential, and its future discussions will play a pivotal role in shaping its trajectory in the tech world.

Chapter: 7

Conclusions

The project, at its core, is a transformative attempt to push the boundaries of human-computer interaction. By leveraging the extensive capabilities of computer vision, it endeavours to make the digital experience more intuitive and enjoyable. Python, with its versatility and expansive library support, played an instrumental role in the project's development. The ease offered by Python, combined with the powerful support from the bard API^[5], underscores the assertion that had this been attempted in another programming language, the journey might have been significantly more arduous.

One of the project's most notable features is its cloud-based database integration, specifically with MongoDB Atlas which aids in monitoring user engagement for iterative improvement. While the current implementation is in Python, making it truly universal might require delving into more sophisticated system programming. However, its portability is already showcased with its executable file for Windows systems, indicating a strong foundation for cross-platform adaptability.

Furthermore, the project stands as a testament to the possibilities that lie in replacing hardware devices with software-driven solutions. It acts as a beacon, lighting the path for future endeavours that seek to harness gestures for control in more complex real-world applications. The open-source community edition of the software offers a broad platform for collaboration and innovation. Yet, for those seeking a professional edge, there might be the requisite of investment, ensuring long term support for the features to be continually ensured.

7.1 Scope

The beauty of the software lies in its innovative approach to intuitive human-computer interaction. Currently, the software has successfully evolved beyond the limitations of traditional hardware, pioneering a new era of interaction where gestures are the primary language. This is coupled with its wide-ranging functionalities that not only enhance security through features like facial recognition but also extend to realms of entertainment and utility through AI-driven coding assistance. Furthermore, its commitment to inclusivity is evident. By providing features such as speech-to-text, becomes more than just a tool—it becomes a beacon of accessibility, especially for those with physical impairments. The software's robustness is

further amplified by its integration with MongoDB Atlas, a cloud-based database. This facilitates not just data storage, but also a granular analysis of user interactions, helping the team gain insights and refine functionalities. As of now, Python stands as its backbone, but the creation of an executable file ensures that Windows users find it just as portable and user-friendly. Additionally, its dual-edition approach, offering both an open-source community version and a feature-rich professional one, underscores its commitment to catering to a diversified user base.

7.2 Future Enhancements

Looking ahead, the roadmap for a software like Just Gest is both ambitious and exciting. The immediate horizon sees potential in expanding its wings beyond the Windows ecosystem, aiming for a universal footprint that encompasses platforms like MacOS, Linux, and even mobile operating systems. As technology continues its rapid evolution, the software can be envisioned integrating richer gesture recognition algorithms, diving deeper into the nuances of human movement and offering a wider palette of interactive commands. There's also a fascinating possibility of the concept stepping into the realm of the Internet of Things (IoT), painting a future where users could potentially control their smart homes with a mere flick of a finger. This foresight is not limited to just functionalities. Leveraging the goldmine of data from the cloud, the software could evolve to offer personalized experiences, curating its features based on individual user preferences and behaviours. Augmented and Virtual Reality, two domains that are redefining digital interaction, could very well see the integration of the software in the near future. As digital security becomes paramount, advanced biometric verifications might also become part of its arsenal. The software's potential collaboration with hardware manufacturers can revolutionize out-of-the-box user experiences, and its Slang Code feature has vast untapped potential, with extensions to sophisticated code predictions. Given its open-source foundation, a global community of developers could soon be instrumental in shaping its trajectory, making this software a true testament to collaborative innovation.

To conclude, Just Gest stands at an exciting crossroad, with its roots firmly planted in the present and eyes gazing at a future replete with endless possibilities.

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