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PROJECT REPORT

Title: Cursor control with facial movements.

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Course Code: CSE 3501
Human Computer Interaction

Project Guide

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INTRODUCTION

Recently there has been a growing interest in developing natural interaction between human and computer.All ordinary devices require manual control and cannot be used by persons impaired in movement capacity. The proposed work includes face detection, face tracking, eyeblink detection, voice recognition and interpretation of a sequence of blinks in real time to control a non-intrusive human–computer interface.

To replace the traditional mouse with the human face and eye movements to interact the Computer. It is to assist the physically challenged persons without hands to use the computer efficiently and also easy. As accordingly to the previously invention mouse motion through eye blink was possible but the circumstances that occurred were the small blink or shorts blink were neglected. Even hardware was used for detecting eye blinks but it used to cause a eye damage. Our system uses only webcam for detecting face and eye movements and microphone for voice recognition to give better output.

AIM:

With this project, we aim to create a program that allows the user to interact with the GUI using their face. To implement Mouse Cursor Control Using Facial Movements with the help of Python. This allows for a user experience without the need for hands. A user will be able to control the cursor with their face gestures and do tasks such as selecting, clicking etc.

The target users are the differently abled people who have difficulty in manually controlling the computer.

STAKE HOLDERS PROFILE

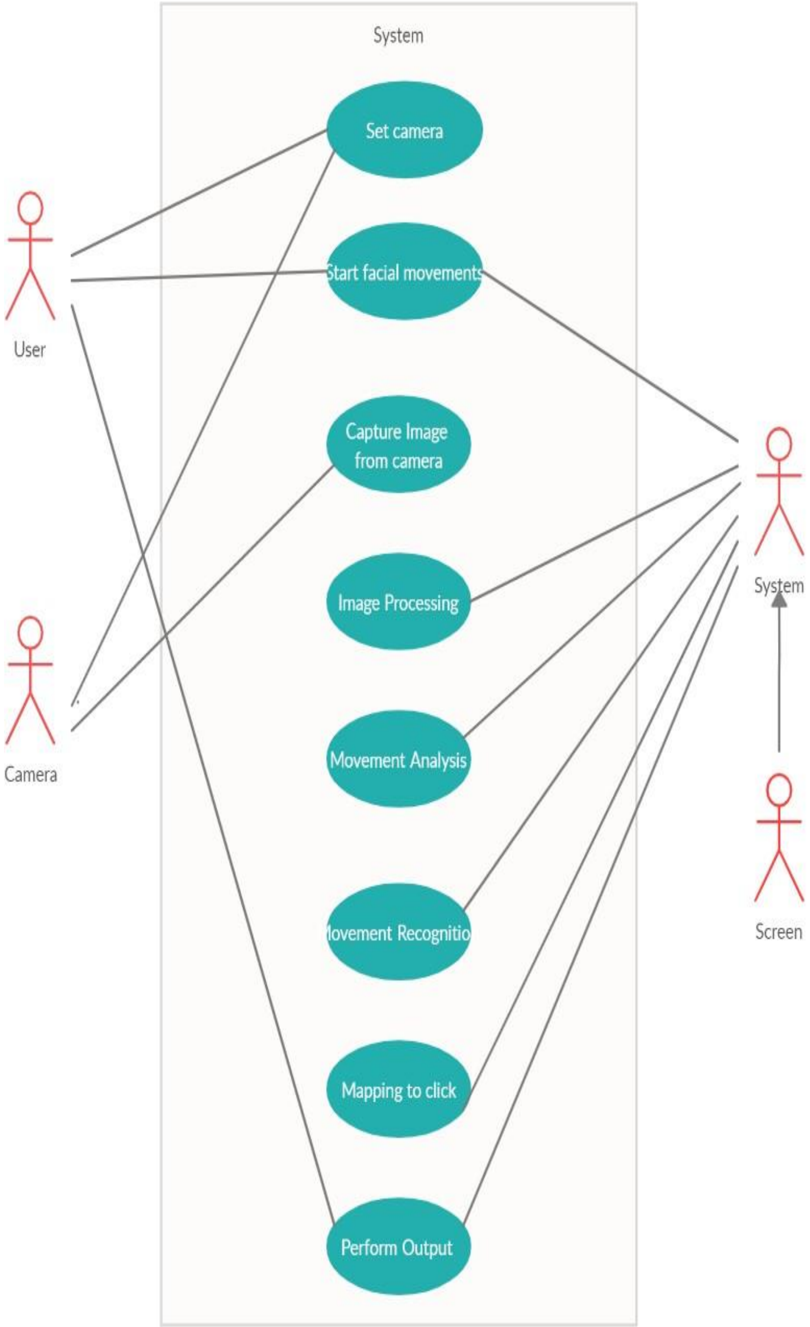
- **Primary Stakeholder -** Differently abled persons
- **Facilitating stakeholders** - Programmer

USE CASES

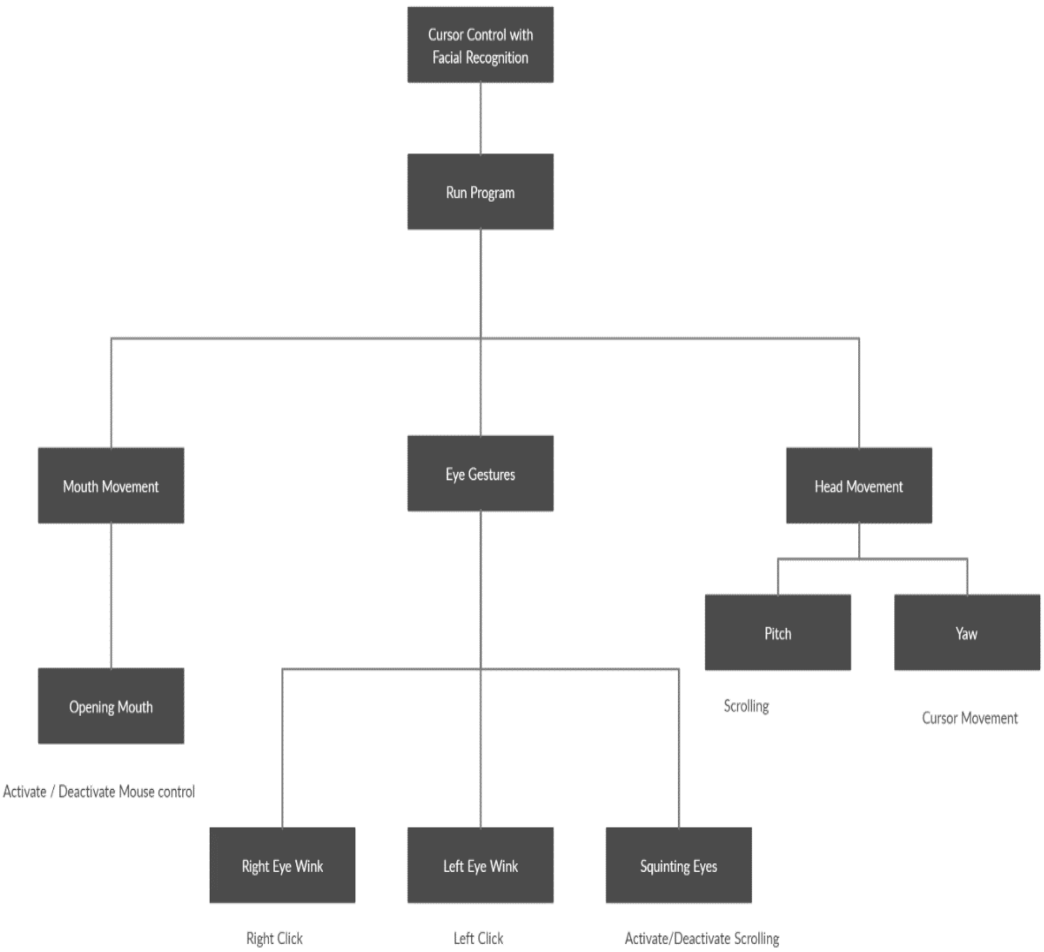
As mentioned, the target user for the project are the differently abled persons or people who have motor issues and is unable to cope with the standard methods of controlling the cursor to interact with the GUI.

The program aids in making a computer system more accessible to a greater number of people who otherwise would have issues operating it.

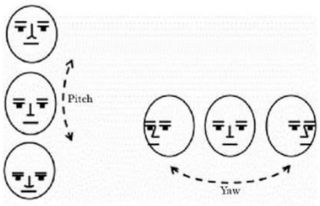
USE CASE DIAGRAM

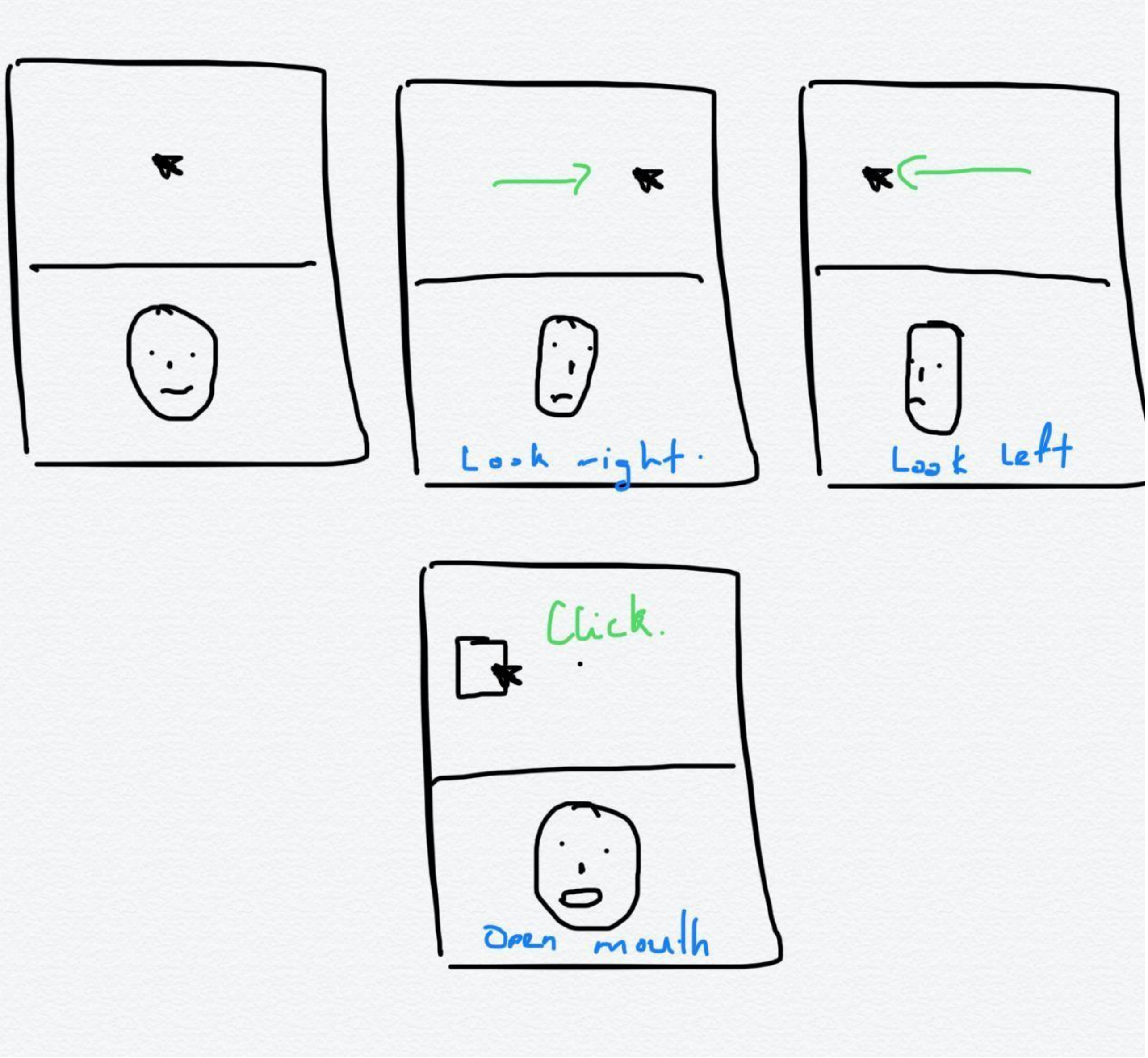


HTA


Cursor Control with Facial Recognition
Run Program
Mouth Movement
Eye Gestures
Head Movement
Pitch
Yaw
Scrolling
Cursor Movement
Opening Mouth
Activate / Deactivate Mouse control
Right Eye Wink
Left Eye Wink
Squinting Eyes
Right Click
Left Click
Activate/Deactivate Scrolling

STORYBOARD

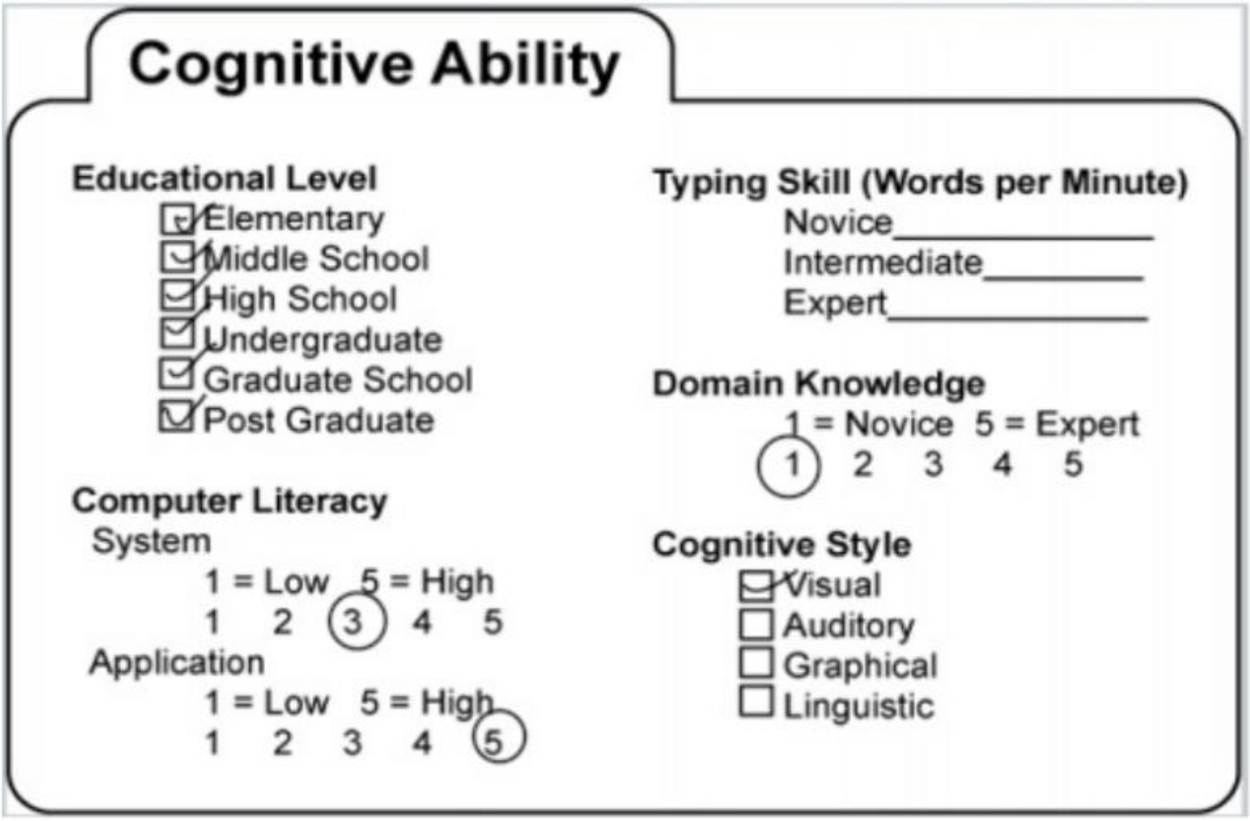
Action	Function
 Opening Mouth	Activate / Deactivate Mouse Control
 Right Eye Wink	Right Click
 Left Eye Wink	Left Click
 Squinting Eyes	Activate / Deactivate Scrolling
 Head Movements (Pitch and Yaw)	Scrolling / Cursor Movement


Look right.
Look left
Click.
Open mouth

STAKEHOLDER PROFILES

Primary Stakeholder - Differently abled persons

The program allows them to use a computer system without external devices. The user should be an intermediate or expert user as the program involves the use of predefi



Cognitive Ability

Educational Level

☑ Elementary
☑ Middle School
☑ High School
☑ Undergraduate
☑ Graduate School
☑ Post Graduate

Computer Literacy

System

1 = Low 5 = High

1 2 [✓ 3] 4 5

Application

1 = Low 5 = High

1 2 3 4 [✓ 5]

Typing Skill (Words per Minute)

Novice_______________
Intermediate_________
Expert_______________

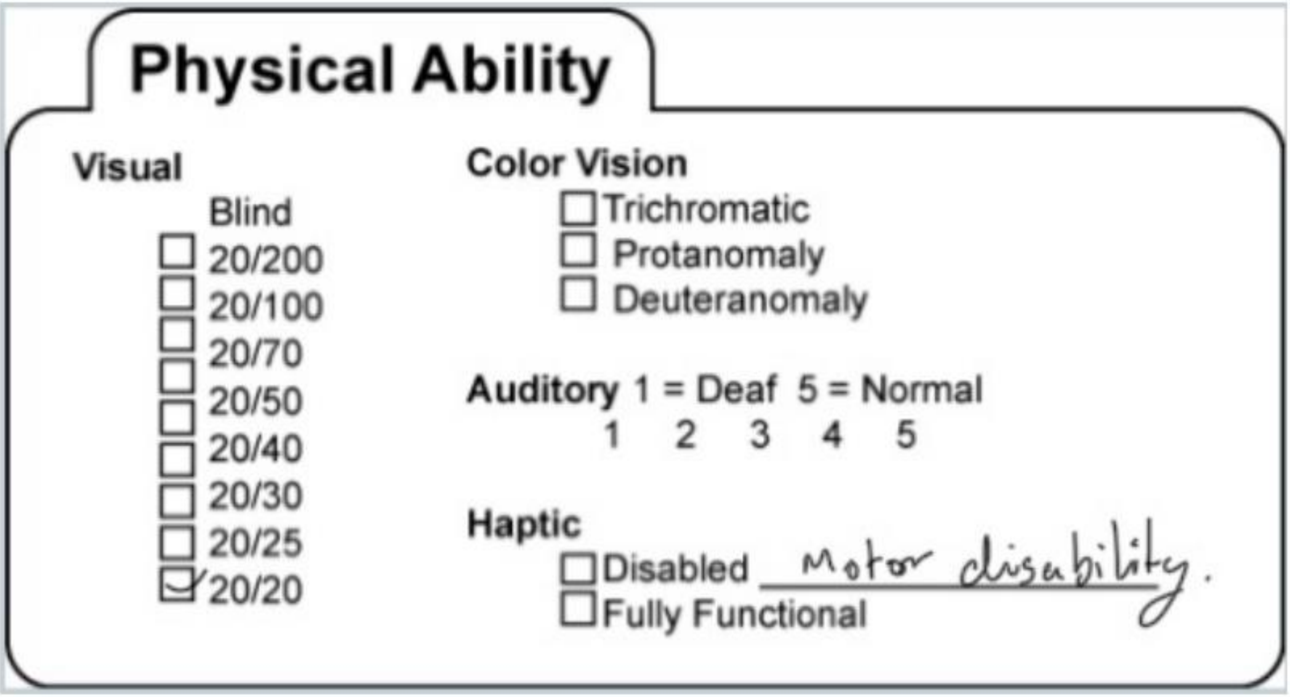
Domain Knowledge

1 = Novice 5 = Expert

[✓ 1] 2 3 4 5

Cognitive Style

☑ Visual
□ Auditory
□ Graphical
□ Linguistic



Physical Ability

Visual

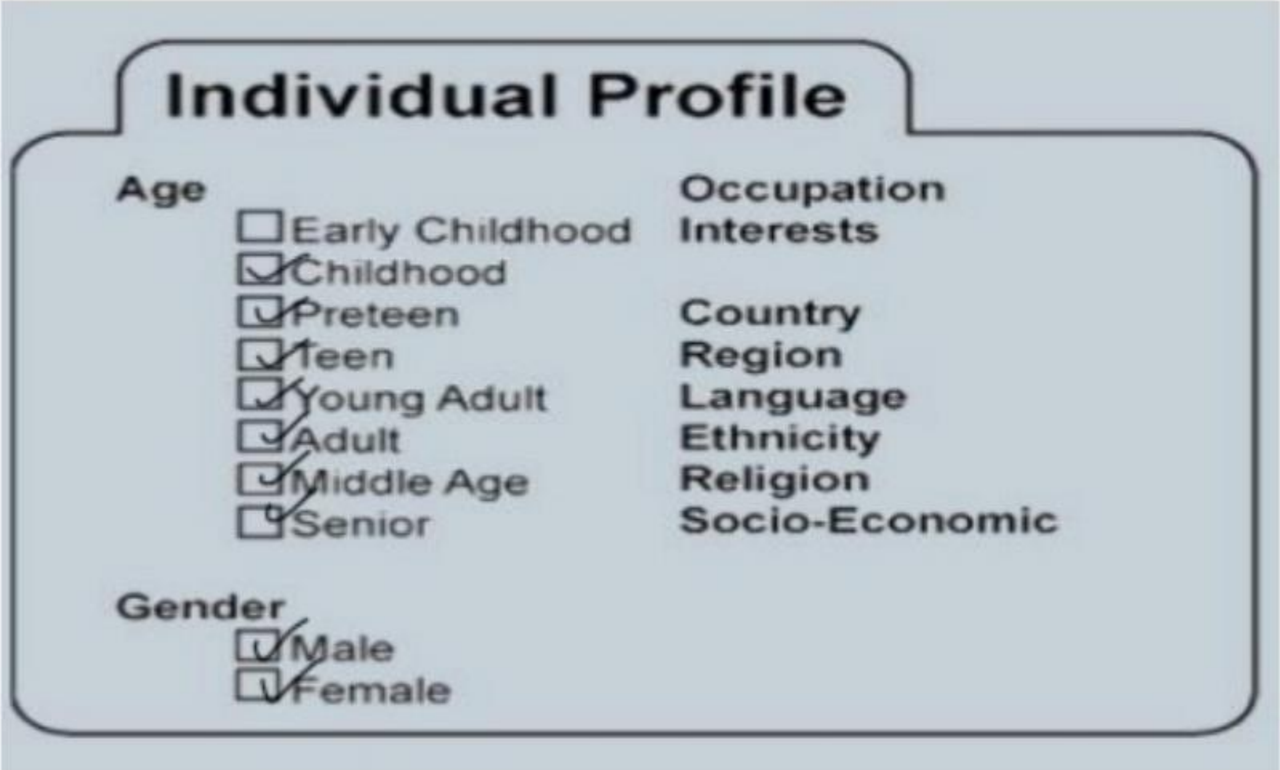
Blind
- □ 20/200
- □ 20/100
- □ 20/70
- □ 20/50
- □ 20/40
- □ 20/30
- □ 20/25
- ☑ 20/20

Color Vision
- □ Trichromatic
- □ Protanomaly
- □ Deuteranomaly

Auditory 1 = Deaf 5 = Normal

1 2 3 4 5

Haptic
- □ Disabled Motor disability.
- □ Fully Functional



Individual Profile

Age
- □ Early Childhood
- ☑ Childhood
- ☑ Preteen
- ☑ Teen
- ☑ Young Adult
- ☑ Adult
- ☑ Middle Age
- ☑ Senior

Gender
- ☑ Male
- ☑ Female

Occupation
Interests

Country
Region
Language
Ethnicity
Religion
Socio-Economic

GOMS

1. **Goal: To right click**
    - Goal:Activate mouse

        Operator: Open your mouth

    - Goal:Righ-click

        Operator:Right Eye wink

2. **Goal: To le3 click**
    - Goal:Activate mouse

        Operator: Open your mouth

    - Goal:Le>-click

        Operator:Le> Eye wink

3. **Goal: To right click**
    - Goal:Activate mouse

        Operator: Open your mouth

    - Goal: Activate Scroll

        Operator: Squint Eyes

    - Goal:Scroll

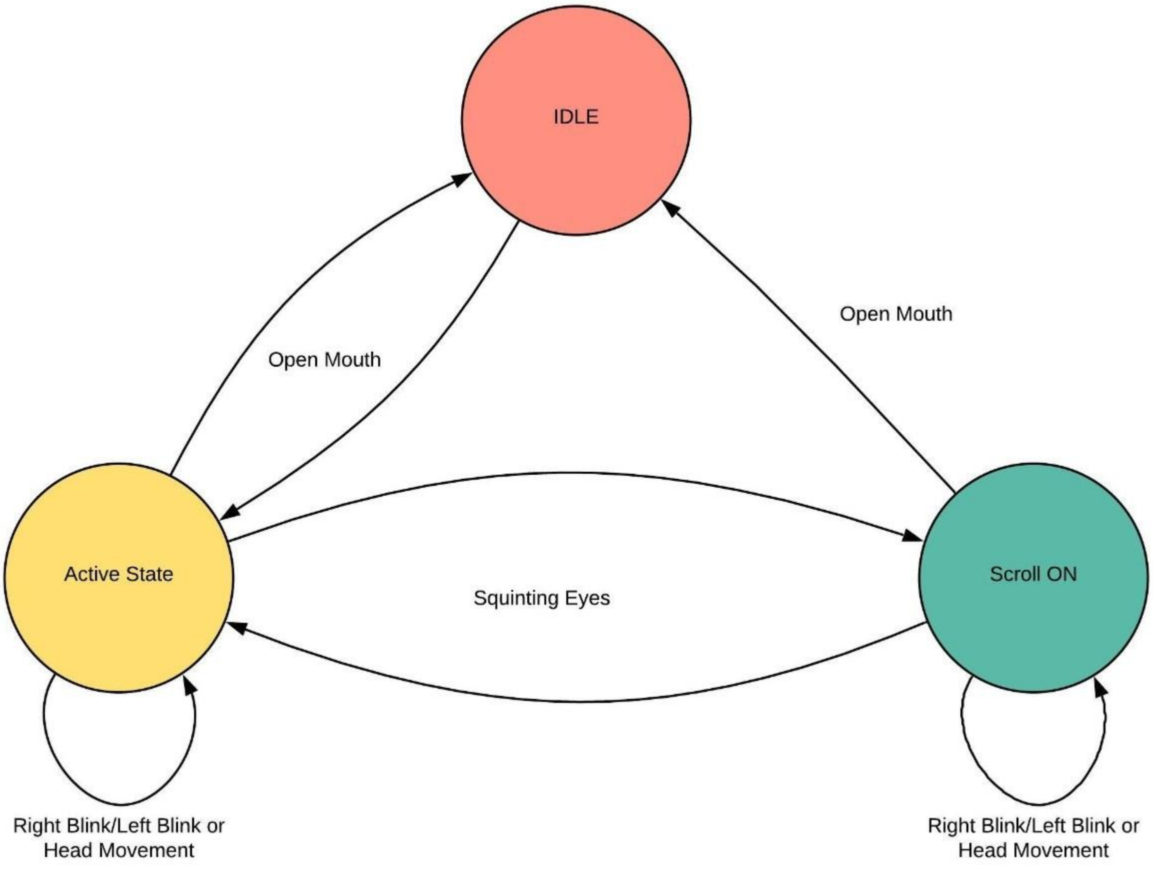
        [Select Goal:Scroll Up

            Operator: Move Head up

        Select Goal:Scroll Down

            Operator: Move Head Down]

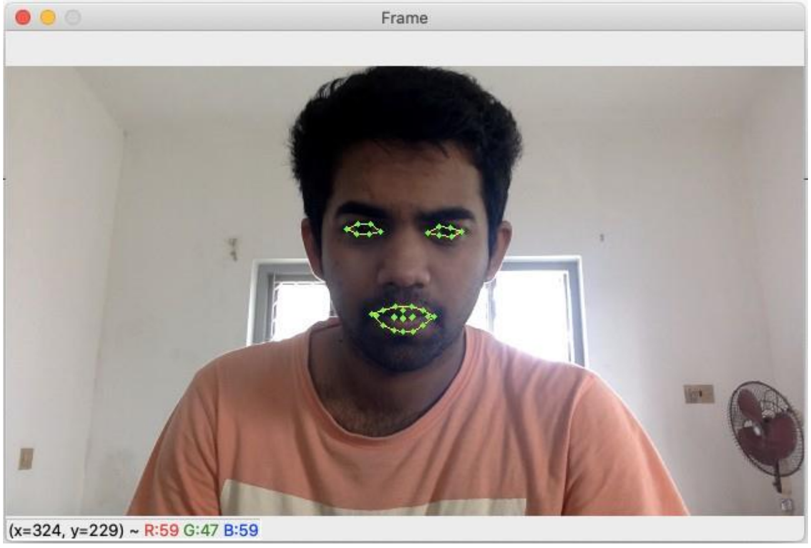
STATE TRANSITION NETWORK DIAGRAM


IDLE
Open Mouth
Open Mouth
Active State
Squinting Eyes
Scroll ON
Right Blink/Left Blink or Head Movement
Right Blink/Left Blink or Head Movement

GUI and HCI principles.

Our project has minimal GUI. The user sees just an image of himself while he performs the actions necessary for doing the mouse actions that the user wishes to do.

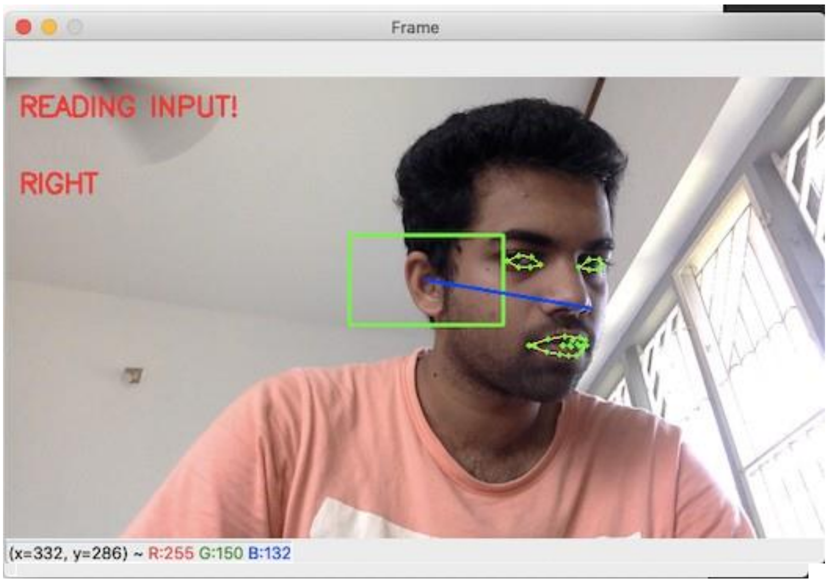
Our program enables the user to interact with other programs in the computer that the user wishes to interact with.



(x=324, y=229) ~ R:59 G:47 B:59

Screenshot of UI detecting face (eye and mouth).

The output shows the actions to the user. ie. **Offers informative feedback**

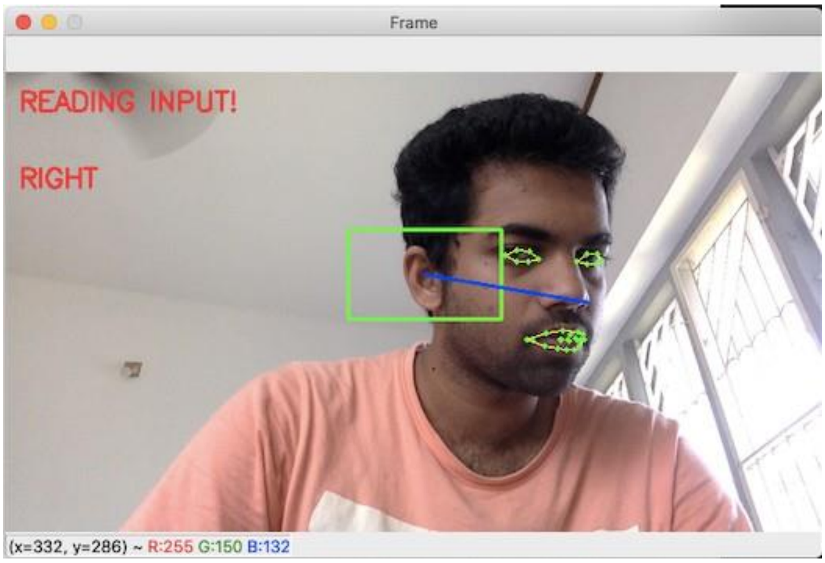


READING INPUT!

RIGHT

(x=332, y=286) ~ R:255 G:150 B:132

Screenshot showing current mode



READING INPUT!

RIGHT

(x=332, y=286) ~ R:255 G:150 B:132

Screenshot showing direction selected

Consistent usage across all programs.

The program behaves similarly across all other programs and GUI’s The output window shows information about the current action.

Program ensures universal usability.

The program allows disabled users access to computers.

Offers informative feedback

The output window shows information about the current action.

Visibility of system status

Since the program directly interacts with the system GUI, status of the system at each instance is visible

Simplifying task structures

It enables disabled users an easy interface to interact with the system in comparison to current existing methods.

Furthermore, since our implementation is dependent on the activity or action that the user wants to conduct, the HCI principles implemented in that particular program is inherited by our program. Hence, flexibility is provided to the user. For example.

Error correction

Error correction depends on the underlying program that we are using.

USABILITY TESTING

Test case	Test Module	Description	Test conditions	Expected results	Actual results	Pass/ Fail
ID_01	Face detection	Open application. Wait for detection of face.	In Daylight	Face is detected	Face is detected	Pass
ID_02			In Dark Light	Face is detected	Face is detected	Pass
ID_03			Face is slightly sideways	Face is detected	Face is detected	Pass
ID_04				Face is detected	Face is not	Fail
ID_05	Activating mouse	Mouse is activated by opening of mouth	In Daylight	Mouth is detected	Mouth detected.	Pass
ID_06			In Dark Light	Mouth is detected	Mouth is not	Fail
ID_07	Moving cursor	Cursor is controlled by tilting face in required	In Daylight	Cursor moves	Cursor moves	Pass
ID_08			In Dark Light	Cursor moves	Cursor moves	Pass
ID_09	Toggling on scroll mode	Scroll mode is switched on by squinting eyes	In Daylight	Scroll mode on	Scroll mode on	Pass
ID_10			In Dark Light	Scroll mode on	No scroll mode	Fail
ID_11	Right click	Wink right eye	In Daylight	Right click	No response	Fail
ID_12			In Dark Light	Right click	No response	Fail
ID_13	Left click	Wink left eye	In Daylight	Left click	Left click	Pass
ID_14			In Dark Light	Left click	Left click	Pass
ID_15	Scrolling	Move head Up and down	In Daylight	Scrolling action	Scrolling action	Pass
ID_16			In Dark Light	Scrolling action	Scrolling action	Pass

TEXTUAL NOTATIONS

Activity: Initial Setup

Event CSP:

- Capture = Select -camera -> get-input facial expression
- Feedback = Main Window -> Understand detected expression -> Show Feedback to be given

Event ISL

- **Event: Get Input**
  - Uses: Input Camera
  - Set: Detected Face=input
- **Event: Feedback-Issued**
  - Uses: Expression-input
  - Set: Match expression to inclusive neural network expression models and corresponding status is shown.

Activity: Move Cursor Movement

Event CSP:

- Moving Cursor = Open Program -> Open Mouth -> Move Your Head
- Feedback=Main Window -> Mouse Cursor Movement

Event ISL

- **Event: Open Program**
  - Prompt: True
  - Out: Display Interface Window
- **Event: Open Mouth**
  - Uses: Input Capture to map to Open mouth
  - Out: Display "Mouse Control ON"

- **Event: Moving Head**
    - Uses: Input the cursor movement direction by moving your head
    - Out: Cursor moves in that direction

Activity: Scroll Mouse

Event CSP:

- Scroll Mouse = Open Program -> Activate Mouse -> Squint Eyes ->Move Your Head (Up/Down)
- Feedback=Main Window -> Scroll Up/Down

Event ISL

- **Event: Open Program**
    - Prompt: True
    - Out: Display Interface Window
- **Event: Activate Mouse**
    - Uses: Input Capture to map to Open mouth
    - Out: Display "Mouse Control ON"
- **Event: Moving Head**
    - Uses: Input Capture to map to Squint Eyes
    - Out: Display "Scroll Mode ON"
- **Event: Moving Head**
    - Uses: Input the cursor movement direction by moving your head
    - Out: Cursor moves in that direction

Activity: Mouse Click

Event CSP:

- Mouse Click = Open Program -> Activate Mouse -> Blink Eyes (Left/Right)
- Feedback=Main Window -> Left Click/Right Click

Event ISL

- **Event: Open Program**
    - Prompt: True
    - Out: Display Interface Window
- **Event: Activate Mouse**
    - Uses: Input Capture to map to Open mouth
    - Out: Display “Mouse Control ON”
- **Event: Moving Head**
    - Uses: Input Capture to map to Eye Blink
    - Out: Display “Right Click” or “Left Click”

CONCLUSION

Our aim while starting this project was to create an application which would allow a physically challenged individual navigate a computer. We believe we have achieved the target we have set for ourself all the while keeping in mind to follow HCI guidelines whenever applicable.