EYE - MOVE: AN EFFICIENT EYE-TYPING APPLICATION

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Introduction:

The aim of this project is to move a step ahead and make sure that people suffering motor neuron disease (MND) can also have the privilege of reading and writing. Motor Neuron disease is a disease that affects the nerves and the brain. People afflicted with this disease may not be able to use speech, and the action of the eyes might be the only means by which they convey their feelings and expressions.

The system will use a video-based eye typing arrangement using a camera to capture the eye movements of the user. The user has to look at a word on the screen and the word gets printed. The system can be divided into two parts. The first part consists of eye typing implementation and the second part is text entry into the system. Users can express their thoughts by writing using eye gaze technology and CNN algorithms.

Objective:

The main objectives this project aims to achieve are as follows:

- Efficient eye tracking system to help people with motor disabilities to communicate
- Reliable eye tracking system for accurate vision based entry under various lighting conditions and angles
- Easily expandable system

Scope:

Our initiative intends to provide a way of communication for severely disabled people, particularly those who communicate entirely through eye signals. Some people with serious motor disabilities find it difficult to communicate by typing with their hands. As a result, typing with eye movement is being used as an assistive technology for people who are physically impaired.

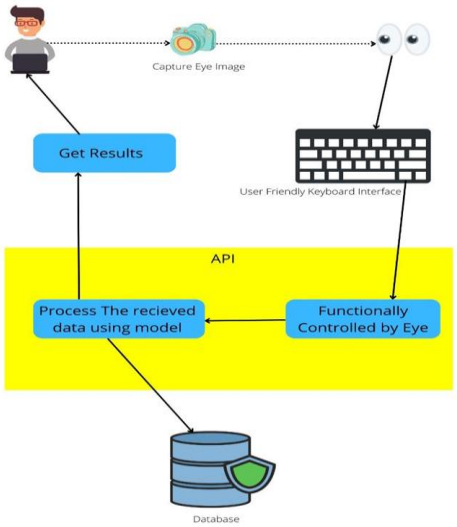
Our project might be expanded to build a security framework in which users enter their passwords through eye signalling, removing the sense of vulnerability. In the future, this could be implemented in ATMs and public lockers.

This concept can also be applied to home automation for disabled individuals. Day-to-day tasks such as turning on the fan and building an eye input text-to-voice converter can be automated. Typed text can be read aloud by a computer speech engine, allowing physically challenged people to communicate verbally. This would help them become less reliant on others.

Methodology

- The proposed system will provide a new user -friendly keyboard interface for the user.
- It will also include an image interface for emergency needs.
- User can see the keyboard layout and can type the text by the movement of his or her eyes. The system contains an image section which has numerous images where the user can just see this image instead of typing; the observed image is automatically converted into text.
- An option to convert the written text to speech using a speech engine can also be made available.
- The user can enhance his typing rate by making use of a word prediction engine.
- Word prediction is an assistive technology tool that suggests words while typing.

System Architecture



System Architecture

The steps are as follows:

- A keyboard interface is supplied to the user.
- The keyboard layout includes extra features such as home automation that can be managed with the eyes.
- A camera is used to collect the user's eye image.
- The image is recorded and submitted to the API, which then sends it to the model.
- The model processes the received data using the ML library and generates the results.
- Show the results to the user.

Results and Conclusion

As part of phase one of the major project, the first step was to conduct the literature survey and we found a few papers which detailed about existing systems and existing approaches to eye-gaze tracking and web-cam based eye movement analysis.

Based on these research papers we were able to define our problem statement and circle down onto a project idea. Hence, the requirements for our project were defined which included functional, non-functional, hardware and software requirements. These requirements also gave us a picture of the estimated cost of the project and based on the requirements we were able to begin the design phase.

The system architecture was first defined which gives the idea of the entire system’s working and all the levels involved. Then the sub-systems or modules were defined and their functions were identified. These subsystems integration will make the project as a whole.

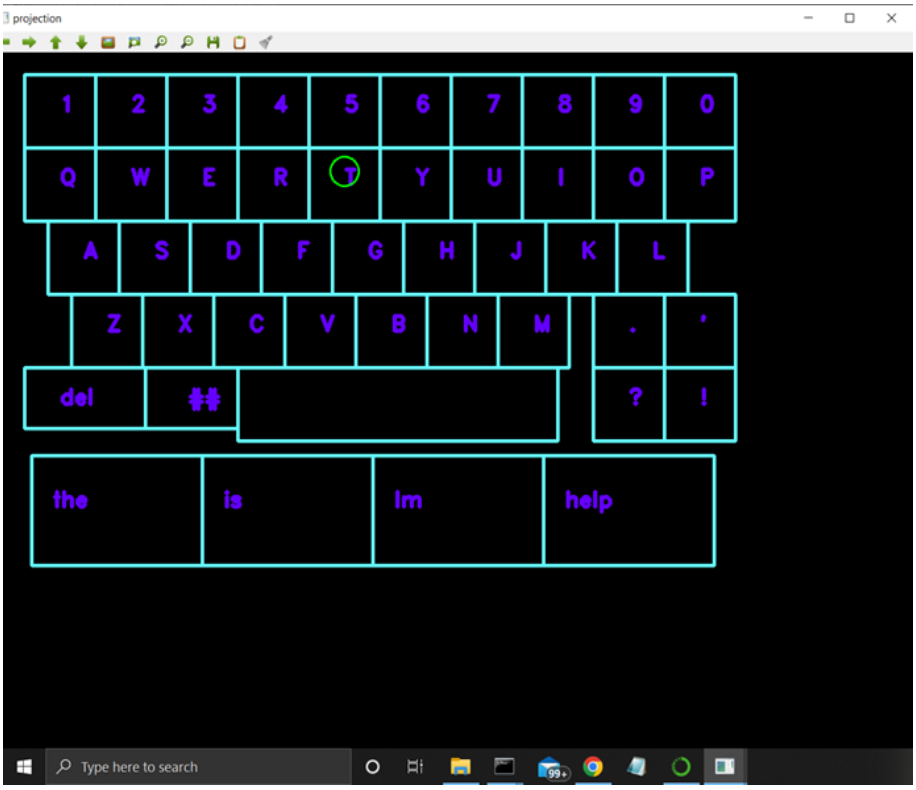
The methodology of the system working was also defined using various interaction models and how the system will work.
The high level design incorporating all the sub-systems as mentioned will be incorporated to make our project reliable and efficiently able to serve its purpose by helping disabled people communicate.

The phase two of the major project began with the implementation. The eye-typing module was first implemented using OpenCV as well as Dlib libraries and a CNN model used to capture eye-gaze direction using eye-coordinates detected using facial landmark points. The user can now type with eye-gaze with the help of the virtual keyboard that has been created which is user-friendly. We can hence establish a communication between user and the computer using eye-tracking.

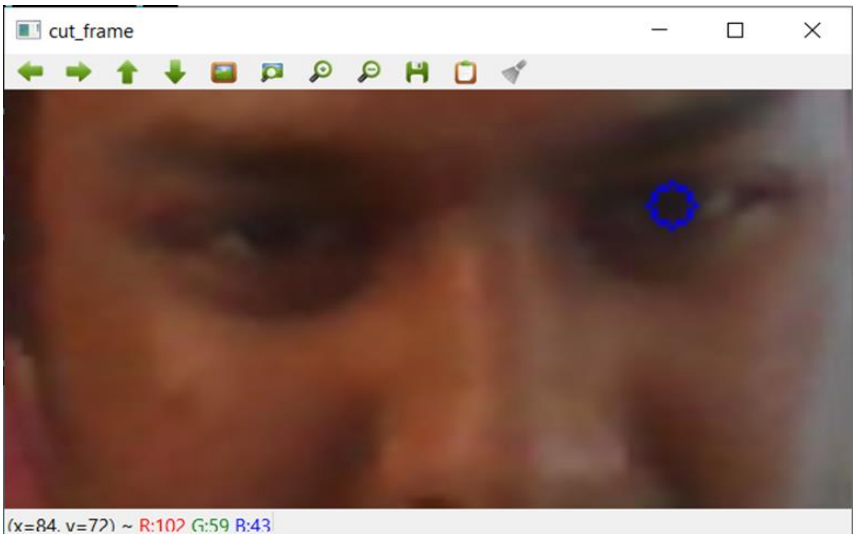
Finally, we use the word-prediction and the Text-to-speech module to get a better user experience. The word prediction module has been implemented using the nltk python library which has been trained using a vast set of english words so as to recognize the incomplete

words and generate the predictions based on the list of words. The text to speech module uses the pyttsx3 python library to convert the typed text to audible sound to enable better communication.

Hence, in the two phases of our major project we have tried to understand and formulate the requirements so as to help people with motor-neuron disabilities and hope to enhance the system in the future.



Virtual keyboard with eye-pointer on key using eye-gaze tracking by CNN



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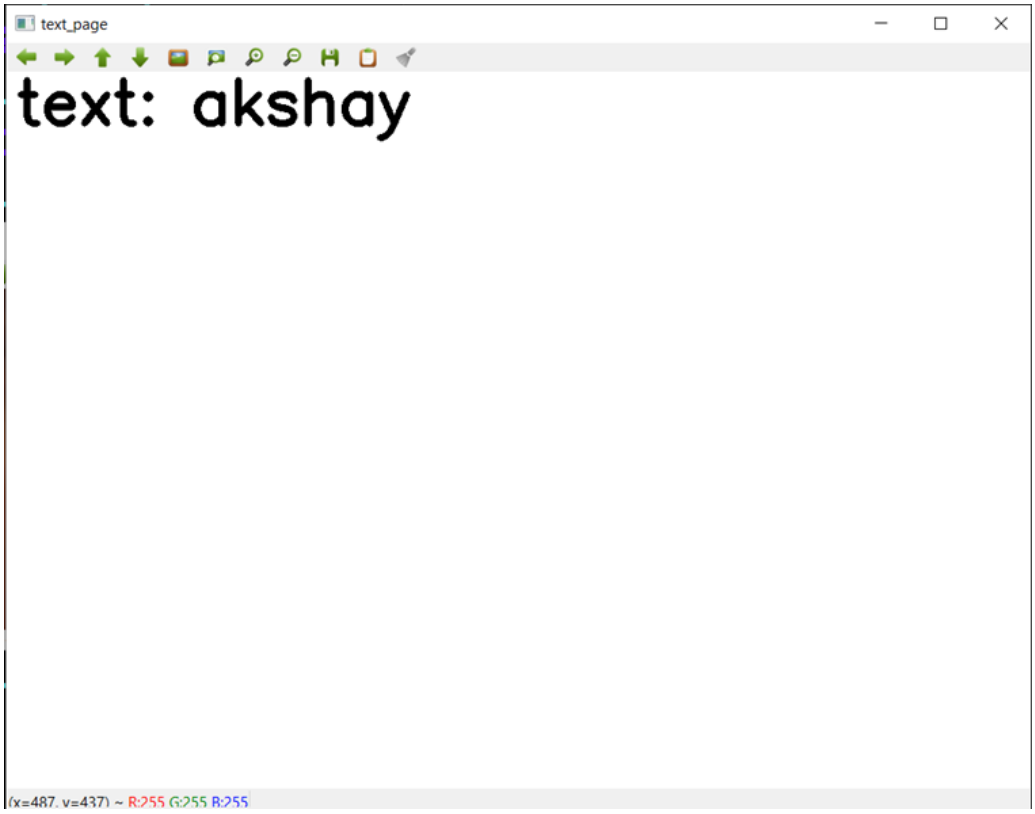

Text typed by the user using eye-typing

Future Enhancements

In the future while implementing this project we would also like to include a home automation module. We hope to connect the system with various home appliances like lights, fans, etc. so that the system can directly be able to operate these devices using IoT upon the user's commands. This home automation module will be able to provide additional function to the user as he will be in control of a few aspects of the house hence providing the user with much more independence and control over his home. Also we would like to incorporate any more modules that can help in providing more independence to the user.