Morse Code Detection Using Eye Blinks

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A new approach for Morse code method with its translation within the English dialect is done. The Morse code is produced with the assistance of the eyes. Each time a person/user flickers his/her eyes an yield of sprint and speck is created which is Morse code. OpenCV and Dlib libraries are utilized with facial point of interest location for eye squint location. There are roughly 21 million individuals in India enduring from one or the other kind of inability. With eye blinks, these individuals can express themselves to the world more smoothly. This framework permits the client to be caught on effectively by anybody who gets it human dialect well.

***Index Terms*—Morse code, OpenCV, Eye Blink**

I. INTRODUCTION

Speech illness can influence the way a individual attempting to speak clearly and unmistakably to make words. Discourse clutters can be due to certain therapeutic afflictions beginning from brain harm, stroke to loss of motion, and a few other maladies. It can too result in collapse of central anxious system's fringe harm amid mischances which can take off a individual totally not able to communicate. In loss of motion, the capacity to control muscle development is constrained indeed around the eye muscles and squints are the as it were way for the understanding to communicate. In such conditions, a framework which is helpful as well as simple is required for the quiet. Since discourse impedance isn't specifically hurtful to the quick wellbeing of the patient, it isn't taken in thought as much it ought to be taken within the advancement of a therapeutic gadget. Human communications are ordinarily through voices and expressions. Other than common dialects (e.g., talked dialects, composed dialects), sign dialect comprising of facial expressions and body signals is another fundamental communication way for extraordinary individuals beneath specific conditions; in the interim, the body motion is exceptionally significant to progress the adequacy of human intuitive. Particularly, finger signal may be a generally steady fashion composed of hand developments. The diverse advances utilized for actualizing the communication between paralyzed patients and the individuals going to and caring for them are mouth incited joysticks, incited breathe puffing straws, tongue development examination, switch mounted close user's head, etc. These frameworks are expensive to actualize, increment push on the patients, and require talented labor to set up and keep up the framework for appropriate working. Barely any gadgets have been created that can address this issue in a patient-friendly and cost-effective way. This work points to plan a basic and cost-effective computer program for patients enduring from discourse clutter as well as individuals with the as it were alternative of eye movements/blinks utilizing eye flickers of the individual. Eye-blink at normal interims can be deciphered for shaping words for communication. A productive, real-time flicker detection calculation can be utilized for nearly any reason like ON/OFF of machines at domestic, factories etc. The Morse code was created within the early 19th century when the individuals did not have any thought of developing circuits to send voice messages from one put to another. The transmit frameworks were implies of sending and accepting messages with offer assistance of electronic driving forces. The Morse code was named so after its innovator, Samuel F B Morse. It proceeds to be the least demanding, productive, and reasonable implies of communication as the gadgets required by it was exceptionally basic. This strategy demonstrated that capability in English was a prerequisite to communicate with the rest of the world. Afterward on, this code was acknowledged universally and a common Worldwide Morse code has been created and utilized. Morse code was prevalently known as the dialect of dabs and dashes. A long time afterward, this dialect came up with extemporized forms like transmitting content data as a arrangement of flipping tones, changing brightness levels, or ticks that can be straightforwardly decoded by a gifted audience or an eyewitness without the utilize of any extraordinary sort of hardware. It has been the foremost easiest and reasonable strategy of transmitting and getting messages. Over the a long time this strategy was basically utilized in radio communication but nowadays this technique has numerous applications in flying, naval force, and assistive strategy like making a difference individuals with incapacities to communicate. We point to grant back to individuals with discourse clutters but there are a few military-strategic circumstances where it can be valuable as well. Here inside eye-blinks, the client can effortlessly express himself/herself. This prepare appears to be time-consuming but it's not, once with a few hone the client will get quick at this.

II. LITERATURE REVIEW

A. Survey Existing system

There's a parcel of innovation utilized in confront discovery or almost how to produce Morse code with different signals and all. There are a part of ventures which can distinguish hand motions to distinguish dialect which in brief a sign dialect discovery and elucidation is performed. There's a parcel of innovation utilized in confront discovery or almost how to produce Morse code with different signals and all. There are a part of ventures which can distinguish hand motions to

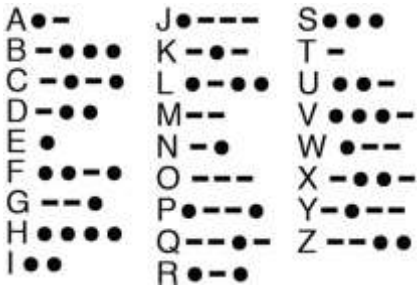

Fig. 1. Morse Code.

distinguish dialect which in brief a sign dialect discovery and elucidation is performed. Now, a brief about these systems will be done here. The generation of Morse code with images used image processing techniques and fuzzy algorithms [1]. Various transformations are performed on an image, the first transformation is color space transformation that is RGB(red green blue) to HSL(hue, saturation, lightness), then the second transformations is Hue panel, the next i.e. 3rd transformations is saturation panel. This saturation panel gives the binary image of the skin area filled with the pixel value of one. The next operation is a combination of results of 3rd and 2nd operation it is the logical operation, the main aim of this logical operation is to get the skin area. From here the co-ordinates of lips are extracted and with the help of fuzzy algorithms, it is checked or verified whether the mouth is closed or open. At the side this, it is additionally checked that, for how much time the mouth is opened, with this it is chosen that the yield ought to be a sprint or a speck which is Morse code. The following framework is finger gesture recognition, a camera is utilized to capture a arrangement of video outlines, at that point it'll recognize the finger signals from these outlines and change over it to Morse code where it'll assist change over the comparing Morse code to lucid content [2]. [3]. Here SVM bases kernel functions and BPNN i.e. back propagation neural network has experimented. It is a 3-layer neural network that is distinguished under supervised learning. The sigmoid function is used for training. BPNN is more about error managing. In short RBF kernel and BPNN algorithms are the two classifiers used to recognize human finger gesture. When the fingertip is touched the threshold is triggered and according to the duration it is touched, the Morse code is generated. These are a handful of methods examined over.

B. Limitation in Existing Systems

The framework and strategy utilized over are limited to a couple of individuals such as individuals crippled where they cannot utilize their hands or finger and cannot move their jawline due to a break or a few of the other reasons. These sorts of things confine the proposed framework to be totally not appropriate to debilitated individuals. Another confinement or downside of their framework is that their framework cannot talk, this major limitation considering the progression of today's innovation is additionally a point to rouse us to form such a capable of being heard framework which can talk that is to decipher Morse code to a human communicative dialect.

C. Objective And Scope

An individual should be unfaltering and keep up an appropriate distance from where the camera remove will be able to distinguish the person's confront and begin capturing and recognizing him/her. On the off chance that this framework would not exist then the individual was in an awfully troublesome circumstance to communicate with the other individual. An impaired individual for the most part employments sign dialect, here the issue is that not everybody is mindful and known of sign dialect so it gets to be troublesome for each individual to communicate. With this computer program, an individual can express themselves speedier and simpler. It is critical to illuminate the problem for such individuals who can communicate with each individual within the world. As we saw within the current frameworks they are not simple with individuals who have spinal line wounds and all. Too, the efficiencies are not up to the stamp for their current frameworks accessible. This program is additionally cheap and can be sent on any Linux, ios, and windows system effortlessly. These all benefits like cost-effectiveness and simple deployment of the framework are the most advantage of the framework. Another prerequisite that is most imperative i.e. inbuilt camera is required within the framework. These days each other tablet contains a camera, on the off chance that not accessible at that point USB amplified cameras are too accessible. This component of the framework is most exorbitant while others are reasonable. This framework will be exceptionally productive for the individuals who can effortlessly flicker their eyes and have a few of the other physical incapacity.

III. PROPOSED DESIGN

A. Analysis

Our project is based on detection of morse code from eye blinks. As discussed in the previous section there are many ways to detect a morse code like by using mouth, fingers or by using hands. We will be detecting morse code from a pattern of eye blink. Before detecting morse code from eye blinks, we first have to detect eyes. Morse code detection has 3 major steps:

1) Locating eyes
2) determining Eye Aspect Ratio
3) detecting morse code from blinks

B. Methodology

1) Locating Eyes

As our project is based on blink detection so, the initial step is detection of an eye, for this we will capture frames from live video or a recorded video that is when the user runs the code the input is taken from the web-cam or a recorded video. The

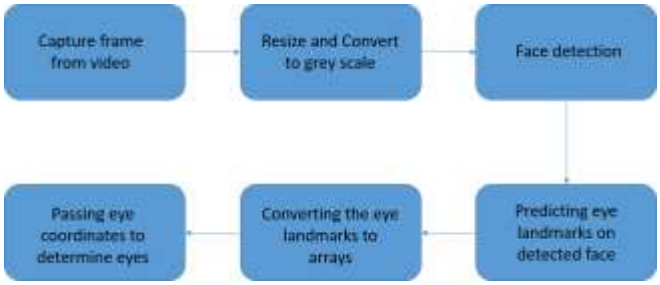

Fig. 2. Block Diagram for eye localization.

captured frame is then resized and converted to grey scale image, now here we will apply face detection technique to detect faces on each frame.

To detect face we have used dlib libraries face detector. Dlib is a tool compartment for making real world machine learning and information examination applications in C++. While the library is initially written in C++, it is great, simple to utilize Python ties. The dlib library uses a pre-trained face detector which is based on Histogram of Oriented Gradients + Linear SVM [5]. The detector from dlib allows us to find a face in an image/video prior to localizing landmarks on the faces.

After successfully detecting faces on each frame we will then predict eyes on the detected faces. For predicting eyes we will be using our "eye only" shape predictor model and the dlib's inbuilt shape predictor function which runs the model and locates position of eyes on the face. The dataset that we have used, for shape predictor model is of iBUG 300-W dataset, for training our shape predictor on this dataset we have used dlib library.

Then we take these landmarks and convert them into arrays by using numpy library. Now on these array we will be passing our eye coordinates (i.e. for right eye coordinates are 0-5 and for left eye coordinates are 6-12). With this we are successfully locating eyes on the face.

2) Determining Eye Aspect Ratio

To decide when an eye is closed or when an eye is opened, we are going be computing a metric called Eye Aspect Ratio. EAR is computed to calculate the flat and vertical remove of an eye. Each eye comprises of 6 (x, y) point as can be seen within the figure 3.

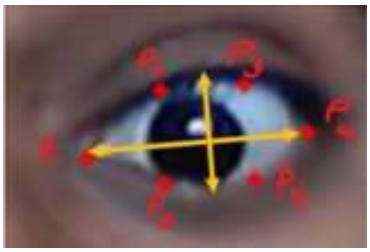

Fig. 3. Single Eye Representation.

The two pairs of vertical points are used to calculate vertical distance, while the single pair of points is used to calculate horizontal distance. An eye aspect ratio formula can be derived from these points [4].

$$EAR = \frac{|p2 - p6| + |p3 - p4|}{2|p1 - p4|}$$

Points p1–p6 are 2D facial landmarks in the above equation, with the numerator representing vertical distance and the denominator representing horizontal distance. The EAR value stays unchanged when the eye is open as seen in the figure 4 , and it reaches zero when the eye is closed as seen in the figure 5. We can tell whether a wink has happened or not using this basic calculation.

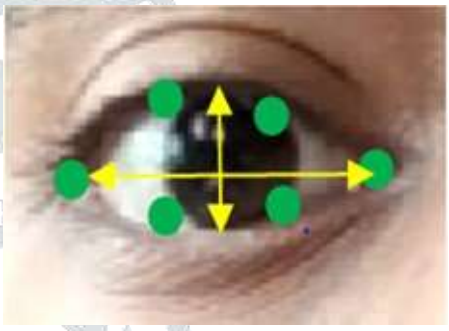

Fig. 4. Opened Eye Landmark.

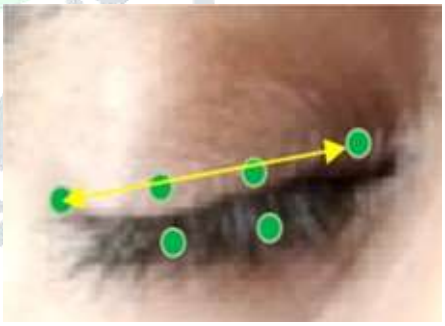

Fig. 5. Closed Eye Landmark.

As can be seen in the graph (figure 6) below, the EAR remains stable until the eye is opened, after which it rapidly reduces until it reaches zero. In the graph below, we can assume that a blink has happened when the value of EAR falls below the threshold value of 0.2 (when the eye is closed) and reaches 0 before rising and going above the threshold value (when the eye is opened). We will decide whether a wink has happened or not using this simple calculation of decreasing and increasing the EAR value.

Fig. 6. EAR Threshold Graph.

3) Detecting Morse Code From Blinks

Following the implementation of blink detection using EAR, we can now understand how the device will produce morse code from these blink patterns. When the user runs the algorithm, data from the camera or a captured video is used to detect the user's eyes using facial landmarks. The data is then analysed, and EAR values are calculated. When the user closes his eyes for 1 second, a '.'(dot) is detected, and when the user closes his eyes for 2 seconds, a '-'(dash) is detected. This dot and dash are saved before being translated to English.

C. Flow Chart

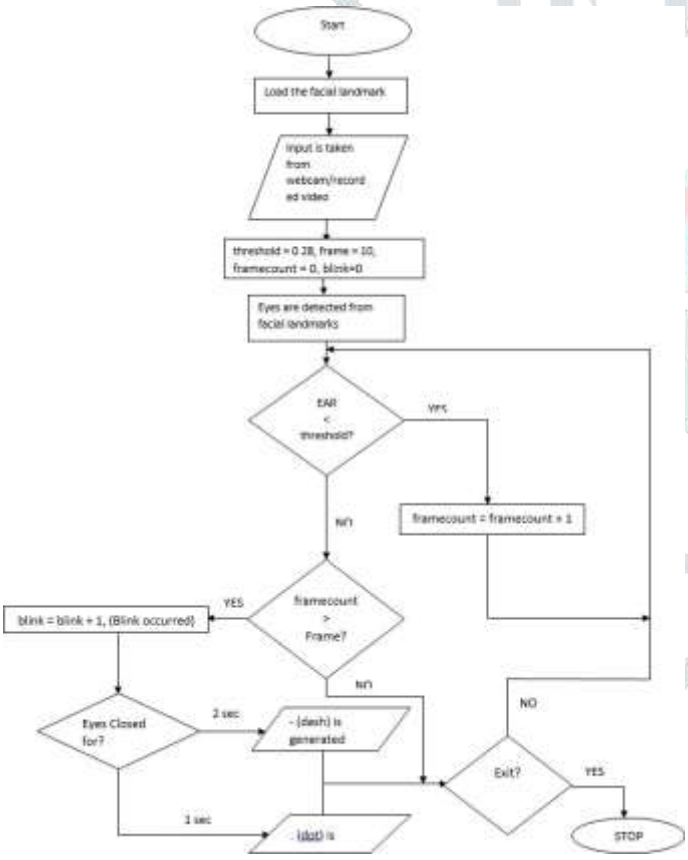

Fig. 7. Flow Chart.

IV. Result

When the code is compiled we can see (figure: 8) a gui window is displayed, the window has slider bars, buttons, labels and text area. The first slider bar i.e. EAR THRESHOLD VALUE is used to set the threshold value that is set to 0.28 it can be seen in output 1, second slider bar is for setting frame which is set to 10. Next is buttons, When the Start button is clicked the system's in-built camera is started which takes the input, in the window on the right we can see that EAR value is being calculated for every frame. The stop button turns off the camera and the second window is closed. The first label is "Current Symbol:" which displays the (.)dot and (-)dash output, second label is "Symbol to Letter", here the pattern of dot and dash is converted to letter and displayed in this field, third label is "Current Word:" which displays a word which is formed from letters, last label is "Current Sentence:", here sentence is displayed which is formed from words.

Fig. 8. Output 1.

In figure 8, the user blinks for 1 second, 1 second and 2 second and output generated is '..-' and the letter for this pattern is 'U', this can be seen in Current Symbol and Symbol to Letter field in GUI window.

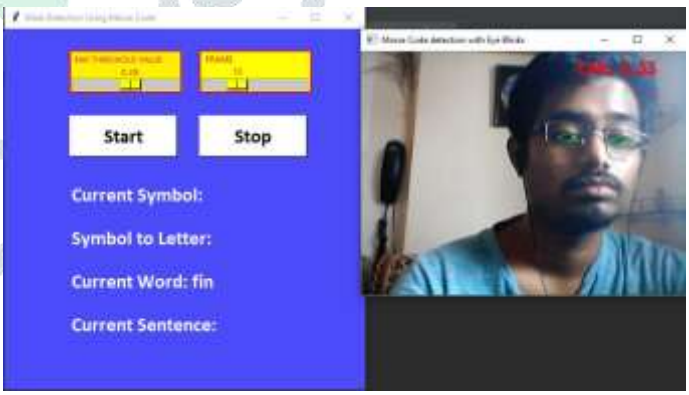

Fig. 9. Output 2.

In figure 9 the current window field has a word 'fin' which is formed form letters and these letters are formed from pattern of morse code (for 'f' morse code pattern is '..-.', for 'i' pattern is '..' and for 'n' pattern is '-.'). In figure 10, a whole sentence that is 'fin is fish' is formed in the 'Current Sentence' field from the collection of words.

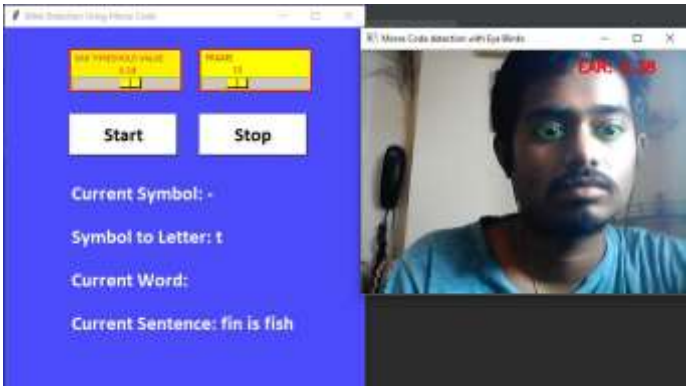

Fig. 10. Output 3.

V. CONCLUSION

We've shown that, in addition to the conventional way of detecting blinks, the Eye Aspect Ratio has proved to be very effective in detecting blinks. Blink recognition in Morse code can be very helpful for individuals who are paralysed but still have any eye control. Blinks can be identified more reliably with the aid of improved algorithms and techniques, as we discussed. In addition, these blinks are translated to morse code. A special code may be conveniently invented for patients with lower speech needs, where a particular sequence would indicate a special expression or commands. There are a variety of simple life functions that can be readily communicated with a few instructions that the patient can understand quickly. This system can be used not only by people with body or speech disabilities, but also in areas like libraries, hospitals, and classrooms. This device may be helpful for spies or military personnel who need to send a coded message without the enemy knowing.

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