Eye-Can

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***Abstract*- The field of human computer interaction has been undergoing a new renaissance day by day. While many companies have to spend millions to develop highly visually appealing GUIs, because the GUI have important role in a good system. Today, development of interactive systems for the disabled people are increasing. Eye gaze systems are one of the most pivotal inventions in this context. The EYE-CAN is a communication and control system for people with complex physical disabilities. Patient run the system with their eyes. By looking at control keys displayed on a screen, a person can synthesize speech and control his environment (lights, appliances, etc.).This system have both control and communication part.**

Index Terms- eye gaze tracking, eye assistance for paralyzed people, Home control using eye, Communication system using eye.

I. INTRODUCTION

As social people, communication is a basic need to support the interaction between many people. The information that people want to share with around can be transmitted well. There are some people who have limitations especially when using their motoric function or spoken ability that impact their interaction among people around. As a disability people, there are many daily activities which they want to do with the help of another people. But sometimes, people around don't understand what they want.

This EYE-CAN system which is operated using eye gaze is very useful for paralyzed people. EYE-CAN is communication and home control system for disabled people. The screen in front of patient contains menu which arranged according to their needs. So patient can select the particular menu using eye blink and he can move cursor using eye. So through this system they can manage their own needs without anyone help.

II. LITERATURE SURVEY

There are some existing eye gaze tracking systems that built in many tools with human-computer interaction concept. Some of those are using addition hardware, such as infrared (IR) lighting or electroculographs (EOG) that have deficiencies in the cost or complexity.

A. Electro Oculo Graphy (EOG)

The human eye can be modeled as a dipole with its positive pole at the cornea and its negative pole at the retina. Assuming a stable cornea-retinal potential difference, the eye is the origin of a steady electric potential field. The electrical signal that can be measured from this field is called the electro oculogram (EOG). Secondary units (in parentheses).

B. Feature-Based Gaze Estimation:

This method explores the various characteristics of the human eye to identify the various distinctive features of the eyes like eye corner, eye pupils and corner reflections .It has the two methods model based and interpolation base.

So we understand that these methods are some types of existing eye gaze systems. This is used to tracking eye gaze. But we use more efficient eye tracking system which is cost effective. And we make use of this eye tracking technology to develop a system for paralyzed people.

III.PROPOSED SYSTEM

The system is designed to operate with eyes. According to the eye movement cursor will move on the screen. GUI Consist of icons which satisfies paralyzed people's need .So person can select particular icon by blinking eyes more than 250 ms.

The most notable eye gaze features in every user's face is iris center. When user look in different side, the position of user's eyeball also change, so do iris center coordinate. With the change of that, it can be used as pointer reference to activate the menu in user interface

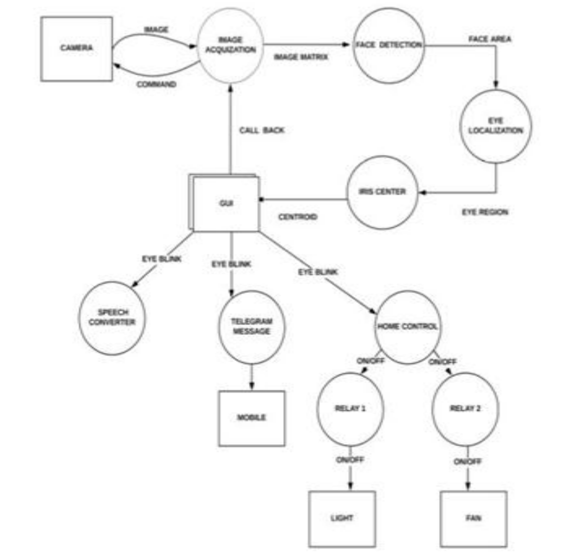

Fig. 1 Proposed System

A. Initial Setup

This research system is built in android device, especially in tablet which has specifications 7 inch LCD display and 2MP front camera. User can use this system either holding the tablet by themselves or using tab holder. For the first, user has to look in front of the tablet screen with condition all of user's face can be captured by camera. There will be a camera preview in the system, so that user can estimate the best position while run this system.

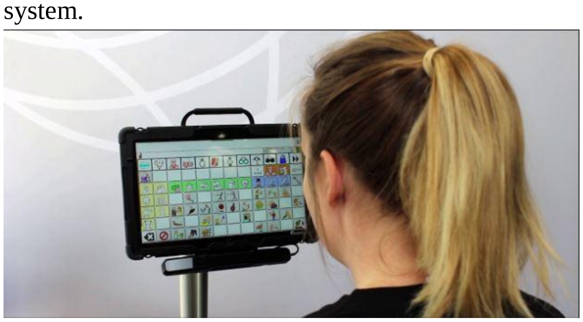

Fig.2 Initial Setup

B. Image Acquisition

Image Acquisition using single, line and array sensor. Image acquisition is the action of retrieving an image from some source. It used for processing the analog images of physical scenes or the interior structure of an object, and converting it into digital.

C. Eye Localization

All of image processing which is proposed in this system is in gray scale mode. It is caused by easy and simple way to calculate any data from image. To get the eye location, here using cascade object detector .Using cascade

Object detector function, it detects the position of left eye with respect to face. This is an object detection method in MATLAB

D. Eye Center Detection

After user's left eye area is founded, the next step is iris segmentation which aim to separate iris with another valueless object, such as background, shadow, eyelid, etc. To obtain the iris image, inverse binary threshold and morphology is used in this system. The morphology process contains erode and dilation with the same value. But, for thresholding, it has to set manually by user to adapt in any lighting condition

The result that is obtained from previous step will be looked for eye's contour. After contour was applied it will produce the contour of eye's shape, where the middle area of iris will has black colour, and the edge will has brighter colour. It will find the biggest contour of image that's mean an iris area. The biggest contour will reduce another object which still caught by system as a result of segmentation process before. After iris contour is founded, the eye center coordinate can be obtained using moments. The moments will find the centre mass of eye contour by counting non zero pixel image, or the image which has color besides black

E. Graphical User Interface(GUI)

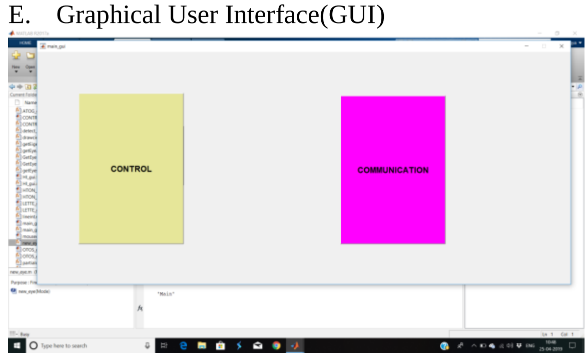

Fig 3.Main Menu

The main menu consists of control menu and communication menu. User can select any one according to their choice by clicking using eye blink. Control menu helps patient to control home appliances like light, fan, T.V…etc

Communication menu contains alphabets which used to type words by looking it.It also contains icons which simplifies the communication.

A)Control Submenu

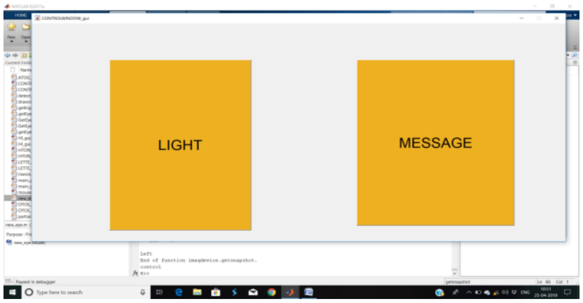

Fig 4.Control Submenu

a) Controling home appliances

When patient wants to control home appliances he wants to choose control menu. So control menu contains many icons which indicates various home appliances. If he wants to on or off any home appliance he just want to blink by looking corresponding icon.so using this he can control his surroundings.

b) Message alert

Most painful thing for paralyzed people is they can't express anything when they feel any physical difficult like pain, fever..etc, So through this message menu they can send emergency message when they feel any physical difficulties. So caretaker can reach near them soon and they can give proper medicines and treatment.

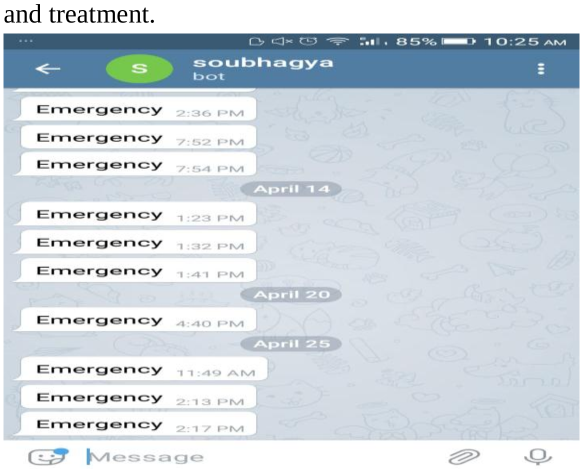

Fig 5.Message Alert System

B)Communication Submenu

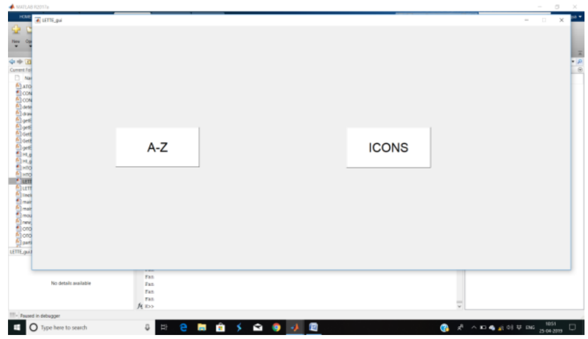

Fig 6.Communication Menu

a)A-Z

Communication menu consist of alphabets and icons which helps to communication. When person blink at A-Z it opens a other window which consist of full alphabets. So by looking it he can type the word and through it he can communicate with dear and near ones.

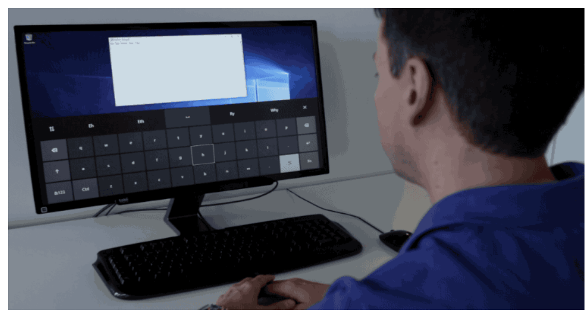

Fig 7. Window with alphabets

b) ICONS

Here Many icons are arranged under this icon menu according to person's need. So this icons simplifies the communication for common things like food, water. When person look corresponding icon the system synthesis that icon as speech. If example, patient want water when he look that icon system synthesis produse sound like "WATER NEEDED".

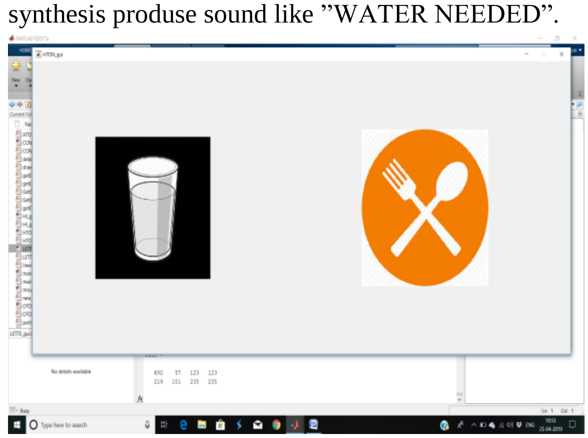

Fig 8.Icons

C).SPEECH CONVERTER

In this system it also have facility to convert text to speech. So here in both like word typing and icon clicking system produce speech. So it synthesis sound according to that. In A-Z menu it produce speech after patient type the word and in ICON case it also produce sound according too that icon.

F. Pointer Movement

After the coordinate of eye center has founded, the next step is making pointer in menu interface based on eye gaze movement. The first initialization of the active menu is on the far left of tablet screen. The active menu is activity. From that first condition the active menu will change based on eye gaze movement either in left or right side. E.g. x is current x coordinate of eye and xmax is the biggest previous value of x, than if x is bigger than xmax, it means that user look at the right side and the pointer of active menu will change to next activity. So based on this cursor move on screen by tracking eye movement. The same principle of the approach 1 is applied to the second approach using the motion by a subtraction between the current pixel coordinates and pixel coordinates that are the initial position of the eyes.

G. Menu Click

This is the last step in the system, when user has located the pointer in the activity menu that user want, he can click the current menu with blink in more than 250 ms. To detect eye blink, it use contour. It give different condition to the system when user only make spontaneous.

Eye Blink Classification		Contour (Large & Long)	Duration (ms)	Action
No Blink		>500 & >100	-	No Action
Blink	Spontaneous eye blink	<500 & <100	< 250 ms	No Action
	Click eye blink		> 250 ms	Choose menu and give audio output.

Table 1. Eye blink classification

IV.RESULT AND EVALUATION

The result of this system has many variable, such as the distance of user look at the display, eye localization, eye gaze tracking, etc. This system is tried to 5 users that have different results. All of the results can be shown more detail in explanation below

USER	DISTANCE (CM)				
	15	30	45	60	75
1	x	v	v	x	x
2	x	v	v	v	x
3	x	v	v	x	x
4	x	v	v	x	x
5	x	v	v	x	x

Table 2. Eye blink classification

Above, the optimum distance that suitable with this system is between 30 – 45 cm. All of face area of users can be captured well in those distances .It's important because the first step is face detection that need face captured of user. After user's face was detected, the next step is left eye localization. From 6 users, the result is shown in above table.

USER	RESULT	DETAILS
1	SUCCESS	Left eye detected
2	SUCCESS	Left eye detected
3	SUCCESS	Left eye detected
4	SUCCESS	Left eye detected
5	SUCCESS	Left eye detected
6	SUCCESS	Left eye detected

Table 3.Left Eye Localization

In the main process, after eye center point was obtained from initialization while looking forward, after that test was done when user look at left side, straight, and right side. Based on below table, from 5 users, there are failures in some user because system only detect center point of users eyebrow and the image of eye is cropped. This is because the large and long of eye is smaller than eyebrow 8 contour. So that system can not track user eye gaze. Besides, the percentage success rate when users look at left side is 80 % with 4 failure, 90 % when users look forward or straight, and 80 % when users look at right side

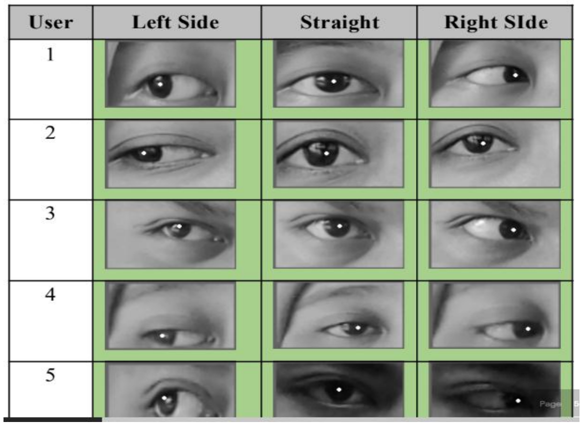

Table 4. Eye tracking

V.CONCLUSION

Eye-Can, the proposed communication system for patients with motor-neuro disabilities is based on eye- tracking and can be used by patients with no controlled movement except eye movement. This system assists and offers the patients a way of expressing their needs or desires in the absence of the caretaker. The System also provides the user a facility to operate the home appliances without any external assistance. Based on experimental results, the process of choosing activity menu can be concluded by eye gaze tracking which can be applied using Haar Cascade method, moment and contour. From the experimental result, it can be concluded that this system can help the users to communicate with their near and dear ones using the activity menu by blinking for more than 250ms.

With the growing technology the possibilities of using this technology will be soon in practice. In the future scope we are also looking forward to develop a system which is more available and affordable .The system is now implemented as a single integrated unit consisting of different modules .The system which is just a prototype now, can be commercialized and sold to consumers in the future. Future work includes developing eye assistance using Deep Learning in order to increase the robustness, accuracy and speed factor of the system

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