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LAGOPHTHALMOS DRIVERS IN LOCOMOTIVES

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Abstract

Every individual desires a restful night's sleep on a comfortable bed, free from stressors. Many people invest thousands of dollars in their quest for a good night's sleep. Medical studies indicate that nearly 20% of individuals sleep with their eyes open, leading others to mistakenly perceive them as awake. This condition, known as Lagophthalmos, arises from issues with facial nerves or muscles. Symptoms include weight loss, clumsiness, eye-open sleep, and fatigue. In Western countries, those affected often adopt dogs, whose primary role is to monitor their owners. If the patient's eyes remain open, the dog will bark loudly until they awaken. This study proposes a solution in which a camera monitors the patient via their laptop; when the patient enters an unconscious state, the system will initiate a call to their mobile phone to rouse them from sleep.

INTRODUCTION

Lagophthalmos patients are those who can sleep anywhere for a short interval of time but the impact of their sleep can be fatal, it may cause serious injury or can be a reason for accidental death. The cause of this disease is the malfunctioning of facial nerves or the brain falls asleep with open eyes. Nearby humans think the subject is in the conscious state the patient is in the state of unconsciousness. What would happen if a subject is driving a car? Worst come worst subject falls in sleep. National Geographic researchers depict that in certain case subject usually buy a trained medical dog whose responsibility is to observe its owner 24x7. If the subject falls asleep that dog will bark a lot to break the owner's sleep while they are traveling in public places? Research depicts no one can forecast lagophthalmos absolute time or short sleep time but a technology called pervasive can save such patients while they are driving a car. The taxonomy of this research is initiated by Tianyi Hong from the South China University of Technology, researchers depict that normal drivers can feel sleep or drowsiness during driving. The research proposes that real-time eye state detection can save a life, this research presented a

real-life system called IPP (Integrated Performance Primitives) which follows Haar-like feature detection [1]. Another research is carried out by Muhammad Awais from Italy, research detects subject drowsiness state, subject cognition, and lastly, locomotive & subject behavior. The research adopts an electroencephalogram (EEG) with brain signal to calculate real-time drowsiness state and generate an alert to safe driver life. [2].

Another milestone regarding driver drowsiness is achieved by Muhammad Awais, the study is based on brain activity. According to his study alpha activity in the brain is relatively high when the brain is relaxed, on the contrary, it would be relatively low. This research calculates drowsiness more accurately. In our case, it's necessary to find the alpha activity of Lagophthalmos patients.[3].

Azim Eskandarian did an experiment in which his study relates car steering control and brain alpha activity. These signals correlated with Neural Network

to find the actual response time. These experiments are carried out by two different simulators in control conditions. The outcome of this study does not create an impact because of the slow response from the computational device.[4] Further Forsmana research can forecast moderate levels of incidents by using lane variability, nominal speed of a car, 55mph, angle of steering other 87 attributes. This research is more towards hardware inclination, not focusing on patient cognition.[5]. In the human body, the only internal organ that is visible in the eye depicts the human state by its movement. In software engineering, eye gazing is a technique by which a software engineer checks software usability or the human attention area on the computer screen. In Human-computer interaction, gaze is used to get absolute feedback from the end-user. Similarly, this study focuses on the human eye, movement or no movement [6]. Autism is related to connections in the human brain; 2 disconnected connections out of 2 billion connections may result in autism. This is a disease that can't be cured or forecast. Patient alpha brain frequency range is from 8Hz to 12Hz which changes abruptly [7]. Brian- et al suggested that driving cars and the prompt response of these patients are comparatively higher than others. A study covered the topic in which it showed the statistics the things going worse for such type of patient when they are trying to drive a car on road, report says they frequent receive the ticket by the traffic police.[8]

A researcher named Denise wrote an article that explains the eye blinking rate of such patients is different from normal kids. A normal person blinks 15 to 20 times in a minute, on the contrary, these patients' blink rate is drastically low [14]. Edgar et al depict a relationship in which brain function is poor due to the power of thalamus-alpha. The brainpower increase from 8 to 12 Hz concerning their age but there is an anomaly in such patient alpha brain power [9]. Huixuan et al conducted research that predicts results on the real-time actions of a driver. The core of their algorithm is real-time driver response variations, which forecast the upcoming results [10]. Most of the drivers noticed huge traffic jams occur due to bottlenecks or congestion. Zhendong et al propose an algorithm that deals with strong reasons behind its lack of forecast or time interval recognition and proactive response time. If something is forecasted earlier then there is strong need to remove congestion on those areas where traffic jam is usual. After implementation of these strong reactive and proactive traffic control systems, there is a way to implement our proposed pervasive model [11].According to the website visiobib.com, there are 219 types of researches are available from 1955 to date about drowsiness. In one line the researches are Skolnick in 1955 US patent 2,724,109, Nov 1955 by single image system and most updated research was conducted by Jeong – et el, the topic was Driver Facial Landmark Detection in Real Driving Situations, published on 10, October 2018, pp. 2753-2767[12, 13].

METHODOLOGY

This research explains works only when the sensor gets signals from the camera that eyes are not blinking and so the state will be changed from normal to emergency state. Causes of both these types of lagophthalmos include:

- Bell's Palsy
- Trauma
- Neurosurgery

Bacterial infection Stroke [14] The following diagram is an automata that depicts when to horn and when to on the indicators. Five rows related to the input signal, name of the fields are input, output, state, sensor data, and actuator. Once the patient eye blinking is stopped, the sensor will give 1 to an input, very next moment it observes again no change in state, the same process will be executed for the five consecutive ones than the system sensed that patient is in short sleep, and raise an alert [15]. This alert sends the signal to the car and turns on both side indicators. If the state of the patient doesn't change then it generates the next alert which is a mobile call and pressure horn by the car.

Non-Overlapped DFA for pervasive computing													
Find:11111						1					1		
Input	0	1	1	1	1	1	1	1	1	1	1		
Output	0	0	0	0	0	1	0	0	0	0	1		
State	S_0	S_1	S_2	S_3	S_4	S_0	S_1	S_2	S_3	S_4	S_0		
Sensor Data	N	O	O	O	O	Sleep	O	O	O	O	Sleep		
Actuator	I	I	I	I	I	Car Indicator	I	I	I	I	Horn+Mobile call		

Whereas: S=states;N=Normal;O=Observation;Sleep;I=idle

Fig.1. Pervasive Deterministic Finite Automata

The following diagram depicts about states which tells the pervasive system to generate alert to car and mobile set. The automata depict when eyes are not blinking for the first time, then sense again generate one for the second time. It will continue till five consecutive ones. The non-overlapped DFA is as follows:

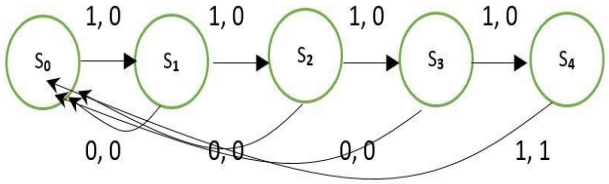

Fig.2. Pervasive Deterministic Finite Automata states

A) The Algorithm:

Step 1. Face detection CAMShift(). **Step 2**. Track the face and Save it as the frame (1) or F1...Fn.

Step 3. After the location of the face, the next step is to identify the eye.

Step 3.1 Loop acquire every third frame

Step 3.2 If Get(systime)= 3

Frame[]=Fn //frame array with n means 1,3,6,9 frames. save in Frame[].

End

Step 4. Locate(eye) step 4.1 Convert color image into greyscale.

Step 4.2 Convert the grey image into a pure black and white image.

Step 4.3 Mapped iris visibility **Step 4.4** If Iris visibility is true

then

Data[]=feature(eye) save in Data[]=F1.

fn=fn+1

If Data[fn]==Data[fn+1]

then

Message ('Alert') and Display ('Normal')

Save Message[n]

If Message[n]>=5

then

Turn on car (indicator ,horn) and call (mobile)

activity=Display ('Do you want to stop this activity',y/n)

If activity = y

Sno	States	Brain activity	Blink	Count			
				Normal	Incomplete blink	Abnormal	Body language
1	Lunch/Dinner	Relaxed	normal	12/Range(12-15)	2.55/Range(12-15)	X<1 (x=0.45)	Normal
2	Morning	Relaxed	normal	13/Range(12-15)	1/Range(12-15)	X<1 (x=0.35)	Normal
3	Video Game	Highly stressed	abrupt	10.95/Range(12-15)	3.3/Range(12-15)	X<1 (x=0.75)	Breath with sound
4	Office	Stressed	normal	12/Range(12-15)	2.55/Range(12-15)	X<1 (x=0.45)	Normal
5	Office	Stressed in presentation	abrupt	10.95/Range(12-15)	3.3/Range(12-15)	X<1 (x=0.75)	Breath with sound

break
else
continue
end if
break
else Display ('Recovered from short sleep')

else
Display ('Normal') goto step3. else goto step 3.//Capture another image **Step 5**. Shared with patient client-server().

Step 6. End
alert. This alert sends the signal to the car and turns on both sides.
B) Working:
Patients are requested to perform their regular activities in front of the newly proposed system, like newspaper reading, office-related work, and PlayStation games. Statistics depict that their mind behaves abnormally when they're asked to do stress-related work. Eye blink rate decreases from normal to none. The aforementioned table also shows 12 out of 15 blinks are normal, but 2.55 blinks are incomplete, and below 1 blinks are not considered. This abnormality increases if someone is not going for treatment or taking medicines. The proposed system always intervenes whenever such an abnormality occurs.

III. RESULT
Patients are very shy and they don't want to reveal their identities. This research checks their consciousness and unconsciousness by doing camera observation. During study or discussion, the patient went to sleep many times, initially two times short sleep in 90 minutes discussion for 7 to 10 minutes. This study observes when the patient is under stress or wants to do calculations or driving his car in a traffic jam brain goes to sleep for a short interval of time. Any alarm or beep may intervene in its sleep. Results are shown as follows.

IV. CONCLUSIONS / FUTURE WORK
This study highlights the significance of the proposed algorithm for those who are suffered from Lagophthalmos, patients worked on a pervasive system where their brain activity was monitored by the number of eye blinks. Events were previously developed like reciting the Quran in the morning, an office-related presentation, its demonstration, and lastly playing video games. Here, different eye blinks this research noticed start from normal, then incomplete blink, and abnormal.

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