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ENSURING ALERTNESS IN HIGH RISK AREAS BY COUNTING BLINKS.

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Abstract: *In this paper we are considering eye blinks for measuring alertness. Eyes are the most important sensitive organ, if any person feels drowsy his eyes blinks pattern and eye blink count changes. This change in blink count tells us that the person level of alertness has changed. People in high risk areas like border security force personnel, nuclear power plant fuel rod observer, security guard cabins of important buildings (parliament, airport, VIP residence, Army or Police head office, armoury, banks) needs to be alert. In our research we will count blinks in common situation and then we count blinks in working situation. If any difference in these blinks count is observed, then change in awareness is there, hence an alarm is initiated. In this system human-computer interface is there. The blinks in our system are counted by the software we have developed in matlab. When the system found the person in in attentive state it starts the alarm, this alarm buzzes continuously until it is switched off by the person. The system works as human computer interface.*

Key words: Eyes, Blinks, high risk areas, awareness, human-computer interface, Alarm.

1. INTRODUCTION

Lack of awareness of security guards is one of the prime causes of crossing line of control, terrorist attack on important buildings, theft, robbery, smuggling and other security issues. If the attentiveness of all such security agents is ensured then the chance of occurrence of any catastrophe is avoided. All the high risk areas need continuous and keen watching. The people involved in this needs to be very watchful and their watchfulness can be ensured by our eye blink counting mechanism which has an alarming system, if any person in security field is found inattentive then the system easily detects it and alarm is turned on. We have developed such a software that measures the difference in blinks in normal and in drowsy state.

- Image sequence of the person is taken manually and then it is taken automatically.
- Image sequence taken manually and automatically while working was found approximately same.
- In this software images of both the eyes are considered.
- The software detects the presence of eyes and then it measures the blinks.
- Our software will ensure awareness of people in high risk areas.

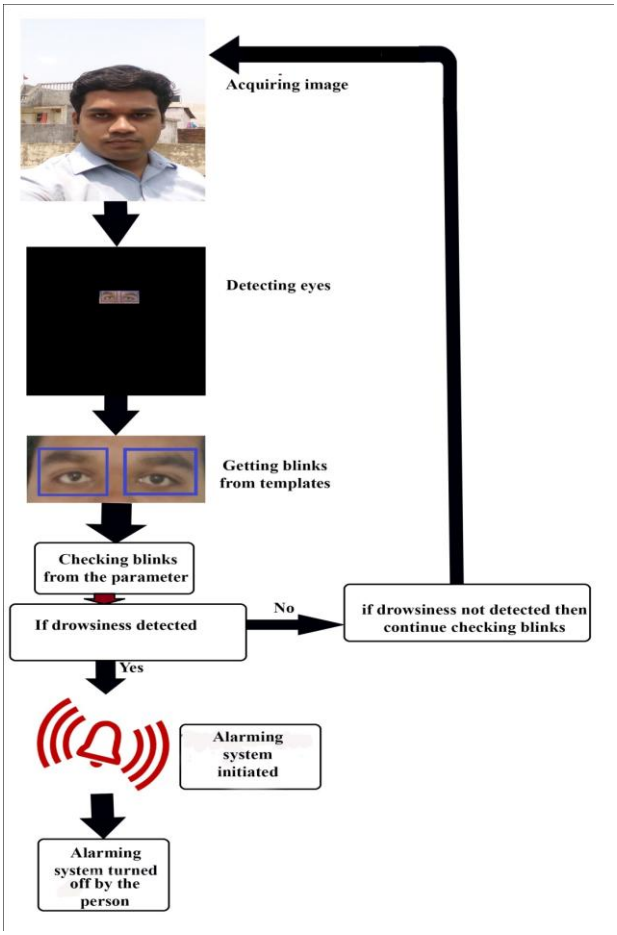

Fig . 1 Main steps for detecting tiredness

2.REVIEW OF VARIOUS TIREDNESS DETECTION TECHNIQUES

Different techniques of drowsiness detection / Comparison basis	Facial expression based approach	Yawning measurement based approach	Eye blink based approach	Measuring non-visual features
Drowsiness detection	yes	yes	yes	yes
Technique used	Facial expressions are considered like tilting head, mouth and eye movements.	Yawning is considered for measuring alertness.	Camera is used for capturing eyes and templates are created on the basis of these templates PERCLOS are calculated.	Sensing electrodes attached directly on to the body
Limitations	In-plane face rotation 1. Out-of-plane face rotation. 2. The presence or the absence of makeup, beard and glasses 3.Mental conditions & Illumination conditions 4.Covering part of the face with an object .	Does not work well in bad light situations.	Some of the blinks are missed.	Long time use would result in perspiration on the sensors, diminishing their ability to monitor accurately.
Ease of using	Easy	Easy	Easy	Difficult
Accuracy level	Moderate	Moderate	Very Good	Very Good

3. OBJECTIVE

- Ensuring attentiveness in high risk areas.
- Software development for automatic eye blinks counting and alarming system.
- Avoiding catastrophe in high risk areas.
- Real time based system.

4. METHODOLOGY

- We propose automatic eye detection and blink counting mechanism for ensuring awareness of people working in high risk areas.
- In this system there are three parts: eye detection system, blink counting mechanism and alarming system.
- Eye blinks are counted in normal conditions are compared with eye blinks in the working circumstances.

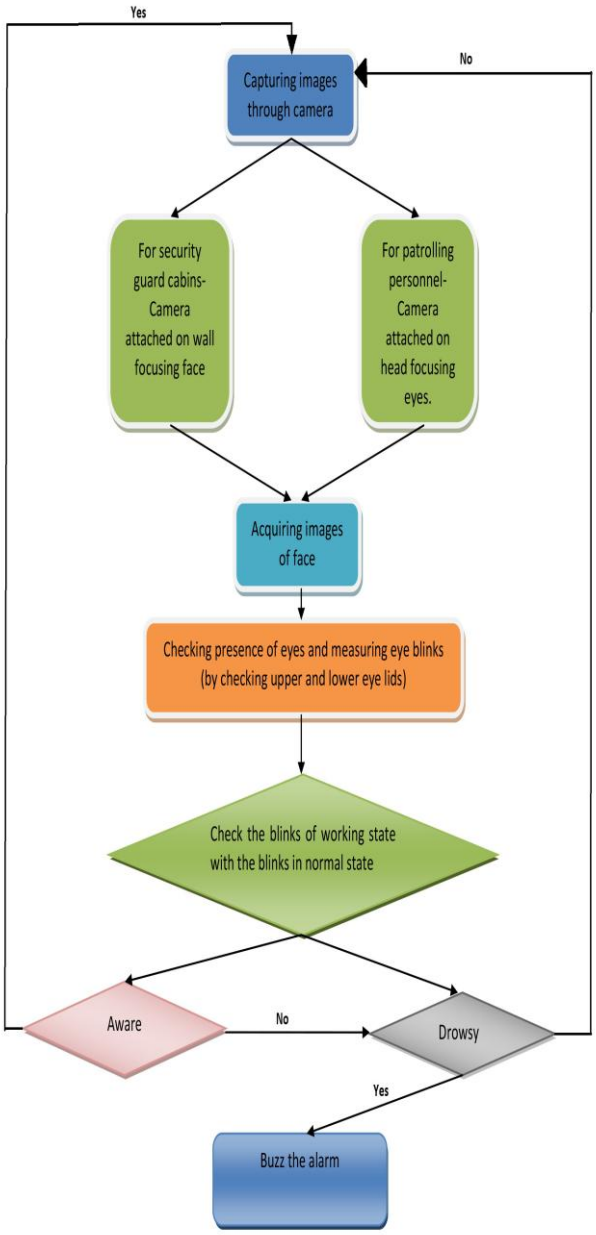

Fig . 2 Flow Chart of main steps

The camera for capturing images is attached to guard cabin focusing the security guard face and in case of patrolling personnel the camera is attached to his helmet focusing his eyes. The camera takes picture of the face and the image sequence of eyes are considered for checking alertness. The templates of eyes are generated from images. Person whose attentiveness is to be ensured has to measure his blink counts in normal state and then his blink counts are taken in his working situations. The blink counts of the person in normal state are considered as a parameter for checking his attentiveness, this parameter is compared with his

blinks in working conditions. The system works on the basis that blink rate of any person changes when he becomes drowsy, hence blinks are considered for attentiveness measurer.

5. RESULT

	A	B	C	D	E	F	G	H	I	J
1					50%	50%	75%	100%	100%	300%
2		Sec	Frame	blink	Lower		Medium		Higher	
3					below	above	below	above	below	above
4		1	30	0.3333						
5	natural	60	1800	20	10	30	5	40	0	60
6										
7		3	90	1	0.5	1.5	0.375	2	0	3
8		6	180	2	1	3	0.75	4	0	6
9		9	270	3	1.5	4.5	1.125	6	0	9
10		12	360	4	2	6	1.5	8	0	12
11		15	450	5	2.5	7.5	1.875	10	0	15
12		18	540	6	3	9	2.25	12	0	18
13		21	630	7	3.5	10.5	2.625	14	0	21
14		24	720	8	4	12	3	16	0	24
15		27	810	9	4.5	13.5	3.375	18	0	27
16		30	900	10	5	15	3.75	20	0	30
17		33	990	11	5.5	16.5	4.125	22	0	33
18		36	1080	12	6	18	4.5	24	0	36
19		39	1170	13	6.5	19.5	4.875	26	0	39
20		42	1260	14	7	21	5.25	28	0	42
21		45	1350	15	7.5	22.5	5.625	30	0	45
22		48	1440	16	8	24	6	32	0	48
23		51	1530	17	8.5	25.5	6.375	34	0	51
24		54	1620	18	9	27	6.75	36	0	54
25		57	1710	19	9.5	28.5	7.125	38	0	57
26		60	1800	20	10	30	7.5	40	0	60
27		63	1890	21	10.5	31.5	7.875	42	0	63
28		66	1980	22	11	33	8.25	44	0	66
29		69	2070	23	11.5	34.5	8.625	46	0	69
30		72	2160	24	12	36	9	48	0	72
31		75	2250	25	12.5	37.5	9.375	50	0	75
32		78	2340	26	13	39	9.75	52	0	78
33		81	2430	27	13.5	40.5	10.125	54	0	81
34		84	2520	28	14	42	10.5	56	0	84
35		87	2610	29	14.5	43.5	10.875	58	0	87
36		90	2700	30	15	45	11.25	60	0	90

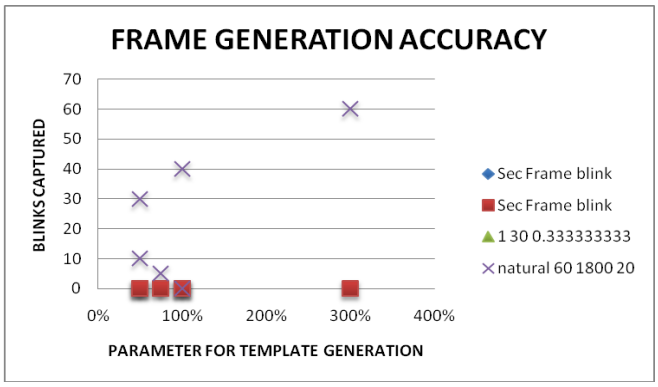

Fig . 3 graph showing frame generation accuracy

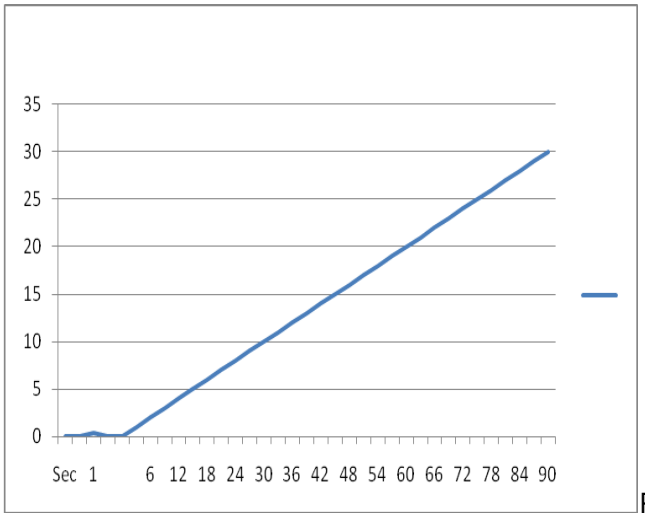

Fig. 4 graph showing eye blinks captured

X-axis shows time(in seconds) and Y-axis shows number of blinks captured in respective time.

The graph of fig.4 shows the number of blinks captured in given time on analyzing the graph we found that a blink is captured in every three seconds. For one second the blink is 0.33, then for three second the blink is 1, then for six second the blinks captured is 2, then for nine seconds the blink captured is 3, then for twelve seconds the blinks captured is 4, then for 15 seconds the blinks captured are 5 and so on.

A large number of videos were tested for checking accuracy of the system. For experiment videos were taken in diverse lighting conditions using inbuilt USB camera of hp pavilion g6 laptop. Each frame size was 480 x 640. Table shows the summary of the main results of the experiments.

The overall work of our experiment was to capture the original blinks with the help of webcam, then converting these original blinks into automatic blinks with the help of Matlab code and thus calculated the missed blinks by comparing the original blinks with that of automatic blinks captured. This experiment has many applications.

6. CONCLUSION

- The alarming system awakes the persons if he feels drowsy.
- Accuracy is good even in low lighting situations.
- Blink rate differs from person to person so the person using the system needs to feed his blink rate in normal conditions.
- Blink rate measured manually and automatically was approximately same.

7. ADVANTAGES

1. Life of people in high risk areas can be saved and by ensuring their alertness security of other people is also confirmed.
2. If the person becomes inattentive then the software easily identifies it.
3. System works well even in low lighting conditions.
4. Software captures blinks efficiently.
5. The system works in real time.

8. APPLICATIONS

1. System can be used in nuclear power plants for the observer of fuel rods.
2. System can be used in border of state and countries for security and patrolling personnel.
3. System can be used in security guard cabins and for watchman.
4. It can be used for person on watch towers of central jails.
5. System can be used in banks for cashier and also for bank security guard.
6. System can be used for ensuring alertness of person at cash counter at shopping malls, shops etc.
7. System can be used for drivers of automobiles and trains, for pilots of aero planes and space ships.
8. System can also be used in class rooms for ensuring alertness of students.
9. System can be used for surgeons doing important surgery for ensuring their awareness.
10. System can be used for camera man covering any important match or speech or any other important program (live).
11. System can work well for driver carrying nuclear waste, nuclear weapon and explosives.
12. System can be used for understanding blinking patterns of different types of people.
13. System can be used for ensuring alertness of crane operators.
14. System can be used for construction workers working on any skyscraper.

9. FUTURE WORK

1. The system can be designed to work in very low light situations.
2. The execution time can also be reduced.
3. Number of missed blinks can be reduced.
4. Work is to be done to make this system cheaper, more effective, accurate and robust.

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