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Design and Development of Plc Based Drowsiness Alert and Control System for Driver Safety

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Abstract- Nowadays the count of vehicles is increasing dramatically due to an increase in populations as the count increases the road accidents rate is also growing day by day. I have an idea to control road accidents and to save the lives of people. Most of the accidents are happening in the highways; the reason may be many, but one among the main reason is Driver's drowsiness. In my idea, I am using the pulse detect sensor and the eyelids monitoring camera. When Driver feels or falls into sleep, his pulse rate and the movement of eyelids will decrease below the nominal level. If the pulse rate falls below the nominal rate alarm and colour lights alert the Driver and the vehicles nearby. Also, the automatic speed controller will reduce the speed of the vehicle drastically to avoid collisions. In this approach, every movement connected with a general programmable logic controller which acts as a brain and controls every process in it. In this work we have designed and fabricated PLC based control system to test it in real time environment.

Keywords: Automation, PLC, Sensor, Speed controller.

1 INTRODUCTION

THE technology made to shrink down everything, in concern in the field of Automation the automobiles has tremendously grown up every year & in accordance with this road accidents has also grown up. A recent study says that about 20% of road accidents are happens due to driver's drowsiness. Some methods need to be developed to prevent the driver from his drowsiness during driving(1). This has become a major challenge to develop a system for the prevention of this issue. In earlier systems, visual analysis of eye state and head pose (HP) are continuously monitored and the result were analysed continuously. Researchers have attempted to determine driver drowsiness using the following measures: (1) vehicle-based measures; (2) behavioural measures and (3) physiological measures. The above measures given importance for driver alert system and not for vehicle control system. Hence, it is essential to develop a real-time and cost-effective control system to monitor driver and the speed of the vehicle to prevent drowsiness-related road accidents(2).

The aim of this work is to design and develop a PLC based control system to monitor the driver's pulse rate and eye blink rate. These factors are measured using the appropriate bio-sensors. The microcontroller compares the sensor values with the reference values provided. It alerts the driver and the nearby vehicle about the driver condition if these values are out of the reference value range. The microcontroller was connected to the speed controller of the vehicle, to reduce the speed to normal range drastically.

The proposed design and the working model of the PLC based control system used in this work is described in detail in the Experimental chapter.

2 METHODOLOGY

The methodology adopted for this work to monitor driver drowsiness based on eye-blink rate and Pulse rate were described with the help of flow diagrams.

2.1 EYE BLINKING DETECTION:

The flow diagram for driver drowsiness detection based on eye blinking rate is depicted in Fig.1. The camera placed in the front panel of the vehicle monitors the eye blinking rate continuously with the help of micro controller (3-5). It compares the observed value with the threshold value. If the observed value is in abnormal range i.e., above or below the threshold it triggers the alarm and alert the nearby vehicle by turning ON the emergency light around the vehicle. The microcontroller was connected directly to the speed control system which control the speed of the vehicle in both the critical cases. If the observed value is within the range the program returns to the initial state. The Bio-signals are acquired from sensors. That converts the bio signal into an electrical signal to the system.

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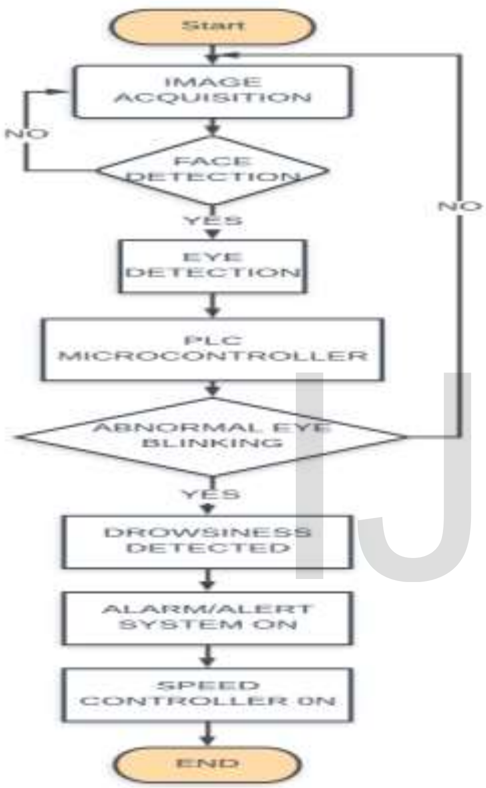
2.2 PULSE RATE DETECTION:

The methodology adopted for driver drowsiness detection based on pulse rate is depicted in Fig.2. The pulse sensor was installed around the inner circle of the steering wheel to measure heart pulse wave, which can ensure the detection even with single hand driving. Each sensor unit has a pair of infrared emitter and detector diode that placed side by side to detect clear ECG signal (6-8). The measured pulse rate by the above method is continuously feed into the micro controller, which compares the measured value with the predefined threshold. If the measured value is lesser or greater than the threshold. It triggers the alarm and alert the nearby vehicle by turning ON the emergency light around the vehicle. The microcontroller was connected directly to the speed control system which control the speed of the vehicle in both the critical cases.



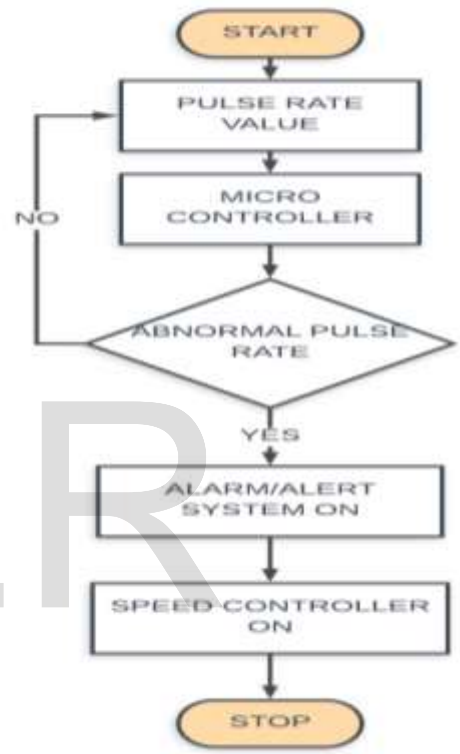


Figure 1: process flow chart to monitor eye-blink rate

Figure 2: process flow chart to monitor pulse rate

3 DELIVERABLES AND OUTCOME OF THE WORK

The schematic of the components used for driver drowsiness detection are shown if Fig.3. In this control system we have used high-end camera (Kinect camera, Microsoft, U.S) coupled with motion sensor (9) were used to study the eye-blink rate of the driver continuously. Similarly, the pulse rate of the driver was measured using the bio-sensor attached to the steering wheel of the vehicle. The output of the above sensors measured in real-time were monitored with the help of PLC based electronic system. In which the out of each sensor is compared with threshold value in order to trigger the alarm and speed control device when the measurement is goes beyond the critical limit. The model installation of Pulse rate sensor on the steering wheel is shown in Fig.4.

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Figure.3

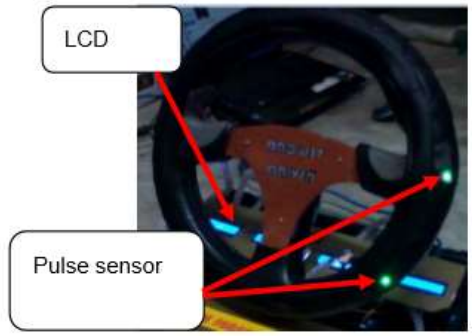

Figure.4

4 OUTCOMES:

The proposed design was developed and installed into the car (Hyundai Creta, Hyundai, India) to test it in the real time. The drivers were allowed to ride the car with the control system at various road condition and time period. The observation was tabulated below. The observation was made during three set of times i.e.., during early morning, afternoon and during late nights. The observations give different result during different period of time. The speed of the vehicle was controlled to the normal limit in those critical situations and the alarm system and alert system has did their work perfectly during those times (drowsiness). The observation made during the testing of our work is given below in Table 1.

5 MATERIALS AND METHOD:

This section describes different aspects of the system considered in its implementation; they include functional requirements as well as the tools and devices selected for this work. The used algorithm processes the condition of the driver in various aspects. The pulse rate sensor (SEN-11574), eye blinking sensor (10), camera and speed controller were connected to the microcontroller (Atmega), beagle board and microcontroller 8051 respectively. These microcontroller works on the given program input and analyse the sensors output with referred values to ensure the driver safety while driving.

TESTING TIME PERIOD AND TRIAL		NORMAL RANGE		EYE BLINKING RATE DURING DRIVING	PULSE RATE DURING DRIVING	CONDITION OF CONTROL AND ALERT SYSTEM
		EYE BLINKING (bpm*)	PULSE RATE (bpm**)			
EARLY MORNING	TRIAL -1	8-12	70-80	10	72	OFF
	TRIAL -2	8-12	70-80	18	65	ON
	TRIAL -3	8-12	70-80	9	70	OFF
AFTERNOON	TRIAL -1	8-12	70-80	9	75	OFF
	TRIAL -2	8-12	70-80	10	70	OFF
	TRIAL -3	8-12	70-80	11	69	OFF
LATE NIGHT	TRIAL -1	8-12	70-80	17	65	ON
	TRIAL -2	8-12	70-80	4	63	ON
	TRIAL -3	8-12	70-80	10	78	OFF

*- blink per minute. **-beats per minute. **Table.1**

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