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International Journal for Modern Trends in Science and Technology, 8(S09): 40-43. 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST08S0910
Available online at: https://www.ijmtst.com/vol8si09.html

Loco Pilot Health Monitoring System

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To Cite this Article
Derick Mathew, Benit J, Rojan Mathew, Rijo M Varghees, Saradhi T Soman and Poojitha Karthikeyan. Loco Pilot Health Monitoring System. International Journal for Modern Trends in Science and Technology 2022, 8(S09), pp. 40-43. https://doi.org/10.46501/IJMTST08S0910

Article Info
Received: 26 May 2022; Accepted: 24 June 2022; Published: 30 June 2022.

ABSTRACT

Heartbeat sensor is an electronic device that is used to measure the amount of heartbeat per minutes. This paper describes the monitoring of physical condition by measuring the heartbeat. A pilot health monitoring system is configured to collect information regarding the pilot's heart rate. Heartbeat sensors are designed to give digital output heartbeat when a finger is placed on it. When the heartbeat detector starts working, the light emitting detector (LED) blinks simultaneously for every heartbeat.

KEYWORDS: *Health monitoring, Heartbeat sensor, Loco piolet*

1. INTRODUCTION

The Railway transportationis one of the biggest, cheapest, and fastest mode of transportation that is ideal for long distance travel and movement of bulk commodities. InIndia, the rail network is widespread and tremendously massive and plays a vital role in socio economic life of the country. TheIndian Railway is one of the largest rails.

Trains are preferred for short distance andlong-distance journeys.Trains carries ginormous number of passengers from one station to another. Railway loco pilots are important members of the Indian Railways. The job requires alertness and concentration of the staff. The section controllers of the operating Department of railways manage train movement. The section controllers work in the control rooms. The loco pilot jobs are high strain. Loco pilot is responsible for the lives of thousands of people and costly goods. Their duty time are not fixed. sometimes they are forced to work more than their duty hours due to non-availability of staff. Insummer, theymust sit in temperature as high 45-60 degree Celsius. Allthese factors led them physical and mental strain. They often acquire various disease like hearing abnormality, heartproblems, eye weakness due to the working conditions. So,it's important to monitoring loco pilots' health. A regularand reliable technology is needed to monitoring loco pilots' health.

The main aim of this project is to build a prototype of health monitoring system for loco pilots. In this project, a Loco pilot health monitoring system is being developed for loco pilots incorporates the Arduino UNO by making use of cost-effective sensors to check the vitals of the loco pilot such as heart rate. Many technologicaldevelopments have ascended in the field. The project is basically done by Arduino. Because Arduino can sense the environment by receiving input from a variety of sensors and can affect its surrounding by controlling lights, motors, andother actuators so Arduino is a main part of this project. Arduino coding is needed for sensing heart rate by using Arduino software. The Arduino Uno is one of the best Arduino boards for beginners. Compared to physical inspection, Loco pilot health monitoring system offers reduced costs and increased security.

2. FATIGUE DETECTION DURING DRIVING

The fatigue/inattention/drowsiness are very vague concepts. These terms refer a loss of alertness of vigilance while driving. Indicators of fatigue can be found in [1].

A. Visual Features

There is an important quantity of studies related with this area [2]. Most of them are based on facial recognition systems to determine the position of the driver's head, the frequency of blinking, etc. This frequency and the degree of eyelid opening are good indicators of tiredness level [3]. In a normal situation,
driver blinks and moves the eyes quickly and constantly, keeping a large space between eyelids. In a sleepy state, we
can appreciate that the speed of blinking and the opening decrease. Regarding the driver's head angle in a normalsituation, he maintains a lifted-up position and only does thetypical movements related to the driving. Passing into a drowsy state implies to nod off as well as a more frequent head's position change. In fact, when it is a deep stage, the nodding off is extremely slow and the head keeps itself completely relaxing [4]. Other research lines are centered in the analysis about facial expression. In general, people are prone to have different expression depending on the alert level that show [5].

B. Non-visual Features

Driver's concentration can be affected by environmental factors;therefore, it would be interesting to sensorize the cabin. Diverse studies analyze the concentration of carbon monoxide and oxygen in air. An intelligent gas sensing system offers an added security in the vehicle, warning when the concentration is higher than tolerable levels (CO of 30 ppm and oxygen levels below 19.5%) [6].
Other non-visual features are physiological variables. Galvanic skin response (GSR) and the conductivity are relation to the psychological state of the person [7]. Gripping force gives us an idea about driver's attention level, and body temperature is an important physiological parameter that depends on driver's state too: body temperature increases due to infections, fever, etc. reflecting the autonomic responses and the activity of a human's autonomic nervous system [8]. Electroencephalogram gives a lot of psychophysiological information about stress state, drowsiness, or emotional reactions [9],[10].

3. METHODOLOGY

A loco pilot heartbeat monitoring system consist of a sensor and the process flow is shown as a flowchart in Fig 1. Theheartbeat sensor will provide digital signal to Arduino Uno. This internally does the calculation as per programming and display heart rate on LCD along with the information. Sensor is designed to provide digital output of heartbeat when a finger is placed on it. When theheartbeat detector is working, beat LED flashes in unison with each heartbeat. This digital output can be connected to Arduino Uno to measure Beats Per minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse [11], [12].

The sensor consists of a super bight LED and light detector. LED needs to be super maximum light must pass spread in finger and detected by the detector. When heart pumps blood through blood vessels, finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. Signal is amplified and triggered through an amplifier which output +5v logic level signal. The output signal is also indicated by a LED which blinks on each heartbeat.

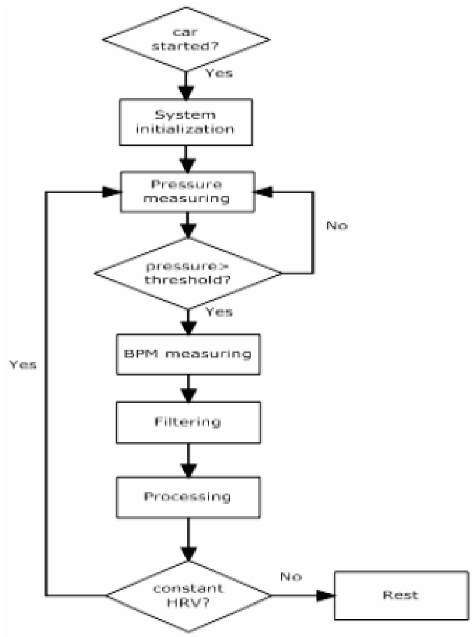

Fig. 1 Software flowchart

3. RESULT

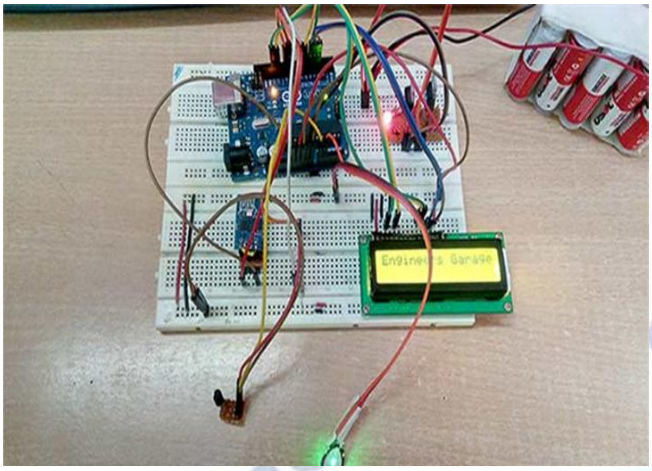

Fig. 2 Hardware setup

The simulation system is created in proteus software. After successful completion of simulation,a laboratory prototype is as shown in the Fig 2.The Arduino Uno will receive a digital signal from the heartbeat sensor. This internally performs the calculation in accordance with programming and displays information and the heart rate on an LCD. When a finger is placed on the sensor, it is intended to produce a digital output of the heartbeat. The heartbeat LED flashes in time with each heartbeat when the heartbeat detector is in operation. To measure Beats Per Minute (BPM) rate, connect an Arduino Uno to this digital output. It operates on the idea of light modulation caused by pulse-induced blood flow through the finger.

The tests on people with a healthy heart in acomfortable environment to get to sleep. The final systemthat we are using at the laboratory uses Lab Windows to takesamples of the pressure exercised on the steering wheel byeach hand, of the electrocardiogram signal boththe signal obtained using the sensors located in the steeringwheel and the one obtained by the commercialcardiothoracic beltand of the steering wheel position every0.05 seconds.The system, besides storing the samples for their laterstudy, also has the capacity to analyze them presenting ingraphic the signals that are being obtained as well as thepower spectrum and the HRV signal histogram, and themean and typical deviation of the steering wheel position.In figure can be observed the HRV captured for thesame person under conditions of extreme fatigue (24 hourswithout sleeping) and in different days. The test consists ofplacing the user on the simulator and to try that this fallsasleep driving. In HRV 1 and 2 the driver falls asleepalthough he wakes up immediately. In HRV 3 the driverdoesn't fall asleep although due the fatigue he yawnscontinually.

4. CONCLUSION

Most driver-state detection systems are based on the analysis of non-visual facts or visual facts (eyes movement, head movement, and facial expression) (HRV, ECG, pressure exercised over the steering wheel, relative humidity, etc.). It is impossible to identify fatigue using a single physiological parameter, necessitating the investigation of numerous variables. To account for this information, we combined it with other pieces of knowledge in this work to be able to assess the driver's mental state. A minimum number of samples is required in systems based on the analysis of heart rate variability, the power spectrum, and the histogram to obtain reliable results.Hence, it is required to obtain a minimum number ofbeats before considering these data as valid. That requires aminimum time before the obtained results are reliable.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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