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Health Monitoring System for Automobile Vehicles to Enhance Safety

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ABSTRACT:

In recent times most of the automotive vehicle accidents are increased day by day in India. Recent causes of the accident shows that more than 20% of accidents are caused due to health issues which occur to drivers while driving the vehicle. In the proposed project we had been monitoring the status of health condition of the driver by using sensors such as pulse rate sensor and temperature sensor. The heart beat rate falls below the lower limit and above the higher limit to the driver. The driver can be prevented from driving the vehicle when he is in extreme emotion such as heart attack, arrhythmias, heart stiffening or weakening, cardiomyopathy, stress, anxiety, depression etc. The speed of the vehicle is measured by speed sensor in the vehicle. The ultrasonic sensor which is used to sense the object placed in the front of the vehicle. The result is to create a system capable of contributing to the reduction of collisions. The driver who suddenly suffers from health issue especially heart attack while driving the vehicle cannot handle the vehicle because during heartache the movement of hands is difficult to control the vehicle which leads to accidents. The heart rate sensor placed in seatbelt of the driver and heat sensor in the driver seat. The sensors collect the data and send it to the control unit which interprets the data with the standard value and if some values are unusual may be in heart rate, blood pressure. The control unit sends out a warning signal to the driver and if the driver doesn't show any reaction within the set time the braking system is actuated.

KEYWORDS:

Heart rate; Pulse sensor; Arduino board; Ultrasonic sensor; Braking system

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1. Introduction

In recent times automobile accidents are increasing day by day. This mainly happens when the driver is drowsy or if he is alcoholic or if he is physically ill. We are going to concentrate mostly on the drivers who undergo heart attack while driving. Because a recent census shows the more number of accidents occur due to heart failure. The drivers lose the control of the vehicle during the attack and it may lead to accidents. We are going to monitor the heart beat rate of the driver of the age group 35-40 years on-board using a pulse sensor. The pulse sensor senses the heart beat rate and sends the data to the Arduino board which interprets the data already fed in the board and gives out a signal when the heart beat rate falls or increases with the set limit. By monitoring the heartbeat, the passengers on board can be prevented from the greater impact of accidents. The Arduino board sends out the warning signal to the dash board and also gives out a buzzing sound from the buzzer. As heart related diseases are increasing day by day, the need for an accurate and affordable heart rate measuring device or heart monitor is essential to ensure quality of health.

However, most heart rate measuring tools and environments are expensive and do not follow ergonomics [1]. An accident, an unpleasant event that no one ever wants to occur in their life, ruins the life of people causing tremendous losing the life. Preventing accident (accident prevention) refers to activities designed to foresee and avoid accidents. There has been an increase of 17.4% in the total number of death rate caused by road accidents during the period of 2011-2014. This percentage has raised eyebrows and caught the attention of many to curb the growing rate. It is found that 80% of the times it is the fault of the driver. Much prevention system has been so far suggested and some were successful to a few percentages. But unfortunately still the accident rate remains a mysterious and very serious problem yet to be solved. So we suggest a technique to prevent accident by alcohol sensor since most of the accident occurring today is mainly because of drunk and drive.

In order to avoid rash driving we go for a new technique of speed reduction system which uses the ultrasonic waves fitted to the vehicle to detect the obstacles and the distance they are apart from which we could reduce the speed of the vehicle automatically if the obstacles are present mere closer. Prevention of accidents remains on one side as a huge question mark but rather on the other we look up for something as a life saving measures to safeguard our self in case of occurrence of any accidents. Many lives would have been saved if the emergency service could get the crash information in time [2]. The National highway recognizes the issue happened due to health condition

and listed a table. The health monitoring system was used for monitoring the exact condition of the driver. Fig. 1 shows the causes of road accidents and it is given by the Government of India Ministry of road transport & highways transport research wing, New Delhi [3].

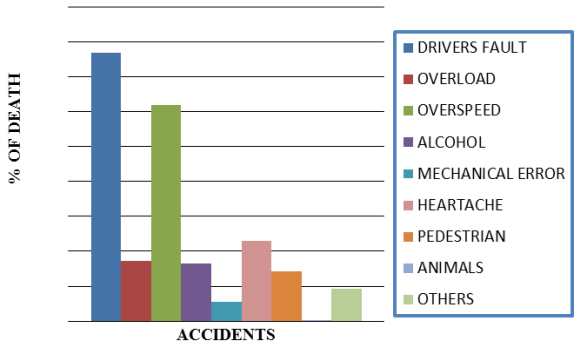

Fig. 1: Causes of accidents in India up to 2015

2. Proposed system

Fig 2 is the block diagram shows the layout of our proposed project which gives an overview what we are going to do in this system. The components used in our project are - Arduino board, Pulse sensor and Buzzer. Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analogue inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button."Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. Fig. 3 shows the control system. The pulse sensor senses the pulse rate by using the light principle. The bright led sends the transmitted light waves into the skin and the reflected waves are detected and the heart beat is calculated for every 2ms. Fig. 4 shows the pulse sensor sensing system.

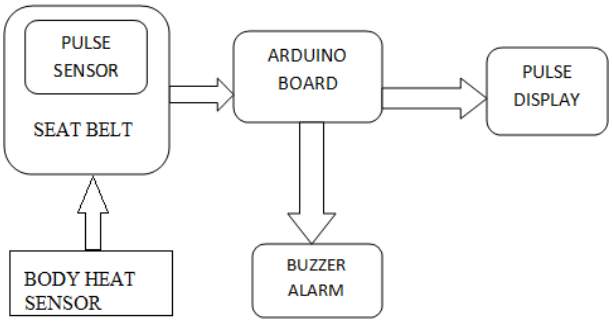

Fig. 2: Block diagram of the system.

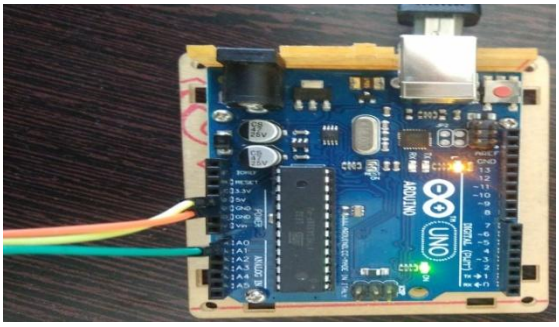

Fig. 3: The control system

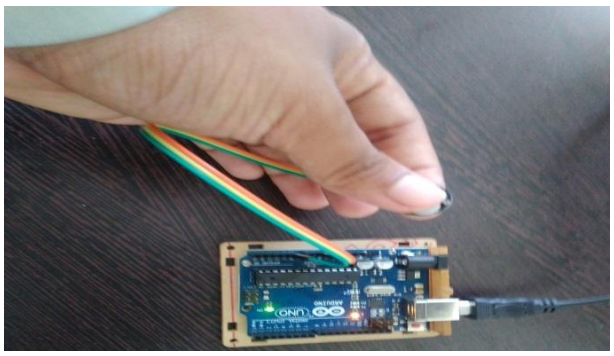

Fig. 4: Pulse sensor sensing system.

3. Methodology

The Arduino board is programmed using IDE software based on the range of heart beat for various persons between age group 35-40. The heart rate is measured using the pulse sensor which is placed in the seat belt. The seatbelt is placed on the chest part to diagnose the pulse rate of the driver. The pulse sensor when senses the pulse rate and it is measured by its range what we programmed in the Arduino board. The pulse range manually is fixed by the driver who knows already heart issue range with the lower limit is set as 50 bpm and the upper limit is set to 120 bpm. The pulse sensor is kept on the seat belt which senses the pulse rate of the driver for every 2mins.If the heart beat goes below 50 or above 120 the programming is done to give a warning signal in the dashboard of the car and the buzzer also gives a sound so that it alerts the driver, heartbeat rate is abnormal. The displayed heart pulse can be noted by the driver or passenger in the vehicle. The temperature sensor is used to sense the body heat and oxygen content in the blood. The variation in the pulse is monitored for a minute and the process is carried out for 2 cyclic periods.

When the heat beat level of the driver is normal then the system remains at the stable state, i.e. the driver can control the vehicle braking system as per its requirement. But if there is any change, occurred in heart beat level of the driver, the heart beat sensor attached senses the condition and sends the feedback signal to the electronic control unit. This tends to activate the solenoid valve and dc pump which get coupled with it. Due to the activation of pump the fluid stored inside the reservoir get pressurizes and transferred to the hydraulic cylinder by means of solenoid opening and tends it to retract back causes the brake lever connected with to move back ward which causes the vehicle to stop. Thus the accident caused due to the inconvenience level of driver during medical issues is completely reduced. Once the driver condition is monitored the signal from the sensor is sent to the control unit which is used to activate the braking.

The braking system is used to activate the brake when the health condition is in critical condition. The braking system contains hydraulic cylinder with solenoid valve to activate the brake lever which is connected to pedal. The pedal force is calculated depends upon the speed, emergency situation and demand. Fig. 5 shows the working model of the braking interaction. Fig. 6 shows the working of hydraulic braking system.

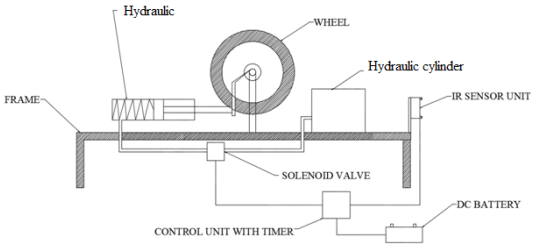

Fig. 5: Control unit of braking system

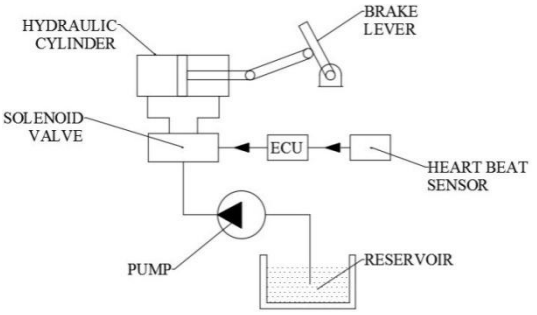

Fig. 6: Working of hydraulic braking system

4. Results and discussions

Table 1 shows the pulse readings obtained from ECG and pulse sensor and the error rate and the abnormal pulse rates that can be attained by people between age groups 35-40. The following graph shows the different heart beat readings for different age groups which were obtained by taking the values from electrocardiogram by testing a number of different persons under the same age group; the normal heart rate varies 72-80. Brake efficiency will be less, does not require skilled driver. Human error is totally eliminated so accuracy is more. This system saves the life of a driver, at the time of suffering from heath issue. This system can be implemented in all four wheeled vehicles easily, and also the maintenance cost is less. Figs. 7 and 8 show the ECG and Pulse sensor reading.

Table 1: Comparison of ECG and IR sensing rate

Age	Max. heart rate	ECG (Bpm) normal	Pulse sensor (Bpm)	Error rate (%)	Abnormal pulse rate (Bpm)
35	120	74	75	1.35	125
36	120	76	77	1.31	124
37	120	77	78	1.29	126
38	120	78	80	2.56	131
39	120	78	79	1.28	124
40	120	80	82	2.5	127

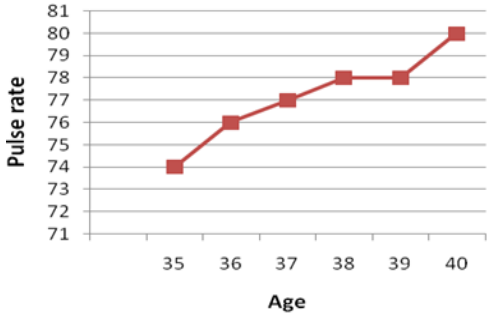

Fig. 7: Age vs. Pulse rate (ECG - Bpm)

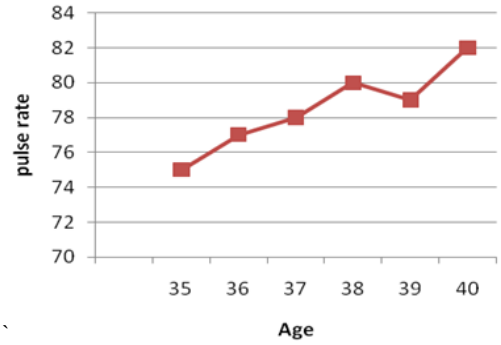

Fig. 8: Age vs. pulse rate (IR pulse sensor - Bpm)

Fig. 9 shows the pulse rate readings that were obtained by using pulse sensor for the same age groups. ECG obtained and the error rate percentage was calculated between the two readings and the graph was plotted. The error were not found to be a big difference in this case and the values are acceptable as the ECG readings were taken in the stationary state and the pulse sensor readings were taken in the dynamic condition when the driver was driving the car.

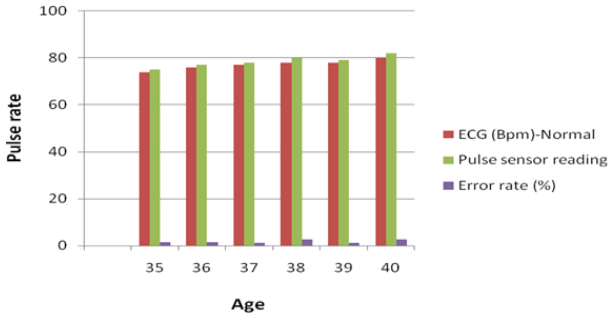

Fig. 9: Error rate

5. Conclusion

Safety is considered a great issue nowadays in automobile as the life of any human being is very precious. Due to lack of safety systems in vehicles leads to accidents which may cause severe damages to the body or it may even lead to death of the driver and co-passengers. Thus it is necessary to consider the safety of both driver and co-passengers. Automotive safety is concerned only to the high end and luxurious cars which can be used only by the rich people but our project aims to provide benefit to middle class people by providing this system to conventional cars and lower end cars and mostly to truck drivers in India where safety to truck drivers is lagging behind. The cost of our system would also be very low when compared to other safety systems available and could be commercialized easily even to normal people.

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