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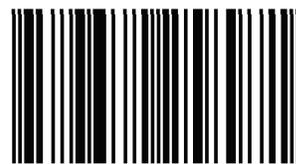
MICROSLEEP DETECT AND ALERT SYSTEM FOR DRIVER

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Abstract

The Road Safety Department of Malaysia logged a total of 535000 road accidents that occurred in 2018 and an increment of 19000 cases in 2019 with fatal accidents totalling 5764 cases in the same year. Statistically, Malaysia is one of the ASEAN countries with the highest road fatalities based on the overall population. In 2020 Human behaviour was listed as the highest-ranking cause of Road Accidents in Malaysia, with drowsiness caused by microsleep and fatigue conditions among the sub-factors. A sudden temporary episode or drowsiness which lasts up to several seconds is defined as microsleep (MS). Microsleep signs can be detected by using a human heartbeat pulse which is used in this system design. Taking the simple concept of other road users honking to alert a wander-off driver, this system combines IoT technology with an applicable device that analyzes data of microsleep signs, alert the drivers by automatically turning on a neck massager and at the same time notify interested parties such as other people in the car or family at home. The system has proven able to detect microsleep of the subject by using heart rate sensor. The system is also used to study the heartbeat pulse patterns when sleepiness occurs and the effects of a sudden stimulus on the pattern. The heart rate that has been detected will notify the blynk app and can be seen by the user.

Keywords: Author Guide, Article, Camera -Ready Format, Paper Specifications, Paper Submission.

1. Introduction

Road accidents that lead to death may cause many people to experience the loss of a family member or close friend [1]. One of the reasons that lead to road accidents is the drowsy driver. Microsleep (MS) and crashes are the two important consequences of sleepiness during driving (Golz et al., 2011). There are several gadgets on the market to prevent microsleep during driving. For example, the Samsung smartwatch can track health, activity, fitness, and sleep. However, most of these solutions focus on detecting microsleeps without any prevention action. There is a need for the development of a device that can detect microsleep and refresh the driver to avoid MSE whilst driving. Still, microsleeps may reoccur even after a refreshing episode. This is why the related parties such as other people in the same vehicle or family at home should be notified about the possible microsleeps incidents during the ride.

A road accidents case which involving cars and heavy vehicles such as buses and lorries is one of the major causes of injuries in Malaysia. The total number of road accidents was 265,175 with fatalities of 5230, seriously injured 6942, and slightly injured 30,684 in year 2001. (Abdul, 2003). Microsleep and fatigue condition is one of the main factors that contribute to road accidents. Driving in this condition will lead to an accident since it affects the driver's concentration. Rest up before driving, taking caffeine or pull over for a rest when the signs of microsleep and fatigue appears could avoid falling asleep on the wheel. However, some of the drivers cannot take this action to refresh themselves from fatigue and continue driving. Therefore, detecting a microsleep is one of the important steps to prevent the road accidents. This project proposed to detect sign of microsleep using a pulse beat sensor also to alert and refreshes the driver using neck massager.

2. Literature Review

2.1 THE INCREASING OF ROAD ACCIDENTS ARE A MENACE TO SOCIETY

Many people had experienced with a road accident in their life, which is an extremely traumatic incident. Road accident which involves cars, lorries and motorcycles will affect our physical whether minor injury or major injury. Based on an article by Abdul Kareem, K. Abdul, according to Ministry of Health Malaysia, during the year 1997-98, accident was the third principal cause of hospitalization in hospitals and accident was the fourth principal cause of death behind heart diseases, septicaemia and cerebrovascular accident [1]. He summarized that accident fatality in Malaysia should be reduced thus saving millions of Ringgits in terms of productivity loss, property damage, medical cost, and others (Abdul, 2003). Based on an official portal website of Ministry of Transport Malaysia, in terms of tracking road accidents and road fatalities, there are two types of crash data collection method which is authorised by the Royal Malaysian Police (RMP) and research conducted by the Malaysian Institute of Road Safety Research (MIROS) [2].

2.2 MICROSLEEP AND FATIGUE ARE ONE OF THE CAUSE OF ROAD ACCIDENT

Every people will experience a microsleep which is an involuntary sleep episode that last for 15 seconds or less 7 seconds rather than minutes or hours. Based on website article, medically reviewed by Dr Anis Rehman, M.D, microsleep referred as behavioural microsleep can be identified by a person's lapses in attention or briefly closing their eyes. Microsleep become risky because it could make a person less responsive for a briefly of time. However, by measuring brain activity or a person's face and body could be one of the ways to detect microsleeps [3]. Electroencephalogram (EEG) will measure brain waves during a microsleep episode. To show the differences of brain activity between microsleep and regular sleep, functional magnetic resonance imaging (fMRI) is use [3].

2.3   NORMAL RESTING HEART RATE RANGE FOR ADULTS

Based on an official website of Mayo Clinic, there are common ways to determine human heartbeat, which is placing your index and third fingers on the side of your throat on your neck or put two fingers between the bone and the tendon over your radial artery, which is located on the thumb side of your wrist, to check your pulse. Multiply the count number of beats in 15 seconds, to calculate beats per minute [6]. Resting heart rate is when your body in a complete rest in a condition such as fall to sleep, sitting or relaxes. Our heart is pumping the lowest amount of blood to supply oxygen for our body when we are at rest. Peter Santucci, MD, professor of cardiology at Loyola University Medical Centre in Maywood, Illinois said that normal rate can be from 40 to 100 beats per minute [7]. Since the body unwinds so profoundly during rest, the dozing pulse ought to be marginally lower than the ordinary resting pulse while conscious. The heart rate begins to slow as a person begins to fall asleep, and studies suggest that this process can begin as soon as a person realises, he is preparing for sleep [8]. Core body temperature can drop and metabolism, as well as heart rate usually will slow down, as the body relaxes into a deep sleep state [8].

An article from British Heart Foundation state that between 60 and 100 beats per minute (bpm), is a normal heart rate whilst resting. But it will vary depending on what you were doing and when it will be measure before the reading is take [9]. However, there are many factors that can influence our heart rate, such as age, body size, medication, body fitness and our activity level also the healthiness of someone's body. The category for normal target of heart rates and the average maximum heart rate based on ages [10]. According to the American Heart Association, 60-100 beats per minute is the reasonable resting heart rate for most people barring any underlying medical conditions and it should be closer scores to 60bpm rather than a 100bpm. Based on a data from the National Institutes of health in, there a typical list of sleeping heart rate by different age [11].

2.3   PREVIOUS RESEARCH

Behind-the-ear wearable system is for microsleep detection that can mitigate motion and environmental noises. The earpieces were thoroughly created by designing the device structure and then the off-the-shelf components implemented. The materials used in the earpieces were also carefully chosen to provide adequate connections between the electrodes and the people skin while also allowing users to wear them comfortably. This intelligent design captures the brain wave using a very sensitive circuit sensing, activity of eyeballs, muscle of human face and electrodermal activities [4]. It can be able to capture key microsleep biomarkers at the intersection of microsleep biomarkers which is our ears. This results the use of minimal number of sensors. It able to collect 35,558 awake and 8,845 microsleep data points. Based on their user's analysis, the device is convenient and comfortable. Hence, the device can be use in our daily life especially while driving [4].

3. Methodology

3.1 BLOCK DIAGRAM

The figure below shows the main components which is NodeMCU, pulse sensor and vibration. For input we will connect pulse rate sensor to detect the heartbeat of the user. Next the power supply with NodeMCU ESP8266 will connected to NodeMCU. For the output, we have vibration motor that will automatically activate when heartbeat below 60-100 bpm is detected. Also, the data will be display on the IoT application, Blynk app.
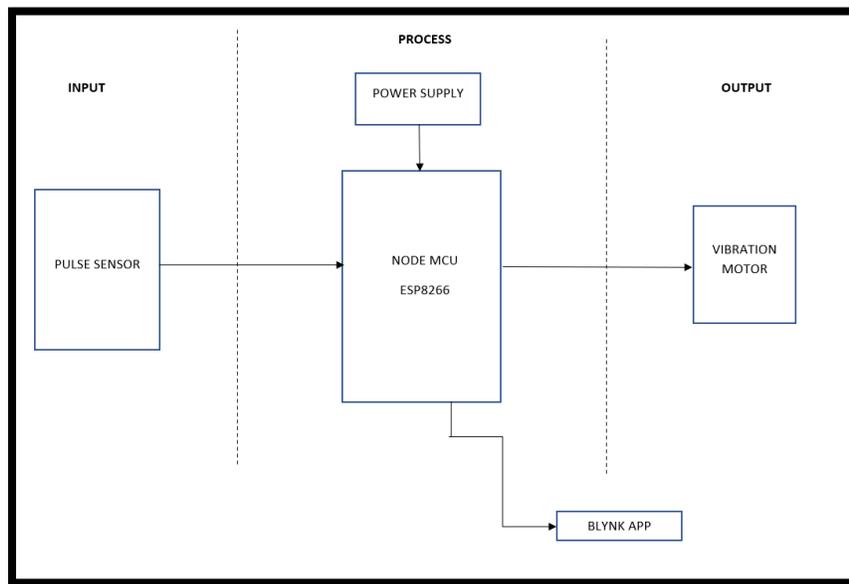
FIGURE 8: Block diagram

4. Result & Discussion

4.1   DEVELOPMENT OF PROJECT
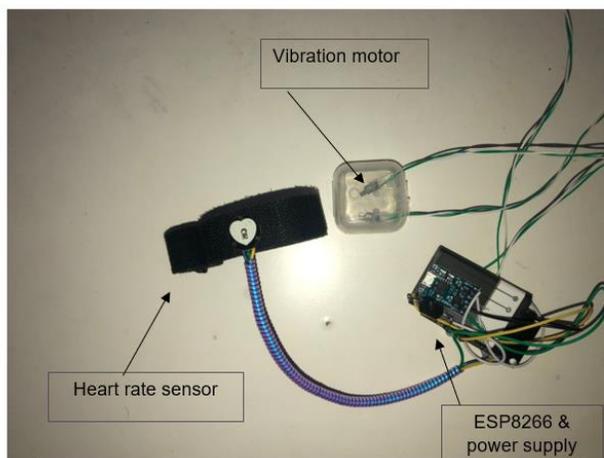
FIGURE 15: The result of microsleep detect and alert system for driver project prototype

The figure above shows project prototype with full casing. The micro motor vibration is put in the headrest to able to put at the driver's seat in the car. It is to be adjusting the micro motor vibration at the neck of driver while their driving. The heart rate pulse sensor is design to be put at the driver's wrist to detect the heartbeat of the user. Lastly, the NodeMCU, rechargeable battery and power switch that connecting with motor micro vibration and heart rate pulse sensor is put in the casing, so the user is comfortable wearing them at their arm.

4.2 Result Analysis

Table 1: Data Collection

Participants	Heart rate when drowsy (bpm)	Time taken for the device to operate (s)	Heart rate when asleep (bpm)	Heart rate when sudden awake (bpm)
1	60	3	30	126
2	42	2	36	138
3	60	2	36	114
4	54	2	18	96
5	54	3	36	90
6	60	3	26	108
7	60	2	54	136
8	48	2	43	126
9	60	2	50	90
10	65	3	54	102

Data Analysis of experiment conduct

	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5
Drowsy	60	42	60	54	54
Asleep	30	36	36	18	36
Awake	126	138	114	96	90

Participants

Drowsy Asleep Awake
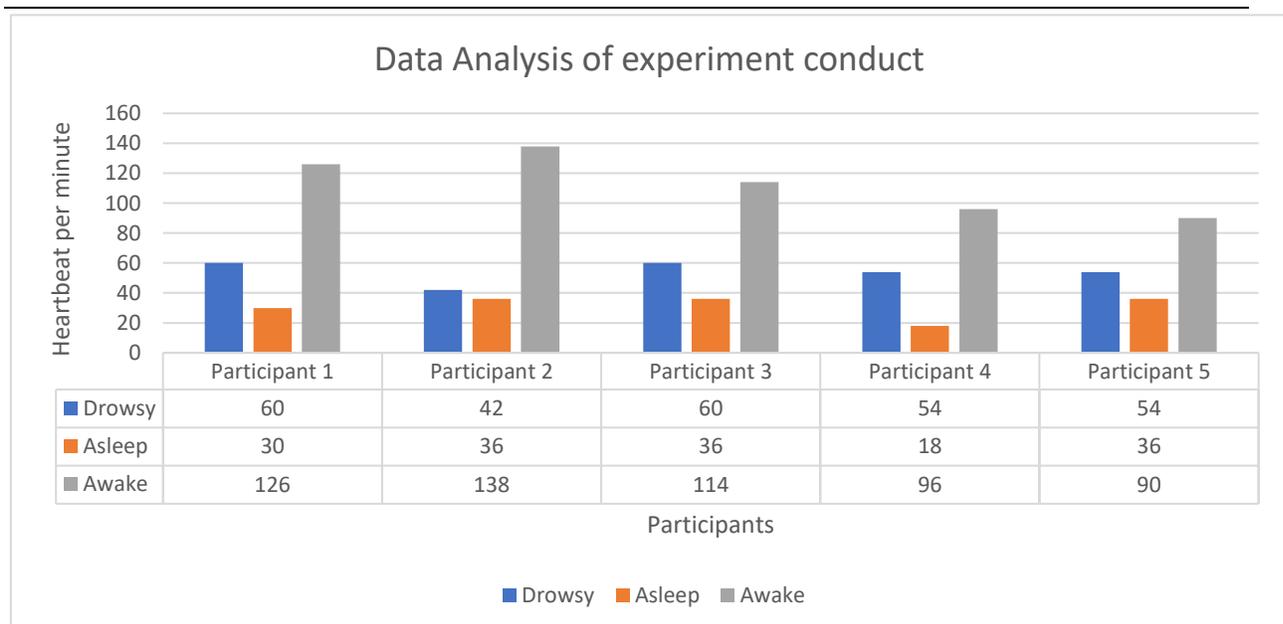
Graph 1: Data Collection

This experiment cannot be conducted on drivers in the car because of the possibilities that would harm the driver. So, I have conducted the experiment on the subject at different places and time. Ten subjects were involved in these experiments to test the ability of the device that I have develop. From the table, we can see the results of heart rate when the subjects are drowsy, sleep and sudden awake. The participants heart rate was recorded between 60bpm and below in drowsy state, the heart rate for the asleep state is also in the lowest number of bpm and the heart rate going spike when the participants in a sudden awake state, which is 100bpm and above. I also have recorded the time taken for the device to operate when the heart rate of the subject in a drowsy state was detected. The Blynk app notify when the microsleep is detected, and the vibration motor will immediately turn on. As we can see from the table, it takes between 2-3 seconds for the vibration motor to activate also the device will be able to detect the drowsy heart rate which falls below 60-100bpm beat per minute and analyse the graph of the heart rate in bpm against time.

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4. Conclusions

The outcome for this project is the Microsleep Detect & Alert System for Drivers able to work well for drivers on the road. Besides, the ability to design a system that detect signs of microsleep by using a heartbeat sensor. Furthermore, to build a device that alert and refreshes the driver showing coming microsleep signs by using an automatic neck massager. Moreover, to develop an application that alert passenger and related parties when the driver showing microsleep signs and to analyse heartbeat pulse patterns when sleepiness occurs and the effects of a sudden stimulus on the pattern. By characterizing this undertaking great on the foundation, issue proclamation and targets of the venture in legitimate design without letting out any featured issue. Additionally, electronic gadgets are known as intricate things to individuals. We as a client can improve it and positive to their life by following the necessities and purposes.

Acknowledgement

References

[1] ANALYSING ROAD ACCIDENT TRIGGERS IN MALAYSIA BY USING ANALYTICAL HIERARCHY PROCESS.pdf

[2] Abdul, K. (2003). Review of Global Menace of Road Accidents With Special Reference To Malaysia- a Social Perspective. Malaysian Journal of Medical Sciences, 10(2), 31–39.

[3] Road Accidents and Fatalities in Malaysia. (2021, November 14). MINISTRY OF TRANSPORT MALAYSIA. https://www.mot.gov.my/en/land/safety/road-accident-and-facilities

[4] Summer, J. (2021, August 26). Microsleep: What Is It, What Causes It, and Is It Safe? Sleep Foundation. https://www.sleepfoundation.org/how-sleep-works/microsleep

[5] WAKE: A Behind-the-ear Wearable System for Microsleep Detection. (2020, June). [Slides]. PowerPoint. http://mnslab.org/nhatpham/files/MobiSys2020_WAKE_Presentation.pdf

[6] Defining Microsleep. (2021, March 12). Sleep.Org. https://www.sleep.org/what-is-microsleep/

[7] Heart rate: What's normal? (2020, October 2). Mayo Clinic. https://www.mayoclinic.org/healthy-lifestyle/fitness/expert-answers/heart-rate/faq-20057979

[8] Iliades, C. (2021, February 25). How to Know If Your Sleeping Heart Rate Is Normal. LIVESTRONG.COM. https://www.livestrong.com/article/105256-normal-heart-rate-sleeping/

[9] What is Considered a Normal Sleeping Heart Rate? (2021, February 6). The Health Board. https://www.thehealthboard.com/what-is-considered-a-normal-sleeping-heart-rate.htm

[10] American Heart Association editorial staff. (n.d.). Target Heart Rates Chart. Www.Heart.Org. Retrieved March 9, 2021, from https://www.heart.org/en/healthy-living/fitness/fitness-basics/target-heart-rates

[11] Target Heart Rates Chart. (n.d.). Www.Heart.Org. Retrieved March 9, 2021, from https://www.heart.org/en/healthy-living/fitness/fitness-basics/target-heart-rates

[12] Cralle, T. (2020, October 8). Average Sleeping Heart Rate by Age: Why it Matters? Terry Cralle. https://www.terrycralle.com/average-sleeping-heart-rate-by-age/#:%7E:text=By%20age%2010%2C%20most%20kids%20will%20have%20an,of%20their%20life%2C%20provided%20they%20remain%20relatively%20healthy.

[13] https://www.elprocus.com/heartbeat-sensor-working-application/

[14] https://www.theengineeringprojects.com/2018/06/introduction-to-arduino-nano.html#:~:text=Arduino%20Nano%20Programming%20%26%20Communication%201%20The%20Nano,the%20board%20and%20the%20computer.%20More%20items...%20

[15] https://www.electroduino.com/introduction-to-l298n-motor-driver-how-its-work/