Journal of Telematics and Informatics (JTI)
Vol.7, No.2, June 2019, pp. 111~117
ISSN: 2303-3703

Real Time Monitoring for Drowsiness and Emergency Detection on Riders Using XD-58C Sensor

Qory Hidayati, Ridho Fadhillah
State Polytechnic of Balikpapan, East Kalimantan, Indonesia
Soekarno Hatta Km.8 Street, Balikpapan
e-mail: qory.hidayati@poltekba..ac.id

Abstract

Drowsiness that felt by the driver will affect the security of someone when driving. It can be seen that many accidents cause death due to drowsiness when driving. Due to the effects of fatigue after some busy activities and the responsibility to keep going home. However, this is not supported by the motorist's awareness of not continuing the journey and resting for a while until the physical condition returns to normal. So to reduce the number of accidents that occurred needed a capable tool of detecting sleepiness through the state's heartbeat using a heartbeat sensor (XD-58C) to the rider who can awaken directly by using vibration motors and buzzer, and if an emergency occurs, namely when the driver crashed, the tool will send point location via SMS to the families, hospitals and police stations using GSM module SIM800L, point locations that are read by an integrated GPS module with microcontroller arduino during an accident that can be used by the driver.

Keywords*: XD-58C Sensor, Drowsiness Detection System, Emergency Detection, GSM SIM800L, modul GPS*

1. Introduction

Rest is a basic requirement of every human being, because by resting, humans can return to freshness and fit so that they maintain a healthy body. Rest is not only in the form of sleep, but can be a variety of other activities so that a person's physical condition can be healthy and ready to move back. Stamina recovery process is diverse, there is only a short time to refresh the body, but there is also a need to sleep to make the body really fit. Sleep is a state where one is not conscious because of the delta wave effect that arises. Sleep also has a specific time range for each person, where the time to sleep for infants to adults every day is different (children + 8 hours a day, adults + 6 hours a day). Of course, rest becomes the main thing for every human being, because by resting it can avoid the appearance of diseases.

Predetermined bedtime should be maximized by everyone to keep the body healthy. However, bedtime seems not always used regularly by everyone, especially for those who have enough dense activity every day so that sleep time is reduced. Some people can stand with the drowsiness they feel when they are in dense activities, but some are not even when the activity should require individual fit conditions. Handling drowsiness that can attack this, usually done with many things such as washing your face or resting for a while. But that cannot be entirely successful, because the nerve center (hypothalamus) has not fully returned to its conscious state.

Sleepiness of a person also occurs when driving, which is evidenced by the many numbers of accidents to cause death due to sleepiness while driving. This (sleepiness while driving) is actually common to everyone, because of the effects of fatigue after a busy activity and the responsibility to keep going home. However, this is not supported by the motorist's awareness of not continuing the journey and resting for a while until the physical condition returns to normal. The security forces also did not stay silent, as we know there are many notices not to drive when sleepy had been seen on the streets. However, in fact it has not been able to reduce the number of accidents.

There have been many previous studies on detection of drowsiness and accidents on drivers driving with different methods and monitoring, Real Time Monitoring for Drowsiness Detection using EEG System [1], Driver Drowsiness Detection With Automated Braking and

Crash Alert [2], Emergency Situation Alarm Motion Systems using Tracking of People Like Elderly Live Alone [3], Car Accident Detection and Notification System Using Smartphones [4]. Research on monitoring drowsiness and emergency conditions has discussed various problems that occur, but not much is discussed about real time monitoring.

The purpose of this study was to design drowsiness and emergency detection systems in motorists by using real time monitoring and heart rate sensors. In order to eliminate drowsiness that attacks suddenly due to fatigue in order to regain consciousness and make sure the drowsiness will be disappeared by itself, which can be used by all car drivers when driving and can send the location of the driver if an emergency occurs or the driver has an accident, so it will create a safe atmosphere.

2. Research Method

Drowsiness is a tendency to fall asleep. Drowsiness may decrease human performance, such as reduced reaction rate, decreased alertness, and decreased ability to process information. Therefore, drowsiness while driving is classified as a dangerous action [5]. A pulse is a condition that occurs when the heart pumps blood throughout the body. The pulse can be measured behind the knee, groin, neck, and wrist. Measuring pulse provides important information about health [6].

Heart rate usually refers to the amount of time required by heart rate per unit time, generally represented as bpm (beats per minute). Optimal heart rate for each individual vary depending on when the heart rate is measured (at rest or after exercise). The variation in the heart rate corresponds to the amount of oxygen needed by the body at that time [7]. Heart rate speed is the amount in the form of heart rate and has units of beats per minute (bpm). The quantity with the unit of bpm states the number of heartbeat per minute. Normal human heart rate is 60-100 bpm. [8]

Real time monitoring system is used as a medium to directly know the conditions that occur on the rider and if there is an emergency condition then the system will give the coordinates point to the receiver coordinates. The method performed in this first study of the Literature Study was done before designing and building telemetry systems for monitoring the location of the coordinator of the rider. Collection of papers, topic deepening, and analysis of website-based applications, as well as any references related to real time monitoring of emergency situations, in this case using a GPS module that can sustain in design. Second, Creation of Prototype; Make a prototype for monitoring during emergency conditions and detection of drowsiness through GSM accurately and real-time. Third, Application Testing; The test is done by using the detection tool that beat pulse in comparison with the system that has been made and check the real time condition of monitoring.

The design of block diagram of real time monitoring of drowsiness and emergency system with XD-58C sensor can be seen in figure 1.

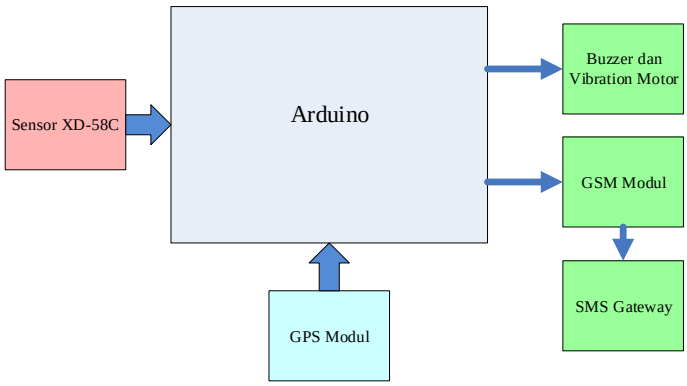

Figure 1. Block Diagram of System Design

1. The initial process of this system is the process of measuring the heartbeat, whether normal, in a drowsy or an emergency condition.
2. The entire performance of the system is controlled by an Arduino Uno microcontroller that works in accordance with the command set through the software.

3. If the sensor reads the drowsy condition, the output of the buzzer and vibration motor will be active.
4. However if the sensor reads the emergency condition, the GPS module will send the coordinate point to the hospital or police station via SMS via GSM module.

Drowsiness flow chart and emergency conditions can be seen in the figure 2:

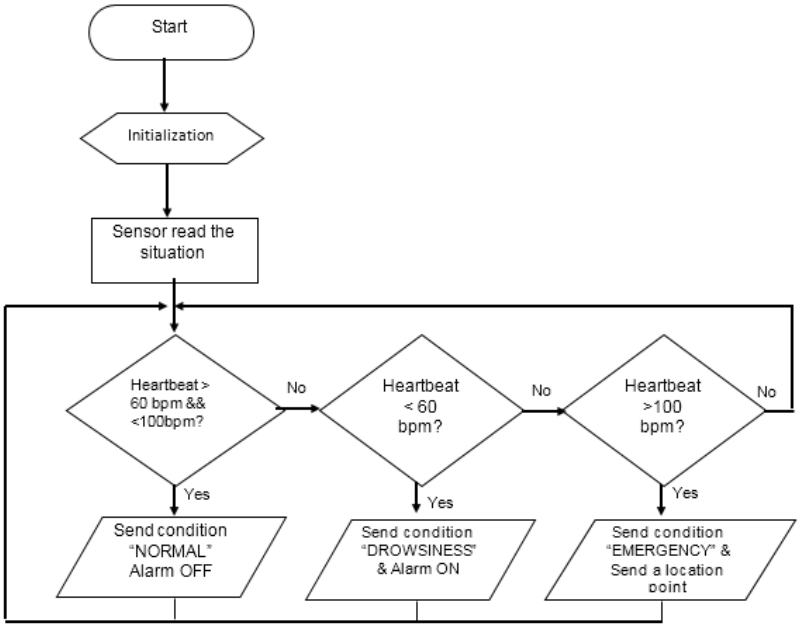

Figure 2. Flow Chart of Drowsiness and Emergency Detection System

Based on Figure 2 the system flow diagram above, it can be seen that the sensor works by reading the state of the heartbeat on the rider. At heart rate> 60bpm && <100bpm, the sensor module will send SAFE data to Arduino Nano. When the heart rate <60bpm, then the sensor module will send the data LOAD to Arduino Nano and Alarm ON. When the heart rate is> 100bpm, the heartbeat sensor module sends EMERGENCY data and the GPS module sends the location point to the Arduino Nano. All data transmissions that occur between the GPS module and Arduino Nano are via wireless communication via SMS via GSM SIM800L module to riders' families, hospitals and police stations.

3. Results and Analysis

The implementation of this drowsiness and emergency detection system is to determine the condition of the driver during an emergency and directly connected to the hospital and the police station. The result of this process is the heart rate bpm value on the rider.

3.1. XD-58C Sensor Testing

XD-58C sensor testing to measure the level of the sensor's accuracy. How to perform this test by comparing the reading results of the XD-58C sensor with the reading from android smartphone via instant heart rate application.

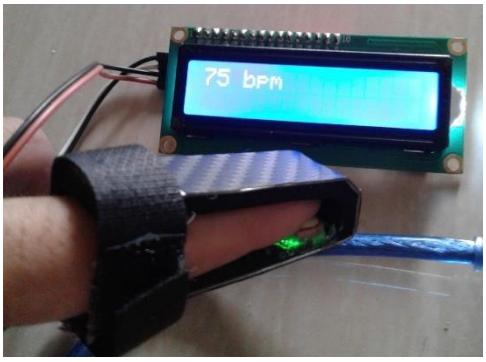

Figure 3. Heart Rate Measurement Using XD-58C

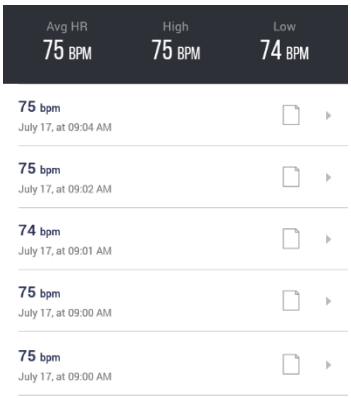

Figure 4. Result Using Instant Heart Rate Aplication

Measuring the heart rate using XD-58C sensor is by putting the fingertips on the sensor, whereas if using the application of instant heart rate, fingertips are placed on the smartphone camera when the flash camera is on.

Table 1. Sensor XD-58C Test Result

Measurement XD-58C	Measurement Heart Rate	Error
75 bpm	75 bpm	0%
75 bpm	75 bpm	0%
74 bpm	74bpm	0%
74 bpm	75 bpm	1,33%
74 bpm	75 bpm	1,33%
Average Error		0,53%

The error value is obtained from the following formula:

$$error = \frac{sensor\ measurement - Instant\ Heart\ Rate\ Measurement}{\text{Instant Heart Rate Measurement}} x100\%$$

Based on the above test results it can be seen that the average value of error on the measurement of XD-58C sensor is 0.53%.

3.2. GSM Module Testing

Testing on GSM module is done on 3 SMS recipients. How to perform this test is the SMS sends program uploaded on Arduino Nano which is connected with GSM module, when the program has been completed, the SMS will be sent to the three recipients. the results of the experiment can be seen from the time SMS received on the three recipients.

Table 2. Result GSM SIM00L *Module*

SMS Sending Time	Time received Recipient -1	Time received Recipient - 2	Time received Recipient - 3
20.10	20.10	20.11	20.12
15.04	15.04	15.05	15.06
15.11	15.11	15.12	1513
04.56	04.56	04.57	04.58
05.23	05.23	05.24	05.25

From the GSM SIM800L module result, the following receiver received the following message: the first recipient of the SMS received on the 20th second, the second receiver 1 minute after the first recipient receives the SMS, the third receiver receives the SMS 1 minute after the second recipient.

Testing on GPS Module is done to measure the accuracy of the distance from the read point location obtained from the GPS module readings. The way to do this testing is to copy the link point location that has been read by GPS module like picture 4.4 to the browser, it will show the distance between the original location point with the location point read by GPS module.

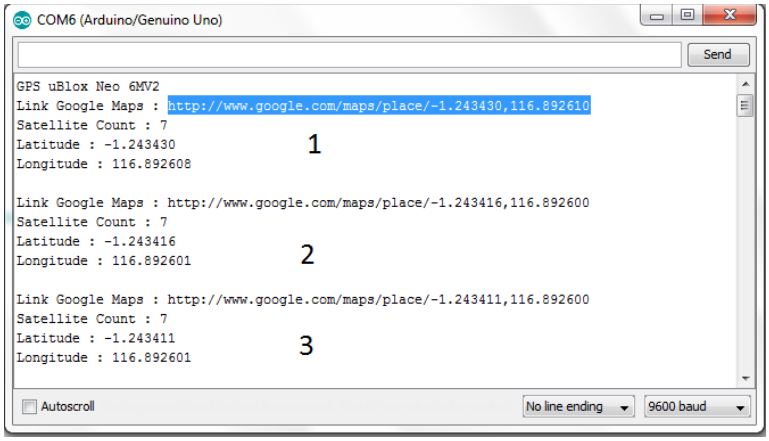

Figure 5. Location point using GPS Module

Figure 6. Result Location point on Google Maps

This GPS module reads latitude and longitude which will be added to google maps web address on the program so that when clicked directly leads to google maps and displays the location point that has been read by GPS module.

Table 3. Test Result GPS module

Test	Location Point is legible	Distance of Reading Reference	Distance of Reading The Test	Difference Distance
1	http://www.google.com/maps/place/-1.243430,116.892610	9 m	7,52 m	1,48 m
2	http://www.google.com/maps/place/-1.243416,116.892600	9 m	9,35 m	0,35 m
3	http://www.google.com/maps/place/-1.243411,116.892600	9 m	9,54 m	0,54 m
	Average		0,79 m	

From the results of GPS testing module above the difference in the distance of the test reading with reference distance reading has an average value of 0.79 meters.

3.2. Overall Testing

Overall testing is done to find out whether the system that has been made works according to the plan or not. This test includes XD-58C sensor, GSM module, GPS module, LCD, and other components. This test is done by looking at the display on the LCD and the output that occurs when the sensor reads the condition of the fingertips.

Figure 7. Test System

Table 4. Test Result

XD-58C Reading	DisplayLCD	Buzzer and Vibration Motor Conditions	GSM SIM800L Sending SMS to Receiver			GPS Module Sends Location
			1	2	3	
75 bpm	75 bpm Normal	OFF	X	X	X	X
86 bpm	86 bpm Normal	OFF	X	X	X	X
45 bpm	45 bpm Drowsiness	ON	X	X	X	X
52 bpm	52 bpm Drowsiness	ON	X	X	X	X
113 bpm	113 bpm Emergency	OFF	√	√	√	√
105 bpm	105	OFF	√	√	√	√

92 bpm	Emergency 92 bpm Normal	OFF	X	X	X	X
82 bpm	82 bpm Normal	OFF	X	X	X	X

When the sensor is placed at the fingertips, the GPS module and GSM module have received signal, so the tool will work according to the state read by XD-58C sensor if the condition is read <60 bpm then output (buzzer and vibration motor) is active (ON) but not send SMS to the 3 recipients (family, hospital and police station), if condition is read 60 bpm s / d 100 then output is off (OFF) and not send SMS, if the condition is read > 100 bpm then output is off (OFF) and it will send SMS.

4. Conclusion

From the test results, it was found that a person is in drowsiness if the pulse is below 60 Bpm. If the human pulse is less than 60 Bpm, the system will issue an alarm in the form of Buzzer. Moreover, if the pulse is less than 60 and the head is skewed, the system will emit an alarm sound and release a vibration from Vibration. Testing on the sensor value XD-58C, there is an error of 0.53%. this error value is quite small and still in tolerance. When testing the value on the GPS module, there is a difference of distance of 0.79 meters from the distance of the test reading with the reference distance reading. On GSM module has difference between receiver 1 about 20 second, while at second recipient that is 1 minute after first recipient receive SMS and third recipient receive SMS after 1 second recipient receive SMS.

References

[1] D Mahalingam, P Rajkumar. Real Time Monitoring for Drowsiness Detection Using EEG System. S*SRG International Journal of Electronics and Communication Engineering (SSRG-IJECE). 2015;* 2(5): 42.
[2] Reddirajula P, Susmith B. Driver Drowsiness Detection With Automated Breaking And Crash Alert. *ARPN Journal of Engineering and Applied Sciences.* 2018; 13(1)
[3] Kim Jong-Tak, Soh Jae-Yong. Emergency Situation Alarm System Motion using Tracking of People Like Elderly Live Alone. IEEE. 2013
[4] Ali Hamid, Zainab. Car Accident Detection and Notification System Using Smartphone. *IJCSMC-International Journal of Computer Science and Mobile Computing*. 2015; 4(4): 620-635
[5] A.A Simandjuntak A, B. N. Moch, "Pengukuran Kelelahan Aktivitas Mengemudi Mobil Dengan Pendekatan Fisiologis, Kognitif, dan Subjektif," 2014.
[6] Angga, Bayu. 2015. Perancangan Sistem Pendeteksi Denyut Nadi Menggunakan Metode *Eulerian Motion Magnification.* Bandung: Universitas Telkom.
[7] Gunawan, Hanapi. 2011. Alat Untuk Memperagakan Irama Denyut Jantung Sebagai Bunyi dan Pengukur Kecepatan Denyut Jantung Melalui Elektroda pada Telapak Tangan. Bandung: Universitas Kristen Maranatha.
[8] Toban Ray, Finandhita A. Pembangunan Aplikasi Pendeteksi Kantuk Berbasis Android. *Jurnal Ilmiah Komputer dan Informatika (KOMPUTA)*
[9] Hidayat, A. A. A & Uliyah, M. Kebutuhan Dasar Manusia. Jakarta: EGC. 2012.