DEVELOPMENT OF SAFETY RIDE APPLICATIONS USING SMARTBAND AND ACCELEROMETER ON ANDROID

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ABSTRACT

Safety Ride Application Development Using Smartband and Accelerometer on Android is a research aimed at motorists and aims to sensitize motorists who were drowsy also to transmit information to the families of the accident the rider when an accident is detected. The method used is quantitative research and development. The collection of user needs using observation and interviews. Currently there Smartband technology that can track every user activity. As shown in Smartband Xiaomi Mi Band 3. This Smartband can track user activity such as heart rate, footsteps, the quality of sleep and the number of calories burned and this study utilized to obtain the data its heart rate to detect drowsiness riders. Besides these applications require Accelerometer sensor used to detect if an accident to the rider who will be sent information about the location and the time of the accident via SMS to his family. After testing the method of black box and do the questionnaire, the conclusion obtained is need for applications that can awaken the rider when riding alone and can provide information about the accident to the family. Besides these applications require Accelerometer sensor used to detect if an accident to the rider who will be sent information about the location and the time of the accident via SMS to his family. After testing the method of black box and do the questionnaire, the conclusion obtained is need for applications that can awaken the rider when riding alone and can provide information about the accident to the family. Besides these applications require Accelerometer sensor used to detect if an accident to the rider who will be sent information about the location and the time of the accident via SMS to his family. After testing the method of black box and do the questionnaire, the conclusion obtained is need for applications that can awaken the rider when riding alone and can provide information about the accident to the family.

Keywords: Safety, Ride, Smartband, Accelerometer, SMS.

1. INTRODUCTION

1.1 Background

Every day a lot of motorists passing by on the highway. Due based on data from BPS (Central Bureau of Statistics) recorded until 2017, there were 138 556 699 units of motor vehicles in Indonesia. It does not cover any possible accidents when traffic [1].

Based on data released by the NTSC (National Transportation Safety Committee) from 2010 to 2016 there has been 41 investigations of accidents that killed at least 443 people. One of the causes of accidents are from rider error. Amounting to 69.7% of motor vehicle accidents caused by rider drowsiness [1].

Drowsiness while riding can occur due to several factors such as travel that far, less fit body condition, or because it was late. Besides being able to do harm to themselves Drowse while riding also can-do harm to other motorists. While riding alone no one can help resuscitate the rider [2].

Accidents can occur not only because of the human factor but also because of the road or the vehicle. Handling accidents can also be performed if the rider was still conscious then ask for help or there are the families who know the time of the accident. There is a late accident cases handled because neither party knows the family [3].

The development of technology on smartphones today have a variety of sensors and innovative applications created to help users to make or monitor a case. Like accelerometer sensor found on smartphones. The accelerometer sensor can be used to detect the slope or change in position of an object [4].

In addition there smartband present technology can track every user activity. As shown in smartband Xiaomi Mi Band 3. This Smartband can track user activity such as heart rate, footsteps, sleep quality, and number of calories burned [5].

There are several studies that have been done to support this research, the research done by Ray and Alif [6] which discusses the wearable device technology used to detect drowsiness on employee travel that is used to obtain the data drowsiness and location of the break. Later studies conducted by Eko

and Hadi [7] which discusses the smartphone remote control using SMS. And research conducted by Fandi and Angga [8] which discusses the accident detection using an accelerometer sensor which is attached to the car using the IOT technologies which then sends the location and time of the accident. Also research conducted by Othniel, Dawn and Rizky [9] which discusses detect bumps or damaged roads using the accelerometer sensor contained in a smartphone which is then sent to the server location.

Based on the problems described above, by utilizing smartband to take the rider's heartbeat and the data sent to the smartphone for the calculated average heartbeat if otherwise Drowse then smartband smartphone vibrates and sounds an alarm. Also in case of an accident while riding is detected using an accelerometer sensor in the smartphone location data and the time when the accident occurred is sent to the family.

It is expected that by utilizing existing technology in smartband and the smartphone can help awaken a Drowse rider or can provide information to the family in case of an accident.

1.2 Purpose and objectives

Based on the problems studied, the purpose of writing this proposal is to establish a Safety Ride Applications Using Smartband And Accelerometer On Android.

Objectives to be achieved in the design of the Safety Ride Applications Using Smartband and Accelerometer On Android are:

1. Can help sensitize motorists who were drowsy while riding alone.
2. Can provide information to the family when the accident occurred.

1.3 Research methodology

The research methodology used in this research is quantitative research methods. The implementation is organized in several stages, namely:

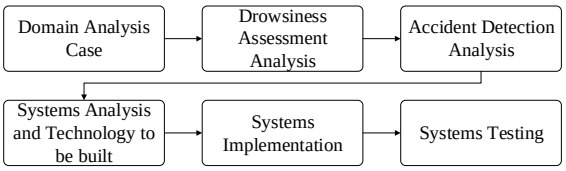

Figure 1. Stages Research

The following is an explanation of the stages of research by drawing on research methodology groove to be performed:

1. **Domain Analysis Case**

At this stage, an analysis of the case in the form of analysis of common problems an accident while riding.

2. **Sleepiness Assessment Analysis**

At this stage, an analysis of the data obtained from the heartbeat Smartband which will be calculated based on data from previous studies to determine if someone is Drowse or not.

3. **Accident Detection Analysis**

At this stage, an analysis of the data value of the slope of the Smartphone that will be calculated based on the data values from previous studies to determine the position of the motor falls to the left or to the right.

4. **Systems Analysis and Technology to be built**

At this stage will perform analysis of what kind of system to be built based on the problems that have been identified and the data previously obtained facts. Also analyzes the technologies that will be used by the analysis system to be built before the one in which these technologies will be used:

a. Smartband
   This technology is used to get the heart rate value that will be used to detect drowsiness.
b. accelerometer
   This technology is used to get the value of the slope of the Smartphone that will be used to detect a crash.
c. Google Maps API
   This technology is used to get the latitude and longitude values that will be used to determine the current location of the accident is detected.
d. SMS Gateway
   This technology is used to provide information to a predetermined destination number that is sent when detected accidents.

5. **System implementation**

At this stage of the application development along with the implementation of technology that have been previously analyzed. Start of implementation of Smartband sleepiness assessment, implementation of crash detection accelerometer, linking implementation Smartband and also the implementation of SMS Gateway.

6. **testing Systems**

The results of these implementations will be tested at the testing stage system testing using alpha and beta testing. In alpha testing, will wear black box testing as a test method. This method will test the functionality of the overall system. After the beta test. This test aims to get feedback on how to benefit from applications that have been created. In addition, this testing is to evaluate whether the materials research conducted successfully achieve the purpose of research or not.

2. RESULTS AND DISCUSSION

2.1 System Architecture Analysis

The system will be constructed that road safety applications using smartband and accelerometer sensor on your android smartphone. The system architecture to be built can be seen in Figure 4.

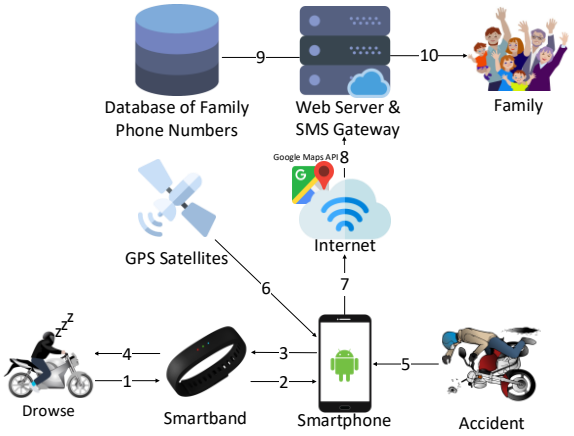

Figure 2. System Architecture

Smartband used to detect the heartbeat and drowsiness detection system when the system will sound an alarm and vibrate to motorists. If an accident occurs the system will detect and take the scene and then sends the location information to the family of the accident or the destination number.

2.2 Problem analysis

Based on the background of the problems previously described, problems experienced by motorists Drowse when riding alone is nothing that can help resuscitate. This can lead to an accident that could harm the rider or other riders.

As well as the accident happened late handled because there is no family party that knows when the family had an accident that can be life-threatening.

2.3 Analysis procedures will be set

The analysis procedure is a description of a system built which will run on road safety applications using smartband and accelerometer sensor on android smartphone, depicted in the form of Business Process Model and Notation (BPMN) as follows:

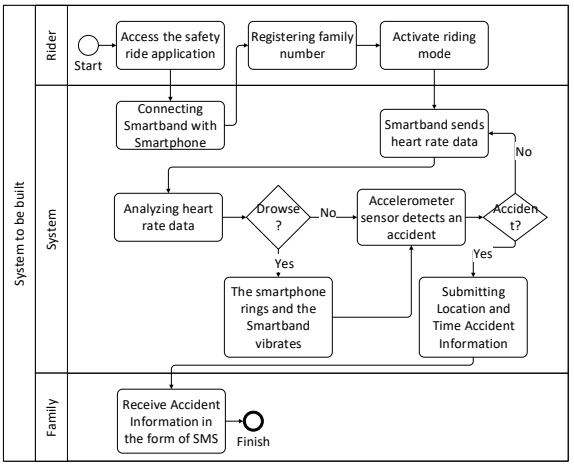

Figure 3. The analysis procedure is Built

2.4 Analysis technology used

Analysis technology is used to determine what technology is needed in the design of safety riding and decompose applications. This application design utilizing smartband to detect heart rate, accelerometer sensor on your smartphone to detect accidents and GPS to determine the location when the accident occurred.

1. Sleepiness Assessment Analysis

Drowsiness detection applications that are built using tools that smartband. Smartband can be used on the left or right wrist that will be used to detect the amount of blood is taken. Mi Band 3 uses a green LED light that is paired with a light-sensitive photodiode to detect the amount of blood flowing through the wrist. When the heart beats, the blood flowing in the wrist will reflect light and its reflections readable by a photodiode, the blood does not reflect light means a higher blood volume. Through the reflection of light, the sensor analyzes the data and calculate the heart rate. By blinking LED light hundreds of times per second, Mi Band 3 can calculate the frequency of the heart beat.

1.a. When Heartbeats Life

The calculation of the average value of each sample heart rate while activity such as walking, learning, and drive.

Table 1. Heartbeats while on the move

samples	On average Heartbeats (BPM)
Samples All 1	85
Sample All 2	91
Samples All 3	82
Samples All 4	80
Samples All 5	88

Of the values calculated in Table 3.2 can be averaged value of heart rate during activity, namely:

The number of heartbeats = 85 + 91 + 82 + 80 + 88 = 426

Divided by the number of calculation = 426/5 = 85.2 => 85 BPM

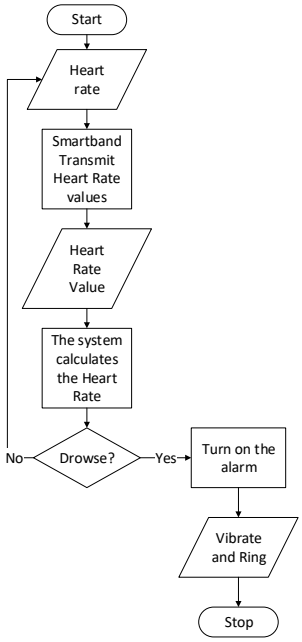

Figure 4. Sleepiness Assessment Workflow

1.b. Case Assessment Sleepiness

A rider named Indra aged 22, is in a fit condition have normal heart rate of 80 BPM. By using the theory of dr. Anggi R. Wahyu Nugroho which is when a person experiences drowsiness heart rate decreases of 10-20% from the current normal circumstances. So to determine the heart rate when drowsy formula:

$$R = N - \frac{20}{100} \text{ x } N$$

Where :
- R = Heartbeat when drowsy
- N = normal heartbeats

If N = 80, then:

$$R = 80 - \frac{20}{100} \text{ x } 80$$
$$R = 80 - 0{,}2 \text{ x } 80$$
$$R = 80 - 16$$
$$R = 64 \text{ BPM}$$

So, when the value of Indra heart rate less than 64 BPM or 64 BPM otherwise Drowse.

2. Accident Detection Analysis

Smartphone today generally already has Accelerometer sensor for various needs such as changing the display from portrait to landscape or vice versa by tilting the body of the phone, this happens because of a change to the coordinates x, y and z a Smartphone. The x-axis is the form a horizontal line, vertical line forming the y-axis and z-axis pointing to the front and rear of the display device. The table below illustrates the value of the accelerometer.

Table 2. Accelerometer Axis

Position	X	Y	Z
Vertical	0	1	0
vertical Reversed	0	-1	0
left landscape	1	0	0
right landscape	-1	0	0
Flat	0	0	1
Flat reversed	0	0	-1

The calculation of the value of the accelerometer will be focused on the x axis, because the value of x to determine the slope of the smartphone which is placed on speedometers overall effect accelerometer to detect an accident.

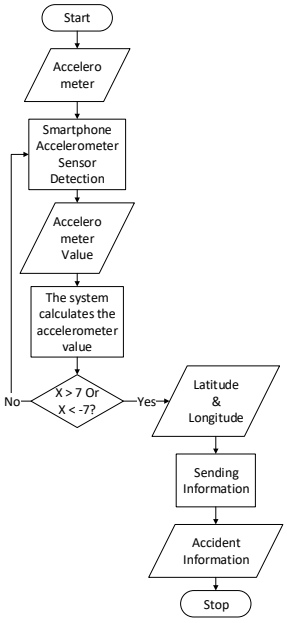

Figure 5. Accident Detection Workflow

2.A Case Detection Accident

A rider named Indra were 22 accidents resulting in motorcycle fell to the right and delivering value on the x-axis accelerometer of -7.56 m / s. With some trials to make sure the motor falling when the x-axis value> 7 m / s or x <-7 m / s. So to determine the occurrence of an accident or not by logic formulas:

$$A = x > 7 \vee x < -7$$

Where :
- A = Boolean when the tilt motor
- x = value on the x-axis Accelerometer

If x = -7.56, then:

$$A = -7{,}56 > 7 \vee -7{,}56 < -7$$
$$A = \text{false} \vee \text{true}$$
$$A = \text{true}$$

So, when A is true then it will be detected accident.

2.5 Functional Needs Analysis

Analysis of functional requirements describe the process of the activities to be implemented in a system and explain the necessary requirements so that the system can run properly as needed.

Analysis conducted modeled by UML (Unfield Modeling Language). The stages of modeling in the analysis of which use case diagrams, activity diagrams, class diagrams and sequence diagrams. The diagram is used as a design plan to simplify the process of designing applications, especially for applications developed using object-oriented programming [10].

2.6 Use Case Diagram

Use Case is a technique used in the development of a software or information systems to capture the functional requirements of the system is concerned, Use Case describes the interactions that occur between the "actors" as the initiator of the interaction of the system itself with the existing system, a Use

Case represented by simple sequence of steps. On road safety application using the Use Case diagram as shown in Figure 5.

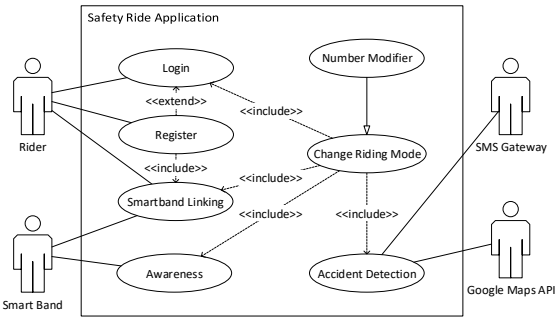

Figure 6. Use Case Diagram Safety Ride Applications

2.7 Use Case Scenarios

Use Case Scenario is a flow of events for the main use case to illustrate the sequence of interactions with the actors use case starts from the beginning of the actors interact to complete. Here is a use case scenario that formed in the Safety Ride applications:

1. Name Use Case: Connecting Smartband
   Scenario: Connecting Smartband
   Description: Used when the riders will connect Smartband with Smartphone.

Table 3. Use Case Scenarios Connecting Smartband

Use Case Name	**The connecting Smartband**	
Goal In Context	Riders select and connect Smartband be used	
preconditions	The rider has not chosen Smartband	
Successful End Condition	The rider managed to connect Smartband	
Failed End Condition	Rider fails to connect Smartband	
primary Actors	Rider	
Secondary Actors	Smartband	
Trigger	Applications are on the page linkage Smartband	
Main Flow	Step	Action
	1	Riders choose Smartband available
	2	The system connects the selected Smartband
	3	Showing notifications successfully connect
	4	The system displays the login page
Extensions	Step	branching Action
	3.1	Showing notifications failed to connect

2.8 Class Diagram

Class diagrams are used to describe the structure in terms of defining the classes are connected.

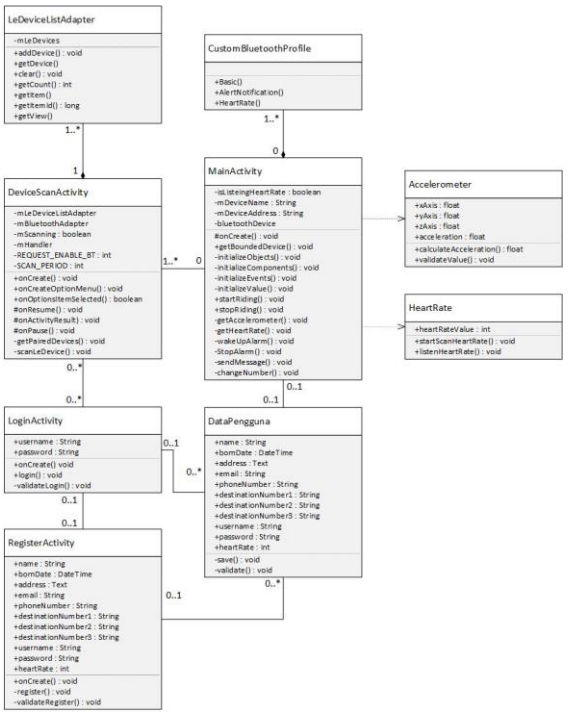

Figure 7. Safety Ride Applications Class Diagram

2.9 sequence Diagram

Sequence diagrams are used to describe the behavior of a scenario. Diagram of this type provide clarity a number of objects and the messages placed on them in a use case. Here Sequence Diagram contained on Safety Ride application design:

1. Sequence Diagram Connecting Smartband
   Sequence Diagram Smartband linkage is used when the riders will connect smartband smartphones. Sequence Diagram Smartband linkage can be seen in Fig.

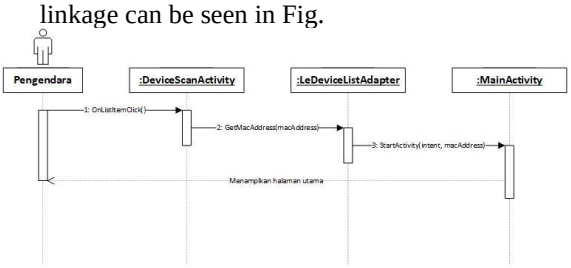

Figure 8. Sequence Diagram Connecting Smartband

2.10 System planning

2.10.1 Menu Structure Design

Architectural design menu provides an overview of the structure of the program menu or a blueprint of software built. The purpose of this design is to build a modular program structure and describes the relationship between the control of program modules. Here is an overview of the architectural design of the menu.

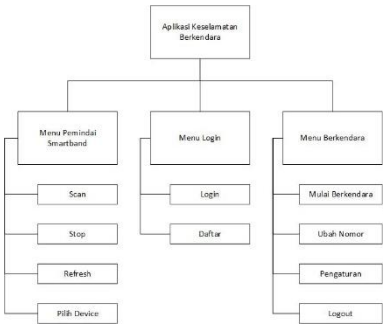

Figure 9. Menu Structure Design

2.10.2 designing Interfaces

Interface design application is intended to describe the function - a function that will be built on the application.

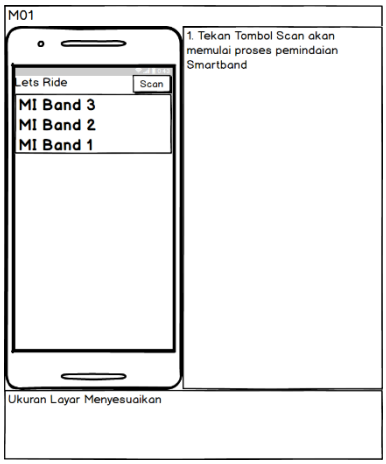

Figure 10. The connecting interface Smartband

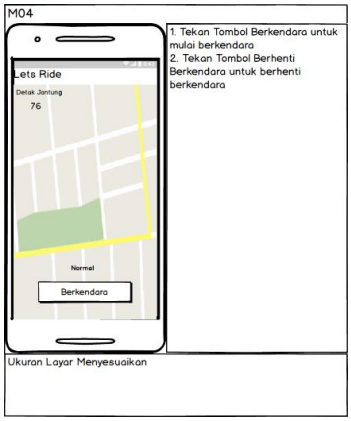

Figure 11. Riding Display Interface

3. END

The conclusions and recommendations obtained from the results of this study are:

3.1 Conclusion

Based on the results of the design is made, then the Safety Ride application design using Smartband and Accelerometer sensor on your Android Smartphone is in conformity with what is expected to further testing.

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