

# Integrated Speed Limiter and Fatigue Analyzer System

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**Abstract.** The traffic accident increase in line with the growth of the vehicle, so the safety system must be developed to decrease the accident. This paper will purpose the integrated between speed limiter and fatigue analyser to improve the safety for vehicle, and also to analyse if there is an accident. The device and the software or application are developed and then integrated into one system. The testing held to prove the integrated between device and the application, and it show the system can work well. The next improvement for this system can be developing the server to collect data from internet, so the driver and the vehicle owner can monitor the system by internet.

## 1. Introduction

The traffic accident in Indonesia based on the report of Indonesia Police Department close to 31.234 fatalities cause by traffic accident. The average annual vehicle growth from 1996 to 2006 of 20%, the data is shown in Table 1.

**Table 1.** Number of Vehicle growth in Indonesia [1]

Year	Total registered vehicle	Annual growth of total vehicle (%)
1996	14530095	
1997	16821076	16
1998	17644885	5
1999	18224149	3
2000	18975344	4
2001	21201272	12
2002	24671330	16
2003	32774929	33
2004	41986814	23
2005	47654826	13
2006	50102492	5

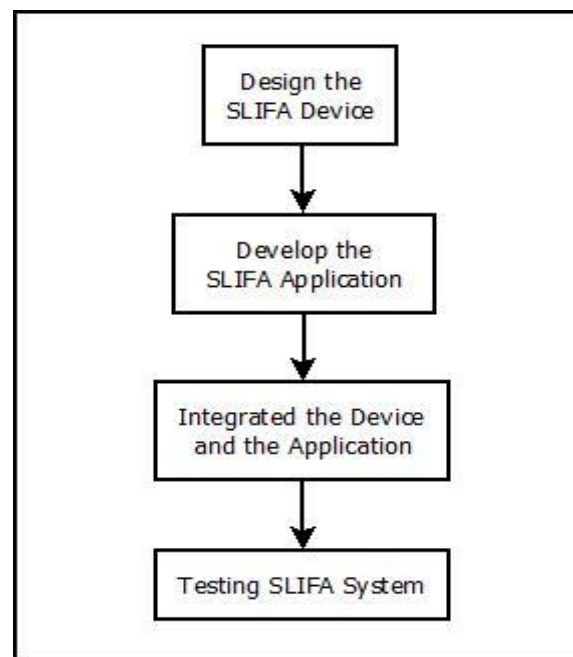


This vehicle growth in Table 1 will also increase the percentage of traffic accident. The accident can be caused by many problems, such as fatigue, engine problems, over speed attitude and external cause [2]. From [3], the development of speed limiter has been developed, and tested in bus. The results show that the speed limiter can increase the safety for driver in bus and also in tank truck [4]. A proposed product titled on "Proposed simple electro-mechanical automotive speed control system" is a speed limiter which integrated RFD (Radio Frequency Decoder), the working principle of the proposals of this tool is RFD as a switch module speed limiter installed in the sign board on the highway that each vehicle must reduce the speed, RFD is connected to the engine cut-off system on the machine [8]. Then several patents related to the tools to prevent the fatigue of drivers among others, as in Volvo vehicles, podusen Automotive is developing a system called driver alert control, which can alert a driver drowsiness before he or she dozes of at the wheel [9]. Similar systems can also be found in other vehicles, such as the Driver Monitoring System in Toyota [10] and the Attention Assist System in the Mercedes-Benz [11]. To decimate accident rate that causes the driver fatigue factor, there has been increasing interest in the development Fatigue Warning System (FWSs) over the last two decades [12].

To improve the safety system, we propose a system by integrating the speed limiter and the fatigue analyser. The system will detect the limit speed from the vehicle and also the fatigue from driver.

## 2. Methodology

To achieve the purpose of this research, we propose a methodology in Figure 1, and the methodology consists of the steps how we develop the system.

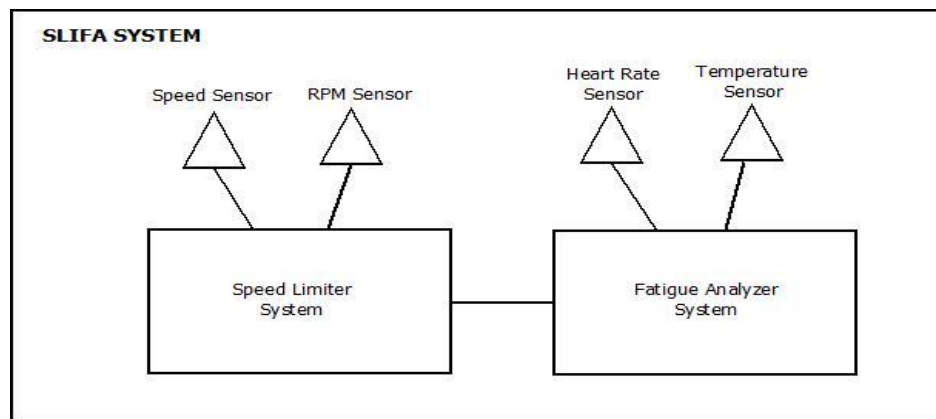


**Figure. 1.** The Proposed Methodology

In the first step of methodology, we design the devices for SLIFA. In this step, the speed limiter system [1] will be collaborated with the fatigue analyser system. After designing the SLIFA system, the next step is development of the SLIFA Application. This step needs the concept of SCADA and the software engineering. The next step is integrating the device and the application into one system. The final step is Testing the SLIFA System in a test bed environment. We will describe all of the step more clearly in the subsection below.

### 3. Design The SLIFA Device

The SLIFA device compose from the speed limiter system, and the fatigue analyser system. The SLIFA device will be bundle into one board, so the implementation of the SLIFA system will give a convenience to the user. The architecture of SLIFA system will be describe in Figure 2.



**Figure. 2.** Architecture of SLIFA System

Based on [1], the speed limiter that has been developed will read the speed of the vehicle and also improved with the engine rotation (RPM). These two data will be used as parameters from the speed limiter device. The speed limiter consists of sensor to read these two data from the vehicle, and save the data to the storage devices.

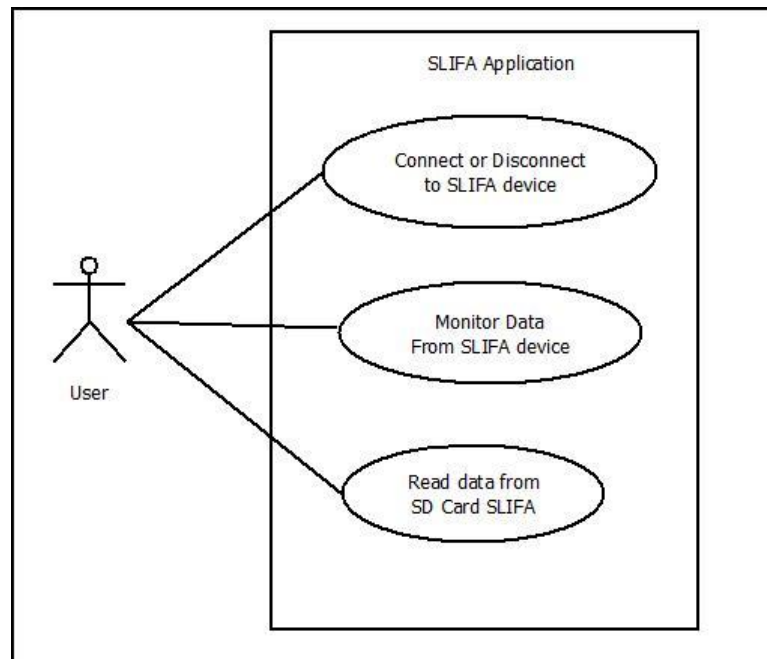
The fatigue analyser system will be equipped with two sensor, the first sensor is temperature sensor, and the second sensor is heart rate sensor. The temperature sensor will sense the temperature from the driver, meanwhile the heart rate sensor will take the heart rate value from the driver.

The main device for SLIFA system is an Arduino UNO, and some the sensors need by the system. All the sensors connected to Arduino board, and the Arduino manage all of the sensor for getting data are needed by SLIFA system. The sensor will be facing the object to be measured, such as the body temperature of driver, and also the heart rate of driver, the sensor will be implemented closed to the object.

#### 3.1. Develop the SLIFA Application

This subsection will describe the development of SLIFA Application. This application will monitor data from SLIFA device and show them graphically. Also this application can read the data saved in SD Card SLIFA, the purpose to read captured data from SD Card is to analyse if there is an accident happened to the driver and the vehicle. The data could show the condition from driver when the accident happened, whether the driver in a good condition or in a tired condition.

To develop the SLIFA application, the first step is analyse the need of the software. The SLIFA application was not need much requirement, because the software only real time monitoring from the SLIFA device, especially monitoring data from the sensors. Figure 3 will show the use case diagram for this SLIFA application.



**Figure 3.** Use Case Diagram of SLIFA Application

Basically, from Figure 3, the user only has three features with the application. The first is connected or disconnect with the SLIFA device. This is the important thing must the user done before using the other features in the application, because without connected to the SLIFA device the application couldn't be used well. The second step is monitoring the data from SLIFA device, if the device can be connected with the application. And the last feature is reading data from SD Card SLIFA, and making the report from the data.

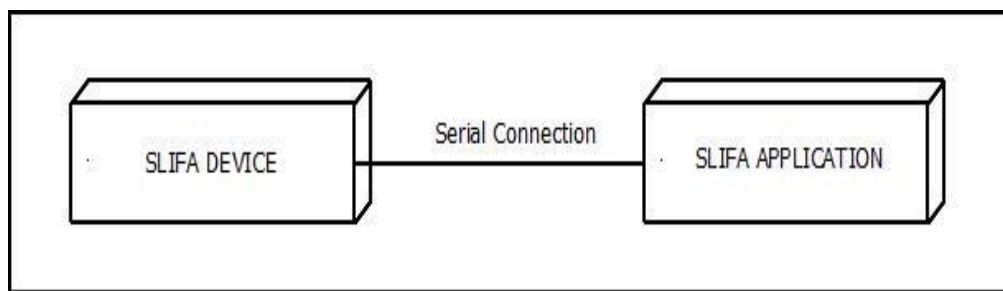
The development of this application uses some software development kit. Below are the requirements to develop the SLIFA application [5].

1. Programming Language. Java Development Kit version 1.7 was used to develop this application.
2. IDE for designing the application use Netbeans 7.0
3. IDE for Arduino use Arduino IDE

One thing we consider when developing this application was the way for connecting between the SLIFA device and this application. The serial connection is one of the way to communicate between Arduino device and the application [6,7]. So, we also adding the serial programming module into this application to handle the connection between both of them.

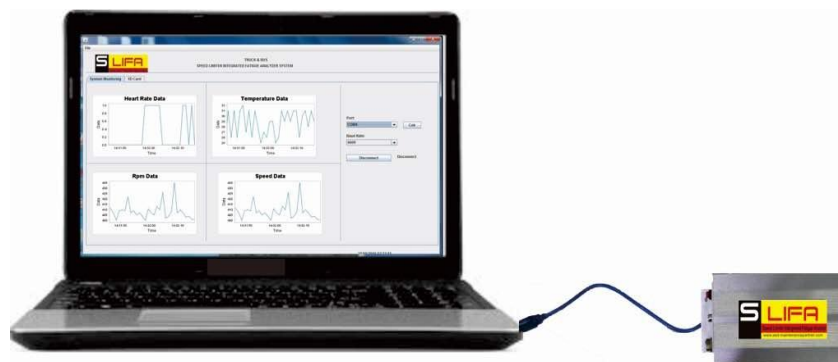
### 3.2. Integrated the Device and The Application

After the SLIFA device and the SLIFA application have already developed, the next step is to integrate both of them into one bundle system. The mechanism to integrate both of them physically using the Universal Serial Bus (USB) cable, and programmatically using serial programming. The SLIFA device connected as client device, while the PC or Computer installed with SLIFA application act as a server. The architecture to integrated these two devices describe in Figure 4.

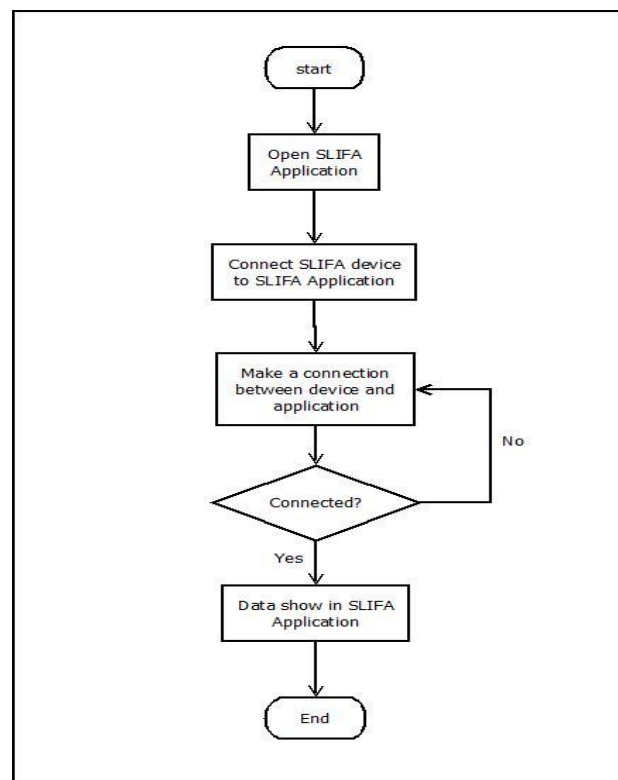


**Figure 4.** Architecture of Integration for SLIFA System [5]

The implementation of integration for SLIFA system is shown in Figure 5. The Notebook installed with SLIFA application and the SLIFA device. And Figure 6 will be shown a flow how to integrate and operate the SLIFA System.



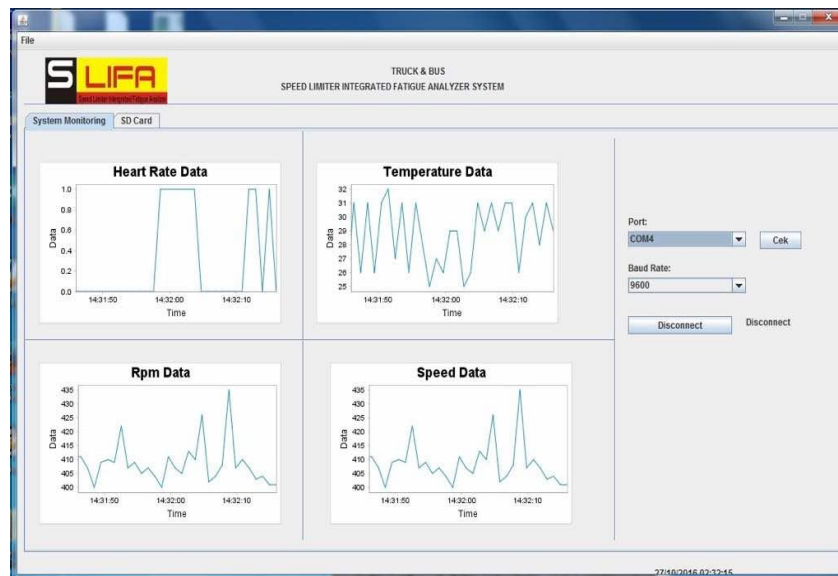
**Figure 5.** Architecture of Integration for SLIFA System



**Figure 6.** Flow of Integration for SLIFA System

#### 4. Testing The SLIFA system

The testing for SLIFA system will be done in a test bed condition for the first time. The sensors will be simulated with some potensio meter, especially for speed and RPM sensor, for the last two sensors we use our body to connect the sensors. The purpose of the testing is for reaching the data into the SLIFA application, because it show the good integration between SLIFA device and SLIFA application. Figure 7 show SLIFA application visualize the sensor data in dynamic chart.



**Figure 7.** Testing Data from SLIFA System

#### 5. Conclusion

Integrating SLIFA device and SLIFA Application has done the development of Integrated Speed Limiter and Fatigue Analyzer System. The Speed Limiter device develops from [1], and improves with Fatigue Analyzer in this paper. This paper describes the development of entire SLIFA system, and testing the SLIFA device with the SLIFA application. The testing shows that the device and the application can be integrated well. For the improvement of this research, it can be develop a server that can collect the data from the SLIFA system. So the owners of vehicle can monitor the vehicle and also the driver by cloud.

#### 6. References

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