SAM (Smart Assisted Motor) Maintenance Alarm of Motorcycle Based Android

Hadi Fauzan H.*, Ari Prahastomo R., Yumna Novikhati A., Moechammad Sarosa
Electrical Engineering Department, State Polytechnic of Malang, Malang, Indonesia

*hadifauzanhanif@gmail.com

Abstract: Increased owners of vehicles, especially motorcycles are also directly proportional to the increasing needs for maintenance. However, users of motorcycles are not so concerned about the damage to spare parts if not done regular maintenance of the motorcycle. The owners are often ignorant of maintenance on the basis of how far within kilometers has been used. This is because there are no reminders or indicators that provide information that the motorcycles has entered maintenance time. One way to overcome this, we designed a system of intelligent maintenance of periodic maintenance on a motorcycle based on the distance of mobile android based. This system brings the arduino module to read the rotary encoder sensor as the distance counter. The data obtained will be sent using GSM module to the server for further processed as a reference in providing a notification to the owner. Based on GPS, SAM also has information about the existence of the nearest workshop and queue information on the workshop. Applications built have functioned by the planning, can provide a warning when the distance has reached. Also, with the web, the application has also been able to show the location of the nearest workshop and queue conditions in the workshop.

1. Introduction
The increasing demand for transportation is directly proportional to the number of motor vehicles operating on the highway. Motor vehicles are vehicles that are driven by mechanical equipment in the form of machines other than vehicles running on the tracks [1]. According to its type, motor vehicles include passenger cars, buses, freight cars, special vehicles, public transport, and motorcycles. Motorcycles as one type of motor vehicles in 2016 reached 105,150,082 units or 81.33% of the total of 129,281,079 units with an average increase in the number of motorcycles during the last 64 years which total 1,668,976 units per year [2].

The increasing number of motor vehicle owners, especially motorcycles is directly proportional to the increasing need for maintenance services. Vehicle maintenance consists of two types, namely planned maintenance or periodic maintenance and unplanned maintenance or repair in case of damage at any time [3]. Each motorcycle generally contains the main data and characteristics of the engine used. The data is found in the owner's manual or the repair manual [4]. However, some motorcycle users are unaware of the contents of the manual so that motorcycle owners often forget the time periodic service, because it triggers spare parts damage to their vehicles if no regular maintenance is done. Though it is an important factor in the comfort and safety of motorcycle owners and to get the best performance for the motorcycle. Motorcycle owners are often ignorant of periodic maintenance on mileage basis or vehicle usage duration. This is because there are no reminders or indicators that provide information that the vehicle has entered maintenance time and the owner does not know how much to prepare when
going to the workshop. Generally the information about the next service using stickers affixed at the bottom of the seat. This method is less effective in reminding the next service to vehicle owners.

One of the solutions to overcome that problem is to make a smart system to remind them to do periodic maintenance to their motorcycle based on the vehicle mileage android-based mobile. The system is working based on the owner's manual book provided by the manufacturer to predict when to service, the diagnostic and cost estimates for the maintenance of the motorcycle. This allows motorcycle users not to forget when the best maintenance time their vehicle needs and can prepare cost predictions before serving. It is based on the microcontroller embedded in the motorcycle to read the distance on the proximity sensor and process the distance data to be sent through GPRS to the database server. However, in android mobile, SAM application can display a notification if mileage of the motorcycle is approaching maintenance time. Moreover, in the workshop side, the application can provide queue information through the website. In addition, Smart Assisted Motor is very beneficial to the users of motorcycles in providing information on service time, vehicle conditions, and estimated service costs. Moreover, the benefits for the workshop is that the customer will be on time in performing routine maintenance and speed up work because there is queue information.

2. Related Work
Periodic scheduling service system of motor vehicles has been performed by the researcher, one of the methods used was periodic service scheduling to workshop customers using notification via SMS based gateways website [5]. In this case, customers are reminded of the sms submitted by the website automatically. Reminder on the system based on the last service time of the vehicle at the workshop inputted by the workshop.

Research [6] designed an oil change reminder on a motorcycle based on arduino-based vehicle mileage as a distance reader in prototype form. With GSM arduino module help, notification for oil change is sent using SMS. The distance reading prototype of the system uses an arduino that manages data from rotary encoder sensors with a 400 m distance rule and multiples as an indicator of data transmission.

In the application of data transmission system using GSM module, it allows arduino send data, voice, and SMS with low power usage. In case of real time monitoring, sending data via SMS is considered less efficient, then used SIM 900 via GPRS in sending data sensor processed arduino [7]. By using GPRS, data can be sent to the main system of the webserver and stored in a database.

3. Proposed System
This study refers to a previously proposed study [5][6][7]. The scheme used in this article is divided into four parts, first designing the arduino system to read the distance of the motorcycle and sending the distance data via GPRS using GSM Module SIM800L; second, making the SAM application system to read the distance and remind the user to do maintenance; three, website designing for the queue workshop information system.

3.1 System Design
System design is divided into three parts, they are; as the android application side, the hardware side of the arduino, and the side of the website connected to one server. The overall system block planning diagram is presented in Figure 1.

3.2 Hardware Designing
The designed hardware consists of arduino to process the rotary encoder sensor data which is converted into distance data. Rotary encoder is an electro-mechanical apparatus that uses an optical sensor that produces a series of pulses which can be converted into a movement, position, or direction with the output of a pulse in which the velocity increases and the frequency also increases. Arduino as the brain of the system will perform the sensor rotary encoder readings to determine the distance and then sent to
the server using GSM SIM800 module. Data that has been stored on the server will be readable by android to be processed so that it can be obtained diagnosis or treatment based on the distance exceeded.

There are two methods of data transmission, namely; 1) wiring: Sending data via wiring system using coaxial cables or fiber optical cables; 2) Wireless: Sending data via channel with bandwidth through carrier such as (Wi-Fi - Wi-Max - GSM - GPS - GPRS - Satellite)[9]. Due to the condition of motorcycles that is moving, sending data on this system using GPRS. The selection of data transmission using GPRS, because the data transmitted is not large which is distance data. So, the selection of data transmission via GPRS is believed to be quite efficient in usability and cost.

![Figure 1. Smart Reminder System Block Diagram](image)

3.3 Application Users
This design is to be applied on Android devices as a smart motorcycle reminder care system. This app has two entities, guest and user. Guest is a user who has not registered yet or has not logged into the app. The facilities that a guest can obtain are information about periodic services based on the distance and the nearest workshop information, while the user entity has the same facilities as the guest plus the distance information, the diagnosis and the prediction of the costs that must be incurred if the motorcycle maintenance is done. The design of the Data Flow Diagram (DFD) application created is shown in Figure 2.
Figure 2. DFD level 0 SAM application

Figure 2 shows DFD on level 0 which is a general depiction of SAM application program. A unique data diagram entered into the information system and the resulting system. The users of the system are user and guest. Users log in and find out the exact distance information of his motorcycle. Users can make subsequent service diagnoses, the nearest workshop information and find out how much the service cost predictions will be cleaned up according to the diagnosis. Users can also input service history to remember what services have been done and can set how many alarms used as service reminders are close. While the nearest workshop information using the location of the workshop with a radius of three kilometers from the point of coordinate users.

While the explanation of how the working distance read the data from android web applied as follows:
1. Application software on mobile android will read the distance data on database server that has been sent by arduino that is in the form of JSON data at www.sambengkel.com/apijarak/jarak_byid?data1=1.
2. If distance is -10 Km = rules {n} then the alarm will light up. The existed Rules are periodic service rule data based on distances in the user manual (Appendix 1). If the distance has not entered the rules then the program will always re-read the database to fill up the rules.

2.4 Workshop Website Design

In Figure 3 the website has two data streams, the first as the user workshop and second as the Admin website. Users of the workshop can only give access to input and delete queues. While the website admin serves to add a new workshop and change the existing workshop data on the workshop website. The data that can be changed include the name of the workshop, workshop address, the location of workshop coordinates, opening day, opening hours, and workshop user login.
4. Discussion Result

Smart Systems of Motorcycle Maintenance Alarm have been tested on Honda Vario 125 motor. Discussion of the test results in this paper is divided into two parts: simulation software, including SAM applications and websites, and hardware simulation, including the test results of distance reading.

4.1 Simulation Software

4.1.1 Distance Data Delivery. For example, the distance data sent is 5990 and it has been sent through url http://sambengkel.com/ dpijarak/jarak_add?data1=1&data2=5990. The value that has been sent can be seen in the url http://sambengkel.com/jarak. The last distance sent is 11990 with ID = 1, the ID is used as identity in the data retrieval by the SAM app on Android so that the application looks for data based on that ID. Sample views of distance reading results, proof of notification and diagnosis results can be displayed by selecting the available menus as shown in Figure 4.

![Image of SAM Main Menu with Distance Viewer, Notification and Diagnostic Results](image)

**Figure 4.** SAM Main Menu with Distance Viewer, Notification and Diagnostic Results

Based on the measurement of the distance that is sent will activate a notification or reminder because the distance has reached 11990 KM or has approached the distance of service time is 12000 KM. While the results of diagnosis made the system can be known by choosing a diagnosis menu that contains what is needed when the service at that distance following the prediction of costs that need to be prepared if there is replacement of parts because it has experienced wear or the other causes.

![Image of Customer queue input on the web](image)

**Figure 5.** Customer queue input on the web
4.1.2 Input Queue Workshop. This workshop web has been uploaded in the address www.sambengkel.com. The simulation done was in the form of input queue data on the web and the queue was only for one customer at AHASS Putra workshop. Web page of sambengkel when displaying the menu to entering the customer’s queue is shown in Figure 5. The display presented by the SAM application is shown in Figure 6, where this app displays the total of queues and queue numbers in the sam workshop. By using SAM application, the user would be able to find out the queue condition of the listed workshops.

![Figure 5. The workshop menu closest to the number of queues](image)

4.2 Hardware Testing and Simulation

4.2.1 Testing of Rotary Encoder. Distance calculation here based on the size of the motorcycle wheels to be tested. In testing this system, the vehicle used was Honda Vario 125 production in 2013 which has a size of 14-inch alloy wheels. So, the calculation of the wheel circumference as follows:

$$\pi = 3.14$$

$$d = 14 \text{ inch} = 35.56 \text{ cm}$$

$$\text{circumference} = 2\pi r \text{ or } \pi d$$

Outing the calculation of wheel circumference = $$\pi d = 3.14 \times 35.56 = 1,117 \text{ m}$$

Based on the circumference diameter of a 14-inch motorcycle wheel of 1.117 meters, it can be assumed in one rotary encoder to be 1.117 meters apart. The tests performed with frequency readings with oscilloscope used four sample speeds of 10km / h, 20 km / h, 30km / h, and 40km / h and converted units in m/s. Before getting the frequency at one-wheel spin, then change the speed to m/s unit and calculate the frequency in 1,117 m / s by comparing each sample, as shown in Table 1.

| Wheel Speed | Output Frequency | One wheel rotation frequency |
|-------------|------------------|-----------------------------|
| 2.77 m/s    | 88.97 Hz         | 35.79 Hz                    |
| 5.55 m/s    | 142 Hz           | 28.58 Hz                    |
| 8.33 m/s    | 217 Hz           | 29.09 Hz                    |
| 11.11 m/s   | 290 Hz           | 29.16 Hz                    |
| The Average |                  | 30.655 Hz                   |

So that the rotary encoder frequency in one wheel rotation is 30,655 Hz.
4.2.2 Distance Simulation. To get the result of a planned hardware simulation, distance simulation was required, comparing the distance measuring system to the SAM with other distance measuring systems. In this test was done by comparing with the Nike Run Club application based on GPS in the distance calculation.

| Distance | Distance on Nike Run Club | Distance on Arduino |
|----------|---------------------------|---------------------|
| 500 meter| 530 meter | 530 meter |
| 1000 meter | 1100 meter | 995.5 meter |
| 1000 meter | 1000 meter | 1076.89 meter |
| total  | 2630 meter | 2572.39 meter |

The first experiment a distance of 500 meters, Nike Run Club and arduino at the same distance of 530 meters. The second spacecraft at a distance of 1000 meters, Nike Run Club has a difference of 4.5 meters greater than the arduino and the third experiment Nike Run Club has a difference of 76.89 was smaller than the arduino. While in the total distance achieved was Nike Run Club of 2630 meters and the arduino read 2572.39 meters with a distance difference of 57.61 meters. With this, arduino also had the same ability with the Nike Run Club in calculating the distance.

5. Conclusion
1. Smart application of motorcycle maintenance reminder had been successfully made by utilizing rotary encoder as wheel rotation counter to determine vehicle mileage.
2. If the distance has been exceeded the application would give warning when the motorcycle maintenance to the owner, the location of the nearest workshop and diagnostic results in the form of replacement parts that need to be replaced so that owners can prepare the necessary costs.
3. The facilities provided in the form of the location of the nearest workshop and queue list will help the owner of the vehicle in providing maintenance time so as to ensure the maintenance schedule was not missed.
4. The result of comparison of Arduino distance measurements with Nike Run Club had a distance difference of 57.61 meters.

6. Acknowledgments
The Authors would like to thank the Directorate of Student Affairs, Directorate General of Learning and Student Affairs for the funding that has been given so that this research can be done in Student Creativity Program (PKM) Year 2018.

References
[1] Peraturan Pemerintah Republik Indonesia Nomor 44 Tahun 1993. *Kendaraan Dan Pengemudi*. Lembaran Negara Republik Indonesia Tahun 1992 Nomor 49. Jakarta.
[2] Badan Pusat Statistik. (2016). Perkembangan Jumlah Kendaraan Bermotor Menurut Jenis, 1949-2016. <https://www.bps.go.id/linkTableDinamis/view/id/1133>
[3] Bintoro 2013 *Pemeliharaan Mesin Kendaraan Ringan*. (Malang: Kementerian Pendidikan & Kebudayaan) p 9
[4] Moch S and Sutiman 2005 *Mesin Sepeda Motor* (Yogyakarta: Insania) p 2
[5] Anggit H 2016 *Perancangan dan Implementasi Sistem Penjadwalan Servis Berkala Kendaraan Bermotor Berbasis Website Menggunakan Notifikasi SMS Gateway* (Salatiga: Universitas Kristen Satya Wacana)
[6] Maulana A R, Saptadi A H and Pujiharsono H 2017 Multi Disiplin Ilmu *Perangkat Peningkat Penggantian Oli Pada Sepeda Motor Via Notifikasi SMS Berbasis Arduino* (Unisbank vol 3)
SENDI_U (Yogyakarta:Universitas Stikubank) p 8-9
[7] Abdul H and Lakmal R 2015 Innovative Systems Design and Engineering *Design of Wireless Sensor Network Using GSM/GPRS for Real Time Monitoring of the Pipe-Born Chlorine in Sri Lankan Water Supply System* 6 75

[9] Rizal B 2011 Thesis *Alat Penunjuk Arah Angin dan Pengukur Kecepatan Angin Berbasis Mikrokontroller At89c51* 007