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# Motorized Vehicle Security System With Master And Slave Key Models

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**Abstract.** Indonesian are carrying out routines both for personal gain, groups can use a variety of transportation in land, sea and air. Kinds of transportation that are available in the middle of the community that is affordable to have, are vehicles both two-wheeled and four-wheeled. The tendency of motorized vehicles to increase due to various factors including more economical compared to other transportation, simplify and speed up the duration of the trip, encourage the economy of the motorcycle taxi online or traditional. In the midst of people enjoying transportation, there are threats made by certain elements who take advantage of the owner's carelessness and of course the security weaknesses of the vehicle. The threat that occurs is motor vehicle thief. Based on data from the Central Statistics Agency for motor vehicle theft in Indonesia in January 2016 was 3,468 cases, February 3,595 cases, March 3,518 cases), meaning that in 2016 for three months as many as 10,581 people were disadvantaged because of the crimes. Di era industrial revolution 4.0 marked the massive implementation of information technology in all fields including transportation. Collaboration of information technology with the field of automation, in this case the workshop can create new innovations in securing motor vehicles so that they are not vulnerable to deception. The innovation is SIKEMO, works based on inputs known by the sensor, if the sensor recognizes the input data, the process can be continued and the motor can be used (starter is on status), and vice versa if the sensor does not recognize the input data, then SIKEMO will reject and of course the vehicle cannot be used ( starter in the off status). The Security System developed at SIKEMO uses data input with two models, namely the master key and the slave key. The master key input data has the highest authority besides being recognized by SIKEMO, the master key can be used to grant access rights to the slave key to be recognized by the SIKEMO security system. To support the work of SIKEMO which is equipped with a master and slave key, some hardware including arduino which is programmed to select whether the input data is known or not. RFID as a sensor media that connects the input data (master and slave key) with Arduino. To integrate the existing hardware and software in SIKEMO, the process uses a prototype software development methodology

## 1. Introduction

The development of transportation in Indonesia is progressing very rapidly in line with the development of the means of transportation itself. At present, transportation, in the form of vehicles, has become a necessity for people throughout the Indonesian archipelago; both of two-wheeled or four-wheeled vehicles (private and public transportation). According to the Central Bureau of Statistics (<https://www.bps.go.id/linkTableDinamis/view/id/1133>), the number of vehicles in Indonesia in 2017 had reached 138,556,669 with the following details: Motorcycle (113,030,793), Passenger Cars (15,493,068), Bus Cars (2,509,258) and Freight Cars (7,523,550). Based on these data, motorcycle vehicles are the most popular transportation tools for the people of Indonesia with a total of the number of vehicles is 138,556,669.

In the middle of the community enjoying the means of transportation owned, there are some threats made by certain elements to get benefits both personally and in groups that can harm the wider community. The loss that means is a loss of personal loss of motorized vehicles that have an impact on the economic value of the community itself. Based on data from the Central Bureau of Statistics for motor vehicle theft in Indonesia on January 2016, there was 3,468 cases, on February 3,595 cases, and on March 3,518 cases); means that in 2016 for three months as many as 10,581 people were harmed because of the crime. According to Imam Saroni (2017, 67-72) the factors causing motor vehicle theft are economic, socio-cultural and environmental factors. The numbers also show that the security or key lack of security

provided by the manufacturer, so that the vehicles are prone and still find weaknesses that are exploited by motor vehicle thieves. In the era of the industrial revolution of 4.0, a variety of new innovations can be a choice solution for the creation of a motor vehicle security system. Collaboration between the automotive service sectors, in this case the workshop with the computer sector is able to produce a new form of computer-based security system innovation.

At present, safety is a major concern in vehicles. Current security offers very little safety for vehicles. The cost of an anti-theft security system is also very expensive so that an effective alternative is needed[1]. From year to year, the increase in the use of transportation equipment, especially private vehicles, has triggered the emergence of several individuals, both individually and in groups, committing criminal acts of motor vehicle theft. This condition is certainly a new problem in the community environment of comfort. The community needs a system as a step to protect motor vehicles that are more efficient and effective. The system created is inseparable from the two devices both hardware and software[2]

With the increasing of crime of motor vehicles theft, it is not surprising that people are interesting to have a modern and sophisticated motorcycle safety system. One of the innovations that is able to anticipate this is SIKEMO, the Motor Vehicle Safety System. SIKEMO works through two functions or models of master key and slave key. However, not all vehicles equipped with SIKEMO can use or start the vehicles because the right access are needed. The owner of the vehicles can use the rights as a master key to give other people the right access as a vehicle user, even with the master key the owner can move access rights that have been given to other users (slave key). The security system is also equipped with monitoring that is stored in the vehicle usage identity database, when the motorbike is started and when the motorbike is turned off. With a master and slave key vehicle security model and monitoring that can be done at any time. SIKEMO can be developed in collaboration with workshops to test and ensure the reliability of the system designed is in accordance with and compatible with the vehicle system. By involving the stakeholder, the workshop is expected to produce a quality vehicle safety system in accordance with community expectation

## **2. Metodology**

### *2.1. Variable Research*

In motor vehicle safety systems, there are several variables that are examined in developing a good security system. The two models used are the Master key and the Slave key. For example, the clock comes from the master as synchronizing a data that gives instructions and slaves as the recipient of information information for translation.

### *2.2. Device Functionality*

Moreover, even all the functions of the device can work well in terms of wireless reaction range and also the reading distance of RFID [3], still, both of them need to be tested. As well as monitoring the use of vehicles and also the ability to provide access rights. The microcontroller device used is Arduino Pro Mini which has a small size, simple and inexpensive but has reliable reliability (figure 1).

Arduino is an electronic open source kit that has a microcontroller chip with AVR type as its main component from the ATMEL company [4]



Figure 1: Arduin Pro Mini

### *2.3. Parameters*

Access rights become the main reference in this study. How does a parameter read, add, delete or reset key.

### *2.4. Architectural Schema Model*

The security system is made to be able to provide good protection for vehicle owners. The workflow is using to store user ID data based on the Master key and Slave key. With Master and Slave keys, key duplication can be done as well as increasing key owner access through their vehicles. Using prototype software methods, the software is ready to be redeveloped is suitable to use prototype as one of the software development methods [5]. Moreover, the stages of the prototype method are:

#### *2.5.1 Communication*

In this case the data collection is based on an analysis of user needs. There is an analysis of data and functional requirements.

1. Analysis of data requirements of user data that requires the user's suitability to start a motorized

vehicle.

2. Analysis of functional requirements is the function that is contained in the application
  - a. The key reading function, which is a function that verifies whether the key is the vehicle owner's key.
  - b. Add key function, which is a function to register the owner's key so that the owner can start the motorized vehicle.
  - c. The key delete function, which is a function to delete a key that you don't want to use again.
  - d. The key reset function, which is a function to reset all user or owner data, is used if the vehicle owner changes hands or wants to delete all keys that have been registered.

### 2.5.2 Prototype Planning

Make a temporary design to be immediately shown to users who will be developed again.

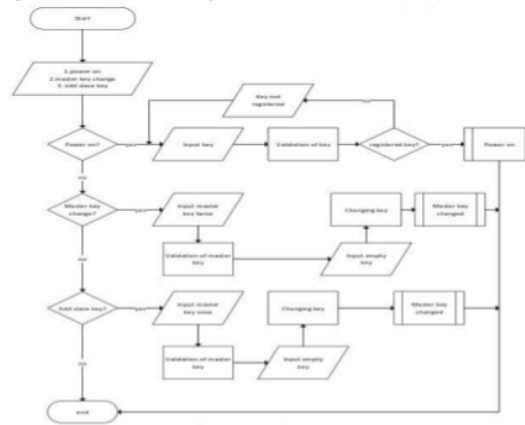


Figure.2. System flowchart Motorized Vehicle Security System

Explanation, In the program flowchart image above it can be explained that there are three processes in this program, namely:

1. Turn on the power  
Power can be turned on by attaching a key that has been registered to the sensor. The key can consist of a master key or a slave or duplicate key. Once the key that is pasted is already registered in the security system, the system will recognize the key and the power will turn on.
2. Changing the Master Key  
A master key is a master key that has the authority to add and delete slave keys or duplicate keys. The trick is to paste the master key on the sensor twice with a pause of about two seconds. Then, paste the surrogate key, then the master key status will move to the surrogate key.
3. Add a Slave Key  
As explained in point 2, the master key can be used to add duplicate keys or slave keys. This can be done by attaching the Master key to the sensor 1 time. Then, attaching a new key to the sensor to be used as a duplicate or slave key. When it is successful, the new key can be used to turn on the power.

### 2.5.3 Formation of Prototypes

Making devices and testing and perfecting prototypes of motor vehicle safety systems are the most important things that should be done. The tools used include RFID, Arduino, standby indicator lights, speakers, blue indicator lights, starter button, white indicator lights, orange indicator lights and green indicator lights.

### 2.5.4 Evaluation

As evaluation, we have to evaluate the prototypes of motor vehicle safety systems and improve analysis of user needs. There are several evaluations that could be carried out:

1. Does the key reading function can verify the vehicle owner?
2. Is it able to register a new owner's key to start the vehicle?
3. Is it able to delete keys that you don't want to use again?
4. The ability to reset keys is to reset all user data.

### 2.5.5 Result of the Research

Based on the results of evaluating the prototype of a motorized vehicle safety system, the actual type is made. Everything that was not working according to the user's wishes is corrected and perfected. The concept in this application is user data must be in accordance with the owner in starting the vehicle. User data is divided into two kinds of keys, namely:



1. Master Key, the highest authority, as the highest authority of the vehicle owner, the master key has special privileges that can create user or delete user access rights.
2. Slave Key, where a user who gets access rights from the master key to start the vehicle.

#### 2.5.6 Final Production

Researchers are working hard to create a vehicle safety system device that can be used by users correctly. In the sensor reading, the use of the master and slave key and its functions, it also requires a coding which is arranged in two modules, namely playing as main flow and resetting the EEPROM which functions to erase memory if the master key is lost.

#### 2.6. Literature Review

1. Parveen Kaur, et al, Smart Vehicle System using Arduino, 2019 AJEEE

In this paper, they discussed about the weakness of security system on vehicles while driving in the context of the level of accidents. Vehicle System, such as detection of hazard signal while we were driving, can reduce the accident level because the security system gives a message to control the situation while driving. Nowadays, in the automotive world, the development of technology grows rapidly, so it can enhance safety features for drivers. Arduino is a major solution in development of driving safety features for the driver. Arduino, not only able to receive motion sensors input, but also able to receive temperature sensors, ultrasonic sensors, even GPS; it can be directly processed data by requirements and actions in the output. The smart vehicle system is the result of Arduino integration into the motor-vehicles, give the automatic output to the vehicles for giving security signals while driving.

2. Ramdhansya Adimas Fiqri, Ariyanto Endro, Nuha Hilal Hudan, Implementation of Advanced Encryption Standard (AES) on vehicle electronic key system based on Android operating system and Arduino microcontroller

The problem in this research is to start the vehicle manually that must require a key, so when you want to access more than one or two vehicles, you will use many number of keys. With the application of Arduino microcontroller on the vehicle, it allows you to restrict even reduce using many locks in accessing or powering the vehicle. In this literature, Arduino will get an input signal through an Android-based application then the signal will process data with the message encryption system using AES technique, when the signal is received, then the vehicle can be switched on. User access to the vehicle is determined from the registered or unregistered user in the Arduino microcontroller system itself. So even if you have an app in your phone, you can not access the vehicle if it is not already registered on the Arduino microcontroller system that integrated with the vehicle.

3. R. Ramani, et al, Vehicle Tracking and Locking System Based on GSM and GPS. ijisa

Vehicle security is made by tracking and locking system using GPS and GSM technology. This system will give a control to stop the vehicle when theft occurs

4. G. K. Mishra, "Advance Automobile Security and Locking System Using

The Use of Arduino as the main center in system control. All programs and stored logic are used to connect with the LEB and DTMF modules.

### 3. Results and Discussion

#### 3.1. Program Prototype

Result of the prototype tools design that used in this motor vehicle safety system can be seen in the following figure.



Figure 3. Motor Vehicle Safety Systems Prototype Design

In the prototype design there are several components used, such as the Arduino circuit, RFID Sensor, RFID key, a car toy as simulator and resources. RFID consist of Master Key and Slave Key. The Master Key has the highest authority that can add new users or delete certain users, while the Slave Key is a user who has the access rights from the Master Key to access the system.

To start the vehicle's engine, bring the Slave key close to the RFID sensor. If the slave key unregistered, the system will refuse it and the vehicle engine can not be started. If the Slave Key has been registered, the system will accept it and the vehicle engine can be started by pressing the start button. To monitor vehicle usage activities (log) an Android-based prototype is made as followed:

## 1. Login Application

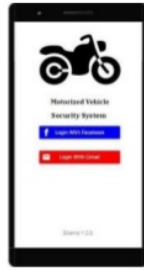


Figure 4. Vehicle Monitoring Login Program Prototype

## 2. Monitoring Log



Figure 5. Vehicle Monitoring Login Program Prototype

### 3.2. Testing the program

The testing model that researcher use is blackbox testing. The following are the results of blackbox testing:

Table 1. Blackbox Testing Result

No	Testing Plan	Expected Result	Conclusion
1	Bring close the cards to the sensor on arduino which doesn't have master key	The system will make that card as a master key and display the Message "Master card defined", Testing Result: Access Control Example v0.2 No Master Card Defined Scan A PICC to Define as Master Card Master Card Defined	Valid
2	Bring close the cards that have been registered when idle mode	The system will accept the cards and display the message "Welcome, you shall pass" Testing Result : Access Control Example v0.2 Master Card's UID 00 27 24 2C ..... Everything is ready Waiting PICCs to be scanned Scanned PICC's UID: 00 24 41 0F Welcome, You shall pass	Valid
3	Bring close the master key when idle mode	The system will switch to program mode and display message "Hello Master - Entered Program Mode", Testing Result: Access Control Example v0.2 Master Card's UID 00 27 24 2C ..... Everything is ready Waiting PICCs to be scanned Hello Master - Entered Program Mode I have 0 record(s) on EEPROM Scan a PICC to ADD or REMOVE to EEPROM	Valid

#### 4. Conclusions

The prototype method is a reference in developing a systematic vehicle safety system. After carrying out step by step, so that an integrated security system is produced. Moreover, there are some important points are as follows:

1. Innovations developed in research are very relevant to the needs of the community to protect the use of motorized vehicles that do not get owner's permission
2. Testing the work system of motor vehicle safety uses the principle of Input-Process-Output
  - a. Input, using two types of RIFD tags
    1. RFID master tag, used as the identity tag for the master key
    2. RFID slave tag, as the identity tag for the slave key
  - b. Process-Output, by using an RFID reader, the system is able to control:
    1. The input signal is a master and slave RFID tag. If the system does not recognize the RFID tag, the system will provide information "You Shall not pass" and automatically the user cannot press the starter button that has been connected to a motorized vehicle
    2. The input signal from the master and slave RFID tags that have been identified by the system, the system automatically conveys "Card Scanned" information and the user can use the starter button that has been connected to the motorized vehicle
    3. The system can recognize or distinguish RFID tags as master and slave key, meaning that the system is able to set user requests to grant access rights or revoke access rights to other users (slave key)
3. The advantages of vehicle safety systems other than the master and slave key, have been equipped with recording data input (master and slave RFID tags) as the identity of the vehicle user. The data is stored in a database so that vehicles can be monitored for 24 hours, including information on who, when, and duration of time the vehicle is used.
4. Several points of opportunity that can be used as a reference in developing vehicle safety systems in line with the development of science and technology, including:
  - a. Cooperate with various workshops or motor vehicle manufacturers to improve the performance and performance of the motor vehicle safety system.
  - b. User permissions (slave keys) can be remotely removed, this is to avoid losing slave keys

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