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Design and Implementation of Keyless Entry and Starter Rfid System on Daihatsu Xenia Type Xi Year 2010

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Abstract

The design and implementation of keyless entry and starter rfid on Daihatsu Xenia Type Xi Year 2010 aims to: 1) Know the tools and materials used in the design and implementation of keyless entry and starter rfid on Daihatsu Xenia type Xi year 2010; 2) Understand the steps of the design and implementation of keyless entry and starter rfid on Daihatsu Xenia type Xi year 2010; 3) Be able to find out the results of testing the design and implementation of keyless entry and starter rfid on Daihatsu Xenia type Xi year 2010. The research method used is research and development. Based on the test results, it can be concluded that the design and implementation of keyless entry and starter rfid can work well, according to the following: increasing security, increasing comfort, increasing prestige, facilitating access, damage to the electrical system, not easily duplicated, still vulnerable to theft, easy battery drop, susceptible to electromagnetic signal interference.

Keywords: Keyless; RFID; Daihatsu Xenia

Abstrak

Perancangan dan implementasi keyless entry dan starter rfid pada Daihatsu Xenia Tipe Xi Tahun 2010 bertujuan untuk: 1) Mengetahui alat dan bahan yang digunakan dalam perancangan dan implementasi keyless entry dan rfid starter pada Daihatsu Xenia tipe Xi tahun 2010; 2) Memahami langkah-langkah perancangan dan implementasi keyless entry dan starter rfid pada Daihatsu Xenia tipe Xi tahun 2010; 3) Mampu mengetahui hasil pengujian perancangan dan implementasi keyless entry dan rfid starter pada Daihatsu Xenia tipe Xi tahun 2010. Metode penelitian yang digunakan adalah penelitian dan pengembangan. Berdasarkan hasil pengujian dapat disimpulkan bahwa perancangan dan implementasi keyless entry dan rfid starter dapat berjalan dengan baik, antara lain: meningkatkan keamanan, meningkatkan kenyamanan, meningkatkan gengsi, memudahkan akses, kerusakan pada sistem kelistrikan, tidak mudah rusak. terduplikasi, masih rawan pencurian, baterai mudah terjatuh, rentan terhadap gangguan sinyal elektromagnetik.

Kata-kata kunci: *Tanpa Kunci; RFID; Daihatsu Xenia*

1. Introduction

The development of automotive technology is currently growing rapidly, this is based on human thoughts and needs that are also growing rapidly. On that basis, the application of technology in the automotive world continues to evolve until increasingly sophisticated technology is created in accordance with the development of the times. The development of automotive technology is also followed by the development of ignition key technology in vehicles. The ignition key in a vehicle is one of the most important objects. Although its size is small, if the vehicle does not have an ignition key, the vehicle cannot be turned on and cannot be run **[1]**. The ignition key is a vehicle security component that is one of the important aspects that vehicle owners need to pay attention to. The Central Statistics Agency (BPS) reported that 372,965 crimes occurred in Indonesia throughout 2022. Of that number, 14,184 crimes were motor vehicle theft. The number of motor vehicle theft cases decreased by 21.22% compared to the previous year. In 2021, there were 18,005 cases of motor vehicle theft. While in 2020, there were 18,557 cases of motor vehicle theft. Looking at this data, the number of motor vehicle theft cases in the country has continued to decline since 2020-2022 **[2]**.

In the 2010 Daihatsu Xenia type Xi itself still uses a conventional ignition key that has weaknesses in its security system. The RFID keyless entry and starter system offers a more sophisticated and practical security solution compared to conventional ignition keys. For the design and implementation of this keyless system, an aftermarket keyless entry module is used, which is already widely available, combined with this system using RFID (Radio Frequency Identification) technology based on Arduino Uno to identify keys and allow access to vehicles which are expected to provide increased vehicle security in layers.

The process of formulating this idea began with field observations as well as interviews with the Head of the Automotive Engineering Study Program at the Piksi Ganesha Indonesia Polytechnic. The results of the interview at the Automotive Workshop Laboratory were the lack of education and learning about technological developments in vehicles, especially in electricity, which can be used as an effort to reduce crime in vehicles. In addition to the results of the observations at the Piksi Ganesha Indonesia Polytechnic Workshop Laboratory, other results were obtained, namely the lack of learning media both in material and practicum so that students do not understand the Keyless Entry and Started RFID technology.

Based on the description above, there are several problems that underlie this research, namely (1) The security of conventional ignition keys is low and vulnerable to theft; (2) The keyless entry system and RFID starter are not yet available on the 2010 Daihatsu Xenia type Xi; (3) Lack of education related to the development of security technology on vehicles. Design is an innovative and creative activity in applying science and technology to realize existing or future technology and is predicted to be useful in meeting current or future human needs according to the demands of the times **[3]**.

Design or planning is a series of procedures to translate the results of analysis and a system into a programming language to describe in detail how the system components are implemented **[4]**. The definition of system development or building is the activity of creating a new system or replacing or repairing an existing system as a whole **[5]**. Thus, the understanding of design is an activity of translating the results of analysis into a software package and then creating the system or improving the existing system. Determining the concept will determine the results of the design in the form of tools, there are various ways to do it, but usually the most effective, efficient and economical way is chosen.

A system is a combination of several components that work together and form a specific goal [6]. Based on this understanding, it can be concluded that a system is a network of interconnected procedures, gathered together to carry out an activity or to complete a certain target.

With the development of technology, a more sophisticated security system has now been created, known as keyless, on each vehicle so that motorcycle theft or other criminal acts can be avoided as much as possible **[7]**. While the keyless system is a supporting security system on the vehicle. This system functions in the process of locking or turning on the vehicle. This system is a development of the conventional alarm system that has been circulating in the community [8]. Based on the explanation above, it can be concluded that the keyless entry system is a series that is implemented with procedures or steps in accessing and securing a vehicle.

Radio Frequency Identification (RFID) is a system that transmits a specific identity in the form of a unique number from an object using radio frequency waves. This technology is part of automatic identification technology such as barcodes, optical character readers, and several biometric technologies such as retinal scans. [9]. RFID is also used as a tool to identify an object such as an ID card or KTP where the sensor reads data in the form of a unique code or line on the card. Data is sent from RFID to the microcontroller to be adjusted whether the data has been registered on the tag register or not **[10]**.

Based on the above understanding, it can be concluded that RFID (Radio Frequency Identification) is an identification technology that uses radio waves to read and write data to RFID tags. RFID tags can be attached to any object, such as products, animals, or people. Data read from RFID tags can be used to track and manage the object. In addition, RFID is also a way to identify a person or object through radio transmission frequencies. RFID uses radio frequencies to read information from a small device called an ID tag. The ID tag will recognize itself when it detects a signal from a compatible device, namely the RFID Reader. RFID is an identification technology that is flexible, easy to use, and suitable for use in automatic operations **[11]**.

In the RFID system, there are RFID tags and RFID readers/writers RFID Tag, can be a sticker, paper or plastic with various sizes. In each tag there is a chip that can store a certain amount of

information. A tag that is installed does not use an energy source such as a battery so it can be used for a very long time. RFID Terminal Reader, Consists of an RFID reader and antenna that will affect the optimal identification distance. The reader sends electromagnetic waves, which are then received by the antenna on the RFID label. The RFID label sends data usually in the form of a serial number stored in the label, by sending radio waves back to the reader **[13]**.

In this design using RFID Tag Keyfob Keychain 13.56 MHz. RFID Reader/Writer using RFID-RC522. RFID-RC522 is an RFID module equipped with IC (Integrated Circuit) MFRC522. How RFID works is by using radio frequency to read information from a small device called a tag or transponder (transmitter and responder). RFID tags will recognize themselves when they detect signals from compatible devices, namely RFID readers. Where the RFID reader is connected to the Arduinouno microcontroller **[9]**.

The microcontroller is the brain in controlling a robot by entering the programming language into it according to the designer's wishes **[14]**. A microcontroller is a chip in the form of an IC (Integrated Circuit) that can receive input signals, process them and provide output signals according to the program entered into it **[8]**. The microcontroller input signal comes from the sensor which is information from the environment while the output signal is directed to the actuator which can have an effect on the environment.

So in simple terms, a microcontroller can be likened to the brain of a device/product that is able to interact with its surroundings. In simple terms, a computer will produce a specific output based on the input received and the program being executed. The use of programming languages is adjusted to the microcontroller used in this study using the Arduino microcontroller. Arduino is an open source single-board microcontroller designed to facilitate the use of electronics in various fields. The hardware has an Atmel AVR processor and the software has its own programming language **[11]**. The Arduino IDE software is published as Open Source, available to experienced programmers for further project development. The language can be further developed through C++ libraries based on the C Language for AVR **[15]**.

2. Method

This study uses the research and development (R&D) method. The research and development (R&D) method is a research method used to produce certain products, and test the effectiveness of the product. The development model used adapts a design known as the 4D model (Four D Models). The 4D model consists of 4 stages of activity, including: 1. Define, 2. Design, 3. Develop, and 4. Desseminte **[16]**.

1. *Define*

   At this definition stage, it is the stage of determining a problem that is obtained when conducting observations and interviews to identify the conditions in the Workshop Laboratory of the Indonesian Piksi Ganesha Polytechnic to be used as research material.

2. *Design*

   At the design stage is the initial design stage in the creation of the keyless entry and start rfid system design. In this process it is designed to adjust the type and number of components of the system.

3. *Development*

   Development is the stage of realization in the real form of the previously created design. At this stage of manufacture, it is adjusted to the design form and number of components which are then realized in a system that is intended as a security feature on the Daihatsu Xenia Type XI 2010 car. The creation of the keyless entry and start engine rfid that has been developed is in accordance with the contents of the research background that is the reference for the problem. The creation of the system will be used by automotive engine study program students who are taking advanced body electrical engineering courses. At this stage, the work of the keyless entry and starter rfid system is tested.

4. *Dessimination*

   Dissemination is the stage where the system is delivered to students and lecturers as a security feature on vehicles at the Workshop Laboratory of the Piksi Ganesha Indonesia Polytechnic. The purpose of this dissemination is to provide information that there is a keyless entry and starter RFID system that can be used to improve vehicle security against criminal acts in parking lots. Dissemination is carried out in several stages, namely testing the work of each system and component and dissemination via social media. The research flow is presented in **Figure 1**.

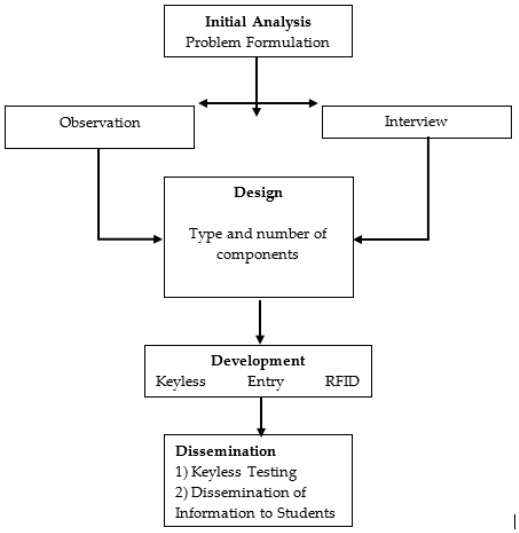


Figure 1 4D Model Research and Development Diagram

3. Results and Discussion

Flowchart and Software Sistem

A system flowchart is a chart that shows the workflow or what is being done in the system as a whole and explains the sequence of procedures in the system [17]. With the flowchart the system that was designed and built can be seen in **Figure 2.**

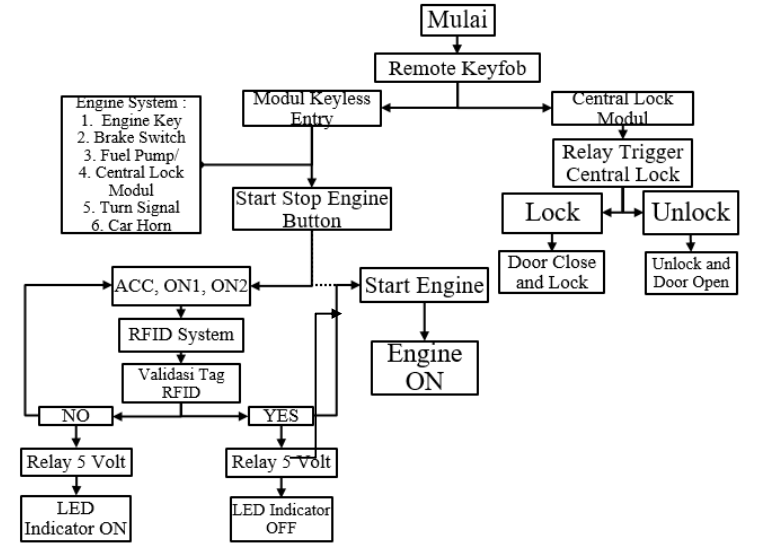


Figure 2. Flowchart of The Keyless Entry And Starter Rfid System On The 2010 Daihatsu Xenia Type Xi

Diagram Block

A block diagram is a pictorial representation of the cause and effect relationships between inputs and outputs of a physical system. Block diagrams are equally useful in management science, criminal justice and economics for modeling and analyzing systems **[18]**.

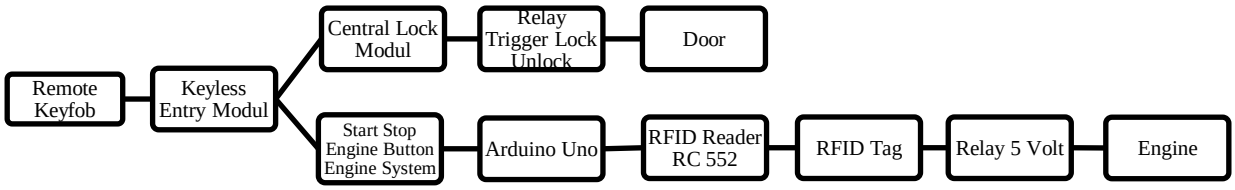


Figure 3. Block Diagram Of The Keyless Entry And Starter Rfid System On The 2010 Daihatsu Xenia Type Xi

Hardware Desaign

Hardware design is a stage or process in making hardware. Hardware design aims to facilitate and reduce the level of error in making hardware so as to obtain optimal results **[19]**.

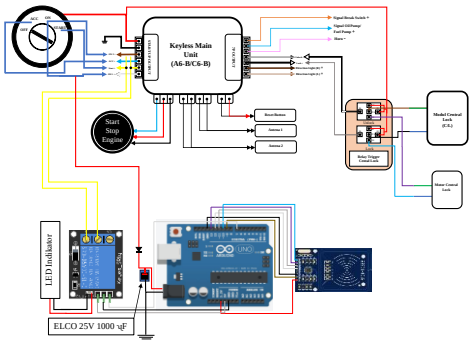


Figure 4. Hardware Design Of RFID Keyless Entry And Starter System On Daihatsu Xenia Type Xi 2010

Stages of Design and Implementation of Keyless Entry System and RFID Starter on Daihatsu Xenia Type Xi Year 2010, namely:

a. Design

In the process of designing and implementing keyless entry and starter RFID on the 2010 Daihatsu Xenia Type Xi car at the Piksi Ganesha Indonesia Polytechnic Workshop Laboratory, there are several steps that will be defined by the scheme in **Figure 5.**

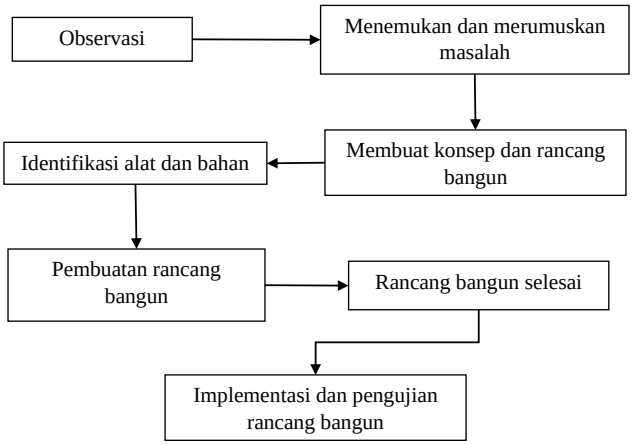


Figure 5. Diagram Of The Creation Of The Design And Implementation Of Keyless Entry And Starter RFID On The Daihatsu Xenia Type Xi 2010 In The Workshop Laboratory Of The Indonesian Piksi Ganesha Polytechnic

b. Development of Technology Architecture

1) Design and Construction Concept

The design and implementation of keyless entry and RFID starter on the 2010 Daihatsu Xenia Type Xi is a tool or product used to improve vehicle security when left unattended and to increase students' insight into technological developments.

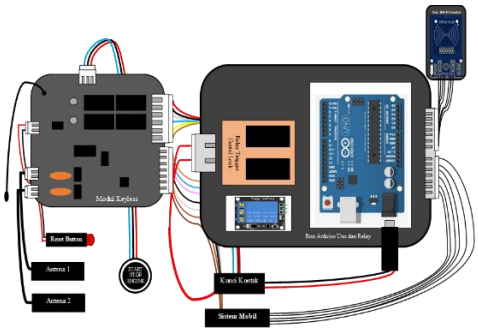


Figure 6 Design and Build Concept

The use of a keyless system also provides other conveniences, namely that this system does not require a physical ignition key, which offers convenience and efficiency when used because accessing the vehicle does not require more force like conventional ignition keys in general.

2) Identification of Tools and Materials

In the design and implementation of keyless entry and starter rfid on Daihatsu Xenia Type Xi Year 2010 using several tools used are tools that are easy to use and easy to find around us or in the Laboratory Workshop of Politeknik Piksi Ganesha Indonesia. While for the materials used in the design and implementation of keyless entry and starter rfid on Daihatsu Xenia Type Xi Year 2010 are materials that are easy to find in various electronic equipment stores and building materials stores.

3) Design and Build Process

The design and build process is a process from start to finish to produce a design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi Year 2010. The initial process of design and build planning includes making designs and determining the tools and materials to use. The design and implementation process of keyless entry and starter on the Daihatsu Xenia Type Xi Year 2010 in its manufacture there are several processes as follows:

a) Arduino Uno-Based RFID System Assembly Process

It is the initial process in making keyless entry and starter RFID on Daihatsu Xenia Type Xi Year 2010, namely by assembling components to become the RFID system unit itself. This assembly uses manual techniques, namely by combining or connecting the existing cables according to the diagram in **Figure 7** by combining several pins that can be seen in Table 1, the results of which can be seen in **Figure 8**.

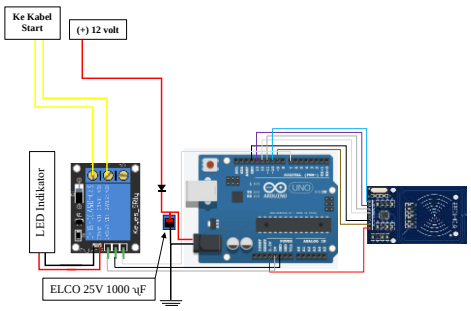


Figure 7. Assembly Schematic

Table 1. Arduino Uno Assembly Schematic with RFID Reader RC522

	Component	Component Pin Code	To Pin Code	Connected components
1	RFID Reader RC522	3,3 V GND SDA MOSI MISO SCK RST	3,3 V GND 10 11 12 13 9	Arduino Uno
2	Relay 5 Volt	Vin GND In COM NO	5 V GND 7 IN ON2 OUT ON2	Arduino Uno (Start)

b) RFID Tag Data Input Process to Arduino Uno

Next is the Arduino coding process, where the coding process translates the design into a language that can be understood by the computer [20]. Arduino Uno really needs coding so that the application of the automatic system runs perfectly. Which can be seen in Figure 10 and Figure 11.

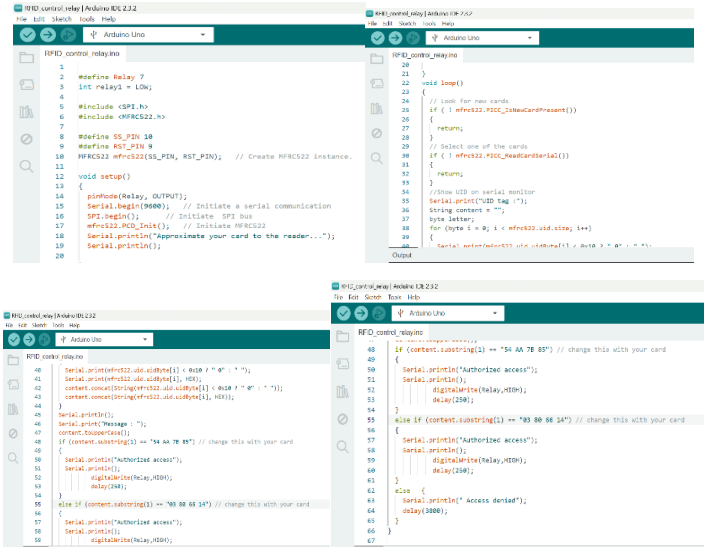


Figure 10. RFID Coding

Figure 11. Coding Process

c) Keyless Module Cable Assembly Process to Car Electrics

Next, the keyless module cable assembly process where there are several cables used to obtain power supply so that the system works or to obtain signals that support the operation of this system with cable connections can be seen in Figure 12.

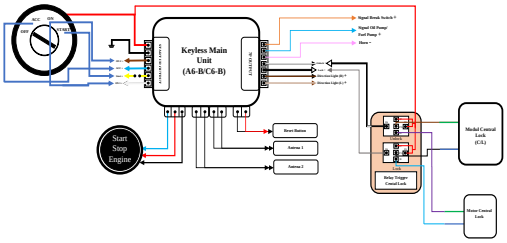


Figure 12 . Flowchart

d) Integration of Keyless Entry Module with Arduino Uno-based RFID System

Furthermore, the integration of keyless entry system with Arduino Uno-based RFID system is expected to provide increased security for vehicles.

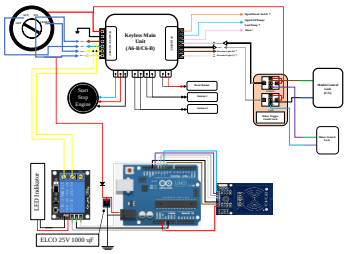


Figure 13. Merge scheme

e) Placement of Keyless Entry Module, Antenna, Start Stop Engine Button, and RFID System

Then the placement of the keyless entry module, antenna, start/stop engine button, and RFID system where the keyless entry module, Arduino Uno box and RFID Reader box are located around the car dashboard which can be seen in **Figure 14.**

Figure 14. External Antenna Placement

f) *Finishing*

The final process in assembling the design is to visually re-check all systems, including bolt tightness and cable and component installations, to reduce the risk of electrical short circuits, as shown in **Figure 15**.

Figure 15. The System Works

How Technology Objects Work

The design and implementation of keyless entry and starter RFID on the 2010 Daihatsu Xenia type XI is presented in **Figure 16**.

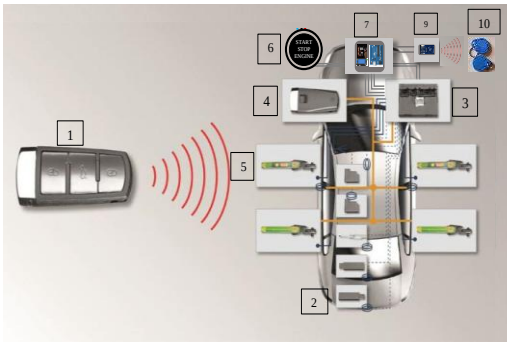


Figure 16. Tool Workflow Schematic

Information:

a. Remote key fob, to transmit signals.
b. Keyless module antenna, to detect signals from the remote key fob.
c. Keyless Main Unit, to handle communication and authorization to access without a key.
d. Central lock module, to control the locking and unlocking of all doors in the vehicle simultaneously.
e. Central lock motor, to translate electrical signals into mechanical movements to lock or unlock the doors.
f. Start stop engine button, as an ignition switch in turning the engine on and off.
g. Arduino Uno box, to store Arduino Uno components and Relay Trigger central lock.
h. RFID Reader MFRC522 box, to store RFID Reader MFRC522.
i. RFID Tag, to store and transmit data in identifying access.

How Keyless entry and starter RFID Works:

a. Make sure all cables are connected according to the specified scheme.

b. Open and lock the door (Lock and Unlock)

    1) When the vehicle is in a locked door state, press unlock on the remote key fob to send a signal to the keyless entry module which then activates the trigger unlock relay and activates the turn signal which is forwarded to the central lock module to operate to unlock the door. And vice versa when locking the door the only difference is the relay used.

c. Turning on the Engine.

    1. After the remote key fob gives a signal to the keyless entry module to unlock the door, the keyless entry module then activates the start stop engine button.
    2. When the start stop engine button is given the command 1 short press which then sends a signal to the keyless entry module to activate the ignition to the ACC position.
    3. And when the start stop engine button is given the command 1 short press which then gives a command to the keyless entry module to activate the ignition to the ON 1 and ON 2 positions and activate the Arduino Uno and 5 Volt Relay and LED Indicator which then the Arduino Uno orders the RFID reader to detect from the RFID tag. After detecting the RFID tag, the RFID reader sends the RFID tag data to the Arduino Uno to verify whether it matches the registered RFID tag data or not. If it matches, the Arduino Uno will then send a command to the 5 Volt Relay and LED Indicator to be inactive which then connects the Starter cables, if the detected RFID Tag is not registered then there is no command from the Arduino Uno to the 5 Volt Relay and remains off.
    4. Next, when the start stop engine button is given a command to press 1 short press again and press the brake pedal, the engine can start, but if you do not press the brake pedal, the keyless entry system gets a command to position the ignition key to OFF and turn off all systems and the engine will not star.

d. Turning off the engine

    1. Next, when the car engine is on and the start stop engine button gives a command to press one short press to the keyless entry module along with getting a signal from the brake light switch, the keyless entry module gets a command to the ignition key in the OFF position to turn off the car engine.

Technology Implementation and Testing

a. Functional Test

Functional testing is carried out to determine whether each part of the device has worked according to the functions and desires that will be needed [21]. The functional test carried out in the design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi 2010 functions according to its respective functions. The steps that must be taken in this functional test are to start by testing the function of the Keyless Entry and Start Stop Button Module because it is one of the main parts of this keyless system, then testing the RFID system section, this system is also very complex if damage occurs, the keyless module cannot work.

If all components function according to their respective functions as a security tool for the ignition key on the Daihatsu Xenia Type Xi 2010 car in providing security when the car is parked, especially in public places. So that it can be seen that the results of the design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi 2010 can function properly. From the tests that have been carried out, the following functions can be identified:

1. The design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi 2010 can function as they should, including parts of the keyless system, rfid system and Relay trigger system functioning as they should, as can be seen in **Table 2**.

Tabel 2 Kondisi Alat

Numb	Tools	Condition	
		Functioning	Does not work
1.	Modul *Keyless Entry*	✓	-
2.	*Start Stop Button*	✓	-
3.	Arduino Uno	✓	-
4.	RFID *Reader* RC522	✓	-
5.	RFID Tag	✓	-
6.	Relay 5 Volt	✓	-
7.	Relay *Trigger Central Lock*	✓	-

2. Design and implementation of Keyless Entry and Starter RFID on Daihatsu Xenia Type Xi Year 2010 is a tool that can improve vehicle security when left or parked so that drivers, both Staff and Students, have a sense of security when the car is parked. From the test results above, it can be concluded that the design and implementation of keyless entry and starter RFID on Daihatsu Xenia Type Xi Year 2010 can function well and effectively.

b. Application Testing

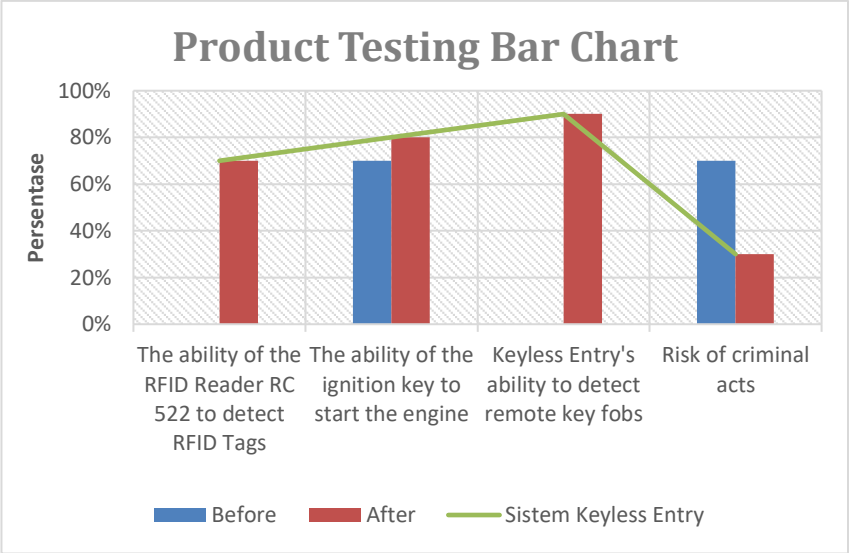
Application testing is carried out to determine and ensure that the design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi Year 2010 can

function according to its function. The steps in testing the application of the design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi Year 2010 start from introducing the design to automotive mechanical engineering study program students.

Furthermore, it is used as an alarm and vehicle starter on the Daihatsu Xenia Type Xi Year 2010 during practicums or when used. The process of using the design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi Year 2010 is used to compare between using a keyless ignition system and using a conventional ignition system on the Daihatsu Xenia Type Xi Year 2010 based on interviews with users, especially students of the automotive mechanical engineering study program (TOM). From this test, the following data can be obtained:

a. The design and implementation of keyless entry and starter RFID on Daihatsu Xenia Type Xi Year 2010 presents a valuable asset for TOM students and staff of Politeknik Piksi Ganesha Indonesia. This system enhances learning opportunities, security, and comfort.
b. Design and implementation of keyless entry and starter rfid on Daihatsu Xenia Type Xi Year 2010 where the RFID system can function as a valuable practical learning tool for TOM students, allowing them to gain practical experience with automotive electronics and RFID technology that can learn components, operations, and system troubleshooting techniques. In addition, the RFID system can be a platform for students to develop projects related to automotive electronics and RFID applications that can explore various functions and improvements to improve understanding and skills. And the RFID system can facilitate research projects in automotive electronics and RFID technology. Students can also investigate performance optimization, security enhancements, and integration with other vehicle systems.
c. The design and implementation of keyless entry and starter rfid on Daihatsu Xenia Type Xi Year 2010 provides an additional layer of security for vehicles on campus, reducing the risk of unauthorized access and theft. Staff can manage access permissions and monitor vehicle usage. The keyless entry and starter feature can increase convenience for staff members, eliminate the need for physical keys and simplify the vehicle's starting process.
d. Table 3 shows the results of the design and implementation of keyless entry and starter RFID testing on Daihatsu Xenia Type Xi Year 2010 in tables and bar charts**.**

Table 3. Product Testing Diagram



c. Impact of Application

Installing Keyless Entry and Starter RFID on Daihatsu Xenia Type Xi 2010 can provide several positive and negative impacts after installing the keyless entry system, including:

1. Positive Impact:
   a) Increase security: Keyless Entry and Starter RFID uses RFID technology which is safer than traditional keys. This is because RFID keys cannot be easily counterfeited and can only be used by people who have authorized access.
   b) Increase comfort: Keyless Entry and Starter RFID allows users to open and close car doors without a key. Users can also turn on and off the car engine simply by touching the start/stop button.
   c) Increase prestige: Keyless Entry and Starter RFID are features that are considered sophisticated and modern, which can increase the prestige of the car owner.
   d) Facilitate access: Keyless Entry and Starter RFID facilitates access to the car, especially when carrying many goods or when hands are wet.
2. Negative Impact
   a) Damage to the electrical system: Installing RFID Keyless Entry and Starter on a car that is not designed for this feature can cause incompatibility with the car's electrical system, which can result in damage.
   b) Not easy to duplicate: If the user loses the RFID key or the key is damaged due to water or heavy impact, they will not be able to open or start the car. This can cause major problems because the key is difficult to duplicate.

c) Vulnerability to theft: Although RFID Keyless Entry and Starter can improve car security, this system is still vulnerable. Skilled thieves can use special tools to disable the system and steal the car.

d) Battery: The RFID Keyless Entry and Starter use a battery to operate. This battery needs to be replaced periodically, and if it runs out, the user cannot open and lock the car doors or start the car engine.

e) Signal interference: RFID Keyless Entry and Starter can be interfered with by electromagnetic signals from other devices, such as mobile phones or radio antennas. This can cause the system to not function properly.

4. Conclusion

Based on the results of research and development research with library techniques, observation and documentation conducted at Politeknik Piksi Ganesha Indonesia entitled design and implementation of keyless entry and starter rfid on Daihatsu Xenia Type Xi Year 2010, several conclusions can be drawn. The conclusions are as follows:

a. The tools and materials used to support the formation of the design and implementation of keyless entry and starter rfid on Daihatsu Xenia Type Xi Year 2010 include: Keyless entry system module, Arduino Uno, RFID Reader RC522, RFID Tag, 5V Relay, 5-foot 12V Relay, Jumper Cable, 12V DC Jack, 6 Pin Connector XH.2.54, 2 Pin Motor Connector, Duplicate Key, Tin/Tinol, Double Tip Foam, Cable, Bolt.

b. The working method of the design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi Year 2010 is the functioning of each component that makes up the design and implementation of keyless entry and starter rfid works according to their respective tasks. The next step is to use the design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi Year 2010 to add education and experience of vehicle electronics on vehicle body electrical technology in the practical activities of students of the Automotive Mechanical Engineering Study Program.

c. From the results of functional testing of the design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi Year 2010 which supports the design to work according to their respective functions and can be used by students of the Automotive Mechanical Engineering Study Program (TOM) and staff employees of the Piksi Ganesha Indonesia Polytechnic as a system that provides an additional layer of security for vehicles on campus, reducing the risk of unauthorized access and theft.

d. From the results of testing the application of the design and implementation of keyless entry and starter rfid on the Daihatsu Xenia Type Xi Year 2010 by interviewing students of the Automotive

Mechanical Engineering Study Program (TOM), it can be said that the use of a keyless entry and starter system can increase convenience for staff members and students who can eliminate the need for physical keys and simplify the process of starting the vehicle.

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Reference

[1] H. D. Muhamad Islakhudin, Sigit Joko Purnomo, A.Noor Setyo, "PEMANFAATAN SMART KEY PADA MOBIL LISTRIK BERBASIS RFID."

[2] F. Sulistya Pratiwi, "Data Jumlah Kejahatan di Indonesia pada 2023 - Dataindonesia.id," *DataIndonesia.id*, 2023. [Online]. Available: https://dataindonesia.id/varia/detail/data-jumlah-kejahatan-di-indonesia-pada-2023

[3] T. Rahmasari, "Perancangan sistem informasi akuntansi persediaan barang dagang pada Toserba Selamat menggunakan php Dan mysql," vol. 04, pp. 61–75, 2019, doi: 10.34010/aisthebest.v4i1.1830.

[4] R. Gunawan, A. M. Yusuf, and L. Nopitasari, "Rancang bangun sistem presensi mahasiswa dengan menggunakan qr code berbasis android," *J. Ilm. Elektron. DAN Komput.*, vol. 14, no. 1, pp. 47–58, 2021, [Online]. Available: http://journal.stekom.ac.id/index.php/elkom

[5] M. Haisyam, "Rancang bangun sistem informasi monitoring marketing penerimaan mahasiswa baru (STUDI KASUS : LP3I TASIKMALAYA)," *J. Sist. Inf. GALUH*, vol. 1, no. 1, pp. 21–31, 2023, doi: https://ojs.unigal.ac.id/index.php/jsig/index.

[6] W. Gede and E. Bratha, "Literature review komponen sistem informasi manajemen : software, database dan brainware," *J. Ekon. Manaj. Sist. Inf.*, vol. 3, no. 3, pp. 344–360, 2022, doi: : https://doi.org/10.31933/jemsi.v3i3.

[7] D. Saputro, "Rancang bangun keyless ignition pada sepeda motor berbasis arduino," vol. 9, no. November, p. 9, 2018.

[8] V. Razaqta, S. Sumarno, and P. Pangaribuan, "Perancangan sistem elektronik kunci kontak keyless pada sepeda motor," vol. 5, no. 3, pp. 4112–4119, 2018.

[9] S. Suradi, S. Karim, W. Tahir, and Z. Yusuf, "Perancangan Kunci Kontak Sepeda Motor Menggunakan Rfid Berbasis Arduino Uno," *ILTEK J. Teknol.*, vol. 13, no. 02, pp. 1949–1952, 2018, doi: 10.47398/iltek.v13i02.256.

[10] J. Subastian Manurung, Iin Parlina, Fitri Anggraini, Dedy Hartama, "Penggunaan sistem arduino menggunakan rfid untuk keamanan kendaraan bermotor," *J. Penelit. Inov.*, vol. 1, no. 2, pp. 139–148, 2021, doi: https://doi.org/10.54082/jupin.17.

[11] Afriyandi, *Rancang bangun sistem keamanan sepeda motor menggunakan gps dan sim800 berbasis mikrokontroller arduino nano*. 2022.

[12] R. Athallah Aditya and A. Setia Budi, "Prototipe Sistem Keamanan Parkir berbasis RFID dengan Protokol MQTT," vol. 7, no. 7, pp. 3287–3295, 2023, [Online]. Available: http://j-ptiik.ub.ac.id

[13] S. Nasution and Program, "PRESENSI ONLINE MENGGUNAKAN RFID PADA KARTU MAHASISWA ONLINE PRESENCE USING RFID ON STUDENT CARDS Salhazan," *J. Inf. Technol. Comput. Sci.*, vol. 1, no. 2, pp. 19–27, 2018.

[14] P. Prasetyawan, Y. Ferdianto, S. Ahdan, and F. Trisnawati, "Pengendali Lengan Robot Dengan Mikrokontroler Arduino Berbasis Smartphone," *J. Tek. Elektro ITP*, vol. 7, no. 2, pp. 104–109, 2018, doi: 10.21063/jte.2018.3133715.

[15] L. Citra, Y. Iswara, P. Studi, T. Elektro, F. Teknik, and U. M. Ponorogo, "Sistrem pengaturan running text menggunakan android dengan interface bluetooth berbasis arduino," 2017.

[16] I. G. Nyoman, S. Waisnawa, I. Ayu, A. Arsani, and I. N. Sutarna, "Pengembangan Jobsheet Berbasis Teaching Factory Dengan Model 4D sebagai Media Pembelajaran Praktek Bubut," *J. Sinestesia*, vol. 12, no. 2, pp. 346–352, 2022.

[17] I. A. Ridlo, "Pedoman Pembuatan Flowchart," *Academia.Edu*, p. 27, 2017, [Online]. Available: academia.edu/34767055/Pedoman_Pembuatan_Flowchart

[18] N. A. Pratama and C. Hermawan, "Aplikasi Pembelajaran Tes Potensi Akademik Berbasis Android," *Jnteti*, vol. 6, no. 1, pp. 1–6, 2016, [Online]. Available: http://jurnal.unda.ac.id/index.php/Jpdf/article/view/11/13

[19] Y. Triawan and J. Sardi, "Perancangan Sistem Otomatisasi Pada Aquascape Berbasis Mikrokontroller Arduino Nano," *JTEIN J. Tek. Elektro Indones.*, vol. 1, no. 2, pp. 76–83, 2020, doi: 10.24036/jtein.v1i2.30.

[20] L. D. Ummah, "Rancang Bangun E-Commerce Pada Toko Kerudung Nuri Collection Berbasis Customer Relationship Management," *Nuansa Inform.*, vol. 12, no. 2, pp. 10–17, 2018, doi: 10.25134/nuansa.v12i2.1350.

[21] Raju Rizkyana and Awang Surya, "Sistem Keamanan Sepeda Motor Dengan Mengganti Saklar Starter Menggunakan Fingerprint," *JTTM J. Terap. Tek. Mesin*, vol. 2, no. 1, pp. 43–51, 2021, doi: 10.37373/jttm.v2i1.90.