**International Journal of Economics, Management, Business and Social Science (IJEMBIS)**
**Peer-Reviewed – International Journal**
**Volume 2, Issue 2, May 2022**
**E-ISSN: 2774-5336**
https://cvodis.com/ijembis/index.php/ijembis

# Development of Prototype System Design with The Application of Technology

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**Citation**: Ratnasari, T., Yanti, I. R.S., & Anggaini, D. (2022). Development of Prototype System Design with The Application of Technology. INTERNATIONAL JOURNAL OF ECONOMICS, MANAGEMENT, BUSINESS AND SOCIAL SCIENCE (IJEMBIS), 2(2), 292-298.
https://cvodis.com/ijembis/index.php/ijembis/article/view/70

***Abstract.***
The development of a system designed in such a way as to become security that makes everyone feel the need to ensure the safety of everything that includes himself, both from his activities and the assets he owns. This system uses an RFID Reader with a frequency of 13.56 MHz and an ATMega328 Microcontroller that acts as a controller or circuit controller and is tested with hardware and software testing to determine the performance between the software and hardware of the device. This research shows that the RFID Reader can detect E-KTP with a maximum distance of 2.5 cm, and the solenoid will lock back after 3 seconds. The utilization of Renewable Energy is currently a priority in carrying out technology development, one of which is solar energy with solar panels as electrical energy. This research supports efforts to develop energy-based technology that is converted with various supporting components and system authentication designed using the use of control security systems both in terms of administration and information technology-based on population data and uncontrolled system prototypes.

***Keywords:*** *Cabinets, RFID, Mikrokontroller, Arduino, Renewable energy*

## 1. Introduction

The importance of security makes everyone feel the need for security guarantees against everything that includes him, both from his activities and his assets. However, security issues are still common anywhere and in many ways. One of them can happen in the locker cabinet. Personal access security such as those mentioned in locking lockers generally only applies to a manual security system, which is easy to break into. So with the development of technology, a personal access security system has been created that uses electronic systems and is more automatic with a more guaranteed level of security. Security systems can be done by using electronic devices as an innovation to create a sophisticated security system tool—one of them is Automatic Identification (Auto-ID) technology by utilizing E-KTP as an RFID Tag Card. E-KTP is an Identity Card (KTP) made electronically and is included in the type of smart card that can be utilized in various things such as health services, access tokens, passports, and others. E-KTP can be used as an RFID tag because it contains a chip that stores a unique ID number. Radiofrequency identification (RFID) is a technology that automatically identifies an object by transmitting and receiving data from radio frequencies. The data is transmitted in the form of a unique information code and cannot be duplicated so that it is safer to use it and the level to Amanan is more secure. One of the technologies that help design a modern and efficient locker security system is RFID (Radio Frequency Identification) technology. Radiofrequency identification (RFID) is a technology that automatically identifies an object by transmitting and receiving data from radio frequencies. The data transmitted is in the form of a unique information code and cannot be duplicated to be more secure.


**Figure 1.** card shape of Electronic Card Base

In addition to this, in February 2011, the Ministry of Home Affairs of the Republic of Indonesia announced a new program that is a program wait from conventional identity cards to electronic identity cards or electronic-KTP (e-KTP). The utilization of solar power generation systems (PLTS) can be a solution in the face of the threat of the electricity crisis. Power generation systems that use solar panels or solar panels become an environmentally friendly energy source. Solar panels are a system that can be used to convert sunlight energy into electrical energy using a principle called the photovoltaic effect. A solar panel consists of solar cells that convert the photo energy of light into electricity. They are called the Sun's upper Sun or "sole" because the Sun is the strongest light source that can be harnessed. Solar panels are often called photovoltaic cells; photovoltaics can be interpreted as "light-electricity." "Solar cells or PV cells rely on the photovoltaic effect to absorb the Sun's energy and cause currents to flow between two opposing charged layers" (Solanki, 2013:15).

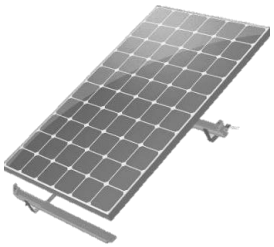

**Figure 2.** Solar Panels

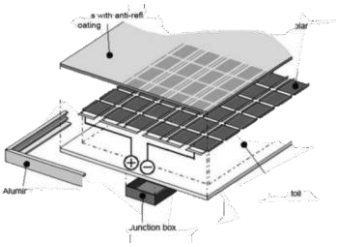

**Figure 3.** Solar Panels System environments

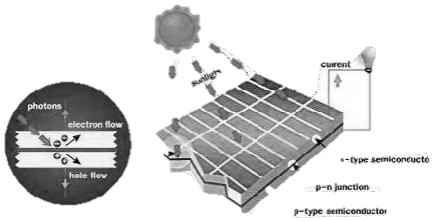


**Figure 4.** Photovoltaic Effect in Solar Panels System

Radiofrequency identification, better known as RFID, is an object identification method that uses radio waves. The identification process is carried out by an RFID reader and an RFID transponder (RFID Tag). An RFID tag is attached to an object or an object to be identified. Each RFID tag has a unique identification number data, so no RFID tag has the same ID number. RFID describes a system capable of transmitting an object's identity data wirelessly using radio waves. RFID is included in Automatic Identification (Auto-ID) technology. The automatic identification system is becoming very popular in various industries such as services, purchases, manufacturing, etc. Other technologies included in Auto-ID are barcodes, optical character readers, and biometric technology. An RFID tag is attached to an object or an object to be identified. Each RFID tag has a unique identification number data, so no RFID tag has the same ID number. Barcode labels everywhere are the originators of the revolution of automatic identification systems. Although barcodes are very cheap, there are disadvantages in terms of low storage and the lack of the ability to be reprogrammed. The technically optimal solution is to utilize a silicon chip as a storage medium adopted in RFID systems.

## 2. Research Method

I have seen some intersection relationships in the security locker's radio frequency identification application system. From the figure, the Arduino Pro Mini is the central part that serves as the main controller of the CPU (Central Processing Unit). RFID tags and RFID readers (RFID tag readers) As input or input data to the Arduino Pro Mini, which will be processed for access to a locker. While the output of the system is an explanation of the flowdiagram of the working system of the locker security system program:

a. Start: The first step to operating the device is to provide voltage to the system or circuit.
b. Initialization of Arduino Pro Mini: Once the system is active, the Arduino Pro Mini will perform its function as control of all inputs and outputs. Arduino Pro Mini enables RFID and LCD readers. Once active, the LCD will display the writing to paste the e-KTP.

c. Scan E-KTP to RFID Reader: The RFID reader will read the data on E-KTP through electromagnetic wave emission. The data read by the RFID reader will be forwarded to the Arduino Pro Mini to be validated with the ID adjustment listed on the Arduino Pro Mini memory.
d. If the data sent by the RFID reader is registered, the Arduino Pro Mini will carry out the next instruction to register the KTP code you want to register or pass the registration process. Suppose the E-KTP code corresponds to the Arduino Eprom memory. In that case, Arduino will activate the green LED Indicator, buzzer, relay driver, and solenoid so that the locker will open according to locker code 1 or locker two that has been registered.
e. Solenoid off After 10 seconds, the Arduino Pro Mini will instruct the relay to be active low, and the solenoid (Off) lock will be closed.
f. If the affixed E-KTP is not registered on memory, the red LED lights up, and the buzzer will sound as a sign that the affixed E-KTP is not recognized.
g. Completed: All locking and opening processes will return to the initialization position of AT Mega 328(Looping).

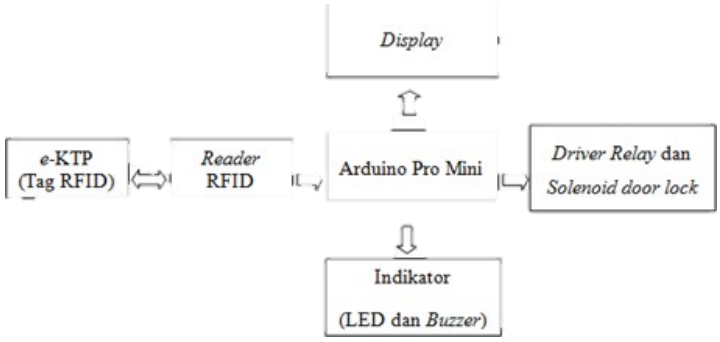


**Figure 5.** Block Diagram Working of RFID Tag Response

This circuit serves as the control center of the entire existing system. The circuit has become a module with an IC regulator for Arduino power supply and IC for communication between Arduino pro mini to PC. The main component of this overall circuit is the AT Mega 328 microcontroller IC. In this IC, all programs are filled so that the circuit can run as desired.

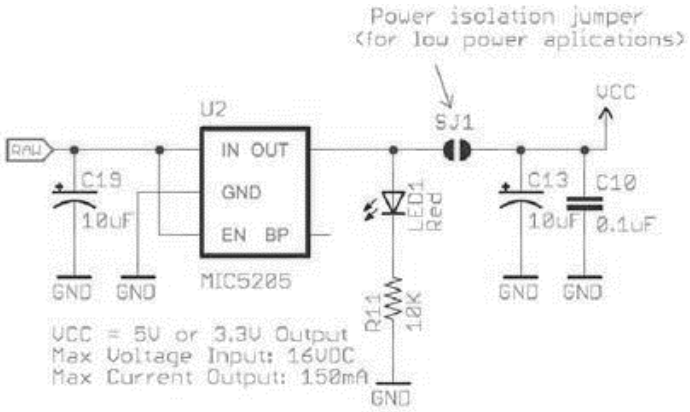


**Figure 6.** Arduino Pro Mini Minimum System

This RFID reader module serves to read the data or ID number on the E-KTP, sending the data to the Arduino Pro Mini. Installation of RFID reader module components with Arduino Pro Mini port can be seen in the table.

**Table 1**. RFID Reader Module Specification

| No | Parameter | Description |
|---|---|---|
| 1. | Supports Card | ISO/IEC14443A/MIFARE |
| 2. | Frequency | 13.56 MHz |
| 3. | VDDA (Working Voltage) | 2.5 – 3.6 Volt |
| 4. | IDDA (Work Flow) | 10 Ma |

**Table 2.** RFID Reader Pin Connection to Arduino Promini

| No | Name | Pin Arduino Pro Mini |
|---|---|---|
| 1. | NSS | Digital Pin 10 |
| 2. | MOSI | Digital Pin 11 |
| 3. | MISO | Digital Pin 12 |
| 4. | SCK | Digital Pin 13 |
| 5. | RST | Digital Pin 9 |
| 6. | GND | GND |
| 7. | VCC | 3.3 Volt DC |

Arduino Pro Mini will carry out the instructions that have been given; if the code is Appropriate, it will automatically activate the relay so that the solenoid is active and open the door, but if the code or ID number isnot approved, then the solenoid is active relay will (Off) and the door does not open.

## 3. Results and Discussion

### 3.1. *RFID Tag Code Reading Results*

This test was conducted using an RC522 RFID reader, 4 E-KTP, four white card type tags, and four key chain type tags to test the data and compare the data Weather data from the RFID reader can read information or not. Next, the data is processed on Arduino. Data from RFID module tests are shown in Table 3 below.

**Table 3.** RFID Tag Code Reading Results

| No | Kode RFID e-KTP | Tag RFID |
|---|---|---|
| 1. | C7167021 | e-KTP 1 |
| 2. | C7167046 | e-KTP 2 |
| 3. | C7167032 | e-KTP 3 |
| 4. | 45F42055 | e-KTP 4 |
| 5. | 162101663 | White Card 1 |
| 6. | 163254871 | White Card 2 |
| 7. | 161432022 | White Card 3 |
| 8. | 167895829 | White Card 4 |
| 9. | 331561985 | key chain 1 |
| 10. | 3343452767 | key chain 2 |
| 11. | 3377822291 | key chain 3 |
| 12. | 3355369397 | key chain 4 |

### 3.2. RFID Control System

Radio frequencies used by tags to send and receive signals affect performance, distance, operation,tag read speed, and frequency of RFID data used by RFID systems.:

- Band LF (Low Frequency) with a frequency range of 125 kHz – 134 kHz with a short

distance usage, approximately 50 cm, is for identification systems that only require short distances.

- Band HW (High Frequency) Operating at a frequency of 13.56 kHz with readings up to approximately 3m, this frequency is suitable for reading on RFID tags. It is also widely used to match items in industrial warehouses, buildings, or tracks requiring a reading speed of 10 to 100 RFID Tags/second.
- Band UHF (Ultra High Frequency) is about 915 MHz with a reading range of 9 m. UHF tags can be read at up to 1000 Tags/second speeds. It is usually widely used for tracking goods in truck containers.
- Microwaves of 2.4 GHz with a longer reading distance (10 m) experience more reflection of waves and objects around them and can interfere with the RFID reader's ability to communicate with RFID tags.

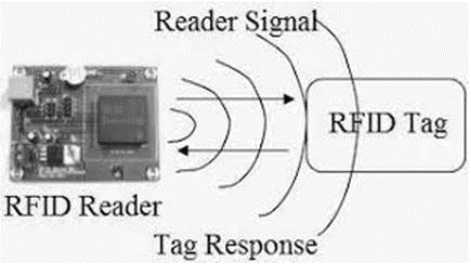


**Figure 7.** Tag Response and Reader Signal of RFID

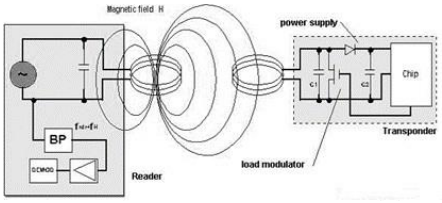


**Figure 8.** Reading Distance of RFID Tag Response

Arduino is an electronic kite or open-source electronic circuit board with the main component, a microcontroller chip with AVR type from the Atmel company. The microcontroller itself is a chip or IC (Integrated Circuit) that can be programmed using a computer. The purpose of embedding the program in a microcontroller is so that the electronic circuit can provide input, process the input, and then produce the output as desired. So the microcontroller serves as the 'brain' that controls the input and output of an electronic circuit. In general, Arduino consists of two parts:

- Hardware in the form of an open-source input/output (I/O) board.
- Software Arduino is also open-source, including Arduino IDE software to write programs on the computer, then transferred to Arduino.

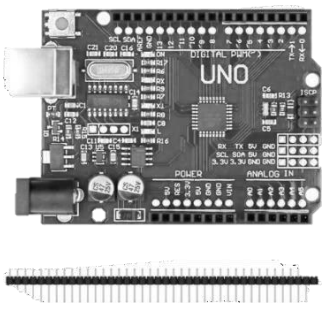


**Figure 9.** Arduino Board

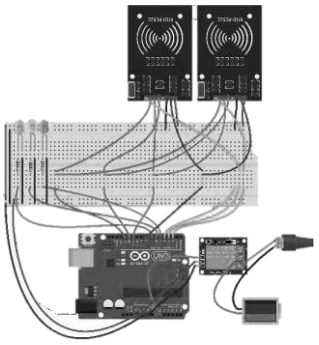

**Figure 10.** Circuit of Microcontroller programmed with Arduino Board

## 4. Conclusion

Based on the results of tests and observations that have been done on the locker security system with the use of radio frequency identification (RFID) technology on E-KTP for safety, we can conclude the following:

a. After doing 66 Arduino pro mini E-prom testing combinations, the data storage system is still stable and cannot be interfered with if given access to other types of RFID tags. The data recognition process is so sensitive that the design of these security tools is more secure.
b. This tool has been tested as capable of recording more than two locker users, namely as many as 15 locker users.
c. Effective read distance key chain type tag with a success rate of 100% read distance ≤ 2.5 cm for E-KTP user's effective read distance with a success rate of 100% is ≤ 3.5 cm and RFID white card tag type with a success rate of 100% read distance ≤ 5 cm, white card tag is the furthest read distance between E-KTP and key chain according to RC522 RFID reader datasheet.
d. After being tested, on the three types of RFID tags, the reading distance is different because the antenna design of each tag is different, affecting the distance of operation of its work.

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