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PARKING CROSS PROTOTYPE USING RFID AS A MICROCONTROLLER BASED PAYMENT TOOL

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ABSTRACT

The process control of the parking cross which is manually still has weaknesses. This weakness can be exemplified by the obligation to place someone to guard the bar so that it can be opened and closed when guests come in and out. And on the other hand the guards cannot memorize the faces of the guests who are allowed to enter through the bar. A well-structured parking system that is able to offer a variety of solutions to existing parking problems is the most needed parking system today. RFID (Radio Frequency Identification) can be the answer to build this system. In this research, a parking barrier lock system design automatically uses RFID. RFID is a technology to identify an object automatically (Automatic Identification System). The process of transferring data on RFID can occur without having to touch (contactless) between devices. RFID consists of 2 main components, namely a tag and a reader. The RFID Reader is used to read the ID numbers on the RFID card, and the Arduino Uno is the controller. With the development of a parking system using RFID, changing the manual parking system to a computerized system that provides a lot of facilities and controls that are more effective and efficient.

Keyword : Parking Crosss, Microcontroller, RFID.

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1. INTRODUCTION

Parking is a place to stop motor vehicles for a short or long period of time, according to the needs of the motorist. Based on its type, the parking system is divided into 2, namely: the first is the conventional parking system, which still uses parking tickets as proof of parking and the computerized parking system, which uses computer assistance to automate the parking process. Both types of parking systems have advantages and disadvantages. For conventional parking systems, the advantages are that it is familiar, easy to use, and does not require technology investment.

On the other hand, this system has a weakness, namely the frequent errors in writing tickets by parking attendants, resulting in a long service time due to duplicate ticket rewriting processes. Another weakness is the waste of parking paper and unrecorded transaction data. The current parking system is still conventional, namely by means of the officer recording the vehicle number on a paper and then giving it to parking users. Payment transactions made by parking users are also less efficient, because the officer error rate when calculating parking fees and change is high. In everyday life, humans cannot be separated from the various uses of technology, especially RFID (Radio Frequency Identification) technology.

RFID technology is very influential in various aspects such as control systems, identification, security, payments and so on. At this time the attention to RFID is increasing. RFID is used as a tool to automatically control a chain of activities [Charles and Fakhruddin, 2014]. Another factor that causes the use of RFID is the speed of reading data, the minimum error rate in reading data, and flexibility Suryadiputra, 2010]. One of the applications of RFID technology is the use of RFID which is used as a key to open parking latches.

2. LETERATURE REVIEW

2.1. RFID (Radio Frequency Identification)

RFID is an automatic identification technology based on remote data storage and reception using an RFID tag. RFID tags can be in the form of cards (cards), key chains, stickers. RFID is equipped with the ability to read (ReadOnly) or read and write (Read / Write). RFID uses a reader and special equipment that is owned by RFID. RFID uses RF (Radio Waves / Electromagnetic Waves) signals to transfer the RFID device to the reader. RFID technology works by utilizing radio transmission frequency waves to identify an object in the form of a small device called a tag or transponder (transmitter + responder). The identification system in RFID is a type of automatic identification system that aims to allow the data transmitted by the RFID tag to be read by an RFID reader which will then be processed according to the needs of the application being made. Data received by the RFID reader is data obtained from the process of transmitting data from the tag. The data is a unique number arrangement that contains identification information that can be used for smart card applications, location searches, and specific information contained in a tagged product.

2.2. Arduino Uno Microcontroller

Arduino Uno is a board that uses the ATmega328 microcontroller. The Arduino Uno has 14 digital pins (6 pins can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power supply connector, an ICSP header, and a reset button. Arduino Uno contains everything needed to support a microcontroller. Just connecting it to a computer via USB or providing DC voltage from a battery or AC to DC adapter can make it work. The Arduino Uno uses the ATmega16U2 programmed as a USB to serial converter for serial communication to a computer via the USB port. "Uno" means one in Italian and was named to mark the release of Arduino 1.0. Version 1.0 is the reference version of Arduino in the future. The top view of Arduino Uno can be seen in Figure 1. The Arduino programming language is a C language that has been simplified with its programming language so that it makes it easier to learn and explore the microcontroller.

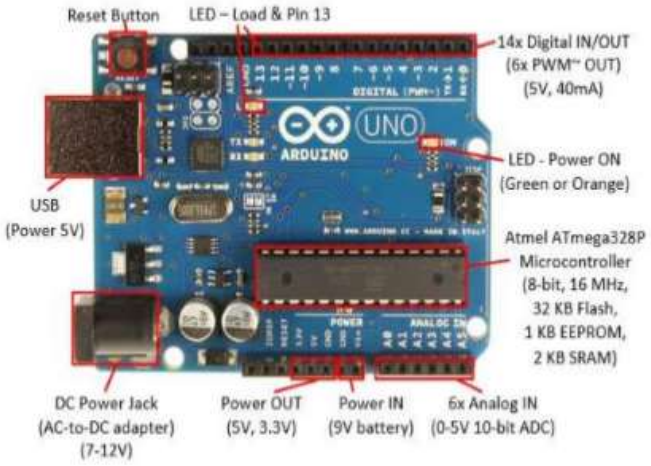

Fig 1. Arduino UNO
(Source: www.ntu.edu.sg/home/ehchua/programming/arduino/Arduino.html)

2.3. Servo Motor

A servo motor is a device or rotary actuator (motor) designed with a closed-loop (servo) feedback control system, so that it can be set-up or adjusted to determine and ensure the angular position of the motor output shaft. servo motor is a device consisting of a DC motor, a series of gears, a control circuit and a potentiometer. A series of gears attached to the DC motor shaft will slow down the rotation of the shaft and increase the torque of the servo motor, while the potentiometer with its resistance changes when the motor rotates functions as a determinant of the position of the servo motor shaft rotation. The use of a closed loop control system on the servo motor is useful for controlling the movement and final position of the servo motor shaft.

2.4. Infrared

Infrared (infra red) is an electromagnetic beam whose wavelength is longer than visible light, but shorter than radio wave radiation. Infrared radiation has a wavelength between 700 nm to 1 mm and is in the red spectrum. Infrared rays are light that is not visible. When viewed with a light spectroscope, infrared light radiation will appear on the electromagnetic spectrum with a wavelength above the wavelength of red light. With this wavelength, infrared light will not be visible to the eye, but the heat radiation it causes is still felt / detected.

2.5. Photodiode Sensor

Photodiode is a type of diode whose resistance will change when exposed to light rays sent by the transmitter "LED". The resistance of the photodiode is influenced by the intensity of the light it receives, the more light it receives, the smaller the resistance of the photodiode and vice versa if the less light intensity is received by the photodiode sensor, the greater the resistance value. Irmatrianjaswatifst11.web.unair.ac.id "Photodiode Sensor" (trianjaswati: 2012). Photodiode sensors are the same as LDR sensors, changing the amount of light received by the sensor into a change in conductance (the ability of an object to conduct an electric current from a material). As seen in Figure 2.13 is the physical form of the photodiode sensor.

2.6. LCD (Liquid Crystal Display)

LCD is an electronic component that functions as a display of data, either characters, letters, or graphics. LCD requires a small voltage and power so it is often used for applications in calculators, digital watches, and electronic instruments such as digital multimeters. LCD utilizes silicon and gallium in the form of liquid crystals as light emitters. On an LCD screen, each matrix is a two-dimensional arrangement of pixels divided into rows and columns. Thus, each row and column meeting consists of an LED in the backplane, which is a glass plate on the back with an inner side covered by a layer of transparent electrodes. Under normal circumstances, the liquid used has a bright color. Then certain areas of the liquid will turn black when a voltage is applied between the background plane and the electrode pattern found on the inside of the front glass. The advantages of using an LCD are relatively small power consumption and draw a small current (several micro amperes), so that the tool or system becomes portable because it can use a small power supply. (Setiawan, "Bascom-AVR ATMEGA 8535 Microcontroller", 2010: 24-27). As seen in Figure 2 is an image of the physical form of the 16x2 LCD.

Fig 2. LCD
(Source : http://www.leselektronika.com)

3. RESULTS AND DISCUSSION

3.1. System Design

This parking latch system will be designed automatically using Arduino. With the design of this system, access in and out through the parking barrier system can be more assisted. In order to make the system easier, the initial step is to make a block diagram of the system. This block diagram illustrates how the overall circuit works in general. The block diagram of this system is as follows:

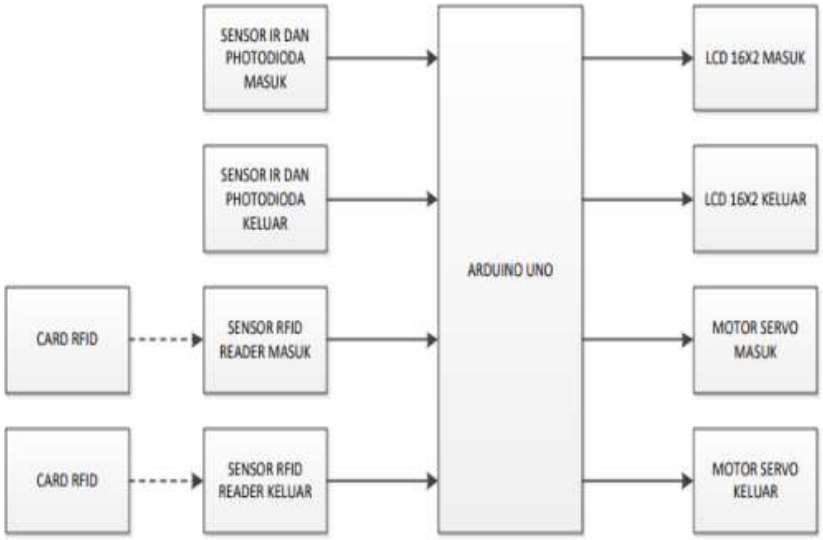

Fig 3. Block diagram of the system

The following is an explanation of Figure 3:

a. The input block contained in the input block is in the form of an RFID card as an identifier for access in and out, an RFID Reader for reading the RFID card, an IR sensor and a photodiode as an object detector, so that the parking bar is closed again when the object has moved away.
b. The Process Block contained in the Microcontroller block. The microcontroller used is the Arduino Uno which functions to process and process input from RFID into output in the form of a display on the LCD and provide access to the servo.
c. The output blocks contained in the output block are LCD and Servo which will later display information and provide access.
d. The overall system design is to combine all series of components into one, where all components are connected to the Arduino Uno. The overall system design can be seen in Figure 4. While the software design uses Arduino IDE 1.8.5 based on the C language as the programming language used. The programming that is carried out as a whole must be in accordance with the system flowchart, namely:
e. Input and Output Initialization: The process by which the first system must be connected to the Microcontroller.
f. Check incoming RFID: The process by which to check whether the RFID card is detected or not.
g. Is the card registered: The process by which to check whether the card is registered or not, the results will be displayed on the LCD.
h. If it is registered: a process where after the card is registered the system will process it, if it is not registered then the bar will not open.
i. Show on lcd: the process by which the LCD will display the name of the owner of the RFID card.
j. Open entry parking barrier: the process by which the parking barrier automatically opens.
k. Check IR sensor and Photodiode entry: a process where the IR sensor and Photodiode will process the presence of a passing object, if so then the parking bar will be closed after the object has passed.

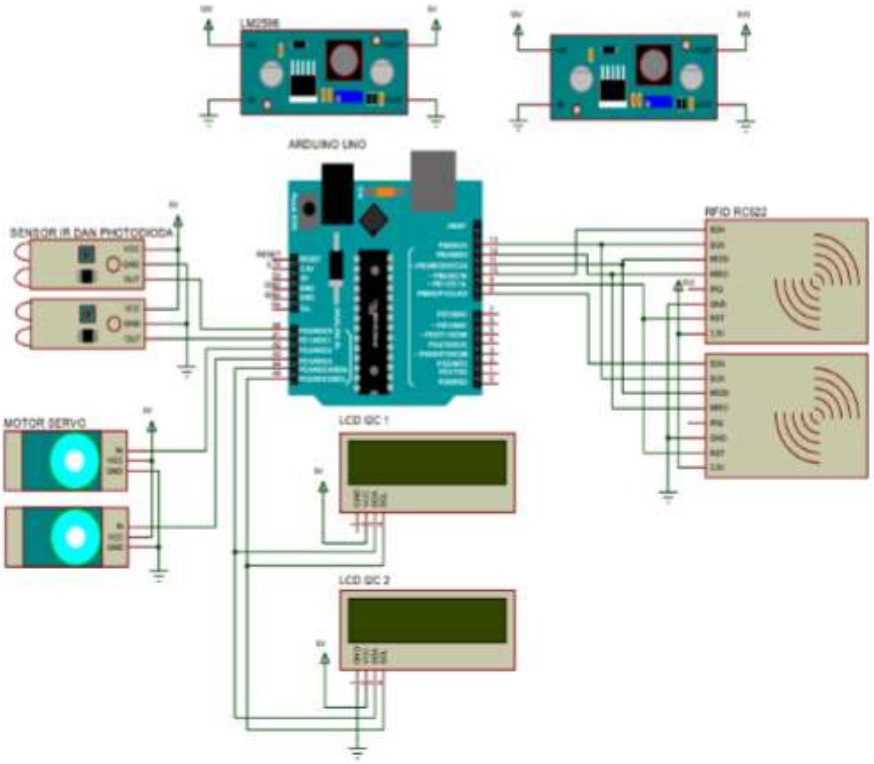

Fig 4. The whole system circuit

3.2. Discussion

The following describes the implementation of the parking crossbar prototype using RFID as the key, where the system unit consists of Arduino Uno, RFID, Servo, and LCD. These components are designed in such a way as to look neat, and the results of the design can be seen in Figure 5. The stress test on the tool is carried out using a digital multimeter on the components to be measured. The parts to be tested are the source voltage and output voltage on the device which consists of measuring the power supply output voltage, measuring the IR and photodiode voltages, and testing the RFID.

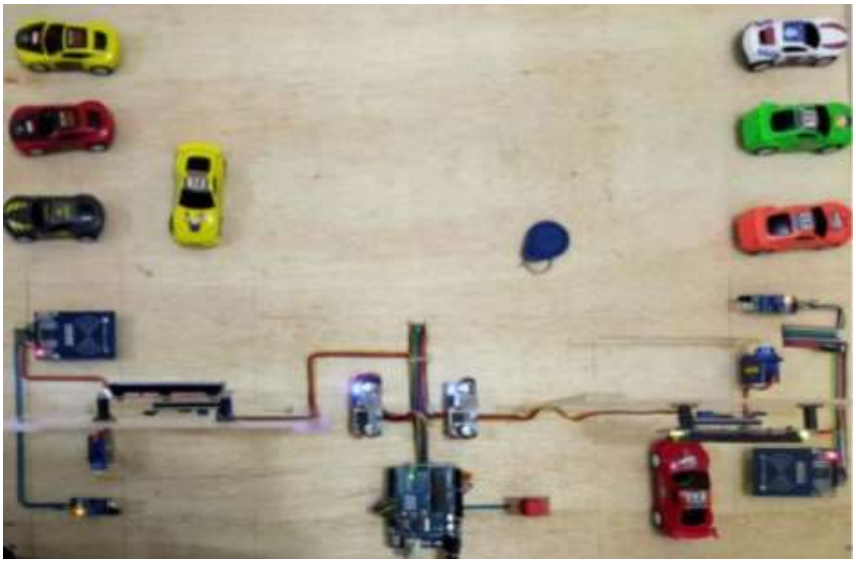

Fig 5. Design result system

Testing the distance between the RFID reader and detecting the RFID Card can be seen in table 1 below:

Table 1. Testing the detection distance

Detection distance	Detection Results
0 cm	Detected
0.5 cm	Detected
1 cm	Detected
2 cm	Detected
2.5 cm	Detected
3 cm	Detected
3.5 cm	Detected
4 cm	Detected
4.5 cm	Not Detected
5 cm	Not Detected

The detection results column in table 1 is obtained by looking at the display on the LCD screen as shown in Figure 6. The data collection procedure is as follows:
1. Prepare the RFID card that has been registered to the RFID reader
2. Set the distance as shown in the detection distance column in table 1.
3. Position the RFID card as in point 2, then observe on the LCD. If there is a text that appears as shown in Figure 6, then write "Detected" in the detection results column in table 1.

Fig 6. Display Example

4. CONCLUSION

Arduino plays an important role in the system because it can regulate and control the overall system performance, only registered RFID cards have the right to enter. From the results of several tests, the RFID reader has a delay time of approximately 3 seconds in reading the RFID card, the ideal distance is 3 cm to 4 cm, while the distance of 4.5 cm cannot be read.

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