PROTOTYPE DESIGN OF PARKING SLOT AVAILABILITY INFORMATION SYSTEM USING ARDUINO UNO AT NABIRE AIRPORT CENTRAL PAPUA

Demianus Yogi[1], Sofyan [2], Zulkarnin [3]

[1,2,] Computer Science, Kreatindo College of Management Manokwari, Indonesia
[3] Information Systems, Kreatindo College of Management Manokwari, Indonesia

Yogidemianus06@email.com[1], *sofyanarifin018@email.com*[2], *nain.g4t@email.com*[3]

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ABSTRACT

The increasing number of vehicles and limited transportation infrastructure are common problems at Nabire Airport, Central Papua Province. In the current parking area monitoring process, manual methods are still used to determine the number and availability of capacity in the parking area. The research process is carried out in several ways, such as recording the number of vehicles entering and directly observing the condition of the vehicles that are parked. The method of developing a parking slot availability information system using Arduino Uno at Nabire Airport, Central Papua Province, will follow an adaptive and responsive software development approach. The system development method used is the incremental model. This model was chosen because it allows for gradual system development, allowing for the addition of features iteratively based on user needs and feedback in the Purpose of Designing a Prototype of a Parking Slot Availability Information System Reducing Waiting Time Minimizing in Improving User Experience to Provide comfort and satisfaction to users by simplifying the Nabire Airport parking process 1.Optimizing Parking Slot Usage: Helping in better parking slot management.

*Keywords***: *Parking Area, Arduino Uno, Sensor, LCD, Indicator*

A.   INTRODUCTION

In today's digital age, efficiency and practicality in every aspect of life is very important, including in the management of parking in public facilities is a critical aspect in the planning and efficient operation of urban infrastructure but the main challenges in parking management include optimal use of space, to ensure accessibility for users, reduce traffic congestion, and minimization of environmental impacts so that some important aspects of parking management in public facilities, as well as strategies that can be applied to overcome challenges in Indonesian airports, especially Nabire airport, as one of the main gateways in Central Papua.

Problems that occur insufficient parking space or an inefficient parking management system can cause congestion and inconvenience for airport users to cause parking users to have to turn back their vehicles to find parking locations and also the lack of a correct and timely flight information system can cause inconvenience for users in the parking lot to design and implement a parking slot availability information system using Arduino Uno for Nabire airport, Central Papua.

The solution to the implementation of the parking slot availability information system using Arduino Uno at Nabire airport, in this problem can streamline time, energy, and gasoline for visitors who bring vehicles needing parking slot information. The availability of information will simplify and speed up the process of finding parking slots, to

based on this, the authors make a tool "Prototype of parking slot availability using Arduino Uno." To find out the availability of parking slots using a microcontroller and apply the concept and testing of the tools made in an open room at Nabire airport.

The study aims to design and implement a parking slot availability information system using Arduino Uno for Nabire airport, Central Papua. The system will integrate several technologies, including sensors to detect parking slot availability, Arduino Uno as a microcontroller to process data from sensors, and wireless communication to send availability information to end users.

B. RESEARCH METHOD

Methods The development of a parking slot availability information system using Arduino Uno at Nabire airport, Central Papua province, will follow an adaptive and responsive software development approach. The system development method to be used is the incremental model. This model was chosen because it allows the development of the system in stages, allowing the addition of features iteratively based on the needs and feedback from users. The following are the stages of system development using the Incremental Model.

1. Diagram Blok Sirkuit

The series of block diagrams that run on the design of this tool can be seen in the picture below:
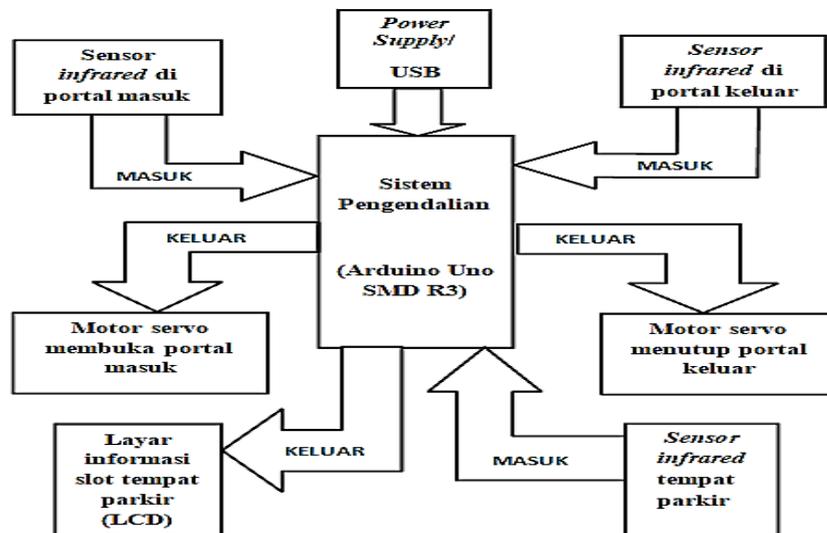

Figure 3.1 Circuit Block Diagram

The function of each block that is above this:
   a) Power supply / USB, functions as a voltage to provide electrical power to turn on the arduino microcontroller.
   b) Arduino microcontroller, as a control device that converts data or processes objects into data.
   c) Infrared sensor, functions as an object reader (input) and sends data to the Arduino

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uno microcontroller.
d) Servo motor, functions as a means of driving the entrance portal and exit portal.
e) LCD, functions as a means of providing information on the availability of parking slots.

2. Flowchart

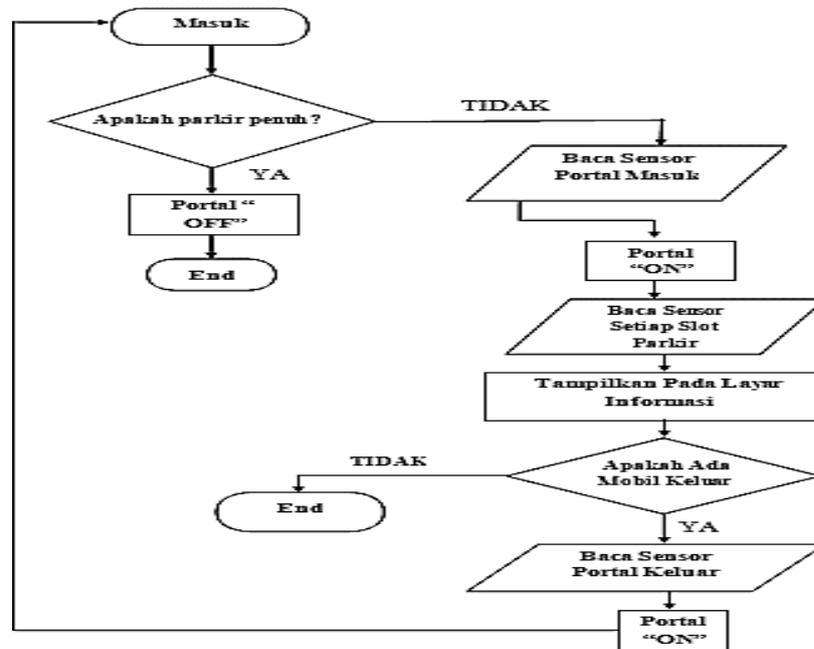The flowchart of this design can be seen below:

Figure 3.2. Flowchart

In Figure 3.2 the arduino will receive input from the infrared sensor placed at the entrance, then the arduino will process the input to turn on the servo motor so that the door portal opens, but if the parking lot is full then the servo motor will not work, resulting in the entrance portal will not open. Arduino will receive input from the infrared sensor that detects each parking slot, then Arduino will process the input to display the condition of the parking lot that is filled or not filled on the LCD screen that will be installed at the entrance. Arduino will receive input from infrared sensor 1 and infrared sensor 2 placed at the exit, then the arduino will process the input to turn on the servo motor so that the exit portal opens. The system will continue to run if the arduino is given a voltage source from the power supply.

3. Overall Tool Set
Ardino Uno and IR Sensor
The following is a brief explanation of the Arduino Uno circuit with the IR sensor
Figure 3.3 IR Sensor and Ardino Uno circuit
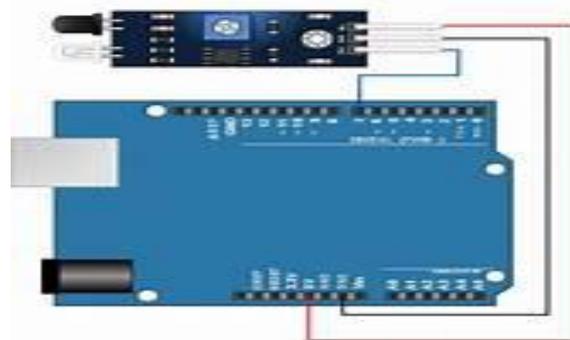
1.Main Components

Arduino Uno: A microcontroller board used to control the IR Sensor circuit (e.g. TSOP38238): Detects the infrared signal from the remote control in the automatic doorstop. Ardino Circuit to Lcd Module

LCD (Liquid Crystal Display) modules are used to display information such as text, numbers, or graphics. In Arduino projects, LCDs are often used to provide visual feedback to users.

Figure 3.4 LCD Module Ir and Ardino Uno Rangkaiyan
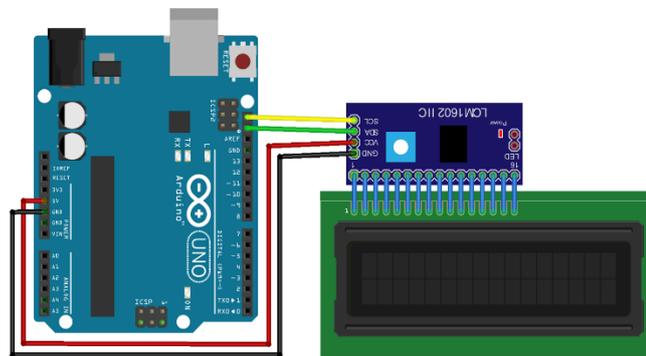
2. Required Components:

- Arduino Uno: A microcontroller board for processing data and controlling other devices.
- 16x2 LCD module: Displays 16 characters per line and has two rows.
- Potentiometer (10kΩ): Adjusts the contrast of the LCD display.
- Jumper wires: For connecting components.

Ardino to IR Output Circuit

The following is an explanation of the circuit between Arduino and the IR (infrared) module, as well as its function.
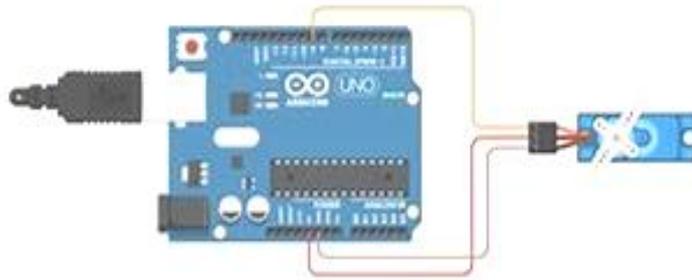
Figure 3.3 Circuit of IR Sensor and Ardino Uno
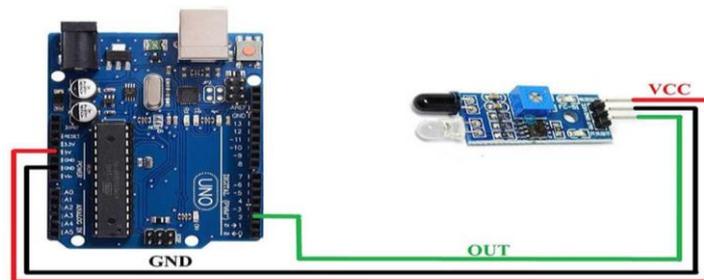
3. Circuit for IR Receiver:

If we also want to send IR signals, here is the circuit for IR infrered.

Arduino To IR Servo Circuit

To string an Arduino with a servo motor controlled via IR signals, you will need a few components and certain steps. Here is the full explanation:
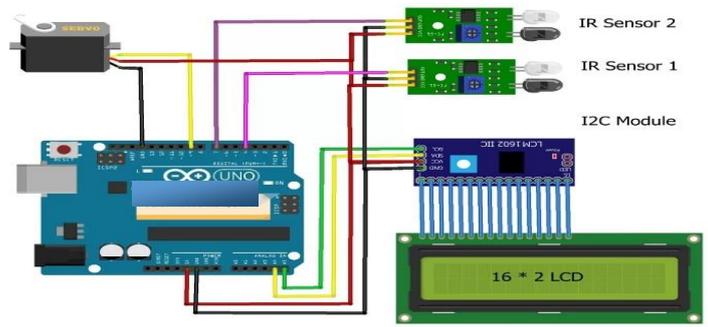
Figure 3.5 Circuit of Servo Motor and Ardino Uno

4. Circuit Connection
   Here are the steps
   Overall Design of t
   The overall circuit   main components,
   such as IR sensors, drive motors, and control systems. The following are the steps and
   components that need to be considered in the picture below:

Figure 3.6 Servo Motor Circuit and Ardino Uno

Here is a guide to assembling a servo motor, infrared (IR) sensor, and LCD using an Arduino Uno. This circuit can be used for simple projects, such as controlling a servo motor based on detection from an IR sensor and displaying the status on an LCD.

C. RESULTS AND DISCUSSION

The results of the design of the parking system design tool and the availability of automatic parking slots using Arduino carried out by researchers are applied in the form of prototypes and simulations, where the initial step of the process of this tool starts when a new car enters the parking area and at the same time the driver will see an LCD screen in the front area of the parking lot, the LCD in front of the parking lot will provide information about the status or condition of the parking area. If the condition on the LCD screen shows that the parking slot is full, the entrance portal will not open automatically through the detection of the inprared sensor.

Then the design stage is carried out after the hardware and software needs analysis stage has been carried out. Based on the previous chapter regarding the design of the system in the form of block diagrams and flowcharts, as well as the design of the tool design, the research results of the automatic slot availability parking pototype using Arduino Uno can be seen in Figure 4.1 below:

Figure 4.1 View of the Automatic Parking Tool
Source: Photo by Damianus Yogi 2024

Infrared sensor 1 and infrared sensor 2 which can detect 2 pieces of Infrared DT I/O Sensor as a car detector that wants to enter or exit the parking area, the detected car acts as input data that will give commands to the driving servo motor to open and close the doorstop automatically using this Arduino Uno which is as follows:Gambar 4.3 Peletakan Sensor ir *Input* dan *Output*

Source: Photo by Damianus Yogi 2024
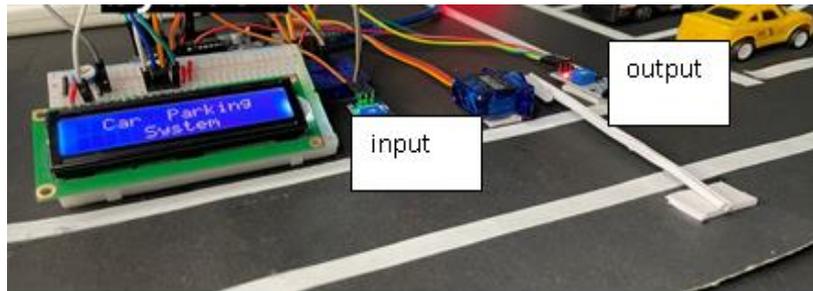
Infrared Sensor Testing1

Infrared sensor testing is connected to Arduino Uno, to determine the level of ability to read the distance of infrared sensor 1 (output) and sensor (input) to the object in front of it, the servo motor will detect the incoming vehicle when the object is detected and the servo motor will open, then the distance measurement results by the sensor will open and close the test Table 4.1.

Table 4.1 Infrared Sensor Testing Results

Trial Sample	Time Distance (cm)	Conditions	Description
Infrared sensors 1 and 2 output and input	1 cm	On	Ir Detected
	2 cm	On	Detected Ir
	3 cm	On	Detected Ir
	4 cm	On	Detected Ir
	5 cm	Off	Not Detected Ir
	6 cm	Off	Not Detected Ir
	7 cm	Off	Not Detected Ir

2024 research

Table 4.2 Servo Motor Testing Results

Trial Sample	Distance (cm)	Conditions	Description
	150 cm	Off	Less upright
	100 cm	Off	Less upright
	90 cm	On	Upright

Source: Primary data from research 2024

Table 4.3 Ir Output Sensor Testing

Table 4.1 above is the result of testing the Ir Sensor (input and Output) by using a sensor with a distance of less than 4 cm, the condition is on, the servo motor opens and does not

import through the LCD if slot 1 is empty, the door will automatically open and the parking lot is provided if the parking slot is full, it will not open and will inform the full parking lot through the LCD.

no	Form Name	Testing Conditions	Testing Results
1.	Sensor Inframerah Ir	Putting a car in front of the infrared sensor beam	Servo motor automatically opens
		Move a car away from the infrared sensor beam.	Servo motor closes automatically
		Placing and dropping a car right in front of the infrared sensor beam in darkness	Can still input and send instructions to the servo motor (no light influence)
2.	Sensor Ir	Placing a car right in front of the beam of the infrared sensor module	Performs the counting process by subtracting the previous remaining slot by -1.
		Keeping a car in front of the beam of the infrared sensor module.	Perform the counting process by adding the previous remaining slot by +1.
		Putting and dropping a car right in front of the beam of the infrared sensor module in dark light.	Can still perform the counting process (no light effect)

Arduino Uno Program Implementation

The Arduino Uno application is used to program to run commands according to the desired way of working. Programming is designed using an automatic doorstop vehicle using the following programming language coding to display data on the lcd

Figure 4.4 Ardino Uno LCD Coding
Source: Primary data from research 2024

1. Parking Slot Testing

Table 4.5 Empty Parking Slot Testing

Parking Slots	Correct Parking Slot Detection	Description
Blank	0	Successful

Figure 4.5 Testing Empty Parking Slots
Source: Photo by Damianus Yogi 2024

2. Full Parking S
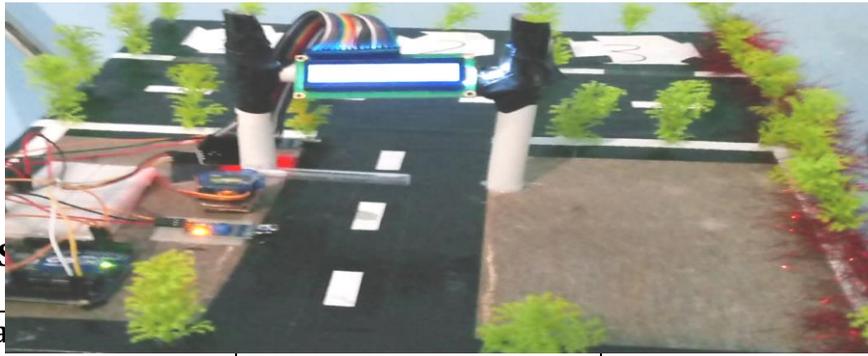
Pa...		
	Detection	
Full	3	Successful

Figure 4.6 State of Full Slot Parking
Source: Photo by Damianus Yogi 2024

3. Testing Empty Parking Slot 1

Table 4.7 Testing Empty Parking Slot 1

Parking Slots	Correct Parking Slot Detection	Description
Blank 1	2	Successful

Figure 4.7 State of Empty Slot 1 Parking
Source: Photo by Damianus Yogi 2024

4. Testing Empty Parking Slot 2

Table 4.8 Testing Empty Parking Slot 2

Parking Slots	Correct Parking Slot Detection	Description

Blank 2	1	Successful

Figure 4.8 State of Empty Slot 2 Parking
Source: Photo by Damianus Yogi 2024

Here is the LCD Display of Parking Conditions

Figure 4.9 LCD Display of Empty Slot 1 Parking Condition
Source: Photo by Damianus Yogi 2024

Figure 4.10 LCD display of empty slot 2 parking condition
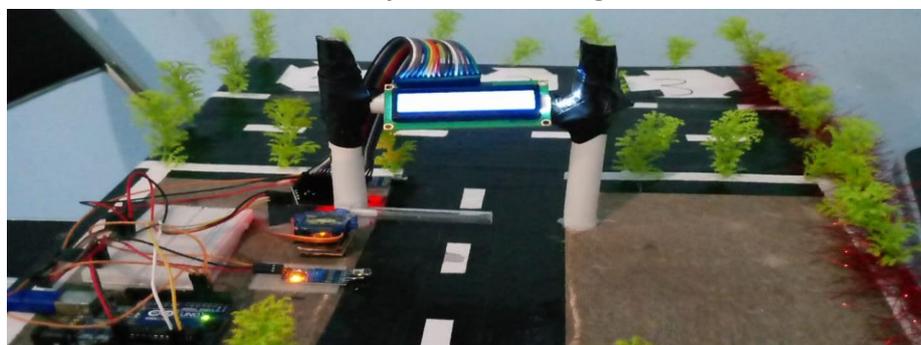Source: Photo by Damianus Yogi 2024

Figure 4.11 LCD display of empty slot 3 parking condition
Source: Photo by Damianus Yogi 2024

Figure 4.12 LCD Display of Slot 0 Parking Condition
Source: Photo by Damianus Yogi 2024

Figure 4.14 Display of All Front Parking Slots
Source: Photo by Damianus Yogi 2024

D. CONCLUSION

From the results of designing and building a car parking slot parking system based on Infrared sensors and I2C LCD, the following conclusions can be drawn: The design of the car parking slot system at Nabire airport is designed in accordance with the program or tool that has been made. Where the design is several variations, namely empty parking slots / no parking cars, full parking slots, empty parking slots 1, and empty parking slots 2. Correct parking slot detection and successful information system integration of parking slot

availability, a system intended to facilitate the location of available parking, so that the infrastructure and traffic policies at Nabire airport can function efficiently.

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