

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

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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 the contemporary era characterized by rapid digital advancements, the importance of efficiency and practicality permeates every facet of daily life, and this is particularly evident in the realm of parking management within public facilities, which plays a pivotal role in the strategic planning and operational effectiveness of urban infrastructure. However, it is imperative to recognize that there are significant challenges inherent in parking management, which encompass the optimal utilization of available space, the assurance of accessibility for all users, the alleviation of traffic congestion, and the reduction of environmental impacts, all of which are critical considerations in the context of parking management at public facilities. Additionally, there exist specific strategies that can be effectively employed to tackle these challenges, particularly at Indonesian airports, with a focus on Nabire Airport, which serves as one of the principal gateways to Central Papua.

The difficulties arising from inadequate parking space or the implementation of an inefficient parking management system can lead to significant congestion and inconvenience for airport patrons, necessitating that drivers repeatedly circle back in search of available parking locations, while the absence of accurate and timely flight information systems can further exacerbate the frustrations experienced by users attempting to navigate parking areas. This situation underscores the necessity for designing and implementing an innovative parking slot availability information system utilizing Arduino Uno technology specifically tailored for Nabire Airport in Papua, Central Papua, aimed at addressing these pressing issues.

The proposed solution to implement a parking slot availability information system that leverages the capabilities of Arduino Uno at Nabire Airport aims to optimize the experience for visitors who arrive in vehicles and require up-to-date information regarding available parking slots, thereby conserving valuable time, energy, and fuel. The provision of real-time

availability information is anticipated to significantly simplify and expedite the process of locating suitable parking spaces, which is why the author has undertaken the development of the prototype titled “Prototype Availability of Parking Slots Using Arduino Uno.” This innovative tool is designed to ascertain the availability of parking slots through the utilization of a microcontroller, with the concept and functionality of the device being rigorously tested in an open setting at Nabire Airport.

The primary objective of this study is to meticulously design and implement a comprehensive parking slot availability information system using Arduino Uno specifically for Nabire Airport, located in Central Papua. This system is envisioned to seamlessly integrate a variety of advanced technologies, including sensors that are capable of detecting the occupancy status of parking slots, the Arduino Uno functioning as a microcontroller responsible for processing data gleaned from these sensors, and wireless communication mechanisms that will disseminate real-time availability information to end users, ultimately enhancing the overall parking experience.

B. METODE PENELITIAN

The approach to developing a sophisticated parking slot availability information system utilizing the Arduino Uno platform, which is intended for implementation at Nabire Airport located in the Central Papua province, will adhere strictly to an adaptive and responsive software development methodology that is designed to meet dynamic user needs. The specific system development methodology that will be employed for this endeavor is the incremental model, which is characterized by its capacity to facilitate the gradual and systematic enhancement of the system over time. This particular model has been strategically chosen due to its inherent flexibility, as it permits the step-by-step addition of new features and functionalities that can be integrated iteratively, reflecting the evolving requirements and valuable feedback provided by the end-users throughout the development process. Presented below are the comprehensive stages involved in the system development lifecycle, all of which will be guided by the principles of the Incremental Model, ensuring that each phase builds upon the last while remaining responsive to ongoing user input and testing.

Circuit Block Diagram

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

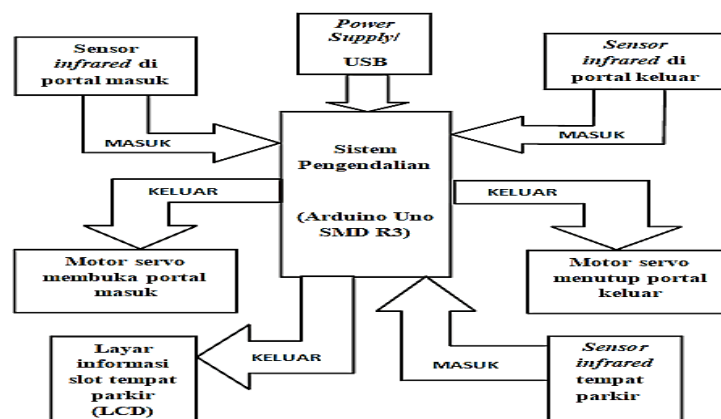


Figure 3.1 Circuit Block Diagram

The function of each block that is above this:

1. Power supply / USB, functions as a voltage to provide electrical power to turn on the arduino microcontroller.
2. Arduino microcontroller, as a control device that converts data or processes objects into data.
3. Infrared sensor, functions as an object reader (input) and sends data to the Arduino uno microcontroller.
4. Servo motor, functions as a means of driving the entrance portal and exit portal.
5. 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:

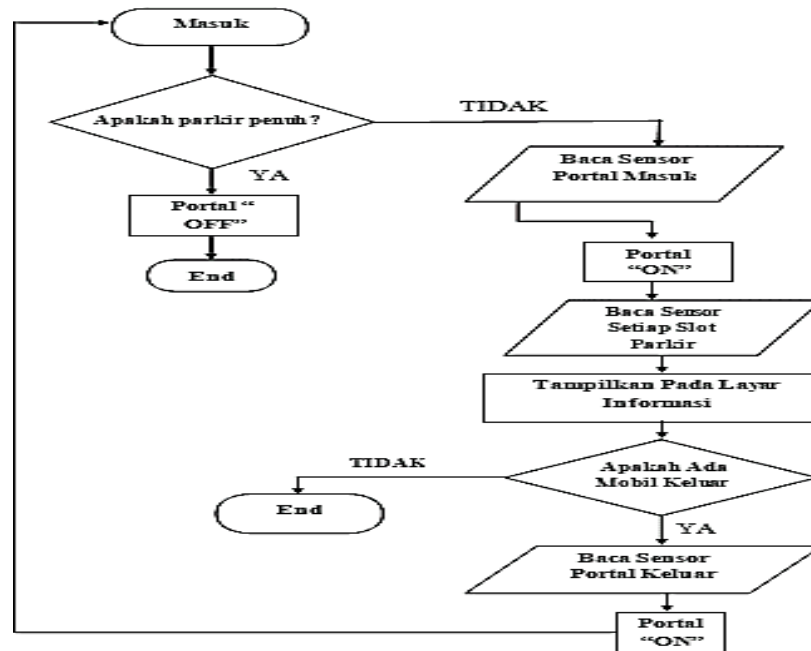


Figure 3.2. Flowchart

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

Arduino Uno Relay and Ir Sensor

The following is a brief explanation of the Arduino Uno circuit with the IR sensor

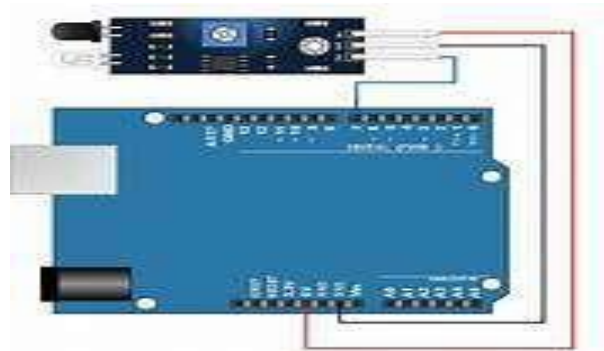


Figure 3.3 Arduino Uno and Ir Sensor Assemblies

1. 1. Main Components

Arduino Uno: A microcontroller board used to control IR Sensor circuits (e.g. TSOP38238): Detects infrared signals from the remote control in the automatic doorstop.

Arduino 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.

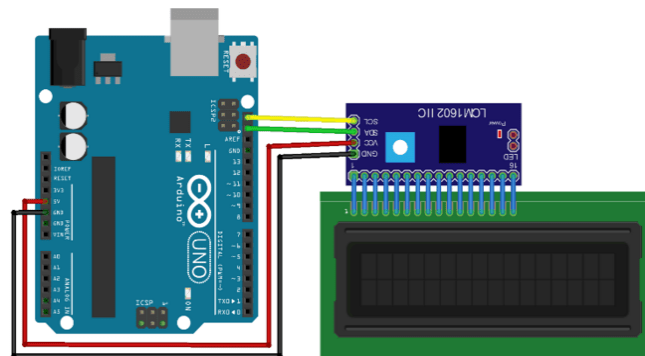


Figure 3.4 LCD Module Ir and Arduino Uno assembly

1. 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.

Arduino To Ir Output circuit

The following is an explanation of the circuit between the Arduino and the IR (infrared) module, as well as its function.

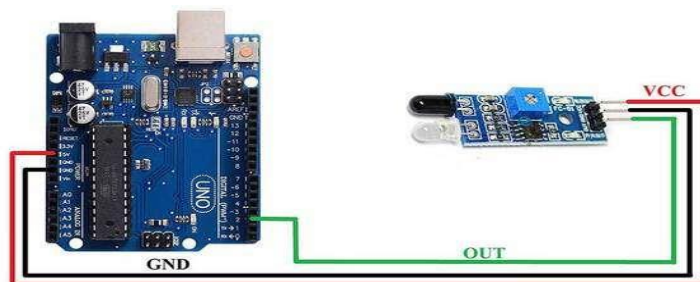


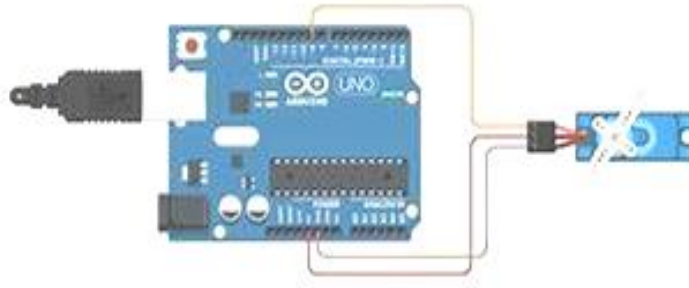
Figure 3.3 Arduino Uno and Ir Sensor Assemblies

1. Circuit for IR Receiver:

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

Arduino to Ir Servo circuit

To string an Arduino with a servo motor controlled via an IR signal, you will need some components and certain steps. Here is the full explanation:



Gambar 3.5 Rangkaian Motor Servo Dan Arduino Uno

Circuit Connection

Here are the steps to connect the Arduino, IR Receiver, and Servo Motor

In-circuit design of the automatic doorstop

The overall circuit design for an automatic doorstop can include several major components, such as Ir sensors, drive motors, and control systems. The following are the steps and components that need to be considered in this figure:

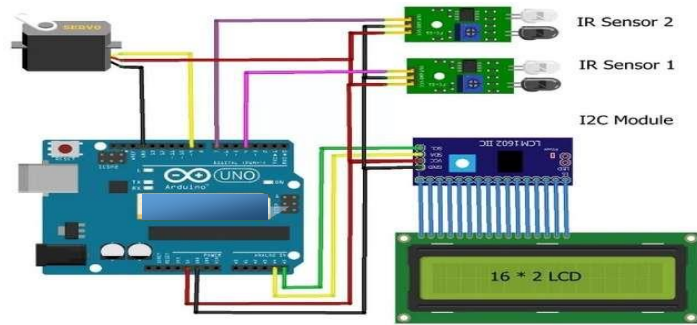


Figure 3.6 Series of Servo Motor and Arduino Uno

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 infrared 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 Automatic Parking Device

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:

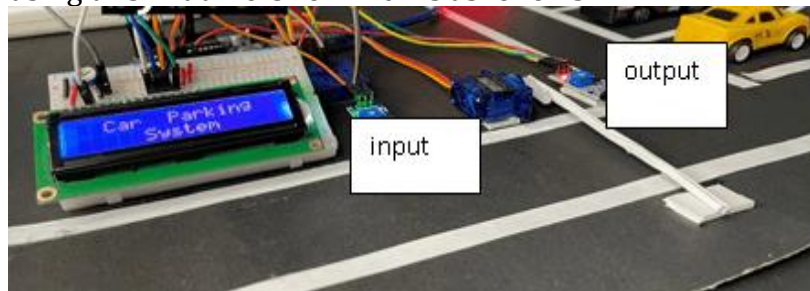


Figure 4.3 Sensor placement ir Input and Output

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)	Kondisi	Description
Sensor inframerah 1 dan 2 keluaran dan masukan	1 cm	On	IR detected
	2 cm	On	IR detected
	3 cm	On	IR detected
	4 cm	On	IR detected
	5 cm	Off	IR not detected
	6 cm	Off	IR not detected

	7 cm	Off	IR not detected
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Table 4.2 Servo Motor Testing Results

Trial Sample	Distance (cm)	Kondisi	Explanation
	150 cm	Off	Very upright
	100 cm	Off	Less upright
	90 cm	On	Upright

Table 4.2 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	Formulir Nama	Testing Conditions	Testing Results
1.	Sensor Inframerah Ir	Placing a car in front of the infrared sensor beam	Servo motor opens automatically
		Keep a car in front of the infrared sensor beam.	Servo motor closed automatically
		Placing and dropping a car right in front of the infrared sensor beam in a dark light environment	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 remaining previous slot by -1.
		Keep a car in front of the beam of the infrared sensor module.	Performs the counting process by adding the remaining previous slots by +1.
		Place and drop a car right in front of the beam of the infrared sensor module in dark light.	Can still perform the calculation process (no light influence)

Implemented Program Arduino Uno

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 Coding the Arduino Uno LCD

```

jadit
#include <LiquidCrystal.h>
// Created by Simple Circuits
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27,16,2);
#include <Servo.h>
Servo myservo;

int IR1 = 3;
int IR2 = 4;
int Slot = 3;           //Total number of parking Slots

int Flag1 = 0;
int Flag2 = 0;
void setup() {

Serial.begin(9600);
lcd.init(); //initialize the lcd
lcd.backlight(); //open the backlight

pinMode (IR1, INPUT);
pinMode (IR2, INPUT);
myservo.attach(5);
myservo.write(100);

```

Pengujian Slot Parkir

Table 4.5 Empty Parking Slot Testing

Slot Parkir	Correct Parking Slot Detection	Description
Kosong	0	Successful

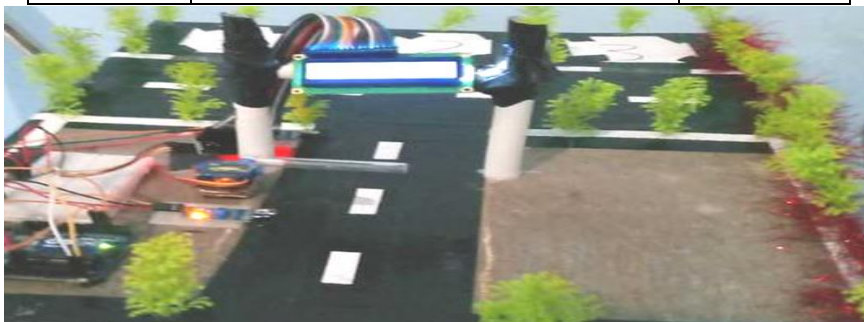


Figure 4.5 Testing Empty Parking Slots

Full Parking Slot Testing

Table 4.6 Full Parking Slot Testing

Slot Parkir	Correct Parking Slot Detection	Description
Full	3	Successful

Figure 4.6 State of Full Slot Parking



Testing Empty Parking Slot 1

Table 4.7 Testing Empty Parking Slot 1

Slot Parkir	Correct Parking Slot Detection	Description
Kosong 1	2	Berhasil

Figure 4.7 State of Empty Slot 1 Parking



Empty Parking Slot 2 Testing

Table 4.8 Testing Empty Parking Slot 2

Slot Parkir	Correct Parking Slot Detection	Description
Kosong 2	1	Successful

Figure 4.8 State of Empty Slot 2 Parking



Here is the LCD Display of Parking Conditions



Figure 4.9 LCD Display of Empty Slot 1 Parking Condition



Figure 4.10 LCD display of empty slot parking condition 2

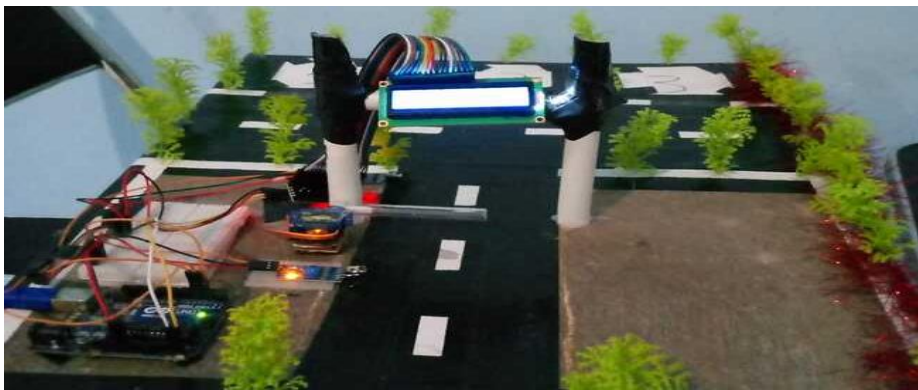


Figure 4.11 LCD display of empty slot parking condition 3



Figure 4.12 LCD Display Slot 0 Parking Condition



Figure 4.14 Display of All Front Parking Slots



CONCLUSION

Based on the design and implementation of the car parking slot management system utilizing advanced Infrared and LCD I2C sensor technologies, a multitude of significant conclusions can be derived regarding its functionality and efficacy: The conceptualization and architectural framework of the car parking slot system implemented at Nabire airport have been meticulously crafted in accordance with the pre-established programming protocols and tools that were previously developed. This multifaceted design encompasses several distinct variations of parking slot statuses, which include but are not limited to, empty parking slots with no vehicles present, fully occupied parking slots, as well as two additional categories identified as empty parking slot 1 and empty parking slot 2. The precise detection of available parking slots, combined with the successful integration of the information system that communicates the availability of these parking spaces, constitutes a vital system designed to enhance the facilitation of parking location accessibility; consequently, this system is aligned with the infrastructural and traffic management policies in place at Nabire airport, ensuring that it operates with optimal efficiency and effectiveness.

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