Bangladesh University of Professionals

Department of Computer Science and Engineering

Digital Logic Design Laboratory (CSE-1202)

Car Parking Identifier Using Logic Gates

Group-5: **Network Knights**

Team members:

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Introduction:

Abstract:

Not finding a parking space for you sometimes is indeed a critical issue. An important appointment might be missed. Time will be wasted, and more money will be spent. Criticism and inconvenience are more likely to happen. So, parking monitoring is an important solution. It has many practical advantages. It can arrange the passage of vehicles inside the parking area in addition to avoiding contention. It can reduce the suffering of sick and disabled people looking for a parking space. It is a good denote to such a part of society. It is like providing them with the smile and hope that helps them to overcome their disability. This project can provide information about the future need to make more parking spaces and also has many uses such as security issues and database. The project consists of four main subsystems; the first subsystem is designing the power supply and the sensor subsystem circuit, which includes RFID and IR sensors. The third subsystem is the LED matrix, to displays the free parking lots and authorized and unauthorized personnel.

Project Definition:

Design a project parking monitoring and control system for counting the number of automobiles entering and leaving the parking, opening the gate for authorized personnel, providing information about free parking spaces, and creating a database to provide statistics about people entering and leaving the parking space in addition to using this system for security issues such as preventing violating people to enter the parking space, for this system uses efficient sensors and display circuits to withstand the surrounding environment. The power utility available to supply the system components will empower the system.

Project Specifications:

The main marketing features or specifications are:

- Low power consumption.
- High-quality sensor and long-life LED.
- Very clear display and efficient controller.
- Easy to install and maintain.
- Easily designed system to minimize the cost.

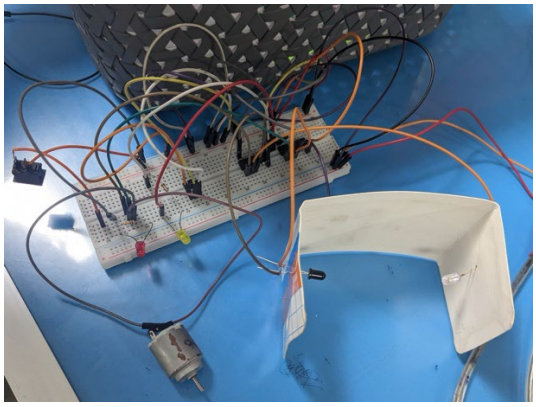


Figure: Project view-1

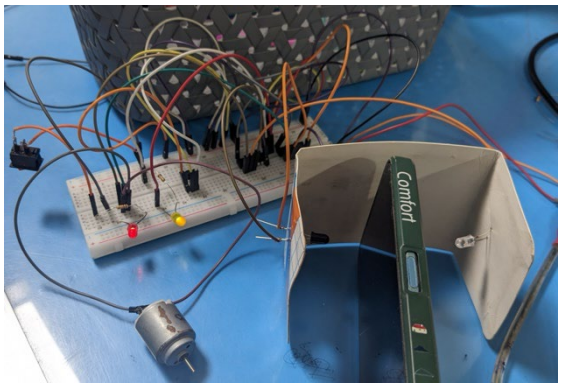


Figure: Project view-2

Theoretical Background:

This project is designed to create a system that displays the occupancy status of parking spots using digital logic circuits. This project uses basic digital components such as logic gates, flip-flops, and counters. The theoretical background of this project includes principles of digital logic design, the combination of various logic gates, and the use of sequential circuits. Besides, the other equipment was also used to control and employ the project.

Logic Gates

Two logic gates (NAND & NOT) were used to

- Analyze the IR sensors' signals.
- Make rational choices regarding the parking slots' condition.
- Manage the DC motors and LEDs' outputs to show when parking spots are available and to open or close gates or barriers.

IR (Infrared) Sensors

Electronic gadgets that emit and detect infrared light are called infrared sensors. In this project, the presence of a vehicle is detected using infrared LEDs. The sensor's output changes when an automobile gets in the way of the IR beam between the emitter and the receiver; this signal can then be used as an input for logic gates.

Light Emitting Diodes (LEDs)

LEDs are used as indicators to display the parking spaces' status.

Circuit Transistors

An NPN transistor's base permits current to move from the collector to the emitter in response to a signal, lighting up the matching LED.

Resistors
To guarantee that the LEDs and transistors work within safe parameters, resistors limit the current passing through the circuit components. In this project, typical resistor values are 100 ohms and 1k ohms.

DC Motor
To illustrate a mechanical feature of the project, like a gate or barrier that opens or closes in response to parking status, a DC motor (3–4V) can be utilized.

Switches

Switches replicate various parking system scenarios, such as manually varying space availability.

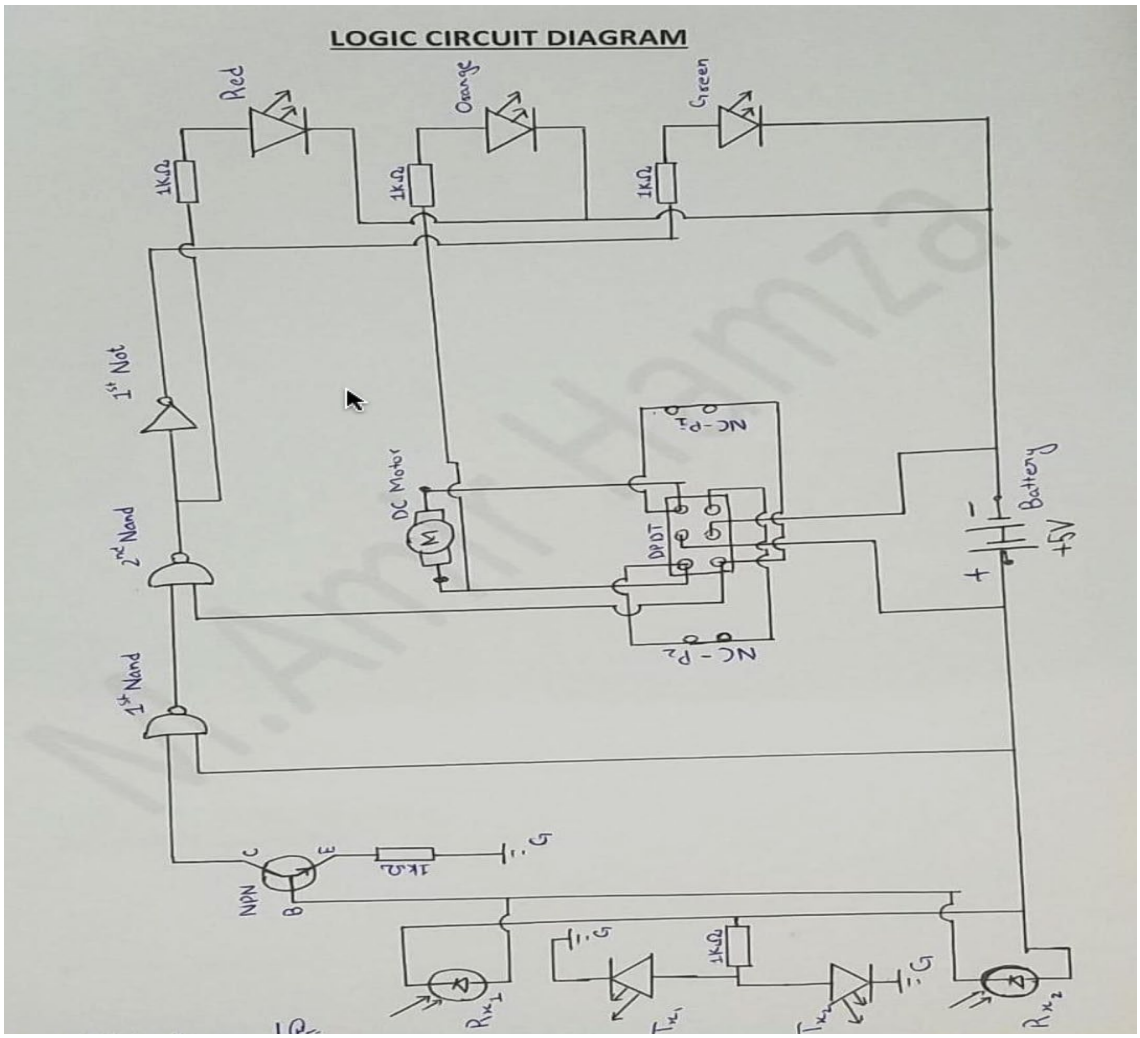
Objectives:

The task is to create and execute a system that utilizes logic gates to identify and determine the availability of car parking spaces. We aim to develop a comprehensive logic circuit that accurately detects whether each parking spot is occupied or vacant. We aim to optimize the arrangement of logic gates to maximize space utilization and minimize power consumption. We will integrate sensors or input devices that can interface with the logic gates to acquire real-time data. Before deploying the system, thoroughly testing and validating its functionality in a simulated environment is crucial. To ensure reliability and accuracy in identifying parking availability, extensive performance evaluations will be conducted. We will implement feedback mechanisms to notify users in real-time about the availability of parking spots. It is important to explore scalability options that can accommodate varying sizes and configurations of parking lots. The design, implementation, and testing procedures will be documented for future reference and maintenance. The system will continuously be refined and enhanced based on user feedback and technological advancements.

Equipment:

1. Logic Gates (NAND & NOT))
2. LED (Red, Yellow, Green)
3. IR (Infra-Red Led Diodes)
4. Breadboard
5. Transistors (NPN)
6. DC Motor (3-4V)
7. Resistors (100/1k ohms)
8. Switches
9. Wires

Circuit Diagram:



Project Implementation:

Step 1. Setup Sensors:

- We must place IR transmitters at entry and exit points and connect them to the input pins of the logic gates.
- Need to ensure proper power supply to the IR transmitter.

Step 2. Connect Logic Gates:

- We must connect the output of the IR transmitter and receiver to the inputs of a NAND gate.
- The output of the NAND gate goes to the Full Indicator LED.
- The supply voltage needs to be connected to the DPDT switch.
- The output of NAND gates from the IR sender is connected to the baseline of the n-p-n Transistor.

- The output of the IR receiver through NAND gates is connected parallel to the collector line of the transistor and the DPDT switch.
- The emitter line of the transistor is connected to the ground point.
- One 10k Ω is connected in series with the LED indicators so that there is a reasonable voltage drop not exceeding the LED indicators' maximum voltage tolerance.

Step 3. Testing:

- We must simulate car entries and exits, observe the Full Indicator LED, and adjust connections and sensors to ensure correct operation.

Testing and Validation

- We must ensure all parking spaces are detected accurately and verify that the Full Indicator only lights up when the parking lot is occupied.
- We have to ensure the indicator turns off when there is an available space.

Troubleshooting

- Sensor Issues: We need to check connections and power supply to sensors.
- Logic Gate Errors: Verify the correct configuration of logic gates.
- LED Indicator Issues: We have to check the LED connections and ensure the correct orientation of the LED.

The Demonstration Video Link Is Given Below:

https://drive.google.com/file/d/1YbYq4mdJ6EKDnDq7PgCUmVduGCKrcbtj/view?usp=sharing

Result:

The Car Parking Identifier system integrates IR sensors strategically at the entrance and exit gates. When a car enters, it interrupts the IR signal, triggering the system. Logic gates (specifically NAND and NOT gates) process these input signals. Additionally, a DC motor controls the sliding gate, automatically opening it upon car detection. Visual feedback includes a yellow LED turning on when the car enters, a green LED indicating an empty slot, and a red LED signalling a full parking area.

Applications:

1. Parking Lot Management: The application can be implemented in parking lots to automatically recognize and handle available parking spaces, simplifying the process for drivers to locate vacant spots.

2. Smart Cities: Integrating the application into smart city infrastructure can aid in optimizing traffic flow and reducing congestion by directing drivers to available parking spaces efficiently.

3. Automated Toll Booths: Utilizing logic gate-based car identification systems in toll booths enables automated toll collection, enhancing the speed and convenience of the process.

4. Vehicle Tracking: By implementing logic gates, the application can monitor and track the movement and presence of vehicles in restricted areas or specific zones, contributing to security and monitoring applications.

5. Garage Automation: The application can be employed in home or commercial garages to automatically detect and manage parking spaces, streamlining the process of vehicle storage and retrieval.

6. Traffic Control Systems: Integration with traffic control systems allows for monitoring and managing traffic flow by providing real-time data on parking availability in different areas.

7. Event Management: The application can efficiently manage parking spaces and guide attendees to available parking spots during large events or gatherings.

8. Fleet Management: Businesses with vehicle fleets can effectively monitor the usage and availability of parking spaces for their vehicles using the application, optimizing fleet operations.

9. Safety and Security: By accurately identifying parked vehicles, the application enhances safety and security measures in parking areas by detecting unauthorized or suspicious vehicles.

10. Environmental Monitoring: The application can also monitor vehicle emissions and pollution levels in parking areas, contributing to environmental management efforts.

Improving the Project's Scope:

There's critical room for advancement by consolidating extra components:

1. Integration:

Presenting a microcontroller bridges the crevice between rationale and usefulness. It can:

- Handle Complex Rationale: Oversee client input, installments, and execute progressed highlights.
- Interface with Assorted Sensors: Interface with extra sensors like permit plate perusers or weight sensors for more comprehensive information collection.
- Control Real-World Components: Work entryways, shows, and coordinated with installment frameworks for a consistent client encounter.

2. Remote Communication:

Including Wi-Fi or Bluetooth permits for:

- Inaccessible Administration: Screen stopping status, control highlights, and create reports remotely.
- Portable App Integration: Clients can save spots, see real-time accessibility, and pay for topping specifically from their phones.

3. Information Capacity and Analytics:

Interfacing the framework to a database empowers:

- Track Stopping History: Analyze utilization designs to distinguish top times and optimize estimating procedures.
- Produce Reports: Give experiences into stopping part proficiency and recognize ranges for enhancement, driving to data-driven choice making.

Conclusion

A creative and useful solution to the widespread problem of effectively managing parking places is the Car Parking Identifier, which uses logic gates. By applying basic concepts of digital electronics, this project provides a dependable, affordable system that can greatly improve the user experience in various parking situations. The Car Parking Identifier's simple design, long-lasting LEDs, high-quality sensors, and low power consumption make it simple to install and maintain. The range of applications may demonstrate adaptability and scalability it can use, from event management and garage automation to smart cities and automated toll booths. Ultimately, this project exemplifies how basic electronic parts can be integrated to produce an effective and working system. It presents a feasible way to enhance parking space management, which will cut down on drivers' time and effort searching for parking, improve user happiness generally, and help create parking lots that are safer and more orderly.