SMART PARKING SYSTEM USING IOT

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ABSTRACT

*This paper defines the methodology of systematic smart parking system design consisting of Arduino, IR detectors, one servo motor, and one 16*2 i2c Display. The Arduino is the main microregulator that controls the whole system. Two IR detectors are used at the entry and exit gates to monitor vehicle entry and exit in the parking area. Other four IR detectors are used to detect the parking slot's availability. The servo motor is placed at the entry and exit gate that is used to open and close the gates. Also, an i2c display is placed at the entrance, which is used to show the available parking slots in the parking area. The benefits of this are real-time slots, parking procedures, and information, and improves users' ability to save time on proper parking.*

KEYWORDS: *Smart parking system, IR sensors, LCD screen, servo motor.*

1.1 Introduction

There are various types of parking systems that have been developed using IoT technology. And it has a wide spectrum of applications. The infrared (IR) sensor is also a part of the WSNs technology and it is commonly used in developing a smart parking system. IR sensor is used to detect obstacles by emitting radiation. It is also known as the general-purpose proximity sensor. IR sensors can sense or measure the heat and the motion of an object. Hence, an IR sensor is a suitable sensor to detect the movement or the motion of a vehicle when it is occupying parking spaces. The selection of the IR sensor to be implemented in the car parking system is to highlight the potential solution that can help to improve the process of finding a vacant parking space which becomes troublesome for most car users. Besides, most of the car parking available today, especially in shopping malls or tourist places, or any other commercial areas has a major drawback of the parking system the system helps the user to find the available spaces for parking but not the exact location of the parking slot.

Therefore, the existence of IoT technology is one of the popular elements to use when it comes to the parking system. The difficulty to find a vacant parking space is on the rise and if the IoT technology is adapted to the parking management system, it is expected to ease and help the citizen, especially those for whom finding an available parking space is their daily routine in life. With the existence of this technology, it is possible to improve the quality of life.

To solve this issue, we have created a "Smart Parking System" This initiative provides

1. precise information about parking space availability,

2. Reduce traffic

3. Reduce pollution allowing drivers to park their vehicles efficiently and quickly.

1.2 Background Theory

Currently, the majority of current parking lots lack a well-organized framework. The majority of them are run by hand and are inefficient. The issue that constantly arises in the car park is the time spent looking for available parking spaces. Users will continue to circle the parking lot until they find a vacant spot. This problem is most common in urban locations, where the number of automobiles exceeds the number of parking places available.

These ineffective situations occurred as a result of a lack of implementation in already accessible technologies. To provide space for car drivers, many local car parks are now developed inside retail malls or multipurpose buildings. Because it is user-friendly and prevents cars from being exposed to the sun, parking within a structure is becoming increasingly popular in many shopping malls. This sort of parking lot typically has a parking guidance system that primarily relies on the usage of message signs to notify drivers about parking availability inside the lot. The availability of a parking lot within a car park is typically determined by sensors that measure the number of automobiles entering and exiting the parking lot, or, in other situations, by comparing the tickets issued by machines. On the display board at the car park's entrance, this information about parking lot availability is often expressed in terms of full or empty. The actual number of parking spaces available within a parking garage is rarely provided. Hundreds of cars enter the parking lot every day, hoping for an empty parking spot. As a result, finding an empty parking space is tough. Car drivers still have to find an empty parking spots in most local parking lots. They will undoubtedly waste slot time looking for empty parking slots if they don't know where they are, especially if each row of parking slots only has a few empty parking spaces. As a result, having an effective empty parking slot tracking system that displays vacant space availability at each row of parking slots and directs automobile drivers there is critical. The development of this project prototype can operate as a way-finder, directing automobile drivers inside the car park to available parking slots and directing them there. It's a project that uses an Arduino microcontroller. It employs an infrared sensor to detect the vacancy of each parking space at a car park level, then sends a wireless signal to a microprocessor, which processes and shows the total number of available parking slots on 16x2 LCD displays. Knowing how difficult it may be to obtain a parking spot in some regions, this project was created to address the issue. The project's main goal is to figure out the best way to direct drivers and vehicle users to a free parking lot in a short amount of time.

1.3 Problem Statement

Finding Vacant Spaces Is Difficult, finding an empty place in a multilevel parking garage quickly is difficult, if not impossible, especially on weekends or during public events. For almost 66 per cent of customers, finding places at the end of the week or during open events can take more than 10 minutes. At peak times, stadiums and shopping centers are swamped, and clients have a difficult time finding empty spaces in these locations. Inadequate automobile parking spaces cause activities to be stifled and drivers to be dissatisfied. We can get around this by utilizing Smart Parking Assistance As the cost of gasoline continues to rise, drivers will do all possible to conserve energy in their vehicles. They must wait long at the entrance gate during busy hours before finding an empty parking space. As a result, users will waste time and energy looking for a spare area. Last but not least, the main problem with the parking system is the lack of available parking places. This could be due to developers' poor planning of the areas. Aside from that, the user-friendly system lacked useful information. When the parking bay is at its busiest, the user will seek the same location for a parking place several times before finding it, if they are lucky. The car park operator did not always post a notice that the area was filled and there was no more parking available.

2.1 Literature Review

In [1] author says the system is developed to display the vacant or available parking slots. It integrates a nodemcu microcontroller with IR Sensors and an LCD screen is used to display vacant to the screen.

In [2] author says smart parking systems are designed for vehicle parking and the main aim of this paper is to atomize to allow vehicles to park. And the use of Arduino and IR Sensors to identify the vehicle.

In [3] author explains the architecture and design of IOT based smart parking system. The system design is used to eliminate time conception to find empty parking spaces.

In [4] author explains the parking guidance and information system based on wireless sensor networks. It deals with effective ways of finding empty spaces and managing the number of vehicles to modify multi-parking.

3.1 Proposed Architecture

The following two key elements make up an Arduino-based IOT-based car parking system. The first section consists of an IR sensor, and a servomotor, all of which are connected to an Arduino using jumper wires. As a result, whenever a car pulls into a parking space, an IR sensor recognizes the presence of the vehicle, sets its

output to high, and communicates the information to an Arduino board. 2. There is an LCD in the section that notifies users when our required parking place is empty for free. The availability of parking spaces can be checked by the user using this Infrared rays sensor(IR sensor) from a distance, and the 20*4 LCD should be used to show the current position of a slot.

3.2 Hardware Components

1) Arduino:

The Arduino Uno is a popular open-source microcontroller board designed by Arduino. cc. It is built around the Microchip ATmega328P microprocessor and offers a range of digital and analog input/output pins for connecting to other circuits and expansion boards. The board features 14 digital I/O pins, with 6 of them capable of generating PWM output, and 6 analog I/O pins. It can be programmed using the Arduino IDE and a Type B USB cable. Power can be supplied through a USB cable or an external 9-volt battery within the voltage range of 7 to 20 volts. The Uno is part of the USB-based Arduino board series and was the first release of the Arduino Software. It comes pre-programmed with a boot loader, allowing for easy updates without an external hardware programmer. The Uno uses a USB-to-serial converter based on the Atmega16U2 (or Atmega8U2 in earlier versions) rather than the FTDI USB-to-serial driver chip used in previous boards.

Fig 1: Arduino UNO

2) IR Sensors:

The most fundamental and widely used sensor in electronics is the infrared (IR) sensor or IR Sensor Module. It is utilized in wireless technology for features like remote controlling and obstacle detection. IR sensors typically comprise an Infrared (IR) LED and a Photodiode; collectively, these components are referred to as an "IR pair." A special-purpose LED called an IR LED can emit infrared light with wavelengths between 700 nm and 1 mm. Our eyes cannot see these kinds of radiation. In contrast, an IR Receiver LED or photodiode detects infrared rays. It is also used to detect vehicles.

Fig 2: Proximity IR Sensor

3) Servo Motor:

A servo motor is a type of motor that can rotate very precisely. This type of motor typically includes a control circuit that provides feedback on the current position of the motor shaft; this feedback allows servo motors to rotate with great precision. A servo motor is used when you want to rotate an object at a specific angle or distance. It is simply a motor that is controlled by a servo mechanism. If the motor is powered by a DC power supply, it is referred to as a DC servo motor; if it is powered by an AC power supply, it is referred to as an AC servo motor. This tutorial will only cover the operation of a DC servo motor. It will act as a barrier gate. It will help to open the entry and exit gate.

Fig 3: Servo Motor

4) Breadboard:

In the early days of radio, hobbyists used to solder electronic components to bare copper wires or terminal strips on wooden boards, often repurposing breadboards. These boards were typically used to mount components and wires based on a paper schematic diagram pasted onto the board. Thumbtacks or small nails were commonly used as supports. Over time, breadboards evolved into a variety of prototype electrical devices. In 1961, a wooden plate breadboard with mounted springs and other capabilities was described in a patent. In 1970, a specific printed circuit board configuration was referred to as a Printed Circuit Breadboard in another patent. In 1971, Ronald J Portugal invented the familiar white plastic pluggable breadboard that is widely used today. This solder-less breadboard allows for easy component mounting and wiring during prototyping.

5) LCD Display:

An LCD (Liquid Crystal Display) screen is a type of electronic display module with numerous applications. A 16x2 LCD display is a very basic module that is widely used in a variety of devices and circuits.

A 16x2 LCD can display 16 characters per line and has two such lines. Each character is displayed in a 5x7

pixel matrix on this LCD. The intelligent alphanumeric dot matrix display has a resolution of 16 x 2 and can display 224 different characters and symbols. This LCD contains two registers. These displays are mainly based on multi-segment light-emitting diodes. There are a lot of combinations of display available in the market, but the 16×2 LCD is widely used. The command registers store various commands that are sent to the display. The data register stores data that will be displayed. The process of controlling the display entails entering the data that will form the desired image.

The main advantages of this LCD device are its low power consumption and low cost.

The main disadvantages of this LCD device are that it takes up a lot of space, it is slow, and its lifespan is reduced due to direct current.

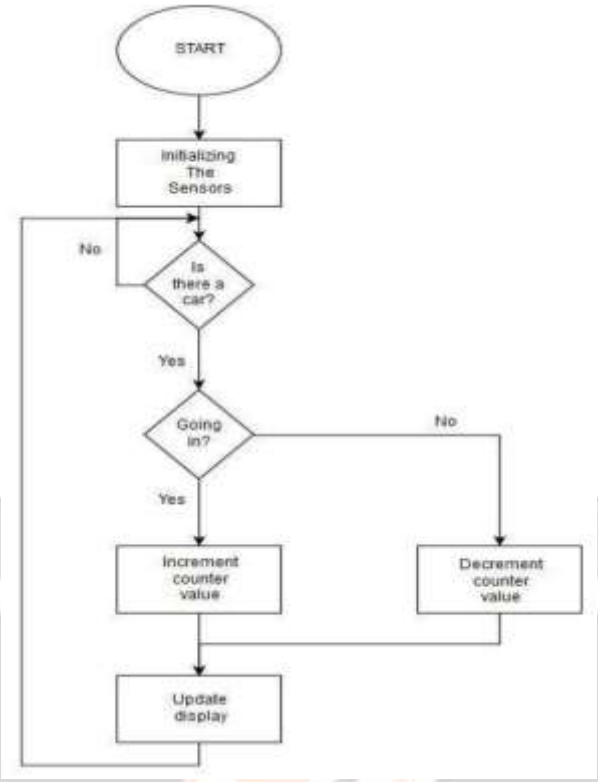
This LCD screen is used to display the availability of parking slots according to the instruction in the code.

Fig 4:16x2 LCD Display

6) Arduino IDE:

Writing and uploading code to the Arduino UNO board is made incredibly simple by this software. Based on open-source software, the code is. Using a USB cable, the program was uploaded to the Arduino Uno board. Special coding guidelines are supported by the Arduino IDE for C languages.

3.3 Flowchart



3.4 Working

This operates under the straightforward tenet of obstacle detection and visual feedback. An infrared transmitter and a receiver make up the proximity sensor, which is fixed to the parking lot ceiling. Infra-red rays are emitted by the IR emitter, and these rays typically reflect off of objects. These rays are picked up by the IR receiver, which transforms them into an electrical signal and a potential difference. The ensuing potential discrepancy aids in closing the circuit. The Light Emitting Diode (LED) is positioned along the driveway and turned on in response to the input the IR sensor receives.

In order to fix a certain distance based on the typical height of the cars used to send and then receive the radiations, a threshold distance is calibrated using a potentiometer.

After putting together every part in accordance with the circuit layout and programming the Arduino board. Now, precisely position the sensors and servo motor.

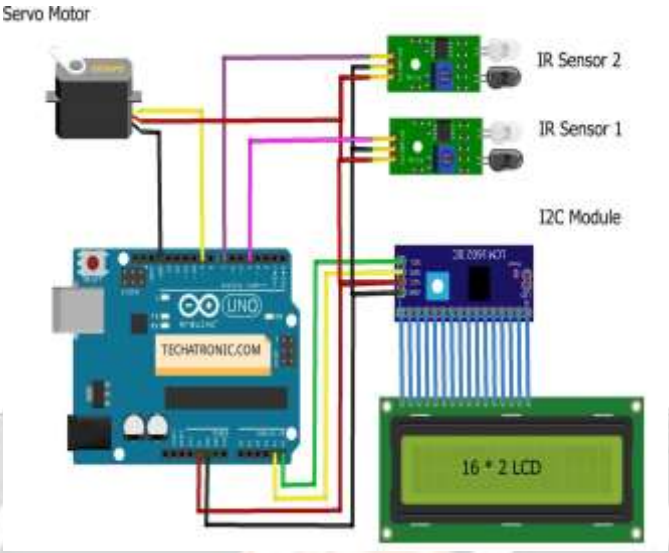
We have four parking slots in this to park our vehicle and we place two IR sensors. IR sensor-1 is placed at the entrance and IR sensor-2 is placed at the exit gates respectively and a servo motor is used to operate the common single entry and exit gate. We can place our LCD display based on our convenient place. We used IR sensor 1 to identify whether or not vehicles were coming at the gate and IR sensor 2 to determine whether or not the parking space was unoccupied. The LCD display initially indicates that all parking spaces are unoccupied when they are all empty.

The IR sensor-1 detects a vehicle when it approaches the parking area gate, and the system then permits entry into the car by opening the servo barrier. Once a vehicle has entered the parking lot and is parked there, a Light Emitting Diode (LED) display indicates that the specified slot is full. This way, the system permits 4 automobiles automatically.

The mechanism barred the entrance gate by closing the servo barrier in the event that there is no more room for parking. Additionally, the LED display reveals that slots 1, 2, 3, and 4 are all taken.

The IR sensor-2 identifies the car when it exits a slot and approaches the parking area gate, at which point the system opens the servo barrier. The slot is then empty as indicated by the LED display. Once more, the system will let the entry of a new vehicle.

3.5 Circuit Diagram



4.1 Results

The IoT-based Car Parking Management System with an IR sensor was able to identify the presence or absence of a car, show the availability status of parking slots, and save the IR sensor data into a database. According to the findings, the proposed car parking system with IR sensor was a good idea and a great system to develop, and it indicates that the respondents positively accepted the proposed parking system in order to minimize and reduce the problem of vehicle parking, particularly the time spent looking for available parking spaces.

5.1 Conclusion

The Internet of Things (IoT) was the key concept used to construct the proposed parking system employing an infrared sensor, and this study proposes an effective way of identifying a parking space.

The IoT-based Car Parking Management System with IR Sensor was created as a prototype to help drivers locate a vacant or available parking spot. This parking system presented employed an infrared sensor to detect the presence and absence of a car in order to determine the state of a parking slot's availability. The parking places are continuously monitored, and the data on the LCD screen is updated on a regular basis. The LCD screen shows the parking slot availability status. In the meantime, the data from the infrared sensor is also saved in the database.

The suggested parking system's prototype was designed for a single storage parking space, but the concept can be expanded to accommodate several storage spaces. In addition, for administrative purposes, a car parking management system interface was created to record the state of a parking slot as well as the precise time a car enters or quits a parking slot.

The proposed parking system's conclusion is beneficial for implementation in any parking zone region to assist drivers in finding a vacant parking spot quickly.

Furthermore, the proposed parking system was evaluated utilizing a user acceptance test to determine public acceptance of the proposed parking system. The majority of respondents thought the proposed parking system with an IR sensor was a wonderful concept and that developing a parking system that can help cars find a vacant parking spot quickly was a terrific idea.

As a result, it provides convenience to users by allowing them to save time, energy, and fuel. This work might be expanded by creating a mobile app that allows users to navigate, identify, and reserve a parking spot online.

6.1. Future Scope

Future studies can improve this framework by adding additional applications, for instance, online reservations made using GSM. The customer can reserve their parking space either at home or on the way to the shopping center. The client may spend less time looking for vacant parking spaces as a result. To further examine, unique sensor frameworks are introduced to improve this framework in order to identify the query and direct the driver or customers as quickly as possible. We'll try to reduce the mechanical construction and make it more environmentally friendly.

6.1 References

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