TuijinJishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 44 No. 5 (2023)

A Useful Model-Based System for Forecasting Parking Availability Using IOT

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***Abstract*:** The past two decades have witnessed a significant surge in the number of vehicles, emphasizing the need to leverage technology for efficient parking solutions in both public and private spaces. Traditional parking systems present challenges for drivers, including the difficulty of locating available parking spaces, overlooking on-road parking, issues with time management during peak hours, and instances of improper vehicle placement in designated slots. Additionally, these conventional systems rely heavily on human intervention within parking zones. To address these issues, there is a pressing need for the development of Intelligent Parking Systems. In this document, the authors propose an Intelligent Parking System based on the Internet of Things (IoT) to address real-time parking management challenges and uncertainties. The primary objective is to establish seamless coordination with end-users. The proposed system adeptly tackles various challenges, including providing advanced notice of parking slot status to end-users, incorporating both reserved and unreserved parking slots, and conducting real-time analyses of parking space availability. Importantly, the system significantly reduces the necessity for human intervention, resulting in savings in time, cost, and energy. Through the implementation of this proposed system, individuals can proactively determine the availability of parking spaces by consulting LCD displays located outside premises. Furthermore, a dedicated Android application offers a user-friendly platform for users to view all vacant parking slots. This innovative solution represents an intelligent and efficient approach to alleviate the complexities associated with parking management, offering substantial benefits in terms of time, cost, and energy efficiency.
Keywords: *Intelligent Parking, Object Detection, Image Processing, Internet of Things, Cloud Computing*

1. Introduction

As the population in the cities is increasing, thenumber of vehicles got increased dramatically. It causes issues for parking in the public places like cinema halls, hotels especially during festivals. Now a days driver invests around 10 min to park his vehicle because he isn't able to find free slot which leads to 30-40 minutes to congestion. Here we are going to see the solution of the above problem. This problem is a issue of significance not only on a local level and at the higher level of planning. This task aims to solve this problem of car parking. To solve this problem we have created this system which uses open source hardware, sensors,and computers to understand the output. In addition an Adafruit IO Platform is used to check priorly whether there is a free slot or not

The prototype uses IR sensors alongside engines, LCD and microcontroller for controlling the system. The lCD shows void spaces to new car at gate of parking. On the off chance that no parking spot is accessible the system does not open the door and lcd says parking full. If space is vacant system enables car to enter the parking lot. To identify vehicle opening inhabitance the system utilizes IR sensors. Additionally System utilizes IR sensors to distinguish vehicles touching base at stopping gates, to open the doors naturally on vehicle landing. The microcontroller is utilized to encourage the working of the whole system. Adafruit IO Platform show publish the data on cloud can also be used to find alternate parking premises in the area by displaying number of vacant parking slots in them too.

2.1 ArduinoUNO 328.

Arduino is an open-source Computer equipment/programming stage for creating digital devices and interactive objects which detects and control the environment surrounding it. It consists of an open supply

device that allow the clients to create their own working kit. The software of the Arduino is applicable to a huge range of activity frameworks like Ubuntu, Microsoft OS, and Macintosh. It likewise consists of wide supply software system feature that allows tough software framework developers to use the Arduino code to execute with the prevailing programing language framework and can be extended and altered. For Starters, it is extremely easy to use as well as economic. It very well may be used to create such gadgets that can cooperate with the surrounding to make use of the sensors and modern actuators. Like, ROBOTS, Motion Detectors ,etc.

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

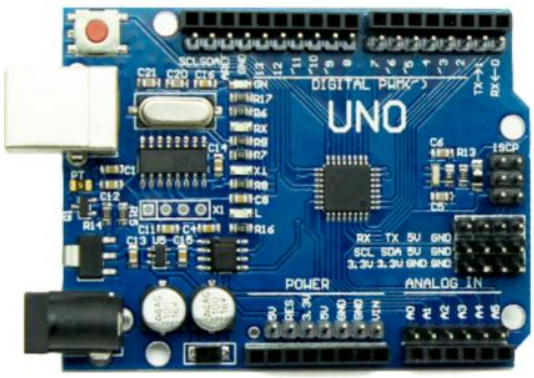


Fig 1. Arduino Uno

2.2 Breadboard

A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode). To learn more about individual electronic components.

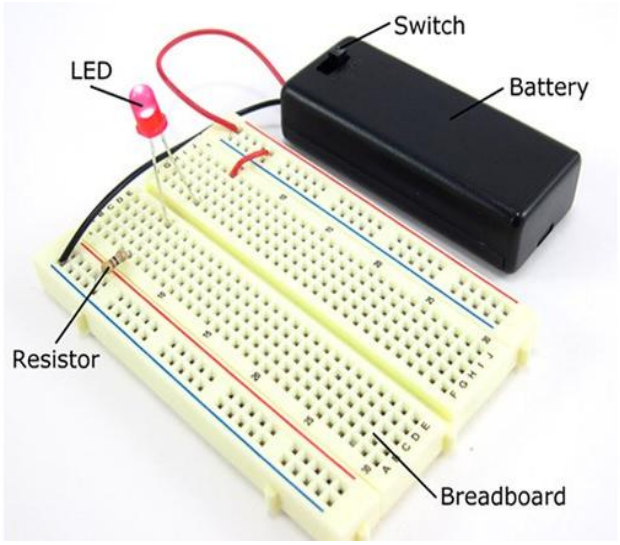
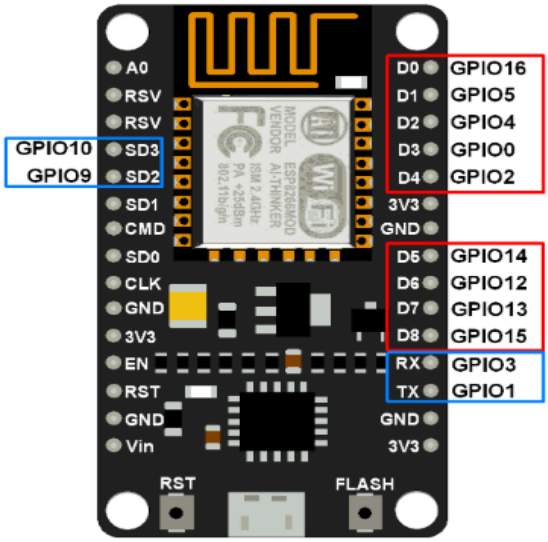


Fig 2. Breadboard



2.3 Adafruit IO Platform

Adafruit IO is one such cloud provider focusing more on IoT deployments on the cloud. Adafruit IO supports different hardware like Raspberry PI, ESP2866, and Arduino. Adafruit.io is needed to display the IOT project's data online in real-time. It is a cloud server that can be used to connect to IoT devices through wifi and to control these devices through a dashboard. It can be used as a free service and it has got a simple easy-to-use interface to design dashboards.

2.4 NodeMCU

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added.

The NodeMCU (*N*ode *M*icro*C*ontroller *U*nit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip. You also have to program it in low-level machine instructions that can be interpreted by the chip hardware. This level of integration is not a problem using the ESP8266 as an embedded controller chip in mass-produced electronics. It is a huge burden for hobbyists, hackers, or students who want to experiment with it in their own IoT projects.

2.5.Motor Drive IC :

A Motor Driver IC is a current amplifier or group of machinery that governs an embedded circuit in some predetermined to regulate the performance of an Electric motor. This motor controller may include a manually operated or automated means for turning the motor on or off, selecting the rotation whether back or fro, selecting and regulating the present speed, limiting the regulated torque, and protecting the circuit against anyshort circuit, overloads or errors.

3. Working of a prototype

There are two working of the system:-

When the car is at the gate of parking:- The System starts working when a car reaches the gate of the parking which are equipped with IR Sensors . The IR sensors senses the obstruction caused by the car and sends a signal to the microcontroller indicating that there is a car at the gate and to check whether there is a free slot for parking or not by using the sensors applied on the parking slots. The sensors installed at the parking slots detect whether any car is parked or not. If there is a car parked and there are free slots available after sensing and checking the bookings the microcontroller will display the respective numbers of the parking slot which are free on the IO Platform. and opens up the barrier,if no parking slot is found free then it will display no free slot and the barrier wont open .When the car is getting out of the parking it again reaches a barrier the IR sensors senses it and send the message to the micro controller then the micro controller opens the barrier for the car to leave.

4. Prototype

This prototype made by us. You can see all the components used in it . The two sensors are being used at the gate to sense the entry and exit of the vehicles. And the four consecutive sensors are placed over the slots to detect whether there is any car parked or not and display the result on the display screen after all the processing is dont in the ArduinoUno. The Sensors uses Infrared Rays to sense the presence of any vehicle at the defined parking slots and it notify the Arduino. Similarly, the sensors at the gate senses the incoming and outgoing vehicle at the gate and then notify the Arduino to open the gate. The Adafruit IO Platform is being used here to show which parking slot is vacant at the real time with car entry and exit time so that the driver can directly go to that slot to park the vehicle. All the connections are being done via, Jumper cables which makes is easier to do all the connections. The Motors serves as the barrier at the entry and exit gate.

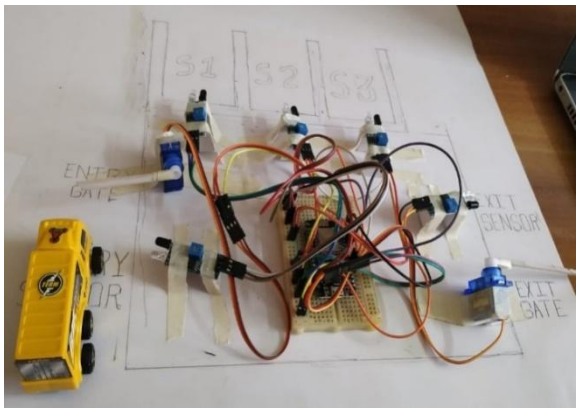


Fig 4. Working Model

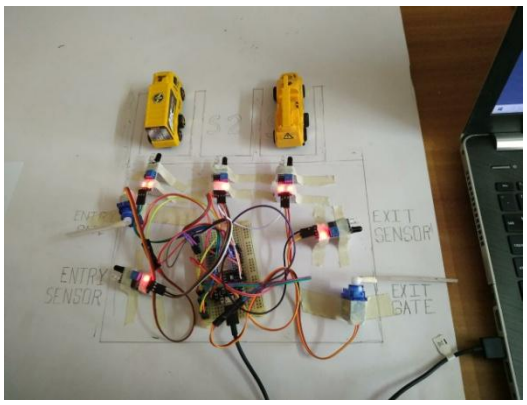


Fig 5. Working Model

- Here, in this prototype NodeMCU, five IR sensors, and two servo motors are used.

- Two IR sensors are used at entry and exit gate to detect the car while three IR sensors are used to detect the parking slot availability.
- Servo motors are used to open and close the gates according to the sensor value.
- Adafruit IO Platform show publish the data on cloud which can be monitored from anywhere in the world.

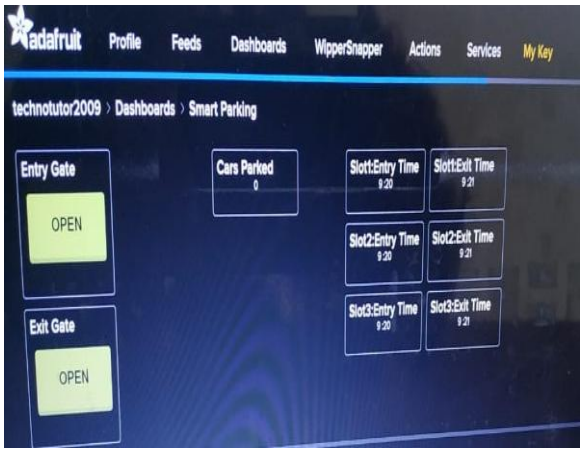


Fig 6. Dashboard

Software : In order to achieve the desired goal, a coding language aka programming languages and user interface was to be implemented to deduce a logic that make the Arduino Board understand the general requirements. As arduino has it own editor that uses C and C++ languages. In addition to it uses Java to provide a virtual environment for hardware to execute. In addition to all the sensors were to be coded to execute properly and accurately so the coding for the same is also done in Arduino using an embedded C programming. For the creation of android application Java Language.

5. Conclusion and Future Work

This system ensure that whether a free parking slot is available or not . As soon as it a slot is detected it is reported by the sensors. We achieved this by programming of the microcontroller and sensors. The main objective of the paper is to find early solution so that anybody can find vacant slots in parking and spend a very limited amount of time. As Arduino is a modern technology it gives uniqueness.In Future certain changes can also be done like System can be used in multi-level parking system by doing some changes in hardware setup and Searching of free slots can be done by using other search algorithm.

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