IoT Based Parking Space Detection System

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Abstract— IoT is an extensively used technology moment. In metropolitan areas, chancing a suitable parking system has come an important issue. In present era, traditional parking systems are less efficient and effective. Parking space tracking is an essential component. Finding a parking space is a critical challenge, notably for users who want to park their car in a densely populated area. The conventional method of finding a parking space is to look for an empty spot on your own. This fills up more time and energy for users and ended up causing congestion. This paper proposes an intelligent parking system that detects and locates consumer vehicle parking positions as well as detects obstacles in parking lanes. The system detects vehicles in the parking lot and detects obstacles in the parking lane using Arduino, infrared, and ultrasonic sensors. Use a Wi-Fi module with a local Wi-Fi connection to update lane busy/empty via the obtained IP address.

Keywords— Internet of Things, RFID, Arduino, GSM Module, IR Sensor

I. INTRODUCTION

Due to the high growth in vehicles, it is now quite difficult to locate a free parking space in major cities. Parking a car in a big city is particularly challenging. By knowing where parking spaces are available for a car to be parked, we want to solve the driver's dilemma with this initiative. Without having to deal with the trouble of driving about looking for parking places, one can check whether any free parking spaces are available or not using a smartphone. Finding a parking space can be made easier with theuse of the Arduino-based device that is utilised in project, sensors, and the telnet app. The Arduino is an open-source electronic device with hardware that is simple to use and is programmable to interface with any sensors or modules. All of the parts utilised to solve the problem will be controlled by the Arduino program that will be built.

Riders typically waste litres of petrol looking for a parking space. Additionally, it typically takes the rider 5 to 15 minutes to find a parking spot. In addition to that, it is annoying because of the traffic, fuel use, and pollution. Therefore, in the described scenario, being aware of the parking spaces that are available in advance can help to resolve the problems. By analysing, forecasting, and reserving a parking place, we may reduce this problem with the aid of IoT integration and deep learning algorithms.

It has become crucial to find a solution on how to manage the parking lot effectively and show drivers the information for each parking division before they enter. In order to help drivers quickly park their cars, a system is proposed in this study that will count the amount of parking spaces that are available overall and show that information to drivers.

II. LITERATURE REVIEW

Document [1]The scheduling of parking spaces is transformed into an offline issue. A linear problem is used to characterise the offline issue. An algorithm was used to solve the linear issue. Lastly,

simulations from experiments were performed. That being said, vehicle guidance is not the subject of this paper.

A parking lot solution based on radiofrequency identification (RFID) and wireless sensor networks is presented in paper [2]. does not, however, handle a sizable parking lot.

A ZigBee-based parking system has been proposed in Paper [3]. Here, data regarding the parking spot is gathered via a web service. Our method is based on the Arduino microcontroller, which is an 8051-type microcontroller that requires the installation of the Arduino IDE application on the system in order to operate. We use a microcontroller to execute basic embedded C code. and inserted it straight into the Arduino framework. We programme a microcontroller to execute basic embedded C code, which we then feed into the Arduino microcontroller. As a result, the code system maintains track of how many automobiles have entered the parking structure. A liquid crystal display board will be used to display the counting.

Document [4]The induction loop sensors are installed beneath the surface of the road to carry out the counting. While using sensors was less expensive, they were harder to install and damaged roads, but they were also more accurate and resistant to environmental changes. In the event of a malfunction, maintaining it was equally challenging.

III. SYSTEM DESIGN

The parking system that has been designed has the capability to compute and identify the existence of vehicles within the designated parking space. The cloud database will receive the information gathered at the parking lot. An Android application will utilise the data to tell users where to find parking spaces. The parking system's mechanism is depicted in Figure.Until the text has been prepared and stylized, keep your text and graphic files apart. Hard tabs should be avoided, and hard returns should only be used once, at the conclusion of a paragraph. Nowhere in the manuscript should pagination be added. The template will number the text heads for you; you don't need to.

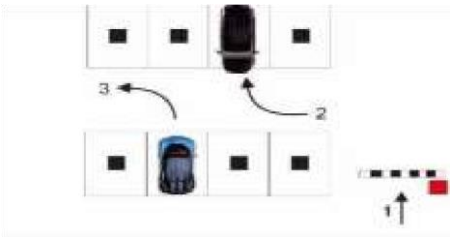

Figure1.Species the process of parking space

Three primary procedures need to be followed:

- paying at the entrance gate
- registering for a parking space
- and processing out of the parking space.

Payment is made at the door, where a board, etc., is located. The board has shields, additional circuitry, a liquid crystal input/output pin (I/O), an analogue and digital RFID reader, and a controller. There will be an LCD display put at the entrance gate. Car drivers need an RFID card with an e-money feature. The gate can be opened with just a single tap of the card on the scanner to send the data on it to the cloud and local server. This chapter describes a series of data readings and transmissions rather than the construction of a parking gate bar. Relays are incorporated into the circuit, so if needed, the microcontroller and RFID reader can be linked to the parking gate bar.

A. Arduino

One of Arduino's standard boards is the UNO. Here, UNO is an Italian word for "one." Additionally, it was Arduino's first USB board to be released. It is regarded as the strong tool used in many different tasks. The ArduinoUNO board was created by Arduino.cc.

The Arduino UNO is built around the ATmega328P microcontroller.When compared to other boards, such the Arduino Mega, etc., it is simple.

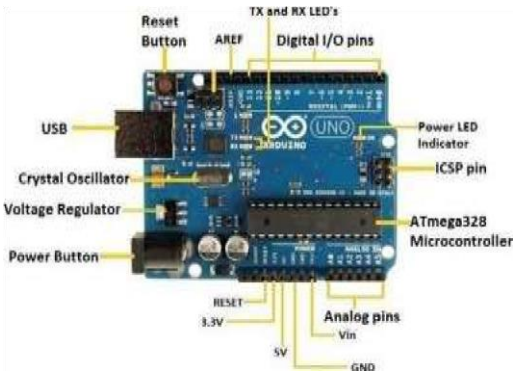

Figure:2Arduino UNO

B. IR Sensor

An electrical gadget called an infrared sensor emits Obtaining an order to feel certain features of the environment is the second procedure. a parking spot in IR. In order to keep the parking lot maintained, sensors that monitor object heat and orderly sensors that detect motion from cars are both used. Rather than emitting it like sensors on the parking sign, these sensors measure the amount of infrared radiation that is extra and installed in each parking space. Every spot in the parking lot contains a unique device known as a passive infrared sensor. Typically, every device emits some kind of data, and the infrared address system will send the most recent spectrum. in order to be updated if an automobile is discovered at a designated slot address, to the cloud. The process of leaving the parking spot is the following step. The second technique and this one are almost the same. A sensor notifies the system when a car is observed pulling out of a certain parking spot, and the system adjusts the cloud-thermal radiation.

Figure:3 Infrared Sensor(IR Sensor)

C. Servo Drive

One kind of motor that can rotate extremely precisely is a servo motor. The control circuit for this kind of motor typically offers feedback on the motor shaft's current position, enabling servo motors to rotate extremely precisely. Utilising a servo motor allows you to spin an object at precise angles or distances. All that's involved is a basic motor that powers a servo mechanism. When a motor is powered by an AC power source, it is referred to as an AC servo motor; otherwise, it is called a DC servo motor.

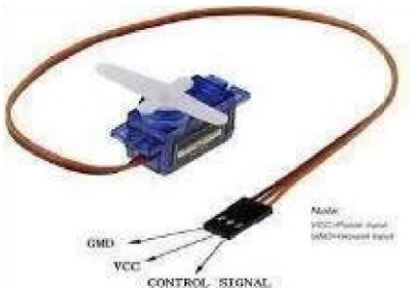

Figure:4 Servo Motor

D. 16*2 LCD display

A type of electronic display module called a 16*2 LCD display is utilised in a wide range of circuits and devices, including TV sets, computers, calculators, and cell phones. Seven segments and multi-segment light-emitting diodes are the major applications for these displays. The primary advantages of utilising this module include its low cost, ease of programming, animations, and unrestricted display of unique characters, special effects, and animations, among other things.

Figure:5 16*2 LCD Display

E. I2C Module

An integrated PCF8574 I2C chip in the I2C module translates I2C serial data to parallel data for the LCD display. Currently, the default I2C address for these modules is either 0x27 or 0x3F. Examine the black I2C adaptor board on the module's underside to find out which version you have. In case there are three sets of pads with the labels A0, A1, and A2, then 0x3F will be the default address. The default address in the absence of pads is 0x27. On the underside of the display, there is a contrast adjustment pot on the module. In order for the screen to properly show text, this may need to be adjusted.

Figure:6 I2C Module

IV. DESIGN METHODOLOGY

Two infrared sensors that are placed at the parking lot's entrance and exit will make up the smart parking system and will be used to determine if a car is there or not. The sensor data is sent to a central server upon a car passing the first sensor. The server analyses the data, provides real-time parking availability information, and unlocks the gate. The parking lot entry will include a display with this information. The number of open spots in the parking lot will be shown by the system to direct drivers to available spots. The display will read "No parking slots available" when every parking space is taken, and the gate won't open until a car enters. till a parking space becomes available. In a similar vein, another sensor activates while leaving. When it detects motion, the gate will open and the available spots will be shown. The basic idea behind how the smart auto parking system operates is to identify obstacles and provide a visual cue. The InfraRed emitter and receiver of the proximity sensor, which is installed on the parking lot ceiling, are connected. Infrared rays are released by the IR emitter, and these rays typically reflect off of objects. These rays are picked up by the infrared receiver, which transforms them into an electrical signal and perhaps causes a difference. The potential difference that results aids in finishing the circuit. The potentiometer is used to calibrate a threshold distance, which fixes a specific distance based on the average till a parking space becomes available. In a similar vein, another sensor activates while leaving. When it detects motion, it opens the gate and the car doors so that radiation can be sent and received. Based on the project's size, every component is powered by a 12V battery.

V. SENSORS FOR PARKING SPACE DETECTION

Parking Space Recognition In a parking lot, sensors are utilised to identify the presence of cars and notify users when a spot opens up. Parking detection sensors can be used for both on-street and off-street parking; they are embedded in asphalt and other types of road surfaces. Among the most popular kinds of sensors are:

A. An induction coil is used by a wireless magnetic sensor to identify changes in the magnetic field of the earth produced by immediately above-parked autos. It is advised against using it in close proximity to high-voltage power lines due to its susceptibility to electromagnetic interference.

B. To scan, gather, and communicate real-time parking occupancy information that directs vehicles to available parking spaces, an ultrasonic sensor uses high-frequency sound waves. It is less accurate than radar technology, but it functions similarly.

C. A radar sensor uses radio waves reflected from parked cars to identify the presence of an automobile at a certain parking post. It is more suited for outdoor use since it is more resilient to contamination and weather.

D. Any object with a temperature of 5°K or higher emits infrared radiation, which is detected and measured by an infrared detection sensor. emits infrared radiation, and anything that is in the immediate area will reflect that energy back. Every one of these detection methods has advantages and disadvantages of its own. No single sensor detection system can offer sufficient precision when it comes to accurately monitoring the occupancy of outdoor parking lots. For this reason, multiple detection techniques are used in a single system by smart parking detecting sensor-based solutions. Dual-detection sensors use two different detection modalities, such as magnetometer and radar or ultrasonic and infrared, to determine if a space is filled or not. Although these systems can give customers up to 99% accuracy, they also cost a lot more than single-detection systems.

One of the main advantages of sensor-based systems, besides precision, is that they are battery-powered, which implies that they run entirely on their own without the need for an external power source. This is advantageous since it enables you to use them in locations without power sources.

VI. BENEFITS OF SMART PARKING SOLUTION FOR THE DRIVERS

1) Use of Reduced Fuel

The result of human ingenuity and cutting-edge technology, the smart parking solution not only makes parking spaces easily accessible but also helps save important resources like time, fuel, and space. When smart parking solutions are

implemented in metropolitan areas, cars are directed directly to the available parking spaces.

2) Time and Money Saving Approach
Drivers may save money and time by utilising smart parking solutions. This is due to the fact that drivers hunt for a parking space for several minutes before entering the crowded parking area. In the end, this wastes their time and aggravates them since the drivers can't get to the intended location in a timely manner.

3) Reduce Your Individual Carbon Footprint
By lessening traffic and the movement of cars looking for parking, smart parking also helps to cut down on carbon emissions from moving cars. The drivers' individual environmental impact is enhanced when they travel to different locations to park. Every vehicle in the USA wastes around twenty minutes looking for a place to park, which adds to traffic congestion in urban areas and fuel waste.

4) Lessen Stress from Parking
Most people stay away from the crowded areas of the city because they don't want to deal with the bother of parking, which makes drivers anxious and stressed. It is really discouraging to know that even after spending a lot of time looking for parking, you will still park your car far from your destination. It is also annoying to drive around the same block repeatedly and yet not find a spot to park your car.

5) Lessen Street Search Traffic
Parking searches account for over 30% of traffic in urban areas. Municipalities can control and lessen the amount of people searching for parking on the streets thanks to smart parking systems. While this technology guarantees parking safety as well, its primary impact on traffic congestion comes from features that make parking easier, quicker, and more convenient. The amount of cars circling the streets in search of a parking space is guaranteed to decrease thanks to smart parking technologies.

VII. SCOPE

Future developments of this system could include the addition of additional applications, including gsm-powered online booking. The user or motorist can reserve a parking space at home or while travelling to the retail centre. This may shorten the user's search time for empty parking lots. To enhance this system's ability to recognise objects and direct drivers or users as quickly as possible, other sensor systems may be included as part of a future study. Our goal is to minimise the mechanical structure while enhancing its environmental friendliness.

We can also incorporate alternative payment methods, such as linking the payment to the user's bank account.

VIII. CONCLUSION

To sum up, a parking spot detection system is a cutting-edge invention that has a lot to offer drivers. managers of facilities and parking operators. It can boost safety and security, optimise traffic flow, and raise the effectiveness of parking facilities. The need for these systems to be implemented is growing due to the growing demand for parking in urban areas.

REFERENCES

[1] S. Wybo, R. Bendahan, S. Bougnoux, C. Vestri, F. Abad and T. Kakinami, "Movement detection for safer backward maneuver", in 13th World Congress on Intelligent Transport Systems, London, UK, 2006

[2] H. Satonaka, M. Okuda, S. Hayasaka, T. Endo, Y. Tanaka and T. Yoshida,"Development of parking space detection using an ultrasonic sensor", in 13th World Congress on Intelligent Transport Systems, London, UK, 2006 [3] Linko pings University Evolve project, http://www.ikp.liu.se/evolve/ [4] TU Darmstadt parking assistance project, http://w3.rt.etechnik.tudarmstadt.de/~ kochem/forschung.en.html [5] Citroe n Parkering Sensor, http://www.citroen.com/CWW/enUS/TECHNOLOGIES/COMFORT/ParkeringSen or/ParkeringSensor.htm [6] N. Kaempchen and U. Franke, "Stereo vision based pose estimation of parking lots using 3D vehicle models," in Proc. 9th IEEE Intelligent Vehicle Symposium, Versailles, 2002.

[7] Ho Gi Jung, Chi Gun Choi, Dong Suk Kim, Pal Joo Yoon "System configuration of intelligent

parking assistant system", in 13th World Congress on Intelligent Transport Systems, London, UK, 2006

[8] Edmond Boyer and Marie-Odile Berger,"3D Surface Reconstruction Using Occluding Contours", in International Journal of Computer Vision,Volume 22, Number 3 / March, 1997

[9] K.Fintzel, R.Bendahan, C.Vestri, S.Bougnouxand T.Kakinami, "3D Parking Assistant System", in 11th World Congress on Intelligent TransportSystems, Nagoya, Japan, 2004.