IOT Based Smart Parking

Smart Parking For Smart Cities

IoT Based Smart Parking

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Abstract:

Smart Parking project aims at providing a faster and easier parking. The widespread acceptance of IoT gave the open source hardware a new life, potentially challenging many industrial products and new interests in hardware prototyping and electronics. Recent transition has been made from 8 bit to 32 bits and it is expected that in future Arduino may be seen in form of a cheap practical computer. Looking at this actionable advancement towards Arduino, it allured us to make systematic and organized parking system for vehicles, using Arduino Uno. It also allows the operator to collect parking fees efficiently.

Introduction:

In today's scenario, parking space is hard to search in a day to day life for the people. According to the recent survey, there will be a rapid increase in the vehicle's population of over 1.6 billion around 2035. Around one million barrels of world's oil is being burnt everyday.

Smart parking can be a solution to minimise user's time and efficiency as well as the overall cost of the fuel burnt in search of the parking space. Smart parking is an automated, flexible, user friendly and highly efficient technology. Also, the operator can easily keep the track of vehicles entering and exiting the parking space and parking fees collected. This project's main purpose is to produce a real life solution to the car parking problem which the whole world is facing frequently. People usually roam around in the parking lots trying to find a suitable place to park in. To solve that problem we created the automatic car parking system, using an open source hardware, programmable sensors and the use of computers to provide an interface to understand the digital output produced. In this, the data is collected from the sensor and through analysing and processing, the output is obtained. This data gets transmitted in the devices which extracts the relevant information and sends it to the Arduino device which gives the command instruction for the data to the particular devices simultaneously. Smart parking using IoT technology helps to designs and develops a real smart parking system which provides information for vacant spaces and also helps the user to locate the nearest availability. The user is notified about the parking location, number of slots available and all other relevant information.

Architecture:

      This project includes 2 Arduino Uno microcontrollers to which the servo motors, LCD, ultrasonic sensors are interfaced. The LCD displays the availability of the space, the servo motor helps as gate for the entry and exit of the cars. The ultrasonic sensors detect the availability of the parking space. The IoT can be extended to provide a wireless access to the system and the user can keep a track of the availability of the parking area.

Hardware:

1. Arduino UNO

      The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 6 analog inputs, 14 digital input/output pins, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

2. LCD Screen

      LCD screen is a flat-panel display, electronic visual display that uses the light-modulating properties of liquid crystals and the liquid crystals do not emit light directly. LCDs are available to display arbitrary images. It displays preset words, digits, and 7-segment displays. It has a wide range of applications including computer monitors, televisions, instrument panels etc.

3. Ultrasonic sensor

The Arduino Ultrasonic Range Detection Sensor is used with Arduino in order to calculate distances from objects. It's an IC (Integrated Circuit) that works by sending an ultrasound pulse of about 40KHz. And then it waits and listens for the pulse to echo back, by calculating the time taken in microseconds. HC-SR04 is the ultrasonic ranging sensor used here. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit. There are only four pins on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground).

4. Servo motor

A servo motor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. Servo can rotate approximately 180º. It has an operating voltage of 5V and operating speed of 0.12sec/60º with torque of 1.8 Kg-cm. It allows the control of angular as well as linear motion. A servo motor is used for the opening and closing of the gate. Servo drive transmits electrical signals to the servo motor for producing motion
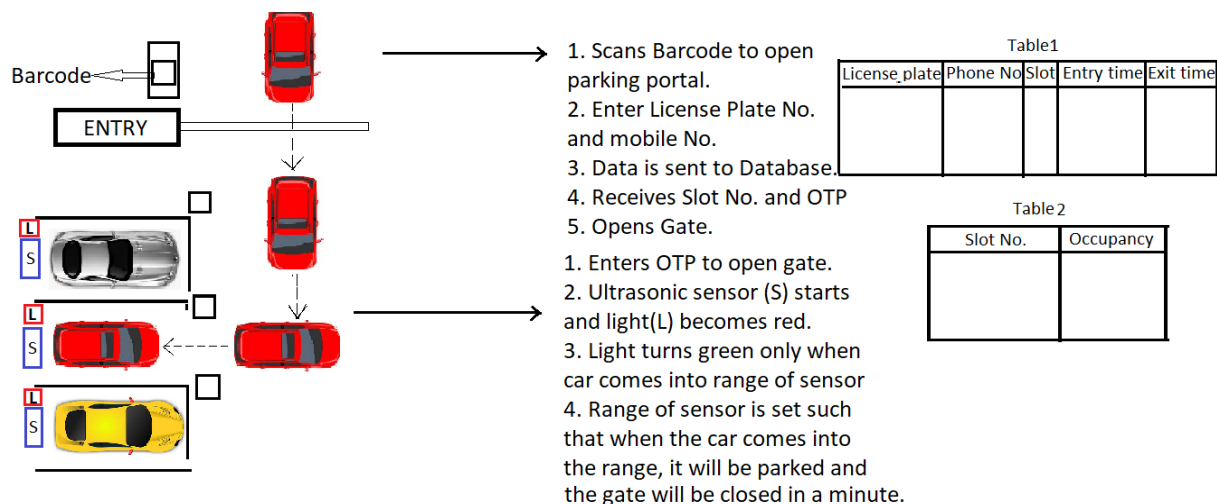
Software:

To achieve the desired results, a programming language and interface was needed to devise a logic that'd make the Arduino board understand the requirements asked of it. Arduino comes with its own code editor, which accepts the C and C++ languages. An Arduino code ready for usage is provided along with the report.

Working:

The proposed system consists of 3 parts:

1) Entry section:

When a car enters the parking lot, a barcode will be present at the entry section that leads to a portal to enter the License plate number and other details required. On submitting, the user receives an unique identification number and a slot number that is free. Then the Arduino uses the servo motors to open the gate to allow the car.

Barcode

ENTRY

L
S

L
S

L
S

1. Scans Barcode to open parking portal.
2. Enter License Plate No. and mobile No.
3. Data is sent to Database.
4. Receives Slot No. and OTP
5. Opens Gate.

1. Enters OTP to open gate.
2. Ultrasonic sensor (S) starts and light(L) becomes red.
3. Light turns green only when car comes into range of sensor
4. Range of sensor is set such that when the car comes into the range, it will be parked and the gate will be closed in a minute.

Table1

License_plate	Phone No	Slot	Entry time	Exit time

Table 2

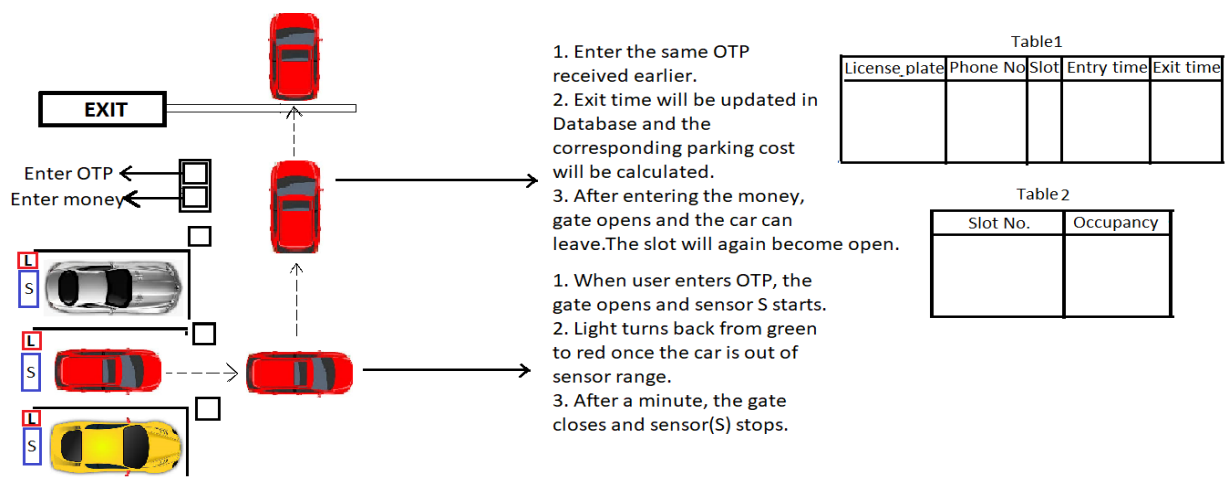| Slot No.	Occupancy

2) Parking section:

In the parking section at the allotted parking space, the unique identification number has to be entered to open another gate that is presented as a security measure in our scheme. There will be an ultrasonic sensor to tell the status of parking, an LED to indicate how far the car has been parked and a buzzer that rings if the car goes too near to wall as the car might get damaged. Then the gate gets closed after the car got parked. When the car has to be taken out, the user enters the same unique number to open the gate which automatically closes after some time.

3) Exit section:

While driving out of the parking area, the user enters the same unique identification number to calculate the parking cost and after entering the money in a box by the side, the servo motor starts and the gate opens.

1. Enter the same OTP received earlier.
2. Exit time will be updated in Database and the corresponding parking cost will be calculated.
3. After entering the money, gate opens and the car can leave. The slot will again become open.

1. When user enters OTP, the gate opens and sensor S starts.
2. Light turns back from green to red once the car is out of sensor range.
3. After a minute, the gate closes and sensor(S) stops.

Table1

License_plate	Phone No	Slot	Entry time	Exit time

Table 2

Slot No.	Occupancy

Due to limited resourses and hardware, this project got limited to only the parking section where the ultrasonic sensors keep track of parking and an LCD displays the slots available. There are buttons to start the servo motors that open the gates.

Simulation video link:
https://drive.google.com/file/d/1RqdLvmsJakhokZTHXv_1iILgJnBNY1iM/view?usp=sharing

Run this project live at
https://www.tinkercad.com/things/c5A0lXmPIhD

Advantages:

1)Smart Car Parking system is easier, efficient and less time consuming as it allocates an empty slot at the entry section.

2) Keeps track of cars entering and time stayed.

3) If a database can be included to store the details, the time stayed and the amount will be calculated in no time.
4) Extra security measure reduces chances of car theft.

5) Can be made fully automatic without a person involving for all the manual labour.

6) Uses buzzers and LEDs to notify if the car is parked too near to the wall.

Disadvantages:

1) The system requires high maintenance as each sensor must work properly to provide efficiency in working.

2) High power dissipation is recorded from each sensor.

Results and Conclusion:

Smart Car Parking aims to provide efficient way of parking for drivers without any hesitation. The existing system in today's world doesn't contain the facilities of parking reservation and parking slot availability checker which can be added in this scheme as a future work. The proposed system was sensor-based system which uses ultrasonic sound waves for detecting the presence of vehicles and it can be extended to two-tier parking came into existence which used the concept of parking cars one above another. A database can be used to keep track of cars entering, slot allocated and time stayed. It also connects the parking area to the real world. The idea of adding an extra password based security scheme to reduce car theft makes this paper different from others. Smart parking also reduces overall fuel energy of the vehicle which is consumed in the search of the car. The cars entering and exiting the parking slots can be tracked with minimum errors. The amount of parking payment can be redeemed by the administrator efficiently.