# IoT Smart Parking System

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## 1.ABSTRACT

A recurring issue in cities today is the availability of car parking spaces, taking away a lot of people's time. However, any problem can have a solution based on complexity and efficiency. Our motivation for implementing the IoT smart parking system came from considering this problem. We thought this can be solved using a smart parking mobile app which can inform the user of available parking spaces. The user can also visualize parking spaces checking to see which are empty and full.

**KEYWORDS**
Mobile, Android, OpenCV, MySQL

## 2. INTRODUCTION

The two key implementations of this project was the mobile app and the image processing using Python and OpenCV. Our project design consists of a login information for each user where the administrator adds users to the database.

## 3. SYSTEM DESIGN

The administrator of the parking space signs in with its credentials to view the logs and the normal user signs in with the user credentials to view parking space availability. The app gets updated each time with information from the database. We have completed the implementation of the server

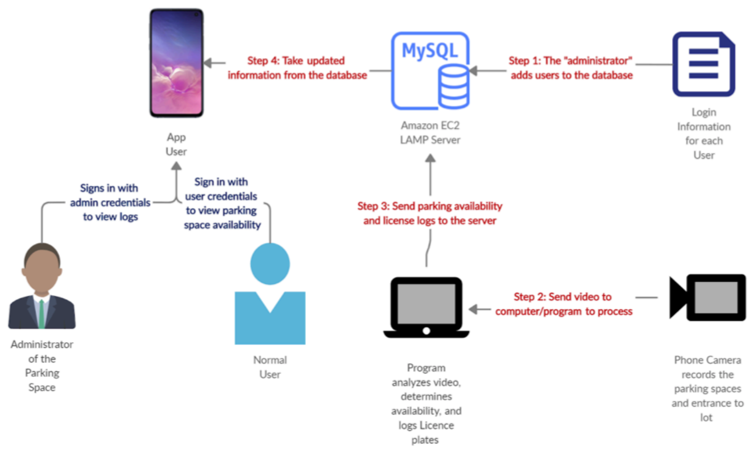
Step 4: Take updated information from the database
MySQL
Step 1: The "administrator" adds users to the database
App User
Amazon EC2 LAMP Server
Login Information for each User
Signs in with admin credentials to view logs
Sign in with user credentials to view parking space availability
Step 3: Send parking availability and license logs to the server
Step 2: Send video to computer/program to process
Administrator of the Parking Space
Normal User
Program analyzes video, determines availability, and logs Licence plates
Phone Camera records the parking spaces and entrance to lot

Figure 1 : System Design

connecting to the MySQL database from the SSHTunnel. We were able to test both our mobile app and image processing implementations together and came up with an effective way to solve the parking lot availability issue.

## 4. HARDWARE

Figure 2 : Phone camera and PC

The phone camera records the parking spaces in realtime and sends the video to process. The program then analyzes the video and determines availability and logs the license plates. This sends the parking availability and license logs to the server.

## 5. MOBILE APPLICATION

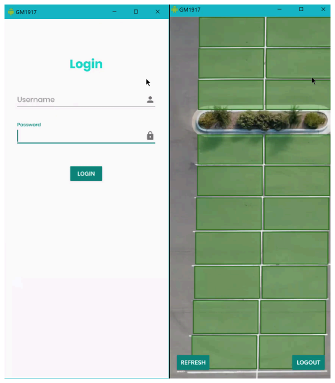

Figure 3 : Android Application

The Android mobile app is designed using the Android Studio, Amazon Web Services, and PHP. Advanced HTTPURLConnection is used which allows easier implementation to connect to the server that holds the MySQL database. The PHP scripts are used for the login, registration, GetData, and DataBaseConfig.

## 6. IMAGE PROCESSING

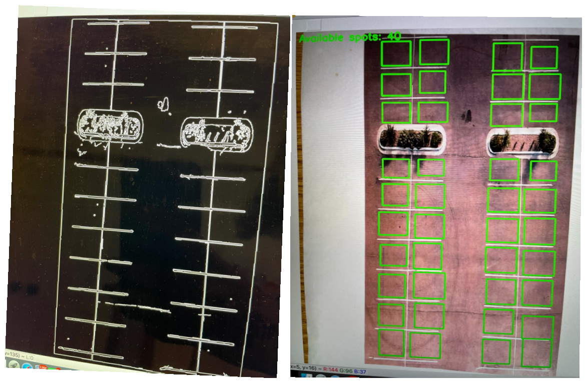

Figure 4: Spot selector and Canny

The image processing implementation consists of selecting the coordinate of the parking space and saving them into a file. Then, getting the coordinates from the file and deciding if the spot is available or not. To implement this we created two scripts called the spot selector and the detector program. First we set up the parking model to capture it live. For the selector program we started by importing the modules we needed and started working on getting the image on which we will select the parking spots. For that we take the first frame provided by the webcam, save it and use the picture to select the spots. We save the first frame and use selectROIs function to mark our parking spots. ROIs are defined as regions of interest and represents a portion of the image on which we will apply different functions and filters to get the results. After selecting parking spots, we apply the Canny function available in OpenCV and count the white pixels inside the new image, establish a pixel range and draw a red or green rectangle on the live feed. There is a SSHTunnelForwarder function in our detector program which is connected to the server.

## 7. CONCLUSION

Smart parking system can be controlled remotely through the Android mobile application which can assist everyone in a very user friendly way. It also makes it easier to locate empty parking spaces saving time.

## 8. REFERENCES

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