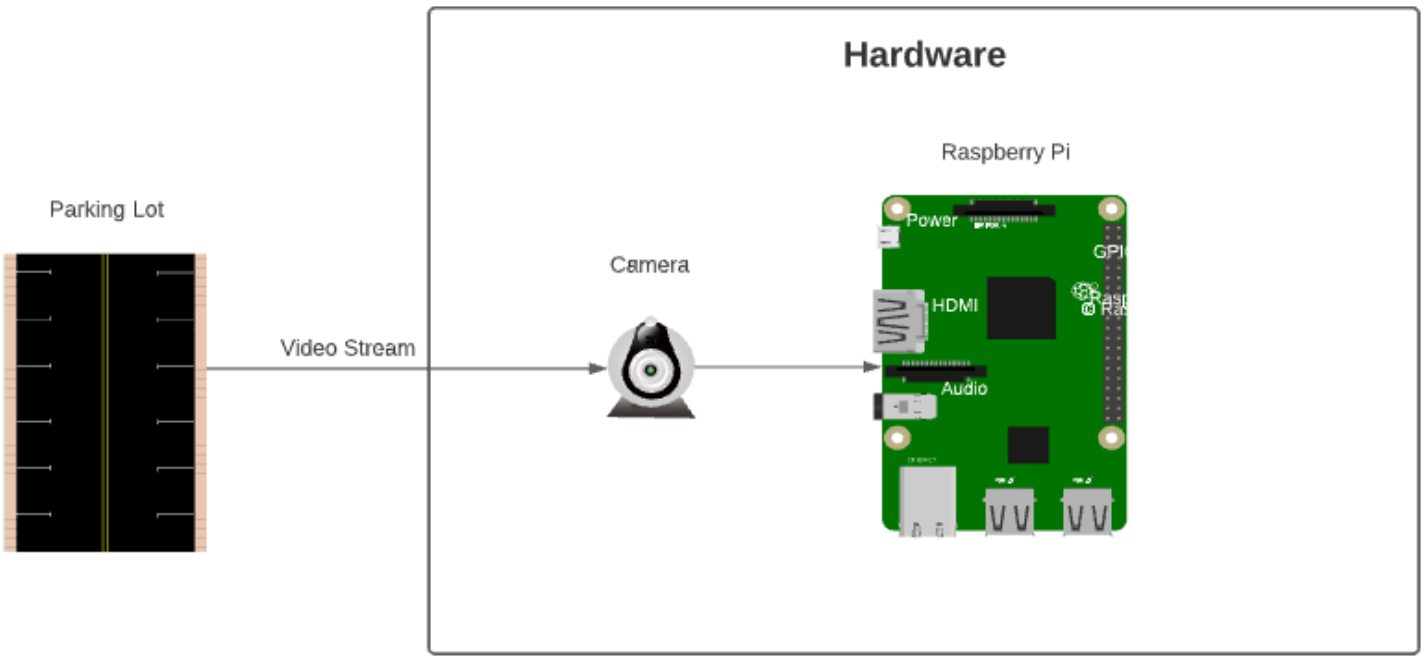
Smart Parking System

Hardware Architecture



1. Raspberry pi 3 model B
2. Camera -> preferably >=5mp

Software methodology

Image acquisition is the first step in any visual based projects and this is handled by the hardware that is the raspberry pi and the camera. The software developed for the system solves a two-part problem:First, objects of interest need to be identified in the image; this is referred to as localization. Second, the objects of interest need to be identified as cars; this is referred to as a classification. The system is subdivided into two submodules:

1. Parking slot/space detection
2. Realtime Car detection and occupancy tracking

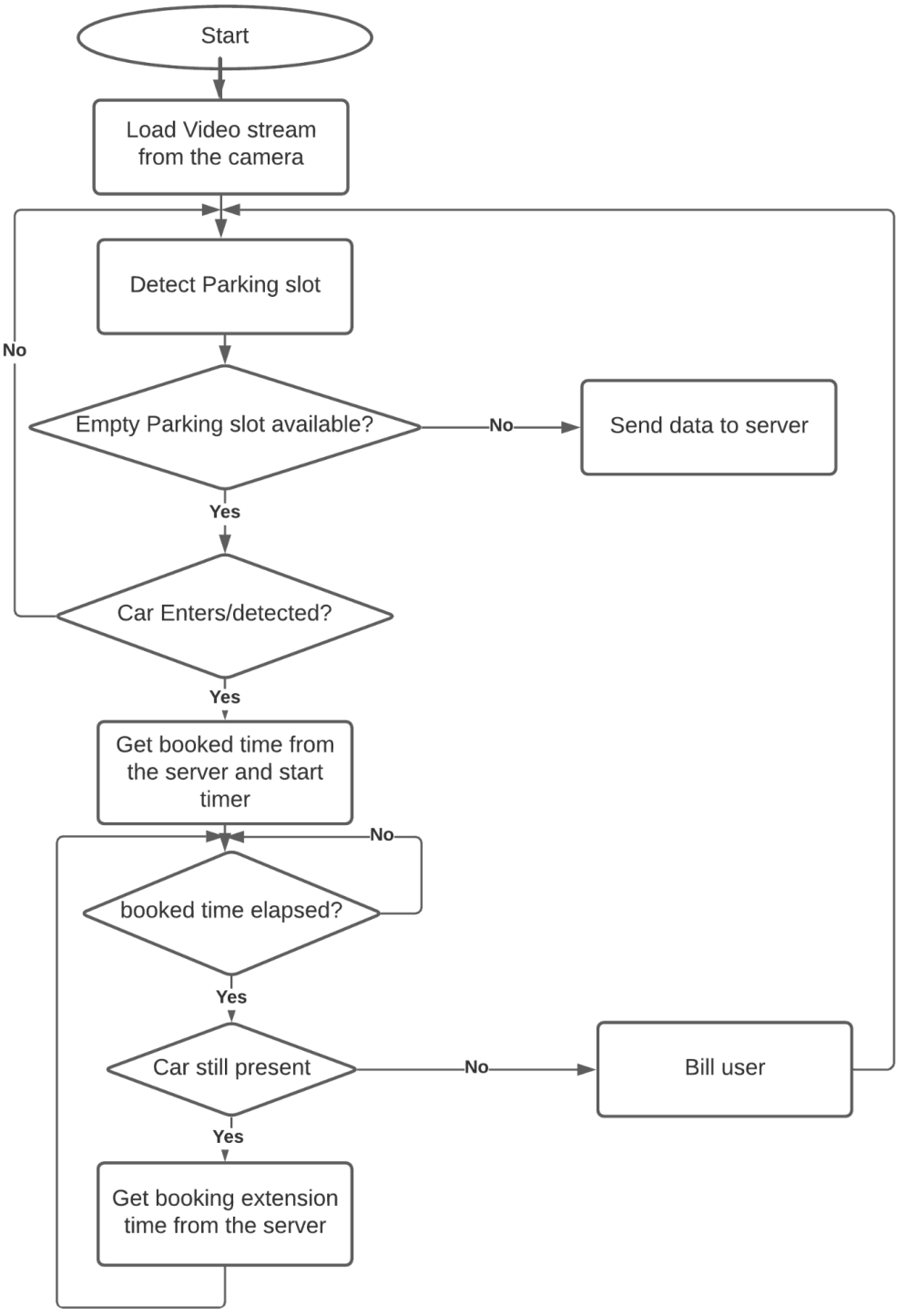
Parking slot/space detection

The very first step in a parking space detection system is to identify the parking spots. This is a localization process and involves deducing a rectangular region from the videostream delimiting a parking slot. There is a wide variety of parking lot designs, where features of one lot aren't always the features of another lot. That makes this problem very hard to solve, let alone from a single camera image. Assuming that the parking slots have predefined boundaries, identifying the parking spots will involve locating the parking lines in a spot. This will be done using the edge detectors that OpenCV provides.

Realtime Car detection and occupancy tracking

Once the parking slot is identified we then check for the presence of a car in that parking spot. A Convolutional Neural Network will be used for this task. The required data for training this network should have a large number of images with cars as positive samples and near equal number of negative samples of images without a car. Once the network is trained it is then used to report the occupancy of a parking slot by running the identified parking slots through the trained car detection model.

Flowchart


Start
Load Video stream from the camera
Detect Parking slot
No
Empty Parking slot available?
No
Send data to server
Yes
Car Enters/detected?
Yes
Get booked time from the server and start timer
No
booked time elapsed?
Yes
Car still present
No
Bill user
Yes
Get booking extension time from the server