System Architecture

The system will consist of four components: a central server containing the database, the camera system, the laser-break system, a number of mobile applications.

Each parking lot will include two cameras mounted at each entrance to the parking lot placed at mid-car level. Two parallel laser break devices will detect when an object enters or leaves the parking lot. When the laser break devices are activated, each camera captures a series of pictures of the candidate object. These images are transmitted to the central server and processed through an image recognition algorithm to determine a) whether or not the candidate object is a passing vehicle, and b) the direction of the passing vehicle. If a valid vehicle is found, a counter associated with the particular parking lot is incremented or decremented, depending on the direction of the vehicle. This counter represents the number of vehicles currently parked in the parking lot.

Customers access this information through a native mobile application. The application consists of a map of the TAMUK campus, with all of the parking lots registered with the system the visibly highlighted. Every 5 seconds, the mobile application sends a web request to the central server. The server will return a web response containing the number of cars in each parking lot as well as the total capacity of each parking lot. This information is visibly displayed over each parking lot in the form “x/y” where x is the number of spots taken and y is the total capacity of the parking lot.

Each day at 2:00 AM CST, a set of overhead cameras mounted above each parking lot capture a single image of the entire lot and transmit it to the central server. The image is processed through another image recognition algorithm to determine the actual number of cars in the parking lot. The counter is reset to this value in order to retain long-term accuracy of the system.

Server

The server will contain all the system data as well as the domain logic. It will receive streaming data from the camera system and laser break system. It will perform calculations on this data as established in the vehicle recognition software and update the database with the resultant values. It will also handle web requests made by mobile applications and return the resultant response.

Each parking lot will have:

* A unique identifier, used to differentiate between two parking lots (positive integer)
* A counter representing the number of vehicles in the parking lot (non-negative integer)
* A number representing the maximum capacity of the parking lot (positive integer)

Static data on the server will include:

* The Vehicle recognition software and Haar cascade files identifying cars

Camera System:

Entrance/Exit Cameras will be mounted near the entrances and exits of designated parking areas to record and transmit continuous video feed to our IP address.

Overhead cameras are responsible for capturing images of the parking lot as a whole. The purpose of these cameras is to get an accurate idea of how many cars are actually in the parking lot, as the counter for each parking lot will become inaccurate over time. These images will be captured in the early morning (2-4AM) where there is the least amount of cars in the parking lot. Using this information, we will know what to reset the counter in each parking lot to.

Laser break system

The laser break system will consist of several laser break devices mounted at the entrance of parking lots. Each entrance will consist of three parallel lasers. Using this system, we will be able to determine