CHAPTER 1
INTRODUCTION

1.1 Background

Providing parking information in the urban area has been one of the important areas of the smart city. Nowadays, the vision detection method for parking lot availability detection has been commonly used. These vision-based detections not only require the system that is cost performance effective, but also the system that meets the real-time requirement. To meet real-time requirements, most object detection has been parallelized using pthread to run full capacity on many cores CPU and using CUDA to run on GPU. Parking lot availability detection usually runs non-stop 24 hours a day and 365 days a year, hence it consumes tremendous power. In this paper, we propose the use and modification of YOLO version 3 to automatically detect parking lot availability which meets the soft real-time requirement as well as to lower the power usage that runs on Nvidia TX2 machine. We use TX2 because it has CPU and GPUs heterogeneous computing, the camera is embedded and the whole system is an affordable cost-effective performance, and it can be mobile and easy to install in a particular parking lot area.

In general, there is a tradeoff between speed and power usage. To speed up the computation, the system is run in full capacity which uses more CPU cores and GPU cores, because the computation requires more power consumption. Hence, there must be a balance between processing speed in this case frame per second (fps) and power consumption. To realize this problem, we perform simulation for parking lot detection by an artificial parking slot with remote control cars.

We use YOLO (You Only Look Once) [1] object detection program because it is fast and accurate which meets the real-time requirement. YOLO takes an input image and divided it into n x n grids. It uses a single neural network with fewer convolution layers and fewer filters in those layers to predict each bounding box and each confidence score; it also calculates the class probability map, and finally, together with high confidence scores, it is considered as final object detection. The detail about YOLO can be found in [1].

1.2 Scope

From the background of the problem, a number of limitations will be determined in this project is:

1.Can YOLO predicts a lot of objetcs fast and accurately?

2.How YOLO predicts a lot of objects in the image?

3.Can YOLO be used to detect the availability of parking space?

4.Can we save more power consumtion and make YOLO faster than the original one?

5.Can YOLO detect a lot of object in any weather an situation?

1.3 Objective

Our goal in this work is to realize a soft real-time parking lot availability detection with an energy-aware algorithm. This is done by detecting whether the object is moving in the parking lot area and any conditions (night and day). When there is no moving object, the parking space remains the same as previously and object detection is not performed invoked in order to save power. This motion detection's time complexity must not greater than object detection algorithm, otherwise, nothing is gained.