

Smart Parking System



Abstract

Smart parking system uses sensors to create a real-time feed of the parking occupancies. This data is aggregated and fed to an ML engine for training on demand forecasting. We also developed a Mobile App that allows the admin to set dynamic pricing based on the forecasted demand. The App also allows end users to view the pricing models and make parking reservation in real time.

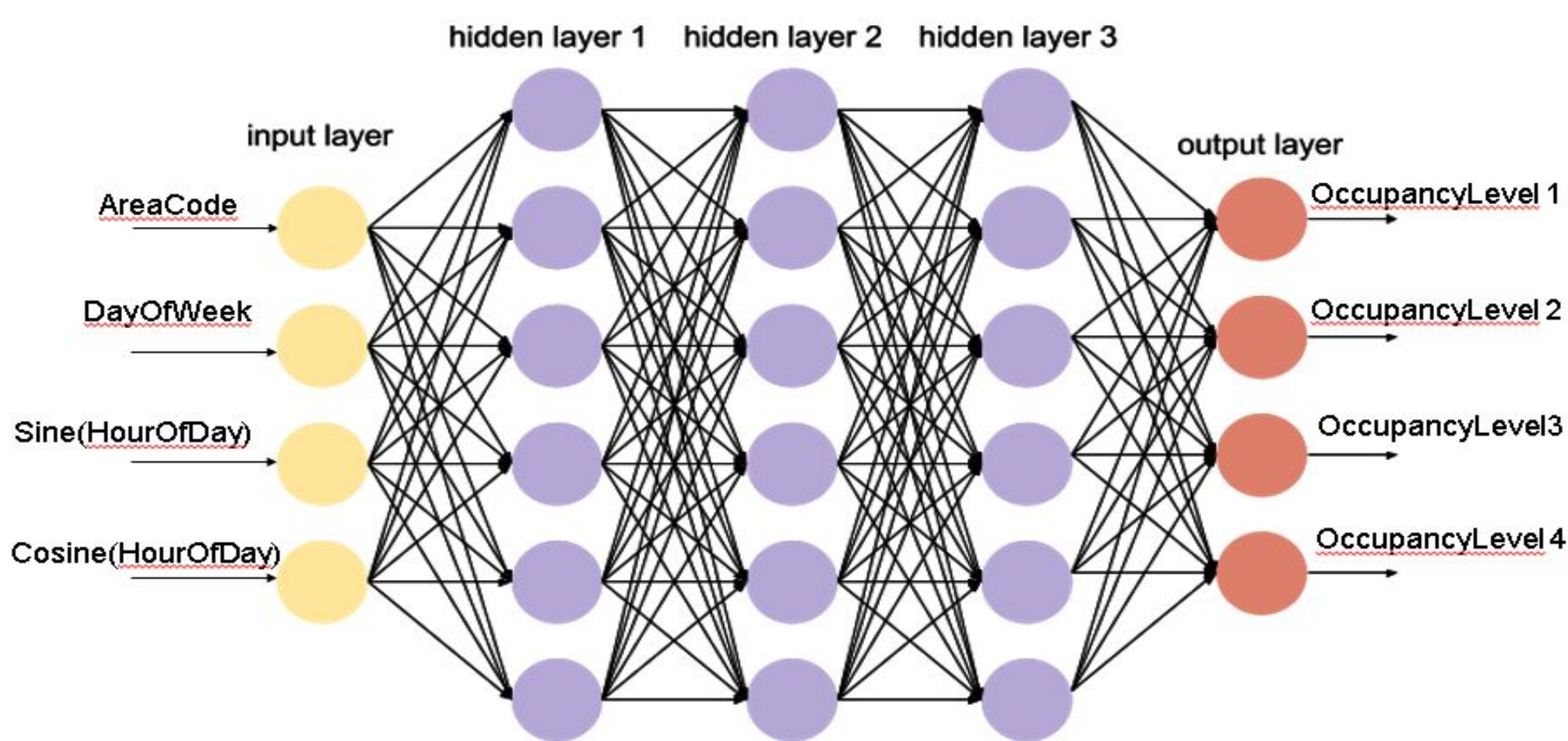
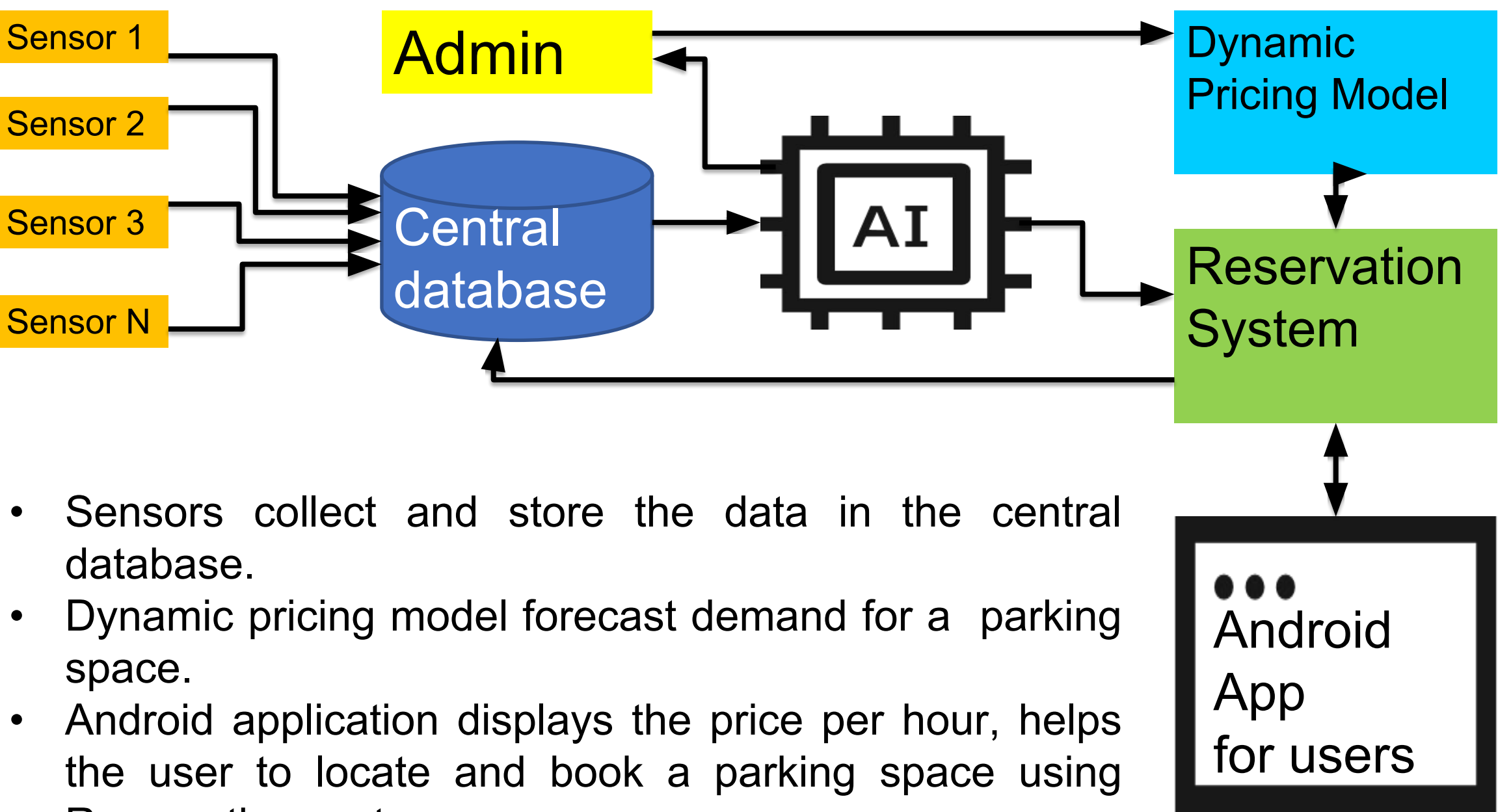


Figure 1

Figure 1 resembles the implemented three-layered Neural network architecture, with a feature set of *AreaCode*, *DayOfWeek*, *Sine* and *Cosine* components of *HourOfDay*. Based on different levels of congestion, *Parking Occupancy* is predicted to facilitate the dynamic pricing in the system. Softmax activation function is used for the output layer and Relu otherwise.

Technologies

- IR sensors (FC-51) and Arduino uno R3 boards
- ML framework – Tensorflow / Keras
- Mobile App Framework–Android Studio
- Data Collection:
 - Real world Data
 - CityOfSeattle – (2014-2018) (15000 entries)
 - Synthetic Data of 50000 parking occupancies
 - Central Business District – 25,000 entries
 - Mall Dataset – 25,000 entries
- Preprocessing methods :
 - Data Cleaning
 - Format Recognition
 - Database Creation
- ML architecture: Three layer neural network architecture.

Business Rationale

The parking management market size is expected to grow from USD 3.39 Billion in 2018 to USD 5.15 Billion by 2023, at a Compound Annual Growth Rate (CAGR) of 8.7% during the forecast period. In the same duration, the number of new vehicles added increases at a CAGR of 10-13%, therefore increasing demand for parking spaces.

Most publicly available parking lots currently use static pricing models depending on the hours of usage.

Our goal is to make use of big data and analytics to provide demand forecasting capability to the parking lot owners. This will enable them to dynamically price the usage of the parking space. The solution has the potential to improve the operational efficiency and bring in additional revenue due to congestion based pricing model.



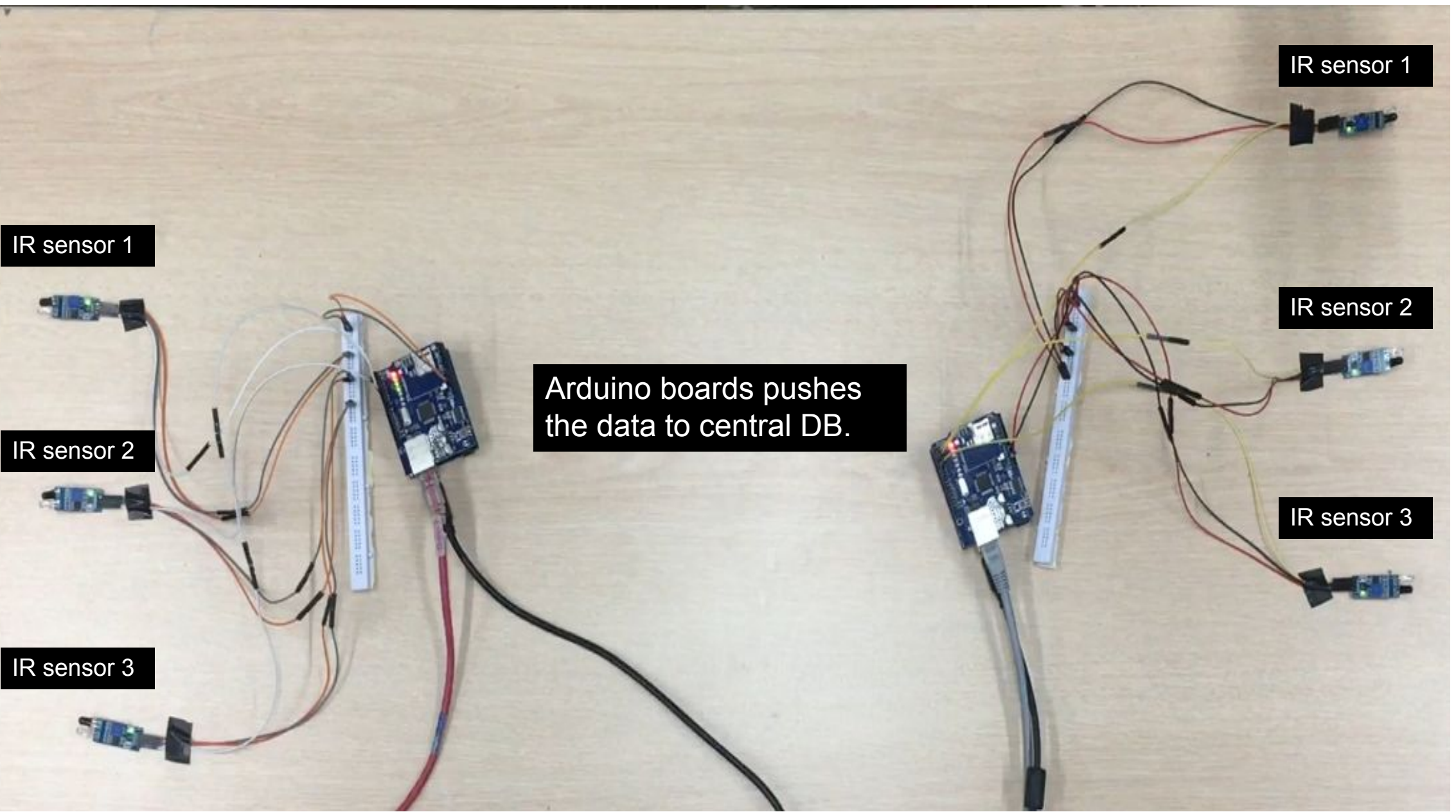
Figure 2



Figure 3

Above Figures are the screenshots of the Android App.

- In Figure 2 App suggests the parking spaces(using static data) for the user based on his location.
- Figure 3 shows pictorial representation of prices for a location in a day and time.



Results

Data-Set	Training accuracy in(%)	Testing accuracy in(%)
Synthetic	88.19	87.56
CityOfSeattle	83.30	83.71