ILR 08 – Progress Review 9

Dorothy Kirlew

Team Daedalus Members: Mohak Bhardwaj, Shivam Gautam, Pranav Maheshwari, and Richa Varma

February 24, 2016

1. Individual Progress

For the progress review on February 24, I worked with Mohak to integrate the Planner with the XBees and Pranav to integrate the UI with the XBees. I also constructed a cardboard mock parking lot to be used for the PR and testing to ensure correct dimensions before the wooden parking lot is constructed.

i. Integration and Testing

Mohak, Richa, and I integrated with Planner with the XBees. When an XBee receives a "Park" command (currently simulated through a talker node), it sends a string to the Planner. The string is a binary list of the 24 spots, where a 0 indicates that the spot is free and a 1 indicates that the spot is occupied. The Planner uses this information to find the most optimal free spot in the parking lot. That is, the spot that is closest to the exit. The Planner then publishes the coordinates of the spot for the Locomotion node and the index of the spot for the XBee. The XBee marks this spot as occupied and communicates this to the other XBees on the network. The integration and testing went very smoothly.

Pranav, Richa, and I integrated the XBee communication system and the UI. When the XBee node is initialized, it takes one argument that indicates whether it should publish information to the UI. This published information is in the form of a custom message that contains the vehicle ID, status, and spot ID. The UI parses this information and adds, moves, or removes vehicles accordingly. Additionally, virtual vehicles can be added or removed from the parking lot through the UI. This information is then relayed to the XBee that is in communication with the UI, which passes it on to the other XBees on the network. We have confirmed that messages are sent and received correctly between the two subsystems, but more work needs to be done to test various vehicle scenarios.

These subsystems follow the software architecture pictured below (Figure 1).

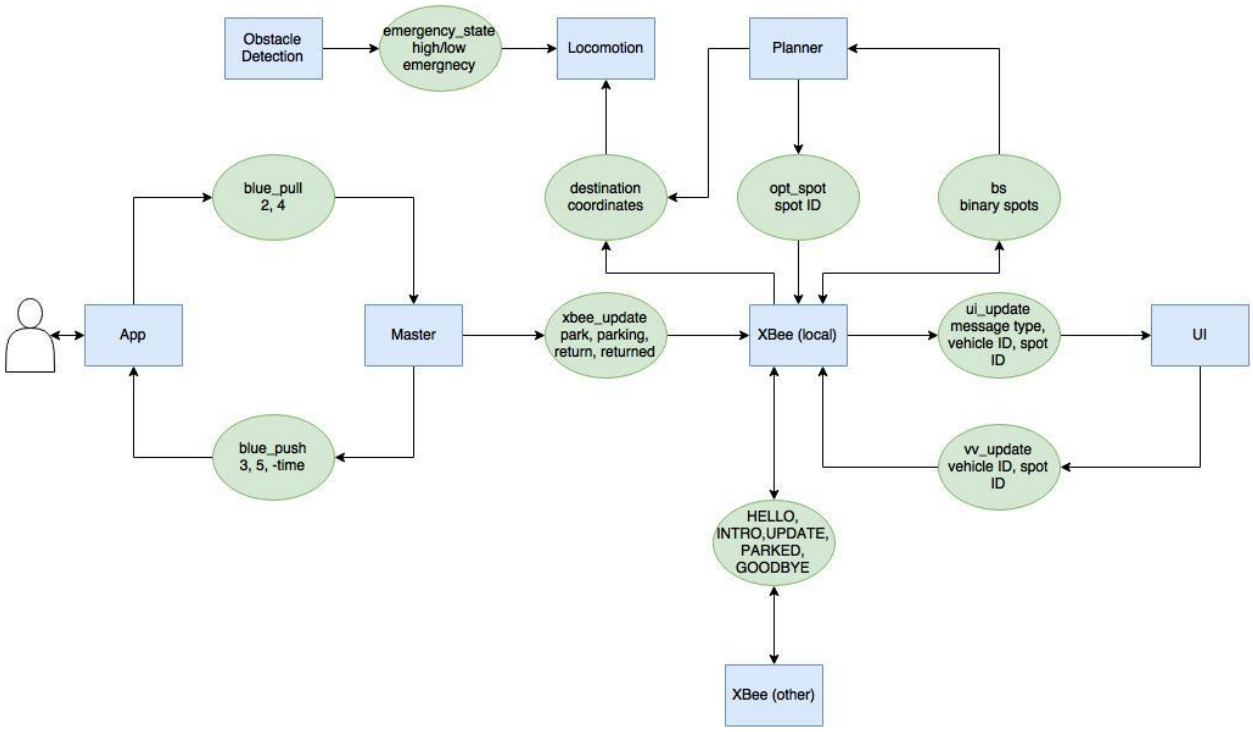

Figure 1: Software Architecture

The three subsystems have all been tested together with 3 XBees. To show this, Richa initialized the XBee and the UI from her laptop (Figure 2). I then initialized the XBee connected to my laptop (Figure 3), which sent it's vehicle ID to the XBee on Richa's laptop and thus the UI (Figure 4). Richa sent a "Park" command, which caused the XBee to publish the binary list of spots to the Planner. The Planner chose the most optimal spot and informed the XBee. The XBee then sent the update to both the UI (Figure 5**: Optimal Spot Chosen by Planner with Updated UI, Photo by Richa Varma**) and the XBee on my laptop. Richa then sent the "Parked" update, which updated the UI (Figure 6). I then sent a "Park" command. It communicated this to the Planner, which chose the most optimal spot. The XBee read this spot (Figure 7) and, because it was not the UI, communicated the spot to the other XBee on the network. The XBee on Richa's laptop passed this information to the UI (Figure 8). I then sent the "Parked" update (Figure 9**:**), which was passed to the XBee on Richa's laptop, and then the UI (Figure 10).

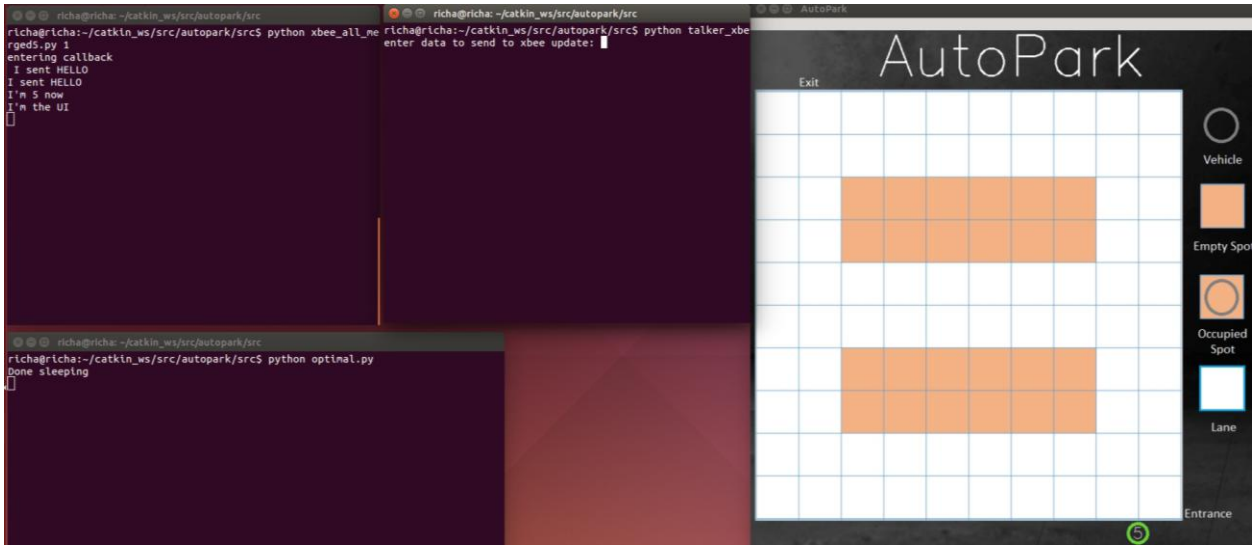

Figure 2: XBee Initialized with UI, Photo by Richa Varma

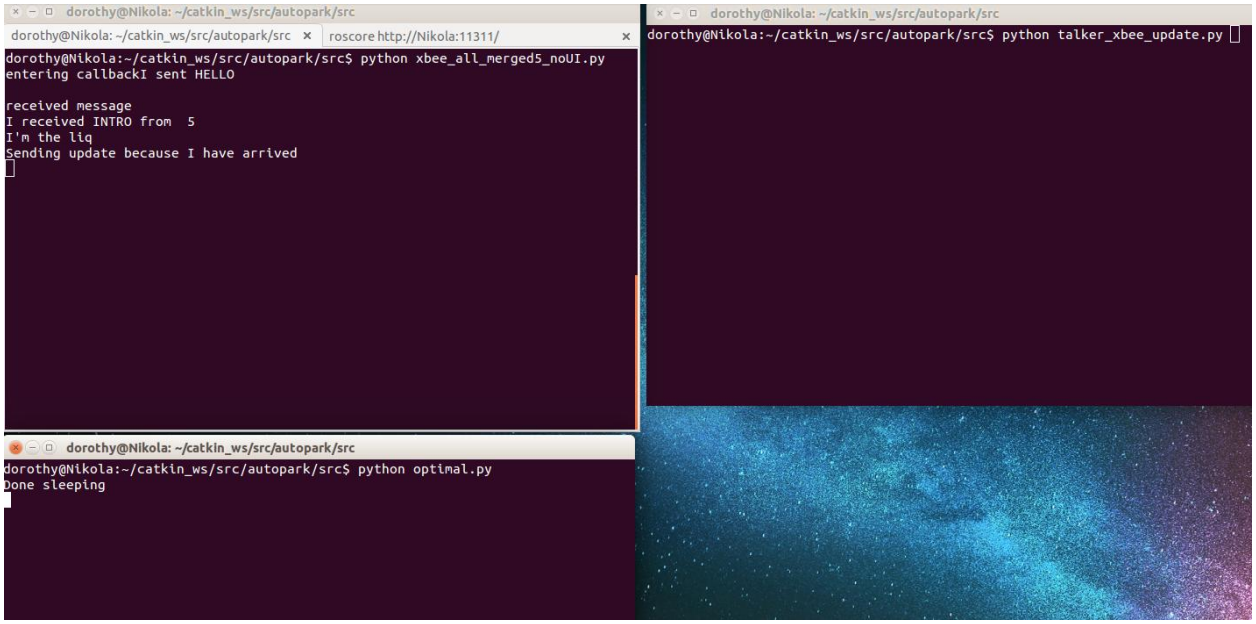

Figure 3: XBee Initialized without UI

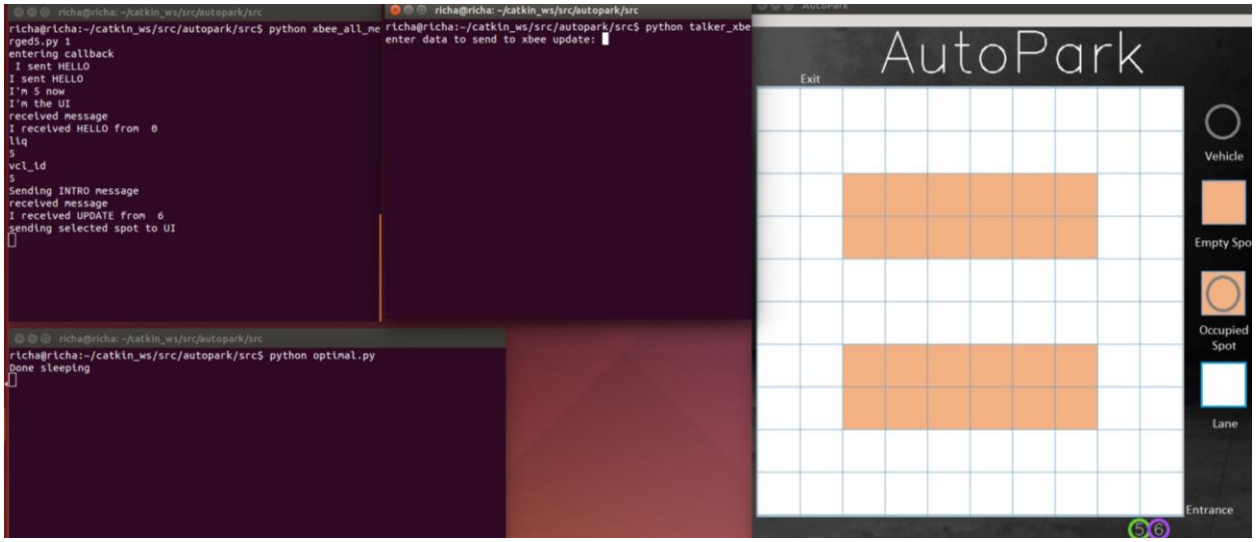

Figure 4: UI Shows Second XBee in Queue, Photo by Richa Varma

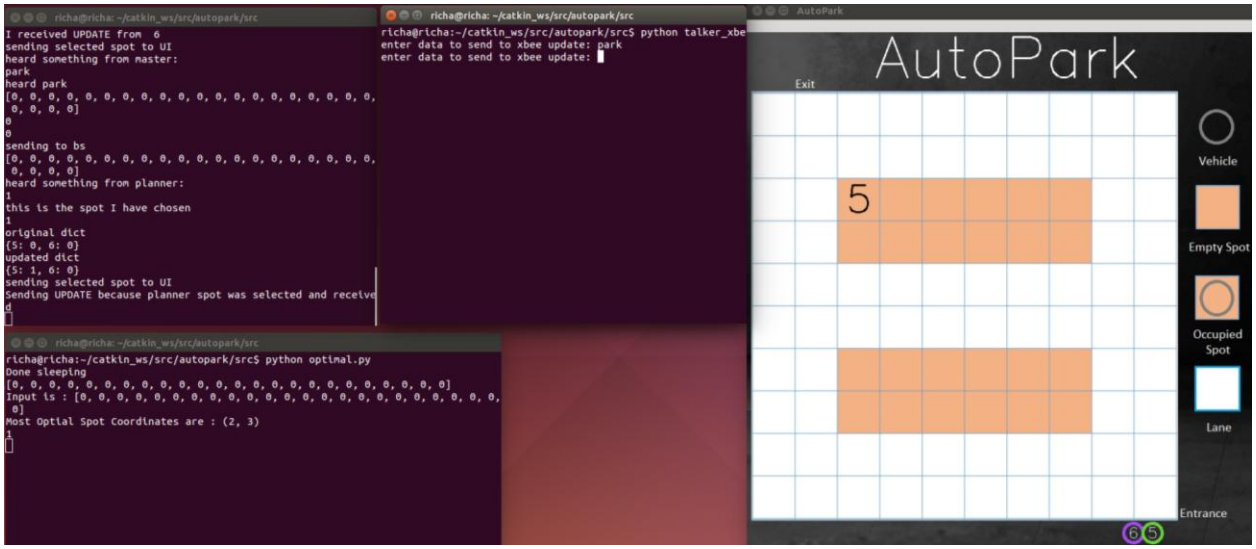

Figure 5: Optimal Spot Chosen by Planner with Updated UI, Photo by Richa Varma

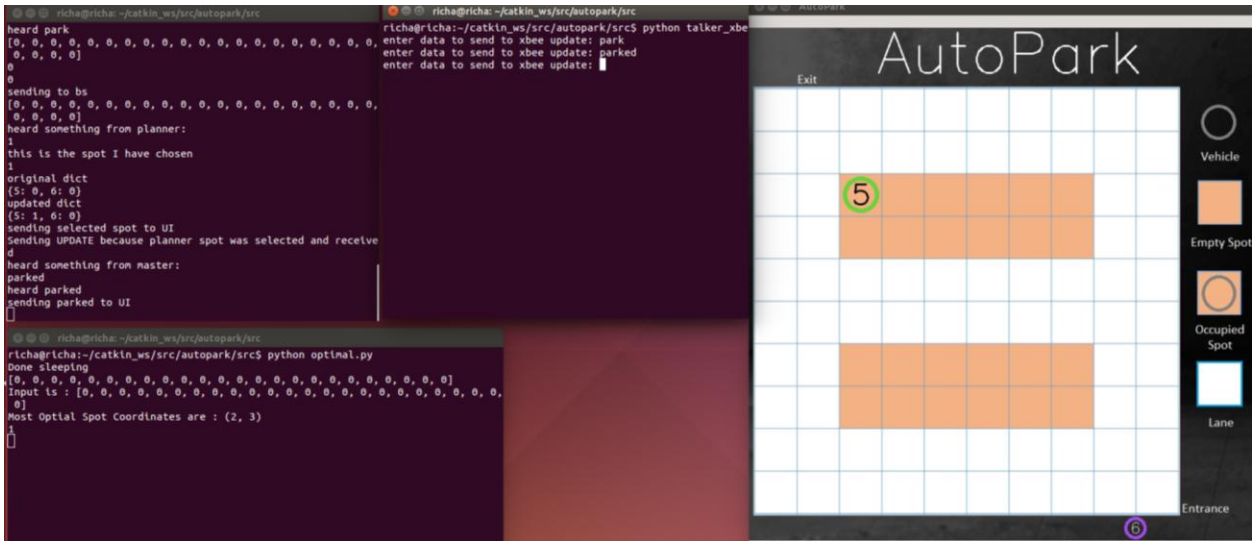

Figure 6: Parked Vehicle Shown in UI, Photo by Richa Varma

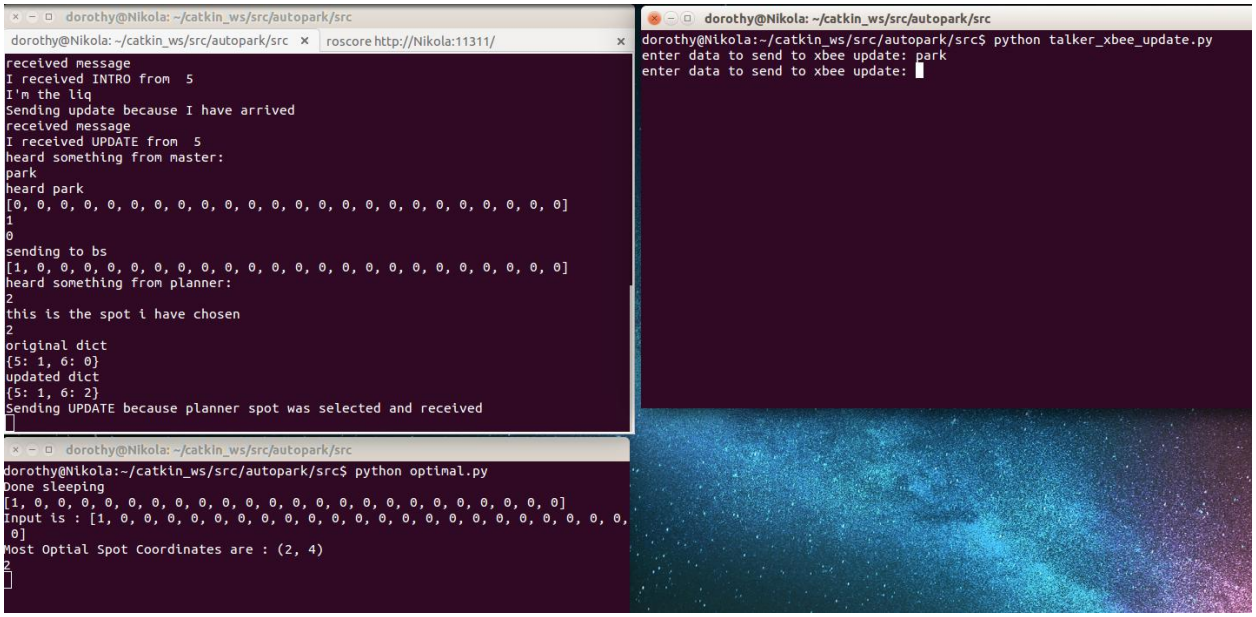

Figure 7: Optimal Spot Chosen by Planner without UI

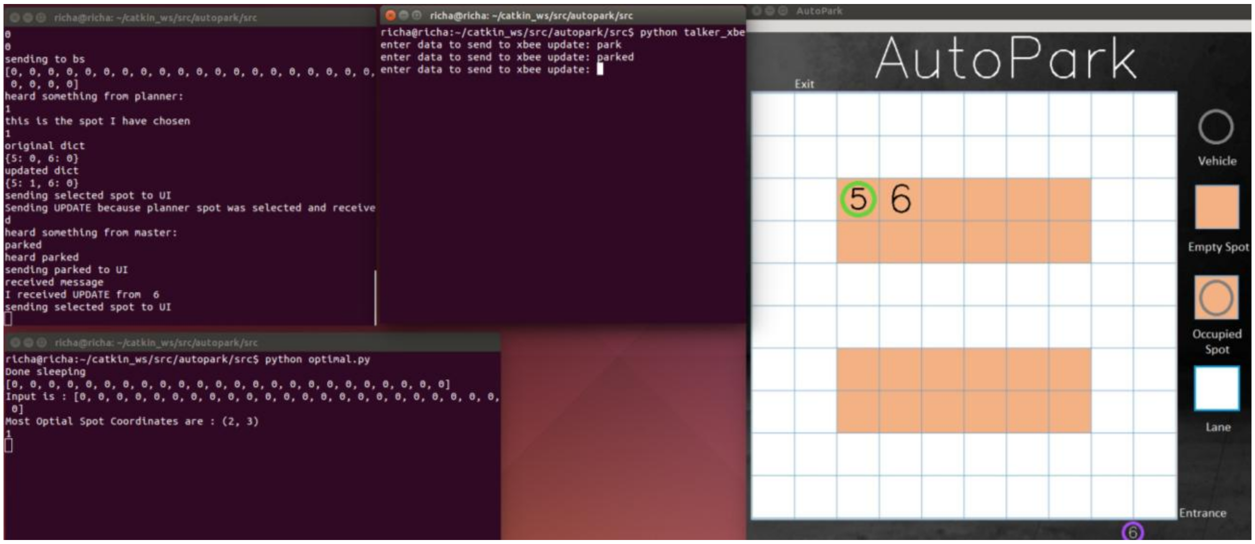

Figure 8: UI Showing Second Vehicle Parking, Photo by Richa Varma

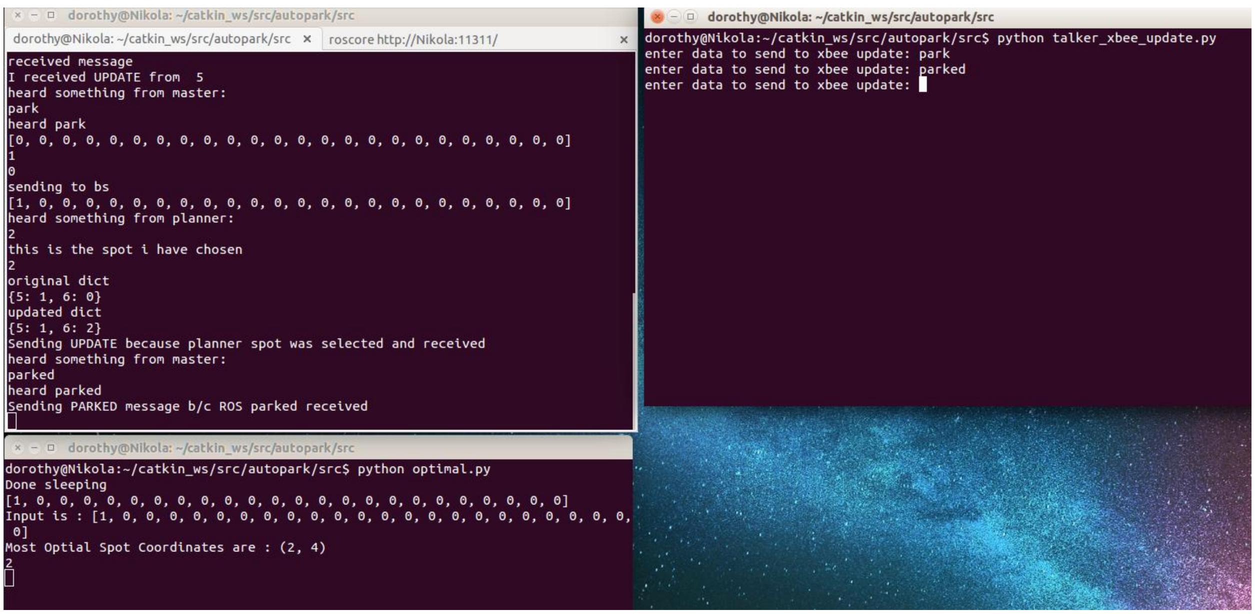

Figure 9: Parked Status Sent from XBee without UI

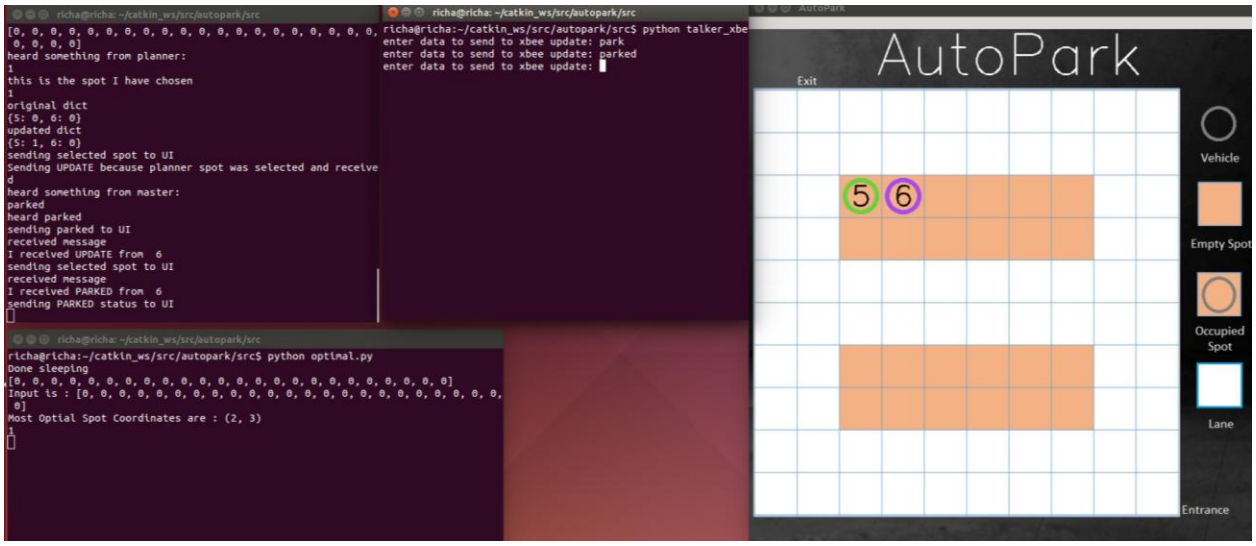

Figure 10: UI Showing Second Vehicle Parked, Photo by Richa Varma

ii. Cardboard Mock Parking Lot

After much discussion, it was agreed that the mock parking lot should have approximately the same dimensions as the final, future parking lot. That is, the parking lot will be 5m square and have walls approximately 0.5m high. I purchased cardboard boxes measuring 18”x18”x16” and removed the flaps from the top and bottom. When folded out, a box is 68” long, so each side of the parking lot is approximately 3 boxes. I used the diagram below to the lengths below in (Figure 11).

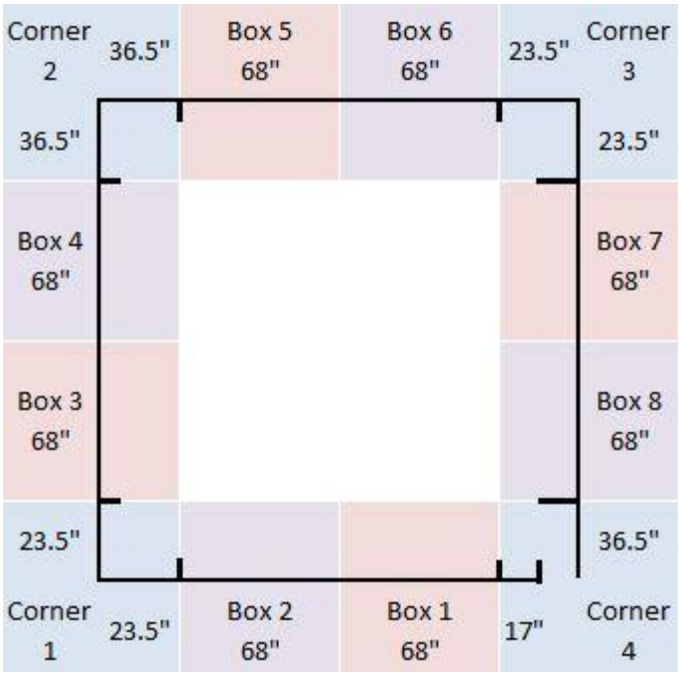

Figure 11: Size of Boxes Used in Cardboard Mock Parking Lot

I attached the boxes using heat-activated tape, which is sturdier than duct tape. I also added two strips of cardboard to prevent uni-directional bends (Figure 12). A similar process was applied to the bends in the cardboard, but using duct tape and three smaller cardboard strips.

Figure 12: Reinforced Joins in Cardboard Mock Parking Lot

When all the pieces were connected, it created a 20m strip of cardboard (Figure 13).

Figure 13: 20m Cardboard Strip

With the help of three classmates, I raised and bent the strips to create the walls (Figure 14).

Figure 14: Assembled Cardboard Mock Parking Lot

Unfortunately, no testing was done using this parking lot before the PR. Directly after the PR, some unknown persons dismantled the structure. At this time, it is unknown whether it is salvageable.

2. Challenges

Due to conflicting schedules, it was difficult to find time to meet with teammates to integrate subsystems. It was also difficult to elicit dimensional requirements for the parking lot. Other than these communication issues, the work went very smoothly.

3. Teamwork

Shivam, Mohak, and Pranav worked on getting the new platform to complete navigation and waypoint navigation. They constructed a mock-mock parking lot to be used for testing. Richa has been working on setting up the Xaxxon-recommended Intel SBC to be installed on the original platform. I worked with Mohak, Richa, and Pranav to integrate the planner, XBees, and UI and I constructed the cardboard mock parking lot.

4. Future Plans

For the next progress review, the Master node will be created and integrated with the Virtual Valet app and the XBees. More testing will be done between the XBees and the UI. The wooden parking lot will be constructed and the platform will be able to navigate within the parking lot. Work will be done with the simulation environment that is intended to show real-time vehicle updates in regards to paths and locations. The path planner and spot planner will be modified to include more heuristics.