PROGRESS REVIEW 9: ILR08

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Team I
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1. Individual Progress

Between Progress Review 8 and 9, the project underwent reconsideration regarding scope and implementation. This held us up on the schedule a bit, but things should move ahead smoothly from now on.

The main tasks I was involved in were:

a. Integrating three subsystems: Communication, Planner and Visualization tool
b. New hardware and software setup for Oculus Prime
c. Literature study of planning techniques and existing libraries for motion planning

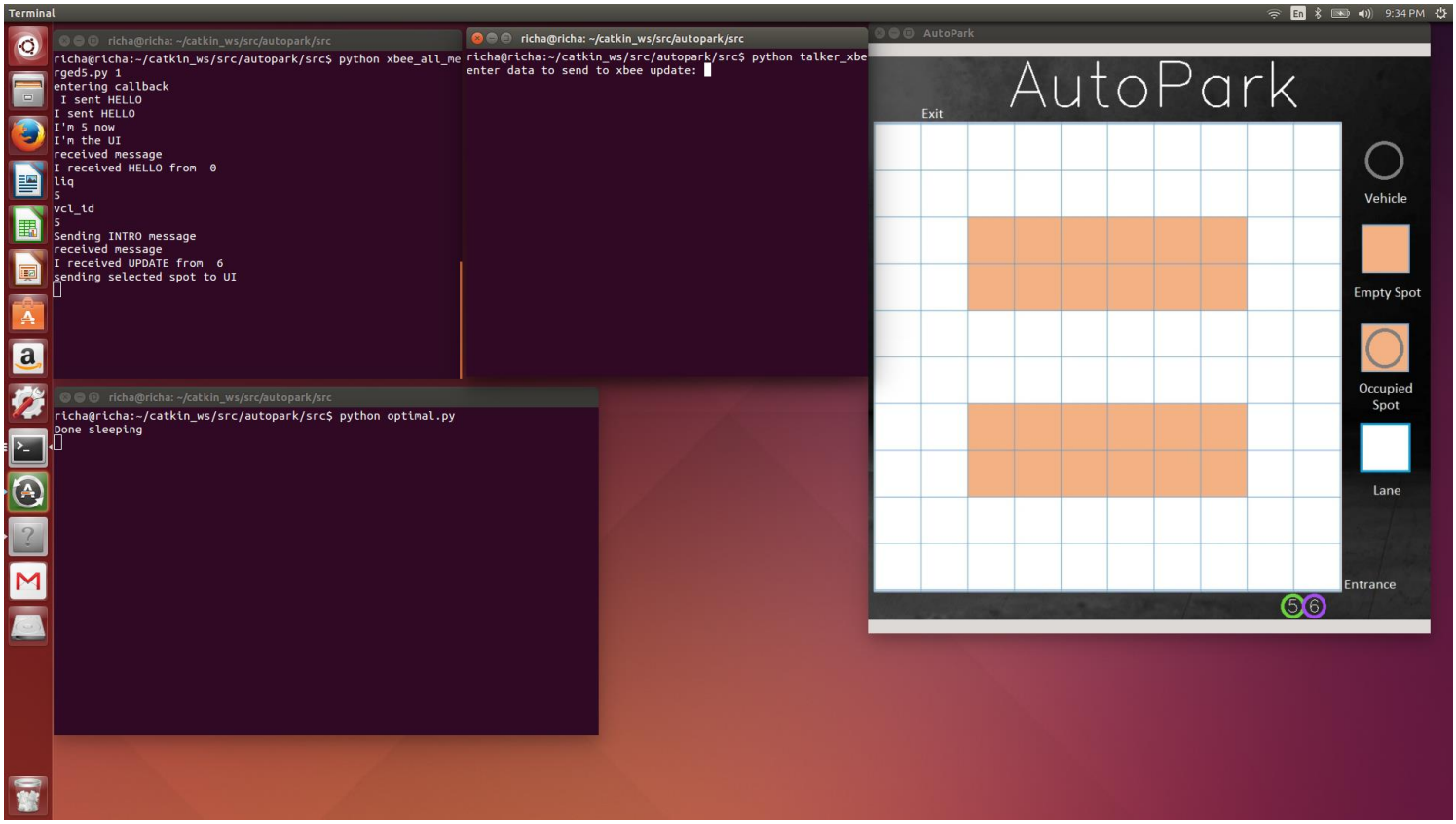
1. Communication, Planner and Visualization tool integration

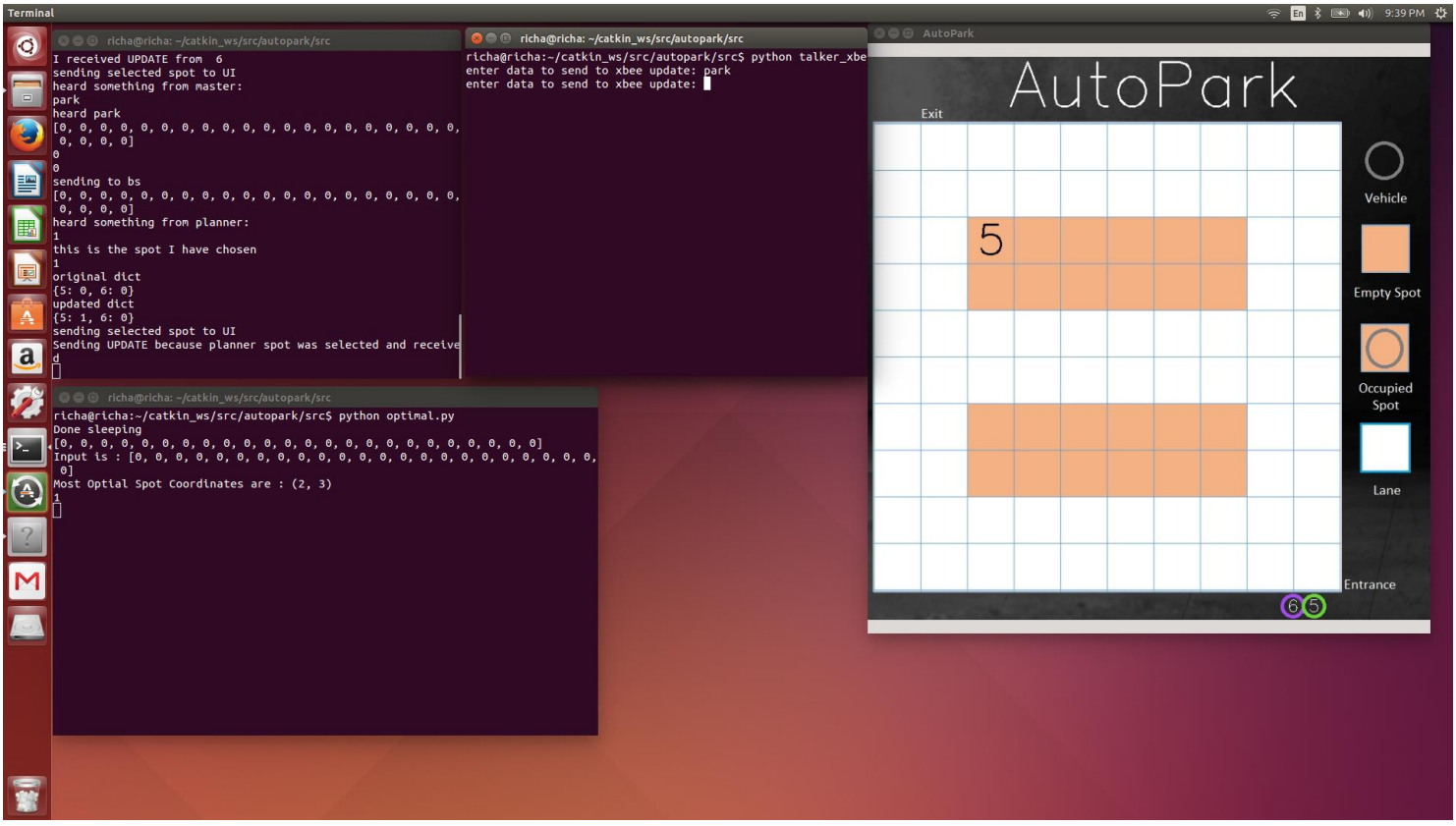
After making some minor bug fixes in the existing code for the collaboration node, Dorothy and I worked on the integration of this node with the planner and visualization tool. This was the first step towards incremental integration of the auto-park system.
It was important that the correct information was being passed on to the concerned node for the entire pipeline to work. The planner was initially sending coordinates of the selected spot to the relevant topic (subscribed to by the collaboration node). We worked with Mohak to sort out this issue and successfully integrated the planner with the collaboration sub-system. On receiving a 'park' command, the collab node sends a message to the planner, which replies with the spot id of the selected spot. This selection is based on a cost-map wherein priority is given to the spots closest to the exit. This might change in the future, as and when multi-heuristic global planning is introduced.

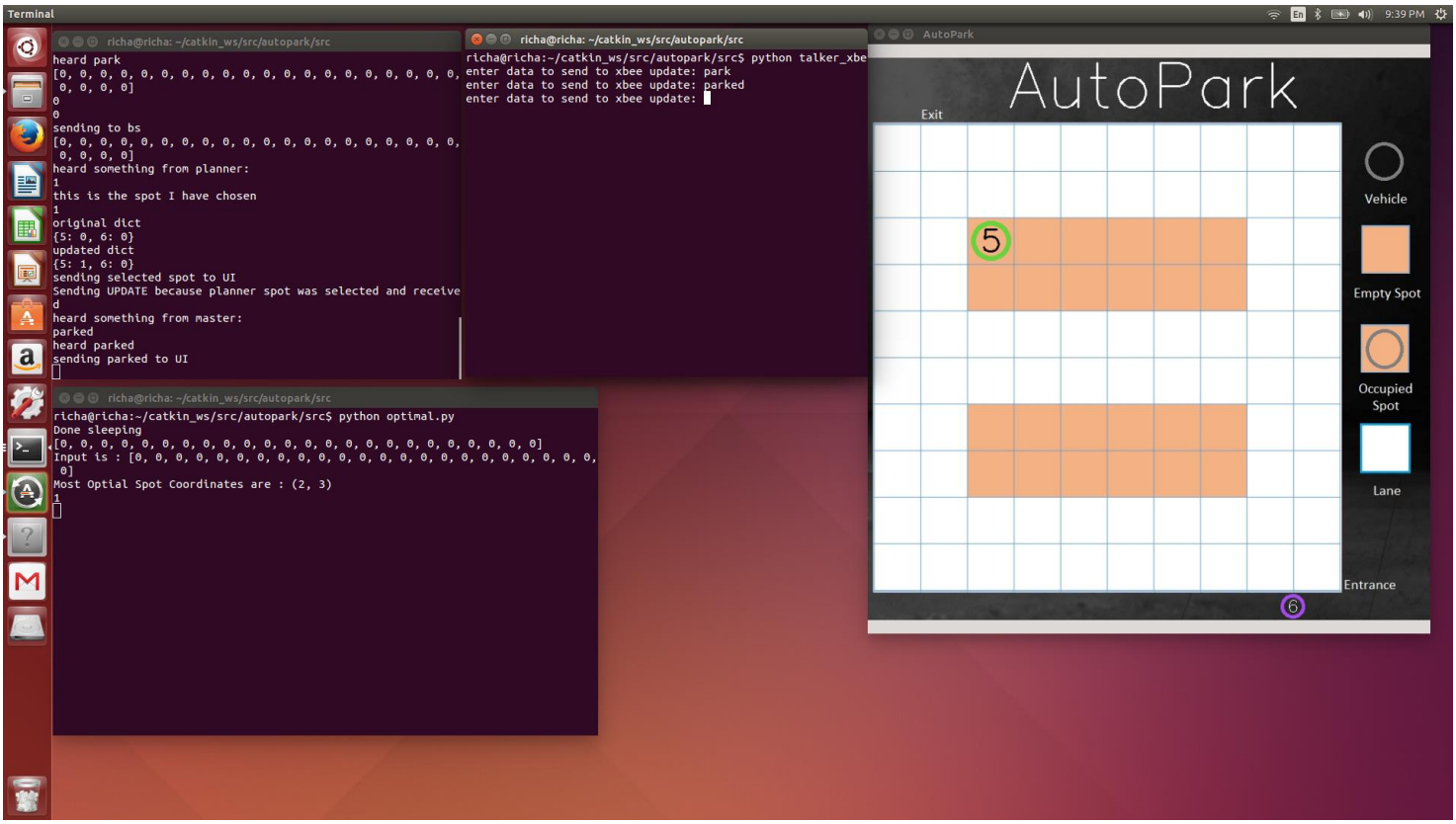
The next step was to integrate the visualization tool with the above. The collaboration node interacts with the UI through ROS custom messages of the format:
status (in_queue/parking/parked/returning/returned)
vehicle_ID
spot_ID

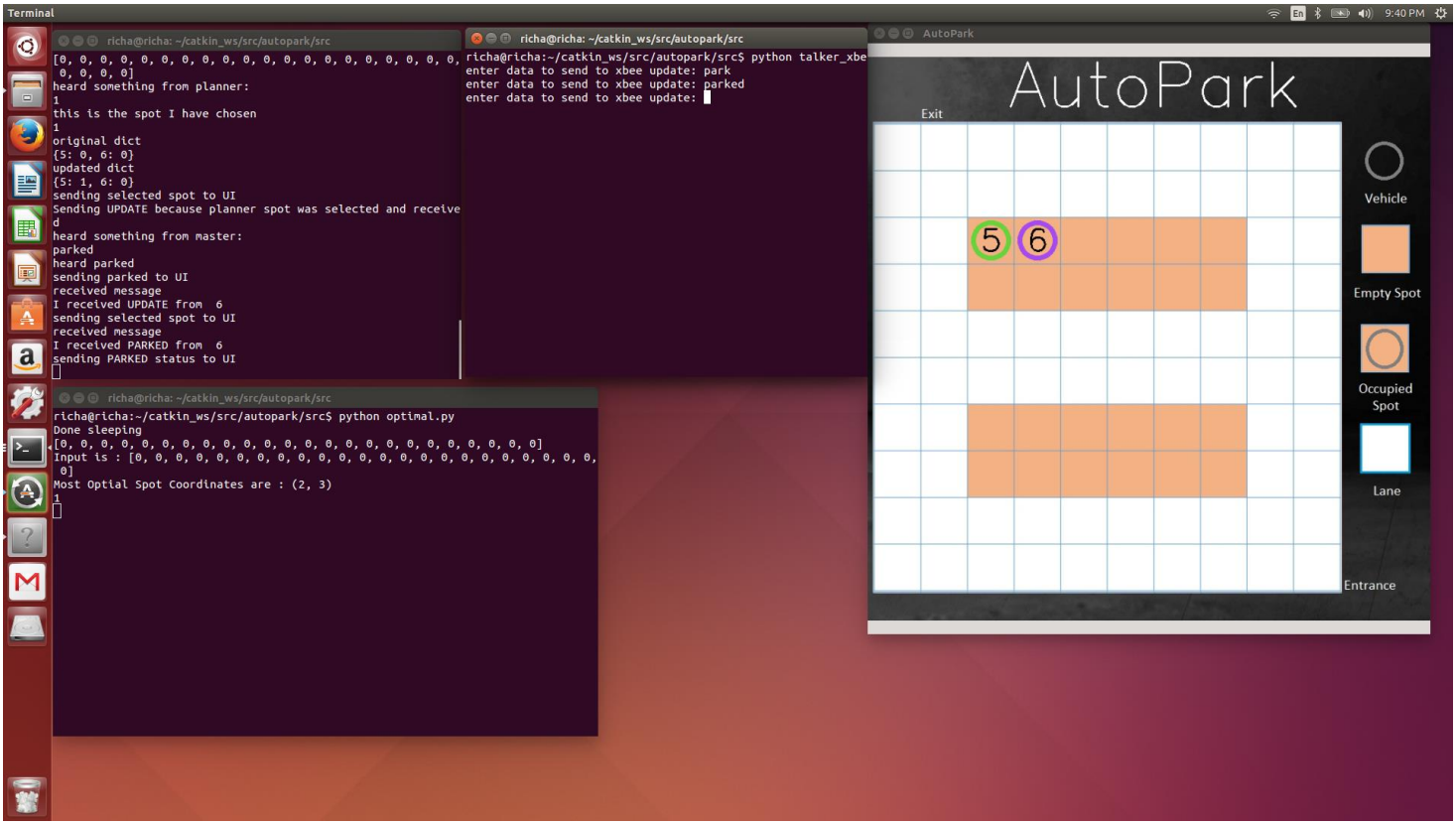
This tells the UI the status of all the vehicles in the parking lot and the UI updates it in real time. The following screen shots depict the sequence of events when two vehicles move in the parking lot:

1. Car 5 and 6 join the entry queue.
2. Car 5 navigates to the spot upon receiving a park command.
3. Car 5 successfully parks itself.
4. Car 6 receives a park command and navigates to its chosen spot.
5. Car 6 successfully parks itself.


Terminal
9:34 PM
richa@richa: ~/catkin_ws/src/autopark/src
richa@richa:~/catkin_ws/src/autopark/src$ python xbee_all_me
rged5.py 1
entering callback
I sent HELLO
I sent HELLO
I'm 5 now
I'm the UI
received message
I received HELLO from 0
liq
5
vcl_id
5
Sending INTRO message
received message
I received UPDATE from 6
sending selected spot to UI
richa@richa: ~/catkin_ws/src/autopark/src
richa@richa:~/catkin_ws/src/autopark/src$ python talker_xbe
enter data to send to xbee update:
richa@richa: ~/catkin_ws/src/autopark/src
richa@richa:~/catkin_ws/src/autopark/src$ python optimal.py
Done sleeping
AutoPark
AutoPark
Exit
Vehicle
Empty Spot
Occupied Spot
Lane
Entrance
5
6


Terminal
9:39 PM
richa@richa: ~/catkin_ws/src/autopark/src
I received UPDATE from 6
sending selected spot to UI
heard something from master:
park
heard park
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0]
0
0
sending to bs
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0]
heard something from planner:
1
this is the spot I have chosen
1
original dict
{5: 0, 6: 0}
updated dict
{5: 1, 6: 0}
sending selected spot to UI
Sending UPDATE because planner spot was selected and receive
d
richa@richa: ~/catkin_ws/src/autopark/src
richa@richa:~/catkin_ws/src/autopark/src$ python talker_xbe
enter data to send to xbee update: park
enter data to send to xbee update:
richa@richa: ~/catkin_ws/src/autopark/src
richa@richa:~/catkin_ws/src/autopark/src$ python optimal.py
Done sleeping
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
Input is : [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0]
Most Optial Spot Coordinates are : (2, 3)
1
AutoPark
AutoPark
Exit
5
Vehicle
Empty Spot
Occupied Spot
Lane
Entrance
6
5


Terminal
9:39 PM
richa@richa: ~/catkin_ws/src/autopark/src
heard park
[0, 0, 0,


Terminal
9:40 PM
richa@richa: ~/catkin_ws/src/autopark/src
[0, 0, 0,

The spares for the power PCBs have also arrived. I have started work on both the hardware and software setup.
On the software end, the full version system image needs to be installed on the motherboard which contains Oculus Prime Server version 0.704, Xubuntu 14.04.3 and ROS Indigo.
On the hardware end, the MALG, power PCB and the Intel motherboard need to be integrated.
Despite some challenges, I have made progress on the above tasks.

3. Literature study

Since a new planning module is being added to the software architecture, I went ahead and did some independent literature study of existing planning techniques and ROS supported libraries for multi-agent and multi-heuristic planning. This is important for getting a realistic picture of what heuristics are suitable for our application and the feasibility of their implementation with the existing packages and libraries available.

A few topics I read research papers and documentation on:

1. OMPL (Open Motion Planning Library)
2. DTG heuristic (Domain Transition Graph) – This is a global heuristic function
3. Multi-heuristic approach

In order to build additional capabilities on the planning front, knowledge about these domains will aid in selecting a suitable approach.

4. Challenges

The main technical challenge I faced was while setting up the Intel motherboard. The board requires an 8-19V power supply. I could not find any adapters of the required voltage and current rating in the lab. I tried powering the board with the lab bench top voltage supply which did not work. I tried with another adapter I found, to which I soldered the appropriate barrel connector but it did not work as well. The power LED on the board isn't coming up despite appropriate voltage on the power leads. I am still in the process of sorting out this issue.

5. Teamwork

For this Progress Review, I continued to work with Dorothy on the integration of the planner and UI with the collaboration node. We debugged our code and tested extensively with three computers, one of them being and ODROID XU4. . Eventually we worked with Mohak and Pranav to successfully integrate the three subsystems. Dorothy worked on the construction of the mock parking lot. Pranav, Mohak and Shivam worked on mapping and navigation of the mobile platform.

6. Future Plans

The next major task is testing and integration of all the subsystems associated with the physical platform and develop a simulation environment for our Auto-Park system. Dorothy will be working towards the completion of the final parking lot for SVE. She will also be working with me on the hardware setup of the old platform and integration of the smatphone app. Mohak, Shivam and Pranav will work on bringing together different aspects of the Simulation Environment together.