Parking Occupancy Radar

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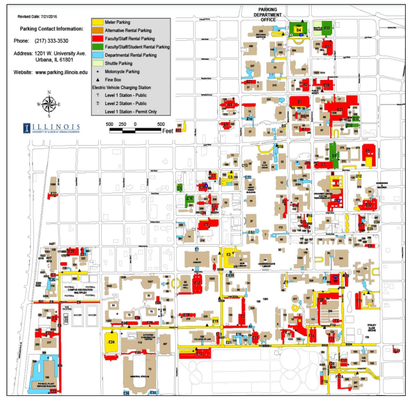
Motivation: Horrible Parking

Finding parking is horrendously bad at UIUC; UIUC only provides an illegible map that has no live updates.



Challenges:

(1) Fine-Tuning Radar Configuration

```
channelCfg 7 3 0
chirpCommCfg 18 0 0 128 4 30 0
chirpTimingCfg 6 28 0 90 59.75
frameCfg 8 0 400 1 250 0
% guiMonitor 2 2 0 2 0 1 1 0 0 0 0
guiMonitor 2 2 0 0 0 1 1 0 0 0 0
sigProcChainCfg 64 8 2 0 4 4 0 .5
cfarCfg 2 4 3 2 0 12.0 0 0.5 0 1 1 1
aoaFovCfg -60 60 -40 40
rangeSelCfg 0.1 .6
clutterRemoval 0
compRangeBiasAndRxChanPhase 0.0 1.00000 0.00000
adcDataSource 0 adc_data_0001_CtestAdc6Ant.bin
adcLogging 0
lowPowerCfg 1
factoryCalibCfg 1 0 40 0 0x1ff000
```

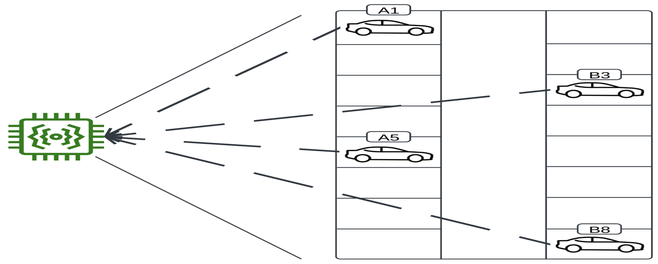
Parameter	Value
Operating Frequency	77 GHz
Azimuth Resolution	15 deg.
Range Resolution	0.977 m
Maximum Unambiguous Range	50 m
Maximum Radial Velocity	23.03 m/s
Radial Velocity Resolution	2.89 m/s
Frame duration	33.333 ms
Range Detection Threshold	15 dB
Doppler Detection Threshold	15 dB
SDK Version	3.2

(2) Balancing Stationary vs Moving Object Detection

(1) Tuning the radar for parameters such as scaling, clustering thresholds, noise reduction, and power was very time consuming
(2) Extracting too much information from the radar led to I/O overflow, so running both presence detection and tracking stationary objects was limited

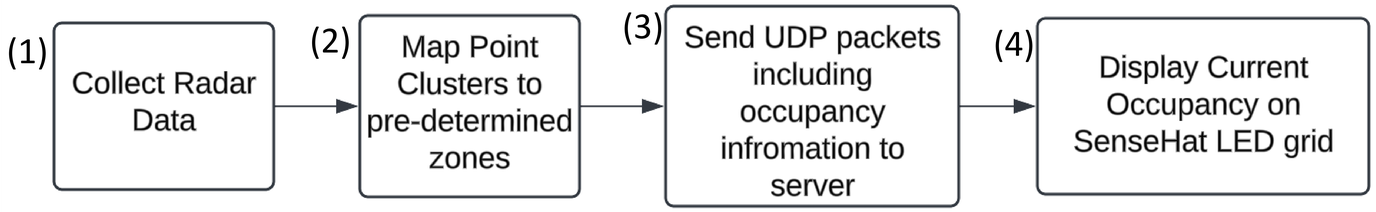
Proposed Solution: Radar Point cloud

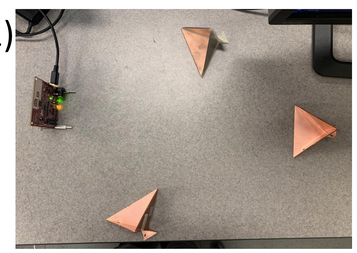
Collect radar data in real-time to generate a point cloud that identifies stationary vehicles in virtual boundary boxes that represent parking spaces.

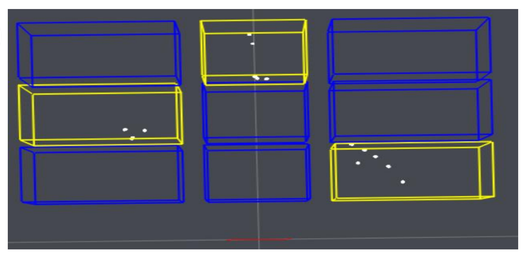


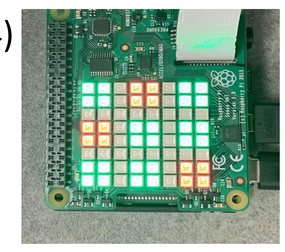
Approach: 3D Mapping Data -> Server Grid

Utilize the mmWave RADAR with the TI Industrial Visualizer for real-time segmentation. Then, transmit the occupancy grids to the server that will display available parking spaces.









Main Results

Successfully mapped 3d point-clouds and transmitted packets to a server that displays a grid showing available parking spots.