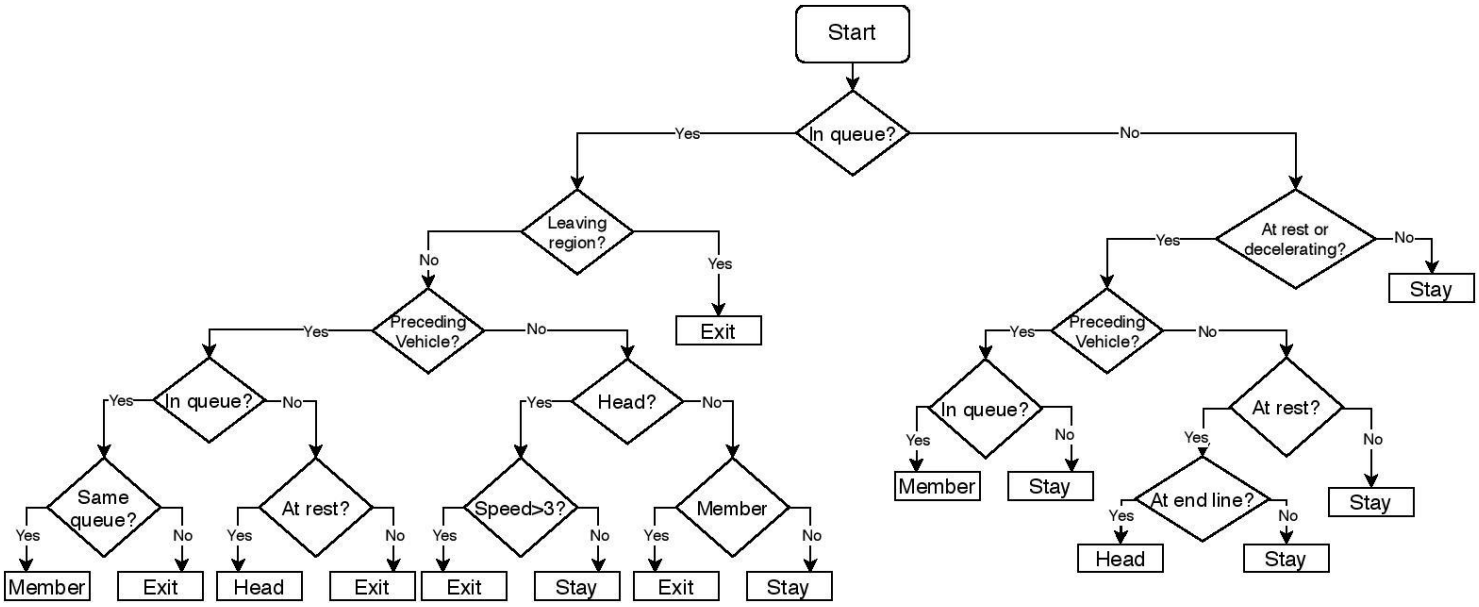
UAS4T Competition Report

Proposal:

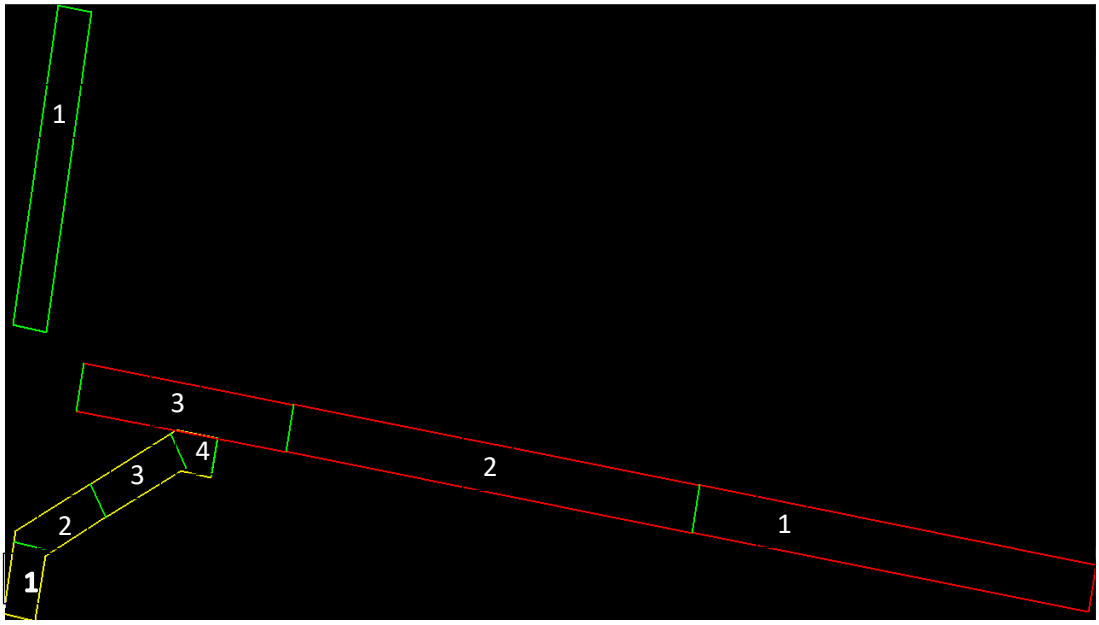
- Proposed algorithm depends on the on-time detection of the queues and spillbacks
- The algorithm is summarized in the following steps:
  1. The algorithm takes GPS coordinates for the specified areas as input in addition to the locations of the traffic signals in the selected areas.
  2. The GPS coordinates are converted to UTM coordinates and used to create polygons representing the selected areas.
  3. After that, each area is divided into small regions, whose number is less than the GPS points of each area by one to increase the accuracy of the queue detection
  4. The dataset is then loaded from the CSV file and each line, which corresponds to the data of each vehicle, is extracted into an object called Vehicle
  5. The algorithm then assigns each vehicle to their corresponding region at each timestamp before the beginning of the detection
  6. After sorting the vehicles by distance to the traffic line, in an ascending order, the algorithm loops over the time to execute the finite state machine, which is shown below:



7. The detection of the preceding vehicle, mentioned in the flowchart, is based on the detection of the nearest vehicle that lies in a rectangle between the current vehicle and the traffic line. The width of that rectangle is estimated for each vehicle type.

Results:

- The areas are divided and named as shown in the below image:



- There were two sets of vehicles' widths, a tolerant one and a conservative one. The results of the tolerant set of widths are listed below:

1. **Area 1:**
   a. Color: yellow
   b. Maximum Queue Length = 7
   c. Lane of Max Queue = 1
   d. Coordinates of Max Queue = first vehicle [23.731129, 37.990736] and last vehicle [23.731121, 37.990746]
   e. Time of Max Queue = 423.48s
   f. Spillbacks:
      i. Region 3:
         1. Spillback 1:
            - When? 507.28000000000003

- Where? lane 1
- Final Queue Length? 6

2. **Area 2:**
    a. Color = green
    b. Maximum Queue Length = 13
    c. Lane of Max Queue = 2
    d. Coordinates of Max Queue = first vehicle [23.731536 37.992773] and last vehicle [23.731535 37.992793]
    e. Time of Max Queue = 342.72s
3. **Area 3:**
    a. Color = red
    b. Maximum Queue Length = 21
    c. Lane of Max Queue = 3
    d. Coordinates of Max Queue = first vehicle [23.736487 37.99098] and last vehicle [23.736492 37.990993]
    e. Time of Max Queue = 802.36
    f. Spillbacks:
        i. Region 2:
            1. Spillback 1:
                - When? 47.160000000000004
                - Where? ['red', 1]
                - Final Queue Length? 15
            2. Spillback 2:
                - When? 204.72
                - Where? ['red', 1]
                - Final Queue Length? 8
            3. Spillback 3:
                - When? 292.28000000000003
                - Where? ['red', 1]
                - Final Queue Length? 8
            4. Spillback 4:
                - When? 560.6
                - Where? ['red', 1]
                - Final Queue Length? 9

5. Spillback 5:
    - When? 746.76
    - Where? ['red', 1]
    - Final Queue Length? 5
6. Spillback 6:
    - When? 747.84
    - Where? ['red', 1]
    - Final Queue Length? 3

ii. Region 3:

1. Spillback 1:
    - When? 285.72
    - Where? ['red', 0]
    - Final Queue Length? 5
2. Spillback 2:
    - When? 473.48
    - Where? ['red', 0]
    - Final Queue Length? 3
3. Spillback 3:
    - When? 565.44
    - Where? ['red', 0]
    - Final Queue Length? 4
4. Spillback 4:
    - When? 736.36
    - Where? ['red', 0]
    - Final Queue Length? 5
5. Spillback 5:
    - When? 741.88
    - Where? ['red', 0]
    - Final Queue Length? 5

- The results of the conservative set of vehicles widths is listed below:

1. Area 1:

a. Color = yellow

b. Maximum Queue Length = 6

c. Lane of Max Queue = 1
d. Coordinates of Max Queue = [23.731116 37.990744] [23.731142 37.99074]
e. Time of Max Queue = 513.88

2. **Area 2:**
   a. Color = green
   b. Maximum Queue Length = 11
   c. Lane of Max Queue = 2
   d. Coordinates of Max Queue = [23.73149 37.992756] [23.731528 37.992758]
   e. Time of Max Queue = 702.2

3. **Area 3:**
   a. Color = red
   b. Maximum Queue Length = 21
   c. Lane of Max Queue = 3
   d. Coordinates of Max Queue = [23.736487 37.99098] [23.736492 37.990993]
   e. Time of Max Queue = 802.36
   f. Spillbacks:
      i. Region 2:
         1. Spillback 1:
            - When? 204.72
            - Where? ['red', 1]
            - Final Queue Length? 8
         2. Spillback 2:
            - When? 292.28000000000003
            - Where? ['red', 1]
            - Final Queue Length? 8
         3. Spillback 3:
            - When? 560.6

- Where? ['red', 1]
- Final Queue Length? 9

4. Spillback 4:
    - When? 746.76
    - Where? ['red', 1]
    - Final Queue Length? 5
5. Spillback 5:
    - When? 747.84
    - Where? ['red', 1]
    - Final Queue Length? 3

ii. Region 3:

1. Spillback 1:
    - When? 473.48
    - Where? ['red', 0]
    - Final Queue Length? 3
2. Spillback 2:
    - When? 565.44
    - Where? ['red', 0]
    - Final Queue Length? 4
3. Spillback 3:
    - When? 741.88
    - Where? ['red', 0]
    - Final Queue Length? 5