Grading Rubric Final Project – ECE 4122/6122

Student Name:
Grading TA:

Overall Deductions

☐ 40% - Code Does Not Compile on PACE-ICE (please note that this is a base deduction, if you see other issues, please mark them down as well).
- max deduction: -40%

☐ 1% (each) - for each warning when compiled
☐ 1% - inconsistent use or no use of camel case
☐ 2% - incorrect file naming or file structure of submission
☐ 5% - if there is no docstring at the beginning of the document
☐ 5% - if there are no comment section describing the purpose of the function, the input and output parameters, the return value, or a comment section for classes
☐ 5% - insufficient comments placed inside of functions/loops
☐ 2% - incorrect indentation
- max deduction: -25% (outlined in the assignment)

Total Overall Deduction:

Grading:

1) ☐ The show is made up of 15 UAVs that are placed on the football field at the 0, 25, 50, 25, 0 yard-lines (2%)

2) ☐ The UAVs remain on the ground for 5 seconds after the beginning of the simulation (2-5 secs are acceptable as there might be some timing delay while loading) (2%)

3) After the initial 5 seconds the UAVs then launch from the ground and go towards the point (0, 0, 50 m) above the ground with a maximum velocity of 2 m/s
   a. ☐ UAVs launch from the ground and head to the point (0, 0, 50m) (2%)
   b. ☐ Maximum velocity is 2 m/s (3%)

4) As they approach the point, (0, 0, 50 m), they began to fly in random paths along the surface of a virtual sphere of radius 10 m while attempting to maintain a speed between 2 to 10 m/s.
    a. ☐ After reaching the radius, the flight path is random (2%)
    b. ☐ The UAVs relatively maintain a distance of 10 m from (0, 0, 50m) (oscillating around the surface between 3 – 20 m from the surface is acceptable) (2%)
    c. ☐ Speed of each UAV is between 2 m/s to 10 m/s (2%)

5) ☐ The simulation ends once all of the UAV have come within 10 m of the point, (0, 0, 50 m), and the UAVs have flown along the surface for 60 seconds (does not have to be exactly 60 seconds as some logic will make this slightly longer or shorter but should be relatively 60 seconds in length) (2%)

6) Each UAV has the following
    a. ☐ Each UAV has a mass of 1 kg (2%)
    b. ☐ Each UAV can generate a single force vector with a maximum magnitude of 20 N in any direction (2%)
    c. ☐ Each UAV it just small enough to fix in a 1-m cube bounding box (up to 3m is acceptable) (2%)
    d. ☐ The color of your UAV is determined using the first letter of your last name (color last name is supposed to be: ___) (students assigned to green can use any color as green will be slightly ambiguous against the green field) (5%) – [See appendix for assignments]
    e. ☐ The shape of your UAV is determined by the first letter of your first name (shape first name is supposed to be: ___) (5%) – [See appendix for assignments]

7) You must develop an MPI application using 16 processes. The main process (rank = 0) is responsible for rendering the 3D scene with the 15 UAVs and a green (RGB=(0,255,0)) rectangle representing the football field in a 400 x 400 window. You will get 5 extra bonus points for using a bitmap file called ff.bmp in the same location as the executable to apply a football field texture to the rectangle. The other 15 processes are each responsible for controlling the motion of a single UAV.
    a. ☐ Rank = 0 is rendering the 3D scene (6%)
    b. ☐ The other 15 other processes will control the motion of a single UAV (2%)
    c. ☐ Starting with a 400 x 400 window (2%)
    d. ☐ Green rectangle to represent the football field (2%)
    e. ☐ (Extra credit) Using ff.bmp for texture to the field (+10%)

8) ☐ The main process gathers the location and velocity vector of each UAV every 100 msec and immediately broadcasts this information to all the UAV processes, and updates the 3D scene (10%)

9) The coordinate system of the 3D simulation is defined as flows: The origin is location in the center of the football field at ground level. The positive z axis points straight up, and the x axis is along the width of the field and the y axis is along the length (x and y axis can be switched but needs to remain consistent in logic).
    a. ☐ Origin is located at the center of the football field (2%)
    b. ☐ X, Y, and Z lattice is defined correctly (2%)

10) ☐ A camera location, orientation, and field of view should be used so that the whole football field and the virtual 10m sphere is in the view (slight clipping is acceptable as long as the simulation demonstrated the flight path effectively) (10%)

11) The flight of the UAV is controlled by the following kinematic rules
    a. ☐ The force vector created by the UAV plus the force of gravity (10 N in the negative z direction) determine the direction of acceleration for the UAV (6%)
    b. ☐ Use Newton's 2nd Law to determine the acceleration of the UAV in each direction (6%)
    c. ☐ Use the equations of motion for constant acceleration in each direction (xyz) to determine the location and velocity of the UAV every 100 msec (6%)
    d. ☐ You can use any method you want to maintain the UAVs flight path along the surface of the 10m radius virtual sphere (there is some logic to control the flight path along the surface) (7%)

12) ☐ If the bounding boxes of two UAVs come within 1 cm of each other an elastic collision occurs. For simplicity we are going to model the UAVs as point objects and the UAVs will just swap initial velocity vectors for the next time step (5%)

(For 6122 Only): ☐ The magnitude of the color of your UAV should oscillate between full and half color throughout the simulation. The RGB values of your color should decrease by one every 20 time steps until it reaches 128 and then increase by one every 20 time steps until it reach 255. Example below: Red : (255,0,0), (254,0,0)...(128,0,0), (129,0,0)...(255,0,0) [*the color should change every time step*] (10% of assignment)

Total (Total of Grading – Deductions + EC from 7):

Appendix A: Color and Shape Assignments

The color of your UAV is determined using the first letter of your **last** name:

- Red: A,K,T
- Green: B,L,U
- Blue: C,M,V
- Cyan: D,N,W
- Magenta: E,0,X
- Yellow: F,P,Y
- Red: H,Q,Z
- Green: I,R (Any color is acceptable)
- Blue: J,S
- Any color (was not initially assigned): G

The shape of your UAV is determined by the first letter of your **first** name:

- Sphere: A,K,T
- Cube: B,L,U
- Cone: C,M,V
- Torus: D,N,W
- Dodecahedron: E,0,X
- Octahedron: F,P,Y
- Tetrahedron: H,Q,Z
- Icosahedron: I,R
- Teapot: J,S