Air Traffic Control System

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The software was done in C++ with SDL2 library for graphics. The three main objects are Traffic control zone, Runway and Plane. Traffic control zone(TCZ) and Runways will be created at the beginning of the program, and Planes will be spawned once there are availabilities(current number of plane is less than the maximum number of plane at the same time). Runways will be hold in an unordered\_map, unordered\_map[0] represents available runways and unordered\_map[1] will represents occupied runways. Planes will be hold in a deque, which consciously adapt a First-in-First-out order.

When a plane was spawned it will be added to the end of plane queue. The system will check if there is another plane that is within the minimum safety distance of the current plane, and would trigger the displacement of the plane to another spawn location if needed.

A plane object has 4 stages:

* 1 for normal flying - It will avoid any possible intersections with other planes at this state,
* 2 for holding/circling - until there is an available runway and set the stage to stage 1
* 3 for the state of plane entering the TCZ while there are not any available runway, which causes the plane to move toward the center until it can circle around a point without leaving the TCZ and set the stage to stage 2
* 4 for landing - move along the runway and disappear(pop from the front of the Plane queue)

The system is fully customizable without any modification to the code, users may choose if they want to customize any value at the beginning of the program via a shell interface. Here are example valuable names: TCZ\_RADIUS, MAX\_NUMBER\_OF\_PLANE, NUMBER\_OF\_RUNWAY, RUNWAY\_Width, RUNWAY\_Length.

The best way to transmit messages between the airplanes and the ATC is via VHF.

The best way for the ATC to set holding patterns and paths for the planes such that they will not come too close to each other is:

1. designing predetermined routes
2. designing predetermined holding areas
3. assign airplanes to above
4. have contingency zones and runways available, and the ability to interrupt other planes’ state

Reference:

FAA’s Holding, Approach, and Departure Procedures

https://www.faa.gov/air\_traffic/publications/atpubs/aip\_html/part2\_enr\_section\_1.5.html