CSci363 User Interface Design - Fall 2019

Team Project

This document, hereinafter referred to as the **Contract**, sets out the: (1) team description; (2) requirements, (3) deadlines, and (4) grading scheme for the CSci 363 – fall 2019 team project. This contract has been prepared by Dr. Emanuel S. Grant, hereinafter referred to as the **Contractor**, for the CSci363 – Fall 2019 team project**.**

Project: The US Government Federal Aviation Administration (FAA) has awarded a contract to your company (the Team) to analyze the requirements, design, and implement a graphical user interface for the Next Generation (NexGen) air traffic control (ATC) display system.

Teams: The class will be divided into teams of two students each. The teams will operate as independent entities, with the purpose of completing the task of developing the term project within the specified timeframe. The teams will elect a team-leader, and that leader is responsible for ensuring that essential information are sourced and submitted by her/his team. Team members will decide on a name for their team.

Team dynamics: Teams may negotiate to trade members, but such trades have to be approved by the contractor – there can be no trades after Friday, October 4, 2019. If there are persons not on a team after Friday, September 13, 2019, such persons will be assigned to a team by the Contractor. If there is any conflict within a team, it must be brought to the attention of the contractor for resolution. Teams are not allowed to collaborate with, nor spy on any other team. Such activity will result in a penalty of points being subtracted from the final total of the offending team(s).

Project requirements: The term project report is to confirm to the following presentation format:

- The term's project report length is to be five (5) to ten (10) letter size pages, double space, 10 – 12 point Times New Roman or Arial font (***excluding models and code***). All pages are to be numbered, bottom center.
- The report must have a title that is one to two point sizes larger than the body of the report; it is to be justified center at the top of the first page and may be presented in **bold** font style.
- The title is followed by the team and team members' name, and must be the same font size as the body of the report. Members' names are to be separated by commas and separated from the title by one blank line.
- A bibliography of references must be included at the end of the report, and is included in the page-limit count. References must be in the numerical order of their first occurrence in the report and referenced by that sequence number, which starts at 1 for the first reference entry. The format of the bibliographical entry is as follows (note the font style of <*title*>):
  <reference> ::= <reference-number>**.** <authors>, <*title*> <source>**,** <date>
  <authors> ::= <first-names> <last-name> | <first-names> <last-name>**,** <authors>
  <first-names> ::= <name> | <initials>
  <source> ::= <journal-name> | <book-name>
- An invoice is to be produced, for the work done in completing the project. The invoice should include a statement of the hours spent on each phase of the project (requirements modeling, design modeling, code generation, and testing), along with the charge/hour. This invoice should also include a statement of the percentage contribution from each member of the team. The invoice must be signed by each member of the team.

System requirements: System requirements: The system will be used to simulate the radar observable taking off, landing and parking of three types of aircrafts. The system must display the positions and movements of aircrafts in the air, within a 50-mile radius (the airport's airspace) of the airport. The airspace is centered on the airport – i.e. the assumed location of the ATC tower with the radar mounted on the top of the tower. The display must be a simulation of a radar viewing scope, and may display multi-color formatted information. The information to be displayed are:

A circular line, designating the airspace of the airport, with a scaled 50-mile radius. Optional circular lines (distinguishable by color, style, or thickness, from that of the airspace boundary line). Scaled circular lines, at 5- or 10-mile intervals, that are concentric with the airspace boundary line. The airspace line must include exit/enter points (at least two) that are used by the aircrafts to enter/exit the airports airspace and come under control of the airport's air traffic controller (ATC).

Double thick lines that represents the runways on the ground, and double thin lines that represents the approach path to the runways (the length of the runway lines are not to scale with the airspace lines).

An icon (of your choice, but the same for all aircrafts) for each aircraft within the airspace, and within a range of 10 miles of the airspace. Displayed with each aircraft icon are the aircraft's ID, destination Airport ID, Control, Altitude, Speed, and Heading. An aircraft's ID (flight number) is a capitalized two alpha character designation, followed by three numeric characters, with no separation – the two alpha characters are the airline identifiers (for American Airline it is AA), and in the case of a private aircraft it must start with either the character P or R, (commercial airline IDs cannot start with either characters). Airport ID is a capitalized three alpha character designation (for Grand Forks it is GFK). Control is a single alpha character that indicates whether the aircraft is under the control of the airport's ATC (A if it is an arriving aircraft, D if it is departing, and space if is not under the control of the airport ATC). Altitude is given in three digit hundreds of feet, for an aircraft at 25,000 feet 250 is displayed. Speed in given in integral Knots, for an aircraft traveling at 250 Knots 250 is displayed. Heading is given as a three-digit degree heading. The layout of this information on the display is as follows:

line 1 – icon <no space> aircraft ID <space> destination airport <space> control
line 2 – if necessary continuation of icon <no space> altitude <space> speed <space> heading.

For an America Airline that is under the control of the ATC, departing Grand Forks for Minneapolis, at an altitude of 2,000 ft, traveling at a speed of 175 Knots, on a heading of 120° it is:

AA263 MSP D
020 175 120

Aircrafts are limited to a ceiling of 10,000 feet and a speed of 250 Knots within the airspace. They may only enter or depart the airspace via the designated enter/exit points.

Collision Avoidance (CA) is maintained, within the airspace, by monitoring an ellipsoid area around each aircraft of three miles radius, and altitudes of 1,000 feet above and below each aircraft. If any aircraft comes within the CA space of another then audible, and visual warnings are initiated, until the situation is resolved. If aircrafts collide then their icons and information are replaced with a single collision icon (of your choice).

Movement of the aircraft through the airspace may be simulated by redisplaying the icon and information in a new location at least once every five seconds (simulating a rotation of the radar antenna).

Arriving aircrafts are randomly created on the airspace display simulation by clicking on a location outside the airspace circle. Its initial path must be taking it towards the closest airspace entry point and it is initially not under the control of the ATC. Once it enters the airspace the ATC may take

control of the aircraft by clicking on its icon – its control indicator must then change from <space> to A. The ATC issues directives to the aircraft by clicking on the icon of the aircraft and then typing in altitude, speed and heading (in designated fields at the upper or lower left area of the screen). The entered information will replace the previous information of the aircraft, and if the heading was changed, the aircraft must begin moving in the new direction. The intent of the ATC is to have the flight path of the plane intersect with the approach-landing path of the runway. Once this intersection is about to occur and the aircraft is below 5,000 feet and above 1,000 feet the ATC will enter a new heading that is the degree direction of the runway. The aircraft will then fly along this path and its icon and information will be removed from the display once it is along and within the runway lines (indicating a safe landing).

Departing aircrafts are randomly created by clicking on a point within the air space circle. The aircraft's initial information must be the Aircraft ID (Flight number) and destination airport. To obtain departure clearance – select the icon and its control indicator should change from <space> to D (for departure), runway ID, altitude = 000, speed ≤ 20 Knots. The icon should then start moving towards the assigned runway – A runway is assigned based on a selected algorithm (ex. take-off runway with the smallest queue) of your choice. If the runway queue is not empty, the aircraft should wait in until it is granted take-off clearance, by getting to the front of the queue. During taxi to the apron, along the taxiway, the speed should not exceed 50 Knots. On takeoff, the airspeed should be in the range 100 – 250 Knots, and remain so while the aircraft is in the airspace. The aircraft should be directed to the airspace exit gate that is closest to the direction of the destination airport.

Display must be overlaid with weather and terrain information to provide a near realistic video imagery as depicted in the illustrations below.

NB. These specification are incomplete (specifications are NEVER complete), thus you will have to consult with the Contractor, and make certain assumptions. All assumptions MUST be documented and included in the project deliverables. The specifications will be updated over the semester, and you will be notified of these updates.

Presentation Requirements: Explanation of the project assignment, methodology applied examples of models and code developed, issues encountered and resolutions, and statement of learning. Demonstration of the system developed that illustrates at least the following scenarios:

- Creation of an aircraft that is approaching the airport and executes a safe landing,
- Creation of an aircraft that is departing the airport,
- Collision avoidance between two aircrafts, and
- A collision between two aircrafts.

Design Sessions: Each team will participate in system design sessions that will be conducted during selected class sessions. During these sessions, teams will assemble and conduct work on their project, by way of discussion and decisions on project matters.

Class Presentation: Each team will make a presentation of their work to the class, during the last week of the course. The presentations will be for 12 minutes, and each member of each team is expected to participate in the presentation.

Deadlines:
Submission of team and team member names – Friday September 9, 2019
Assignment of the term project to the class – Friday September 27, 2019
Assignment of team and team member names – Friday September 13, 2019
First progress report due Friday October 11, 2019
Second progress report due Friday November 8, 2019
Submission of term project – Thursday December 11, 2019

In-class presentation/demonstration of projects December 2, 4, 6, 9, 11, 2019

Grading: Each team will submit a report, signed by each member, which identifies the percentage of work that each member contributed to the paper/project. That percentage will determine the points that each member of the team receives. An example: for a team of two, where A = 55%, B = 45% and the point for the project is 90%. Then, A gets 90%, B gets 74%.

Miscellaneous: Teams are expected to consult with the contractor, either during the designated office hours or by appointment. Such consultations are to be used to seek help and advice with any difficulties that the teams may encounter.

Disclaimer: Changes may be made to this document with notice, and all teams are expected to comply with all changes. Good luck …