Maintenance document

Potkuri-group

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Software Engineering Project

UNIVERSITY OF HELSINKI
Department of Computer Science

Course

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Change Log

Version	Date	Modifications
0.1	8.12.2008	Document created.

Contents

1 Introduction

The purpose of this document is to help those who want to modify the program. It contains installing instructions, information about how this program has followed its requirements and design documentations, instructions to maintain code, bugs, enhancement suggestions etc.

2 Vocabulary

Airport Airport is where arrival tree begins. If map is presented as a circle, airport will be in a middle of the circle. If the map will be presented as a fourth of a circle, the airport will be at the center corner.

Arc Arcs are circles (or fourths of circles) at a determined radius distance of the airport. The merge points are located into these arcs.

Arrival tree A binary tree consisting of paths. Has a root at the airport.

dbZ decibels of Z, a measure of rain.

Flight plan Every plane has a flight plan which describes its path.

Map A map from somewhere in the world used in this product.

Merge point A point on the map where two paths merge into one path.

nmi nautical mile (=1,8520km)

Path A route to the airport that should avoid storms.

Plane An airplane that tries to land at an airport along a path avoiding storms.

Storm A set of pixels with dBZ-values above 24 dBZ close each other on the map. Indicated with red color on the map.

User A person using the product to watch animations on aircrafts landing at an airport in presence of hazardous weather systems.

3 How to install the program

4 Detailed information on design issues

We found no issues.

5 Unfulfilled requirements and parts of design

5.1 Requirements which were not implemented

Speed of the planes decelerates when approaching the airport.

F8 - Map can be zoomed

F10 - Wind has direction and speed

F11 - Weather data is generated randomly

F12 - User is able to give storm centers, their intensity and wind speed

F14 - Program stores every weather data picture from Testbed to hard drive

5.2 Other things about requirements

A requirement was that planes should not fly too close to each others. In the program planes do slow down their speed when they are too close each others, but this is not sufficient condition to prevent plane crashes. This problem may be solved in future by control planes speed on the grounds of arriving time to merge point.

It is said in the requirements document (section 6, user requirements) that the purpose of the program is to count and model as safe as possible way to approaching planes to airport through changing weather conditions. However, the group accentuates that the program doesn't calculate the safest path but rather the optimal path with defined safety distance.

5.3 Unfulfilled parts of design

Everything that was designed has been implemented.

6 Code maintenance

The program has been coded following the the code conventions for the Java programming language by Sun microsystems: http://java.sun.com/docs/codeconv/html/CodeConvTOC.doc.html. Following these instructions is highly recommendable also during maintenance. A plugin for Eclipse called Checkstyle has been used to check that these instruction are followed. In addition to Checkstyle another Eclipse plugin, PMD, has been used to look for some potential problems in code.

6.1 Bugs

Plane can in certain situations teleport backwards. This happens because Plane is not able to update it's TreeNode because of storm. If Plane gets inside storm it cannot create path of TreeNodes. Instead it is flying to TreeNode possibly very far away from it's current location without path. This can lead to Astar finding path from last place where TreeNode was updated and at same Plane also appears at this location.

Planes can sometimes be given a path that flies away from direction of airport. This can happen when closest TreeNode is found other side of storm and path that is found is u shaped going around the storm.

When Plane is out of storm no new path is given although it could be because there has not been need to calculate Tree again. This is caused by following: Plane is only given new path when Tree has changed.

7 Other things affecting maintenance

7.1 Enhancement suggestions

The arrival tree should be re-calculated regularly when a certain time passes by or otherwise prevent situations where the tree has useless curves even without storms nearby. Currently this could happen sometimes because the tree is calculated only when a storm comes over the tree.

The heuristics of the A* algorithm could be modified so that A* would always find a path (between two vertices of a graph) that looks as straight as possible. Currently the path can go very close to a storm before it makes a curve around it, even though it would look better if the path would change the direction as soon as possible so that it would not have to make a curve just before the storm. Currently the length of the path is, however, optimal. It is just a matter of how it looks on a screen.

Also, routes in a graph could be formed so that they wouldn't allways have to go to adjacent vertices but could make a straight line between two vertices that are not adjacent. This would reduce zigzags but doing this would require lots of changes to different classes in the code.

Planes are now following path of TreeNodes although Graph is made of Vertices. This creates a bug that might be avoided by maintaining path of Plane as Vertices instead of Treenodes.

Astar method can't currently search routes through storms which could be useful for certain situtations for Planes. For example to find shortest way a way from center of large storm.

Setting safety distances to paths of the arrival tree could have propably been done in an more efficient way. Now the safety distance can only be set to some five nodes away from the nodes without slowing down the program too much. The recursive algorithms without too much repeat were tried, but none did make the program signifigantly faster. There should anyway be a more efficient way to do this.

The paths of the arrival tree can be in a bit tricky ancle, when thinking about planes flying, if there are many storms nearby. This could be eliminated from the program if wanted by setting the arc on where the path leaves to be not available during the calculation or by looking, if the path intersects the particular arc twice or more times.