### **School of Electronics and Computer Science**

### **University of Southampton**

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### **Runway Redeclaration Tool - Envisioning**

### **COMP2211 Software Engineering Group Project**

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### Stakeholder Analysis

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| Stakeholder | Stakeholder Type | Role |
| Redeclaration calculators | Primary | These individuals will input the parameters for the airport (runways, direction etc) and details about any obstacle affecting the operation of the runway.  They will use the output of the program to quickly indicate the effect of the obstacle on the operation of the runway (can limited operations continue) and compare their calculations to the ones produced by the application. |
| Pilots | Secondary | The pilot receives details of the redeclared runway and uses them to make a decision about whether to take off and land (taking into consideration safety, their airlines procedures and fuel remaining). These new values will dictate how they approach landing or taking off. They may also decide to not land (reroute to another airport) or postpone takeoff based on these calculations. |
| Air Traffic Controllers | Secondary | Given the output of the application, the ATC crew may start to make arrangements for rerouting aircraft and keep other aircraft informed of the situation (until an official decision is made by the calculators).  Should the runway be redeclared, then they will have to inform aircraft of the changes. |
| Airport Management Team | Secondary | The decision whether the keep a runway open is a commercial decision, as well as a decision based on safety. The team will receive the output of the application, as well as the decision from the calculators. They will then weigh up numerous factors, and decide whether to close the runway or not. |
| Airport Owner | Tertiary | The airport’s owner is affected by the decisions made about aircraft landing and taking off - as this ultimately affects their profits. Operational failures could severely damage the airports reputation. |
| Runway maintenance team | Tertiary | The maintenance crew need to safely remove the obstacle/fix any damage as quick as possible, to restore normal runway operations. The speed at which the runway can be redeclared has an effect on this. |
| Civil Aviation Authority | Tertiary | The CAA provide the procedures for redeclaration of a runway and the safe operation of an airport. |

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### Personas

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| --- | --- |
|  | **Michael** is a 37 year old, from Leeds. He works as a redeclaration calculator at Heathrow Airport. He is married and has two kids. He recently moved to London from Cardiff and is away from home for the first time in his life. He is still getting used to the different work environment in London. His job is to input parameters for the airport and details about obstacles on the runway into the system to check the effect of the obstacles on the runway. He finds his job interesting and knows that accuracy and precision are essential in his work. The calculation process must be as accurate as possible so that he passes correct information that would lead to important decisions. |
|  | **Carol** is 28 years old who grew up in Aberdeen. She works as a pilot for British Airways. She loves her job as it enables her to travel the world and see new places. She receives details of redeclaration calculations and makes an informed decision on whether she should take off or land the aircraft. Carol is very focussed on the safety of her passengers and will land or takeoff from an airport only if it is very safe to do so. |
|  | **George** is a 41 year old from Stratford and has been working as an air traffic controller at Gatwick Airport for more than 15 years. His job is to reroute aircrafts and keep other aircrafts informed of the situation on the runway based on the redeclared calculations. He is often busy and expects to receive quick, accurate and easy to read information about any of the runways so that he can report the current state of the airport to any inbound or outbound aircraft. |
|  | **Jim** is 45 years old and works at Newcastle Airport. He grew up in Leeds and moved to Newcastle to take up this job, which he has been working for 8 years. He is part of a team that decides whether the runway should be closed or allowed to function as usual based on redeclared calculations. He feels that his job is vital for the safety of the passengers and would want to feel as confident about his decisions as possible. He needs to receive quick and accurate information on the state of a runway to do this. |
|  | **Harry** is a 68 year old reputable businessman from Manchester and the owner of Manchester Airport. He is married and has two kids. He is responsible for maintaining the profitability of the airport, which is only possible when safety is maintained at the airport runway for aircrafts to land and take off. He is solely focused on keeping the airport open and running without any occurring problems and expects the system and staff to be able to achieve this. |
|  | **Nicole** is 33 years old and works for the runway maintenance team at Heathrow Airport. She is part of a crew that safely removes obstacles and fixes any damage on the runway quickly and efficiently so that runway operations can be resumed. Heathrow is very busy and Nicole likes to act quickly and avoid disrupting passenger’s holiday plans. |

### User Stories

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| --- | --- | --- | --- | --- |
| ID | Title | User story | | |
| 1 | Universal UK Compatibility | **As a** Redeclaration calculator | **I want** to be able to use the system for multiple airports | **So that** any airport could integrate this system into their procedures. |
| 2 | Calculation Functionality | **As a** Redeclaration calculator | **I want** the system to calculate the various metrics for a runway, given one obstacle (given its parameters) | **So that** the runway can be closed or redeclared accordingly. |
| 3 | Predefined Obstacles | **As a** Redeclaration calculator | **I want** to have access to a predefined set of common obstacles | **So that** I can input an obstacle quickly, without specifying all parameters manually. |
| 4 | Manual Input/Output | **As a** Redeclaration calculator | **I want** to be able to manually input the coordinates and dimensions of an obstacle | **So that** I can add an obstacle whose parameters differ from the pre-defined obstacles. |
| 5 | Visualisation of data and recalculation | **As a** Redeclaration calculator | **I want** to view the re-calculated values and the originals | **So that** I can compare them with other data, such as distances required for landing for specific aircraft. |
| 6 | Recalculation breakdown | **As a** Redeclaration calculator | **I want** to view a breakdown of the calculations | **So that** I can compare them with the paper results from the official process, as a confirmation of correctness. |
| 7 | XML Input/Output | **As a** Redeclaration calculator | **I want** to be able to import and export details of obstacles, airports and other data using XML | **So that** I can avoid re-entering commonly used data - which can be tedious. |
| 8 | Graphic Threshold orientation | **As a** Redeclaration calculator | **I want** the lower threshold to always be located on the left | **So that** a clear distinction between runways can be made |
| 9 | Graphic Runway Strip Rotation | **As a** Redeclaration calculator | **I want** to have the runway rotate to its compass heading | **So that** I can orientate myself easier with the runway and obstacles. |
| 10 | Visualisation of area around the runway | **As a** Redeclaration calculator | **I want** to see the Cleared and Graded areas around the runway strip displayed | **So that** they can be taken into account when making the calculations |
| 11 | Runway and Threshold Selection | **As a** Redeclaration calculator | **I want** be able to select different runways and thresholds | **So that** I am able to recalculate the parameters on every runway at the current selected airport. |
| 12 | GUI Notifications | **As a** Redeclaration calculator | **I want** to get notifications from the system | **So that** I can see that my changes have been applied to the configuration. |
| 13 | Top-down Visualisation | **As a** Redeclaration calculator | **I want** to have a 2D top-down view of the airport | **So that** I can see the effect of obstacles on the various metrics (e.g LDA) |
| 14 | Side-on visualisation | **As a** Redeclaration calculator | **I want** to have a 2D side-on view of the airport. | **So that** I can view the TOCS and ALS for the runway in its current configuration. |
| 15 | Pan and Zoom GUI functionality | **As a** Redeclaration calculator | **I want** to be able to zoom and pan the views | **So that** I can focus on a particular area of the runway/airport. |
| 16 | 3D visualisation | **As a** Redeclaration calculator | **I want** to be able to view the runway in 3D | **So that** I can better visualise the runway and obstacles. |
| 17 | Export displays in different formats | **As a** Redeclaration calculator | **I want** to be able to export the displays in different formats like JPG and png | **So that** I can share data between colleagues in a visual way. |
| 18 | Accessibility for color blind people | **As a** Redeclaration calculator | **I want** to be able to choose different colour schemes for the program | **So that** people who have color blindness can perform the calculations with ease. |
| 19 | Runway situation text view | **As a** Redeclaration calculator | **I want** to be able to view the current runway situation in text form | **So that** I have a concise record of the current situation. |
| 20 | Runway overlaid over real-world images | **As a** Redeclaration calculator | **I want** to be able to view the runway overlaid over real-world images | **So that** I can visualise the airport with the other features of the landscape. |

### Product Backlog

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| --- | --- | --- |
| **Priority** | **ID** | **Description** |
| Must  have | 2 | Calculation Functionality |
| 5 | Visualisation of data and recalculation |
| 6 | Recalculation breakdown |
| 1 | Universal UK Compatibility |
| 11 | Runway and Threshold Selection |
| 13 | Top-down visualisation |
| 14 | Side-on visualisation |
| 4 | Manual Input/Output |
| Should have | 3 | Predefined Obstacles |
| 7 | XML Input/Output |
| 9 | Graphic Runway Strip Rotation |
| 12 | GUI Notifications |
| 8 | Graphic Threshold orientation |
| Could have | 15 | Ability to zoom and pan the views |
| 17 | Export displays in different formats |
| 18 | Accessibility for color blind people |
| 19 | Print out results of current situation in text format |
| Won’t  have this time | 20 | Map view of runway overlaid over real-world images |
| 16 | 3D visualisation |

### Increment Plan

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| --- | --- |
| **1st Increment** | |
| 2 | Calculation Functionality |
| 5 | Visualisation of data and recalculation |
| 1 | Universal UK Compatibility |
| 4 | Manual Input/Output |
| 3 | Predefined Obstacles |
| 19 | Print out results of current situation in text format |
| **2nd Increment** | |
| 6 | Recalculation breakdown |
| 11 | Runway and Threshold Selection |
| 14 | Side-on visualisation |
| 7 | XML Input/Output |
| 12 | GUI Notifications |
| 17 | Export displays in different formats |
| **3rd Increment** | |
| 13 | Top-down visualisation |
| 9 | Graphic Runway Strip Rotation |
| 8 | Graphic Threshold orientation |
| 15 | Ability to zoom and pan the views |
| 18 | Accessibility for color blind people |

### Sprint Plan

* 1. Calculation Functionality
     + Write unit tests for calculation logic
     + Recalculation of available runway space
     + Object model of the application (Create object structure using classes - Airport, Runway, Obstacle)
     + Test the backend against the example calculations
  2. Rudimentary GUI (values only)
     + Ability to display re-calculated values
  3. Manual Input/Output
     + Create GUI Elements for input/output
     + Inputs in GUI affect the airport configuration and the calculations
  4. Universal UK Compatibility
     + Constraints on configuration to allow all UK airports to be compatible
     + Acceptance testing of the compatibility with airports
  5. Predefined obstacles
     + Create Obstacle class
     + Make instances with different properties
     + Add GUI Elements for selecting and placing these obstacles
     + Acceptance testing - do obstacles get added
  6. Print out results of current situation in text format
     + Print state to text file

### Burndown Chart

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| Tasks | 19 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Day | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

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### Risk Analysis

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| --- | --- | --- | --- | --- |
| **Risk** | **Probability**  **0-5** | **Severity**  **0-5** | **Risk Exposure** | **Mitigation** |
| Change/Growth in requirements | 2 | 2 | 4 | Keep project tasks separate from feature requests |
| Team member illness  (inability to work) | 1 | 3 | 3 | 1. Moving ahead of schedule gives the team enough time to make up the loss of a member. 2. Renegotiate with client, reduce scope of the project (slightly less functionality) |
| Changes in government/airport policies | 1 | 4 | 4 | Doing extensive background checks into the topic, making sure that the development team has ample time to cope with drastic changes. |
| Developer-made mistakes | 2 | 2 | 4 | Do thorough testing at each step to make sure that mistakes are fixed as early as possible. |
| Discovery of conflicting requirements | 2 | 3 | 6 | Do a deep analysis of requirements and discuss with the product owner which requirement has priority. |
| Market competition (existing tools prove to be better/more affordable) | 1 | 3 | 3 | Have clear goals during the envisioning period. |
| Delay in modification/change in project requirements | 1 | 2 | 2 | Start working on the tasks that will remain unchanged so that the project doesn’t fall behind. |

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### Summary of agile methodologies and software tools adopted

My team is currently employing a variety of **online and conceptual tools**.

As per specification, our team employs the **Scrum** framework of managing our coursework. We have appointed roles and have broken down the coursework into iterations (sprints). We have Scrum meetings (at least) twice a week, where we update each other on the progress of the each member’s respective job. The product owner is present at all meetings, which helps us move in the right direction.

For overall project communication, apart from face-to-face, our group uses **Slack.** Slack is an instant messaging tool, that also supports file-sharing and video calls. Everyone on our team has had previous experience with the software so it ended up as the obvious choice of communication.

**Trello** is a task management tool that has proven to be quite helpful in keep track of our progress. The tool gives us a concise visual overview of the workflow, by displaying what is being worked on and by what person. Trello has been incredibly useful in helping us have all tasks we need to work on in one place.

For the coding increments of the coursework, our group decided to use **Github** as our main method of version control. Since UoS gives us access to Github premium, and because it was what the team members were used to, we decided that the tool is both really useful and convenient.

As a team we also decided to use the same IDE, as programming in different IDEs can sometimes create problems with version control. We have decided to use **IntelliJ**, as it supports quite a bit of plugins, has good version control integration and is free for students.

For documentation and PDF creation, my group decided on **Google Docs**. This tool is both easy to use and has great export functionality. However, the selling factor for the tool is the collaboration feature which lets us all work on the same document at the same time without concurrency problems as well as incredible 3rd party add-ons (Code Blocks, Drawing).

Work distribution

Stakeholder analysis - Andrew John Evans

Personas - Suyash Datt Dubey

Requirement planning - Lyubomir Hristov and Kemal Yesildagli

Project planning - the whole team

Project set-up - Denis Kovachev