

COMP2211

Software Engineering Group Project

Deliverable 1 - Envisioning

Group 49

Members:

Muhammad Ahmad Shaharuddin (mnas1g22@soton.ac.uk)

Abdul Bari Ibrahim (abi1g22@soton.ac.uk)

Siddharth Prasad (sp12g22@soton.ac.uk)

Tianrui Hua (th7n22@soton.ac.uk)

James Stevenson (jems1g21@soton.ac.uk)

Submission Date: 22.02.2024

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1. User Understanding

1.1 Introduction

In this section we explore user identities, needs, and how our project enhances their lives. Through stakeholder analysis, we grasp the interests and impacts on involved parties. Crafting personas allows us to visualise and cater to user preferences, ensuring our project is both valued and utilised effectively.

1.2 Stakeholder Analysis

Stakeholder	Type	Role/Description
Air Traffic Controller	Primary	Air Traffic Controllers rely on the runway redeclaration system for recalculating the parameters and providing accurate and timely information to guide the pilot and ensure the safety of the aircraft.
Runway Technician	Primary	Runway Technicians perform critical measurements and site assessments to ensure accurate data for runway parameter recalculations, pivotal for air traffic safety and efficiency.
CAA	Secondary	The Civil Aviation Authority provides regulatory information and input to the system to ensure compliance with aviation standards and regulations.
Pilot	Secondary	Pilots will receive the recalculated runway distance from the ATC and make the final decision to land on or take-off from the updated runway.
Airport Operations Management	Secondary	Airport Operations Management is crucial for integrating the outcomes from the system with existing airport processes, ensuring the runway project aligns with broader operational, safety, and regulatory standards without directly participating in its execution.
Passenger	Tertiary	Passengers are the main source of income for airlines and airport, and are affected by disruptions caused by limited runway operations.
Investors	Tertiary	Investors rely on the airport being run safely and efficiently as they have a monetary incentive for as many flights to occur as possible.
Residents near airport	Tertiary	Residents near the airport are indirectly affected by noise and environmental changes.
Airline Companies	Tertiary	Airline companies are impacted by adjustments in runway availability and scheduling, affecting their operations, and possibly revenue or demand for their services.
Software Developers	Facilitating	Software Developers are responsible for developing and maintaining the runway redeclaration system.
IT Department	Facilitating	The IT department provides the necessary technical support and infrastructure, ensuring that the system's software and hardware components operate efficiently and reliably.

1.3 Personas

Air Traffic Controller - David	David, a 35-year-old air traffic controller at a major international airport, combines his engineering background and passion for
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	<p>aviation to manage aircraft movements efficiently. Utilising advanced systems like the runway redeclaration system, he ensures the safety and smooth operation of air travel. Despite his expertise, David remains humble and dedicated to continuous learning in the ever-evolving field of aviation. This dedication not only enhances his proficiency but also reinforces his indispensable contribution to maintaining high safety standards in air traffic management.</p>
<p>Aviation Regulatory Specialist - Emily</p> 	<p>Emily, at 44, is an esteemed aviation regulatory specialist with the Civil Aviation Authority. Her primary focus is ensuring that industry practices, especially in areas like the runway redeclaration system, adhere to the most rigorous safety and compliance standards. Emily's role is critical in bridging the gap between innovative aviation technologies and regulatory compliance, making her collaboration with a broad spectrum of stakeholders indispensable. Her expertise allows her to provide essential insights into system designs, ensuring they meet regulatory expectations without stifling innovation. Emily's dedication to staying at the forefront of technological advancements enables her to assess their regulatory implications proactively, ensuring the aviation industry's seamless adaptation to evolving safety and compliance requirements.</p>
<p>Runway Technician - Ryan</p> 	<p>Ryan, a 51-year-old runway technician with a civil engineering degree and a passion for aviation, ensures the safety and functionality of airport runways. He conducts inspections, checks for obstacles, assesses surface conditions, and uses specialised equipment to meticulously record findings. His work, crucial for the runway redeclaration system, directly contributes to aircraft safety. Ryan's attention to detail and technical expertise are vital in the dynamic airport environment, where he embraces daily challenges and opportunities to enhance operational safety.</p>
<p>Pilot - Spencer</p> 	<p>Spencer, a 34-year-old seasoned pilot with over 12,000 flight hours, has a career marked by a deep commitment to aviation, starting from his teens and spanning various industry roles. His extensive training and varied flying experiences inform his meticulous, safety-first approach. Spencer leverages technological advancements to improve flight safety and efficiency, adept at managing complex flight plans and dynamic conditions. His strong sense of responsibility, passion for flying, effective communication, and teamwork contribute to smooth operations and enriching experiences for passengers and crew.</p>
<p>Software Developer - Sophie</p> 	<p>Sophie, 27, with a rich history in aviation technology, works on enhancing airport operations through advanced solutions, focusing on developing runway redeclaration software to meet top industry standards. This software aims to automate runway redeclarations, ensuring regulatory compliance and minimising disruptions. Viewing it as crucial for safety and efficiency, Sophie prioritises regular stakeholder communication, emphasising user experience and system reliability. Their work underscores the importance of adapting to evolving aviation requirements, demonstrating a commitment to improving airport operations through technological innovation and collaborative development efforts.</p>

2. Requirement Understanding

2.1 Introduction

In the "Requirements Understanding" section, we detail our project's necessities through user stories, capturing user desires in a straightforward manner. These stories form a product backlog-a comprehensive to-do list. Prioritisation follows the MoSCoW method, distinguishing between must-haves, should-haves, could-haves, and will-not-dos.

2.2 User Stories & Product Backlog

ID	Task	User Story	Priority
1	Permit any UK commercial airport	As an Air Traffic Controller, I want to input and save runway configurations to accurately reflect airport layouts for effective planning and operations.	Should
2	Create 2D top-down view	As an Air Traffic Controller, I want to view 2D top-down visualisations of runways to have a comprehensive overview of airport layouts for better traffic management.	MUST
3	Create 2D side-on view	As an Air Traffic Controller, I want side-on runway visualisations so that I understand vertical dimensions and obstructions for enhanced safety.	MUST
4	Calculate runways distance when ONE Obstacle present	As an Air Traffic Controller, I want the system to calculate new runway distances with ONE obstacle present to adjust flight takeoff and landing procedures ensuring safety.	MUST
5	Create a list of predefined obstacles	As a Runway Technician, I want a list of predefined obstacles accessible in the system so that I can quickly identify and assess potential risks.	Should
6	View recalculated values and original	As an Air Traffic Controller, I want to compare recalculated values with original runway distances to evaluate the impact of obstacles on operational capacity.	MUST
7	View breakdown of calculations	As an Air Traffic Controller, I want a detailed breakdown of calculation results to verify accuracy and compare with manual calculation.	MUST
8	Import XML files	As a Runway Technician, I want the ability to import airport and obstacle data via XML to facilitate data sharing and analysis.	Should
9	Export XML files	As a Runway Technician, I want the ability to export airport and obstacle data via XML to facilitate data sharing and analysis.	Should
10	Display runway strip	As an Air Traffic Controller, I want both views to display the runway strip so that I have a clear understanding of the runway's physical layout for planning and managing aircraft movements.	MUST
11	Display threshold indicators and designators	As an Air Traffic Controller, I want both views to display threshold indicators and designators (e.g., 27R or 09L), so that I can accurately identify runway ends and manage aircraft landings/takeoffs accordingly.	MUST
12	Display any displaced thresholds	As an Air Traffic Controller, I want to see any displaced thresholds in both runway views, so that I can adjust aircraft landing and takeoff points, ensuring safety and compliance with runway usage	MUST

		procedures.	
13	Display Stopway/Clearway for both ends	As an Air Traffic Controller, I want stopway and clearway details for runway ends in both views so that I can calculate accurate takeoff/landing distances for aircraft.	MUST
14	Display Indication of the take-off / landing direction	As an Air Traffic Controller, I want take-off/landing direction indicators on both views to efficiently and safely guide aircraft directions for takeoffs and landings.	MUST
15	Display re-declared distances	As an Air Traffic Controller, I want re-declared distances with start/end indicators on runway strips in both views to accurately inform pilots of takeoff/landing available distances.	MUST
16	Display distance broken down into their respective parts	As an Air Traffic Controller, I want the distances broken down into their respective parts, including RESA/Blast Allowance, in both views, so that I can facilitate detailed planning and ensure all safety margins are maintained.	MUST
17	Display obstacle	As an Air Traffic Controller, I want to see any obstacles present on the runway depicted in both views, so that I can assess and mitigate their impact on aircraft operations, ensuring safety.	MUST
18	Display offset caused by RESA and slope angles	As an Air Traffic Controller, I want both views to show the offset caused by the RESA and slope angles relative to the obstacle on the runway, so that I can accurately evaluate and communicate takeoff and landing adjustments to pilots.	MUST
19	Display runway centreline in top-down view	As an Air Traffic Controller, I want the top-down view specifically to display the runway centreline, so that I can aid in navigation and alignment during aircraft takeoff and landing procedures.	MUST
20	Display Lower threshold	As an Air Traffic Controller, I want the runway visualisation to show the lower numerical threshold on the left (e.g., 09L for runway 09L/27R) for standardised orientation interpretation and communication.	Should
21	Rotate runway strip	As an Air Traffic Controller, I want runway strip rotation in visualisations to match real-world compass headings for accurate geographical alignment.	Should
22	Display cleared and graded areas	As an Air Traffic Controller, I want the top-down view to show Cleared and Graded areas around the runway strip, to enhance situational awareness and operational safety.	MUST
23	Display representation of TOCS\ALS slope	As an Air Traffic Controller, I want the side-on view to depict the TOCS\ALS slope over obstacles, ensuring aircraft safety during takeoff and landing.	MUST
24	Selecting different runways	As an Air Traffic Controller, I want to select different runways and thresholds, so that the views update accordingly, enabling precise monitoring and decision-making for aircraft movements.	MUST
25	Display notifications upon actions	As an Air Traffic Controller, I want real-time notifications for significant events like obstacles added, runways re-declared, or changes in values, so that I stay updated on airport operations and safety.	MUST
26	Export PDF files	As an Air Traffic Controller, I want to export visuals, reports, and user operations in PDF format for easy sharing and review of airport operational data with stakeholders.	Should
27	Create user authentication and authorisation	As an Air Traffic Controller, I want a secure login mechanism, so that only authorised team members can access the dashboard and ensure operational security.	Should

28	Add user roles	As an Air Traffic Controller, I aim to tailor team access (admin, editor, viewer) to match job roles for efficient workflow and data integrity.	Should
29	Store information in database	As an Air Traffic Controller, I want secure storage for user activities and permissions to enable auditing and ensure operational security and accountability.	Should
30	Display error messages	As a Runway Technician, I want clear error messages for issues like login failures or invalid inputs to swiftly resolve problems and ensure smooth operations.	Should
31	Export Displays in different formats	As an Air Traffic Controller, I want the ability to export display views in JPEG, PNG, GIF formats to facilitate easy sharing and analysis of runway and airspace configurations.	Could
32	Zoom and pan the views	As an Air Traffic Controller, I want the ability to zoom and pan the views, so that I can closely inspect specific areas of interest or get a broader overview as needed.	Could
33	Provide alternative colour schemes	As an Air Traffic Controller with colour vision deficiency, I want alternative colour schemes in the program to ensure accurate visual data interpretation and operational safety.	Could
34	Display 3D visualisation of the airfield	As an Air Traffic Controller, I want 3D visualisation of the airfield to understand spatial relationships and identify obstacles, enhancing traffic management and safety.	Won't

3. Project Planning

3.1 Introduction

We would like to show how we're going to build our project step by step. We structure our project with an increment plan, dividing it into smaller, manageable segments for gradual development. Each segment involves a sprint plan for completing specific tasks within short, focused periods, outlined in the sprint backlog. A day zero burndown chart tracks our progress, comparing remaining work against available time, ensuring organised, goal-oriented advancement.

3.2 Increment Plan

Increment 1: Basic System Setup and Initial Visualisation

The first increment will be focused on setting up the basic framework of the system and initial visualisation of the program.

The plan is to have a working prototype with the following functions:

1. Configurable to be used at any UK commercial airport
2. Basic visualisation features of the runway: 2D top-down view, and side-on view
3. Calculation of new runway distance when one obstacle is present on the runway
4. Have a predefined set of possible obstacles
5. Import and export function for information regarding obstacles, airports, and other appropriate data in XML format
6. Logon system to authenticate and authorise users to facilitate collaboration between multiple users or agencies on the same workspace

Increment 2: Advanced Visualisation and Interactive Features

The second increment will be focused on enhancing the visualisation aspect based on the recalculation and adding more interactive features to the system

The plan is to add the following features to the current prototype:

1. Ability to view details of the recalculation and its breakdown for cross-checking purposes
2. Show detailed information of the runway when in top-down and side-on view
3. Display the runway centreline, Cleared and Graded areas around runway strip in top-down view
4. Display a representation of the Take-Off Climb Surface (TOCS) and Approach/Landing Surface (ALS) slope when one obstacle is present in the side-on view
5. Ability to automatically rotate the runway strip to its compass heading
6. Ability to choose different runways and thresholds with updated views upon selection

Increment 3: Reporting, Collaboration Enhancement, and System Refinements

The third increment will be focused on user-oriented functionalities regarding communications, and refinements of the system

The plan is to create a prototype with these features:

1. Notification system which allows users to monitor system changes when actions are taken e.g. obstacles added, values changed, etc.
2. Export function for visualisations, reports, and user operations in formats such as PDF
3. Enhance the collaboration system by adding user roles with different access levels
4. Database to store user information, e.g. usernames, passwords, and permission levels
5. Capable of issuing clear error messages for all operations (such as logging failures, invalid actions, etc.) to assist in troubleshooting

3.3 Sprint Plan

For the estimation technique, we have opted to use the Fibonacci scale to quantify the story points because it provides distinction between two numbers in the sequence as numbers that are too close to one another are impossible to distinguish as estimates. The plan also follows the MoSCoW prioritisation as follows: **MUST** **SHOULD** **COULD** **WON'T**

Sprint plan for next Increment (Increment 1)

Member	User Story ID	Task	Estimation
Tianrui	1	Permit any UK commercial airport	3
Abdul, Muhammad	2	Create 2D top-down view	8
Abdul, Tianrui	3	Create 2D side-on view	8
Muhammad	4	Calculate runways distance when ONE Obstacle present	5
Abdul	5	Create a list of predefined obstacles	2
Siddharth	8	Import XML files	5
Siddharth	9	Export XML files	5
James	27	Create user authentication and authorisation	8

Sprint plan for Increment 2

Member	User Story ID	Task	Estimation
Muhammad	6	View recalculated values and original	5

Muhammad	7	View breakdown of calculations	3
Abdul	10	Display runway strip	3
Abdul	11	Display threshold indicators and designators	5
Siddharth	12	Display any displaced thresholds	3
Abdul	13	Display Stopway/Clearway for both ends	5
Tianrui	14	Display Indication of the take-off / landing direction	2
Siddharth	15	Display re-declared distances	3
James	16	Display distance broken down into their respective parts	3
Muhammad	17	Display obstacle	3
James	18	Display offset caused by RESA and slope angles	5
Muhammad	19	Display runway centreline in top-down view	3
Tianrui	20	Display Lower threshold	3
James	21	Rotate runway strip	8
Tianrui	22	Display cleared and graded areas	5
Tianrui	23	Display representation of TOCS\ALS slope	5
Siddharth	24	Selecting different runways	5

Sprint plan for Increment 3

Member	User Story ID	Task	Estimation
Abdul	25	Display notifications upon actions	3
Muhammad	26	Export PDF files	3
Abdul	28	Add user roles	2
Siddharth	29	Store information in database	8
Abdul	30	Display error messages	3
Muhammad	31	Export Displays in different formats	5
James	32	Zoom and pan the views	5
Tianrui	33	Provide alternative colour schemes	8
James, Siddharth	34	Display 3D visualisation of the airfield	21

3.4 Sprint Backlog

The highlighted colours indicate priorities according to MoSCoW : **MUST** **SHOULD** **COULD** **WON'T**

Sprint 1

1	Story points: 3	2	Story points: 8	3	Story points: 8	4	Story points: 5
	Permit any UK commercial airport		Create 2D top-down view		Create 2D side-on view		Calculate runways distance when ONE Obstacle present
5	Story points: 2	8	Story points: 5	9	Story points: 5	27	Story points: 8
	Create a list of predefined obstacles		Import XML files		Export XML files		Create user authentication and authorisation

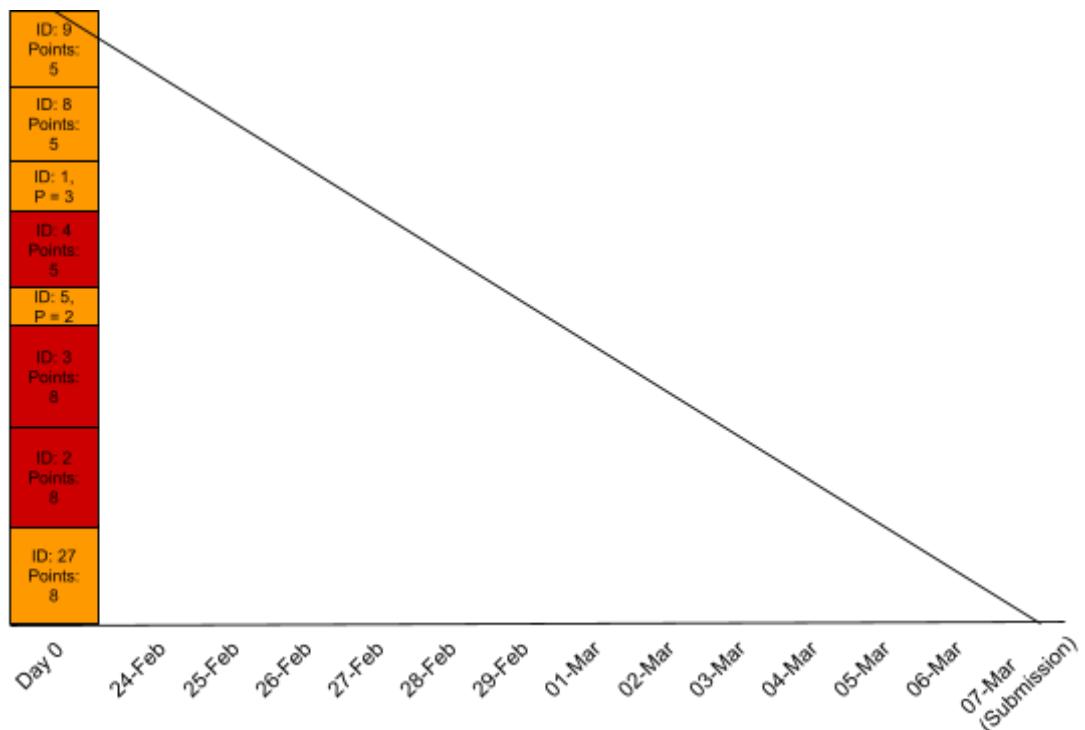
Sprint 2

6	Story points: 5	7	Story points: 3	10	Story points: 3	11	Story points: 5
	View recalculated values and original		View breakdown of calculations		Display runway strip		Display threshold indicators and designators
12	Story points: 3	13	Story points: 5	14	Story points: 2	15	Story points: 3
	Display any displaced thresholds		Display Stopway/Clearway for both ends		Display Indication of the take-off / landing direction		Display re-declared distances
16	Story points: 3	17	Story points: 3	18	Story points: 5	19	Story points: 3
	Display distance broken down into their respective parts		Display obstacle		Display offset caused by RESA and slope angles		Display runway centreline in top-down view
20	Story points: 3	21	Story points: 8	22	Story points: 5	23	Story points: 5
	Display Lower threshold		Rotate runway strip		Display cleared and graded areas		Display representation of TOCS\ALS slope
24	Story points: 5						
	Selecting different runways						

Sprint 3

25	Story points: 3	26	Story points: 3	28	Story points: 2	29	Story points: 8
	Display notifications upon actions		Export PDF files		Add user roles		Store information in database
30	Story points: 3	31	Story points: 5	32	Story points: 5	33	Story points: 8
	Display error messages		Export Displays in different formats		Zoom and pan the views		Provide alternative colour schemes
34	Story points: 21						
	Display 3D visualisation of the airfield						

3.5 Day Zero Burndown Chart for Increment 1



4. Project Setup

4.1 Introduction

Our project focuses on risk analysis and Agile methods, aiming to efficiently manage challenges. We evaluate risks for preparedness and employ Agile and software tools for adaptability, collaboration, and focus, enhancing process flexibility and efficiency.

4.2 Risk Analysis

P = (Probability of risk actually occurring; 1,low - 5, high)

S = (Severity of how badly development would be affected by a risk occurring; 1,low - 5,high)

E = (Risk Exposure is the chance of development being impacted by a risk; $E = P * S$)

Risk	P	S	E	Mitigation	Backup Strategies
Product Doesn't Meet Customer Expectations	3	5	15	A thorough breakdown of requirements based on customer needs and ensuring the product meets them at every step.	As a last resort cutting out requirements so that at least the "must" requirements are met.
Individual Task Delays	4	4	16*	A well paced project plan with small, specific goals to help keep team members on task and on time.	Team will help any struggling members complete tasks they're struggling with.
Poor Risk Management	3	3	9	Potential risks will be identified and monitored. Mitigation plans will be followed to alleviate risks. Backup strategies will be utilised when risks occur.	The team will actively communicate as issues occur and develop plans to handle them on a case by case basis.
Gaps in Required Knowledge	4	3	12	Team will research and learn skills that we predict to be necessary to create the product before they are needed.	Team will strive to learn on the fly and research necessary tools.
Programming Problems / Bugs Slowing Development	4	3	12	Code will be tested frequently, logical issues and bugs will be solved when they're found. The team will prioritise using good coding practices.	The team will support each other in bug fixing and talking through logical errors when needed.

4.3 Summary of Agile Methodologies and Software Tools Adopted

Monday.com (Agile Scrum)	We utilise Monday.com for task assignments, progress tracking, and deadline management, ensuring that every project component is completed on time and within scope.
Overleaf (Documentation)	Overleaf streamlines documentation and report drafting with consistent formatting and collaborative editing, enhancing productivity and speeding up document creation and review processes.
WhatsApp (Communication)	We use WhatsApp for quick updates, urgent alerts, and informal discussions, ensuring team synchronisation and prompt responses.
MS Teams (Communication)	We use MS Teams for virtual meetings, brainstorming, and document sharing. It allows for real-time collaboration on documents, making it easier to manage project workflows and ensuring that team members have instant access to information and resources needed for the project.
IntelliJ IDEA (Development)	IntelliJ IDEA facilitates efficient code development, ensuring high-quality software delivery. Its intelligent code editor and tools streamline our development process, enhancing productivity and innovation.
JUnit (Testing)	JUnit is crucial for testing, enhancing code quality, supporting debugging, and continuous integration. It ensures software reliability and performance by validating code units against expected outcomes.
GitLab (Version Control)	GitLab is essential for version control, code repository management, and continuous integration/continuous deployment processes, facilitating efficient teamwork and code quality assurance.