# DocDuck Functional Specification

SWEng Group 1

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## Contents

| **Functional Specification Version** | **Release Date** | **Changes** | **Contributors** |
|---|---|---|---|
| 0.1 | 7/11/23 | Initial Version. Created Sections: 1.1, 1.2, 2.1, 2.2, 2.3, 2.4 | wab513 jrb617 nc1196 ttc515 zm926 htsm500 js2140 rw1834 lw2380 |
| 0.2 | 21/11/23 | Transfered V0.1.0 from .doc file to .TeX file. Created sections 3, 4, 5 | wab513 jrb617 nc1196 ttc515 zm926 htsm500 js2140 rw1834 lw2380 |
| 0.3 | 30/11/23 | Created Section 7. Clarified Project Scope, Product Overview added. Added and Modified Mock-ups to match 3.2. Edited NFR with regards to feedback by SJP. "Likely UI Control" Column removed from 3.6 | wab513 jrb617 zm926 js2140 lw2380 htsm500 |
| 1.0 | 5/12/23 | References added to 2.2.1. General formatting and grammar. 3.3 User Stories added. Section 4 updated and clarified. Hardware requirements added to section 3.5 | wab513 jrb617 ttc515 zm926 rw1834 lw2380 |
| 1.1 | 26/01/24 | Tweaked Formatting | jrb617 |

# 1 Introduction

## 1.1 Product Overview

### 1.1.1 The Product

Our product is intended to provide businesses with an application that increases the efficiency of the maintenance engineering team by providing an easy and efficient way for engineers to access, edit, track and create documentation as well as provide easy and clear communication between admins engineers and operators. The application, DocDuck, is an all in one application for the documentation side of engineering, from tracking diagnostic and calibration dates to having clear and easy access to maintenance history and number of parts in stock all in one convenient place. The three main pillars for DocDuck are affordability, efficiency and usability.

### 1.1.2 Our Intentions

- To provide an affordable, versatile product for upcoming businesses as well as set up longstanding local businesses.
- To increase efficiency of the maintenance engineering sector by saving documentation time.
- To provide a long lasting, ever evolving product.
- To be the most customer friendly product of its genre on the market.
- To become versatile enough for multiple sectors of engineering and multiple business types.

## 1.2 Project Scope

By the time of project completion the project should be able to accomplish the following as a summary:

### 1.2.1 User roles and permissions

**Operator** The Operator will be able to:

1. View and book machines
2. Report broken machines (blocks out booking system)
3. Upload media with the breakdown report
4. Access limited search functionality (machines only)
5. Utilise operator specific tutorial

**Engineer** The Engineer will be able to:

1. Do everything that the operator can already do
2. Create and manage machine lists
3. Access each machines parts list
4. View repair history and replaced parts
5. Add new machines to the list
6. Override blocked booking system for repairs
7. Set machine in a repair state and override said repair state

8. Access the full search system, allowing the engineer to search for particular machines as well as particular parts
9. View the booking state of machines whether active or inactive
10. Check machine part stock

**Admin** The Admin will be able to:

1. Do everything the engineer can already do
2. Manage accounts, including password recovery
3. Update parts list and stock availability
4. Use full search functionality

### 1.2.2 Booking System:

Here is the specific scope of the booking systems:

1. Can check machine availability
2. Can book specific machines and times
3. Can block out machines for repairs
4. Can check a database for history of machine use and breakages
5. Will notify engineer of frequently breaking parts or machines

### 1.2.3 Machine Maintenance:

1. Monthly/set period notifications for diagnostics and re-calibrations
2. Audit dates recorded will give advanced notifications before the deadline
3. Engineers can book out service time

### 1.2.4 Breakdown report system:

Here is the operations of the breakdown report system:

1. Report machine failure or broken part
2. Add description and machine part code
3. Drop down section of all registered machines
4. Upload media showing the issue
5. Option to report without specifying an issue

### 1.2.5 Repair Logging System:

1. Engineers can describe and fix problems
2. Specify repaired or replaced parts
3. Request parts for fixing machines

### 1.2.6 Security:

1. Passwords will be encrypted
2. Packet encryption for server to server communication
3. Two factor authentication for users logging in

### 1.2.7 Extra features:

These are extra features to be completed:

1. Operators can request help from online engineers or admins
2. Notifications for online status changes for users
3. Engineers can announce when a machine has been fixed

# 2 Solution Overview

The product will be written in Java and will be provided as a desktop application, with the possibility of an additional web-app for portability to be considered as well.
The application will access a cloud database so that it is not restricted to being used in one location (providing you have internet access), however, it also enables users to store files temporarily offline until they have a network connection and can then sync any data.
The application will be tailored for engineering labs and work spaces by providing a service which will allow users to track all the updates and fixes to machines as well as report any new faults.

## 2.1 Context Diagram

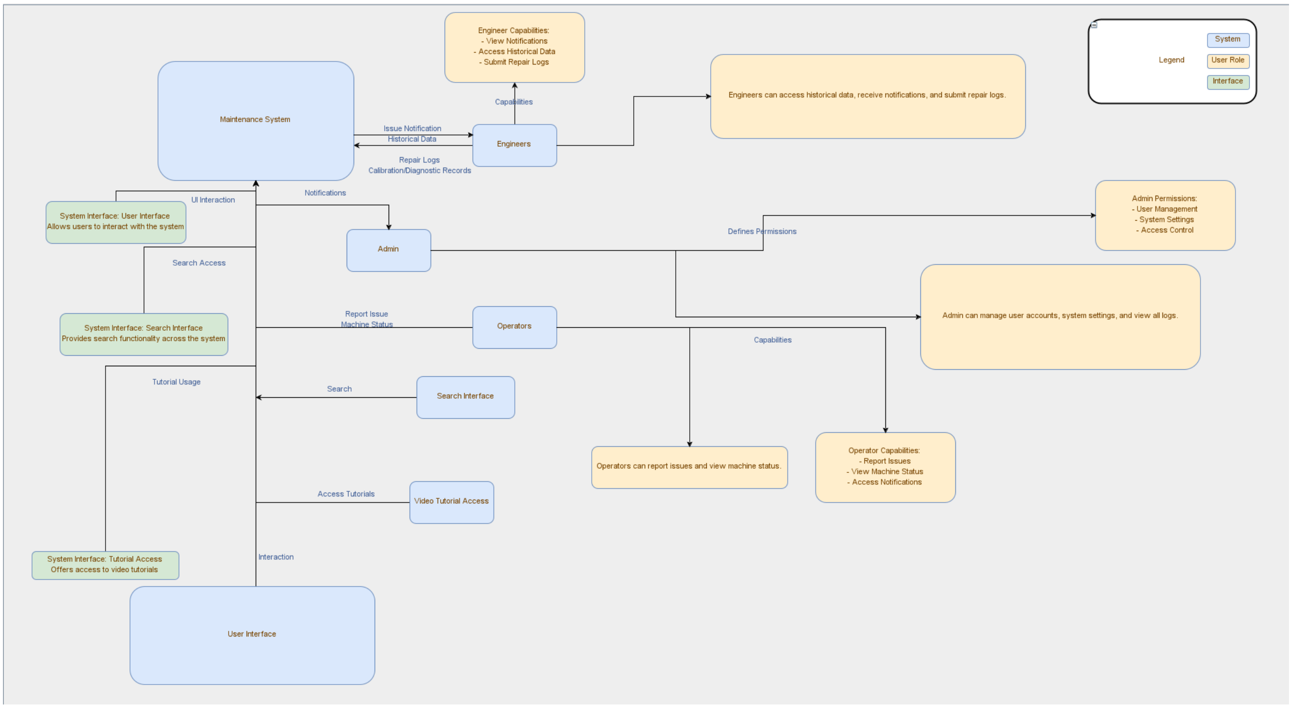


Figure 1: Context diagram

## 2.2 System Actors

### 2.2.1 User Roles and Responsibilities

| User | Role | Frequency of use | Features used |
|---|---|---|---|
| Operator | Individual machine operator | Occasional, only when there is a machine fault | Minimal Access, logging machine faults and receiving confirmation when fixed. See 1.2.1 ”Operator” |
| Engineer | Machine engineer | Frequent, notified when maintenance is required | Receiving maintenance requests, machine part lists, maintenance video watching. Making part purchase requests See 1.2.1 ”Engineer” |
| Admin | System/company administrator | Occasional | Setting up accounts. Viewing machine statistics. Receiving part purchase requests. See 1.2.1 ”Admin” |

Table 1: Different User types and their Responsibilities

## 2.3 Dependencies and Change Impacts

### 2.3.1 System Dependencies

1. Access to the internet for a cloud server or a local server to store data such as machine status, logs, login details, images and videos.
2. Windows 10 or above as the operating system running on the client machine with Java 11 installed.

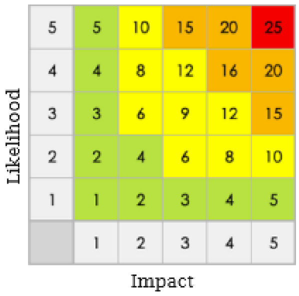
### 2.3.2 Change Impacts

1. How issues with machines are reported.
2. How maintenance/repair is recorded.
3. How machine statistics are handled.
4. How administration manages the engineers and operators.
5. Customers may require transferring across a lot of past machine log history that has been stored in another format
6. Customers may previously have been using no form of maintenance system prior to DocDuck or may have been using a manual method with a log book or similar

## 2.4 Risks and Mitigations

| **Risk Description** | **Likelihood (1-5)** | **Impact (1-5)** | **Priority (1-25)** | **Mitigation** |
|---|---|---|---|---|
| Lack of productivity & communication | 3 | 4 | 12 | Minimum of 1-2 weekly meetings and attendance recordings. |
| Incomplete requirements; may lead to incorrect implementation. | 2 | 5 | 10 | Conduct thorough requirement analysis and include detailed use cases, user stories, and prototypes. |
| Changes to the scope made after the initial scope is established. | 2 | 4 | 8 | Clearly define the scope of the project and implement a change control process in order to assess/approve any changes. |
| Ambiguous descriptions of functionalities may result in differing interpretations by developers | 3 | 3 | 9 | Ensure to use clear and concise language, providing examples and diagrams and mock-ups to illustrate complex ideas. |
| Critical method solutions & Problem diagnostics | 5 | 5 | 25 | Research on design implementation prior to semester 2. Plan additional meetings for software development and have an active communication across the team. |
| Learning/Education Disruptions | 4 | 5 | 20 | Communicate with the team online and include dynamic workloads for co-workers. Address future problems before they can occur so the team is able to react. |
| High spending or overspending budget | 2 | 2 | 4 | Plan meetings and work ahead of time and stick to the financial plan laid out beforehand wherever possible. |

Table 2: Project Risks and Mitigations



| Likelihood | | | | | |
|---|---|---|---|---|---|
| 5 | 5 | 10 | 15 | 20 | 25 |
| 4 | 4 | 8 | 12 | 16 | 20 |
| 3 | 3 | 6 | 9 | 12 | 15 |
| 2 | 2 | 4 | 6 | 8 | 10 |
| 1 | 1 | 2 | 3 | 4 | 5 |
| | 1 | 2 | 3 | 4 | 5 |
| | Impact | | | | |

Figure 2: Priority Colour Chart

# 3 Functional Specifications

## 3.1 Purpose

This section covers the use cases of the software, the user environment, specifies the minimum and recommended specifications for a user's system, and software to ensure optimal software performance and user experience. These specifications aim to create a standardised, user-friendly, and secure environment for the software, ensuring compatibility, reliability, and an optimal user experience across diverse hardware and software configurations.

## 3.2 Use Case

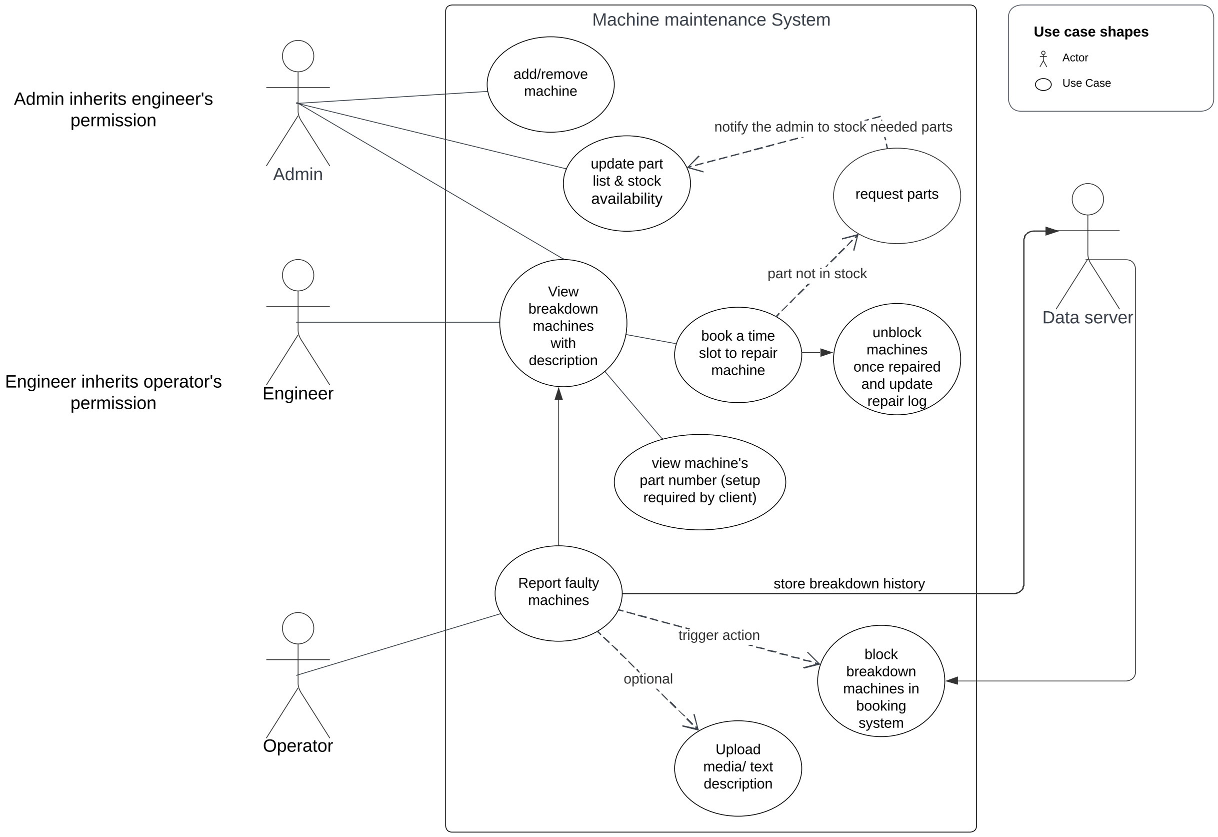

Admin inherits engineer's permission
Engineer inherits operator's permission
Admin
Engineer
Operator
Machine maintenance System
add/remove machine
update part list & stock availability
notify the admin to stock needed parts
request parts
View breakdown machines with description
part not in stock
book a time slot to repair machine
unblock machines once repaired and update repair log
view machine's part number (setup required by client)
Report faulty machines
store breakdown history
trigger action
block breakdown machines in booking system
optional
Upload media/ text description
Data server
Use case shapes
Actor
Use Case

Figure 3: Machine maintenance use case

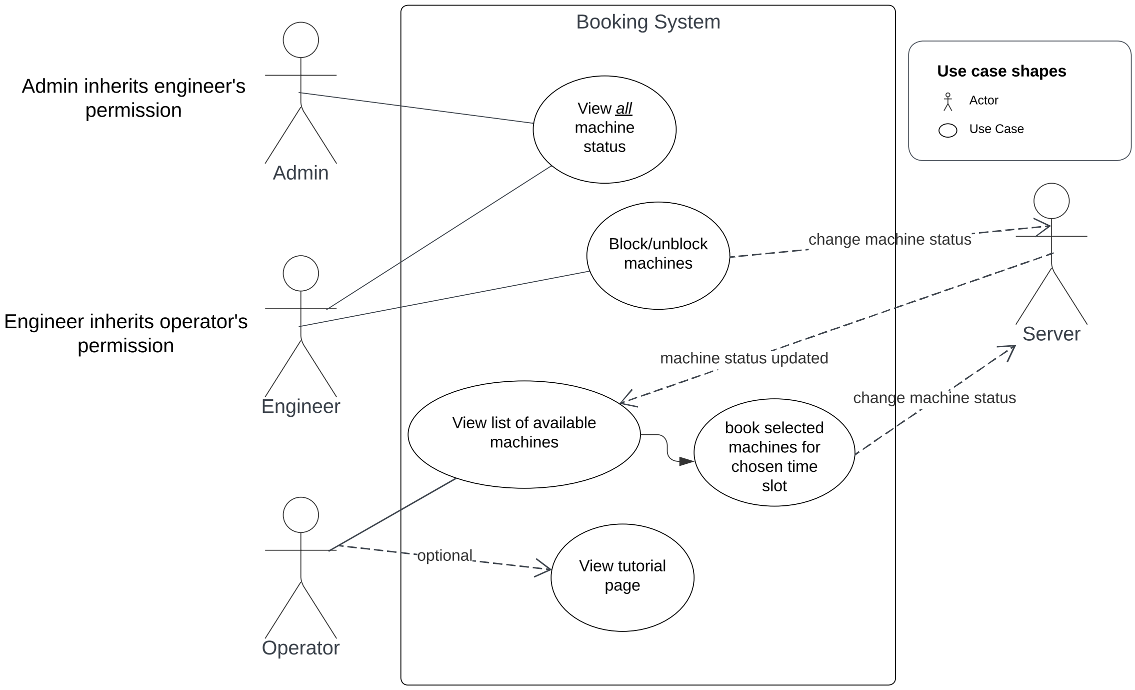


Figure 4: Booking use case

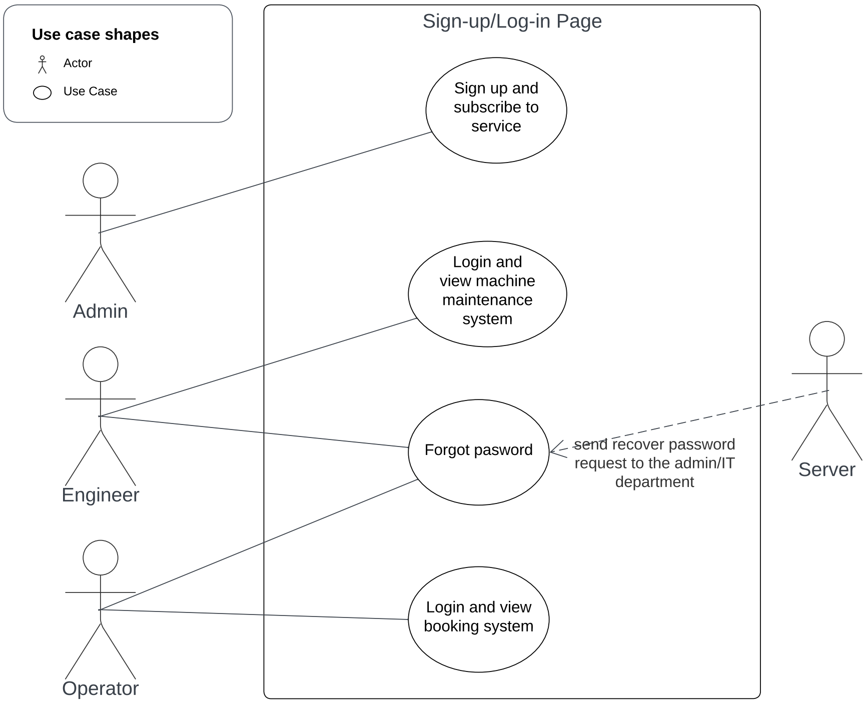

Use case shapes
Actor
Use Case
Sign-up/Log-in Page
Sign up and subscribe to service
Admin
Login and view machine maintenance system
Engineer
Forgot pasword
send recover password request to the admin/IT department
Server
Login and view booking system
Operator

Figure 5: Sign-up/Log-in use case

## 3.3 User stories

### 3.3.1 Task: Machine health status overview

1. Operator reports a faulty machine (optional: Operator describes the issue by uploading text/image/video)
2. System blocks the faulty machine in the booking system
3. System stores breakdown history and provides a monthly/set period report to the admin/engineer for diagnostics and re-calibrations
4. Engineer sees the list of broken-down machines with part numbers needed (setup required by the client) (optional: Engineer requests part(s) if not in stock)
5. Admin gets notified for parts needed and updates parts stock availability (setup in step 4 required)
6. Engineer books a time slot to repair the machines
7. Engineer unblocks the machine and the system updates the status of the machine to ”fixed” (optional: update repair log)

### 3.3.2 Task: Sign-up

1. Admin presses the ”Sign up your business here” button to create an account
2. Admin enters their email, user name, password (twice for confirmation) and payment method, account is created and subscribed to the service
3. Admin sets up the machines, engineers and users (optional: Admin presses skips for later)

### 3.3.3 Task: Log-in

1. Admins/Engineers/Operators enter their account details to log-in
2. Engineer/operator forgot the password, presses the ”forget password” button to recover the password by sending a password recover request to the admin
3. Admin forgot the password, contact DocDuck for support through email

### 3.3.4 Task: Booking machines

1. Operator sees a list of available (non-faulty/non-booked) machines
2. Optional: Operator clicks the button for the tutorial page and watches the tutorial video navigating through the system
3. Operator clicks into the selected available machine and books a time slot
4. System updates the status of the machine to booked

## 3.4 Mock-up

### 3.4.1 Login Page Concept

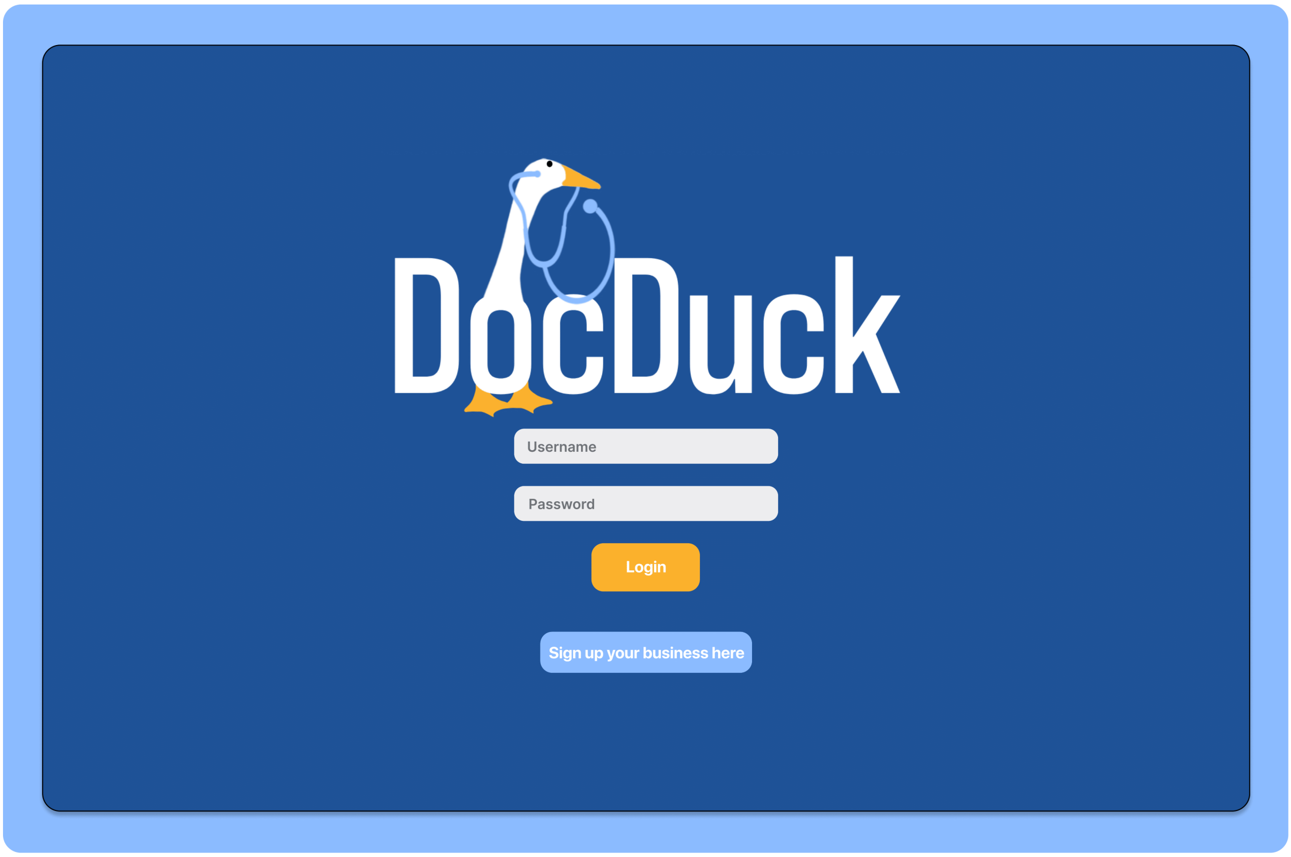


Figure 6: UX App design (Figma)

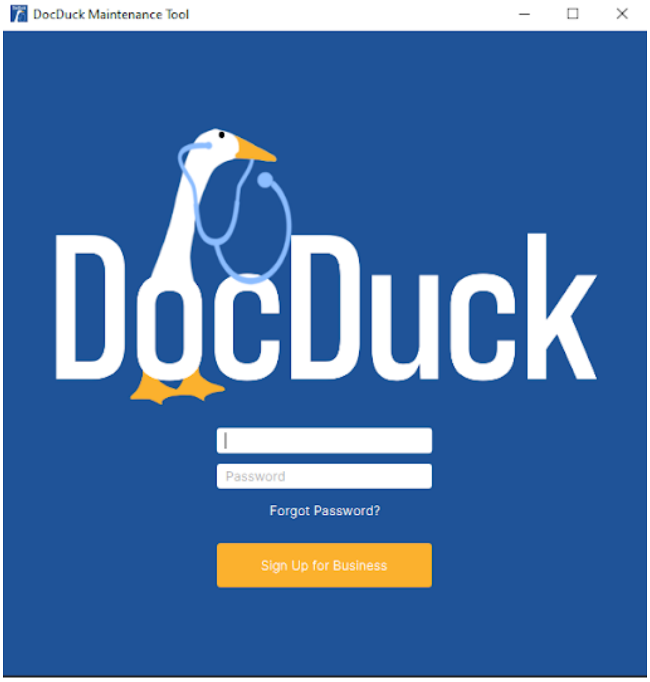
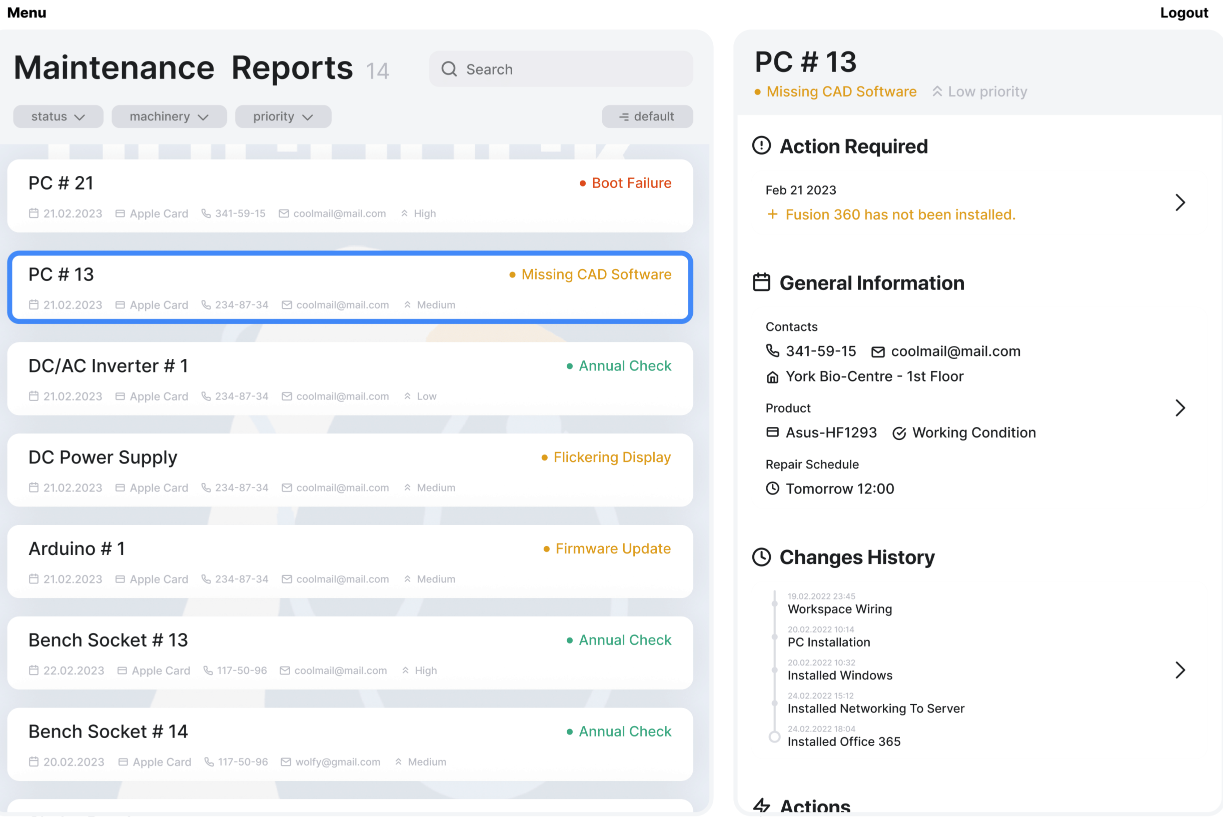


Figure 7: Java SDK 11 with JavaFX, Gradle and CSS Scalable Demo Design

### 3.4.2 Engineers Report Page Concept



Maintenance Reports 14

PC # 21 • Boot Failure
21.02.2023 Apple Card 341-59-15 coolmail@mail.com High

PC # 13 • Missing CAD Software
21.02.2023 Apple Card 234-87-34 coolmail@mail.com Medium

DC/AC Inverter # 1 • Annual Check
21.02.2023 Apple Card 234-87-34 coolmail@mail.com Low

DC Power Supply • Flickering Display
21.02.2023 Apple Card 234-87-34 coolmail@mail.com Medium

Arduino # 1 • Firmware Update
21.02.2023 Apple Card 234-87-34 coolmail@mail.com Medium

Bench Socket # 13 • Annual Check
22.02.2023 Apple Card 117-50-96 coolmail@mail.com High

Bench Socket # 14 • Annual Check
20.02.2023 Apple Card 117-50-96 wolfy@gmail.com Medium

PC # 13
• Missing CAD Software Low priority

Action Required
Feb 21 2023
+ Fusion 360 has not been installed.

General Information
Contacts
341-59-15 coolmail@mail.com
York Bio-Centre - 1st Floor
Product
Asus-HF1293 Working Condition
Repair Schedule
Tomorrow 12:00

Changes History
19.02.2022 23:45
Workspace Wiring
20.02.2022 10:14
PC Installation
20.02.2022 10:32
Installed Windows
24.02.2022 15:12
Installed Networking To Server
24.02.2022 18:04
Installed Office 365

Actions

Figure 8: UX App design for Report(Figma):Video Demo Here

## 3.5 Functional Requirements

This section contains the specification requirements for a machine/pc to run the application. It can be split into three sections consisting of software, hardware and also user environment requirements.

### 3.5.1 Hardware Requirements

**Minimum Requirements:**

- 2 Core 2.4GHz CPU
- 4 GB DDR4 RAM
- 1 GB free storage
- Keyboard and mouse for user input.
- 720p resolution monitor.
- Access to the internet

**Recommended Requirements:**

- 4 Core 3GHz CPU
- 8 GB DDR4 RAM
- 5 GB free storage
- Keyboard and mouse for user input.

- 1080p resolution monitor.
- Access to the internet

### 3.5.2 Software Requirements

- Windows 10 and above.
- Java SE 11

### 3.5.3 User Environment Requirements

- User Accounts consisting of Operator, Engineer and Administrator; each with different permissions depending on role.
- Login credentials containing usernames and passwords. Furthermore, two factor authentication with encryption to combat an ever-changing data protection landscape.
- Localisation support with the correct time, date and language for the user interface.
- Security embedded into the software such as a firewall to protect data as mentioned above.
- Tutorials to guide users on the functionality of the software
- Updates process for the software for patches etc.

### 3.5.4 Server Backend Requirements

All server hardware is run and maintained by DocDuck, the following specifications are allocated to each client. These specs are scaled depending on the subscription tier or size of the company.

- 2 cores at 2 GHz each
- 2 GB DDR4 RAM
- 40 GB database storage

### 3.6 Field Level Specifications

| Field Label | Users with access* | Mandatory? | Editable? | Data Type |
|---|---|---|---|---|
| User Name | All | Yes | Only by Admin once set | Alphanumeric |
| Password | All | Yes | Only by Admin once set | Alphanumeric |
| Fault Report: Machine name or auto generated | Operator | Yes | Yes | Alphanumeric |
| Fault Report: Machine problem | Operator | Yes | Yes | Alphanumeric |
| Fault Report: Problem Specifics | Operator | No | Yes | Alphanumeric |
| Fault Report: Media Upload | Operator | No | Yes | Video/ Photo |
| Search machines | All | No | Yes | Alphanumeric |
| Parts List: Search Parts | Engineer | No | Yes | Alphanumeric |
| Parts List: Remove Parts | Engineer | No | Yes | Integer |
| Parts List: Add Parts | Admin | No | Yes | Integer |

Table 3: User Enter-able fields

*Engineer inherits Operator permissions and Admin inherits both permissions, This column is those roles who will access this field in normal use.

## 4 System Configuration

Configuration of the system involves several steps. Below is an overview of the key setups and configurations, including user accounts for admin, engineers, and operators. The configuration may vary based on the needs of the organisation.

### 4.1 User Creation, Authentication and Authorization

**Intent/Purpose:**
Ensure secure access to the application with appropriate permissions for different user roles.

**Steps:**

- Create individual users under the roles of admin, engineer and operator.
- Allocate usernames and passwords.
- Configure role-based access control.

**Alternatives/Customisations:**

- Integrate with 2FA for external authentication.

## 4.2 Job Order and Maintenance Scheduling

**Intent/Purpose:** Efficiently manage job orders and maintenance schedules for machines.

**Steps:**

- Create a job order creation and tracking process.
- Set up maintenance scheduling with appropriate notifications.

**Alternatives/Customisations:**

- Integrate with a calendar for visual representation.
- Allow recurring maintenance schedules.

## 4.3 Logging and Monitoring

**Intent/Purpose:**
Track machine activities and monitor performance.

**Steps:**

- Implement logging processes for user actions and machine events.
- Set up monitoring for machine health and performance.
- Define alerts for critical events.

**Alternatives/Customisations:**

- Automatically detect when a machine has failed or has faults.

## 4.4 Notifications and Alerts

**Intent/Purpose:**
Inform users about important events and impending maintenance.
**Steps:**

- Modify alerts for machine issues or upcoming maintenance.
- Customise notification preferences.

**Alternatives/Customisations:**

- Integrate with other messaging platforms like email or SMS.
- Provide escalation levels for critical alerts.

## 4.5 Backup and Recovery

**Intent/Purpose:**
Protection against data loss and ensure system resilience for clients maintaining their own database/server.

**Steps:**

- Implement regular database backups.
- Define a disaster recovery plan.
- Test backup and recovery procedures periodically.

**Alternatives/Customisations:**

- Use cloud-based backup solutions.
- Implement versioning for critical data.

# 5 Other System Requirements & Non-Functional Requirements

The Non-Functional Requirements can be compartmentalized into the following:

- **Performance and Scalability:** The response time of the system is high; the page must load within 2 seconds even under higher workloads. It must be designed for both small startup engineering companies as well as pre-existing companies that have a higher workforce, therefore under higher stress levels the product will continue to function at a high rate. The highest workloads the system will encounter are: if multiple operators have breakdowns of machines and must log it using the system, and multiple engineers need to access the system to check the breakdowns and report when their machine is fixed.

- **Reliability:** The system is expected to operate without any failures. In the rare event of failure the software will automatically generate an error report, and the team will receive it swiftly. This ensures a rapid resolution to any problems.

- **Security:** All sensitive data including usernames and passwords must undergo encryption. We must conduct regular security audits to ensure any potential vulnerabilities are addressed. The system must include measures to prevent unauthorized modification of data; this includes the use of checksums and digital signatures as well as other integrity verification techniques.

- **Capacity:** There is no predefined system limit and is designed to handle dynamic workloads. It must be able to accommodate at least 100 users simultaneously without any serious degradation in performance. It must seamlessly accommodate new and additional users in order to meet the client's evolving needs. Administrators must be able to add users freely without concerns of system limitations. Regular load testing must be carried out to test the system's performance under stress conditions. The system must accommodate a growing database to allow engineer users to look at the history of a machine.

- **Usability:** The design must be user friendly, with new users being presented with a video tutorial of how to navigate and use the system. Common actions must be easily accessible with clear labelling. Must conduct client-side feedback through a feedback mechanism within the system to provide any missteps.

# 6 Integration Requirements

The application will be a fully graphical program which will run on all major operating systems requiring Java and an internet connection. In order to meet all the requirements for the software, a number of external libraries and dependencies will be required. The libraries that will be used and the features they will be used for are presented below:

- **VLCJ:** A Java framework which allows an instance of native VLC media player to be embedded in the application to display and playback audio and video files
- **OpenJFX:** Open JavaFX is the modern version of JavaFX which used to be included in the JDK, now it is open source and separate. OpenJFX will allow the creation of rich client applications and having a GUI which will display the software allowing the user to interact and operate the application
- **SNF4J:** Simple Network Framework for Java is an asynchronous event driven network application framework. Utilising both this library along with `java.net` and `java.io` standard libraries will enable user uploaded files to be stored on a remote server and other media and information to be retrieved from the server for the client to display.
- **Java TOPT:** TOPT is a time-based one time password library for Java which allows users to generate and verify time-based passwords for multi-factor authentication. This will effectively enable Two-Factor Authentication to be used for all application users, adding additional security to the software application

External hardware will be required for the data server to run on, this will be suitably chosen to have enough processing power to handle all client requests and send & receive data. This server will be stored in a secure location at the company HQ. This hardware will require to run additional software which will enable the application to interface with it appropriately.

## 6.1 Exception Handling & Error Reporting

| Exception | Error ID | Root Cause | User Impact | Handling Strategy |
|---|---|---|---|---|
| Database Connectivity Issue | DB_CONN_001 | Failure in establishing connection with cloud database | Users unable to access machine data, book machines, or report breakdowns | Immediate alert to users, Error logging, Fallback to local cache, Notify administrators, Monitoring service |
| User Role Permission Error | USER_ROLE_002 | Unauthorized access attempt | System integrity issues | Validate access control, Provide error messages, Log attempts, Notify admins |
| Machine Booking Conflict | BOOK_CONFLICT_003 | Simultaneous booking attempts | Confusion, potential double-booking | Locking mechanism for booking, Conflict resolution, Real-time update |
| Machine Maintenance Alert Failure | MAINT_ALERT_004 | System fails to send maintenance notifications | Missed maintenance schedules | Automatic rescheduling, Immediate notification to engineers, Log and report issue, System health check |
| Breakdown Report Error | BREAKDOWN_005 | Incorrect or incomplete breakdown reports | Inaccurate maintenance response | Validate report entries, User guidance, Error messages, Admin review option |
| Repair Logging System Error | REPAIR_LOG_006 | Failures in logging repair activities | Incomplete repair history | Automatic data validation, Log error details, Notify engineer and admin, Backup data entry options |

Table 4: Exception Handling/Error Reporting