Enhancement of an electronic document management system in a healthcare environment

By

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for the degree of

Declaration

I hereby certify that this report constitutes my own work, that where the language of others is used, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of others.

I declare that this report describes the original work that has not been previously presented for the award of any other degree of any other institution.

Josh Awozele

Date: Enter the date here

Signed (apply signature below)

Acknowledgements

For *Ann, my love*! I miss you. I love you. I will always remember those last words and your tone of excitement. I love you Ineh. The long pauses will not help me relive this reality that you are no longer here with us. I miss you. I thank you for all.

I feel great to have been taught by some of the best lecturers in the software industry. Your impeccable soft skills will always be a guiding light to doing things in the simplest way possible while maintaining high standards.

I love you Damola.

Abstract

Table of Contents

1. Introduction

Problem Description, Context and Motivation

An Electronic Document Management System is efficient for the safe record keeping of service users within a healthcare environment. The electronic means of storing documents expedites a search process for information when requested. Unlike the traditional methods of paper-copy documents, electronic storages allow data to be manipulated in line with requirements. In an era where the need to manage complex data has become prevalent, it is important to facilitate a simulator project where adequate testing can be done to validate against requirements. Some of the notable benefits of simulator projects reduce financial cost overheads. The core activity is usually a presentation on how software components enable the sign-off of a fully-fledge software application.

The project involves the need to create collaboration between medical professionals tasked to seek betterment for the care of their service users. In an era where sectors are constantly adopting new and smarter ways of working, medical personnels are ever focused on the practical aspects of ensuring that service users are well looked after. While they pay close attention to wellbeing, the documentation areas which include correspondence, feedback and update about a patient are mostly handled by those without a medical professional background.

Understandably, the lack of communication can be attributed to a non-use of electronic collaborative tools to form engagement. In an ever-evolving sector where medical professionals are afforded with groundbreaking equipment to help foster the ease of providing quality care to service users, the use of IT systems can sometimes be rarely used by professionals, especially if there has been no adequate or relevant training and development.

The project maintains a qualitative aspect of information gathering. As with other sectors where numerical data audits the outcome of results, software engineering focuses on the artefacts that are required to build a fully fledge and robust software application. A technical project relies on industry-led standards to facilitate gathering relevant information while fine-tuning requirements in alignment with industry standards. A software application

cannot be agreed upon as complete if there are no technical elements of system modelling like showing users the functionality of the software application, their roles, and what types of operations the application can be used for. A software requirement specification document forms the documentary charter that technical teams can reference to understand their roles and responsibilities across projects. The project's foundation creates a prototype application to provide insights into the capabilities of a developed system with high-level programming languages for front-end and back-end data management.

Aims

The aims of the project will allow seamless collaboration between medical personnels whereby preference is given to managing service user information that are stored online and required to be remotely managed by an administrator that can act as a focal point of contact between doctors and external medical professionals. Time management is crucial to healthcare, the need to retain a professional with a non-medical background can be supportive to promote communication in a manner where information is provided to both doctors and pharmacists using clear terms to provide information such as the impact of the issue under study and how expeditiously possible to resolve the situation if it does not require a stay at a hospital. The project aims to achieve the following:

- Create a collaborative tool where medical professionals can validate requests that are passed on to pharmacists
- Information retrieval by patients to understand their frequency in visits to a GP, rank the visit and provide feedback to a professional with a non-medical background
- Allow seamless communication between patients, medical professionals, and regulatory bodies where information about care can be stored
- Escalatory means outside the patient's local GP so that another surgery can provide care should the local service be over subscribed

Objectives

Within a small clinic environment, the use of IT systems as a collaborative too can support cohesive communication between internal and external stakeholders. The core steps to follow towards problem-solving any issue presented by a service-user include:

- Recording adequate notes about service-users' visits. Consider personal hypothesis and record notes as a follow-up.

- Share information with the service-user to edit any typographic error or exempt certain personal information to be recorded on a database that is only accessible by a non-medical professional with a need to reduce ay form of bias.

- Provide a print copy to the service-user to serve as a reminder of their visit or provide a feature where they (service-users) can view or print their own visit history to a GP.

- Send information regarding prescriptions directly to pharmacies. The service-user can decide on where they feel convenient to collect their prescribed medicine. A nominated pharmacy can be beneficial if the service user is most likely to use the pharmacy. Although, a choice to use other pharmacies can provide a feeling of well-being where medicines can be collected with proof shared by a medical professional to provide medicines.

Legal

The Data Protection Act 1998 provides an outline regarding the importance of safeguarding information which can be attributed as objects to individuals. The information provides the basis for the type of data that can be stored. It advises about processing data in alignment with data integrity so that any information held on database accurate and needed for the purpose of secure collaboration.

The data processing policy builds upon General Data Protection Rights (GDPR) 2018. The new Act gives users additional rights on how they can retrieve and manage personal data held on computer systems. The new policy extends past UK borders with other countries under the European Union (EU) signing a treaty to adhere to how data is effectively managed. The current issue with securely managing sensitive data can be categorised as internal organizational issues, where organisations within the health sector invest financially in developing core systems that can help promote well-being with less focus on training the administrative staff responsible for supporting end users with adequately engaging with the system in a manner that would help expend important organisational time and resources towards other vital aspects of managing business operations.

Social

Health and social care notably begin from a foundation of developed communities seeking divisive methods to find treatments regarding their well-being. Within a community, it is important to engage in studies to understand the demographics, literacy knowledge and their receptiveness towards using a software application that can be made available on their personal mobile devices. While the process to self-manage personal information can be a welcome approach by service users who have a strong understanding of interacting with computer systems, a certain proportion within the primary care catchment area may rely on visiting a GP as their core responsibility, thereby allowing a remote management of their own personal information.

Facilitating workshops to create walkthroughs for end users can be a simplistic method to gain user buy-in via testing the software application with several stakeholders representing the end-users, so that their interests can be taken into consideration before the final product approaches a go-live stage. Stakeholder meetings can be efficient in understanding user requirements and how they fit into the organisation's aims and objectives.

Ethical considerations

Safeguarding service user information can contribute to their overall need to use a service at a point of need. It is important to collate mostly information that relates to the treatment plan of a service user. For example, during the information gathering phase, a Business Analyst field questions like a respondent's favourite programme, their choice of entertainment or favourite colour. Although information such as their body weight, height, next of skin, address can be stored electronically via a database. Service users must be made aware of the importance of collating personal data without a further need to explain about safe data storage as it is the core function of the organisation to ensure that the data mining process include security triggers that can safely protect against any data leaks.
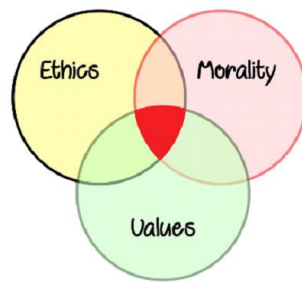
Administrative users must understand the technicalities of parsing information within and outside the healthcare environment by liaising with other medical professionals tasked with the service user's treatment. Medical history of each service user must fully follow a fully-fledged network intrusion system that can first operate as a network security system security system, followed by an assessment of rules to ascertain their validity before granting access to data flow management. Moodley (2024)

Professional

Scalability and capacity are core drivers of managing the professional aspects of software applications. As service user registration increases, it is important to bear in mind the design of a software application with ease of enhancements to accommodate new data retention. Developers guide must be drafted so that during a handover, new joiners within technical teams can easily follow drafted steps on how to provide solutions to newly developed or known problems. Software applications that are known to contain a large amount of data must undergo load testing to further explore the amounts of users that the application can handle at a given time without delaying core components of the application. Developers can focus on referencing best practises on how other healthcare organisations invest in developed software systems or those that are pre-built with add on features to meet customer needs and expectations. KMS Staff (2024)

Background

The project begins by understanding the downturn in communication after a patient visited a GP practice where they raised concerns about a skin infection which had first been assumed to be manageable with off the shelf products. It became apparent that the medical situation required professional care. The increase in feeling unwell prompted a visit to a

doctor's office where explanations were given about overall health and the effects of the current illness on everyday activities. Based on the necessary steps required to administer care to a patient, medical notes were written and securely stored on a web portal for reference to other medical professionals which include nurses, clinicians, and pharmacists. The experience the patient had includes lack of communication between the doctors and pharmacists. The patient had been advised to visit the nearest pharmacy to obtain medicine. It was believed that all the activities related to the visit were electronically stored and viewable by people interested in the utmost care of service users. Surprisingly, the patient visited the pharmacy on multiple occasions and was advised to return to the doctor's office to seek approval for their prescription.

Report overview

2. Literature - Technology Review

Literature Review

Edoh (2021) addresses the need for GPs to base their decision-making process via the use of IT systems. The aims and objectives entail collating data that is scientifically understood by those responsible for managing patients' health records, however granular or complex they may seem. The chunk of information is important for record keeping and the safe storage for data retrieval when the need becomes available. The use of IT systems can pose its challenges by employees' preference to use other applications that they deem simple and easy to complete similar activities. Hare (2010) denotes how organizations are yet to professionally apply the importance of data management to their operations. The research sheds coverage on Enron, a financial organisation which went out of business by its lack of adequate data management. The research shares lack of communication between experts with technical experience and business professionals with a sole purpose in maximizing revenue. Software Engineering encompasses the need to create dynamic strategies that can supportively allow organisations to function as Business as Usual during enhancement periods. It can be advised that organizations experience the loss of data during maintenance where systems are integrated as a fully-fledge software application. Data management cannot be mapped via visualization, this process further creates complexities where data

may become clustered within a database memory. It will require the assistance of professionals with industry knowledge to resolve any technical situation regarding the search and management of data. Evgeny (2024) research states points which can promote the advancement of big data processing, based on several statistical and semantic analysis, integration, simulation modelling and machine learning. The project delivers its final output through the delivery of a simulator system which displays the flow of users' interaction with the webpages.

The technology review sub-heading provides an outline of the types of technologies that are efficient in developing robust applications that can support smarter ways of working by incorporating a list of activities in a specific area- web app, so that service users can manage records related to their registration at a GP surgery. Grain (2013) shares a few issues likely to emerge in the future from retaining complex data, most of which are intended for training models across future systems while it is beneficial to store and manage data. The governance and control on how the flow of data will be made available will involve a challenging process where documentation processes exceed the practical need to resolve a technical situation.

The studied literature reviews reveal how the management of electronic records via healthcare management can contribute to well-being of service users. Technology supports the development of usable systems that can reduce the technicalities of remote record keeping which is usually stored and can delay information search when needed for a valuable reason. It is evident medical professionals need to rely on the use of software applications can experience enhancements on a yearly basis without reverting to traditional methods of record keeping. The financial cost it will bear on investments will reflect across how prices are set for the successful delivery of software applications to organisations who are focused on reflecting a positive brand image within its business operations.

Technology Review
Figma

A versatile tool for designing software prototypes. The open-source tool functions as a test-phase for how developers intend to create engagements between users and the application. The artefact developed on the site can be used as high-level walkthrough for finance teams

to plan towards material and work-related resources so that they can efficiently manage their project budget in agreements with budget tolerance. The enterprise tool can be used as a collaborative tool between teams located in geo-locations where varied expertise contributes towards the development of a complete software application. Iteratively, products development can be enhanced through the development of prototypes. The visual presentation can help clients have better understanding of their investment and accurate decision making such as enhancing current systems or investing in a new product that can increase the business profits. Figma is widely used across software development organisations by teams who are confident in delivering customer expectations through the exploration of their technical capabilities of technically presenting their best-in-class understanding of the customer requirements while collaboratively gaining their buy-in to implement quality processes that can help sustain their business processes.

Summary of Outcomes of Literature and Technology Review
Technologies

Technology	Limitations	Benefits
Figma	It is mostly available as a prototype tool and cannot function as an actual working software application	Easy to use by developers to create walkthroughs on how software components interact within the application
PHP	It is mostly suitable for commercial applications and cannot be advised to sufficiently build commercial applications	A programming language that can robustly be used for software development.
MySQL	Stores and manipulates only structured data with known columns and rows	The back-end programming language cannot efficiently manage unstructured data like MongoDB.

Amazon Web Services	Requires an operating license which can be costly to manage through yearly subscriptions	Manages data in real time and can backup data for safe storage should there be an experience of data loss

Figure 1: Literature review of studies

Literature review of technologies

Technologies

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Figure 1: Technologies in use

Figma

The enterprise tool is widely used in software engineering. It allows for fine tuning requirements without affecting other core developed prototype areas. Remotely, developers can contribute via a comprehensive approach of creating connections between webpages to understand how page displays or data transmission can be enhanced to meet standardised methods. The adoption of an agile project management process would ensure that the project does not follow a set plan without refactoring new features or components that can support in the development of a complete product. Staiano (2022) provides a comprehensive approach on how Figma has become a favourite tool for both software developers and professionals tasked with highlighting a visualization on what to expect from a final product if any financial investment is taken into consideration. Figma has an array of tools that can be utilized by developers to expedite complex programming tasks that may usually require elements of coding. The number of contributors to the creative idea making tool allows for constant updates with the ever-evolving smarter ways of achieving high-level goals.

PHP / Python

A programming language efficiently developed to create software applications. Most legacy systems are known to have been developed with now obsolete programming languages like Fortran and Kobol, Python has an extensive community of developers contributing to the successful delivery of software applications via gaining sheer knowledge available through open-source information sharing.

MySQL

A simple to use database management tool for efficiently placing data in rows and columns. Most health-related information requires a defined structure where succinct information can be stored in related columns that can be easily manipulated through data manipulation languages. Structured data are easily understood in lieu of unstructured data which can require a proficient level of understanding before they can be used for operational purposes.

Amazon Web Services

Efficient for cloud management of data that can increase over time. The proprietary based application can support in dynamically managing data via cloud services which can allow the organisation to channel its resources such as managing adequate workspaces with a less focus on investing on hardware applications that can require spacious environments solely for the placement of heavy goods. A simplistic method to managing high-level data adopts cloud services which also supports automation of complex tasks.

3. Methodology

Design

Barbara (2023) conference paper advice about the need for datafication, a process whereby organizations are focused on data-driven management of shred services. The research paper covers salient points such as developer's inclusion of new methods which must also follow strict GDPR regulations when developing an application that must fulfil a purpose. Notably, the delay to approve of notifications from intra medical professionals can be attributed to the under-training or over-training of employees.

An under-trained employee may feel they do not possess the right escalatory means to complete a request. The lack of adequate training will delay a process which could have been supported by a user manual in readable forms

An over-trained employee may assume they only provide services to senior management, therefore utilizing a computer system to support an onboarding process for new joiners may be a task that can become seconded to another member of staff with only a working knowledge of other software applications.

Barriga and Clementes (2022) publication describes the importance of model driven development, it uses domain knowledge to create software systems which outlines the correlation between software components using code generators. The implementation of re-usable codes can expedite a software release or delivery process as developers can create robust applications by designing critical paths that must be outlined as a 'Must have' should there be a requirement list with a MoSCoW requirements gathering method. According to Ordonez et al (2020) systematic review, the research describes practical solutions that can assist the need for users to utilize applications for a sole purpose. One of the issues with user engagement may stem from using various code functions with different front-end output. The lack of user engagement can cause a financial strain on applications that are not in-use but have contractual agreements to maintain licenses over a period. The software development community regards model driven development as a fundamental tool for the development of software applications which can adopt a unison approach. Model driven development can be efficient for developing applications which does not included extensive coding. The key focus is in understanding the data engineering components and how they transport data from back-end applications to end-user visualization.

Siamak et al (2021) shares some of the challenges of model driven development, some of which underwrites how developers are not specifically experts in the development of model driven development applications. The lack of regulation or expertise has caused the software market to reach an overflow of software applications created via model driven development. This has caused irrelevance as to their use as clients would rather personalize their applications in place of buying a commercially available software with similar application having same functionality. Model driven development reduces the need for customization where defects are reduced by only including needed features.

Testing and evaluation

The project adopts the Nielsen Norman Group usability testing methodology. It advises about manageably splitting tasks based on a step-by-step process. Usability testing allows a facilitator to create drafts on the application of the software components responsible for automating complex tasks. The aims of usability testing focus on the reduction of bugs and fixes at a stage where time constraint can be the main area of concern, so that any errors or bugs can be corrected during the evaluation and analysis stage of requirements gathering. McMullin (2021).

Even though the project adopts a simulator / prototype approach, academically, the development of a software application must entail elements of software testing before its release stage. Software developers cannot handover developed applications without adequate testing documentation with details on how each software component interact within the software application. The development stage includes the need to code applications with minimum errors that can be corrected during project an implementation stage. Software development has a wealth of testing tools that are readily available with extensive documentation on its use and application. While usability testing forms a fundamental aspect of testing, other test methodologies such as smoke testing or load testing which gauges the number of users that can use a software application before bugs and errors are reported. According to Hertzum (2024) usability testing dates to the early 1970s, the test method allows a user to interact with a software application while an observer records their mode of engagement, thereby documenting the parts of the webpages / links that they find fit for use. The simplistic test method can take place within a workshop setting where quantitative analysis can be undertaken to map user engagement.

Educate employees

Facilitate training workshops with visual user manuals as a reference guide to find any solutions to known IT problems that are likely to be experienced by frontline administrative staff. Training and development can be beneficial through using the software application by several users where the area of focus can range from bettering processes or adding features that can further allow system users to agree that the software application can relieve their stress of engaging with complex IT systems.

Strong encryption

Adopt prevention and detection software systems with grand configurations that can protect against accessing unauthorized networks. A network administrator with core experience of network traffic management can decide on data transmission through networks as well as those responsible for sending and receiving information through networks. The technical process can help reduce the likelihood of data loss where valuable information related to an old, aged pensioner may be used against the individual should they file a claim in a court of law.

Regularly update and patch

Maintain in-house developed systems such as packet injection systems so that rules to allow dropping packets which are outside the set rules of data transmission within the network. Service users can be advised to invest in non-complex IT devices that can reduce the flow of data to third parties. The application can help protect against data leaks that can be obtained through SQL injection or a man in the middle attack which gathers information and relays it through a PUSH or GET method to a remote hosted network server.

Project Management

The project incorporates the need to highlight steps on how project activities facilitate plans to achieve deliverables. Particularly, Agile project management encompasses how requirements are gathered in alignment with processes. The need to fine-tune requirements which can change overtime as customer needs can fluctuate thereby leading to a positioning which meets sophisticated methods of completing complex tasks. On a weekly basis, the project participants take part in a meeting to address achievements and next

steps, guidance and directives on expectations enable project participants to structure the overall delivery of artefacts in parallel with how multinationals adopt in-house processes that are proven to provide solutions to technical problems within a commercial context.

Some of the benefits of adopting Agile Software Development Life Cycle (SDLC) increases the successful delivery of software applications by working flexibly towards the achievement of quality while minimizing the likelihood of time constraints that can hinder a project's critical path.

According to Olorunshola and Ogwueleka (2021) technical review, the report outlines waterfall, iterative agile and rapid application development (RAD) as the basis of processes that organisations can adopt to management projects through known industry-led guidelines. For software applications to follow evolving processes, it is worth adapting the agile methodology which combines the use of soft skills to build successful working relationships with stakeholders. The software industry has changed from the traditional process of studying/understanding extensive technical documentation while refactoring codes before applications are developed and forwarded on to testers. Agile processes are holistic in which implementations to changes can be in effect while the strategy to formalize the provided solution is kept under coverage so that a reference guide can be traced should there be a need to make further changes, there would already be a versioned document referencing the most recent stage activities.

Sohail et al (2021) studies the impact of choosing a non-suitable software development process, with methodologies structured based on industry. The application of methodologies must be aligned to organisations need to save on cost, time and achieving quality result. It is important to note while agile processes are widely used in software engineering, the process itself is industry-wide and its adoption on an information technology project will require standardized updates to ensure the process is fit for purpose. Daraojimba et al (2024) research conclusion provides solutions to adopting agile processes, its advice on the need to train team members about the values and ethos that bind their ways of working and the need to know when to adopt agile as a project management methodology.

Increased flexibility

Agile allows dynamic teams to explore a wealth of knowledge that are tested and renowned to work across industries. The processes can be personalized to allow teams to focus on the success factors that are required to achieve their aims and objectives. Some of its importance include the flexibility of collaborating across different geo-locations. Organisational management, time management and extensive communication skills are some of the core skills needed to build strong working relationships with stakeholders. Professionals are constantly gearing towards aligning their communication skills towards understanding extensive commercial information that removes technical jargon from high-level business requirements.

Improved product quality

The methodology focuses on capturing issues from an early stage before a release stage where bugs and fixes are known to be costlier to manage than the planning or integration stage. When teams work proactively towards creating high-quality products, Agile can enable teams to seek other methods to fulfil their requirements by building successful working relationship by liaising through planned daily or weekly updates where blockages are quickly addressed. Unlike traditional software development life cycle where testing only takes part after product shipment from developers, Agile focuses on the delivery of a complete product without any recourse to fixes after delivery. The methodology remains a useful project management process for teams where they understand that requirements can be controlled by PESTLE (political, environment, social, legal, and economic) factors. Adopting an Agile process brings together a selection of experts with various skills such as splitting teams to allow experts to focus on document/strategy development and software developers who rely on accurate software documentation detailing their roles and responsibilities.

Technologies and Processes

Software development methodology

Kanban

Kanban is a useful software development methodology as it allows software developers to focus on utilizing liaison skills/soft skills to as a means of achieving aims and objectives through collaboration. Attention is given to incrementing the delivery of high-quality software components through constant updates from industry experts with various skillsets. Progress calculation takes place through a Work in Progress method, whereby a Project Management Office can engage in earned value management of their projects to understand its effect based on budgeting, time, and quality. Mali and Grogan (2020).

Fagarasan et al (2023) research paper promotes the importance of Kanban processes which are dynamically created as multi means of finding the root causes of issues by the reduction of errors and focusing on customer relationship so that requirements can be captured through high-level elicitation methods. Software processes are often overlooked by technical teams. Sometimes mistaken with project management methodologies, developers can deviate from following an industry led software development process like Microsoft Solutions Framework which relies on the use of extensive data, preferably when needed. The MSF process inhibits the loss of data through requests at a point-of-need basis. Software development processes are mostly delegated to project managers, unbeknown to developers, it is their requirements to decide on their own process of delivery in conjunction with project managers implementation of i.e. an agile project management process. Risener (2022)

Draw.io

Draw.io is a technical tool, constructed for creating diagrammatic data as a roadmap into the functionality of software applications. It is intuitive and user friendly for those responsible with creating a strategy in support of a developer's responsibilities. The tool is useful as a standalone tool to create all software documentations required by technical

teams. Draw.io enabled the development of use cases required to understand user roles and responsibilities. The tool allows a user-friendly engagement of mapping ideas without the necessity of manually creating technical diagrams via a complex approach. (Draw.io).

Implementation

Software Requirement Specification

User Story

The project begins by understanding typical steps a system user may take to gain access to the software application. On visiting the webpage, the user is prompted to enter their login details which allows a quick reference from stored information in the database. The document outlines best practices approach to creating a robust security feature which reduces the possibility of unauthorized access to the computer networks or database area where critical data asset is kept. A user story is efficient for implementing a software development component as it can be managed as a reference guide, thereby eliminating errors which can cause a delay. Aqsa et al (2021). See **Appendix 1 for User Story.**

Risk Management

Analysing the proximity and organizing risk responses are important for managing mishaps and unforeseen circumstances that can hinder progress. The risk management plan collates standardized issues that can cause a time delay in managing project activities. The responses are planned in alignment with should the risks occur, there will be a response to resolving the issue. Although some of the risks may remain in their known state, it is important to focus on the risks with high severity which can also cause a delay in quality if project activities are implemented without the correct version history of project documentation. Alves et al (2021). See **Appendix 2 for Risk Management.**

System Architecture

System architecture include the overall components that are required to enable the software application to function as a robust application. The technical aspect of software development involves how data transfer is carried out as a sole purpose of developing the software application. System architecture can also be regarded as the solution provider

through managed services as it includes several components like computer network administration that is required for user authentication to majorly protect against unauthorised access of the software application. Software applications that meet set standards must include a technical documentation, however simplistic or high-level it may be. It is important to own a reference guide that can support developers in enhancing a software application through the study of a reference guide that can contribute to the reduction of manpower hours across technical activities.

Software architecture collates the intricate aspects of software development which include the need to design applications in line with regulations such as cybersecurity to protect against intrusion. It applies a complete approach through best practices by considering providing solutions that can mitigate against known risks. Provaznik (2024).

Software Requirements Specification

Planning

Use cases

Development

GUI

4. Evaluation and Results

5. Conclusion

Future Work

Reflection

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7. Appendices

User Story: Appendix_1_User_Story.pdf

Risk Management: Appendix_2_Risk_Management.pdf

Software Architecture: Appendix_3_System_Architecture.jpg

Project Timeline: Project_Timeline.PNG

Software Requirements Specification: Software_Requirement_Specification.pdf

Login Use case: Login_Usecase.pdf

Cybersecurity Use case: Cybersecurity_Usecase.pdf