Delirium in Paediatric ICUs Project Brief

Silicon Valley Samurai (SvS)

Date: 17-02-2023

Adam Logan, Sections: High-Level System Requirements, Product Vision, Use Case Scenario; 25%
Robbie Duncan, Sections: Sprint Plan, Product Vision, Use Case Scenario; 25%
Ewan Forsythe, Sections: Roadmap, Product Vision, Use Case Scenario; 25%
Andrew Robb, Sections: Problem analysis, Product Vision, Use Case Scenario; 25%

Table Of Contents

1. Vision

1.1. System Introduction

1.1.1. Key Features

Figure 1: A parent and child consulting with a nurse

We propose two systems, one which acts as an e-learning platform and another which allows users to enter data, and view data visualisations. A key feature of the system is the distinctive visualisations, driven by real patient information, allowing nursing staff to examine the data, how they please. Another key feature of our system is the interactive e-learning package that will share knowledge on delirium within the Paediatric Intensive Care Unit (PICU).

Our proposed system will have functionality that allows user accounts to be created. These accounts will be linked to individuals and in turn the individual accounts will be linked to a specific PICU. This will help us achieve our main targets for the system with having individuality for the proposed e-learning system.

1.1.2. How it Differs

This will differ from existing systems, by expanding on the range of the visualisations that is produced by the system. These visualisations will also fit more seamlessly into the system providing an enhanced experience for the user. The visualisations will be driven by a state-of-the-art database system which would also allow for easier data manipulation with the relevant tables embedded into the website.

Our aim is to enhance the e-learning package by making it more robust and developing a wider range of tools used by the National Health Service (NHS) to make the e-learning package as interactive and engaging as possible. This means that NHS staff will have a variety of media options available to choose from to cater towards the needs of the students e.g., videos, quizzes, choose your own path etc. Nurses will be able to provide additional content in the e-learning package, maintaining a high level of interactivity and engagement for the end user.

1.2. Beneficiaries

Addressing the issue of delirium in PICUs is essential for the professional growth of NHS staff, and more specifically nurses within PICUs. It can enhance their knowledge and skills, leading to better career prospects and improved job performance; This, in turn, can boost their morale and motivation. In addition to qualified NHS nurses, our proposed system aims to facilitate the transfer of skills and knowledge to student nurses.

It is crucial to advance the understanding of delirium in PICUs due to its impact on the cognitive and educational development of young children. Delirium symptoms can impede children's ability to learn and understand their environment during this critical developmental stage, which may exacerbate family tensions.

2. Use Case Scenarios

2.1. Nurse Auditing System Scenario

2.1.1. Scenario Introduction
Caroline [Appendix 4.1: User persona for Caroline] is a paediatric nurse working in Royal Belfast Hospital for Sick Children, she has been working there for 7 years and is currently based in the PICU. Caroline wants to input some information she has gathered on a patient regarding delirium into the auditing system. This is so the database of information grows and therefore more research can be carried out regarding delirium within PICUs.

2.1.2. Scenario Mechanisms
After gathering the necessary information from the patient, Caroline opens the Paediatric Group's website and logs into the auditing system using her mobile phone. Caroline then uses the data input feature to add the information she collected to the database, receiving a confirmation popup that then input was successful. Caroline can then move onto the next patient to continue giving care around the ICU.

2.2. Student Nurse E-Learning

2.2.1. Scenario Introduction
Susan [Appendix 4.2: User persona for Susan] is a student nurse, on her placement year, and is doing a rotation in the PICU. A key part of being a nurse in the PICU is understanding paediatric delirium, which Susan has extremely limited experience in. Susan has a goal of expanding her knowledge of this subject to help her with her studies and work.

2.2.2. Scenario Mechanisms
To learn more about this, Susan does an e-learning course on paediatric delirium which allows her to receives a certificate upon completion. This is used as proof that Susan has completed the course and can be put in her professional development portfolio.

2.3. General Public E-Learning

2.3.1. Scenario Introduction
Keith [Appendix 4.3: User persona for Keith] is a single parent of a daughter with health issues currently being cared for within the PICU in the Royal Belfast Hospital. He is very committed to his daughter's wellbeing and interested in learning about her illness. Keith wants to broaden his depth of knowledge on paediatric delirium. Keith wants to support his child to gain a level of confidence and peace of mind by understanding her delirium.

2.3.2. Scenario Mechanisms
An e-learning webpage will help Keith by giving him an introduction into the subject. Keith will log onto the webpage which will provide him with easy to digest topics and interactive learning schemes to make it as enjoyable and interesting as possible, allowing him to better understand the complexities of delirium and how it affects his daughter. Keith can access this e-learning at any time, from anywhere and continue from where he left off previously.
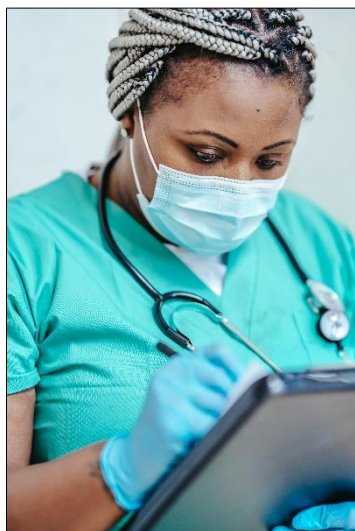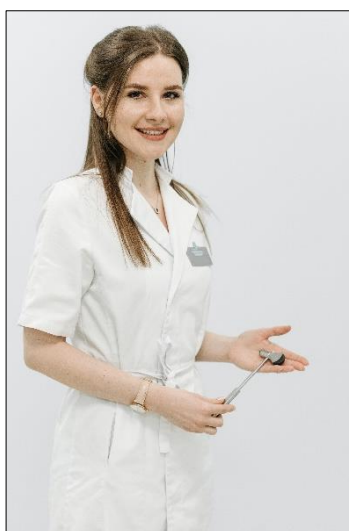

Figure 2: Caroline

Figure 3: Susan

Figure 4: Keith

3. Analysis

3.1 Problem Research

Delirium has been found to be a prevalent issue among critically ill children admitted to PICUs. There have been multiple studies that have concluded a high incidence of delirium in PICUs, with rates varying between 10% and 30%. These studies have discussed that the detection of delirium in paediatric patients can be challenging due to the lack of a standardised diagnosis method, for delirium in children, and the inconsistency of the condition. However, the **Cornell Assessment of Paediatric Delirium** (**CAPD**) [1] is a validated screening tool that has been used in multiple research programmes.

One such study that uses this diagnostic method is **Pediatric Delirium in Critically-Ill Children: An International Point Prevalence Study** [2]. This international study took place across 25 different paediatric critical care units, with research gathered over almost three years and studied all patients admitted to the paediatric critical care units on designated study days. The study found that among 835 patients, 25% were found to screen positive for delirium, 13% were classified as comatose, and 62% were neither delirious nor comatose. These rates of delirium varied significantly based on the reason for ICU admission, with the highest rates found in children admitted with infectious or inflammatory disorders. Furthermore, the prevalence of delirium increased to 38% in children who stayed in the PICU for 6 or more days.

3.2. Critical Problem Analysis

Delirium is a complex illness, which only recently started to be recognised and proper diagnostic consideration given. Due to the nature of the symptoms of delirium and how rapidly it can develop means it can be difficult to diagnose, especially in the younger generation. Already proposed strategies, such as the use of validated screening tools, increased management of medication and non-pharmacological interventions aim to address this issue. However, further research is a necessity to help identify the most effective methods of diagnosis, prevention, and management of delirium in critically ill children across the UK.

The advancement of knowledge regarding delirium in PICUs and a reduction in the time to diagnosis is extremely important when considering the profound impact that this condition can have on the cognitive and educational development of young children. During this formative stage of life, children are highly receptive to new information and experiences and therefore, learn so much in everyday life outside of formal education, delirium's symptoms can impede their ability to learn and understand the world around them, potentially compromising their long-term academic and personal development.

Furthermore, addressing the issue of delirium in PICUs is important for the professional development of nurses and other NHS (National Health Service) staff; By increasing the understanding and proficiency of delirium from within the NHS, healthcare workers can advance their careers, expand their knowledge, and become even more effective in their roles.

3.3. Project Aim

The diagnosis and treatment of delirium remains an under-researched area in paediatric critical care medicine. The aim of this project is to provide a software system that will support a nationwide clinical trial on delirium in PICUs within the National Health Service (NHS). The trial is conducted by the School of Nursing at Queen's University Belfast (QUB). Our system will assist the clinical trial by not only providing a platform for the data collected, to be recorded, stored, and visualised but also to educate parents and nurses through an engaging e-learning package on the subject of delirium.

3.4. Proposed System Solution

There is a pre-existing system; however, the implementation has several limitations. The system is a static website that contains basic information on delirium in the paediatric ICUs, some educational materials that are limited to text and links to external resources. The pre-existing system does include an audit feature, allowing users to submit patient data but the process is drawn-out and involves having to download an excel file, input data and then re-upload this file.

Our proposed system aims to mitigate these issues by creating an improved workflow and more user-friendly platform for submitting audit data and furthermore the ability to share and view this information through the portal in a way that is easy to absorb. Another target is to improve the accessibility and interactivity of the educational materials available; The overarching goal is to create a system that is more intuitive and easier to use, while also providing more in-depth and engaging educational materials.

4. Specifications

4.1. High-Level System Requirements

Table 1, briefly, the key requirements that the systems (both the audit system and the e-learning system) should meet and which should be kept in mind when choosing the technology and designing the architecture of the system. This is not an exhaustive list of all requirements, only those most pertinent to the current report. A draft list of requirements, and how they should be validated can be viewed in the appendices [Appendix A.5: Draft of user requirements]

Table 1: Key Requirements

Functional Requirements	Non-Functional Requirements
FR1: The system will allow users to have accounts, in which they can log into the system	**NFR1**: The system should be able to support 120 concurrent users
FR2: The system will keep track of the user's place within the e-learning course	**NFR2**: The system should display PICU data as interactive graphs and charts, such as bar charts
FR3: The system will be available on major types of devices, such as smartphones, tablets, and PCs through the chrome web browser	**NFR3**: The system should include accessibility features to improve the user experience for the public, such as support for screen readers and a high contrast mode

4.2 Technical choices

Table 2 lists the required technology choices to achieve the key objectives. Additional technologies, that are not a necessity to achieve the requirements above but would assist in achieving these [Appendix A.1: Description of additional technologies choices].

Table 2: Technology Choices

| Tech Choice	Reason	Alternative
React	These two frameworks are both popular and used widely within the industry and have a large library of third-party tools which add to the features offered by both. Angular is considered to be a difficult framework for beginners to learn due to its complexity [3] and the fact that TypeScript is a requirement. This should not be a large problem as TypeScript will be used within the system regardless of the chosen framework [Appendix A.1.1.: A description of why we are using TypeScript]. An advantage of using Angular is that the current e-learning solution uses Angular and therefore we may be able to reuse/expand on the work that was completed. On the other hand, React is a desirable choice for this system as it is intended for mobile devices [4] which meets the requirement FR3. Another advantage towards React is the fact that it has a component-based architecture demonstrating that it is easier to learn [5] than Angular, and the use of a virtual DOM allows the process of reloading to be quick [6].	Angular
Node.js	One key reason why Node.js was chosen was because it allows both front-end and back-end work to be carried out all in one language. This allows for a lesser learning curve, which increases maintainability as new developers do not need to learn the intricacies of another language. This is even considering the new concepts that Node.js introduces. Although, in general, python is considered to be less difficult to learn, the fact that we will need to learn JavaScript in depth for the frontend negates this benefit. Another advantage of Node.js is the asynchronous nature of the technology [6], which will aid development as it will assist in handling calls to APIs and to the database. With the use of promises, managing these calls, without halting the execution of the program is made easier than using the 'async' library in Django.	Django
D3.js	Although Google Charts is currently being used in the existing audit system, it does not have the same support and freedom which D3.js provides. Google Charts is limited to the amount of data which can be passed to it, although it may not be a problem now, looking to the future this could be an issue. Another limitation of Google Charts is the relatively few options of the visualisations which it offers over D3.js. A main drawback with this choice is the added complexity which D3.js brings over Google Charts, although we believe this is an acceptable trade-off for the added flexibility which D3.js provides.	Google Charts
PostgreSQL	PostgreSQL was chosen over MySQL due to the flexibility of choosing either a relational database or a non-relational database while using the same technology. As PostgreSQL supports MVCC (Multi-version Concurrency Control) and therefore serves several clients simultaneously [7], providing better support for concurrent users. This is a disadvantage of MySQL, which does not support MVCC, as one of the requirements of the system is that multiple users will need to use the system at the same time.	MySQL

5. Roadmap

The following section shows a Gantt Chart depicting all steps we will take including: the project goals, milestones, sprints, and work plan for the next 2 semesters.

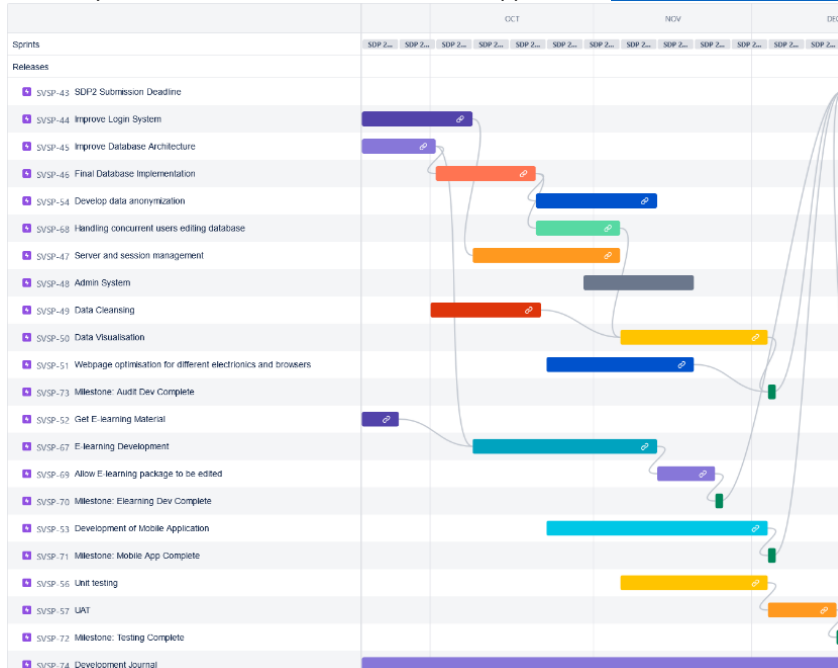## 5.1 CSC3068 - Monthly Gantt Chart (18th Feb – 25th April)

A weekly view of this can be found within the appendices [Appendix A.2.2: A weekly view of the module the CSC3086]
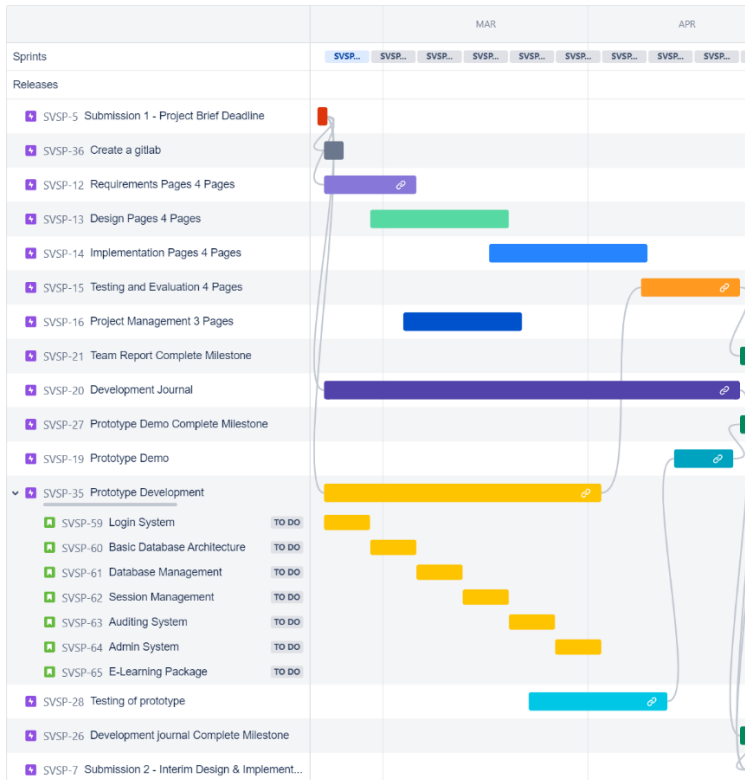
5.2 CSC3069 - Monthly Gantt Chart (18th Sep – 18th December Following Module)

A weekly view of this can be found within the appendices [Appendix A.2.2: A weekly view of the module the CSC3069]

6. Sprint Plan

6.1. Summary of Sprint

For our CSC3068 Submission 2, we plan to create a basic implementation prototype, by designing a multi-tier client-server solution. The first thing we plan to do is create a database system to be used by the PICU nurses. They will use the website to input data into the database as they gather patient information from a mobile device or a desktop computer. The system will then perform the calculations on the data and display this for the nurses to view. We will test this using the data provided by the Paediatric Delirium Group.

We will then develop a tool to visualise the information from the database and show it on the website in a simple format for easy digestion. This will allow the nurses or admins to quickly see how the collection of data is going and will allow them to conduct further analysis. We plan to test this using simple graphs and charts for the prototype. Simultaneously, we will also look to modernise the security of the system and change the code used from PHP to Node.js. This includes updating the login system with the ability to change passwords if a nurse or admin forgets theirs and we will test this by creating an account and changing the password.

We plan to work on feature implementation collaboratively, this should allow us to support each other more effectively as well as allowing features to be 'completed' faster is a target of an agile working environment. The documentation side of our work will be divided up and assigned to individual subject matter experts (SMEs) for that feature, the documentation will be dynamically assigned as development proceeds.

We have laid out our plans for Submission 2 in a Critical Path Analysis diagram shown here [Appendix A.3: Diagram of Critical Path Analysis]

6.2. Risk of Features

Table 3: Risk of Features

Feature	Description	Risks	Mitigation
Database solution	Create a database which will connect to the system, allowing for the PICUs to perform calculations on this data and compare it with other PICUs involved.	One aspect that we cannot control is the internet connection the user will have to our system. There is the risk of those without the proper access, looking at and editing data in the database. There is also the risk of two people entering data at the same time which can lead to errors, or no data being entered at all.	We must make it, so the database is only available for those who require it for data entry and review. This would, perhaps, require a role base access control (RBAC) system to be implemented. There must also be a concurrency control system in place to prevent two people committing data at the same time and causing errors. This would lock entry to make changes while someone is in the middle of entering/editing data.
Simple Visualisation	Create simple visualisations for the data stored in the database and display them on the website	The data used in these visualisations must be anonymised to prevent releasing confidential data.	The system will produce random placeholder values for the names of the other sites each time, this is required
User Login Modernisation	Update the current login page and system from storing passwords as plain text to a version which will include more secure methods, used around the internet e.g., Hashing and SSO	We must have secure storage for hashed passwords and never store them as plain text. There is also the chance that someone forgets their password and cannot login.	We will have a separate database sheet which stores the login data (usernames and hashed passwords) which will be inaccessible to the average user. We will also need to create a way to change passwords through a "Forgot my password" option.

Appendix

A.1 Additional Technology Choices

Below, are additional technology choices which are not specifically required to achieve the requirements but will assist in achieving these and aid development.

A.1.1 TypeScript

Due to the members of the team having more experience with statically typed languages, using TypeScript should allow for a lesser learning curve. As TypeScript is a superset of JavaScript all valid JavaScript is also valid TypeScript therefore further reducing the learning curve.

Typescript allows for more advanced IntelliSense to be used, speeding up development as common mistakes, such as accessing an attribute of an object that does not exist, may occur less often as the IDE will warn the developer as they are typing, rather than at compile time.

As the system will be in place after the development team has left, this allows for better maintainability as people who are not familiar with the system can more easily view the return type of functions, the data types of variables and the methods/attributes of objects.

A.1.2 OAuth

As OAuth2 supports SSO this elevates some of the responsibility of security and 'out-sources' this to more well-funded and reputable organizations, such as Google, who have more resources dedicated to security. This will also be a benefit to our users as they do not need to remember another password for our system.

A.1.3 Message Broker

These are a type of software which sits in the middle between a sender and a receiver. There are two main reasons why a message broker may be used, one of which is to translate between messaging protocols, and to allow communication between the sender and receiver, when one is offline. These do not necessarily apply to this system as we only have access to a single server, if this server is offline for a time, both the message broker and the service would be offline at the same time. For the second point, as there are going to be relatively few services, compared to enterprise grade software, a single messaging protocol can be used to communicate with these services. Message brokers are also used to allow for asynchronous calls but as stated in the main body of the report Node.js supports this regardless and negates this benefit. Therefore, within the scope of this project, it may not be useful to incorporate one of these as it may increase the complexity of the system for little gain.

A counterpoint to the above is that when designing systems, it is important to consider that it may grow and therefore having a system agnostic of messaging protocols may be beneficial. Message brokers also allow a message queue to be implemented which could be a novel way to handle the issue of concurrent users, although as mentioned within the main body of the report PostgreSQL supports concurrent users with MVCC.
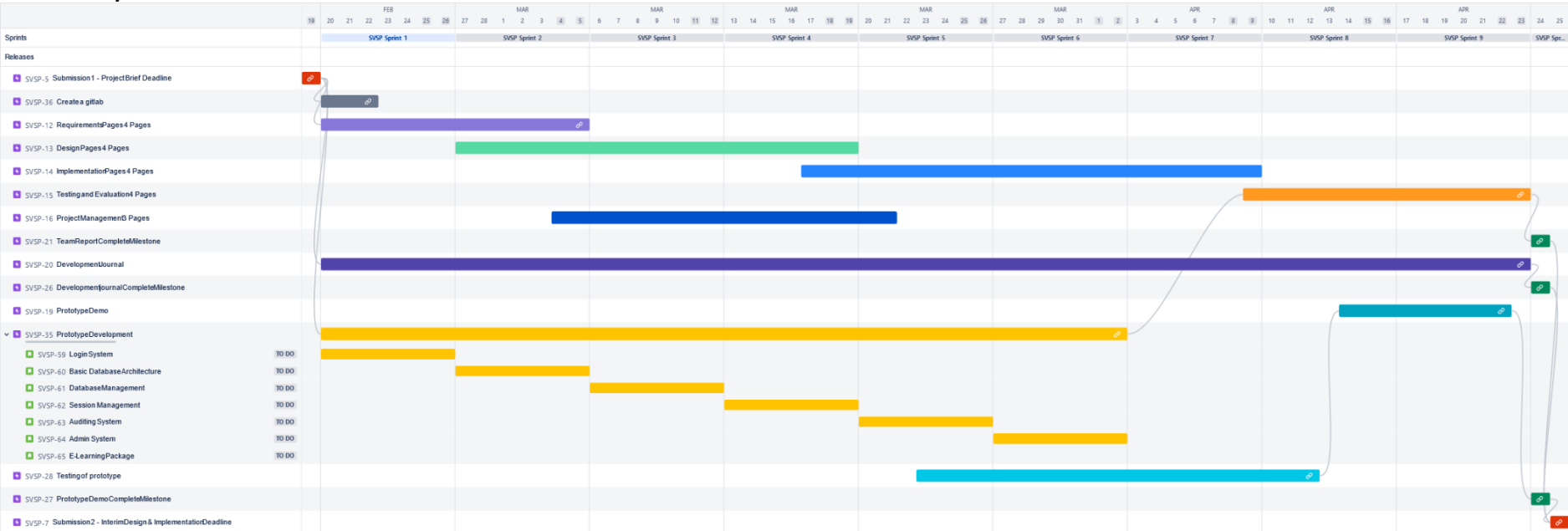
There are two possible message broker systems, Apache ActiveMQ and RabbitMQ. These are both remarkably similar systems, but Apache ActiveMQ would be the preferred option as it has support for the STOMP protocol and supports more architectural models.
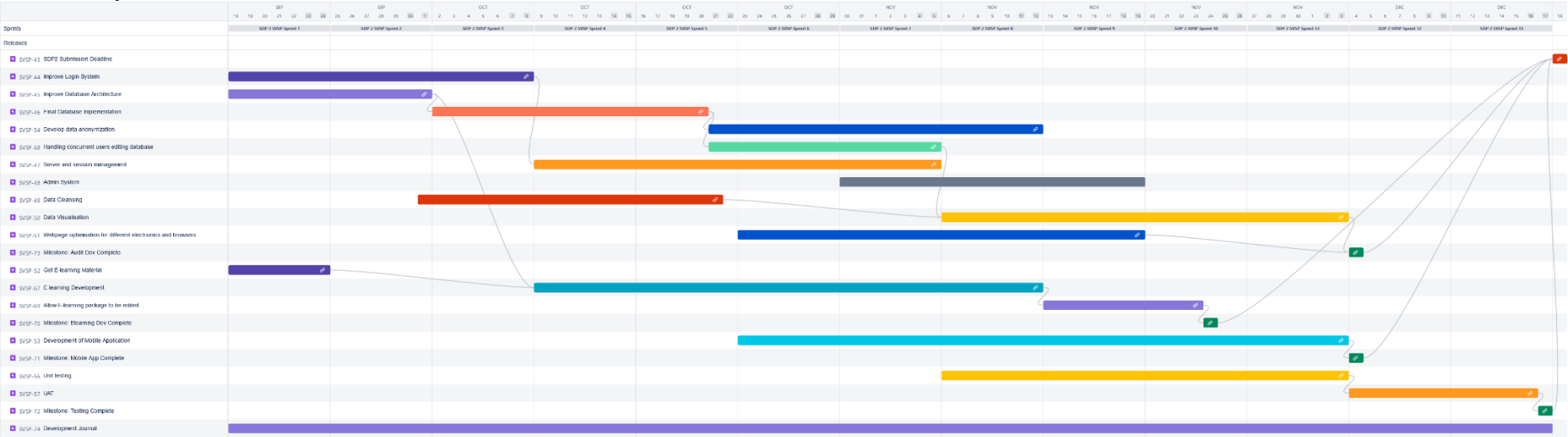
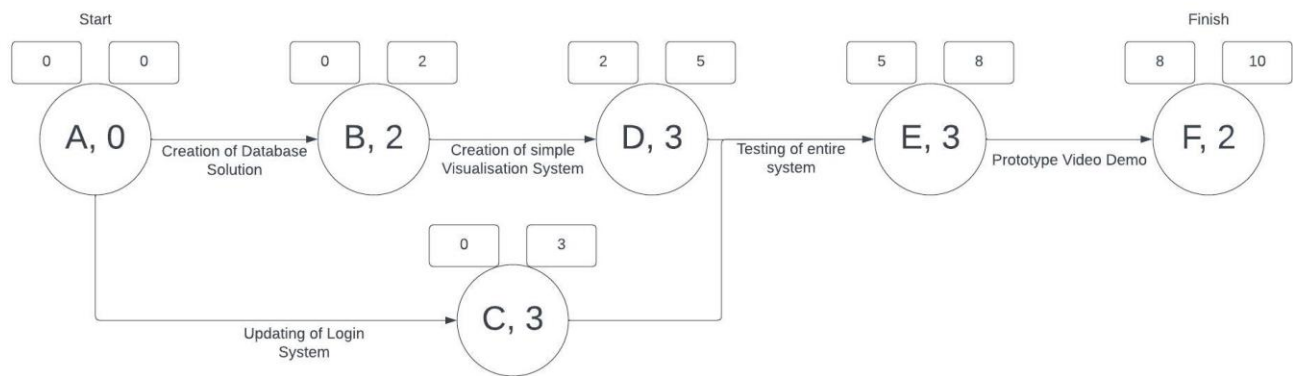## A.2 Monthly Gantt Chart View

A.2.1 Whole Monthly View of Project
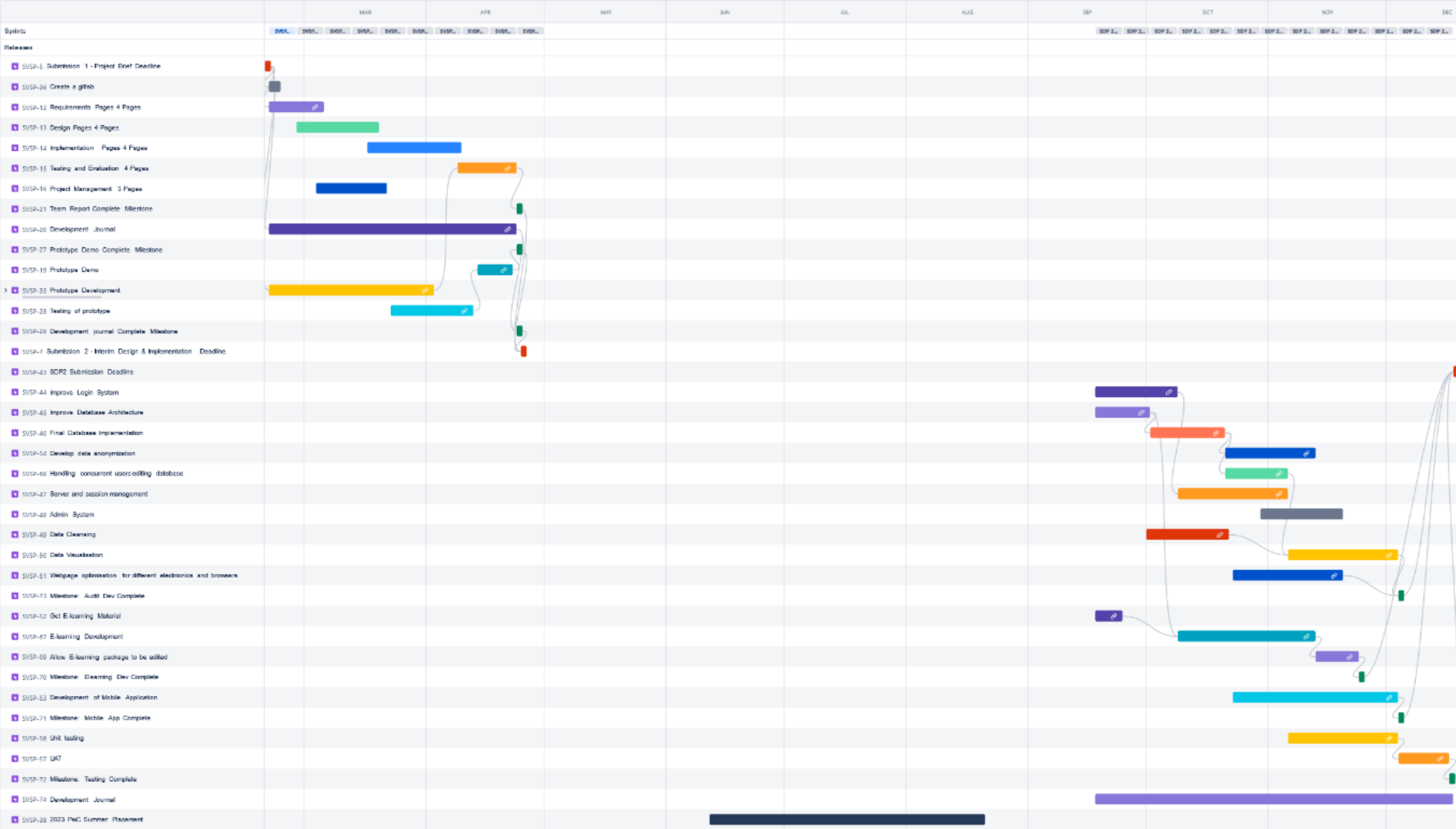
A.2.2 Weekly View of CSC3068

A.2.3 Weekly View of CSC3069

A.3 Critical Path Analysis

A.4 User Stories

A.4.1 Caroline Johnson

Job Description - Paediatric Nurse

Paediatric Nursing is a specialist form of nursing that primarily focus on providing care for children and young people with health problems. Children's nurses provide comfort and reassurance to patients and their parents or carers in difficult or stressful circumstances.

Caroline Johnson

Demographic

Age	36
Location	Belfast
Occupation	Paediatric Nurse
Family	Married with kids

Skills

Healthcare Knowledge

IT Skills

Time Management

Emotional intelligence

Frustrations

- Use of antiquated software can be annoying
- Use of too many applications and software can be confusing
- Dealing with mulitple patients constantly leads to a stressful time at work
- Not enough time in the day to learn how to use new software

Bio

- Graduated from Queen's Univesity Belfast with a Bachelor's degree in nursing
- Has 13 years healthcare experience
- Works within the Royal Belfast Hospital
- Has been working within the Royal for 7 years and has had prior work experience helping children
- Has 2 children under 10 years old
- Big fan of the Belfast Giant's

Goals

- Caroline is passionate with her work and wants to care and help as many children as possible
- Caroline wants to help children's families understand their childs issues and support them through the care process
- Caroline is aiming for promotion within the next 3 years
- To gain a certificate for proof of continued professional development

Motivation

- Aims to send both her children into higher education
- First person in her family to graduate from university
- Enjoys pushing herself into tricky situations.
- She believes her work is very rewarding and enjoys working with children

11

A.4.2 Susan Doherty

Susan Doherty

Demographic

Age	21
Location	Magherafelt
Occupation	Student
Family	has a girlfriend

Job Description - Student Nurse

Susan is a junior Nurse working on her placement year within the Royal Hospital. She is deciding what speciality she want's to work in and is enjoying paediatric nursing. Her job entails caring and helping people under the supervision and guidance of senior nursing staff.

Skills

Healthcare Knowledge

IT Skills

Time Management

Emotional Intelligence

Frustrations

- Struggles explaining in-depth medical terminology to people.
- Struggles to find time between studies and placement to expand her knowledge outside of her current learning experiences.
- Finds it overwhelming working within healthcare for the first time.

Bio

- Is currenlty a student at Ulster University
- Aims to graduate next year.
- Very little practical experience within the nursing field.
- Susan's mother was a nurse.
- Harry Potter Superfan.
- Grew up helping to care for her younger brother.

Goals

- To gain experience in the workplace.
- To assist in clinic trials, to gain more out of her placement.
- Gain a certificate for proof of continued professional development
- Possibly gain a full time position within a hospital in Belfast.
- Wants to become a specialist nurse working with children full time.

Motivation

- To learn about the world of medicine.
- Loves to help children.
- Enjoys studying and academic side of nursing.
- Wants to propel her career in the right direction and develop the necessary skills to have a permenant job within nursing for her future.

A.4.3 Keith Donaldson

Keith Donaldson

Demographic

Age	33
Location	Belfast
Occupation	Joiner
Family	Single Father

Job Description - Joiner

Keith's job consists of early mornings and later evenings, managing his own business means Keith is constantly busy. The nature of Keiths' jobs revolve mainly around general joinery tasks, laying floors and hanging doors; However he is not afraid doing the other odd jobs that need completed.

Skills

Healthcare Knowledge

IT Skills

Time Management

Emotional intelligence

Frustrations

- Wants to spend more time with his child but feels that his work can restrict this.
- Keith has limitted time and has to juggle his time to prioritise his day.
- Offer gets irritated by other tradesmen when working on a job together because they can slow down his work

Bio

- Considers himself a jack of all trades but most of his work revolves around joinery
- Has a daughter called Aimee with severe health issues and is currently being treated in ICU.
- Acheived his Level 3 NVQ joinery qualification from Belfast MET in his early 20's
- Started his career as an apprentice and developed into creating and managing his own business in Belfast
- Has a good relationship with his child's mother
- Likes a sausage bap for breakfast.

Goals

- Gain peace of mind knowing his daughter is being treated with care.
- To provide a safe and stable home for his child
- To ensure his daughter recieves a good education and grows up happy and healthly
- Facilitate a healthy relationship between his child and her mother.

Motivation

- Interested in his child's wellbeing and want's to increase his depth of knowledge on the subject
- Ensure his child is safe and cared for.
- By understanding the nature of his daughter's condition it will help to create a stronger relationship with her.

A.5 Draft Requirements

These are a set of draft requirements which are to provide more context to the key requirements, that are stated within the main body of the report.

Requirement Number	Requirement Type	System	Category	Description	Dependencies	Fit Criterion
FR1	Functional	Audit + E-learning	Login	Allow users to have accounts, in which they can log into the system		For a user to be able to create an account, login when a correct username and password is provided and reject a user which provides an incorrect username and password
FR2	Functional	E-learning	Content	Keep track of the user's place within the e-learning course		For the user to resume their previous place within the course
FR3	Functional	Audit + E-learning	GUI	Be available on major types of devices, such as smartphones, tablets and PCs through the chrome web browser		For the system to be displayed in an appropriate way on all devices
NFR1	Non-Functional	Audit	Scalability	Be able to support 120 concurrent users		The system should be able to handle when 120 users attempt to update the same data, at approximately the same time
NFR2	Non-Functional	Audit	Visualisation	Display PICU data as interactive graphs and charts, such as bar charts		For the data, within the database, to be displayed accurately on a variety of charts and graphs
NFR3	Non-Functional	Audit + E-learning	Accessibility	Include accessibility features to improve the user experience for the public, such as support for screen readers and a high contrast mode	FR15, NFR4, NFR10, NFR12	For the system to contain accessibility features, allowing those with disabilities not to be disadvantaged when using the system
FR4	Functional	Audit + E-learning	Login	Allow SSO for users with Google, Facebook and Microsoft accounts		The user being able to log into the system using one of their accounts with another service
FR5	Functional	Audit + E-learning	Login	Reset a forgotten password		If a user can reset their password, with checks in place to ensure that the individual who is associated with the account is resetting the password
FR6	Functional	Audit	Security	Anonymise the site which data comes from when another site is comparing data		For a user to not be able to identify which site the data is related to
NFR4	Non-Functional	Audit + E-learning	Accessibility	Have a high contrast mode to assist visually impaired individuals		For the high contrast mode to assist visually impaired individuals
NFR5	Non-Functional	Audit + E-learning	GUI	Contain the PDGUKI branding	NFR6, NFR7	If the branding of this site matches that of the other sites hosted by PDGUKI
NFR6	Non-Functional	Audit + E-learning	GUI	Use the colour #009999 as the primary colour of the website		For the colour #009999 to be used within the site
NFR7	Non-Functional	Audit + E-learning	GUI	To use the PDGUKI logo within the website		The logo to be placed in an appropriate position and for it to be identifiable
NFR8	Non-Functional	Audit + E-learning	Security	The passwords should be hashed when stored to ensure security		If the passwords are hashed when stored within the database
FR7	Functional	Audit + E-learning	Login	Need to be linked to the current QUB hosted site		A hyperlink to be included in the current site that points to this system

NFR9	Non-Functional	E-learning	Content	Content should be broken up into logical 'chapters'		For the content to be broken up into chapters which then can be navigated through
FR8	Functional	Audit + E-learning	Login	Store a user's name, email, profession, and geographic location (country level)		For the relevant information to be permanently stored on the system
NFR10	Non-Functional	E-learning	Accessibility	Contain information to assist screen readers		For a screen reader to 'read' all of the information on the system
NFR11	Non-Functional	Audit + E-learning	Security	Passwords should be 8 characters long, contain at least one number, letter, special character, upper case character and lower-case character		A user should not be able to create a password which does not fit the requirements
FR9	Functional	Audit	Content	Process the required calculations based on the audit data		Certain calculations will be applied to the audit data and the results of these will be stored
FR10	Functional	Audit	Login	Each PICU must have their own login		For a PICU to have an account, which allows a user to log into
FR11	Functional	Audit	Logging	Activity on the audit system must be logged	FR12, FR13, FR14	What happens on the system should be stored for a period
FR12	Functional	Audit	Logging	The time, date, where and who viewed certain data and visualisations must be stored		This data should be stored for a defined period
FR13	Functional	Audit	Logging	The time, date, where, what and who updated data must be stored		This data should be stored for a defined period
FR14	Functional	Audit	Logging	The time, date, where, what and who added data must be stored		This data should be stored for defined period
FR15	Functional	E-learning	Accessibility	Transcription of videos must be available to users		A document which contains the transcript of any videos hosted on the system
NFR12	Non-Functional	Audit + E-learning	Accessibility	Alternative text, for both images and graphs, should be provided for users		For all images and graphs to contain alternative text
NFR13	Non-Functional	Audit + E-learning	GUI	Consistency of design across systems		For both systems to use the same design template
FR16	Functional	E-learning	Content	Non-technical staff must be able to add new content		For the content on the site to be available to add to, in a noncomplex way
FR17	Functional	E-learning	Content	Non-technical staff must be able to edit existing content		For the content on the site to be available to edit, in a noncomplex way
FR18	Functional	E-learning	Content	On completion of the course a certificate will be provided to the user		A pdf document containing the full name of the user will be provided to them upon completion of the course

A.6 References

[1] Traube C, Silver G, Kearney J, Patel A, Atkinson TM, Yoon MJ, Halpert S, Augenstein J, Sickles LE, Li C, Greenwald B. Cornell Assessment of Pediatric Delirium: a valid, rapid, observational tool for screening delirium in the PICU*. Crit Care Med. 2014 Mar;42(3):656-63. doi: 10.1097/CCM.0b013e3182a66b76. PMID: 24145848; PMCID: PMC5527829.

[2] Traube C, Silver G, Reeder RW, Doyle H, Hegel E, Wolfe HA, Schneller C, Chung MG, Dervan LA, DiGennaro JL, Buttram SD, Kudchadkar SR, Madden K, Hartman ME, deAlmeida ML, Walson K, Ista E, Baarslag MA, Salonia R, Beca J, Long D, Kawai Y, Cheifetz IM, Gelvez J, Truemper EJ, Smith RL, Peters ME, O'Meara AM, Murphy S, Bokhary A, Greenwald BM, Bell MJ. Delirium in Critically Ill Children: An International Point Prevalence Study. Crit Care Med. 2017 Apr;45(4):584-590. doi: 10.1097/CCM.0000000000002250. PMID: 28079605; PMCID: PMC5350030.

[3] S. Delcev and D. Draskovic, "Modern JavaScript frameworks: A Survey Study," 2018 Zooming Innovation in Consumer Technologies Conference (ZINC), Novi Sad, Serbia, 2018, pp. 106-109, doi: 10.1109/ZINC.2018.8448444.

[4] C. M. Novac, O. C. Novac, R. M. Sferle, M. I. Gordan, G. BUJDOSó and C. M. Dindelegan, "Comparative study of some applications made in the Vue.js and React.js frameworks," 2021 16th International Conference on Engineering of Modern Electric Systems (EMES), Oradea, Romania, 2021, pp. 1-4, doi: 10.1109/EMES52337.2021.9484149.

[5] T. Kaushalya and I. Perera, "Framework to Migrate AngularJS Based Legacy Web Application to React Component Architecture," 2021 Moratuwa Engineering Research Conference (MERCon), Moratuwa, Sri Lanka, 2021, pp. 693-698, doi: 10.1109/MERCon52712.2021.9525659.

[6] K. Saundariya, M. Abirami, K. R. Senthil, D. Prabakaran, B. Srimathi and G. Nagarajan, "Webapp Service for Booking Handyman Using Mongodb, Express JS, React JS, Node JS," 2021 3rd International Conference on Signal Processing and Communication (ICPSC), Coimbatore, India, 2021, pp. 180-183, doi: 10.1109/ICSPC51351.2021.9451783.

[7] I. S. Vershinin and A. R. Mustafina, "Performance Analysis of PostgreSQL, MySQL, Microsoft SQL Server Systems Based on TPC-H Tests," 2021 International Russian Automation Conference (RusAutoCon), Sochi, Russian Federation, 2021, pp. 683-687, doi: 10.1109/RusAutoCon52004.2021.9537400.