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**Title: A Care Management System**

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Michelle Loughran

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* My dad, family and friends who assisted with descriptions of their experience of domiciliary elderly care and the requirements they perceived an application would need whilst they continued to meet family and work requirements and elderly care needs.

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# Abstract

Enable Care is a family-run partnership which delivers domiciliary care in counties Down, Armagh, Tyrone, and Fermanagh. It does not use software to record carer visits, dates, times, or events other than paper-based carer reporting.

Enable Care realised that due to current technology trends, increasingly families are using technology to check family members; they too needed to update their systems and offer families more information on their family member's care needs and health status, and gather more data concerning client care, needs, issues and expectations as inspectorate requirements developed (RQIA 2022). Gather data about carer development and performance to aid planning.

Carers found the writing up of the client visit was the most time-consuming part of each visit, and they needed something more time effective. They required a detailed list of tasks at each appointment and a way to mark each task as completed. Frequently there were issues with ‘the book’. At times, the carer may not complete the details of a visit due to reasons such as a family member moving or misplacing the necessary 'book', or not having enough time to fill in the events of each visit. As a result, the carer may have to return later or seek assistance from another carer or manager to complete the events on their behalf.

This project aims to resolve any concerns and establish a safe web-based API solution that incorporates care plans, a system for marking each care task as finished, and a method for addressing problems that require the manager's attention. This will diminish the time spent documenting visit specifics, freeing up more time to address the patient's or client's needs.

This dissertation comprehensively covers all aspects, including the problem statement, user requirements, proposed solution, web API design, and testing process. It concludes with a thorough report on the success or shortcomings of the solution and a concise summary of proposed future developments.

# Introduction

## Enable Care Background

Enable Care, the customer stakeholder is overseeing the project. Enable Care provides domiciliary care services to both public and private sectors in counties Tyrone, Armagh, Down and Fermanagh (“Enable Care Services – Enabling Independence at Home”). Enable Care is a family-run partnership organisation that understands the importance of family and the challenges involved in choosing care. They collaborate with Social Workers, Occupational Therapists, Speech and Language Therapists, General Practitioners, District Nurses, and service-user families to develop a comprehensive care plan that focuses on the person's needs.

The stakeholders’ managers collaborate with the client-appointed Social Worker to develop a comprehensive Care Plan that considers the client's capabilities, medication requirements, mobility issues, and mental capacity (European Union, 2007).

## The Problem

The stakeholder relies solely on a paper-based record-keeping system to document client and carer interactions. This approach is troublesome, particularly given the use of financial software and Microsoft products in other business areas. The stakeholder perceives a need to invest in a more advanced software system capable of accurately and efficiently recording all interactions to ensure clients' highest level of care. Such an investment would provide the foundation to support delivering exceptional client care.

The stakeholder presently employs postal mail merges with clients to request feedback regarding the quality of their services. Alternatively, they may receive phone calls from clients or their family members. This approach means that any information gathered is typically received after the fact and only when a family member has sought contact due to a missed call or medication.

Using a paper-based system can give rise to a critical issue regarding continuity of care (Pereira Gray et al., 2022). In vulnerable populations, continuity of care is vital, as many individuals have pressing medical needs that necessitate prompt attention. Inaccuracies in the existing manual system can potentially lead to fatalities, as previously highlighted (Pereira Gray et al., 2022).

Digital record keeping has the potential to significantly benefit the care industry by saving time, resources, and money while minimising risks such as medication errors, dehydration, and missed appointments (NHS England, 2023). Implementing digital records can improve communication between healthcare professionals, service users, and caregivers. Data availability can significantly boost the confidence of both caregivers and clients/patients in the care being delivered and received. It fosters a sense of connectedness to the information and data, thereby ensuring the administration of proper care. Applying digital record-keeping in domiciliary care can bring numerous advantages, including improved efficiency, enhanced communication, better quality of care, increased security, improved patient outcomes, and remote access (NHS England, 2023).

## The Proposed Solution

The developer, a family member of a client of the stakeholder, possesses first-hand experience with the agency and the management of client/patient needs. It is common for family members to receive complaints from clients regarding their inability to complete certain tasks or the inadequate implementation of specific aspects of their care plan.

The interactions between patients and carers are recorded in a booklet, which includes details about medication and specific tasks undertaken by the carers. A digital system would be more suitable as it would reduce the likelihood of loss or damage. Thus, the stakeholder requires a digital platform to replace the booklet and facilitate medication management, patient/client conditions, and carer tasks and delivery. Additionally, the platform would enable family members to access and review client care. At the same time, managers could add to the database of carers and monitor care delivery, rota development, and care planning.

Current problems that exist using the paper-based system include:

* Missed appointments.
* Delayed or missed medication treatment.
* Confusion and errors with care delivery

As the clients/patients have many medical conditions, any missed appointments or confusion concerning care delivery affects the client/patient.

Keeping family members informed about their loved one's care is vital. Studies show that family members may feel left out of the process; they must be updated on the patient's condition and treatment. By maintaining open communication and ensuring everyone involved is informed, we can provide the best possible care for the patient and support their loved ones during this challenging time (Home et al., 2021). This would offer an insight into loved ones’ care to family members who lived far away. It would also present a patient care record to the manager when discussing the client/patient with family members face to face or in a phone call.

The project aims to design a Model View Controller (MVC) secure web-based portal, a tool that carers, managers, social workers, and family members could utilise to address the issues encountered with a paper-based system.

Such a system could enhance person-centred care and improve information sharing between care staff, social care professionals and family members. This system could ensure that records are secure, improve efficiency, enhance communication, improve patient/client outcomes, and deliver remote access (CQC, 2023).

The solution proposed enables a carer to easily access and view scheduled appointments with clients/patients through the online portal via their mobile device. Once logged in, they can see all relevant details about the patient, including their conditions and care plan for each visit. During their visit with the patient, they can mark off any completed tasks and bring up any concerns about their care. Keeping track of each carer's visit and addressing any issues raised during the visit with the patient can ensure that any problems are brought to the attention of the patient's care manager or family members. This way, they can take the necessary actions to provide the best care possible for the patient. Attention to detail and a proactive approach ensure that everyone involved is informed and updated on patient care developments.

The solution enables the care manager to access information about carers and patients through the online portal. The manager can review the details of every carer's visit and handle any concerns that may have been highlighted about the patient. As a care manager, you can manage all aspects of patient care. This includes overseeing carers, patients, ailments or conditions, rota planning, and reviewing patient care events and care plans. You also could update records and edit or remove records as needed. Using these tools, you can ensure that patients receive the best possible care and that carers perform their duties to the best of their abilities. Maintaining an accurate record of patient visits is a crucial aspect of caregiving. To this end, it is recommended that one takes the time to thoroughly review each visit and address any concerns that may have arisen during the interaction.

By adopting such a diligent approach, one can ensure that the patient's diverse needs are being met and that they receive optimal care. The key lies in being attentive, responsive, and compassionate towards the patient, always ensuring their comfort and well-being. With a little extra effort and attention to detail, caregivers can make a significant difference in the lives of their patients and their loved ones.

The requirements gathering and analysis phase established that a personalised software solution would simplify processes.

The solution enables Users to be added and assigned distinct roles when registered to gain access to the relevant parts of the program. The assigned roles are admin, carer, manager, and social worker. Throughout the implementation of the project, regular contact was maintained with the stakeholder to discuss the functions and features of the software.

The portal will be hosted on a secure web server through Microsoft Azure. This will ensure that the solution complies with the stakeholders' privacy policy, GDPR (UK Government, 2018), and data storage policy. The information within Azure is encrypted.

Microsoft has a strong focus on operational security. Microsoft employs a team of cybersecurity experts to consistently identify vulnerabilities and enhance operating security procedures to safeguard against potential external threats (Business, 2021). Securely accessing Azure via an encrypted VPN is possible with ExpressRoute, regardless of one's location. It provides a strong security framework that encompasses physical, infrastructure, and operational security, as per Azure's documentation.

After several meetings with the stakeholder, the project's functional and non-functional requirements were established. To meet these requirements, the system's details were thought through and implemented through careful business case analysis and product design. The application was created using Visual Studio Code using C# programming language, with the .Net Core framework for Model View Controller (MVC) projects. at every stage of the process, the system was tested to ensure that appropriate validations were in place and feedback from the stakeholder was incorporated where necessary. It was important to consider all perspectives and adjust to ensure the best possible outcome.

## Dissertation Outline

* + 1. **Analysis**

This chapter provides a detailed account of endeavours to find the best solution to address the problem. How various software options on the market were researched and carefully considered concerning the platform most appropriate for the stakeholder needs. Effective techniques were employed via interviews and questionnaires to gather all the requirements for the system, both functional and non-functional. The approach was comprehensive and aimed at ensuring the solution was optimal in achieving the required outcomes. Potential risks and ethical concerns are discussed as part of the project planning. The final product must be both innovative and safe for users. A plan of action includes regular testing and monitoring of the portal and implementing security measures to protect user and client data. The objective is to create a portal that meets industry standards and upholds ethical principles.

* + 1. **Design**

This chapter investigates the user interface design and the software architecture. It illustrates ideas, including wireframes demonstrating the site's layout. Additionally, how key features such as pop-ups and breadcrumbs enhance the user experience.

Diagrams and models explore user interaction with the application. In terms of the system architecture, a key element is the user interface. This is the point of interaction between the user and the system, and it should be designed with the user experience in mind. Other key elements include the database, which is explained using an entity relationship diagram. UML diagrams are provided, illustrating the main classes and the purpose of each.

* + 1. **Testing and Evaluation**

This chapter will examine the methodology behind testing and the respective tests utilised: unit, system, and user tests. It is important to thoroughly test the system to ensure it functions correctly and meets the users' needs and stakeholder requirements. Combining these tests ensures that all aspects of the system are working together seamlessly and providing a positive user experience.

The system’s success depends on its ability to meet the needs and requirements of its users. An assessment that compares its performance to its requirements must be conducted to determine the system's value. Doing so ensures the system provides functionality and usability for its intended audience.

* + 1. **Conclusion**

The project underwent a critical assessment after its completion, and the conclusions were summarised in this chapter. Valuable feedback was gathered from stakeholders, and the project's success was evaluated. The assessment led to the discovery of some valuable lessons, and ideas for future portal expansion were discussed. This chapter combines the project's qualities and sets the stage for its future success.

Figure : A Model showing the relationships between the portal, staff, family, and patients.

# Analysis

This chapter discusses the stages to ascertain the appropriate solution for the problem faced by the stakeholder. It included conducting background research, gathering requirements, defining them, identifying potential solutions, and defining the proposed solution with the associated business case. The objective was to ensure that the proposed solution met all the requirements and provided the intended audience with the best possible functionality and usability.

## Requirements Gathering

## Requirements Gathering

## Identification of Stakeholders

## Elicitation

## Interviews

## Functional Requirements

## Non-Functional Requirements

## User Stories

## Background

## Table 1: List of User Stories

## Non-functional requirements

## Table 2: Non-functional Requirements

## Potential Software Solutions

## Existing Software

## Table 3: Relevant Features Offered By Existing Software.

## Bespoke Software

## Development Of A Mobile App

## Development Of Web-App

## Conclusion

## Business Case

## Benefits of the Portal

## Costs of the Portal

## Table 4: Table Of Risks And Mitigations

## Ethical Considerations

## Project management

**Figure 3:** Gantt chart showing proposed project milestones.

The investigation of the problem and its potential solution will have led to the identification of a set of clearly defined system requirements (functional and non-functional), which should be presented using whatever descriptive techniques are appropriate for the type of system and type of requirements involved. For example, functional requirements might be documented primarily as user stories or optionally use cases.

The chapter should also give consideration to:

1. The business case associated with the project (benefits and costs)
2. Potential project risks and risk management
3. Any ethical considerations
4. A project plan outlining how the project deliverables will be met.

Length: ~12 pages

# Design

## Introduction

## Design of the User Interface

## Website Design

## Wireframe Designs

## Logo

## Design Features

## Navbar

## Breadcrumbs

## Alerts

## Tooltips

## Data Validation

## Architectural Design

## Classes

## Database Design

## Entity Relationship Diagram

## Algorithm Design

Design covers the user interface, software architecture, data definitions, algorithms and other high-level descriptions of the system you have created. Ideally, a good system design document is one that can be passed to someone else to implement.

It is expected that during the design phase various options will have been considered before any final decision was taken. These options should be identified and the rationale for each decision presented.

You are encouraged to use descriptions and models suitable for your own circumstances. For example,

* In describing how the user will interact with your system you may want to present a block diagram identifying key parts of the user interface in addition to showing screen shots. If you considered Human Computer Interaction (HCI) / User Experience (UX) guidelines, you should explain how these influenced your design.
* You should provide an overall high-level system architecture diagram that highlights the key elements of the application and their interactions. For example, for a web application you could include components such as, database, web server, internet, browser etc. The web server could be broken down to highlight software layers such as UI, Business Logic, Data Models etc.
* If you are using a database, you will need to describe the design schema, including details of any normalisation involved. You may also want to include an entity-relationship diagram.
* Where appropriate you should provide a class design, identifying your main classes and indicating their purpose e.g., UML structural diagrams (class, component etc)
* For some processing it may be necessary to make use of complex algorithms, which should be described and illustrated appropriately e.g., UML behavioural diagrams (activity, sequence, state etc).

Length: ~12 pages

# Testing and Evaluation

## Introduction

## Unit Testing

## System Testing

## Cross-browser Functionality Testing

## Acceptance and Usability Testing

## Evaluation

## Functional Requirements

## Non-functional Requirements

## Summary

The content of the testing and evaluation chapter is largely self-explanatory.

Your approach to testing should be described, identifying the test cases that you have used to verify the correctness of the software. You should consider a range of forms of testing –that may be suitable for your project. For example, unit testing, integration testing and user testing. These should demonstrate that your testing has been appropriate and thorough.

You should demonstrate that you have employed suitable validation within your solution and in particular validating user inputs.

Under evaluation, you should assess the perceived value of your system to its intended users against the specified requirements. You are not expected to create a ‘perfect’ system however you should endeavour to provide a solution that satisfies the defined system requirements. Where this has not been possible, you should use this an opportunity to explain the issue raised and suggest improvements.

Note that when planning your project, sufficient time should be included after implementation for testing and evaluation as these activities have a significant impact on the final quality of your system and the write up in your dissertation.

Length: ~8 pages

# 5 Conclusions

In the final chapter you should summarise your project work overall and assess it critically. This should indicate what lessons you have learned and so clarify what you might do differently if faced with the same situation again. In particular, you should identify and discuss how the project plan evolved as the project progressed.

The limited time available for implementation means that you are likely to have ideas for further work. These should also be included in the conclusions.

The Conclusions chapter, like the Introduction, should be freestanding, allowing the reader to understand what the project has achieved without studying other chapters.

Length: ~4 pages

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# Appendices

The appendices are an opportunity to provide secondary material in support of the description in the body of the dissertation. In principle, the reader need not look at the appendices and no specific marks are awarded for this section.

Sample content:

## A1. Analysis Models

e.g., User stories

## A2. Design Models

e.g., database schema

## A3. Code

Code developed through the project.

## A4. Test Suite

Full set of tests applied to the software.

## A5. Questionnaire Results

Results of questionnaires used to evaluate the software and/or identify requirements.