Agile Development of a Patient Feedback System for Continuous Improvement of Neurology Clinic Services

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Article Info	ABSTRACT
Keywords: Patient Feedback System, Agile Methodology, Neurology Clinics.	This research addresses the problem of insufficiently adaptive and responsive patient feedback systems in neurology clinics, which can hinder service quality improvement. The methods employed include user needs analysis, application development using an agile approach, user acceptance evaluation, and continuous improvement based on feedback. The research findings indicate that implementing a responsive and integrative patient feedback system can enhance patient satisfaction, clinic process efficiency, and overall service quality. This research contributes to providing a framework that can be applied to develop effective and adaptive patient feedback systems in the context of healthcare services, with the potential to enhance patient experience and operational efficiency in neurology clinics.
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INTRODUCTION

In the context of complex neurology clinics, listening to patient voices through feedback systems becomes increasingly critical. Neurology clinics are responsible for providing meticulous medical care and ensuring that the patient experience is optimized. The problem statement in this research arises from the awareness of the challenges neurology clinics face in optimizing their patient feedback systems. The primary objective of this research is to explore how the effective implementation of patient feedback systems can directly enhance service quality in neurology clinics(Ablat et al., 2022; Biondo et al., 2022; A. Lin & Espay, 2021; Morris & Schorge, 2022; Pratap Shankar et al., 2023; Savill et al., 2024; Wu et al., 2023). The research questions aim to identify the main challenges faced in developing effective patient feedback systems, as well as how an agile approach in system development can be used to improve the responsiveness and flexibility of the system. By better understanding this, this research will provide practical guidance for neurology clinics and other healthcare professionals to optimize patient experience by developing adaptive and responsive patient feedback systems.

Patient feedback is a mechanism that allows patients to convey their experiences, evaluations, and expectations regarding the healthcare services they receive. The patient feedback system consists of several interconnected and supportive components. First is the collection of feedback data, which can be done through various methods such as patient

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surveys, interviews, or digital technology such as applications or online portals. Next, this data must be processed and analyzed to obtain valuable information and serve as the basis for decision-making. This analysis includes identifying trends, common patterns, and specific patient problems or needs. Subsequently, the next step is to provide measured and helpful feedback to healthcare providers, individually and through reports or overall service quality evaluations.

In healthcare, particularly in neurology, using patient feedback systems has significant implications. Patients with neurological disorders often require long-term and periodic care; thus, understanding their experiences and needs is critical to providing appropriate and quality care. With an effective patient feedback system, neurology clinics can gain deep insights into their patient's needs, both medically and in other aspects, such as comfort, communication, and social support. This can improve overall patient satisfaction and contribute significantly to the enhancement of neurology clinic service quality(Ferreira et al., 2023; T. Lin et al., 2023; Mohammadzadeh et al., 2017; Shen et al., 2024). The crucial role of patient feedback in improving patient satisfaction and clinic service quality cannot be underestimated. When patients feel heard, valued, and cared for, it fosters better relationships between patients and healthcare providers and enhances patient trust and loyalty to the clinic. Patient feedback also provides valuable information for clinics to continuously improve their services, ranging from administrative processes to more technical, clinical aspects. Therefore, implementing an effective patient feedback system is a necessity and a potentially significant investment in the quality and reputation of neurology clinics.

The agile approach in software development is very relevant to developing patient feedback systems in neurology clinics. Agile emphasizes strong collaboration between developers, users, and other stakeholders and promotes iterative development cycles responsive to change. In developing patient feedback systems, the agile approach enables clinics to be more flexible in responding to changing patient needs, speeding up system development iterations, and ensuring that the resulting solutions meet end-user expectations and needs(Alami et al., 2023; Baxter et al., 2023; Bomström et al., 2023; Dingsoeyr et al., 2019; Estrada-Esponda et al., 2024; Hasan et al., 2013; Humpert et al., 2022; Michalides et al., 2023; Tøndel et al., 2022). Case studies on developing patient feedback systems with an agile approach also provide valuable insights for neurology clinics seeking to implement responsive and adaptive patient feedback systems. From these case studies, best practices, successful implementation strategies, and lessons learned from challenges and mistakes that may occur during the development process can be learned. Thus, using the agile approach in developing patient feedback systems is based on theory and supported by relevant and valuable empirical evidence for neurology clinics.

Neurology clinics are medical facilities that provide specialized services in diagnosing and treating various neurological disorders, including brain diseases, spinal cord, and peripheral nervous system disorders. These clinics have state-of-the-art diagnostic and therapy equipment for precise and effective patient care. The number of patients these clinics serve varies depending on the season and ongoing medical situations, but on average, the clinic receives about 100 patients monthly. Medical personnel involved in the clinic's opera-

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tions include neurology specialist doctors, physical therapy experts, nurses, and administrative staff to handle patient registration, medical record administration, and service coordination.

Moreover, patient feedback can also identify specific problems or needs of patients, allowing clinics to make more accurate and efficient internal process improvements. By developing adaptive, responsive, and evidence-based patient feedback systems, Neurology Clinics can strengthen their position as providers of quality and trustworthy healthcare services for patients with neurological disorders. This system will help improve patient satisfaction and pave the way for continuous and evidence-based internal clinic process improvements.

Agile development methods offer a very different approach from traditional methodologies in software development(Al-Saqqa et al., 2020; Dingsøyr et al., 2012; Kaur et al., 2023; Santos et al., n.d.; Serrador & Pinto, 2015). The basic principles underlying this project's agile development are collaboration, adaptation, iteration, and responsiveness to change. Collaboration refers to close cooperation among all project stakeholders, including the development team, users, and others. Adaptation emphasizes flexibility in responding to changing needs or priorities during development. Iteration refers to repetitive development cycles, where the product is gradually developed with continuous user feedback. Responsiveness to change means the development team can quickly adjust their plans and actions in response to changes.

In this research, the development methodology to be used is Scrum, one of the most popular and effective agile frameworks. Scrum emphasizes transparency, inspection, and continuous adaptation. The development team will work in sprint cycles, designing, building, and testing patient feedback system features within specified periods, usually between 2 to 4 weeks. Each Sprint ends with a review and retrospective, where the team evaluates their performance and plans improvements for the next Sprint. The use of specific tools and techniques in the development of patient feedback systems will include the use of collaboration platforms such as Slack or Microsoft Teams for team communication, task management tools such as Trello or Jira to track progress and tasks, and automated testing tools to ensure the quality of the software produced. In agile development, these tools facilitate effective communication, progress transparency, and rapid iteration in development.

METHODS

This study encompasses three main stages in developing a patient feedback system in neurology clinics. The first stage is User Needs Analysis, where stakeholders are identified, data is collected through surveys and interviews to understand user needs, and data analysis is conducted to formulate system requirements. The second stage is Application Development, which includes system design planning, prototyping, testing, and system iteration to ensure quality and alignment with user needs. The final stage is User Acceptance Evaluation, where the system is implemented and evaluated by end-users to determine effectiveness, usability, and integration with clinic processes. This series of stages forms a methodi-

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cal development process responsive to user needs and feedback to enhance service quality in neurology clinics.
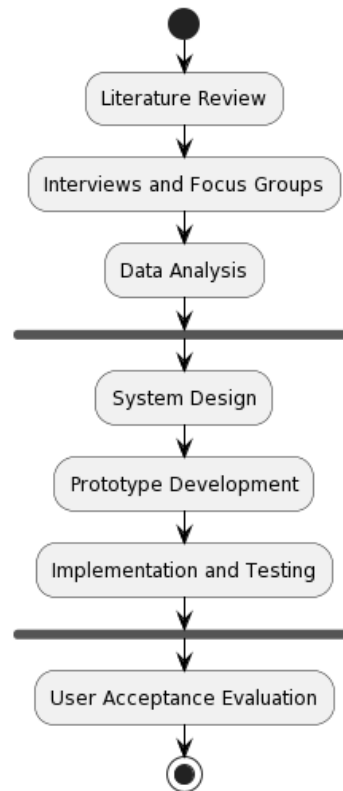

Figure 1. Research Stages

User Needs Analysis

The first stage in this research is User Needs Analysis. In this stage, key stakeholders involved in developing the patient feedback system are identified, including patients, medical staff, and clinic management. Data collection is carried out through surveys, interviews, and focus group discussions to deeply understand the needs, expectations, and issues users face regarding the patient feedback system. The collected data is then meticulously analyzed to identify patterns, trends, and primary user needs, which will serve as the basis for formulating clear and comprehensive system requirements.

Application Development

In the second stage, Application Development, the research team plans the system design based on user needs analysis. This includes planning the user interface, the system's primary functions, and integration with other systems in the neurology clinic. Subsequently, the team develops a prototype of the patient feedback system to test basic functionality and obtain initial feedback from users. This process is followed by iterative testing and iteration to ensure the quality and alignment of the system with user needs.

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User Acceptance Evaluation

The final stage is the User Acceptance Evaluation. The patient feedback system is fully implemented in the neurology clinic environment at this stage. End-users can use the system and actively provide feedback on their experience. This evaluation includes usability, usefulness, effectiveness in obtaining patient feedback, and integration with existing clinic processes. Based on end-user feedback, the team performs regular system improvements and maintenance to ensure the quality and sustainability of the patient feedback system's usage in the neurology clinic. These stages form a structured and methodical process in developing a responsive and adaptive patient feedback system.

RESULTS AND DISCUSSION

User Needs Analysis

The result of the User Needs Analysis stage is the identification of key stakeholders involved in developing the patient feedback system, including end-users such as patients and medical staff, as well as other stakeholders such as clinic management and software developers. The research team collects data through surveys, interviews, and focus group discussions with end-users to understand the needs, expectations, and issues related to the patient feedback system. The collected data is then analyzed thoroughly to identify patterns, trends, and primary user needs, which are the basis for formulating clear and comprehensive system requirements. This allows the team to design a patient feedback system that includes the user interface, main functions, and integration with other systems in the neurology clinic. Additionally, the results of data analysis also serve as the basis for creating a prototype system thoroughly tested by end-users to identify weaknesses, bugs, or necessary improvements. The results of user acceptance evaluation and feedback from end-users are used to perform regular improvements and maintenance of the system to ensure the quality and sustainability of the patient feedback system's usage in the neurology clinic.

Table 1. Data Collection Results

Stakeholder	Main Needs	Challenges	Expectations and Desires
Patients	Get easy and quick access to neurology clinic services. Receive clear information about procedures and treatments.	Communication about health conditions needs to be improved. Lack of understanding of medical procedures.	The expectation is to get fast and quality services. Expectation to get information that is transparent and easy to understand.
Medical Personnel	It is obtaining complete and accurate patient data. I have an efficient sys-	Time constraints in recording patient data. Complexity in managing patient information.	Expectation to have a system that supports efficient management of patient data.

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Stakeholder	Main Needs	Challenges	Expectations and Desires
Clinic Management	tem for information management and patient feedback. Improve service quality and patient satisfaction. Improve the clinic's internal processes based on patient feedback.	Lack of understanding of patient needs and expectations. Challenges in integrating patient feedback into clinical processes.	Expectation to get practical and easily accessible feedback. Expectation to see improvements in patient satisfaction and service quality. Expectation to get information that supports decision-making.

Table 1 illustrates the diverse needs and challenges that must be addressed in the development of a patient feedback system in neurology clinics. Patients seek easy and quick access to clinic services, as well as clear information about procedures and treatments. However, they may encounter difficulties in communicating health conditions and lack understanding of medical procedures. The primary needs of medical staff include access to complete and accurate patient data, as well as an efficient system for managing information and patient feedback. However, they face challenges such as time constraints in recording patient data and complexity in managing patient information. Meanwhile, clinic management aims to improve service quality and patient satisfaction by enhancing internal clinic processes based on patient feedback. However, they encounter challenges such as a lack of understanding of patient needs and expectations, as well as difficulty integrating patient feedback into clinic processes. Software developers are expected to understand user needs well to design appropriate systems, but they also face challenges such as the complexity of integrating various user needs and maintaining system quality and security. In designing a responsive and adaptive patient feedback system, a deep understanding of the needs, challenges, and expectations of each stakeholder is required to create effective solutions and provide significant added value to users and the clinic as a whole.

Application Development

In the Application Development stage, the development team engages in several key activities to design and test the patient feedback system. First, they engage in system design planning based on user needs analysis. This includes designing a user-friendly interface, identifying essential functions for collecting and analyzing patient feedback, and planning system integration with existing technological infrastructure in neurology clinics. Next, the team creates a system prototype to test basic functionality and obtain initial feedback from users. This prototype serves as a foundation for identifying weaknesses, bugs, or necessary improvements in the system. Subsequently, thorough testing is conducted by end-users to ensure system quality and alignment with their needs. The team iterates and

makes repeated improvements, integrating user feedback to enhance overall system quality and performance. Thus, this stage serves as a critical foundation in the development of a responsive, efficient patient feedback system that meets the expectations and needs of users in neurology clinics.

Figure 2 illustrates the application development process, which includes stages of system design planning, prototype development, and iterative testing. The system design planning stage involves designing the user interface, defining key functions, and system integration. The prototype development stage entails testing basic functionality and obtaining user feedback. Meanwhile, the iterative testing stage includes identifying weaknesses, system improvements, and retesting functionality. This diagram aids in visualizing the application development flow clearly and comprehensibly.

The ERD in Figure 3 presents a comprehensive data model for the application involving users, feedback, clinics, appointments, doctors, and prescriptions. The User entity represents individuals interacting with the system, with UserID as the unique identifier and attributes such as First Name, Last Name, Email, and PasswordHash storing user details. The Feedback entity records feedback from users, using UserID as a foreign key for user relations and storing attributes such as Subject, Description, Rating, and DateCreated. The Clinic entity represents healthcare facilities with ClinicID as the unique identifier, and ClinicName, Location, and PhoneNumber as clinic detail attributes. The Appointment entity manages appointments between users and clinics, with UserID and ClinicID as foreign keys and attributes such as AppointmentDate and AppointmentTime storing appointment details. The Doctor entity represents medical professionals with DoctorID as the unique identifier and attributes such as First Name, Last Name, and Specialization storing doctor details. Lastly, the Prescription entity manages prescriptions from doctors with AppointmentID and DoctorID as foreign keys and attributes such as PrescriptionDate, Medicine, and Dosage storing prescription details. This ERD supports efficient data management in healthcare applications, enabling user authentication functionality, feedback collection, appointment scheduling, and structured prescription management.
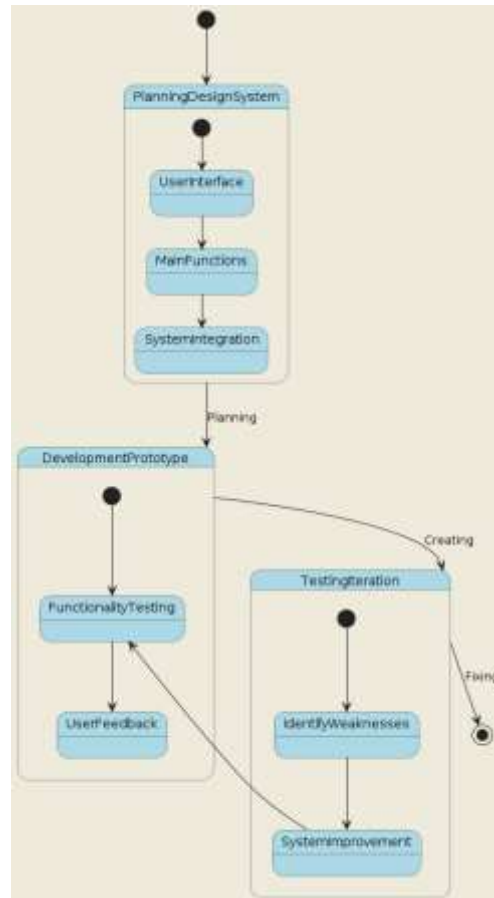
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Figure 2. State Diagram

Figure 3. ERD

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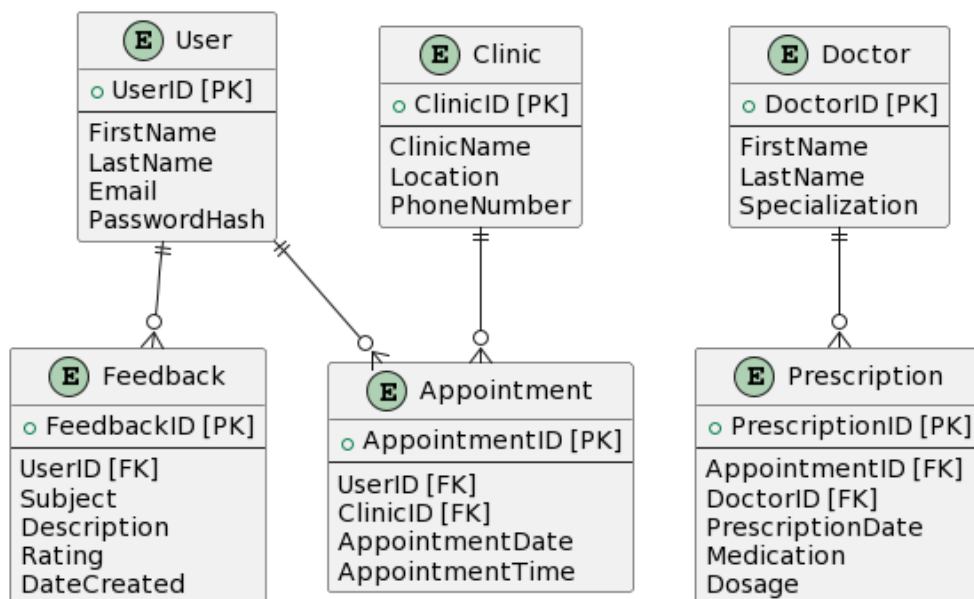Neurology Clinic Services–Denny Jean Cross Sihombing
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User Acceptance Evaluation

The results of the User Acceptance Evaluation stage involve several key activities. Firstly, after developing and testing prototypes, the team proceeds with the full implementation of the patient feedback system in the neurology clinic environment. This includes deploying the system and ensuring its functionality in real-world contexts. Subsequently, end-users are invited to actively use the system and provide feedback on their experience. This evaluation includes aspects of usability, usefulness, effectiveness in obtaining patient feedback, and integration with existing clinic processes. The goal is to assess the extent to which the system meets user expectations and fulfills set objectives.

Additionally, based on feedback from end-users, the team will regularly perform system improvements and maintenance. This aims to ensure the quality and sustainability of the patient feedback system's use in the neurology clinic. These actions involve addressing identified issues, optimizing system performance, and implementing enhancements to meet evolving user needs. Overall, this stage is a crucial part of the adaptive and responsive system development process, thus enhancing patient experience and clinic operations overall.

CONCLUSION

The implementation of a patient feedback system with an agile approach in the context of a neurology clinic can contribute positively to improving service quality. User needs analysis, responsive and integrative application development, as well as user acceptance evaluation and continuous improvement based on feedback, are key steps in delivering effective solutions. By integrating agile approaches, neurology clinics can be more adaptive to patient needs and efficient in service processes. This research provides a deeper understanding of the importance of a responsive patient feedback system in enhancing patient satisfaction and clinic service quality, thus making a valuable contribution to the development of more effective systems in the future.

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