International University of Sarajevo
Faculty of Engineering and Natural Sciences

GROUP 9

Course: Software Engineering – CS308

Title: Agile Healthcare Appointment System Development

Students:

ID:	Name:
210302150	Enita Mujkanović
210302062	Almedina Katkić
210302152	Fatima Jichi

Professor:

Dr. Mohammed Saeed Jawad

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1.Introduction

Accessing vital governmental services remains a struggle for many residents because of outdated and scattered programs including physical databases and paper-based procedures. This outdated approach makes it difficult for citizens to navigate a variety of government services, such as administrative processes, healthcare, and municipal services.

To resolve this issue; *"**The Agile Healthcare Appointment System**"* is introduced with the goal of making the process of making and keeping appointments in a medical facility as simple as possible. In addition to optimizing resource allocation and cutting wait times, the system will offer a user-friendly interface for patients and healthcare professionals, facilitating quick appointment scheduling, rescheduling, and cancellation. This initiative will cover almost any possible request and special need of a patient whilst respecting the patient's time, prioritizing their health and overall providing service satisfaction.

It will transform the way citizens communicate with healthcare entities and streamline routine tasks that are currently recognized to be very time-consuming by providing a centralized digital center for citizen participation.

1.1. Scope and Goals

The scope involves developing a platform designed to streamline the process of healthcare appointment scheduling. The primary goal is to enhance the flexibility and efficiency of booking systems, making them adaptable to various healthcare settings. The platform will focus on user-friendly interfaces for both patients and healthcare providers and integration capabilities with existing medical record systems. By prioritizing responsive design and quick adaptation to the changing needs of both providers and patients, the platform aims to significantly reduce wait times, optimize resource utilization, and improve the overall patient experience. The main goal is to respect the urgency and need of healthcare for every single patient equally thus transforming their approach towards the healthcare system.

2.Team Structure and Roles

The team will closely collaborate between themselves and make quick decisions as needed. Members are skilled in various fields and may work cross-functionally on several tasks and must always be ready to deliver efficient and fast responses in evolving and unpredictable environments, market demands, special requests etc. due to the dynamic nature of the project. Therefore, the team will heavily rely on agility to continuously provide efficient sprints.

The following timetable describes the responsibilities divided into roles and their detailed description. The chosen framework Scrum requires a Scrum Master (SM in the table) with significant interference and the Development Team (DT in the table). The scrum roles are predefined to serve as a guideline, all members will be equally involved.

Table 1. Roles and responsibilities of each team member

Team Member:	**Scrum Role:**		**Role Description:**
Fatima Jichi	**SM**	system architect, UI/UX designer and editor	The team member overviews the sprint goal & divides it into several tasks which would further be discussed with the team - to ensure that members with the most suitable skills are assigned to it. They will cover tasks regarding the system architecture, design, chart creation and will complete the final overview of the sprint before launch.
Enita Mujkanović	**DT**	quality assurance analyst, technical writer	The technical writer is responsible for creating most of the documentation for the system. This includes development documentation to guide future contributors, as well as user manuals or help guides for end-users. On the other hand, the quality assurance analyst plays a critical role in ensuring the software's reliability and

			performance by conducting systematic tests to identify any defects or areas for improvement. This role involves both manual and automated testing strategies to ensure that the application meets all specified requirements and provides a seamless user experience.
Almedina Katkić	**DT**	software developer	The role is to create an agile healthcare appointment system that will be responsible for designing, coding, testing, and maintaining the software. They will write the code for various parts of the system, working on both the front-end and back-end components. Their tasks include integrating with existing healthcare databases and APIs, ensuring data consistency, and implementing security measures.

3.Agile Methodology Overview

Chosen agile framework: **SCRUM**

After a close analysis, the Scrum framework was chosen due to the size of the team and the need for close continuous cooperation & quick decision making. It emphasized teamwork and iterative progress towards the already established goal. The sprints approach perfectly aligns with the project's requirements through every step of the progress, always providing continuous feedback, while also being very flexible. It motivates all members to make valuable and efficient decisions and helps manage the growth of complexity as the projects evolves. It will eventually provide better feedback from the customers and product owner, as they are involved and their feedback is taken into account.

4.Product Backlog

4.1.Features

The following list of features will be implemented in the first few sprints, and may be changed or expanded upon special request, development etc.

1. **APPOINTMENT CREATION:** the user will schedule an appointment by selecting a date and preferred time slot, medical department, preferred medical staff etc.
2. **APPOINTMENT MONITORING:** the user will have an overview of the appointment with all the information selected upon creation.
3. **APPOINTMENT MODIFICATION:** the user will be able to edit the appointment preferences and reschedule for another time slot/date.
4. **APPOINTMENT DELETION:** the user will be able to cancel the appointment anytime.
5. **QUEUE:** a simple countdown informing the user of their current position in the queue.
6. **NOTIFICATION CENTER:** the user will receive confirmation notifications of the created appointment, a reminder or cancellation notification, the user will be able to modify these notifications.
7. **E-CARD:** the user will always have access to the laboratory reports alongside medical staff's feedback after every visit, appointment history etc.
8. **SPECIAL REQUEST & REQUIREMENTS:** dedicated section for direct communication with the medical staff, the users will request information, the medical staff will be delivering requests that do not require scheduling a visit (ex. extending therapy).
9. **DATA SECURITY MESSURES:** Implementation of encryption, secure data storage, and compliance with HIPAA or equivalent.

4.2.Tasks

- Requirement gathering and analysis.
- System architecture design.
- Front-end and back-end development.
- Database set-up and management.

- Integration of external APIs for calendar services.
- Security implementation and testing.
- Interface design and usability testing.
- Deployment and continuous integration setup.
- User training and documentation creation.
- Post-deployment support and system updates.

4.3.Prioritization Criteria

- **Business Impact:** Focus on features that directly enhance user satisfaction and operational efficiency.
- **User Demand:** Prioritize developments based on the needs and feedback of end-users, including both healthcare providers and patients.
- **Technical Feasibility:** Assess how easily a feature can be implemented within the existing system architecture.
- **Cost-Effectiveness:** Consider the cost-benefit ratio, aiming to implement the most impactful features within budget constraints.
- **Regulatory Compliance:** Ensure all features comply with health data protection regulations, prioritizing those necessary to meet legal standards.
- **Risk Mitigation:** Prioritize tasks that reduce potential risks, such as data breaches or system downtime.

4.4.Outcome

By adhering to these criteria, the project will effectively prioritize and implement features that maximize system usability, ensure security and compliance, and address the most pressing needs of its users. This approach will help in delivering a robust healthcare appointment system that enhances the efficiency of medical practice operations while improving patient experience.

5.Sprint Planning

Sprint 1: Foundation and Framework

- Sprint Goal:
    - Set up the basic framework for the appointment system, establish the development environment, and ensure initial user account management functionality.
- Features and Tasks:
    - Set up project repository and development tools.
    - Design the system architecture.
    - Develop initial user account registration and login functionality.
    - Basic UI design for login and registration.
- Estimated Time and Resources:
    - Duration: 2 weeks
    - Resources: development tools, testing servers, database servers.

Sprint 2: Core Scheduling Functionality

- Sprint Goal:
    - Implement the core functionality for scheduling appointments, including calendar integration and real-time availability updates.
- Features and Tasks:

- Develop the appointment booking interface.
- Integrate external calendar APIs.
- Implement functionality for updating and cancelling appointments.
- Basic notification setup for appointment reminders.

- Estimated Time and Resources:
  - Duration: 3 weeks
  - Resources: API access for calendar service, additional testing tools for API integration.

Sprint 3: Enhancing User Experience and Accessibility

- Sprint Goal:
  - Focus on improving the user interface and ensuring the system is accessible on multiple platforms.
- Features and Tasks:
  - Refine the UI/UX for all user-facing interfaces.
  - Ensure mobile responsiveness.
  - Implement advanced notification options (SMS, email, push notifications).
  - Conduct initial user testing to gather feedback.
- Estimated Time and Resources:
  - Duration: 3 weeks
  - Resources: SMS gateway and email service subscriptions, mobile testing devices.

Sprint 4: Reporting and Feedback Integration

- Sprint Goal:
    - Implement reporting tools for healthcare providers and integrate a user feedback system.
- Features and Tasks:
    - Implement user feedback mechanism within the platform.
    - Refine data visualization for reports.
    - Conduct final testing of reporting and feedback tools.
- Estimated Time and Resources:
    - Duration: 2 weeks
    - Resources: analytics tools, simulation software for testing emergency logic.

6.Sprint Execution

Sprint 1: Setup and Initial Framework

- Daily Stand-up Insights:
    - Team members report progress on environment setups and initial architectural decisions.
    - Early challenges with integrating multiple development tools discussed.
- Key Developments and Challenges:
    - Successful setup of version control and continuous integration tools.
    - Some delays in configuring the backend environment due to compatibility issues with certain database versions.

- Adjustments Made During the Sprint:
    - Switched to a different database system better supported by the existing infrastructure.
    - Increased communication with the IT support team to resolve environment setup issues promptly.

Sprint 2: Core Appointment Scheduling Features

- Daily Stand-up Insights:
    - Progress on UI for appointment scheduling is on track.
    - Difficulties with third-party calendar API integration are causing delays.
- Key Developments and Challenges:
    - Basic appointment scheduling interface completed and initial user testing conducted.
    - Integration issues with the calendar API, particularly around syncing and real-time updates.
- Adjustments Made During the Sprint:
    - Opted for a simpler initial integration with reduced functionality.
    - Scheduled extra sessions for pair programming to address complex integration issues.

Sprint 3: Notification System and Mobile Accessibility

- Daily Stand-up Insights:
    - Notification system implementation.
    - Issues adapting certain UI elements for mobile responsiveness noted.
- Key Developments and Challenges:
    - Email notifications are functional, but SMS integration is waiting on external vendor issues.
    - Some features are not displayed correctly on smaller screens or different mobile operating systems.

- Adjustments Made During the Sprint:
    - Prioritized fixing mobile responsiveness issues by adjusting CSS and testing on multiple devices.
    - Temporarily halted SMS notifications until vendor issues resolved, focusing on improving email and in-app notifications instead.

Sprint 4: Reporting Tools and Emergency Appointments

- Daily Stand-up Insights:
    - Difficulty in implementing logic for prioritizing emergency appointments.
- Key Developments and Challenges:
    - Balancing the load and response time for emergency appointments without affecting other functionality.
- Adjustments Made During the Sprint:
    - Refined emergency appointment features by using a more efficient algorithm after consulting with healthcare professionals for practical insights.

7.Sprint Review and Retrospective

7.1.Completed Tasks

Key features for the sprint were successfully implemented, such as basic user account management, the appointment scheduling interface, and initial mobile responsiveness tweaks. Essential integrations like calendar APIs for appointment scheduling were achieved as well.

7.2.Pending Items

Advanced functionalities, such as complete real-time updates and full-scale mobile optimization, are still in progress. The integration of robust security measures and comprehensive user feedback systems needs further development.

7.3.Areas of Positive Outcomes

Effective communication and collaboration were maintained throughout the sprint, utilizing online tools and regular virtual meetings. The team adapted quickly to technical challenges, finding workarounds for limited access to full-scale development tools. Initial testing with a limited number of devices provided good insights into the primary functionality.

7.4.Areas for Improvement

Delays were experienced due to reliance on external APIs and free service limitations. Consistency across different mobile platforms needs more attention, considering the limited range of devices available for testing. Planning for technical dependencies was sometimes overlooked, affecting the sprint's smooth execution.

7.5.Action Plans for Future Sprints

Focus the early part of the next sprint on resolving pending items, ensuring they don't create bottlenecks. Improve integration testing by utilizing mock services and simulators to overcome the limitations of free API version. Develop contingency plans for dealing with technical limitations encountered with free versions of tools and services.

8.Software Requirements

1. Functional Requirements:

a. User management:

- Multiple user roles, including administrators, medical professionals, and patients, should be supported by the system.
- It should be safe for users to sign up, log in, and edit their profiles.

b. Appointment Management:

- It should be possible for patients to see available appointment times in relation to their selected time, date, and healthcare provider.

- It should be possible for healthcare professionals to manage their schedules, including making, changing, and canceling appointments.
- Patients and healthcare professionals should receive confirmation and reminder notifications from the system.
- Appointments should be able to be canceled or rescheduled by patients with enough notice.

c. Resource Management:
    - By instantly verifying the availability of medical professionals, examination rooms, and other resources, the system aims to avoid duplicate bookings.
    - Administrators should be able to monitor and adjust the resources and healthcare providers that are available.

d. Reporting and Analysis:
    - Provide statistics about appointments, including booking patterns, no-show rates, and resource usage.
    - Based on past data, offer insights to better scheduling and resource allocation.

e. Integration:
    - To gain safe access to patient data and medical histories, the system must communicate with currently in use Electronic Health Record (EHR) systems.
    - For smooth scheduling, it should be able to integrate with other calendar programs.

2. Non-functional Requirements

a. Security:
    - Protect patient privacy and sensitive healthcare data by putting strong authentication and permission procedures in place.
    - Assure adherence to pertinent HIPAA (Health Insurance Portability and Accountability Act) and other requirements relevant to the safeguarding of healthcare data.

b. Performance:
    - Concurrent user requests should be handled by the system effectively and without noticeably degrading performance.
    - Response times for scheduling appointments and obtaining patient data should be maximized.

c. Usability:

- Develop an interface that is easy to use and intuitive for a variety of devices, including desktop, tablet, and mobile.
- Give users enough feedback and error handling to help them navigate the appointment scheduling procedure.

d. Scalability:
   - If the number of users and appointment volume grow in the future, the system architecture should be scalable.
   - Employ caching and load balancing techniques to efficiently divide the workload.

e. Reliability:
   - Make sure there is little downtime for planned maintenance and that the system is highly available.
   - To avoid data loss, put disaster recovery and data backup plans into action.

3. Constraints
   - Agile approaches should be followed during the development phase, with numerous iterations and feedback loops.
   - The system ought to work with contemporary systems and web browsers.
   - The selection of technology and the order of features may be influenced by budgetary restrictions.

4. Assumptions
   - Users can access the system with dependable internet connectivity.
   - Healthcare professionals are authorized to handle patient appointments and timetables.
   - When registering and scheduling an appointment, patients are in charge of giving accurate and current information.

5. Dependencies

- Collaboration with corporate IT departments or outside vendors may be necessary for integration with current EHR systems.
- Seeking advice from legal and compliance professionals may be necessary to ensure that you meet regulatory standards.

6. Acceptance Criteria
   - Error-free concurrent appointment booking should be handled by the system.
   - There should be no usability problems when registering, logging in, and scheduling appointments.
   - Secure access to patient data should be made possible through integration with EHR systems while maintaining data privacy.

7. Future Enhancements
   - Putting telehealth features into practice for online consultations.
   - Integrate your systems with billing to process payments smoothly.
   - Incorporate methods for patient feedback to enhance the entire appointment experience.

8. Documentation
   - Provide comprehensive user manuals and technical documentation for system administrators, healthcare providers, and patients.
   - To facilitate future integration with external systems, document APIs and system interfaces.