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MedTracker

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Abstract

The project, ”MedTracker,” is a collaborative effort by authors Paladi Inga, Rotaru Ion, Vladislav Fruze, Buzu Alexandru, and Dorin Otgon, affiliated with the Technical University of Moldova. This abstract provides a concise overview of the project and its structure.

Keywords: MedTracker, Medical Data Management, Healthcare, Database, Software Development.

The goal of MedTracker is to overcome significant problems in managing and tracking medical data. The main goals of the project are to improve overall healthcare administration, optimize data storage and retrieval, and build an effective system for tracking and documenting medical information.

The project uses a variety of approaches, such as database design, software development, and data analysis, to accomplish these objectives. The team has used technologies like web apps and database management systems to produce a stable and user-friendly platform.

By reducing data management procedures and enhancing patient care, MedTracker's outcomes have the potential to completely transform the way healthcare is administered. An introduction, thorough techniques, findings and results, conclusions, and a bibliography are among the chapters that make up this project.

In conclusion, MedTracker represents a significant advancement in medical data management by providing cutting-edge solutions for institutions and professionals in the healthcare industry. The objectives, methods, and anticipated impact of the project are briefly described in this abstract.

Content

Domain Analysis

This section delves into the industry that our app, MedTraker, serves and examines the potential advantages it might have for this industry.

- What domain will our app serve?

The healthcare and medical industries are the target markets for MedTraker. It covers the critical requirement for effective tracking and management of medical data, making it especially pertinent to healthcare institutions, medical practitioners, and patients.

- Why or how could this domain benefit from a MedTracker?

MedTraker offers a number of key advantages to the healthcare industry. First off, it lessens the administrative burden on medical personnel by streamlining the tracking and management of medical information. They can therefore concentrate more on providing patient care and less on paperwork as a result.

Second, by lowering the possibility of errors and facilitating quick access to critical patient data, MedTraker improves the overall accuracy and accessibility of medical records. More informed medical decisions and better patient outcomes may result from this improvement in data quality.

Finally, MedTraker helps patients manage their own health and adhere to prescribed therapies by giving them more visibility into their treatment plans and prescription regimens.

- What problem will be solved by the proposed app?

The widespread issue of ineffective medical data management is something that MedTraker seeks to remedy. Paper-based records or disjointed electronic systems can cause data fragmentation, inaccuracies, and delays in patient care in many healthcare settings. By providing a consolidated and user-friendly platform for recording medical data, encouraging data integrity, and enhancing the entire healthcare workflow, MedTraker aims to address these issues.

- Who are the potential users of the MedTracker?

The healthcare industry is home to a wide range of possible MedTraker users. Doctors, nurses, pharmacists, and other medical specialists who require access to and updates on patient records fall under this category. Patients themselves can also use the app, accessing their own medical records and monitoring their own treatment regimens. The improved data management features provided by MedTraker will also be valuable to healthcare managers and institutions.

In conclusion, by tackling data management issues, enhancing patient care, and providing value to a variety of users within the healthcare ecosystem, MedTraker is positioned to have a substantial impact on the healthcare domain.

1 Crystallizing the topic of the project

1.1 Problem Description and Problem Analysis

Our initiative, MedTraker, was founded as a result of the discovery of a serious issue in the healthcare industry. This part establishes the framework for future project development and progress by defining and analyzing the challenge. It acts as the project's cornerstone.

1.1.1 Problem Description

Our project's main focus is on a critical problem in the healthcare industry. The method of managing medical data is ineffective and frequently prone to inaccuracy. Medical records are dispersed throughout numerous healthcare organizations in a variety of formats, including paper-based documentation and various computerized systems. This fragmentation causes a number of difficulties:

- Time-Consuming Data Retrieval: Healthcare professionals spend valuable time searching for patient records, leading to delays in diagnosis and treatment.
- Data Inaccuracy: Fragmented data systems can lead to errors in patient information, which can have serious consequences for patient care.
- Administrative Overhead: The administrative burden of managing and updating medical records detracts from the primary focus of healthcare providers: patient care.

With its all-inclusive tracking and administration system for medical data, MedTraker attempts to address these problems.

1.1.2 Problem Analysis

It is essential to determine the problem's breadth and effects within the healthcare industry in order to address it effectively. The issue of ineffective medical data management affects numerous areas:

- **Healthcare Providers**: Doctors, nurses, and medical staff are directly affected by the challenges of fragmented medical data. Streamlining data access and management can significantly improve their workflow and patient care.
- **Patients**: Patients also bear the brunt of inefficient data management. They often face difficulties in accessing their own medical records, understanding treatment plans, and tracking medication schedules. MedTraker aims to empower patients to take control of their healthcare journey.
- **Healthcare Institutions**: Hospitals and clinics grapple with the repercussions of inefficient data management, including potential legal and compliance issues. MedTraker provides a solution to enhance data integrity and streamline administrative processes.

The MedTraker project team now has a complete understanding of the problem and its implications across all domains, and we can go forward with conceptualizing and designing an effective solution.

1.2 Objectives

We describe the precise goals of the MedTraker project in this section. These goals act as the guiding concepts that direct the design and execution of our project. They offer a precise road map for completing the goals of our project and successfully resolving the identified issue.

The MedTraker project's main goals are as follows:

1. **Efficient Medical Data Tracking:** Develop a system that allows for efficient tracking and recording of medical information, reducing the time and effort required by healthcare professionals for data management.
2. **Optimized Data Storage and Retrieval:** Implement robust data storage and retrieval mechanisms to ensure the accuracy, security, and accessibility of medical records within the system.
3. **Enhanced Healthcare Management:** Improve the overall healthcare management process by streamlining data management, reducing errors, and enhancing collaboration among healthcare professionals.
4. **Empowering Patients:** Empower patients with tools to access their medical records, understand treatment plans, and adhere to prescribed medications, fostering active participation in their healthcare journey.
5. **Innovation in Healthcare Administration:** Contribute to the advancement of healthcare administration by introducing innovative solutions that simplify data management and compliance within healthcare institutions.

These goals serve as the cornerstone of the MedTraker project, directing our work toward developing a strong and user-friendly platform that overcomes the difficulties of managing medical data and provides major advantages to both patients and healthcare providers.

2 Defining the requirements of the project

2.1 Functional

In this section, we go into detail about the core capabilities and features we want to implement in MedTraker system in this part. These activities specify what the system performs and how it achieves its goals in the healthcare field.

- **User Authentication and Authorization:** MedTraker should provide robust user authentication and authorization mechanisms. It allows healthcare professionals, administrators, and patients to securely access the system with appropriate levels of permission. User roles and permissions are carefully defined to ensure data security and privacy.
- **Patient Treatment Management:** The effective handling of patient treatment is one of MedTraker's key features we want to have. It makes it possible for medical professionals to generate, modify, and access detailed electronic patient health treatments.
- **Medication Management:** Both healthcare professionals and patients should manage their medications more easily with MedTraker. It enables doctors to electronically prescribe medications, and patients can obtain their prescribed medications, dose guidelines, and schedules via the platform. Reminders and alarms encourage medication adherence.
- **Data Analytics and Reporting:** The system should include data analytics tools that enable healthcare professionals to gain insights from patient data. It offers reporting capabilities to generate customized reports, track healthcare trends, and support evidence-based decision-making.
- **Security and Privacy:** A critical function of the system is to maintain the highest standards of security and privacy for patient data. It implements encryption, access controls, and audit trails to safeguard sensitive medical information.

2.2 CIA: Confidentiality, Integrity, Availability

The core of the security and dependability requirements for the MedTraker system is the CIA triad, which stands for Confidentiality, Integrity, and Availability. These non-functional requirements are necessary to protect patient information, uphold data integrity, and guarantee continuous system access.

2.2.1 Confidentiality

Confidentiality is paramount in healthcare, as it involves sensitive patient information. The MedTraker system must:

- **User Authentication:** Ensure that only authorized users can access patient records and sensitive data.
- **Data Encryption:** Encrypt user data during transmission and storage to prevent unauthorized access.
- **Access Control:** Implement access controls to restrict access to patient records based on user roles

and permissions.

- **Audit Trails:** Maintain audit trails to track who accessed what data and when, ensuring accountability.

2.2.2 Integrity

Integrity ensures that data remains accurate and trustworthy. The system must:

- **Data Validation:** Implement data validation checks to prevent data corruption and inaccuracies.
- **Version Control:** Maintain version control to track changes to patient records and ensure data integrity.
- **Backup and Recovery:** Regularly back up data and have recovery mechanisms in place to restore data in case of data corruption or loss.

2.2.3 Availability

Availability ensures that the MedTraker system is accessible when needed. The system must:

- **Uptime Guarantee:** Provide a high level of system uptime to ensure that healthcare professionals can access patient records at all times.
- **Redundancy:** Implement redundancy measures to minimize downtime in case of hardware or software failures.

3 Creating a high level architectural model of the software

3.1 Use Case Diagram

In this use case diagram is presented basic function of MedTracker ”Add Treatment”, here are the basic and additional methods for creating a treatment:

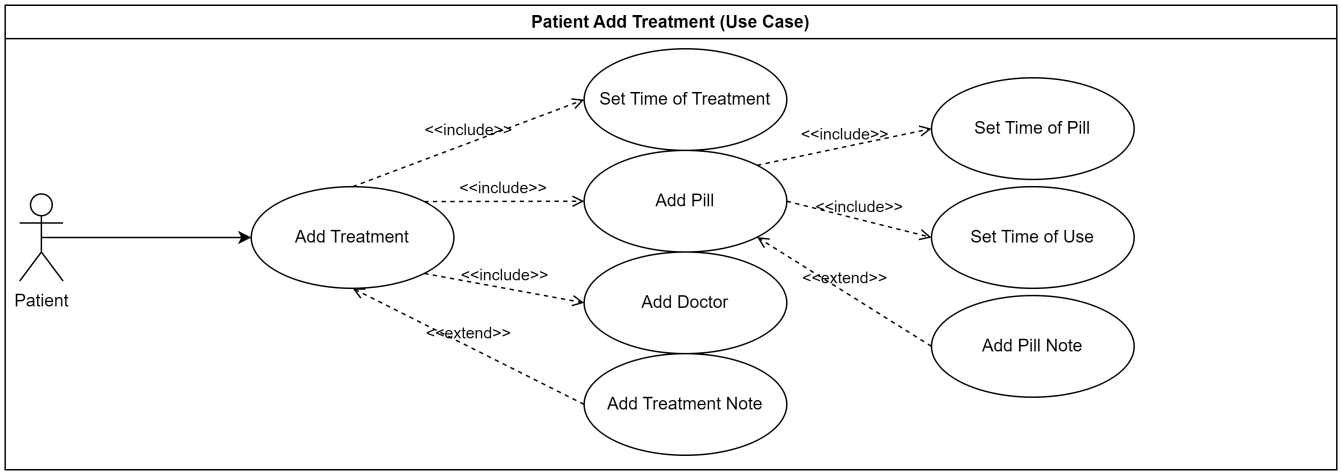

Figure 3.1.1 - Patient Add Treatment

3.2 Sequence Diagram

This sequence diagram is a simple representation of how a doctor will check the progress of treatments of his patients:

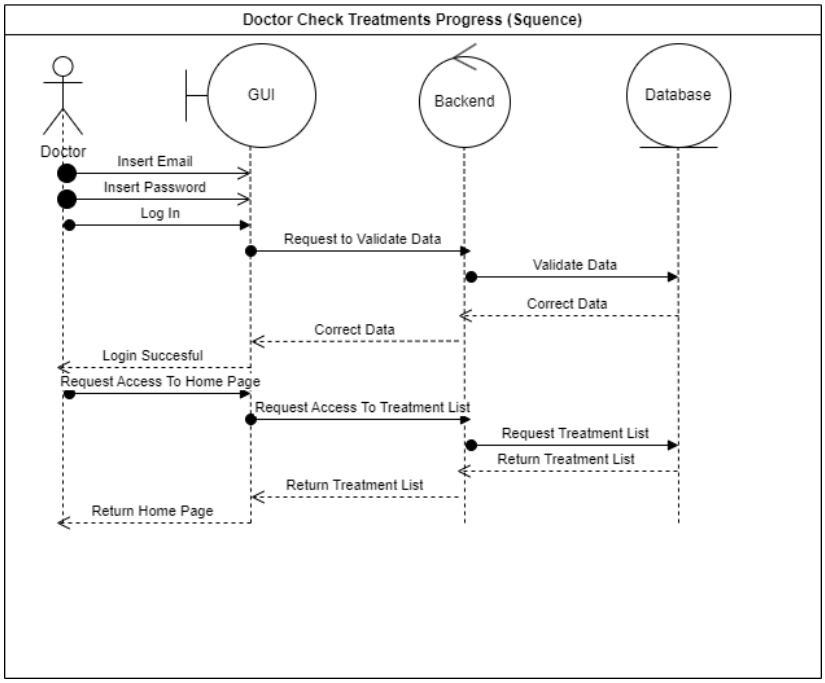

Figure 3.2.1 - Doctor Check Treatments Progress

3.3 Activity Diagram

In this activity diagram, the basic activities that must be performed by the patient in order to create a new treatment are represented:

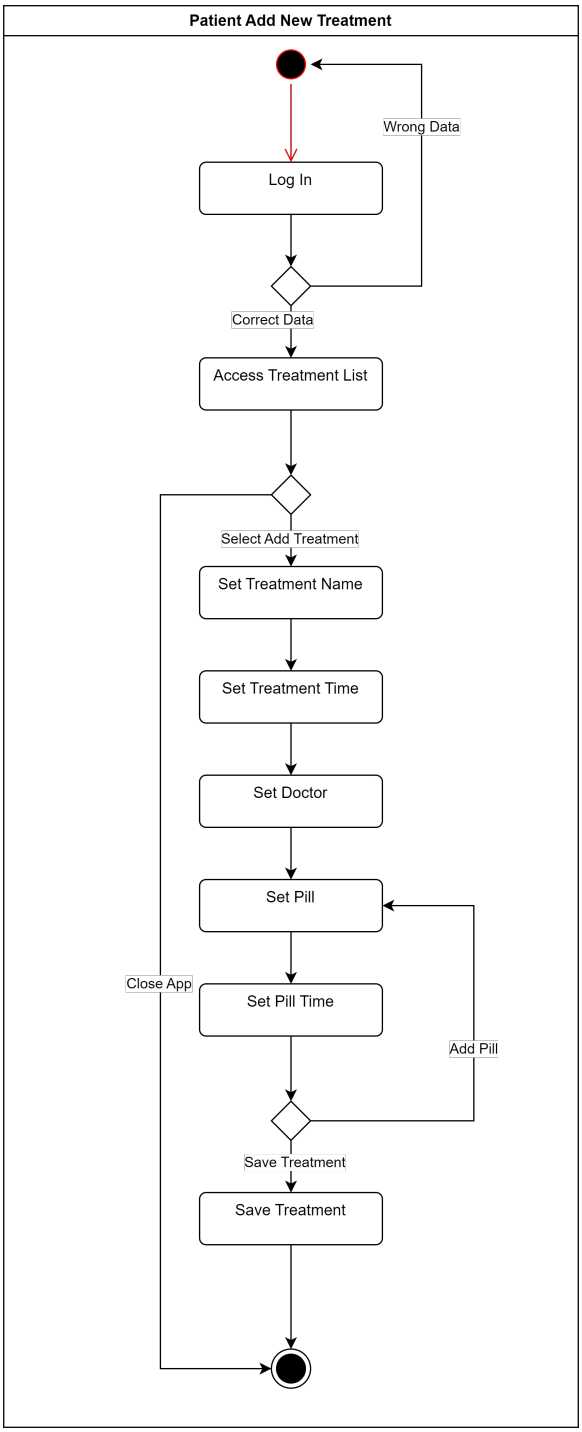

Figure 3.3.1 - Patient Add New Treatment

3.4 Class Diagram

In this class diagram is represented our database tables and relations between them:

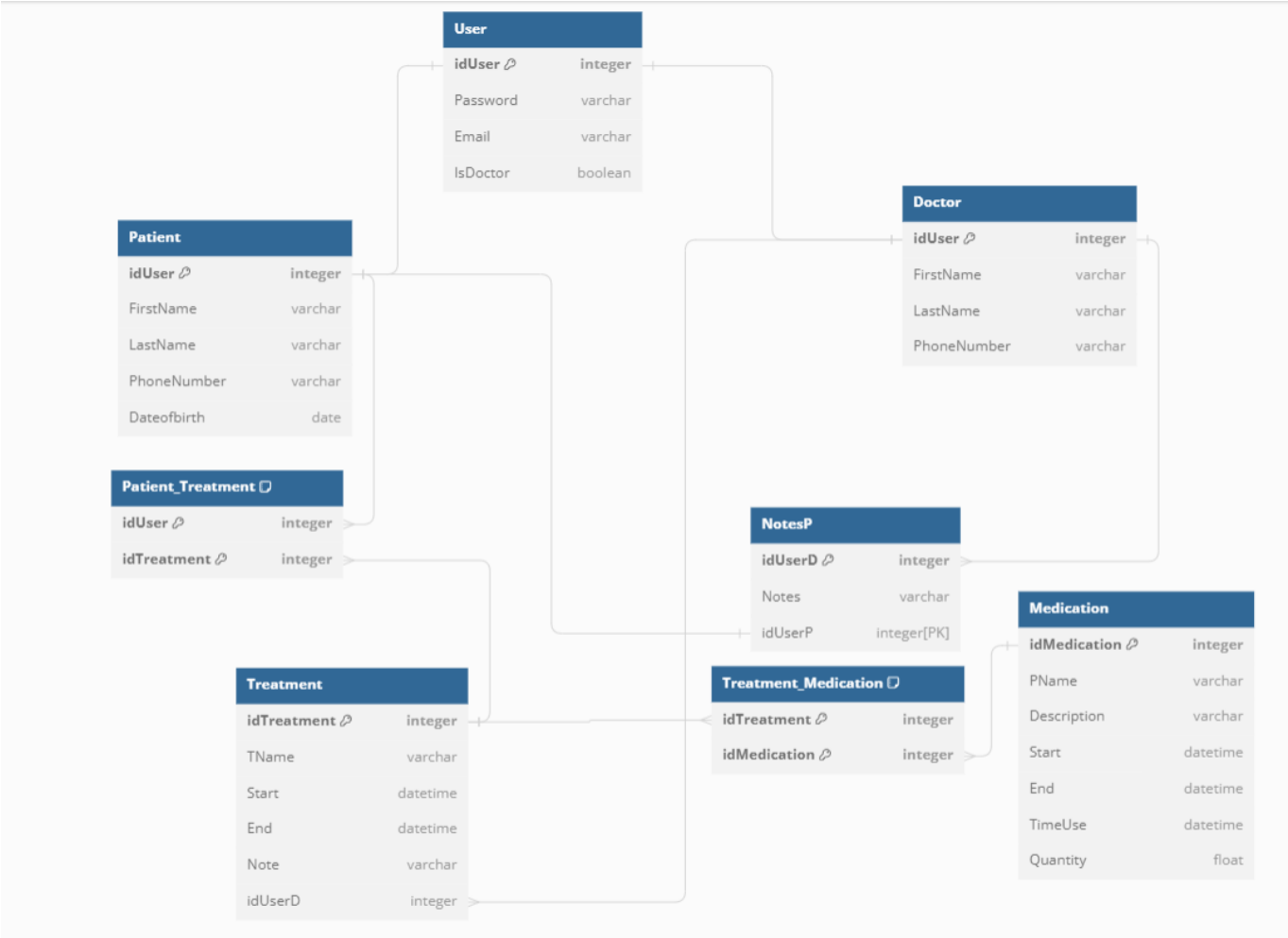

Figure 3.4.1 - The database and the relationships in it

4 Performing threat modelling

4.1 Potential Threats Sorted by Priority/Impact

This section examines potential threats to the MedTraker system, classifies them according to importance and impact, identifies data flows and interfaces that may be vulnerable, and maps these threats to pertinent use cases. Understanding and reducing security vulnerabilities within the system depend on this study.

4.1.1 High-Priority Threats

External Attacks

- **Interface:** Internet-facing components.
- **Impact:** Data breach, unauthorized access.
- **Mapped Use Cases:** User authentication, data transmission, and remote access.

Data Interceptions

- **Interface:** Data transmission channels.
- **Impact:** Data tampering, eavesdropping.
- **Mapped Use Cases:** Data transmission and storage.

4.1.2 Medium-Priority Threats

Insider Threats

- **Interface:** User authentication and authorization.
- **Impact:** Unauthorized data access, data leaks.
- **Mapped Use Cases:** User authentication, data access, and patient record management.

Denial of Service (DoS)

- **Interface:** Internet-facing components.
- **Impact:** Service disruption, system unavailability.
- **Mapped Use Cases:** Remote access and system management.

4.1.3 Low-Priority Threats

Data Corruption

- **Interface:** Data storage and retrieval.
- **Impact:** Data inaccuracies, patient safety risks.
- **Mapped Use Cases:** Data storage and retrieval.

Unauthorized Access

- **Interface:** User authentication.
- **Impact:** Unauthorized data access, privacy breaches.

- **Mapped Use Cases:** User authentication and patient record management.

4.1.4 Threat Mitigation

The MedTraker system will use a variety of security mechanisms, including strong user authentication, data encryption, access controls, routine security audits, and disaster recovery planning, to reduce these possible dangers. In order to stop internal threats, user education and training will also be essential.

The safety and integrity of patient data within the MedTraker system can be ensured by recognizing and prioritizing these threats so that appropriate security measures can be put in place.

4.2 Risk Assessment Methodologies

We may make use of existing procedures that offer systematic approaches to identifying and managing potential hazards to conduct an extensive risk assessment for the MedTraker system. There are several approaches to take into account:

- **Attack Tree:** Attack trees are a hierarchical visual representation of potential threats and weaknesses. They enable us to methodically examine potential attack routes, comprehend them, and pinpoint system vulnerabilities.
- **DREAD:** A risk assessment approach called DREAD (Damage, Reproducibility, Exploitability, Affected Users, Discoverability) assigns numerical values to various characteristics of a threat, allowing us to rank threats according to their likelihood and possible impact.
- **STRIDE:** A threat classification approach called STRIDE (Spoofing, Tampering, Repudiation, Information Disclosure, Denial of Service, Elevation of Privilege) classifies threats based on their characteristics. It aids in locating and addressing particular security issues.
- **PASTA:** Using attack simulations and threat analysis, PASTA (Process for Attack Simulation and Threat Analysis) is a risk assessment approach that offers a systematic framework for finding, assessing, and reducing threats.

The specific goals and requirements of the MedTraker project will determine the best risk assessment approach to use. Every methodology provides different perspectives and methods for identifying and reducing security issues.

4.3 Countermeasures and Mitigation Measures

From this 4 methods, we chose to use the Attack Tree. We have founded a series of countermeasures and mitigation steps which need to be implemented in response to the potential security concerns discovered through our risk assessment methodology to strengthen the security and integrity of the MedTraker system.

4.3.1 Attack Tree Mitigations

- **Implement Strong Access Controls:** Enforce strict access controls to ensure that only authorized users can access sensitive data and system components.
- **Data Encryption:** Encrypt sensitive data both in transit and at rest to protect against eavesdropping

and unauthorized data access.

- **Incident Response Plan:** Develop a comprehensive incident response plan to mitigate the impact of potential attacks and data breaches.

These defenses and mitigating actions are intended to deal with particular security issues and strengthen the MedTraker system's overall security posture. A secure environment for healthcare data will require ongoing monitoring, updates, and user education.