CS-UH 2012 Software Engineering

Fall 2023

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Group 4

EZMedi

Software Requirements Specification Document

1.1 Features

Purpose:

The system is developed with patients with chronic diseases in mind.
It aims to effectively allow patients with chronic diseases to better manage their medications and facilitate medicine-taking for patients. It accomplishes that through a reliable and user-friendly system that identifies medication through barcode scanning and an effective reminder system that reduces the possibility of missing dosages.

The Systems criteria Specifications (SRS), aims to provide developers the direction they need to design and implement software that satisfies all requirements given. It will only focus on the final requirements.

1.2 Scope: What you will implement in the system

Define the scope of the system under consideration by:

a) identifying the system to be produced by name;

b) referring to and stating the results of the earlier finalized needs analysis, in the form of a brief but clear expression of the user's problem(s). It explains what the system will and will not do to satisfy those needs;

c) describing the application of the system being specified. As a portion of this, it should describe all relevant top-level benefits, objectives, and goals as precisely as possible.

EZMedi is a mobile application that allows patients to access information regarding their medication and generate reminders. The system is primarily intended to connect users with a list of their own medications and reminders.

The system is designed to help the users to take their medications on time and better manage their medications. The system should provide accurate medicine information to users.

It is not meant to be integrated with other health providers at this stage or utilized for healthcare providers' own records.

1.3.1 Product Perspective:

Define the system's relationship to other related products.

If the product is an element of a larger system, relate the requirements of that larger system to the functionality of the product covered by the SRS.

If the product is an element of a larger system, identify the interfaces between the product covered by the SRS and the larger system of which the product is an element.

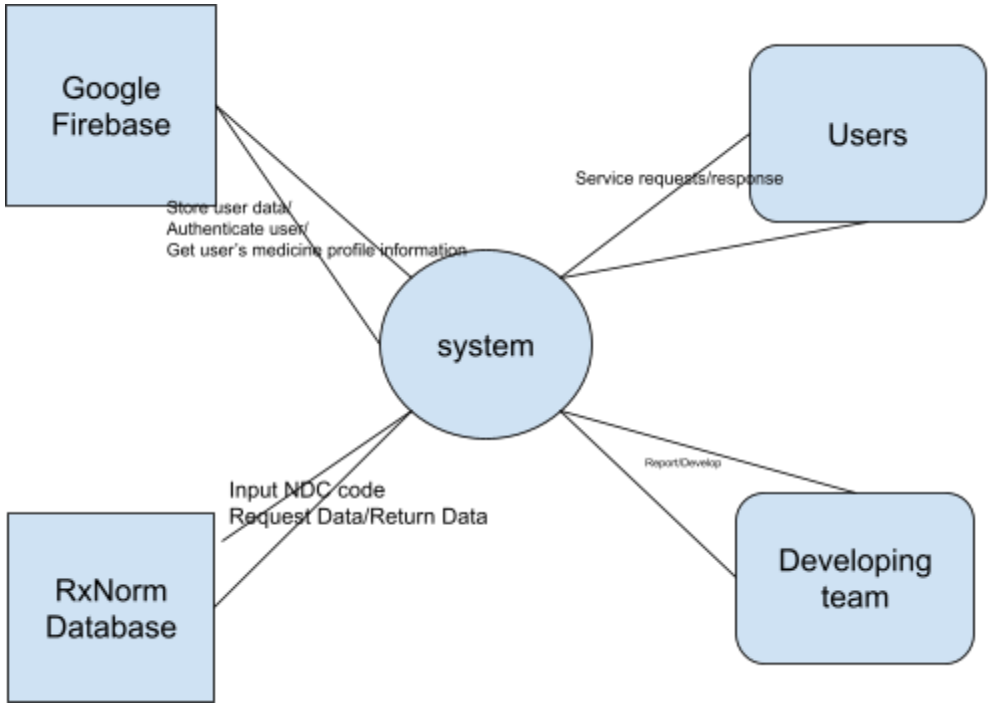
Consider a block diagram showing the major elements of the larger system, interconnections, and external interfaces. This is an excellent place to draw the context diagram that we introduced in Lesson 2.

Integrate with outside API:

Google firebase database: cloud storage to store the user account information and user's medication library of their profile.

Medicine Database:

RxNorm medicine information API: the source of medicine information, which free and easy to access. It ensures the system provides accurate medication data, such as the medication name and the instructions for use. It maintains an up-to-date database of drug information.



1.3.2 Product Functions:

Provide a summary of the major functions that the software will perform. For example, an SRS for an accounting program may use this part to address customer account maintenance, customer statement and invoice preparation without mentioning the vast amount of detail that each of those functions
requires.

User Authentication: Login Page with email and password verification

User registration: Register Page with email, username and password verification

User Logout: The user could quit his or her account.

Medicine data fetch: connect to RxNorm database and fetch data by input medicine NDC code.

Medicine Identification: Barcode Scanning using the camera and returning medicine information. Users could choose to add it to the personal profile - personal medicine library.

Medicine Input and Search: Input the name and the company of the medicine and return medicine information. Users could choose to add it to the personal profile - personal medicine library.

Medication Library Management: Edit/View a list of medications including information such as medication name, dosage and frequency.

Medicine Reminders: Opting in for Medication Reminder and Entry of Details, setting the time for the medication and it will push notification on time.

Reminders Edit: Able to check and edit the reminder in the medical profile.

1.3.3 User Characteristics:

Describe those general characteristics of the intended groups of users of the product including characteristics that may influence usability, such as educational level, experience, disabilities, and technical expertise. This description should not state-specific requirements, but rather should state the reasons why certain specific requirements are later specified

To begin, users have chronic diseases and no specified age range (young adults to seniors). It is expected that the user base has limited technical knowledge; the system must be very simple and straightforward to use. The system should provide clear instructions and UI design.

The system could also expect a higher share of users with disabilities as it is oriented towards patients with chronic diseases so integrating accessibility features within the system is vital. Education backgrounds may also vary with some users having limited formal education which also reinstills the importance of having an intuitive and very simple system to use.

Currently, the system is targeted towards English speaking users. Language accessibility is also very important as users may have very different levels of proficiency in the application's language.

We are taking considerations to different user languages and technical backgrounds, which are very important during our design in user interface design, language localization and accessibility features to ensure a smooth user experience.

1.3.4 Limitations:

Provide a general description of any other items that will limit the supplier's options, including:

a) regulatory requirements and policies;

- HIPAA: We have to follow the HIPAA to preserve the data of the users and patients.
- ISO/IEC 27001 standard for information security management systems.
- HON code principles: The principle ensures our system provides correct information about the medicine to the users.
- ISO 13485:2016: This is a standard set for any sort of medical device that ensures quality and safety in their manufacturing (ISO.org).

b) hardware limitations (e.g., signal timing requirements);

- iOS application wifi connection permission
- Camera access permission and notification permission (to scan through camera input and pops up reminders for users.)
- Camera quality when scanning the barcode (for faster recognize)
- Signal Timing Requirements
- The type of CPU and GPU of the mobile device
- Available memory and storage of the mobile device
- Network connectivity, support 4G and 5G (available to search online and connect to RxNorm API)

c) interfaces to other applications;

The system will connect to the RxNorm API, a medication database's API which allows the system to obtain medication information and ensure the accuracy of it. The limitations may be related to the availability of the RxNorm API. Since the system is available for the user 24/7, any interruption in the API service may affect the system's performance to access the medication.

The system will use google firebase to authentication and store user's information, for example, the user's personal medicine library. Because Google's firebase database has integrated user authentication and encrypted storage, there is no need to worry about user data leakage. The user's password will be encrypted upon registration. Our user data is stored in the America server. Google firebase service is also available 24/7.

d) parallel operation;

The system needs to support multiple users using it at the same time without conflicts. To accomplish it, the system will be able to apply Multithreading, so that we could provide services to multiple users at the same time.

e) audit functions;

Audits may not be able to cover every aspect during the software developing process.

- Implement a background program that automatically checks the system's status every 30 minutes. This ensures that if the system shuts down unexpectedly, it will be promptly detected without user intervention.

f) control functions;

Only authorized users can visit their medicine profile.

Follow the regulation rules such as HIPAA.

h) signal handshake protocols (e.g., XON-XOFF, ACK-NACK);

The system needs to be in accordance with the handshake protocols, such as X3DH, Xon / Xoff, and HTTPS, to ensure the reliability for data transmission.

i) quality requirements (e.g., reliability);

The system shall be 24/7 available and error-free.

The system shall allow a maximum 100 concurrent users and a load of 40–80 transactions. It shall handle up to 10 MB of data in a given amount of time. If the population is exceeded, the system shouldn't shut down but simply remind the user to use the system later.

It should follow the HON standard and optimize the searching algorithm, so that we offer the user accuracy results.

j) criticality of the application;

The system shall be highly reliable, which also indicates the 24/7 availability, as any down time may result in the user not being able to obtain the medication information, and even missing the time to take medications.

k) safety and security considerations;

The system needs to prioritize the safety issues, in particular, the security for user profiles. Compliance with healthcare data protection laws, such as HIPAA is essential. The

system should also include incident response procedures to address security threats timely and effectively. Ensure user data privacy by preventing users from accessing or viewing other users' personal medication profiles. Store each user's profile data separately in the database to maintain data segregation and confidentiality.

l) physical/mental considerations

The system should include designs for accessibility, and meet the diverse needs for users with different physical and mental abilities.

m) limitations that are sourced from other systems, including real-time requirements from the controlled system through interfaces.

The system shall take into account potential restrictions imposed by external systems and interfaces, such as time-sensitive demands from managed systems and limitations resulting from integrating with external applications.

3.1 Requirements Functions:

Define the fundamental actions that have to take place in the software/system in accepting and processing the inputs and in processing and generating the outputs. It may be appropriate to partition the functional requirements into sub-functions or sub-processes. This does not imply that the software/system design will also be partitioned that way.

- Input Handling Function:
    - Different input method: Barcode scanning or manual input.

    - Input data verification: Verify that the input data is correct, ensuring the barcode is valid and rejecting invalid inputs.
    - Structured input format: Ensure that the input data is in a structured JSON format.
- Input with Barcode Scanning:
    - Camera view: Automatically scan the barcode in the camera view when a user selects barcode scanning input and opens the camera on the device.
    - Database inquiry: If recognize an input barcode from the scanning, Search the corresponding medication data in the RxNorm API with the scanned barcode.
    - Data Extraction: Retrieve the data associated with the scanned barcode.
    - Data Transformation: Convert the retrieved data into a standard format string, and display on the user interface.
- Manual Input:
    - Input validation: Ensure the manual input is in the correct string format.
    - Database inquiry: Search the corresponding medication data in the RxNorm API using the manually input medicine name data to search for corresponding information.
    - Data Transformation: Convert the retrieved data into a standard format string, and display on the user interface.
- Add medicine reminder:
    - Intelligence reminder: The system would change the name of the reminder to the name of the medicine.
    - Input Time setting: The user should be able to change the time and the frequency of the reminder for this medicine, it could be input a standard time format or

select the date and time. And the system would send a notification to the user on time.

- Reminder deletion: The user could delete or suspend a reminder of the medicine in the medicine personal profile.

3.2 Performance Requirements:

The system shall be able to support up to 100 simultaneous users connections using the application without significant degradation in performance using Google Firebase Spark Plan.

The system should be able to handle up to 360 MB data transfer per day without experiencing performance deterioration.

The system should be able to support up to 100 concurrent users and a greater load of 40–80 transactions per minute when the system is at its peak workload condition. It shall handle up to 10 MB of data in a given amount of time.

The System shall identify the medicine through scanning the medicine's barcode in 0.5 second if the medicine is stored in the database.

The System shall react to the interaction of the users within 0.2 seconds.

3.3. Usability Requirements:

- User-Friendly Interface: The system should have a smooth interface with a user-centric approach, featuring a smooth and intuitive interface. This design facilitates quick and

efficient medicine searches. The user interface, including icons and navigation elements, is crafted to be easily comprehensible and accessible, ensuring a seamless user experience.

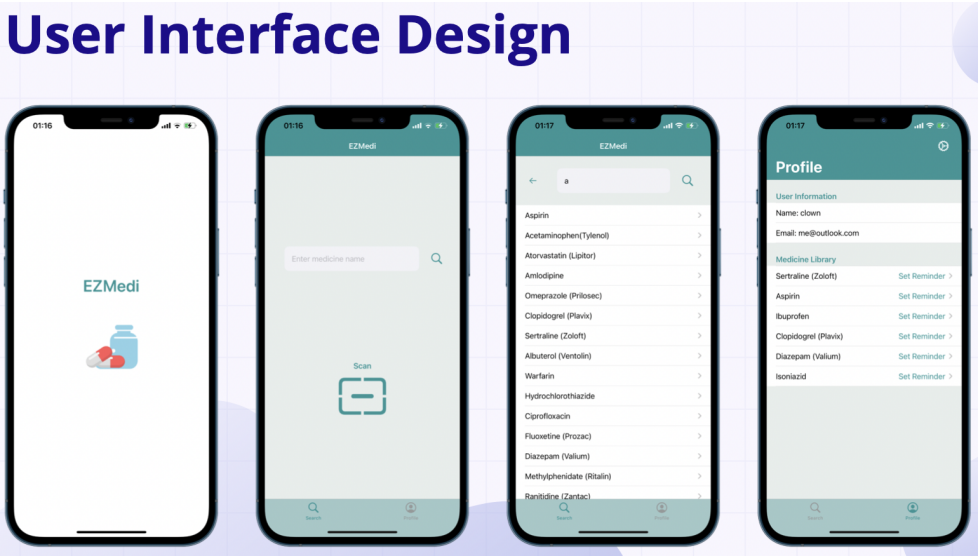
- Responsive Design: The system should be designed to work on various devices with different iOS systems and iOS hardware, suitable for different iPhone screen sizes and iOS systems after iOS 12. This responsive design guarantees that the system provides a consistent experience across a wide range of devices.
- Fast Response Times: The system provides quick responses to enhance user experience. This entails prompt processing and feedback for various user actions, ensuring that the system remains responsive and efficient during use.
- Effectiveness: The system shall accurately identify medications through barcode scanning with a success rate of at least 90%. New users shall be able to complete basic medication setup tasks within 10 minutes of initial system use, with minimal guidance introducing the user about the interface of searching and setting reminders.
- Contextual Adaptability: The system shall adjust reminder timing based on the user's time zone to ensure medication adherence even during travel. The time reminder should change following the phone system’s timing. Contextual adaptability ensures that the system remains effective and reliable in different usage scenarios.

3.4 Interface Requirements:

Interface requirements define all inputs into and outputs from the system.

- Manually Input Searching

    - Description of purpose: Provides a graphical user interface for the user to initiate searches and find the medication they need.
    - Source of input or destination of output: User types in the search bar and the output is the immediate search for medication and displays on the user's interface, which is the medicine detailed information page.
    - Valid range, accuracy, and/or tolerance: Able to get medication information when the user enters certain keywords related to the medication.
    - Timing: User interactions should be promptly handled by the interface with few delays.
    - Relationships to other inputs/outputs: Related to the history searching showing in the search bar.
- Barcode Scanning
    - Description of purpose: Provides the interface for the user to utilize the phone’s camera to scan the barcode on the medication.
    - Source of input or destination of output: Barcode being scanned into the system, and the output is the immediate display of the medication information on the user's interface.
    - Valid range, accuracy, and/or tolerance: The barcode obtained from the user's camera is clear enough to extract the barcode number out of it.
    - Timing: The system should process the barcode information within a few seconds, unless it meets some certain conditions.
    - Relationships to other inputs/outputs: Related to the camera accessibility.



3.5 Logical Database Requirements:

- User ID
    - Frequency of use: high as long as a user register
    - Accessing capabilities: Only the Google Firebase database owner could access the user ID
    - Data entities and their relationships: stored in Google Firebase, links to personal profile
    - Integrity constraints: must be unique for each user for identification.
    - Data retention requirements: retained for historical reference.
- User Profile
    - Frequency of use: high as long as a user register
    - Accessing capabilities: Only the users and the database owner could see
    - Data entities and their relationships: stored in Google Firebase, exist as a class
    - Integrity constraints: must be unique for each user for identification.
    - Data retention requirements: retained for historical reference

- Barcode
    - Frequency of use: high, use when a user search
    - Accessing capabilities: users
    - Data entities and their relationships: the key (NDC code) to use when searching in the RxNorm database, stored in RxNorm database
    - Integrity constraints: must be unique for each medicine.
    - Data retention requirements: retained for historical reference, using as a key for the medicine visit and select data from the database in the user's medicine profile.

3.6 Design Constraints: Define requirements related to standards compliance and hardware limitations.

- Standard Compliance:
    - Regulations: For the protection of patient data and information, the system shall follow the applicable regulatory standards within the industry, including but not limited to HIPAA.
- Hardware Limitations:
    - The system is only developed for the iOS system at the moment.
    - The software should be developed to run on hardware with minimum requirements, including processor speed and memory. To guarantee a smooth user experience, these hardware requirements shall fall within a specific range.

3.7 Software System attributes:

Reliability: The system will not crash on invalid barcode input, instead it will remind the user this seems to be incorrect format, and ask the user to input again.

Usability: Create User-Friendly Interface making it easy to understand and operate.

Accessibility: Make the app accessible to individuals with disabilities, following WCAG standard.

Availability: The app should be available 24/7 with minimal downtime.

Fault Tolerance: Able to handle unexpected errors and not crashing or losing data. When the system unexpectedly shuts down, the finished search is already stored in the database.

Security: Following the data privacy regulations (GDPR, HIPAA), protect user data (such as phone numbers and emails). The system would keep logs in the background recording the user's action.

Data Accuracy: Follow HON code principles and ensure the medication information is accurate and up to date.

Capability: Able to fit with different sizes of phone screen. Adapt systems from iOS 12.

3.8 Additional Information: Additional supporting information that can be considered includes:

Sample Output Format - Medication Data from the database:

Medication Name; Medication Dosage; NDC; drug type; ingredients, synonyms, prescribable information

Sample Input Format - String of the barcode (NDC code) Barcode string;

c) a description of the problems to be solved by the software

- Scan the barcode and receive the information from the barcode.
- Paired the barcode information (UPC-A or NDC code) with the RxNorm medication database. A problem may occur if the system cannot find the

according barcode in the database. The system will ask the user to input the name manually and link the name with the barcode, then put the data in a temporary database and review the data later, and update the database.

- Input the barcode into the database and extract the detailed description of the medication. Solving the problem of an unclear or invalid of the input barcode number. Ask the user to scan the barcode again and perhaps put their device in a lighter place.

d) special packaging instructions for the code and the media to meet security, export, initial loading or other requirements.

The user ID is required when visiting the person's medicine profile.

https://developer.apple.com/ios/planning/

https://zbar.sourceforge.net

https://console.firebase.google.com/u/1/project/ezmedi-2023/firestore/rules

```
rules_version = '2';
    service cloud.firestore {
      match /databases/{database}/documents {
       match /{document=**} {
        allow read, write: if true;
            }
```

}

}

4. Verification: Briefly provide the verification approaches and methods planned to qualify the software/system.

a. Functional Testing: Conduct thorough testing of each function of the system to ensure that it behaves according to the requirements. This includes testing the medication identification, reminder system, user interface, and any other critical functions.
b. Usability Testing: Gather feedback from the target users, such as patients and caregivers, to assess the system's ease of use, intuitiveness, and overall user experience.
c. Performance Testing: Evaluate the system's performance under different load conditions to ensure that it can handle the expected number of users and data without compromising its speed and responsiveness.

5.1 Assumptions and dependencies: List each of the factors that affect the requirements stated in the SRS. These factors are not designed constraints on the software/system but any changes to these factors can affect the requirements in the SRS.
For example, an assumption may be that a specific operating system will be available on the hardware designated for the software product.

a. Assumption that our application is dependent on only IOS instead of Android

b. Assumption that the camera on the users' is fully-functioned for barcode-scanning and the users would guarantee access to the camera.
c. Assumption that the user has relatively stable Internet connection when using our application
d. Assumptions that the third-party APIs (RxNorm) are stable.

5.2 Acronyms and abbreviations: Spell out or define all acronyms and abbreviations used in the documents.

HIPAA: Health Insurance Portability and Accountability Act

HONcode: Health On the Net Foundation

GDPR: General Data Protection Regulation

X3DH: A system for establishing shared secret keys between two parties that is utilized in the Signal protocol.

NDC: National Drug code

UPC-A: Universal Product Code - America