POLITECNICO DI MILANO

MSc Automation and Control Engineering

Software Engineering

Requirements Analysis and Specification Document

For the Application of Medicine Reminder

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1. Introduction

From studying the concept of a medicine reminder through a methodology that goes in line with the identification of the problem and implementing the solution as an application in a convenient platform, the *feasibility study* document provides evident justifications for developing the same. The development of the mobile applications follows different phases of documentation, starting from the *feasibility study* document which explains the feasibility of the concept. Further, the next phase involves the study of requirements to develop the concept that makes the *Requirement Analysis* and *Specifications Document* (RASD). The other phases include the Design Document, Implementation Document, Testing Document, and User Manual, where the information regarding the documents would be mentioned correspondingly in the later phases of documentation.

Here, this document illustrates the Requirement Analysis and Specification Documents (RASD) of the project of the medicine reminder abbreviated and named "MedRem". The application allows the creation of medicine reminders round the clock with a display of the medicine details and stock reminders. RASD discusses the identification of functional and non-functional requirements along with the analysis of different assumptions and constraints. It gives in detail, the results of a User Survey conducted for the study of users and the domain of healthcare with digitalization, identifying some of its properties. Also, it includes the UML modelling, scenarios, and use cases associated with the development of the application. At the end of the document, a short note on the MIT App Inventor's development platform is also mentioned.

2. Health Care & Digitalization

The era of modern medicine started after the Industrial Revolution in the 18th century. With the discovery of antibiotics, a certain level of treatment and medicine was provided. This is the accepted norm all over the world even now with the introduction of the digital revolution. People consume medicines every day and often forget about them also. The old school reminder methodologies were: First, to keep the prescription of the doctor with care and the second was to cut the name on the strip or the box and keep it with care. These methods are flawless but due to any inevitable situation, they can be easily misplaced and worn down.

After the digital revolution, the use of smartphones and other smart devices left a permanent mark on our lives. The application of information and communications technology together bonded to provide digital health interventions which prevent disease and improve quality of life, became a new concept.

Digital health, or digital healthcare, is a broad, multidisciplinary concept that includes concepts from an intersection between technology and healthcare. Digital health applies digital transformation to the healthcare field, incorporating software, hardware, and services. Under its umbrella, digital health includes mobile health (mHealth) apps, electronic health records (EHRs), electronic medical records (EMRs), etc. Mobile health technology - also known as mHealth - is fast becoming the patient-preferred way to access their providers, log in to patient portals, track their steps, and manage their routines and conditions.

These mHealth applications revolve around the point that they enable patients to take control of their health. mHealth apps can help patients with medicine adherence, which is a "reminder" application. The application's main feature is to provide reminders about the different medicines to the users. They can customize it as per the needs which includes an additional description of the medicine, frequency, and interval. A dosage display can also be provided which would further strengthen the application.

Like the identification of requirements, it is equally important to identify the properties of a specific domain, in this case, healthcare, that links to digital applications, which integrates the sub-domain of mHealth applications and particularly "MedRem". The identified properties are included in the application in such a way that it is transformed into suitable components in accordance with the requirements. For following a course of medicines, it is quintessential for the patients to know the information comprised in the prescription and it is the same case for the doctors to proceed with writing prescriptions.

Considering a prescription, the pieces of information that are needed to follow any medicine routine include the name of the medicine, the frequency at which it is taken, and its dosage value. The names could be used to distinguish the drugs from one another. Also, it should be noted that the names can be either generic like paracetamol as used by doctors or pharmacists, or brand names like Panadol, which are provided by pharmaceutical companies. The frequency gives the number of times the medicine should be taken in a day without loss while the dosage gives the number of units (tablets or pills) that should be taken at a time. It is also important to see the time at which the medicines should be taken. Without this information, it is impossible to follow any routines and should be considered a mandatory requirement, which is also needed for the application of a medicine reminder.

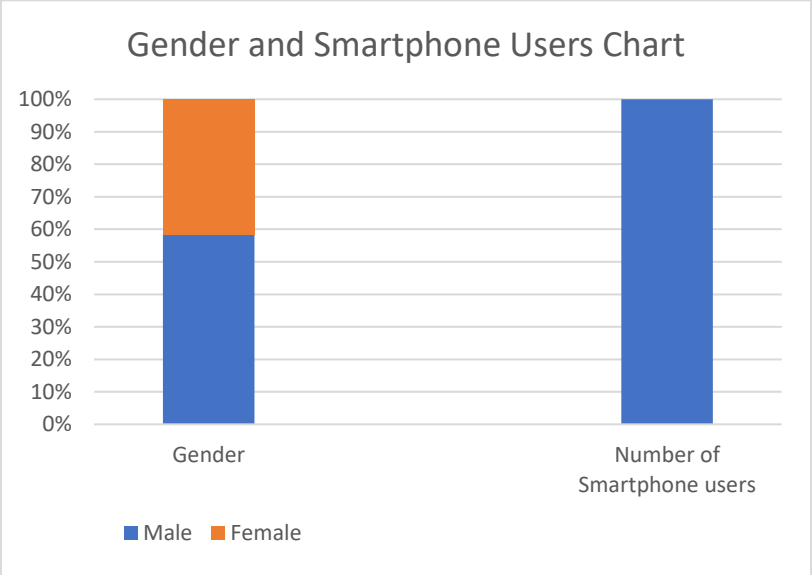
3. User Survey

Medicine reminder applications notify people to take medicines at the right time with prescribed dosages. Anyone can download it on their smartphone and start immediately with it. Taking the medicine at the right time improves the condition as well as the safety against the disease.

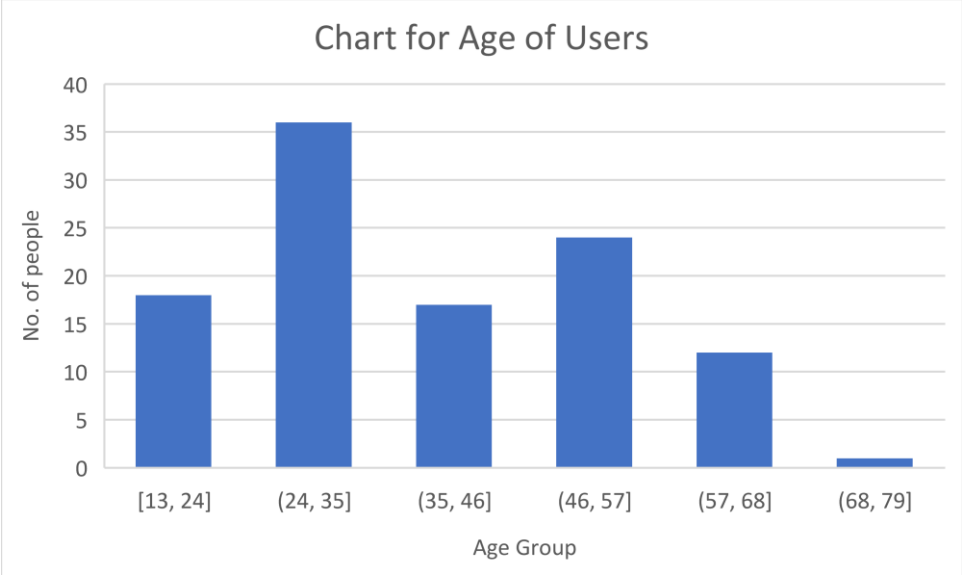
To derive the specifications for the application requires not only the study of properties in the domain but also an interaction with the user which is realized through a user survey. The survey also investigates how users perceive the need for a medicine reminder application.

The survey contains about 10 questions (both in English and Italian) and returns both quantitative and qualitative data for analyzing the user's point of view of such an application. Also, it should be noted that the questionnaire does not need the users to disclose their personal data like name or e-mail ID, therefore making them anonymous. The survey took place in the month of May 2022, using Google Forms as the platform, which further made it easier for link generation and circulating it digitally through social media to friends and family members.

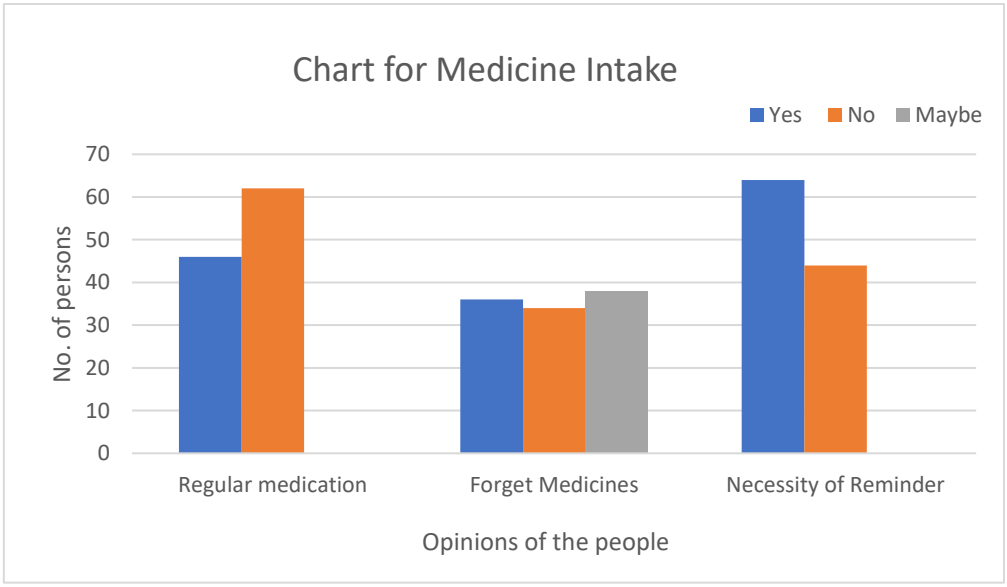
As already mentioned, the respondents were anonymous, and not needed to reveal their personal data apart from their age and opinions about the questions. Altogether, there were 108 responses recorded and analyzed by searching through trends and mapping our findings against existing research.



Of the 108 respondents, 58% were male and 42 % were female. Regarding the age, there were different categories given and it was observed that half of the people were more than 35 and in that, almost 25 people were greater than 50 years. Since the other half of people particularly come in the age group of 21-30 years, because of the distribution of the survey among the students, it should be acknowledged that some interesting nuances about the study are lost as the expectation was to focus more upon the elderly population. In the *feasibility study*, it has been mentioned that the application should be more simple and easier to operate which can be seen as an advantage for older people, identifying them as the target group for the application. Another aspect of the study also says that all the people, even those aged more than 60, possess a smartphone and know how to operate them.

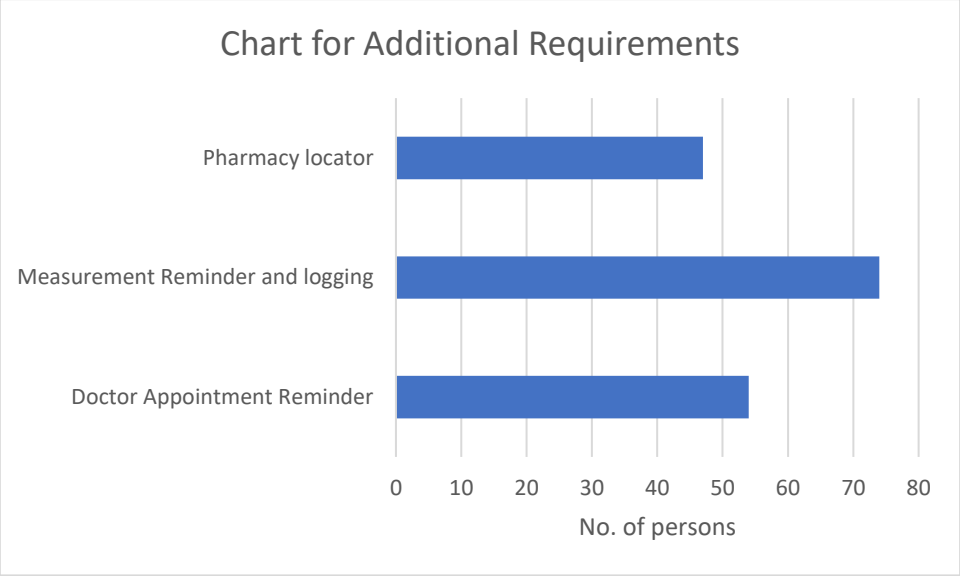


Some of the important aspects of the study revolve around three sections comprising whether the user takes medicines regularly, forgets to take medicines, or the necessary reminder. About 62 out of 108 respondents, claimed they do not have regular medicines, and this could be primarily because the survey had many participants below the age of 30 with no chronic diseases. The question of being forgetful about taking medicines was responded equally likely with all three answers including an additional option of "maybe", beyond the usual binary answers. The added option makes people doubtful for a moment, tending to the reason for the same, and this scepticism can itself be seen as a sign of being forgetful, making more than half of the people to be categorized as people who fail to remember medicine intake. This is further reflected in the section on whether users need a reminder to make them aware, and more than 60 people wanted to have it.



From the market study conducted for the *feasibility study*, the applications were also analyzed with respect to the features implemented. Some of these features have been implemented by multiple applications and out of those, 3 features were identified as more common, which are Pharmacy Locator, Measurement Logger and Reminder, and Doctor Appointment Reminder. The features listed were given as options to find out the user's perspective about keeping them as additional requirements. Almost 75% of the people have voted for Measurement Logger and Reminder while 50% think that both Pharmacy Locator and Doctor Appointment Reader would be a good addition to the application. Also, there has been another option given for the user to mention any other feature that they think would be more helpful, where a lot of people have commented their own responses, some of them are listed below.

Additional Recommendations
Customized health and lifestyle suggestions along with dietary charts and yoga
Price and current availability of the same medicine in nearby different pharmacies.
Instant doctor appointment. An SOS to the nearest hospital.
Reminder related to Regular medical tests (eg. Lipid profile)
Some cumulative data on how healthy I'm based on (age, bp, BMI, sugar level, blood reports) among your other registered users. I will feel better and in a position of improvement rather than being depressed.
Details about the medicine that I'm consuming and the relative side effects.



The user survey is helpful not only in identifying a few of the requirements but also gave an insight into the users' notion of a medicine reminder. The study also laid the answers to the questions of the target groups for the application and the reasoning for the need for such an application. It shows the expectation of users to adhere to the medicine routines with the help of a reminder and

proves their readiness or acceptance to include a reminder in their day-to-day activities. Thus, complying with medicine routines as prescribed by a medical practitioner. The survey has also proved to be an important checkpoint in the entire process of development, giving space to introspect about how the concept of a medicine reminder can change people's lives.

4. Product Description

The scope of the project is to develop an easy-to-use medicine reminder application that anyone can use. From the market research in the feasibility study and the user survey, it is evident that there are a much smaller number of applications that are compatible with the needs of the elderly population. Here, we would be focussing more on the necessities of older people with comprehensible sequences and simple operations to set reminders for their medicines. In further sections, a systematic approach towards development is considered and taken.

4.1. Product Functions

Some of the major functionalities of the medicine reminder, "MedRem" includes the following:

- Add/Modify medicines: The application needs the user to add the medicine details, successfully set reminders according to required schedules and the necessary dosage at the right time. Also, in cases of change in prescriptions, users must be able to modify the information on medicine or the medicine itself and further, the timings of reminders.

- Showing the medicines: The medicines that are added to the application must be shown as a list, in a display, for the user to be sure of which medicines they are taking. It should be listing out all the information regarding the medicine including the name, dosage, and frequency, at the time when it is added. Also, it is to be noted that, whether the user sets reminders or not, the list of medicines should be displayed, nevertheless.

- Stock Management: During the time of adding medicine details or modifying them, a user could be able to mention the number of pills or the stock of it, to keep in account how many medicines are remaining with them. It can be further added or restocked in case of a change in prescriptions.

- Reminders Management: The addition of medicine details to the application can be accompanied by setting multiple reminders according to the prescription for each medicine. As part of the stock management, a stock reminder can also be set, for it turns on when the number of pills reaches a minimum quantity.

4.2. Assumptions and Constraints

Considering the domain of health care, it is imperative to say that the user should be taking medicines whether for the short term or long term, and have a comprehensible prescription, which lists out the required information of medicine to add in the application. As evident from the User Survey, most people have the know-how of smartphones regardless of their age. Thus, it should be taken as an assumption in terms of the digital domain.

Regarding the hardware constraints, the users should possess a smartphone at least with the minimum specifications. The smartphone need not be connected to the internet or any other connectivity interfaces as it might be required only at the time of installation or update. It should be important that the operating system of the smartphones is Android with a version of 4.0.0 or above as per the software constraints of the development platforms. The application does not deal with any personal data other than information on medicines and will be stored in the smartphone itself.

5. Scenarios

1) Dr. Riccardo is an emeritus professor. He has many meetings and affairs in his daily routine. In his busy schedule, he forgets and gets confused to take regular medicine for different ailments and ends up feeling tired. Noticing the situation, co-workers Sara and Francesco told him about the “MedRem” application. Using the app, now he can take medicines effectively and remain healthy.

2) Francesca was recently diagnosed with high blood pressure. She was recommended to download the “MedRem” application by the doctor, as she might forget medicines. Hearing that, Francesca downloaded and registered all her medicines in the application.

3) Mr. Vincenzo is a government-assigned lawyer at the tribunal court of Milano. His irregular eating habits lead to the diagnosis of high cholesterol. He knew about his workload due to which he will forget about his medicine. Knowing this, he went through the play store and came across the” MedRem” application. He took the application as “his lawyer” for the cholesterol.

4) Eduardo is diagnosed with diabetes where he must take insulin by a pump. Being a teenager and due to his carefree and irregular lifestyle, he forgets to stick on to the routine. The “MedRem” application was suggested by his friend Lorenzo and when he explored it, the application was found to be helpful for him to set reminders.

5) Federico is a sound engineer working for a very famous band. They travel worldwide to perform shows. In his busy life of traveling and performances, he often forgets to take medicines, which gets him hospitalized. That is when he came across the application of “MedRem” suggested through advertisements. Now, he can take medicines in a very effective manner by setting reminders and keeping the stock of them.

6) Filippo is identified with bipolar disorder at an age of 15. One day, because of his busy schedule, he forgot to restock his anti-depressants. Since he did not take any, he was filled with thoughts of self-despair and emptiness. When Luca had a talk with him, he immediately understood his condition and took him to the pharmacy. To never face such a situation again, Luca suggested the “MedRem” application where he talked about the stock reminder feature. Filippo found it interesting and downloaded it. Now, he never runs out of medicine because of the “MedRem” stock reminder alongside the medicine reminder.

7) Matteo is a chronic bronchitis patient. He was advised by his doctor to take the pump four times a day without fail. But always, he forgets one or at worst two shots of the pump. Scrolling across social media, he got to know “MedRem” in an advertisement. He gave it a shot and fed the pump frequency and time, setting his reminder. Once he was in the office attending a meeting, he forgot to take the pump but due to the reminder by the application, he was reminded. Seeing its effectiveness, he suggested this application to his colleagues also.

8) Alessandro was taking his anti-stress medicine for almost a year using “MedRem”. Because of its effectiveness, he went to the doctor for a visit and was advised to reduce it by one dose per day. He was sure of managing it as the previous but forgot to make a change in his medicine. He modified his medicine as per the new prescription. Now he knows that to take his medicine, a reminder will be given by the application.

6. Use Cases

- Add Medicine:
  INPUT CONDITION
  - The user must be on the homepage.

  EVENT FLOW
  - User opens the application and clicks on the “Add Medicine” button.
  - User fills the mandatory fields and clicks on “Set Reminder” button.
  - Without adding any reminders, the user clicks on “Save”.

  OUTPUT CONDITION

-User adds up a new medicine to the list.

EXCEPTION

-User enters invalid input in any of the fields.

- Show medicines:

  INPUT CONDITION

  -The user must be on the homepage.

  EVENT FLOW

  -User clicks on the “Show Medicine” button.

  -It displays all the medicines fed by the user.

  -Once the user clicks on any medicine (single press), it displays all the necessary information like frequency, reminder time, dosage value, etc.

  OUTPUT CONDITION

  -User was able to see the necessary information regarding any medicine.

  EXCEPTION

  -User can only view one medicine at a time.

- Delete Medicine:

  INPUT CONDITION

  -The user must be on the homepage.

  -The user must have already added medicine

  EVENT FLOW

  -User clicks on “Show Medicine”.

  -User identifies from the list and clicks on the medicine to be deleted.

  -User sees all the information about the medicine.

  -User clicks on the delete option at the end of the screen.

  OUTPUT CONDITION

  -User performed deletion successfully.

  EXCEPTION

  -User can delete only one medicine at a time.

- Modify Medicine:

  INPUT CONDITION

  -The user should be on the homepage.

  -The user must have already added medicine

  EVENT FLOW

  - User clicks on “Show Medicine”.

- User identifies from the list and clicks on the medicine to be modified.
- User views all the information about the medicine.
- User clicks on the modify option.
- Previously filled data is shown to the user and the user can modify any data.
- User modifies the necessary fields and clicks on “Save”.

OUTPUT CONDITION

-User performed modification successfully.

EXCEPTION

-User entered invalid input in any field while modification.

- Set medicine reminder (when the medicine is added for the first time)

INPUT CONDITION

-The user must be on the homepage.

EVENT FLOW

-User selects the “Add medicine” option and fills in the mandatory details.

-User toggle ON the Medicine Reminder switch.

-User provides the reminder time or interval.

-User clicks on “Save”.

OUTPUT CONDITION

- User set a new reminder for his medicine.

EXCEPTION

- User enters invalid input in the field.

- Set medicine reminder (when the medicine is added already)

INPUT CONDITION

-The user must be on the homepage.

-The user must have already added medicine

EVENT FLOW

-User selects the “Show medicine” option and from the list chooses the medicine.

-User selects the “Modify” option and toggle ON the Medicine Reminder switch.

-User sets the reminder time or interval.

-User clicks on Save.

OUTPUT CONDITION

-User set a new reminder for his already available medicine.

EXCEPTION

- User enters invalid input in the field.

- Modify medicine reminder

  INPUT CONDITION

  -The user must be on the homepage.

  -The user must have already added medicine and set reminders

  EVENT FLOW

  -User selects the “Show medicine” option and from the list, chooses a medicine.

  -User selects the “Modify” option and modifies the reminder time or interval.

  -User clicks on “Save” and the modified reminder is set.

  OUTPUT CONDITION

  -User modifies the reminder for a particular medicine.

  EXCEPTION

  - User enters invalid input in the field.

- Set stock reminder (when medicine is added for the first time)

  INPUT CONDITION

  -The user must be on the homepage.

  EVENT FLOW

  -User clicks the “Add Medicine” option and fills in the mandatory details.

  -User clicks the “Set Reminder” and toggle ON the Stock Reminder switch.

  -User provides the No. of pills and minimum quantity value for the stock reminder activation.

  -User clicks on “Save” and the new stock reminder is set.

  OUTPUT CONDITION

  -User set a new reminder for his medicine.

  EXCEPTION

  - User enters invalid input in the field.

- Set stock reminder (when medicine is added already)

  INPUT CONDITION

  -The user must be on the homepage.

  -The user must have already added medicine

  EVENT FLOW

  -User clicks the “Show medicine” option and from the list chooses the medicine.

  -User clicks the “Modify” option and toggle ON the Stock Reminder switch.

  -User adds the No. of pills and minimum quantity value for the stock reminder.

  -User clicks on “Save” and the new stock reminder is set.

OUTPUT CONDITION

- User set a new reminder for his already available medicine.

EXCEPTION

- User enters invalid input in the field.

- Restock: (Receiving stock reminders, so refilling will stop them)

INPUT CONDITION

-The user must be on the homepage.

-The user must have already added medicine and set a stock reminder

EVENT FLOW

-User clicks the "Show Medicine" option and from the list chooses a medicine.

-User selects the "Modify" option and chooses the restock option.

-User fills the "No. of Pills to be added" with the number of pills he bought.

-After filling in the certain value, the user clicks on "Save".

OUTPUT CONDITION

- User restock the amount of medicine
- User modifies the reminder for a particular medicine.

EXCEPTION

- User enters invalid input in the field.

7. Requirements

7.1. List of Functional Requirements

No.	Requirements
1	System allows users to add medicines and their related information
2	System displays the list of medicines to users
3	System allows users to modify the information of medicines.
4	System allows users to delete medicines.
5	System allows the user to turn on/off the medicine reminder
6	System allows users to set reminders for their medicines
7	System allows users to change the time of the reminders for their medicines
8	System allows the user to turn on/off the stock reminder

9	System allows users to account for the stock of medicines
10	System allows users to add reminders for stock of different medicines
11	System allows users to modify the stock reminder
12	System allows users to modify the quantity of stock

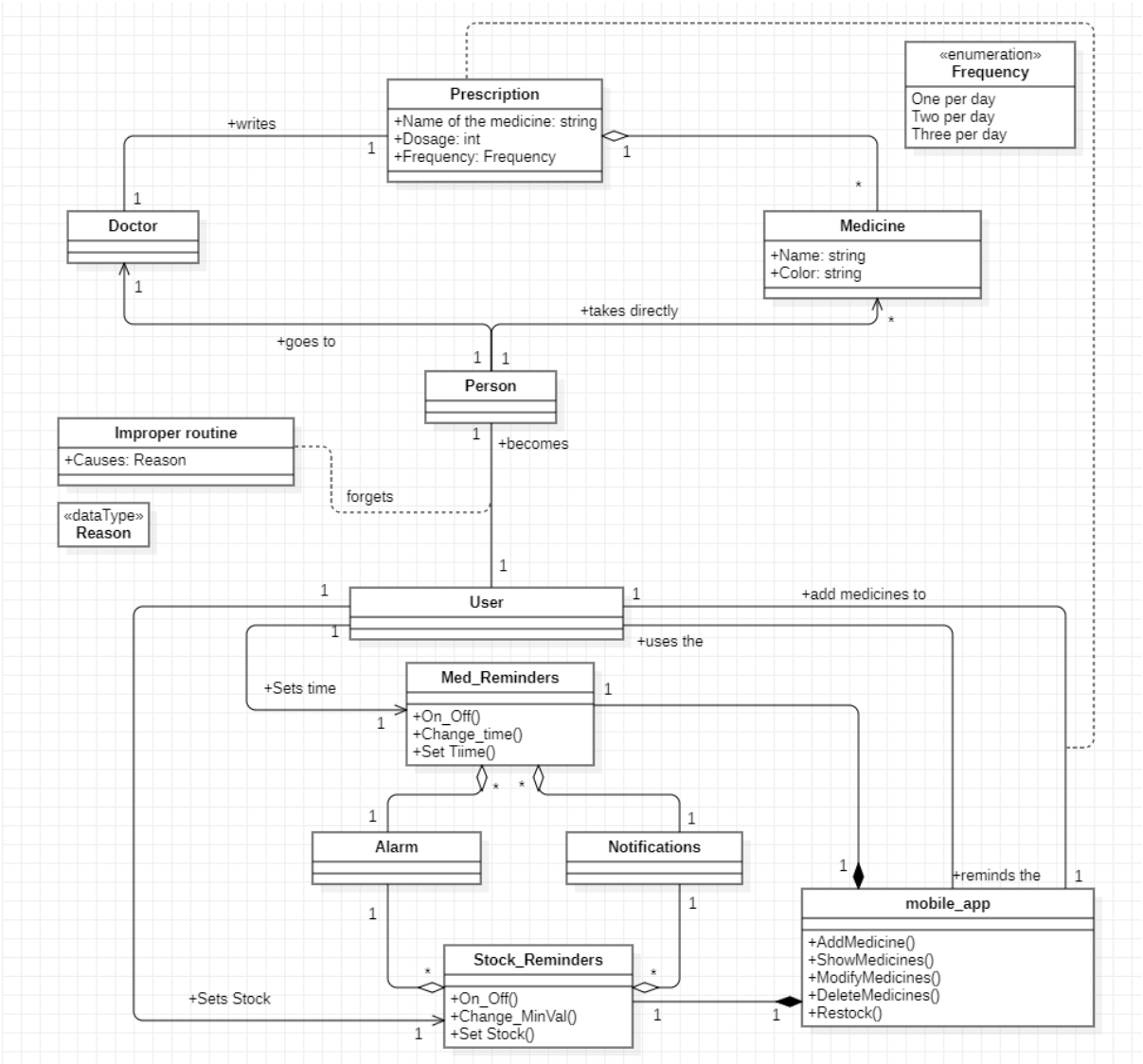
7.2. Additional Specification

The user survey pointed out that the additional requirement as per the users' expectations goes to the **measurement reminder and logger**, in which most of the people gave their responses. As part of this functionality, the users will be able to enter the data on the kind of measurements and set reminders for the same. On the notification of reminders, the user can measure the parameter by themselves and enter the data on the current measurement, in the app which adds the measurement to a database. This data could be further extracted as an excel sheet or can be displayed as a graph. As of now, this functionality is put on hold to be implemented, due to time constraints and can be included in future works.

8. UML Diagram

This UML diagram mentioned describes a person who visits a doctor. The doctor performs a diagnosis and gives a prescription for some medicines which contain the name of the medicine, frequency as well as dosage. The person starts to take the medicines directly following the prescription. But due to some reason, he couldn't follow up on that schedule which led to the download of an application that sets medicine reminders.

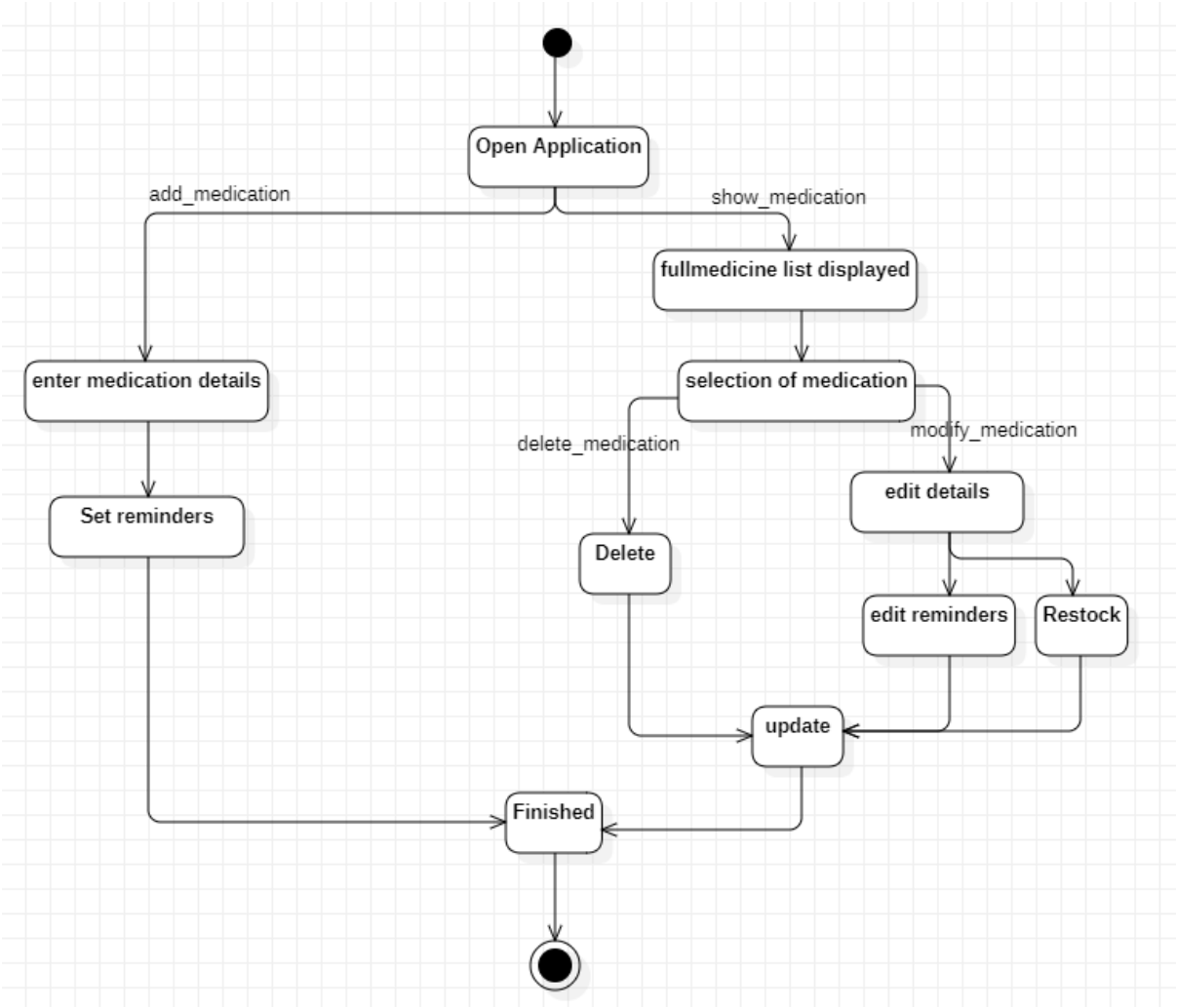
The person becomes an active user of the application, where he can add, show, modify and delete medicines. In the application, there are two types of reminders namely **medicine reminders** and **stock reminders**. The user can set and modify the reminders individually which gives alarms or notifications for the intake of medicine. The restock is a handy option to edit the user's medicine stock.



9. State Chart Diagram

The state chart diagram represents the different functionalities of the application. It shows the different states the application must go through to access or perform any function by the user. The add medicine feature is the first step for the user to perform. Fields like name, frequency, and dosage are provided to fill and set reminders for the medicine.

Once a medicine is added, the user can perform a show, modify, or delete it. The show medicine displays all the names in form of a list. Through selection, the user performs modification and deletion if necessary. The restock option is quite useful for the user to edit the current stock value. Once the user completes a particular operation, it is saved, and the updated list is on the display.



10. Conclusion

The purpose of this document was to analyze the functional and non-functional requirements of the proposed system and provide an integrative view of the state of art of digitalization in the healthcare domain. To identify potential benefits of the previously introduced digital technology, the analysis was broadly classified into user surveys, product descriptions, requirements, use cases, and scenarios.

The user survey gives an idea about the target group of people on which the application is focused on. From the users' opinions, the necessity of such an application is further explained. The sections of product description and requirements throw light on, what the application provides for users in terms of functionalities and non-functional requirements such as performance, and scalability. etc, as taken from the user survey and preliminary analysis. The UML Diagram gives the sequence of functions in the application, to implement in a structured methodology. The UML is also associated with the Use Cases, in such a way to analyze the sequence of functionalities from a user's

perspective, while the Scenarios show different situations in which people start using the application of MedRem and how it changes their lives.

The impact of digital transformation is felt across all aspects of health care, helping enable easier access to care, improving quality, and decreasing the cost of care. A domain like healthcare is accepting this system which is essential for its growth and strengthening customer relationships. Using this, customers will be able to transform their lives enabling easier access to resources, improved quality, and decreased cost of health care.

In conclusion, the document shows that the comprehension of digital technologies in the healthcare domain encompasses the digitalization of information. The user survey for our proposed system allowed us to have different insights and allowed the shift towards better healthcare models, redefining experience and improving outcomes for patients, providers, and insurers.

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