

Department of Electrical and Computer Engineering,
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**ELG 6131: Advance Software Engineering in Biomedical
(E-health, m-health, Telemedicine)**

Project Deliverable: Detailed design & Literature Review

Project Title: *“Meditech – E-health Platform”*

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*This **Detailed design and Literature Review** is Submitted to Professor Ali Hassan Abbas in partial fulfillment of the requirements for ELG 6131: Advance software in Biomedical course.*

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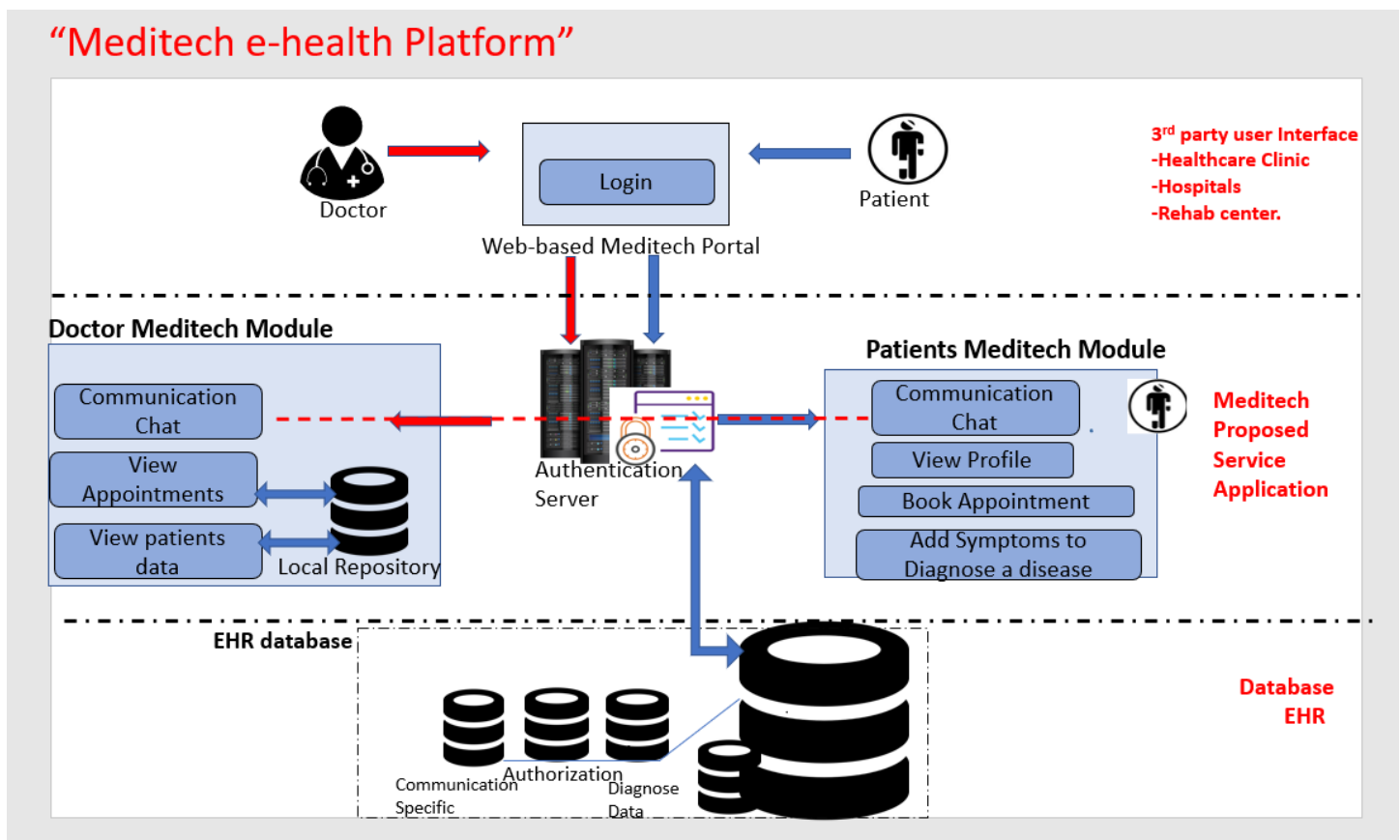
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1. Architectural Design of Web-based Meditech Platform:

Web-based Meditech is introducing a platform to support the Electronic based-health facilities and telemedicine system which simplify and help to co-ordinate the effective home health care function of Hospitals, Clinics, or any Rehab centers. Meditech healthcare is designed as a platform to serve the patients with the best e-healthcare available that are divided in three levels: User level, Application level, Database Level as depicted in diagram below.

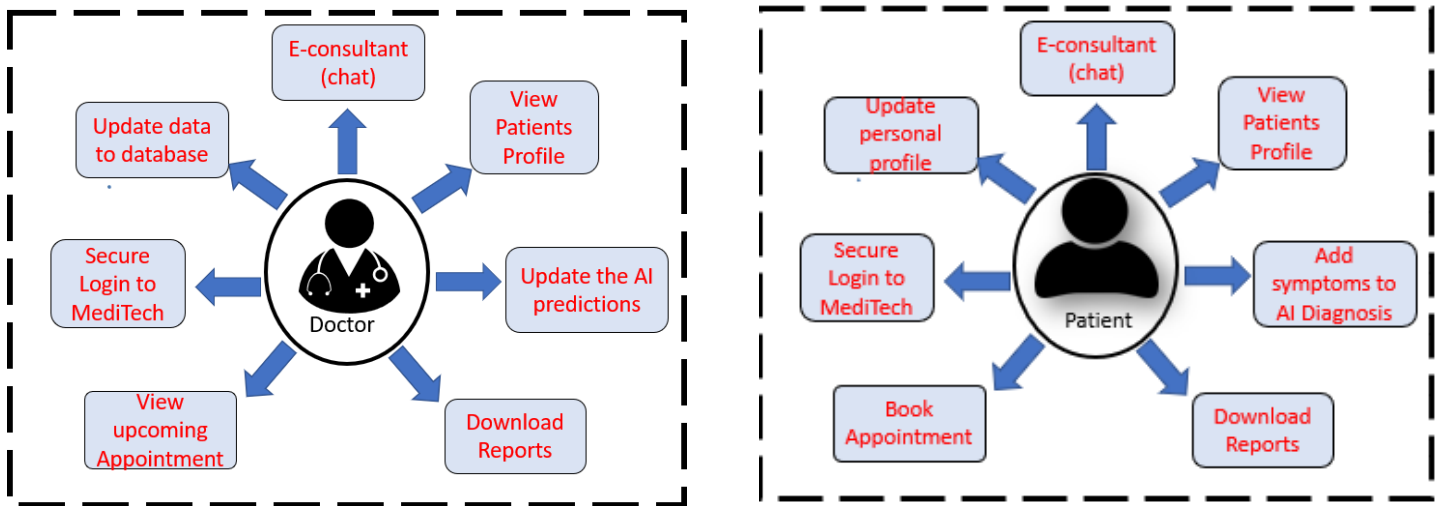
The proposed model not only provides a medical platform but also various technical services which makes e-health more valuable, effective and convenient way of providing healthcare facilities.

Web-based Meditech platform is highly secure due to its feature of Authentication which gives access only to the authorized users and thus makes E-consultancy a reliable service. The main Feature to e-health is that the patients can also communicate with the specialized doctor, thereby minimizing the need of in-person consultancy at hospitals for an improved e-health care service at our vicinity.



1.1 Architectural view of Meditech platform

2. Fundamental Features of Meditech:



1.2 Functionalities of Roles in Meditech

Fundamental features of Meditech platform describes the services and functionality accordance to the role defined in the application. The above diagram defines the various services provided by the Meditech e-healthcare platform to user such as a doctor or a patient. The Following is the detailed Explanation:

1. Secure Login to Meditech:

Members of Meditech can login into the profile in a very secured manner. The model is designed such that the user must prove its identity to the authentication server which will grant access to only authorized users of Meditech, thus the medical records are kept securely, and entity can communicate securely.

2. E-consultancy:

Meditech platform offers a feature called as “E-consultancy” which creates a secure communication channel between the user and patient for exchanging messages. The priority messages are notified to the doctor’s module for a quick response making e-health electronically faster.

3. Patients Profile:

Using the Meditech portal reduces the use of maintaining the paper-based file system and make the record available digitally and in organized fashion. One can view his past records and the medication prescribed in the profile menu.

4. AI Diagnosis:

Meditech offers a Feature to the patients of hospital/clinic who can add symptoms to diagnose a disease and get the prescribed medication through AI using the training dataset. This AI predictions are later consulted by an available doctor and updated if necessary, thus providing the best e-healthcare available.

5. Appointments:

In this feature, patients of a Hospital/clinic can book an appointment through their profile and would be able to visit without having to wait for their turn. The doctor's portal gets notified when a patient tries to book an appointment. He has an authority to accept and send the confirmation about the meeting.

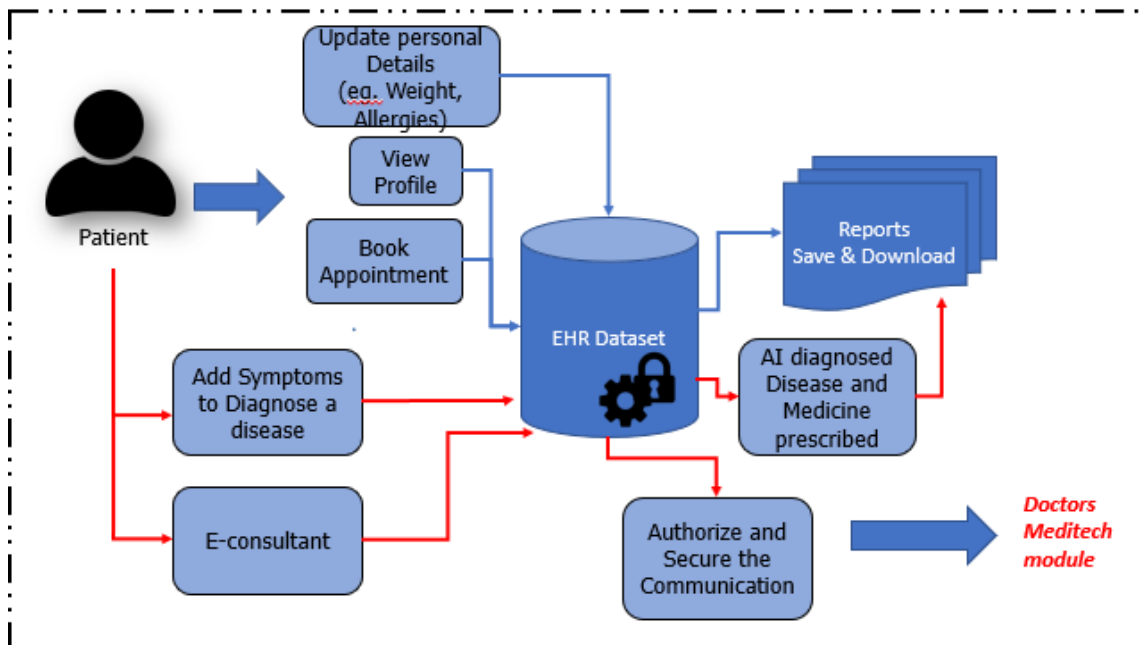
6. Update Personal record:

Patients of Meditech are given an access of updating their personal records such as (weight, age, allergies) or any injuries accidents for an updated profile and doctors' evaluations. Doctors of Meditech can also update the data of patients they have treated, and the medicine prescribed as a documentation to local repository /database.

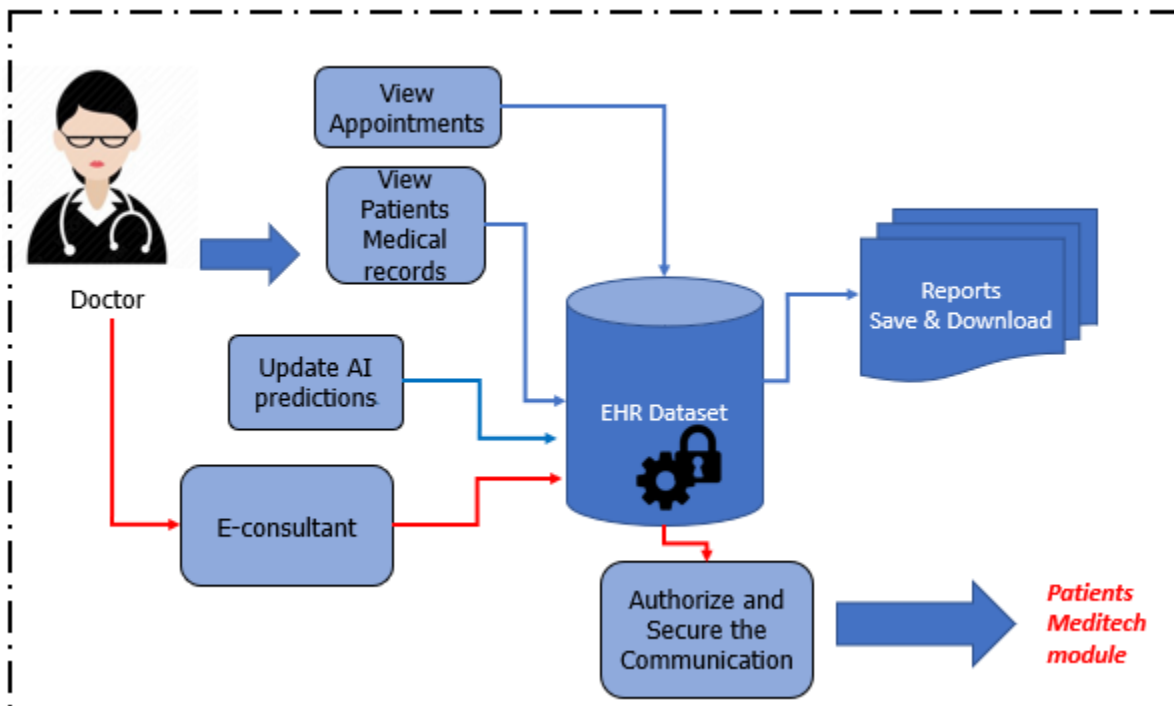
7. Download Reports

Patients are able to save and download an offline copy of their reports using this feature for various purposes like sharing healthcare record with their family doctor or consulting another clinic. The patients are required to agree upon the consent form for sharing the medical records.

3. Sub-system Design of Components:



1.3 Patients Meditech Module (sub-component) Design



1.4 Doctors Meditech Module (sub-Component) Design

Subsystem Component design shown in the diagram above illustrates the internal working of the components for execution of different functionalities proposed in Meditech platform.

Patients Module Component Diagram:

After securely logging into Meditech patient's website a patient can perform certain jobs Such as:

1. View Profile – When user tries to view the personal profile the function is directed to database to fetch the user specific information using session management concept of PHP and then displayed on patient's website. This personal data can be later saved or downloaded for future use.
2. Update Profile- User can update the personal details such as weight, age, allergies which are directly reflected to the database MYSQL and can be viewed by doctor as well as user.
3. Book Appointment- User can provide details such as Problem Description, date and time for meeting etc. and book an appointment with the doctor which will be updated in database and notified to the doctor for confirmation.
4. Add symptoms: The special AI feature of Meditech helps patient to diagnose a disease by just inputting the symptoms which triggers the backend AI training set for prescription.
5. E-consultancy: The secure communication between a user and patient helps to speed up the e-healthcare process and provides support to people at vicinity.

Doctors Module Component Diagram:

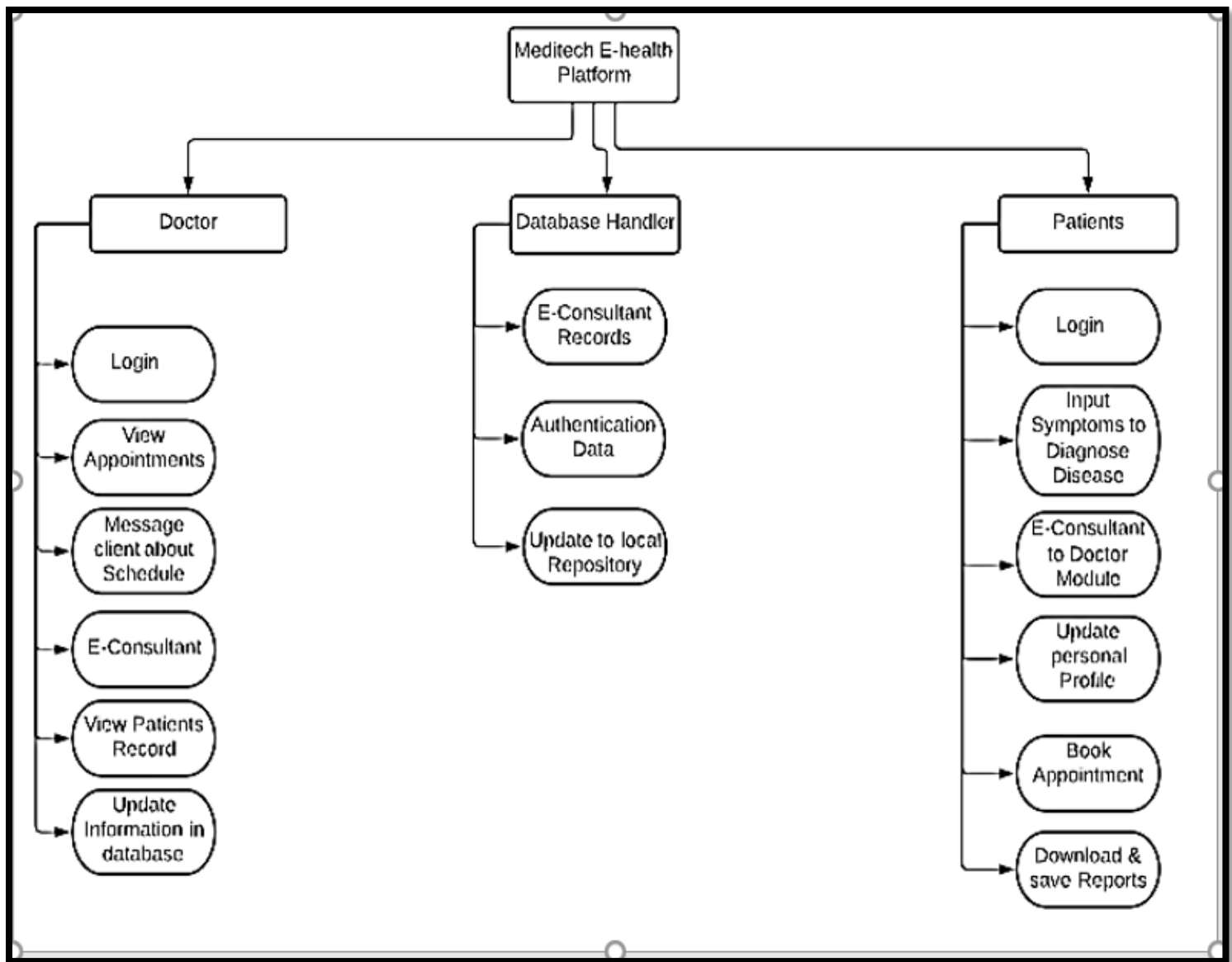
After securely logging into Meditech Doctors website a doctor can perform certain jobs Such as:

1. View Appointments- Doctors portal has a functionality of viewing the upcoming appointments and confirm based on doctor's availability.
2. View Patients Records- Doctor can view all the records of patients he has treated in a very organized way. This organization is done by database management techniques for a user-friendly interface.
3. E-consultancy – E-consultancy is a feature which initiates the communication between patient and user, the doctor's portal during this time can see the patients record for giving a better advice. This communication happens via secure channel with the help of Authentication server.

4. System Decomposition Diagram:

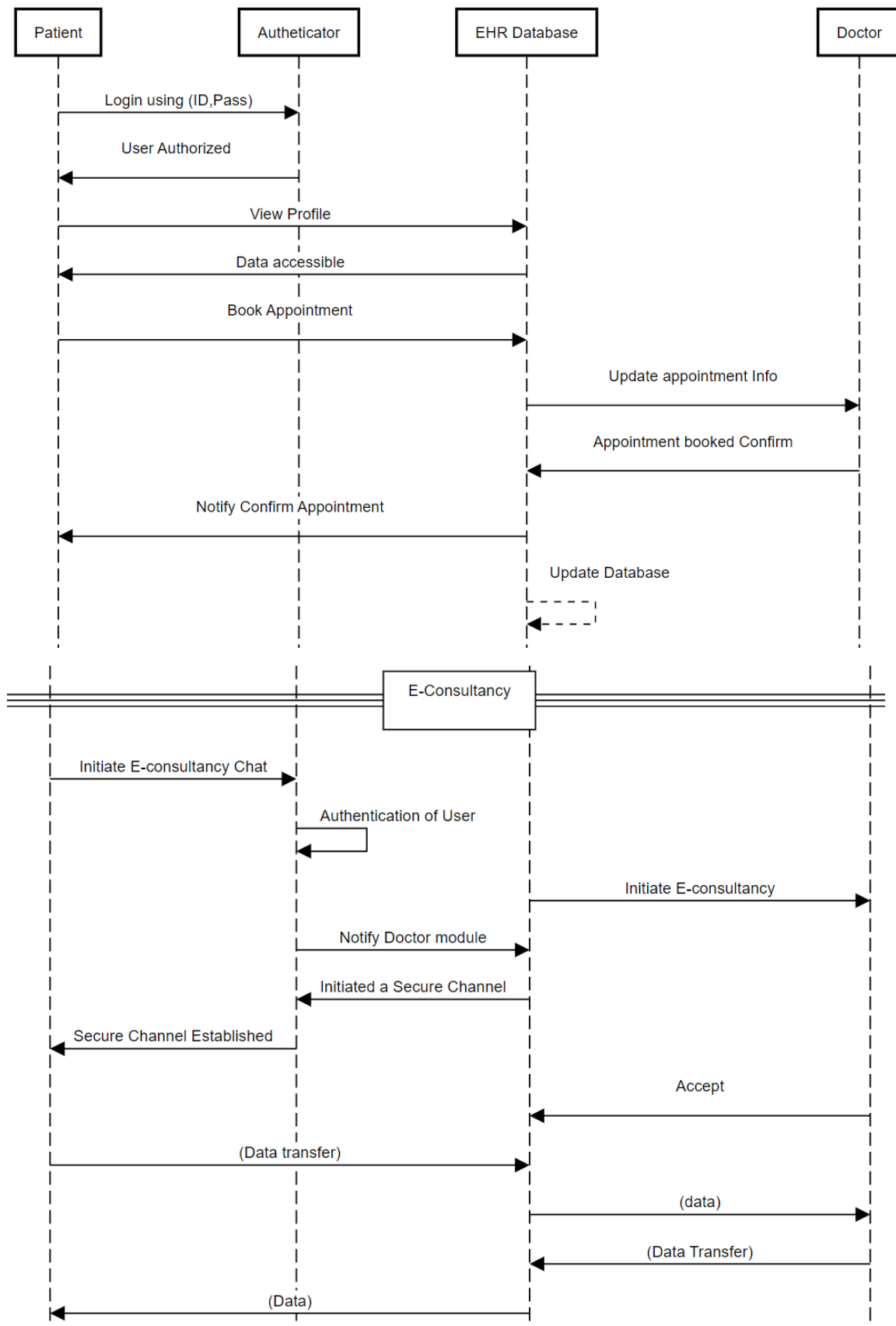
System Decomposition Diagram shown below depicts process of breaking complex functional entities into the smaller functions and sub-components. Similar, Meditech e-health platform is being sub-divided into small sub functional modules which in turn describes the behavior of the system.

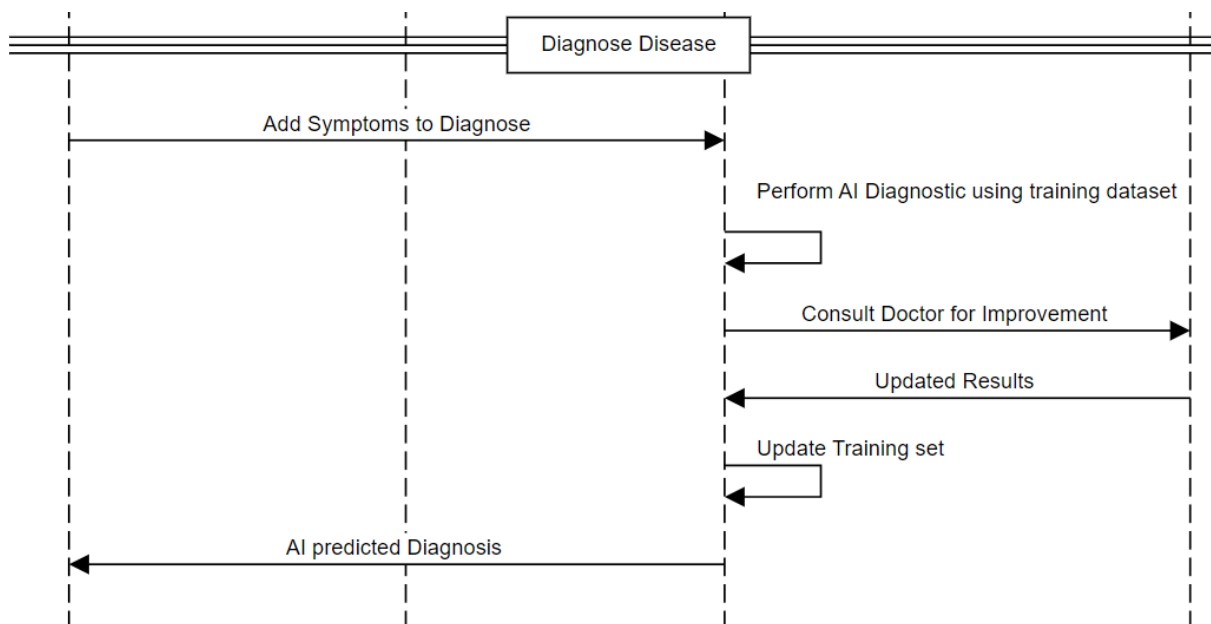
Meditech portal deals with 3 major Modules as shown below: Doctor's Module, Patient's Module and Database handler. They are further sub-divided according to the functions explained in diagram.



1.5 System Decomposition Diagram

5. Interaction and interrelation between the subsystem





1.6 Interaction between Subsystems in Meditech Platform.

6. Evaluation of alternatives (Literature Review):

The literature review is primarily concerned with the approaches taken for developing E-health platform and EHR system that are in being used to support Medical record services. Platform approaches to improve interorganizational integration and eHealth innovation have gained a lot of attention. A variety of platform projects to operate E-health services have been established throughout the world.

However, our approaches of developing Meditech approach will incorporate fundamental features based on the existing features that will enhance the e-health services provided to patients and doctors. This literature survey will survey existing eHealth-platforms and will compare with our existing Meditech E-health platform.

Sr no	eHealth-platform	Type	Source
1	CCS Telehealth Ostsachsen	TSP	http://www.telehealth-ostsachsen.de/
2	openEHR	S	http://www.openehr.org
3	EFA	S	http://www.fallakte.de/
4	Kanta	TSP	http://www.kanta.fi/en/
5	eHealth-Plattform	TSP	https://www.ehealth.fgov.be
6	OpenTele TSP	TSP	http://opentele.org/
7	Danish Health Data Network	DSP	http://medcom.dk/medcom-in-english/other-stuff/the-danishhealthcare-data-network-sdn

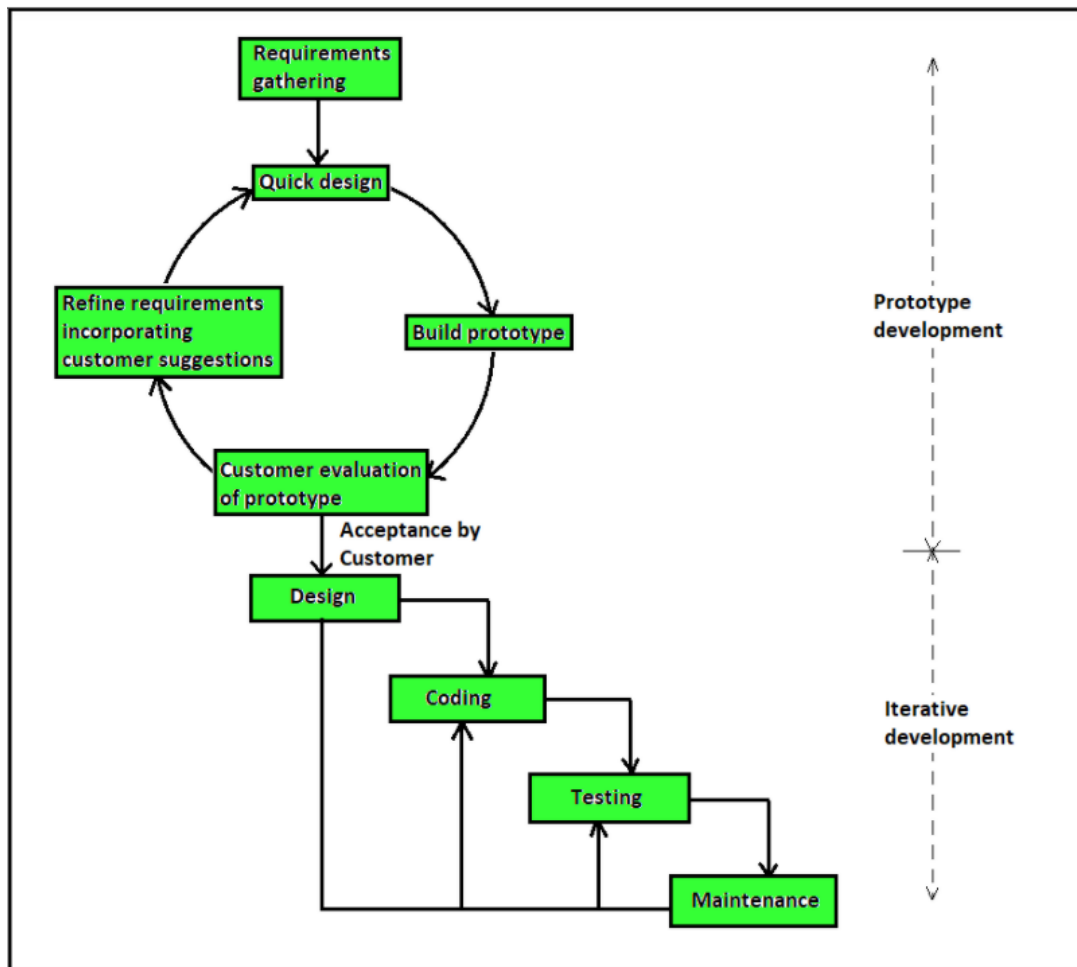
Table 1

In total, 7 eHealth-platforms were identified (see above table 1). All initiators refer to their project with the term 'platform'. First, there are projects such as **EFA** and **openEHR**, which are the norm for centralized (platform-based) systems to be developed. Secondly, there are unique instances of platforms running electronic services that mediate supply- and demand-side consumer transactions, e.g. **Kanta**. They are called the TSP 'Two-Sided Service Systems'. Some of these systems often make it easier for third party providers (e. g. **OpenTele**) to build new eHealth applications.

Thirdly, the last collection of platforms can be interpreted as data exchange platforms that collect technology in the healthcare sector to promote electronic communication. A platform is either assigned a 'S' for platform specification standard, a 'TSP' for two-sided service platform or a 'DSP' for data sharing platform.

7. Architectural development of engineering and prototype models:

We will be following the Iterative Waterfall model approach to develop our MediTech E-health platform. With that approach in place, early development of our project requires an extension of the existing Iterative Waterfall model, hence we will be following prototyping model development which will be an extension of the Iterative Waterfall model.



1.7 Architectural development of engineering and prototype models

Requirement of the Prototyping Model

As our project mostly relies on web-based portal development that involves the development of Graphical User Interface (GUI), using a prototyping model we can experiment with a working user interface so that we can suggest any changes or incorporate any feedback quickly to develop an overall picture of our final product.

The prototyping model will be especially useful for us to test the technical feasibility of developing our E-health platform as it will help us to examine the technical issue associated with product development before we follow the Iterative waterfall model for full-scale development of our E-health platform. The lack of being unfamiliar with the required technology for building the Meditech E-health platform is a great technical risk that we cannot afford. Hence with the use of this approach, we will understand the issues and accommodate the changes in next iteration cycle of the development of the E-health platform.

Projected phases of Meditech E-health platform development:

The Prototyping Model of Meditech E-health platform development has been shown graphically in the architecture diagram figure 1.7.

The software will be developed around two major endeavors –

1. Prototype construction
2. Iterative waterfall-based software development

1. Prototype Construction:

It starts with an initial requirement gathering phase followed by quick designing is carried out and a prototype is built. Once the developed prototype is built, it is then carried out to the customer for evaluation. Based on the customer response, the requirements are enhanced, and the prototype is suitably modified. This cycle of gaining customer feedback and altering the prototype continues until the customer approves the prototype.

2. Iterative waterfall-based software development:

Once the customer approves the prototype, we will proceed with the development of concrete software development for the Meditech E-health platform using the iterative waterfall model approach. The experience that we have gathered from developing the prototype will help us with the development of the actual software. By constructing the prototype and submitting it for user evaluation, many customer requirements get properly defined and technical issues get resolved by experimenting with the prototype