School of Electronic Engineering and Computer Science

Interim Report

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Web application supporting online medical consultancy

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Abstract

Write your abstract here.

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1.Introduction

Write you introduction here.

1.1.Background

Nowadays Information technology and systems enable to solve many problems in absolutely different areas. Examples start with basic day to day routine planning and end with major space discoveries. Question of public health is not an exception in this case. There are already thousands of examples when Information technologies are being used in surgeries, determining diagnosis, supporting life of critically damaged organism. One more example of using information technology in a health care is telemedicine.

Telemedicine is „ … delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities“(**WHO**, 2011:p.9). It has been possible to provide medical services distantly due to the development of Internet as well as new ways for communication some of these are online video calls, emailing, live chats.

According to WHO there has been a substantial increase in number of countries promoting telemedicine through applying policies and strategies in comparison to last 5 years from the moment survey was conducted(**WHO**, 2016:pp.57-60). That may indicate rising recognition of usefulness of telemedicine on national level. But except national or state representatives private organisations also attempt developing full working system to support telemedicine by this making the progress in deployment of telemedicine services quicker.

1.2.Problem Statement

Nowadays quality of medical services being improved constantly by integrating new technology, making new discoveries, finding new solutions etc. Each improvement comes as response to an existing problem. One of the problems I have found out in medicine is limited access to professional opinion that mass public has when it comes to make decision about surgery, treatment and other procedures.

When a person has a problem first thing we expect him/her to do is to go to nearest hospital or regional clinics and request doctor to help him. Doctor will then give list of documents, analysis to be done and then he/she may conclude what is the problem and how to solve it. But how can a doctor know that solution he/she provides is best or one that will solve problem? Of course after years of studying medicine and working in this area he will probably know what should be done in most of the cases to solve existing problem. But we don’t exclude that for some problems that specific doctor or doctors in a specific region may not know the solution. Therefore often when it comes to important issues patients start researching possible treatment, independent opinion, alternative options through reading articles in the Internet, finding other doctors from different clinics, etc. However all mentioned ways to find treatment are limited mostly to local area, financial condition of patient and to popular opinion being shared in the Internet.

As an example of stated above case when local doctors may not know about solution of existing problem let me share my personal experience. From 9 years old I had „flat fleet“ problem, when your foot gets flat overtime. This problem makes very difficult to walk long ways for a long time, it also caused curved spine. When we showed up to our local doctor in a governmental clinics we were told to do some physical exercises and wear orthopaedic insoles. With ages problem was getting worse and limiting my physical activity although I was doing all recommendations. Thus we started to research the problem looking for different solutions, procedures, etc. All information was received either from Internet or from other doctors. Later by chance we met up with our close friend surgeon who told us about invention of new surgery solving „flat fleet“. Once we heard about it we started to read about it, finding clinics doing this surgery, talking with many different experts before we decided to do a surgery. Finally we did a surgery. Now it has been 10 years passed and result worths all the work previously done. I have no more „Flat Fleet“ and any related problems. But to find this treatment which we learned about by chance we spent 5 years. For this 5 years I had to live with many problems caused by „flat fleet“ and had to do absolutely useless exercises. Some may say that it will make sense to ask other doctors except regional ones about possible solutions, and these people will be right. However they should take into consideration that we didn't have enough resources to go from one to another doctors, across our city, country. Moreover in our case opinion of regional doctor was same as opinion of other doctors we visited so far and same with article written in Internet. We didn't have any other way to recheck information. Maybe we could ask a question in Internet about surgeries that can solve our problem, but we even didn't suspect that this kind of thing may exist. So the point is that we trusted doctors and these experts for sure didn't want us suffer most likely the only reasons they didn't tell about surgery is that they even didn't know about surgery at all. Our friend surgeon who we visited apparently is just a rare case of person not only doing his job for salary but also trying to learn new things stay updated but not every one has such a friend. And we personally met this surgeon just year after we started to fight „flat fleet“.

Another way to learn about a medical problems' solution might be receiving consultancy form doctors in different countries like Germany, Turkey, Israel. For example a doctor in Germany may know about methods that doctor in Russia might not know and vice versa. But how a regular person can contact that doctor and request him a consultancy. Many people cannot afford travels for medical purposes.

Here we come to the point that regional clinics doctors may not have information about real solutions of some problems, to find solution in the Internet you should ask right things, but how would you ask about something that you haven't even heard of, to ask foreign doctors opinion often costly and difficult to contact. Main point of all things mentioned above is to understand that people often cannot find solution to problems they have, just because they don't have enough information related to their case. The sources of information were mentioned above are not ideal and have place to be improved. But often patients are limited in access to information just because they don't have enough finance, knowledge or acquaintances who may help them. The problem get even worse when majority of doctors themselves don't know about solutions that might help. Often experts having access to updates in medicine are those who are treating people as well as providing some kind of educations and participating in major medical events putting effort to stay updated in medicine. But not every doctor can and does that way. Some doesn't know where to look for information about new updates, this mostly relates to new ones, others are just not motivated to do something else except their minimum work required. Therefore we aim to propose a solution to the two interrelated problems stated above. One is lack of information

available to patients. Another problem is relatively inefficient share of experience between doctors. We can say that if doctors had better experience sharing down to the local ones then patients would have access to larger information by this solving to some extent the previous problem as well. Proposed system aims to make: simpler access to different doctors for patients; simpler way to share experience for doctors that can be helpful for patients and other specialists. These 2 sub problems can be solved by developing a unique telemedicine system.

1.3.Aim

Develop a website with a search function thaw will allow patients to find and contact a doctor through online chat available on platform. Beside that patients can also have access to a section on website with article written by doctor where experts are sharing their experience related to a specific illness, treatment methods, new technological solutions in medicine. Developed website should make easier receiving medical consultancy as well as make more available information from medical world to public.

1.4.Objectives

To achieve set above aim of the project following objectives should be reached.

- Conduct research to learn about potential users opinion and interest related to proposed system

- Conduct background research on existing analogue systems to identify take aways into our website.

- Make a design of a system, including: determination of user interaction, requirements elicitation.

- System design should be done considering potential users interest

- System should serve both purposes identified in problem definition. One is about access to medical consultancy and another is about effective share of medical experience through publishing articles on website.

- System should allow creation of patient/doctor accounts with further profile data being stored on backend databases and access to account can be provided one username and password entered

- Implement „search of doctors“ function that will allow filtering search results based on different criteria. The search mechanism should show doctors list based on key words entered by user.

- System should have implemented mechanism for requesting doctors consultancy. Request should be a message send to doctor with brief description of problem that patient has and it might contain some documentation if patient wants to send one. Based on request message information doctor expected to decide wether to agree on providing consultancy or not.

- Patients should be able to contact doctors through online chat on website if doctor had agreed to accept request that patient initially should send. Patient and doctors should be able to exchange documents through online chat.

- Implement mechanism of both side dialogue closure to allow users to confirm that a consultancy was provided. If one of the sided doesn't close dialogue he/she may request help from moderator to resolve any raised issue.

- Both side of dialogue should be able to leave a review about each other. Patient can share his/her experience of working with doctor, doctor may evaluate patients behaviour.

- System should have implemented mechanism to prevent fake or unreasonably bad/ good reviews to be published on website.

- There should be a separate section on website with article written by users of systems(doctors) in order to share their experience with public. Any user of system, even guests may access that section to read articles.

- System should have implemented mechanism of confirmation for an article before article is published on website by this minimising publication of fake articles. Confirmation should be given from other doctors registered on website and with few years of experience. There must be a minimum number of confirmations that are required to publish article.

- Registered user of system should be able to leave a review under article and evaluate it. However we should make an operation between patients and doctors reviews under article as these two groups are expected to have different level of understanding in medicine. So other users may see patients and doctors opinion about article separately.

- There must be implemented different status assignment mechanism that will allow doctors to receive achievements, signs or a status that will enlarge patients trust to him/her. Status can be based on different aspects, such as patients opinion, number of consultancy provided successfully, proof of received certificates, proof of received education, etc.

- Registered users should be able to send request for help to system moderators.

- System must allow users to leave a feedback about websites performance.

1.5.Research Questions

Do I need this?

1.6.Report Structure

Achievement of our set aims requires to conduct a background research, understanding our users, designing, implementing, testing a prototype and finally evaluating work done. These start in chapter 1 from understanding the problem we want to solve with some kind of background research. Next we set objectives to be reached in order to achieve our aim. Second chapter of our work is understanding further our potential users and their needs. For these reason we have designed and conducted interviews with our doctors and patients. A part of second phase is also analysing the existing systems providing similar services. Existing systems that already operate can be seen as indirect indicator of users needs and can be used to identify new features that can be useful in our system. Third chapter of our project is about the actual design of system with following requirements list and UML diagrams. But first we have to identify our users and some of their interactions with system. In design phase we should also think about structure of whole application in general Identify what is

going to be implemented in prototype. Once we have the design decisions made, ready models, diagrams, requirements we can move on actual implementation. In chapter 4 we are planning to discuss implementation of core functionalities and deployment of app to server. Chapter 5 is going to be about evaluating our developed prototype from users perspective and testing its features to work appropriately. Finally last chapter is conclusion to whole project with identified achievements and challenges we had during the whole project, with description of further work to be done.

2.Related work

Write you literature review here.

2.1.Interviews

2.1.1.Why do we need interviews?

In our project there are two main reasons for carrying on interviews. First one is that we need to gather requirements for our system. And here potential users opinion on what functionality is needed might be very useful to hear. We can do it with questioner, but for more quality answers better to perform interviews. Second reason is to find answers on doubtful issues relating to project. For example during the design of system I was thinking why should a doctor spend his/her time consulting people online. There should be a motive, but I was wondering wether something else also can motivate specialist to do this work. I assume that making system with achievements being recognised will make sense. But I am not a doctor, they may see it differently.

Note we are not planning to carry on two different set of interviews for each of categories: RQs elicitation and doubtful issues since doctors are being very busy. Interviews will be designed to serve both purposes simultaneously.

About RQs: Based on analysis of interviews will decide wether a change should be done to RQs list designed formed beforehand.

About doubtful issues: Results of interview will be written down in order to be used as a confirmation of the answers on doubtful issues. For example, if someone asks why would doctors be motivated to be part of system I can refer to interview results.

2.1.2.Who are the interviewees?

We are going to interview up to 4 doctors with work experience over 7 years. These are doctors with different area specialisation, from different countries with different backgrounds. There are many doctors around me, but these are ones with whom I was able to arrange meetings at this current moment. Second group of people are regular patients. I plan to interview 4 patients that are potential users of system as well.

2.1.3.Interview design

During the interview I'll follow stated below plan and structure. Interviews answers will be written down in a separate document that can be used for analysing interviewees opinion, vision on some of discussed issues. Interviews will be audio recorded for the case if we need to reassure what interviewee said. After forming „q/a“ document for interviews we will conduct analysis that will help use with RQs elicitation and doubtful issues clarification.

Details of interview
Number of interviewees: 8
Countries of interviewees: Russia, Azerbaijan, Turkey
Type of interviews: physical meetings, online

Expected lasting: 1 hour/interview
Recording: Yes, but recordings won't be provided for final assessment since language of interview won't be English

2.1.4.Interview Structure

Doctors:

Introduction: Explaining to interviewee what kind of system is expected to be developed. Briefly describing expected system

Part 1

1. What do you think of this kind of system to be developed?
    1. Will it be demanded and why?
    2. What is necessary for this kind of system?
2. Will a regular doctor have enough time for this kind of work to be done?
3. What will motivate doctors to be a part of this system?
4. Can you propose a feedback mechanism that will allow people to select best doctor out of alls based on some kind of reviews leaved?
5. Is there a mechanism in medical area to ensure that a person has been graduated and received medical qualification to ensure he/she is not a fake doctor?
6. Can you as a doctor state that it is possible to provide some initial consultancy based on documents that a person can remotely send you? So is it possible for doctor to provide consultancy to someone online without physical meeting for at least basic consultancy purposes?

Part 2

Explain two challenges being addressed

1. Should it serve only one purpose or it will make sense to create something bigger?
2. What features do you think this system should have?

Conclusion, finalising interview

Patients:

Part 1

1. Have you ever faced problem related to lack of access to information about an illness, treatment?
2. Have you ever faced problem related to lack of knowledge of a doctor related to your problem?
3. What do you think of this kind of system to be developed?
    1. Will it be demanded and why?
    2. What is necessary for this kind of system?
4. Will you as a patient mind to share your problem with doctor online?
5. What might make you as patient to trust to a doctor?
6. If the system will require you to pay a specific amount to receive consultancy how likely you will pay for it?
7. Did you have some treatment process or any medical service provided that could be done remotely?
8. Will it be important for you to get an opportunity to contact foreign doctors as well?

Part 2

Explain two challenges being addressed

1. Should it serve only one purpose or it will make sense to create something bigger?
2. What features do you think this system should have?

2.1.5.Interview analysis

Doctors:

For our 4 interviews above we had 4 absolutely different people with different specialisation, experience and even country of work. We can see that all of them had similar opinion about service being demanded and useful. Also according to interviewees if doctors have a motivation mainly in form of earnings or clients, they will for sure consider to participate in this kind of web service.

When it comes to the question of review system obviously interviewees support any form of feedback mechanism to be implemented in system. But their proposed review mechanism differ little bit. Some propose to allow doctors to leave feedback about patients as well another specialist offer to design unique feedback system with some achievements that can be more informative to patients than basic 5 star rating. For our case we have enough resources to try implement both proposals since they are not contradictory.

When we asked doctors about possible ways to ensure in originality of documents a doctor might have, unfortunately none of them knew any way to do that. Best proposed solution was to check with place of work and try to call organisation responsible for issuing a document.

An interesting and core point was made about possibility of online consultancies to be done and their usefulness for different specialists. According to ENT doctor he can only consult about different solutions, operations and methods in medicine, but cannot write a receipt for patient since I must see myself what is a problem. According to Surgeon he can initially state a diagnose based on pictures send and therefore tell about possible operations, but of course before a real surgery doctor will have look again at patients condition. On the other hand Paediatrician can determine a diagnosis as well as write a receipt for solving existing illness in most of the cases if patients send needed documents and photo or video. Similarly endocrinologist can form required diet for patients once required analysis results are send to specialist. From these we can state that at least a basic consultancy or Q&A session can be carried through online surveys but for a bigger treatment some specialisations require physical meetings.

Last minutes of interviews were devoted to the question of serving one or two purposes. These refer to making available an articles section as was described in project definition. All specialist have confirmed that it will make sense to enable doctors to share their experience through articles. Therefore we may conclude that it worths to enable articles section in our system.

Last question was about an important feature and everyone mentioned a registry with history of patients illnesses, treatments and other historical data can be helpful for a doctor meeting a patient first time. In an initial design we didn’t have this point and didn’t even thought of this kind of feature that now looks extremely important this case again mentions importance of interviewing doctors.

Patients:

Similarly to doctors patients expect online medical consultancy services to be demanded. Reasons are opportunity to contact with different doctors from home, receive some services online, have access to independent opinion.
When it comes to mentioning „what this kind of system should have“ answers are strongly varying. Some mention importance of large number of specialist to be present, of thrive entity to regulate interaction between doctors and patients these point relate to organisational aspect.

While other mention more feature specific issues like rating system with ability of patients to leave review.

Next aspects we discussed with patients were their view on sharing personal health problems with doctors online and what makes a patient to trust a doctor. Majority don't mind to share their personal information only if there is going to be implemented some kind of confidentiality policy, technology. One interviewee mentioned that can discuss some problems with online doctors, but when it comes to very personal cases she would like to discuss with her doctor. In a question of trust we had several criteria identified these are work experience, successful cases, education and rating based on previous patients review. In our initial design of system we had already taken stated aspects into consideration therefore no changes are required from this perspective.

During the interview we took a chance to learn about patients opinion to pay for online consultancy service and found out that answers vary strongly. One patient mentioned that will pay for this kind of service only to gather information in case of serious disease, while others are pointing at importance of normal prices to be kept for consultancy, third interviewee thinks that an answer can be found out after receiving medical consultancy first time. If it is satisfactory patients may continue to come back regularly to the service if they have problems.

Ending of part 1 was about patients experience of receiving a service that could be done online and importance of foreign doctors presence in system. All interviewees had cases when a specific treatment, service could be done without even visiting doctors. That indicates existence of potential for our system to be actively used since there are services that can be distantly provided. For example diet control, control of patients condition, etc. Discussing foreign doctors we have determined that patients find this opportunity very helpful in case of upcoming serious operation or in case of having serious problem that require careful analysis. For small problems patients doesn't see a huge need in a foreign specialist.

In part two we wanted to learn about importance of articles section in our system from patients view and asked them about a feature they think should be in a system.

Interviewees pointed out usefulness and perspectives of articles part. According to their opinion it can help other patients to learn about their problems or upcoming surgeries. It can also contribute to distribution of experience across doctors that is one of the problems we try to solve. Need and usefulness for article session is also supported by one of patients opinion that it can bring many visitors on website who probably will not plan to use online consultancy but will look for a doctors opinion, solution etc. in these texts.

When we get to last question about an important feature we had 4 different opinions but each of them looks very useful and helpful. One was about allowing patients to follow their favourite doctor in articles session, other patient proposed to make a profile for patient which later can be send to doctor, that is similar to what doctors proposed with registry of illness and treatments. One person suggested to enable analogy for live conferences in the form on online translation where several doctors will discuss a topic while public can join and learn new things. This idea sounds great but relates more to an extra feature rather than a core one. Last patient proposal we have from interviews is adding a feature that will enable patients to contact each other in order to ask a real person about a specific doctor he/she worked with.

Conducted interviews with doctors and patients lead to better understanding of their view on our proposed system as well as helped to find out answers to doubtful questions. Moreover we have heard about their preference feature that should be in our system. Some of them are going to be added in requirements list while other may be left as an optional ones. Undoubtedly we need to pay enough attention on development of feature 'Registry of illnesses and treatments' since every interview doctor has pointed it as an important feature system should have. We have also found answers on question we had in general not specifically related to features of proposed system. These are helping to understand main users of system better and therefore to develop a better system.

2.2.Existing systems analysis

Part of RQs elicitation process is analysing already existing systems that provide similar service as the one we propose. I have found out several websites that enable medical consultancy to happen remotely. Selection was made based one criteria: serving purposes we have set. Therefore we have only those website that provide online medical consultancy and might have articles section. Meanwhile let me note that we will focus one Russian telemedicine website. Reason for this decision is simple, due to COVID-19 I couldn't travel back to UK and had to stay at home in Russia. Since I cannot easily contact UK services from Russia upon demand basing analysis of Russian websites will save a lot of time and enable more effective analysis. Because I can basically call these firms and learn about an issue that may arise during the project. Also my interviewed doctors can help me more with Russian, rather than UK telemedicine services.

2.2.1. Framework for analysis

1. How focused is a website on providing online consultancy?
    1. Based on information on main page and easy access to the online consultancy section
    2. Based on set of services provided
2. How strong does it engage direct communication between patients and doctors?
3. Type of consultancy implementation: online chat, video call, other
4. Profiles
5. Review system
6. Interesting/unique features
7. Select doctor Use case steps
8. Take aways(Conclusion)

2.2.2. Existing systems list

- https://telemed.chat (Medved) ;
- https://onlinedoctor.ru/doctors/ (OnlineDoctor);
- https://www.drclinics.ru (DrClinics);
- https://medihost.ru (Medihost);
- https://03online.com (03Online);

2.2.3. Comparison

How focused is a website on providing online consultancy?

Homepage

Lets start with Medved. When we enter home page first thing we see is search bar to find a doctor. Similar design is made by OnlineDoctor, but difference is that OnlineDoctor provides search bar with several characteristics for search: full name of doctor, child/adult specialist, specialisation, etc.

DrClinics displays on home page a standard site with availability to read about organisation, select a service, see contacts, etc. To enter telemedicine part of site we have to go into „services" tab and select „Online consultancy". When clicking „Online consultancy" we will be redirected to page with two boxes: one is to contact main doctor immediately another is to select special doctor through a search bar. Nearly similar design made by Medihost, where home page doesn't meet visitor with opportunity to search for doctor immediately, instead it has search bar to find clinics and make an appointment. To find telemedicine user has to click on „Consultancy" and then on „Telemedicine consultancy". Next a new page opens with search bar

enabling search of doctor for online consultancy. 03Online meets visitor with information about website and list of specialisation to select immediately.

Services provided
OnlineDoctor, 03Online provide only online consultancy service, while Medved, Medihost also provide opportunity to make an appointment in a clinic. DrClinics provides online consultancy, as well as standard medical services to be done in their clinics since it's a clinic primary focused on standard interaction with patients rather than through online.

We can conclude that OnlineDoctor is most focused on telemedicine, since it doesn't provide other services and its home page design engages searching doctors. Next comes Medved and 03Online. Least focused is DrClinics since it has a lot of information and provides many other services.

How strong does it engage direct communication between patients and doctors?
OnlineDoctor and Medved strongly engage communication since they allow to contact doctor easily, not requiring many steps to be done. Also on these website intuitive design helps to find a contact specialist. While DrClinics, Medihost have many different tabs, sections on one page that confuses new user who looks for opportunity to contact a doctor. About 03Online we cannot day it engages communication between patient and doctor since it doesn't provide an opportunity to contact a specific doctor directly. Instead users attention is focused on „sending a question" to random doctor.

Type of consultancy implementation: online chat, video call, other
OnlineDoctor provides consultancy mainly through video calls, while 03Online and Medihost provide consultancy only in form of emailing/chats. Dr.Clinics provides consultancy through emailing and phone calls. Meanwhile maybe best option is provided by Medved that has enabled online chat as well as video call in order to support interaction between patient and doctor.

When deciding which option is best to provide consultancy we should also pay attention how these options are implemented. For example chat function is available on Medved, Medihost, 03Online, but Medved has intuitive, user friendly interface of chat that enables simple communication, while others have poor design, with small font size, unattractive color set and complicated navigation.

Profiles
Neither of the systems provide full patients profile with ability to keep record of patients history of treatments. According to interviews doctors find it very helpful for providing consultancy.

When looking at doctors profile all 5 systems have similar implementation of it. Standard template include: full name, years of experience, education/work experience, specialisation, previous users review. Medved, OnlineDoctor, Dr.Clinics also provide scans of doctors diploma, certificates and other documents.

In our project it is critically important to have rich doctors profile as well as providing opportunity for patients to keep profile.

Review system
All 5 examples have standard review system when patients write their review and evaluate doctor on 5 start basis. There are no complicated and detail system of doctor evaluation that can help to analyse doctors performance deeply. For our system it would be an innovative decision to design our unique review system to be able selecting effectively best doctors.

Interesting/unique features
Among other services discussed Medihost provide an opportunity for user to contribute to promotion of a doctor on website by paying for a specific advertisement service. These ad services cost very little by this making such a may of expressing gratefulness attractive for

patients, but disadvantage is that anyone can use this feature to promote themselves. In this case it would make more sense to enable it for patients already received consultancy from a doctor.

Connection of doctors: Although 5 services we analyse are serving similar purposes they have different way of forming. Medved, Medihost and 03Online allow anyone to register as doctor and after a moderation specialist can start to work. Meanwhile OnlineDoctor, DrClinics carry on recruitment process for doctors and doctors on website act more like employees of service rather than an independent specialists. So last two websites are acting as real clinics with their own doctors.

Medihost has an indicator that shows wether a doctor is currently online or not. It is very useful feature that will for sure help patients who need to contact someone urgently. Undoubtedly we have to take this feature in our system.

Another take away refers not so much to technical specification of system but to organisational processes. DrClinics has a role „Main doctor“ that is a specialist available 24 hours and there to help on urgent queries of patients.

Select doctor Use case steps
Next stage of analysis is comparison appearance of use case: select a doctor on different websites.W e have selected one of the main use cases in order to compare different websites on how easily these use cases can be done.

Medved:
Prerequisite: User is logged-in
Steps: Enter a homepage > Select specialisation > Select a doctor from a list>Select available time for an appointment>Pay for consultancy.

OnlineDoctor:
Prerequisite: None
Steps: Enter a homepage > Select specialisation > Select a doctor from a list>Select available time for an appointment>Login/signup> Pay for consultancy.

DrClinics:
Prerequisite: None
Steps: Enter a homepage >Open „Services“ tab> Select „Online Consultancy“>Click on „Make an appointment“> Select specialisation > Select a doctor from a list>Select available time for an appointment>Login/signup> Pay for consultancy.

Medihost:
Prerequisite: None
Steps: Enter a homepage >Open „Consultancy“ tab> Select „Online Consultancy“>Click on „Make an appointment“> Select specialisation > Select a doctor from a list>Enter patients details(Full name, email, etc)>Select available time for an appointment>Receive confirmation from doctor>Pay for consultancy.

03Online:
Prerequisite: None
Steps: Enter a homepage >Select specialisation > Select a doctor from a list>Click on „Ask a question“ button>Enter patients details(Full name, email, documents, etc)>Pay for consultancy.

Medihost and DrClinics have longest path for use case: select a doctor that plays critical role in serving one of our apps' purposes, providing online consultancy. These 2 websites have longest path because they are providing telemedicine as an extra feature, service therefore user has to go through extra steps to find out a doctor. While other websites strongly focus on online consultancy and enable selecting a doctor immediately once user has entered home page.

2.2.4. Conclusion

As we have seen among these 5 website 3 are strongly focused on online consultancy since their design engages to simply find a specialist and contact online, while other 2 (DrClinics, Medihost) require extra steps done to find section with online consultancy. Reason for this kind of difference is not only a design but also range of services being provided. DrClinics and Medihost primarily act as websites to attract patients to attend clinics rather than receive distant help. While OnlineDoctor, 03Online doesn't provide any other opportunity except online consultancy. Medved is also strongly focused on online help, but it has a feature to make appointment in a clinic if one is needed.

One more important thing is positioning of websites. OnlineDoctor, 03Online position themselves as alternative for visiting real clinics with their own doctors being hired. However Medved, DrClinics, Medihost allow anyone to participate as a doctor once he/she has passed moderation and don't try to make doctors as employees of these websites brand, instead doctors are acting as independent entities from website. Meanwhile these websites act as an area where patients and doctors come together and all interactions are regulated by these websites. As an analogy we can look at Linkedin. Linkedin is a platform for candidates to create profile as analogy to resume and for companies to place vacancies. But there are set of rules that both sides have to follow and Linkedin is one who plays role of regulator. For our system being as a platform seems to be a better decision since it allows more flexibility for doctors, who can independently create accounts and start working, while website(Organisation) can focus on controlling and importing the platform.

Most of websites provide a doctors profile for patients, but none of them has implemented patients profile with any history of illness patient had. According to interview results having patients registry profile with all actions done being kept there will be very helpful for doctors to understand situation, therefore for our system we have to implement such a feature. Also feature related issue is rating system. Neither of websites allows doctors to evaluate patients, but this feature could be a nice preventer of fake reviews aimed at spoiling reputation of doctor unreasonably. Moreover we have to take time and evaluate possible alternatives for doctors rating system. Maybe we can find a way to make review system more motivating for doctors and helpful for patients.

Important part of any system providing online consultancy is a way it happens. We can see that each system has different way of supporting consultancy. One use chats/emails other prefer video calls, third ones perform mix of these way like Medved where you can chat or call doctor. Most efficient ways are chats and calls since it allows receiving consultancy immediately, live without waiting long like it may happen with emails.

For our system we can also adopt doctors status(online, off-line, etc) indicator that is implemented by Medihost, as well as promotion system enabling patients to spend money on supporting their favourite doctor. But here we need to implement these with some improvements. However organisational feature of „Main doctor“ supported by DrClinics might be not so useful since in case of emergency people are expected to contact hospitals, ambulance not online service.

3.Design and Requirements

3.1.1. Users and User interactions

One of the steps in our project is designing the system. By design here we mean determining functional RQs and non-functional RQs for system that is expected to be implemented, planning users interaction with system and making UML diagrams to visualise the software part. First thing we should start from in designing system is identifying its users.

Users

Expected users are:

1) Guest - user that is not registered in system and has access only to searching doctors without contacting them, without leaving reviews, with access to read articles published.
2) Patient - regular person that has a problem and seeking consultancy or treatment. Age category expected 18+. Children below 18 are not expected to contact doctors and request consultancy. Wage category of a potential customer may vary.
   - Expected tasks: Contacting doctors through portal, leaving reviews, uploading necessary documentation, accessing extra reading material available on website, purchasing services on website, logging into account, requesting extra help from system moderators
3) Doctor - a regular professional with medical education confirmed by a specific certificate, diploma. Age of doctor is expected to be over 24 since younger people are still studying in universities in UK as well as in Russia. We expect that there will be doctors without any experience after yet, but registered on website in order to find an opportunity to work.
   - Expected tasks: Consulting patients online, reviewing sent documents of patients, writing articles on websites, approving articles of other doctors in website, taking part in online meetings, conferences, invite patients on treatment in a specific clinics
4) Moderator - employee doing procedural tasks to control that rules of the website are followed. If any issue is raised by other users moderator have to deal with it in most of the cases except some technical faults. Moderator can be seen as a customer supporter.
   - Expected tasks: Answering user request, controlling violation of rules, checking reviews, dealing with abusive language cases, helping patients/doctors to use features of website.
5) Admin - person with technical background, having strong technical knowledge to keep system working.
   - Expected tasks: Dealing with system failures, updating system, resolving technical issues.

User interaction

Lets start from describing user interaction. In our system users are expected to interact in many different ways. Some of these are:

<u>Guest</u>

1) **Signup** into a website. Expected to have 2 types of accounts(Doctors/Patients). In case of signup for both users system will require to enter full name, phone number, email, password, address. For doctors there is expected to have additional lines of information: experience, education, place of work, specialisation.
2) **Search a doctor**. Guests will be able to search doctor on website but cannot contact that doctor.

<u>Patient/Doctor</u>

1) **Logging** into a website account. Expected to have 2 types of accounts(Doctors/Patients). In case of login both users will be asked to enter username(email) and password.
2) **Chatting** function will be available for both types of user. Before starting a chat patients will send a request for consultancy, if doctor accepts request then dialogue between users will be established through online chat. Patient will have opportunity to send kind of a introduction message to doctor within a request for doctor to gain a basic understanding of problem.

3) **Sending documents** one of the essential features needed for system to serve its purpose. Patient will be able to send some documents, x-ray images, and other documents for doctor to analyse and provide consultancy. Meanwhile doctor might send a document back to patients with some notifications on it.
4) **Closing dialogue** is a feature that will enable both sides to confirm that a service was provided and system may count consultancy received to patient and provided by doctor. It happens through clicking specific button by patients and doctor. However if patient for example doesn't agree that doctor provided consultancy then patient may click specific button and wrote an explanation for moderator. Then message and request will be send to moderator who can start procedural activities to resolve issues, disputes. Meanwhile doctor may not close the dialogue if he/she thinks that something is left to send or say to patient or if any problems arises and further investigation required from moderators.
5) **Leaving review** function will be available for both doctors and patients.
   - For patients leaving a review about doctor is essential since its one of the criteria playing important role for other patients to select doctor.
   - However leaving a review about patient may also be important and useful feature. Some patients may behave inappropriately to doctors, wasting their time for nothing. Others may just contact a doctor to simulate some interaction in order to be able to leave a fictional review to spoil doctors reputation. There might be many other ways how patients may create extra problems for doctors but not aiming to find a help on website. Therefore if doctor can leave reviews about patients other doctors will know wether that person(account) is really looking for treatment or serving any other purpose, was patient behaving inappropriately or not, etc. This kind of feedback might also be used by moderators to block accounts breaking the rules. Similar mechanism is implemented in Uber. Both driver and passenger can leave feedback about each other, that prevent one of the sides to leave unreasonably bad reviews.
6) **Leave review about system**. Both users may leave a feedback for example with improvements proposed to make system better.

Patients

1) **Search a doctor**. Patients will be able to search doctor on website using search engine.
2) **Send request**. Once patient found a doctor he/she might send a request to establish dialogue. In that request patient may attach an introduction message with some documents if available for doctor to gain an initial understanding of patient to decide wether to agree or not to provide consultancy.
3) **Share a doctor**. Patient will be able to share link on a specific doctors profile to friends. It is making process of contacting doctor and a friend very simple since that fiend may directly see profile of doctor that is recommended.
4) **Leave review about articles**. Patients unlike doctors not expected to leave professional view on issue discussed in article. But it is possible that patient might have experience for example a treatment described in article. Therefore it will make sense if patient leave a review under article about that treatment method for example.

Doctor

1) **Confirm an article** written by another doctor. To ensure that from medical point of view article is correct not fictional we plan to allow other doctors to read article and confirm or reject it. Number of confirmations will make people to trust it more. There will be a minimum number of confirmations for article to be published. Meanwhile to prevent doctors approving article without analysing its writings, doctors that approved an article will be recorded. So others can see who confirmed articles and who is author.
2) **Publish an article**. Since one of the problems we try to solve in our platform is making more effective share of experience we are planning to have a section where doctors can write article to share their experience on a specific problem and issue. This feature will allow to share experience across doctors of different level quicker since mass public will have access to it. Patients will also have access to read these articles

Moderator

1) **Answer users queries**. Moderators primary task is to support users using the system. If user has a query and send a help request moderate have to help user mainly by sending answer to query.
2) **Review user feedback**. Moderator expected to review feedback left by patient or doctor in order to prevent publishing inappropriate review, for example one that has abusive language. Once moderator has checked feedback he/she can give it appropriate status that will mean it can be published on website.
3) **Check articles**. Moderators are also going to check articles being published on portal by doctors in order to avoid publishing article with inappropriate language, advertising, etc. We expect article to be an opportunity for doctors to share their experience of solving some problems, so that mass public can learn about it. Articles are not planned to be an advertisement.
4) **Resolve disputes** between doctor and patient if one arises. A signal of disagreement can be user request for help as well as one of the side of dialogue not closing dialogue(for example not confirming that consultancy was provided). At this point moderator may contact with both sides using mail, phone call or any other available way to understand what happened and solve problem.

3.1.2. Functional Requirements

ID	Requirement	Priority	Use case
1	Guest must be able to create account	Core	Signup
2	Guest must provide required on website data in a specific form when registering an account	Core	Signup
3	Guest must register in system as a Patient or a Doctor	Core	Register Patient account/Register doctor account
4	Both Guest and Patient must be able to search a doctor	Core	Search a doctor
5	Patient and Doctor must be able to login into their account using email/password	Core	Logging
6	Patient and Doctor must be able to contact each other through a chat on website	Core	Chatting
7	Patient and Doctor must be able to send documents through a chat on website	Core	Sending documents
8	Both Patient and Doctor must close the dialogue to confirm that consultancy was provided	Core	Closing dialogue
9	Patient must be able to write review about doctor once dialogue is closed	Core	Writing reviews
10	Doctors must be able to leave a review about patients once dialogue is closed	Core	Writing reviews
11	Patients must be able to send a request for consultancy	Core	Send a request

ID	Requirement	Priority	Use case
12	Patients must be able to write briefs description of their problem when sending request	Core	Send a request
13	Patients must be able to attach any documents that can help doctor to understand a problem when sending request	Core	Send a request
14	Doctor must be able to confirm or reject request	Core	Reply on request
15	Patients must be able to create a profile with registry of their illnesses, treatment and other data.	Core	Edit medical registry
16	Doctor must send a request to patient before being able to see patients profile registry	Core	Get medical registry
17	Patient must be able to confirm or reject doctors reply on receiving medical registry	Core	Edit medical registry
18	Any registered user must have opportunity to show his/her availability online through a specific indicator	Core	Set status
19	Doctor and patient must be able to send an enquiry to Moderator	Core	Send enquiry
20	Moderator must be able to answer user queries	Core	Answer user queries
21	Moderator must be able to confirm a review can be published	Core	Review user feedback
22	Moderator must be able to confirm an article to be published	Core	Check articles
23	Moderator must be able to set different status to a dispute raised by doctor or patient	Core	Resolve disputes
24	Doctor must be able to publish an article on website	Core	Publish an article
25	Doctor must be able to confirm an article written by another doctor and not yet published on website	Core	Confirm article
26	Doctors and Moderators must be able to see unpublished articles in order to confirm them	Core	Confirm article
27	All users must be able to have access to article with several confirmations from doctors	Core	Read an article

ID	Requirement	Priority	Use case
28	Doctors and Patients must be able to leave feedback on an article	Core	Leave a review for article
29	Patients and Doctors must be able to edit their profile data	Core	Edit profile
30	Doctor must be able to add work, education related documents, certificates and similar documents on their profile	Core	Add doctors documents
31	Patient must be able to add health related documents to his/her profile	Core	Add patients documents
32	Patient must be able to see doctors' profile	Core	Open doctors profile
33	Patient must be able to pay doctors consultancy services online	Core	Pay consultancy
34	Guest, Patient must be able to search doctors using filters	Optional	Search a doctor
35	Patient must be able to share doctors profile	Optional	Share a doctor
36	Doctors and Patients must be able to link their social network profile to website profiles	Optional	Link social network
37	Patient and doctor must be able to see their appointments on calendar	Optional	See appointments
38	System must assign range of achievements to doctors profile once a doctor has completed requirement for achievements	Optional	Assign achievement
40	Patient must be able to promote a doctor he/she has been consulted by.	Optional	Promote a doctor
41	Staff must be able to edit doctors' and patients' profile	Core	Edit users profile
42	Patient must be able to create an entry on illness with information about problem provided	Optional	Create illness card
43	System must offer patient list of doctors with specialisations matching patients illness describe on illness card	Optional	Match doctors
44	Patients must be able to add doctors to a „Favourite“ list	Optional	Add favourite doctor
45	System must enable searching doctor based on keyword matching	Core	Search a doctors

ID	Requirement	Priority	Use case
46	Doctor must be able to prevent patients and guest to see his/her contacts unless patients doctor has accepted request for consultancy	Core	— —
47	Doctor must be able to remove his/her article from website	Core	Remove article
48	Doctor and Patient must be able to delete their account	Core	Delete account
49	Admin must be able to delete any account	Core	Delete account
50	Admin must be able to edit any information on website	Core	Edit website info
51	Admin must be able to remove articles from website	Core	Remove article
52	Admin must be able to block account	Core	Block account
53	Doctors must be able to contact other doctors through a chat	Core	Contact other doctor
54	Doctor must be able to recommend another doctor to patient	Optional	Recommend doctor
55	Patient and Doctor must be able to share articles	Optional	Share article
56	Patients must be able to follow favourite doctors for updates in articles section	Optional	Follow doctors
57	Patients must be able to contact each other through a chat	Core	Contact patient
58	Patients must be able to contact another patient once he/she has allowed it.	Core	Send request to patient
59	Patients must be able to reject request for communication from another patients	Core	Reject request from patient

3.1.3. Non-Functional Requirements

ID	Requirement	Priority	Use case
1	Webpages downloading should not take more than 5 seconds when opening through a browser with stable internet connection	Core	
2	Account passwords should be hashed before being stored in database	Core	
3	Users should be able to access website from device with operating system Linux, Windows, MacOs, Android, IOS	Core	
4	Website pages should adapt appropriately under different screen sizes	Core	
5	System availability must be 98%	Core	
6	Website should enable translation of website content on different languages	Core	
7	System must have intuitive design	Core	

3.1.4. UML Diagrams

3.1.5.Design patterns used

4.Implementation

4.1.Languages used

4.2.Required API's and Libraries

Use the *Code* style for presenting code snippets within this report.

```
static public void main(String[] args) {
  try  {

UIManager.setLookAndFeel(UIManager.getSystemLookAndFeelClassName());
  }
  catch(Exception e) {
    e.printStackTrace();
  }
  new WelcomeApp();
}
```

4.3.Implementation of core functionality

4.4.Deployment

5.Evaluation

5.1.Testing

5.2.Usability of system

5.3.Required improvements

6.Conclusion

Write your final conclusion of your project as well as any information related to future work here.

6.1.Project achievements

6.2.Difficulties and challenges

6.3.Further development

References

WHO (2011). *Opportunities and developments TELEMEDICINE in Member States Report on the second global survey on eHealth Global Observatory for eHealth series -Volume 2 2010*. [online] *WHO*, p.8,9. Available at: https://www.who.int/goe/publications/goe_telemedicine_2010.pdf [Accessed 22 Oct. 2020].

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Appendix

Appendix A - Risk assessment

Risk assessment

Description of risk	Impact of Risk	Likelihood rating	Impact rating	Preventive actions
Failure of deployment server	Web-application wont be available to be run online	Low	High	Select several servers which can be used in case of failure of first server
Poor time management	Development of prototype might not be finished in time	Medium	High	Regularly revise timetable and ensure following it
Loss of work done	May lead to loosing all the files related to current project	Low	High	Regularly save all files backup versions
Connection error during test use	Website may work inappropriately because of low internet connection of user evaluating website	Medium	Medium	Ensure that evaluating users will have stable connection
Personal health	Due to risks of getting infected project development may be completely stopped	Medium	High	Avoid visiting popular public places and use personal safety masks and gloves
Cancelation of project presentation	Due to COVID-19 the is a risk of events related to project presentation or evaluation can be cancelled at all	Low	High	This risk is totally out of my control, best thing is to have ready project.
Lack of testing	We may miss testing some critical issues in a software	Medium	Medium	Regularly check list of things should be tested.
Security problems	An error in software may lead to lack of security in a system	Medium	High	Test security functions to work appropriately
Website speed problems	Website may work slowly due to high volume of data being loaded by browser	Low	Medium	Ensure browser download pages of website fast enough. Otherwise improve code.
Browser comparability	Some browsers may not support full functionality of my system	Medium	High	Test our system on different browsers

Additional Appendices (as needed)