Health Information System with Management on Backend Website and View on Frontend Android Application (HealthyGO)

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Abstract— Health is one of the most important part of our life, without a good health we cannot perform things that we like such as exploring, socializing, and more. This research will discuss about why the proposed system "Health Information System with Management on Backend Website and View on Frontend Android Application" is needed and what have been done by the developer to achieve the requirements of the proposed system.

Keywords—Health Information, Android Application & HealthyGO

I.   INTRODUCTION

This study is conducted to develop a system which helps people around the world to keep track on their health status and keep them on current health issues. Health status is the absence or present of a disease or signs in a human's body. It can be measured in several ways like blood pressure test, temperature, x-rays, symptoms, etc. Health issue is the problem faced by a human body that can cause malfunction to human parts, it may have been affected by pollutant, pathogen, etc. The system is a simple health information sharing mobile application where people can check on a certain symptom and follow the steps given by the application to prevent their health from getting worst. If the disease is found out in an earlier stage, the death penalty can be easily prevented by changing the diagnosed patient's lifestyle. Thus, developing this system is important for people to know the symptoms of a disease and take action based on the advice given by professional to reduce the risk of death by the disease.

There is a vague definition of the word "health" since 1982. When Wright take on his study on "The Social Logic of Health", he developed 4 views on health. The first view that he has which is quite common in the medical fields that is refers to the physiological of a human body and it can be tested by external technical means. The second view is that health is only applicable only to the individual which this opinion is normally found in holistic medicine and medical profession. Health is divided into two categories which is mental and physical is the third view of Wright. Lastly, theorists in social science has assumed that health is inevitable that unhealthy conditions is forced by 'healthy society' which at least applicable to some of its members. Then, Wright has approached patient-physician and came out with a deduction that patients have a wider concept on health than "the right functioning of their body". He then continuously suggesting new definition of health where he then place it in a normal context of people and the definition he finds is " an individual's ability to be fully human" [1]. The World Health Organization (WHO) had formulated the definition of health in 1948 which is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". There are many proposals to WHO to change the definition because of the word "complete" in relation to wellbeing. WHO has never considered those proposals [2]. Cancer is a serious worldwide health problem and it is the second top cause of death in worldwide [3]. According to a statistic found in World Health Organization (WHO) website , almost 55.5 million of deaths worldwide in 2016 were due to cancer and the most death cause was Ischaemic heart disease [4]. It is found that about 79.6% of adults in Isfahan had low health literacy[5]. Based on a previous research, it is found that portable devices like handheld computers and mobile devices gives an easy way to acquire new information not only toward patient but also to the clinic. For patient side, it helps them to access to information that is accurate and complete in an easy way [6]. Thus, it is decided that the proposed system should be focus on mobile application development. The limited number of information and support that is given during a consultation is another reason for developing the application on mobile. Mobile technologies have been intended to improve a healthy lifestyle and improve disease management of an individual [7].

The problem of this study is that the awareness of people on their health is not on alert. Although the discovery of cure for disease is getting more, the number of deaths caused by disease is also increasing. This may be caused by their late discovery of sickness because they do not know any symptoms that is related to a disease. If this situation is handled, the amount of deaths resulted by disease will decrease but if is not handled the amount of deaths resulted by disease will increase even though there is a cure. The solution to this problem is to spread the information to people. The information can be helpful for early discovery of disease and they can consult expertise for their next move.

Therefore, the main aim of this research is to provide medical information and health advice to people mainly to the population that has no knowledge in health-related issue.

II.   LITERATURE REVIEW

A)   *Health Information on the Internet*

Internet plays an important role in health information access. According to Tonsaker et al., about 70% of Canadians will search health or medical information on the Internet. It has become the first source of information for a lot of people. The convey of health information has changed from being relay by the expert to the patients to getting health information online. This paradigm shift has bought different views on the value of Internet as a tool to enhance the health care [8]. There will be always be a good side and bad side for everything even for this!

The good part of health information on the Internet is that it can increase the knowledge of the patient and with that they make decision by their own. Moreover, patients now have a platform to find the answer that they missed to ask while visiting the expert and also have the chance to explore a more sensitive questions in a more private way. The bad part of heath information on the Internet is that it is hard to control a standardize information as for every patient it varies. If the information is used in an improper way, then it might harm the patient furthermore.

The point of view of doctors on the health information on the Internet is that it can explain the health issues more easily and might potentially improve one the outcomes of the patient. On the other side, doctors are also concerned about the inaccurate and irrelevant information that might make the patient to have unnecessary fears on their health.

B) Voice Input & Image Input for Search Engine Technology

Hurst-Hiller and Farago point out that searching through strictly text-based systems is unfavourable as it presents a very boring and burdensome task for one to enter and refine queries on devices by hand [9]. Neven Sr. and Neven have stated that the rapid growth of mobile phones having camera provided an opportunity for image-based searching. Its application level could be language translating, mobile advertising, print-to-interest, payment system, learning tool, treasure hunt games, virtual annotation, and business models [10].

C) Similar System
1) Electronic Health Records (EHRs)

Electronic Health Records (EHRs) are the most important part of a valuable medical information processing device that the data can be accessed electronically. EHRs have electronic collection and organization of a stack of essential information like patient demographic, medical history, diagnoses, lab and test results, and billing data. Despite that, the Healthcare Information and Management System Society (HIMSS) has highlighted that EHRs can be used to support quality improvement, clinical research through health information exchange, and evidence-based research. These support elements emphasize that the EHRs can be much more than an electronic based of the regular paper records rather it supposed to be actively helping in delivering a more efficient and high quality of health care. So, health information exchange system can receive and analyse the patient-level data given by the EHRs to improve advance health care delivery and quality. Furthermore, a learning health care system can be developed if the information gathered by the EHRs become more usable [12].

2) Nation Health Service

Another existing system that can be refer for the proposed system is National Health Service, it gives medical information by accessing on the internet and also by telephone. Mike and Pieppre have mentioned that there are various sources of medical and health information on the World Wide Web and are rapidly expanding, but the information they search on the internet only one out of five relevant results was shown. The researchers have suggested that Nation Health Service is a reliable source and should develop new support services [13].

3) MEDLINEplus

There is a web-based medical information resource known as MEDLINEplus, it is created by the National Library of Medicine (NLM). It is the world's largest medical library, it provides the visitor information regarding to conditions, diseases, and wellness issues in a language that everyone can understand. It also provides the latest treatments, drug or supplement information, and view medical videos or illustrations. As regard to each health issue, the librarians have built a MEDLINE search for the website. To expand and sustain the website, it is opened to health sciences librarians to contribute to the resource in anywhere of the world, NLM has used database and web technologies for this. NML launched MEDLINEplus in October 1998 due to the demand of internet user requesting for health information. The challenges faced by MEDLINEplus is the database does not fully cover up every health information such as diseases, conditions, treatments, etc.[14].

4) NetWellness

NetWellness is another web-based, local-based, and consumer-based program to deliver electronic medical information to rural places in southern Ohio and communities of cities in Cincinnati tri-state region. It is a demonstration project that is sponsored by the public and private and it is also developed with few parties. Later it is made available worldwide to access in the internet. The purposes of NetWellness are to

- Give simple, correct, and worldwide access to health-related information resources.

- Give extensive training workshop for use of these medical-related information by teaming with the community.

- Provide medical-related information at lots of cities by utilizing the telecommunication infrastructure.

- Help in the education of health and consciousness of residents.

An online survey, interviews with nurses and physicians and focus group with University of Cincinnati Medical Center (UCMC) was conducted to find out what is the needs of consumers that NetWellness should provide. The challenge faced by NetWellness is to retain and improve the feature of searching software in the Health Source [15].

III.   TECHNICAL RESEARCH

The programming language chosen to develop the android application for this project is Java. Java is a class based, object-oriented programming language released by Sun Microsystems in 1995. It has becoming so popular due to its flexibility which allow the developer to reuse code and

maintain the software easily. The Android SDK uses java libraries and tools to allow developer to use it to develop their application in a more easy and secure way, for example Facebook SDK can be used in an application for the purpose of easier registration process, sharing the application information on Facebook, binding account and more [16].

The integrated development environment also known as IDE is a software that provides tools required to write and test software. The common tools provided includes text editors, code libraries, compilers, debugger and more. Text editors is the place where the programmer writes and edits the source code for a program. Code libraries is something that has already complied by other programmer for some other application but is available to use if needed by the programmer [17]. The IDE chosen for developing the mobile application is Android Studio. It is built on the IntelliJ IDEA, which is a java IDE. Android Studio uses Gradle-based build system, GitHub integration, code samples, and emulator to support the Android operating system. The tools chosen to develop the back-end website for the administrator is Notepad++. It is not an IDE, it is just a source code editor that support most of the programming language extension. The program is written in C++ and uses Win32 API and STL to ensure better performance and smaller program size [18].

The potential library to be included in the project is image processing library and voice recognition library. These libraries are needed to build the search input by image and voice as building it from scratch might be hard and it takes a long time. In the android application, image labelling by Google Machine Learning Kit is used to analyse an image and return a list of word(s) that is related to the image, this is used in the search part of the android application of HealthyGO where user can search a health topic by using an image. Google speech-to-text is also used for the search part of the android application of HealthyGO. It is used to convert the words that a user says to text and perform search based on the text.

The database management system chosen for this project is MySQL. MySQL is an open source DBMS developed by Oracle. The other alternative for database management system is SQL server also known as Microsoft SQL Server (MSSQL) which is developed by Microsoft. The reason on choosing MySQL is that MSSQL is mostly for .NET applications because the fact that Microsoft developed the ASP.NET framework so it works well with the .NET applications.

A web server is a software that serve the user upon request using Hypertext Transfer Protocol (HTTP). The responses are normally web pages that could be in extension of PHP, ASP, and JSP [17]. The chosen web server for the back-end website in this project is WAMP.

WAMP is short for Windows, Apache, MySQL and PHP. It installs the Apache, MySQL, and PHP in a bundle so that the developer does not have to. The Windows is indicating that it is for the operating system Microsoft Windows, if the operating system is Linux then the developer should use LAMP where the L stands for Linux.

IV. RESEARCH METHODOLOGY

The methodology that the developer has chosen for this project is SCRUM, one of the agile methodologies. The

purpose of using SCUM is to assist the development teams to focus on the goals of the project and minimize the effort on less important tasks. It aims to keep everything simple in a complex business environment. SCRUM does not give any implementation level techniques but its emphasis on team development on how they can come out a system with flexibility, adaptability, and productivity in a constant changing environment [19]. The SCRUM consists of these phases which is planning and system architecture, sprints and closure. The table below describes the activities in each phase [20].
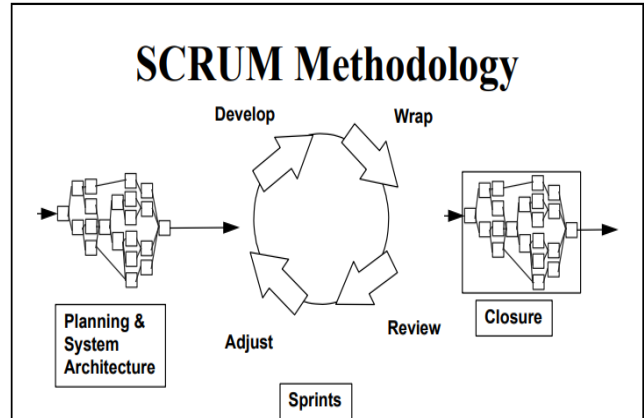

Fig. 1.   SCRUM Methodology

There is total 3 section in the survey which is section A where it asks the demographic profile of the respondent, section B where it asks the experience of the respondent on medical field, and section C where it focus on the technical side of the project and ask the respondent on their preferences on a mobile application. The survey will be created using the Google form that come with auto generation of spreadsheet based on the result and also a chart for each of the questions. This ease the developer to analyse the result.

the methods that the developer used to collect data is both primary and secondary data collection methods. For the primary data collection method, a survey is used to collect information regarding to the project and the target is public. The secondary data collection method used is document and reviews where it used to find technical information that is going to be required in the project.

V. ANALYSIS OF DATA

A survey is conducted, and it is distributed through messages and emails. Total of 35 respondent had taken the survey and below are the results. A spreadsheet of all the response is generated using the Google form function to categorize the results of some of the questions into group age. Below shows the generated spreadsheet.
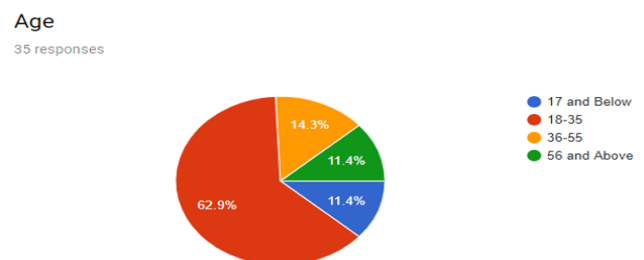
Fig. 2.   Respondent Age

Do you have any health conditions? If Yes, Please answer the next question otherwise please leave it empty.
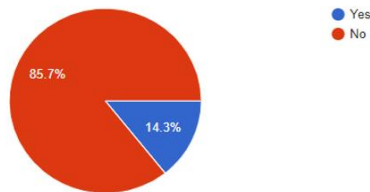
35 responses

Fig. 3.   Respondent Health conditions question

How would you rate your health literacy? (Please rate yourself from 1 to 5)
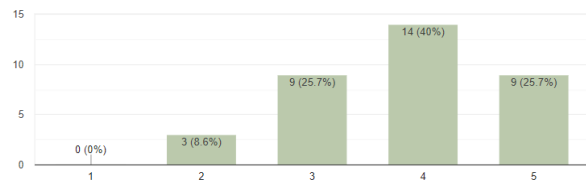
35 responses

Fig. 4.   Vertical Bar Chart for health literacy

Do you feel shy to ask pharmacist or doctor about your health conditions?
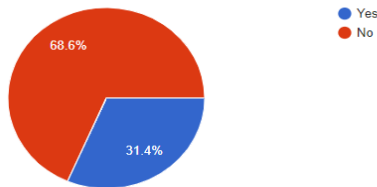
35 responses

Fig. 5.   Pie Chart for pharmacist or doctor question

Is the information(instruction, results, word used) provided by the pharmacist or doctor is sufficient and clear?

35 responses
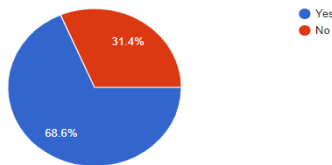
Fig. 6.   Pie Chart for pharmacist or doctor question

Have you ever experienced that the medicine/ointment suggested by the pharmacist or doctor has no effect on any of your health conditions?
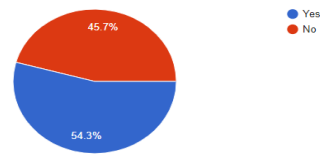
35 responses

Fig. 7.   Pie Chart for pharmacist or doctor question

VI.   SYSTEM ARCHITECTURE

The core feature of HealthyGO is to provide health information such as symptoms, diseases and conditions, healthy lifestyle, tests and procedures, and etc. to the user. There are two main elements of HealthyGO which is the backend side and frontend side which is then further broken into sub-elements of the respective sides. The backend side of HealthyGO is built on a website and is mainly for administrator to manage the system such as managing administrators, managing experts, managing topics, managing feedback, and also send push notification to the users. The frontend side of HealthyGO is built on an Android and is accessible by everyone but some of the elements can only be accessed by the expert that is registered in the system. Below shows a detailed interaction of type of users with the system. HealthyGO (Android Application) allows Users:

- To view health topic that is made available by the administrator.
- To search health topic by its title, content type, or content
- To use image labelling and speech-to-text for searching the health topic
- To view nearby hospital (5000 radius) from the user's location
- To view list of experts that is available to consult with
- To chat with experts that is available in the system for consultation
- To view previous chat messages
- To delete existing chat
- To switch on/off push notification
- To provide feedback on the application

HealthyGO(Android Application) allows Experts:

- To view health topic that is made available by the administrator
- To search health topic by its title, content type, or content
- To use image labelling and speech-to-text for searching the health topic
- To view nearby hospital (5000 radius) from the expert's location

- To chat with user for consultation
- To view previous chat messages
- To delete existing chat
- To switch on/off notification
- To provide feedback on the application
- To provide feedback on the health topic
- To login into the mobile application
- To recover password

HealthyGO(Website) allows administrator:

- To login into the backend website
- To recover password
- To view dashboard
- To manage administrators
- To view list of administrators
- To create new administrator
- To edit administrator details
- To delete administrator
- To manage experts
- To view list of experts
- To create new experts
- To edit expert details
- To delete expert
- To manage speciality
- To view list of specialities
- To create new speciality
- To edit speciality detail
- To delete speciality
- To manage health topics
- To view list of health topics
- To create new health topics
- To edit health topic details
- To manage content type
- To view list of content types
- To create new content type
- To edit content type
- To delete content type
- To manage topic feedback
- To view list of topic feedbacks by experts
- To delete topic feedback
- To manage application feedback

- To view list of application feedbacks by expert/user
- To delete application feedback
- To send push notification to expert/user

VII.   IMPLEMENTATION

Fig 8. shows the overall Context Diagram of HealthyGO. Fig 9. shows the dashboard of the backend website. This is the page where administrator will be redirected to after logging in. This page shows the 5 most recent topic feedback by expert and 5 most recent application feedback by expert or user.
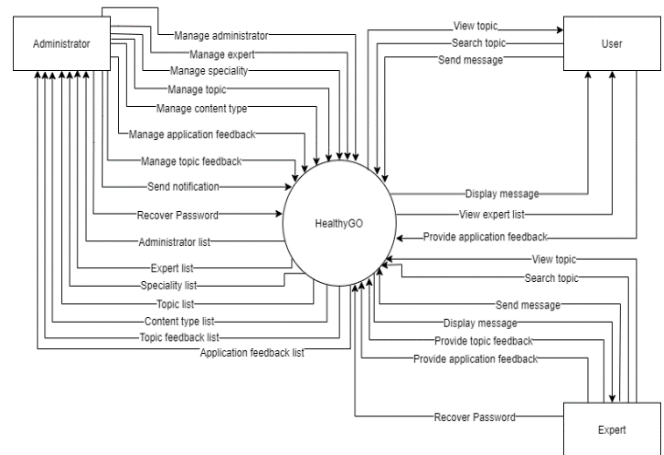

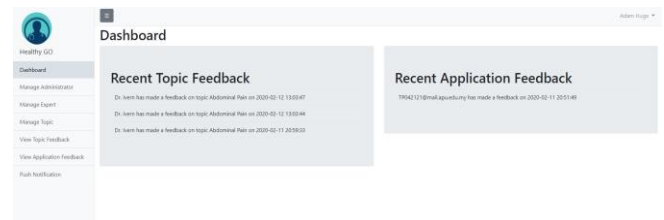Fig. 8.   Context Diagram of HealthyGO

Fig. 9.   Dashboard

Fig 10. shows the administrator list page where it displays the list of registered administrators. The administrator can filter the administrator list by inputting keyword on the search input field. To create a new administrator, the administrator can click on "Add New Administrator" at the top of the page. To edit an administrator profile, the administrator can click on the "Edit" button on the administrator that he or she wish to edit on. The delete button is to soft delete the administrator as it will only update the status of the administrator to inactive.

Fig 11. shows the topic list page where it displays the list of available topics in the system. The administrator can filter the list by entering keyword on the search input field. The administrator can add new topic by clicking "Add New Topic" button. The administrator can edit the existing topic by clicking "Edit" button. To delete a topic, the administrator can click on "Delete" button. The administrator can go to content type list page by clicking "Content Type List" button.
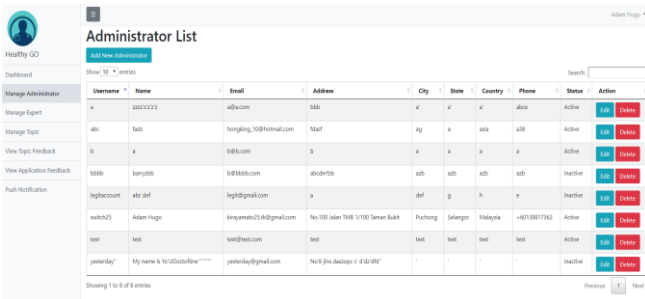
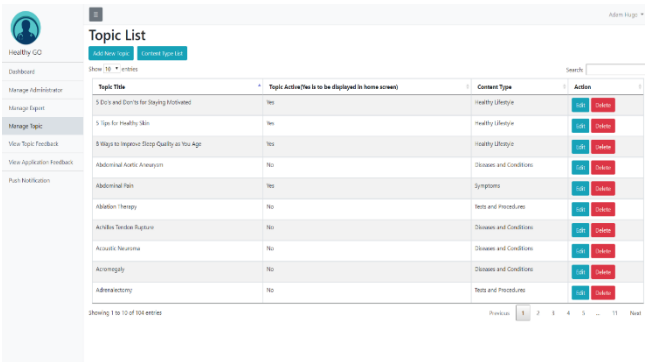Fig. 10. Administrator List Page

Fig. 11. Topic List Page

Fig 12. shows the search screen of the android application. The user or expert can perform search based on the topic, content, and content type by entering keyword into the search field and click on search button on the soft keyboard. The user or expert also can use image recognition and voice recognition to perform search. The user or expert can tap on the result to view the content of the topic.
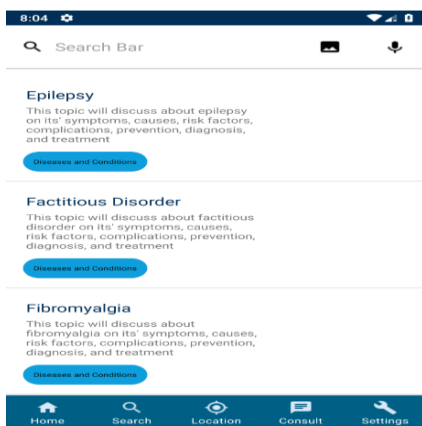

Fig. 12. Search Fragment

Fig 13. shows the content screen of the android application. This screen will display the details of the topic selected by the user or expert. If the current user is an expert (logged in), then it will have a "PROVIDE FEEDBACK" button at the bottom for them. After tapping on the button, a dialogue will pop up. The expert can submit the feedback by writing on the input field and tap on "Submit", tapping on "Cancel" will close the dialogue and no feedback is sent.
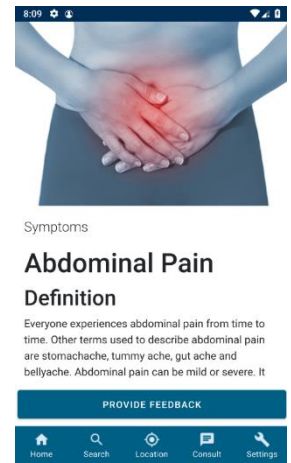

Fig. 13. Content Fragment

Fig 14. shows the location screen of the android application. It shows the name of the nearby hospital to the user or expert. The red dot on Fig. 14 is the hospital location and name, while black dot is the user's current location or expert's current location.
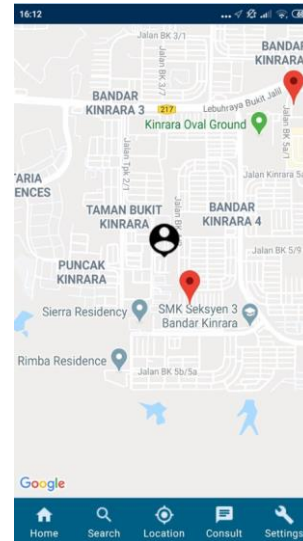

Fig. 14. Location Fragment

VIII.   CONCLUSION

To conclude, HealthyGO is aim to spread health information to every people in the world to raise awareness on their health condition. The administrators and experts of the system are required to work together to create and update the health topic to be view by the user. The expert is responsible to provide feedback on the health topic to let administrator to update the health topic. The expert is also responsible for replying any user consultation message using the mobile application. There is still room for improvement for the HealthyGO such as integrating with the hospital to make book appointment available on the mobile application, available in different language for the health topics, enhance consultation chat with image support or voice support.

REFERENCES

[1] Van der geest, S., 1985. The definition of health. Culture, Medicine and Psychiatry.

[2] Huber, M. et al., "How should we define health? BMJ (Clinical Research Edition), 343, 2011. Retrieved from https://doi.org/10.1136/bmj.d4163.

[3] Rebecca L. . et al., "Cancer Statistics, 2017. CA CANCER J CLIN, 2017, 67, pp. 7-30

[4] WorldHealthOrganization, 2018. The top 10 causes of death. [Online] Available at: http://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death [Accessed 9 November 2018].

[5] Malik, M., Zaidi, R.Z., & Hussain, A, " Health literacy as global public health concern: A systematic review. Journal of Pharmacology & Clinical Research, 4(2), 2017. doi: 10.19080/JPCR.2017.04.555632

[6] Mickan S. et al., "Evidence of effectiveness of health care professionals using handheld computers: a scoping review of systematic reviews. J Med Internet Res 2013;15:e212.

[7] Free C. et al., "The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: A systematic review. PLOS Med. 2013;10:e1001362.

[8] Tonsaker, T., Bartlett, G. & Trpkov, C., "Health information on the Internet," Can Fam Physician, 60(5), pp. 407-408, 2014.

[9] Hurts-Hiller, O. & Farago, J., 2005. Searching for content using voice search queries. United States, Patent No. US 7,672.931 B2.

[10] Neven, H. S. & Neven, H., 2004. Image-based search engine for mobile phones with camera. United States, Patent No. US 7,565,139 B2.

[11] Handler, T. et al., "Electronic Health Record HIMSS Definition Model," HIMSS Electronic Health Record Definitional Model Version 1.0, 7 July, pp. 3-8, 2003.

[12] Miriovsky, B. J. , T. et al., "Importance of Health Information Technology, Electronic Health Records, and Continuously Aggregating Data to Comparative Effectiveness Research and Learning Health Care," Journal of Clinical Oncology, 30(34), pp. 4243-4245, 2012.

[13] Benigeri, M. & Pluye, P., "Shortcomings of health information on the Internet," Health Promotion International, 18(4), pp. 381-384, 2003.

[14] Miller, N., Lacroix, E.-M. & Backus, J. E. B. ., "MEDLINEplus: building and maintaining the National Library of Medicine's consumer health Web service," Bull Med Libr Assoc, 88(1), pp. 11-17, 2000.

[15] Guard, R. et al., 1996. An electronic consumer health library: NetWellnessTM. Bull Med Libr Assoc, 84(4), pp. 468-477.

[16] Jackowski, K., 2019. Kotlin vs. Java: Which One You Should Choose for Your Next Android App (UPDATED). [Online] Available at: https://www.netguru.com/blog/kotlin-java-which-one-you-should-choose-for-your-next-android-app [Accessed 27 August 2019].

[17] Rouse, M., Gillis, A. & Silverthorne, V., n.d. integrated development environment (IDE). [Online] Available at: https://searchsoftwarequality.techtarget.com/definition/integrated-development-environment [Accessed 28 August 2019].

[18] Ho, D., n.d. What is Notepad++. [Online] Available at: https://notepad-plus-plus.org/ [Accessed 28 August 2019].

[19] Stoica, M., Mircea, M. & Ghilic-Micu, B., 2013. Software Development: Agile vs Traditional. Informatica Economică, 17(4), pp. 64-76.

[20] Schwaber, K., 1997. SCRUM Development Process. Business Object Design and Implementation, pp. 117-134.