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Digitalization of Medical Prescription and Localization of Healthcare Products

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***Abstract*- This project enables the doctors to send prescription digitally to the patients who are not able to visit the doctor in person and also allows the patients to check the availability of medical products in nearby pharmacies. The conventional way practised by doctors is to write the prescription using pen and paper and also the patient may not know about the availability of these medical products in nearby pharmacies. The use of pen and paper for medical prescription is not encouraged because the prescription might get damaged, lost over duration of time and no further automations/computations cannot be done that limits the scope of pervasive healthcare system. During emergency situations, the patient might not get the prescribed medical products due to lack of availability in nearby pharmacies which lead to severe health issues. This project digitalizes the prescription given by the doctors and also guides the patients to the nearby pharmacies which contain the required quantity of medicines and other medical products. Due to this digitalization of medical prescription, the patients suffering from severe ailments might not strain themselves to consult the doctor in person. This project also enables the user to check for the availability of the required medical products in the nearby pharmacies using GPS and Google Maps implemented in Android platform. It uses an ranking algorithm to enhance the quantity of information which is fetched from the database and presented to the patient. The ranking also uses a credit-based system, which weightage to rating given in recent years. The uniqueness of the project is to design low cost pervasive healthcare inventory automation system.**

***Keywords:*— automation system, healthcare inventory, ranking, prescription, availability**

I. INTRODUCTION

A. Electronic Prescription

e-Prescribing is the secure, efficient means of electronic creation and transmission of a digital prescription between an authorized prescriber and a patient. Since the Electronic Prescription sent to the patient is digital it is not vulnerable to theft or destruction. Also, the digitalization of doctor provides the first step towards automation is medical field. By eliminating need for prescriptions to be hand written, e-prescribing can improve patient safety, convenience and the overall quality of care.

B. Benefits of Electronic Prescription

The advantages of e-prescribing for patients very significant. Since the prescription given by the doctor is in a digital form it can be sent to a pharmacy to check, with the formulary compliance check already completed by the physician, and any prior authorization activities of dispensing these drugs are completed in advance, there are nearly no hurdles for patients and also the patient no more has the need to check for availability of drugs and other healthcare products prior to visiting the pharmacy. This convenience translates into better medication adherence as well since there is no delay in patient access to their initial prescription and hastens the dispensing of healthcare products.

Lastly, electronic prescribing is simply much more secure than paper prescriptions because of the following reasons. Paper prescriptions are subject to transcription errors and are targets for theft, damaging of paper prescription, prescription tampering, making it relatively easy for drug-seeking patients to alter prescriptions by increasing the given dosage, quantity of prescribed drug, or number of refills of medications.

C. Healthcare

Health care or healthcare is the improvement of health via the diagnosis, treatment, and prevention of illness, vaccination or curing of diseases , cleansing of injuries, and other physical and mental impairments in human beings. Health care is delivered by health professionals in allied health professions, chiropractic, physicians, physician associates, dentistry, nursing, medicine, optometry, pharmacy, psychology, and other health professions. It includes the work done in providing primary care, secondary care, and tertiary care, as well as in public health.

The usage of E-Prescription in the field of healthcare is gaining popularity in recent years. At the

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most basic level, an e-prescribing system can be sent to a patient as an electronic reference handbook. More sophisticated e-prescribing systems acts as a prescription writer with the ability to ease of patient-to-doctor interaction. They can also create and refill prescriptions for individual patients, manage drug dosage and view patient prescription history, connect to a pharmacy or other drug dispensing site, and integrate with an electronic medical record (EMR) system maintained in many hospitals.

D. Localization

Localization in this paper refers to the process of making medical resources easily available to the patient in need. Also, the latest trends in talks about the how devices are implemented using localization. Nowadays, any new generation devices and any upcoming devices include a localization engine, which exploits the numerous embedded technologies to retrieve location information. The current question in this field has changed from knowing "how to make a localization engine" to "how to make a localization engine efficient?". The efficiency means lightweight on the device's resources consumption, responsive, accurate and safe in terms of privacy. In fact, since the device's resources are limited, all the services have to manage their trade-off between consumption and reliability, to prevent a drastic reduction of the phone's life. Furthermore, among all the available services the localization is the most challenging one in terms of resources consumption. Recently, many methods for efficient resources usage in location-based applications have been suggested. [12]

II. LITERATURE SURVEY

Medication prescription is one of the most common and powerful treatment methods used by many doctors. For centuries in the field of medicine, hand-written prescription has been a well accepted communication method for doctors in decision making concerning medication therapy, and pharmacists in dispensing medications. On the other hand, it has been a valuable instruction on how to use medications for patients. Besides, it is considered as a base activity in the health care process as patient's health-care or treatment begins from the prescription of drugs. National health care systems face numerous problems such as demographic changes followed by increasing need for health care services. Hence, people tend to use more medications for even the simplest illness which has lead to a rise in the number of prescriptions and diversity in medication types. Therefore, society became much more reliant on hand-written medication prescribing which tends to be faulty or not precise in many instances [3].

A. Problems and Errors in Medical Prescriptions

Prescribing problems listed in this survey amounts to almost all prescription problems faced by respective individuals and some of them are (1) interference with the dispensing of prescriptions, such as illegible prescriptions and prescriptions with wrong information; or (2) be potentially harmful to the patients, such as over dosage, side-effects produced by consumption of a certain combination of drugs, drugs which are inappropriate to be consumed by people of a certain age, adverse drug reactions, allergy to drugs, and drug duplication. Prescribing problems cover a wide area, but pharmacists only focus on efficiency of dispensing drugs and quality of drugs that are dispensed. This lack of foresight of pharmacists or doctors has made it for them to realize the problem and act accordingly [2].

Caplan (2007) mentioned in his article in Time magazine, that a Doctor's sloppy handwriting kills more than 7,000 people annually. He also mentioned that one of the solutions to address the problem is by electronic prescriptions. But the professional magazine PT in Motion (2011) by the American Physical Therapy Association stated that electronic prescription error rates are similar to handwritten errors. Their researchers examined 3,850 electronic prescriptions that a pharmacy chain received over 4 weeks in 2008. Of the e-prescriptions studied, researchers found that 452--or nearly 12%--contained a total of 466 errors. Error rates varied from 5% to 37% among the 13 electronic prescribing systems analyzed. Researchers noted that their findings on e-prescribing error rates are consistent with earlier studies on error rates for handwritten prescriptions. They also stated that of the 466 prescribing errors; about one-third could have caused patient harm. Here it is mentioned that e-prescription is not a viable solution because it is too costly for everyone to adapt to. But since in today's society nearly half of urban populous have access to a smart-phone and internet, this percent of smart-phone users is said to rapidly in near future [6].

The best solution to the problems mentioned above is obviously e-prescription method. Since no perfect method of e-prescription is in use anywhere, henceforth our goal is to produce a e-prescription method which is comparatively better than other existing methods.

B. Success rates of E-Prescription

A survey list in an IEEE paper shows that the doctors, nurses and other paramedical staff would prefer switching

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to the e-prescribing system in the longer run due to various reasons. Firstly, it can record drug administration, saves staff time as no transcription is required for the charts. Better and more reliable information is available for patients on medication from clinicians. It supports a direct communication of prescribing the pharmacies. It improves the availability of patient information when needed, e.g. patients' preferences, allergies and diseases suffered and also older people who have no one to take care of, could be tracked and rescued medically. The survey showed that majority of the doctors, nurses and the paramedical staff are similar with the latest technology and would take the required training when the system is launched.

Thus it is clear that e-prescription is readily accepted in the medical society. Also during the recent years, the adoption of e-prescriptions has been spreading relatively rapidly. Henceforth if implemented it would be a huge success [1].

Table I: User Survey

S.No	Survey on User opinion		
	Question Asked	*Yes*	*No*
1)	Are you satisfied with the current prescribing system?	20%	80%
2)	Are you familiar with the e-prescribing system which is in use at Kings College Hospital in some departments?	35%	65%
3)	Do you think e-prescribing system should be introduced in the Newham University hospital (NUH)?	71%	29%
4)	Do you know that e-prescribing system can play an important role in improving the quality of care?	82%	18%
5)	Does you know that e-prescribing system can record drug administration?	37%	63%
6)	Are you familiar with the latest technology?	58%	42%
7)	Will you be happy if this system is launched in the NUH?	68%	32%
8)	Will you be happy to take the required training if this system is launched in the NUH?	84%	16%

From the above survey conducted on medical practitioners it can be easily derived that paramedical staff would prefer switching to the e-prescribing system.

C. Existing system of E-Prescription

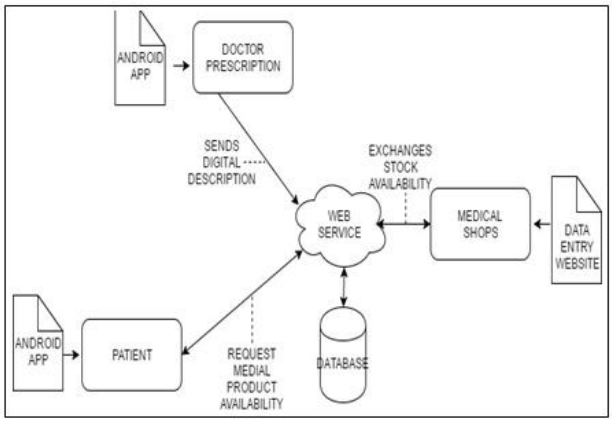
Existing system of e-prescription uses Linked Open Data as an effort to interlink and integrate the many isolated sources of information. This method is now obtaining more attention in the domain of pharmaceutical, medical and life sciences.

The sources of data present within a Linked Open Drug Data(LODD) ranges from drugs, general information, interactions and impacts of the drugs on gene expression, through to the results of clinical trials. LODD will survey publicly available data about drugs and create Linked Data representations of the data sets then interesting scientific and business questions that can be answered once the data sets are connected. Also, the produces using LODD is a Semantic Prescription.

But since such an E-prescription methodology is potentially time consuming, complex and unreliable at most times due to lack of the human element i.e., it prescribes medical without a doctor's consent with just using available meta-data on drug interactions. Since such a method is highly prone to be errors, we have given e-prescription method that facilitates the digitization of doctor's prescription and also have specified a means for the patients who receive the above prescription to check for the availability of drug and medical products in nearby pharmacies. [8]

III. SYSTEM ARCHITECTURE

In this section, we explain about the android architecture that we plan on implementing. This architecture a detailed description of interactions taking place between patient's UI, doctor's UI, server, pharmacy database.



A. Architecture

This architecture contains 3 modules namely

i. Android Application
ii. Web Server
iii. Pharmacy Stock Update Website

a) Android Application

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This android application in-turn consists of two user interfaces namely Patient UI and Doctor UI. The doctor side user interface is used to draft the medical prescription in a digital form and send to the patient via an external server in the form of an application message. Also, to make the doctors and other medical professionals comfortable in prescribing medicines using this method, we have also the idea of implementing a custom dictionary containing all the medical terms so that the doctor can use the swipe feature available in almost all the smart-phones to make prescribing process faster and easier. The medicine prescriber must specify the drug name, dosage, type of drug (depressant, hallucinogen, painkiller), classification of drug (syrup, tablet, capsule) and quantity to be brought. The doctor is also able to check a patient's previous history via the data stored in the web server.

The user interface of the patient is mainly designed to receive the prescription from doctors. This digital prescription also contains the doctor's details for patient reference such as doctor's name, specialization and hospital he/she is working in. From here the patients can select the medicines which are needed to be searched in the nearby pharmacies. Also, the patient/user is opted to give a feedback which is crucial to the ranking algorithm implemented here.

b) Web Server

The Web server denotes the services provided by server connected to the mobile application where it stores the list of registered doctors and patients and website which is used for the collection of stock information from pharmacies from any locality. The Web server is also responsible for the interaction of doctor-to-patient, while sending the prescription the data is first stored in the server and then relayed to the respective patient. The server will also be responsible for the interaction from patient user interface to google maps API which will be used to plot the pharmacies that have available stock of selected medicines.

c) Pharmacy Website

The major function of this module is to collection stock information from the pharmacy vendor and store it into the web server also it can be used by the vendor to update the stock available has it tends to change each day. Also, the data retrieved from the web server is done using a ranking algorithm which enables the patient to find and purchase the required drugs from trusted retailers. Also, we will acquire the latitude and longitude of shop location which will make it easier to be plotted in the Google Maps API.

B. Features

- The usage of a custom dictionary we are able to hasten the rate of distributing prescriptions
- Since Google API for maps is already available it is easier to plot the location of pharmacies
- The ranking algorithm which is implemented here will filter the best result and presents it to the patient.
- Since the prescriptions are sent through the server we can keep a record of all the prescriptions, which might prove useful as reference later on.

IV. ALGORITHM

The algorithm used here is similar to a relevance ranking algorithm. It also uses the feedback given by the patient. This algorithm uses three factors namely: finding out the pharmacy which is closest to current patient location, also has stock of the highest number drugs required by the patient and also has the highest of feedback rating.

The feedback is produced by the patient via the patient UI and rating is based on customer care, delivery of good quality goods and the availability of drugs as per specified in the database by the respective pharmacist. The feedback given by user is then processed by an algorithm which gives weightage to a feedback based on its timeline.

Rank is calculated based on the credit system, most recent years have assigned more credits and less to the previous year and goes on. This feature help the patient to locate the medical easier way.

```
Algorithm rank_calculation(Input weightage, reg_year, current_year,feed_back)
No_of years=round(year-current_year)
For each(year=reg_year; year<=current_year;year++)
        dx=current_year-reg_year
        for each(i=1;i<=current_year;i++)
                weightage[i]=feed_back(5-i)/(dx-i)*5;
                weightage+=weightage[i]
        rank=weightage/5
if(weightage==0)
        exit(0)
end
```

Consider a drug medical shop which was 3-year-old, the credit is calculated by

Year1(current) = credit 5; year2 = credit=4; year3=credit = 3 and so on. The user rating obtained from the UI is

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multiplied with the respective year in which the rating is given

Example, assume the current year is 2017, then if the user gives 4-star rating in previous year and 4-star rating in current. Rank will be calculated as follows:

Given: previous year ranking:3, current year ranking:4,

((3 x 4) + (4 x 5)) / 9 = round (36 / 9) = round (3.55) = 3.6

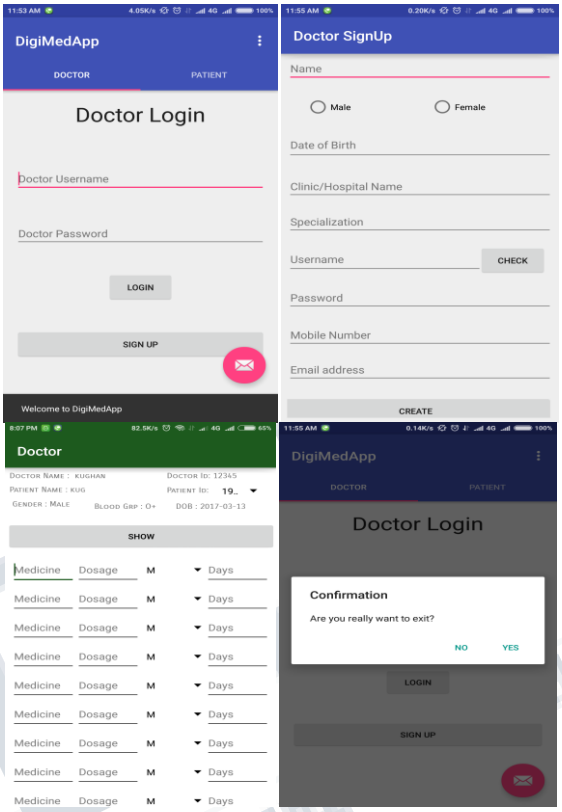
While implementing the custom dictionary, we can also implement an algorithm to filter the suggestion produced to user by filtering the drug according to the patient age, gender, blood pressure, personal allergy record and patient's sugar level to even more enhance rate of drafting a medical prescription.

V. IMPLEMENTATION

The implementation of this idea requires the presence of three end users such as doctors, patients and pharmacist. The doctor first needs to login to account and if the doctors does not have a account he then proceed to sign-up first, then after logging their account they are required to frame the prescription and send it to the patient.

The patient also needs to login and then he/she able to receive the prescription in a format that will be easier to search the nearby pharmacies for stock availability. After purchasing medicines from a shop, the patient is opted to give feedback based on certain factors.

The role pharmacist is to register his/her store on the website to be able to create, update or modify the available stock in the respective pharmacy. Then after the patient searches the nearby pharmacies the Google Map API is opened the nearby pharmacies with the availability of required medicines are plotted in map with user's current location highlighted. Also, the API provides the user with the nearest pharmacy and the distance between them.



VI. RESULT

We have taken samples from user, for five years and have computed values based the rating given in these five years based on credit-based system.

The comparison between conventional method and our credit-based method is shown in graph given below. In the above graph, in the comparsion between the techniques yield higher result for our methodology because of the weightage concept implemented here. In other words,
for the first three entries the user gives a higher rating in the recent years and the next two years there is a decrease, henceforth Credit-based is high and vice-versa. X axis assumed as years and yaxis assumed as rating.

VII. CONCLUSION

The primary objective of this paper is to produce a method of e-prescription such that a doctor experiences relative ease in drafting a prescription and also the patient undergo less trouble to find rare medicines visiting and enquiring in each and every nearby pharmacy.

VIII. FUTURE SCOPE

The future of electronic prescriptions will be based on the implementation of a widely-accepted system within the medical society. As improvements are made in technology, more people will be willing to adapt to a system that works much more efficiently than the existing system. It is not only important to implement a new system to help the performance of healthcare, there must also be a stable support system to keep this system going for years to come. There has to be a lot of time given for the adoption of the new system to take place. Most Physicians will not jump on board to a new technology without seeing that this technology is well worth the effort that it will take to get their whole team to put this system to use. It usually takes a couple of physicians in an area to adapt to a new system and then spread the word and show people that this new technique can help improve how the healthcare system can run by saving not only time but also reducing the number of errors and problems that may arise from regular handwritten prescriptions. There also needs to be technicians who will be available to help solve any problems that may arise in using the system [4].

REFERENCES

[1] Shamim Ayaz, Athar Naqvi and Geof Branch, "The Role of E-Prescribing in Health Care, A Case Study of Newham University Hospital"," Internet Technologies and Applications (ITA), 2015", Sept 2015.

[2] Yen-Fu Chen, Karen E Neil, Anthony J Avery, Michael E Dewey and Christine Johnson, "Prescribing errors and other problems reported by community pharmacists", "Therapeutics and Clinical Risk Management", Dec 2005,

[3] Mahnaz Samadbeik, Maryam Ahmadi, and Seyed Masoud Hosseini Asanjan3, "A Theoretical Approach to Electronic Prescription System: Lesson Learned from Literature Review"," Iran Red Crescent Med Journal",2013.

[4]https://campus.fsu.edu/bbcswebdav/users/bkv04/LIS4708/InformaticsPaper.doc

[5] Firat Kart, Louise E. Moser, and P. Michael Melliar-Smith, "Building a Distributed E-Healthcare System Using SOA" ,"IT Professional (Volume: 10, Issue: 2)", March-April 2008.

[6] Rosaly B. Alday, and Ruel M. Pagayon, "MediPic: A Mobile Application for Medical Prescriptions" ,"IISA 2013", Oct 2013.

[7] Hugo Rodrigues, Luis Filipe C. Antunes, Cristina Santos, Manuel Eduardo Correia, Tiago Miguel Pinho and Hilário Gil Magalhães "Physician's awareness of e-prescribing security risks"," Computer-Based Medical Systems (CBMS)",Oct 2013.

[8] Ali Khalili, Bita Sedaghati "Semantic Medical Prescriptions -- Towards Intelligent and Interoperable Medical Prescriptions"," Semantic Computing (ICSC)", 06 January 2014.

[9] Abinaya, Ganesan R, "Effective Search Mechanism For Finding Nearest Healthcare Facilities", in International Conference-IEEE Global Conference on Communication Technologies, 2012

[10] Poornima, Ganesan R, "Implementation Of Health Information System Using Location Based Services", IEEE International Conference on Advanced Communication Control and Computing Technologies, 2014

[11] Ganesan R, Harish "Design and development of secured m-healthcare system, IEEE Conference, 2012

[12] Michela Papandrea, Silvia Giordano "Enhanced Localization Solution"," Pervasive Computing and Communications Workshops (PERCOM Workshops)", 10 May 2012.