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A Smartphone-Based Application for Rural Nepal

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Key words: Android, disease, healthcare, health information system, patient rural

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Abstract: With the growing healthcare crisis, a rising number of people are being afflicted by diseases that they are unaware of. People in cities may have easy access to health care but people in rural areas rarely have access to high-quality care. In urban areas, there is the availability of health workers and advanced health care but the peoples in rural areas don't have these services which led to serious cases and sometimes even death. Brief information regarding the disease and patient state will reduce the damage and will provide information for future actions. Thus, this study purposes a health information system which serves as a link between urban doctors and rural residents. It gives general knowledge about various diseases. The framework offers more reliable results, since, data obtained from users via. a huge number of Android devices users is more accurate than data obtained from a sample survey. The obtained data can be used to forecast upcoming events which can aid in the distribution of future health-related services.

INTRODUCTION

With the growing healthcare crisis, a rising number of people are being afflicted by diseases that they are unaware of. People in cities may have easy access to health care but people in rural areas[1] rarely have access to high-quality care. Most of the time, they receive services weeks or even months after being ill. Most of the time, this happens because they are oblivious to the issue. The provided pre-vaccination program is ineffective and government funding expenditures in the health sector are unscientific because hospitals and physicians are not based on population size. The health information system serves as a link between urban doctors and rural residents. It gives general knowledge about various diseases and how they affect different parts of the world. The framework offers more reliable results, since, data obtained from users via. Android devices is more accurate than data obtained from a sample survey. The obtained data can be used to forecast upcoming events which can aid in the distribution of future health-related services.

The evolution of healthcare information systems[2]: To begin with, the history of healthcare information systems and how analytics became so relevant. This can make better sense with some historical context. Medicare and Medicaid were the primary healthcare drivers during the 1960's. The mainframes and storage became the IT drivers. Hospitals usually shared a mainframe because computers and storage were too massive and costly. In this environment, the most important applications that emerged were collaborative hospital accounting systems. One of the primary healthcare drives in the 1970's was the desire to improve coordination between departments

(ADT, order correspondence and outcomes review) as well as the need for discrete departmental processes (e.g., clinical lab, pharmacy). Computers may now be deployed in a single department without the need for environmental restrictions. Departmental processes proliferated as a result. Unfortunately, these transactional structures which were usually rooted in individual offices were also islands unto themselves. DRGs and reimbursement were important healthcare drivers in the 1980s. To be reimbursed, hospitals had to draw substantial details from both health and financial networks for the first time. Simultaneously, personal computers, widely used non-traditional computing applications and networking solutions joined the industry. As a result, hospitals started to integrate applications, so that, financial and health networks could communicate in a small capacity. Healthcare was driven by competition and restructuring in the 1990's as well as the desire to consolidate hospitals, providers and managed care. Hospitals now had access to large, distributed computing platforms and robust networks in terms of information technology. As a result, we established an Integrated Distribution Network (IDN)-like integration as well as the impetus to automate data and monitoring. Increased convergence and the beginnings of 2000s outcomes-based compensation were the primary healthcare drivers. A sufficient amount of equipment and bedside clinical software is developed to allow a significant run at industrial, real-time clinical decision support. Pinem[3] created a suitable smartphone application for high mobility medical workers to support the Indonesian universal health care health referral scheme. Two versions of the design science research (DSR) methodology were carried out. According to the findings, the first iteration's design was fine and the second iteration's design was satisfactory to the respondents. Several improvements were made to the knowledge quality elements such as the addition of local language because users felt it was necessary to help them better understand and use the system and ultimately support their mobility at the health facility. Nicolai *et al*.[4] carry out an observational survey aimed at categorizing user reviews of healthcare open-source applications and evaluating the sentiment with which users write down user reviews of those apps. As a result, the authors describe a manual method for creating an expanded taxonomy of healthcare user's demands. According to the findings of their report, users of healthcare apps are more likely than users of other types of apps to order additional functionality and support for other hardware. Furthermore, consumers are less suspicious of program flaws and provide better assistance to developers when debugging.

In Nepal, their menu health page information system is currently in operation. The majority of them are software that offers health-related statistics. The "Hamre Doctor Android" app[5] is one of them. It offers contact numbers for hospitals, doctors, blood donation services and ambulances. It also has a Track Your Prescription choice which helps to remind you when to take your medication. It also has an article tab that provides health-related content. Another app is "Hospital Nepal," which offers health-related statistics. It provides choices for hospitals, Doctors, Ambulances, Clinic Diagnostics, Daily Health Tips and Health News. Nepal's Minister of Health also announces a smartphone app to encourage teenage sexual and reproductive health. MHP[6] is a smartphone application of the Government of Nepal to provide Nepali people with quality health information. It is created by the Ministry of Health and Population. This program is dedicated to COVID-19 tracking and awareness at this moment of a global pandemic but the application's ultimate goal is to cover all health-related issues in the coming days.

This application captures, stores, manages, analysis and transmits information related to the health of individuals or the activities of organizations that work within the health sector. The application provides the following features:

- An android app which will provide various health-related information and acts as an interface between urban doctor and rural people
- The android app will also collect information from the user (the information consist of the name of a disease, district and zone name where there is the effect of it)
- Data mining is now used to mine the data thus gained from the android app

The major objective of this project is to build and incorporate a framework that provides a dedicated website for health with features such as real-time contact with doctors, illness statistics, surveys and data collection. To interpret health data more scientifically to offer facts in a more readable format.

MATERIALS AND METHODS

Requirements: The following software and hardware resources were used to complete the whole project.

Hardware requirement:

- Laptop
- Android Device

Software requirement:

- Android Studio
- Genymotion
- Photoshop

Programming language:

- Python
- PHP
- Java
- MySQL

Data acquisition and pre-processing

Data collection: We gathered the information from numerous health organizations and reliable website such as opennepal.net[7]. Data about Nepal's health sector was of greater interest to us, so, we gathered information from various website such as opennepal.net. Finally, we agreed to use the District-Wide Communicable and Immunizable Disease Database from open Nepal.

Data cleaning: Once the data has been obtained, it must be interpreted to be in the proper format. Only mandatory fields should be picked. MySQL is used to clean the files. Excel was used to do some manual work.

System design and architecture: The system is designed as per the basic health need of the people of the rural areas considering the limitation of mobile health services. Figure 1 is the level zero data flow diagram which gives a high-level view of the application. The three components of the system Patient, Hospital and Admin interact with the system and perform required functionalities.

Figure 2 is a more in-depth view of DFD. The diagram is divided into four layers from bottom to top.

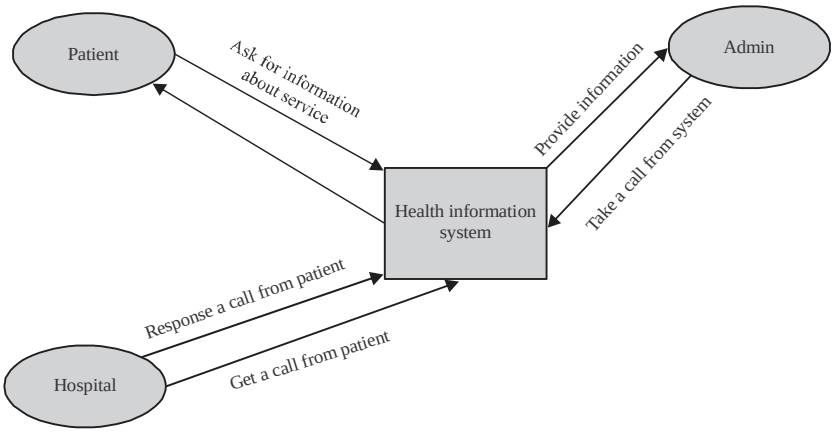

Fig. 1: Level 0 DFD

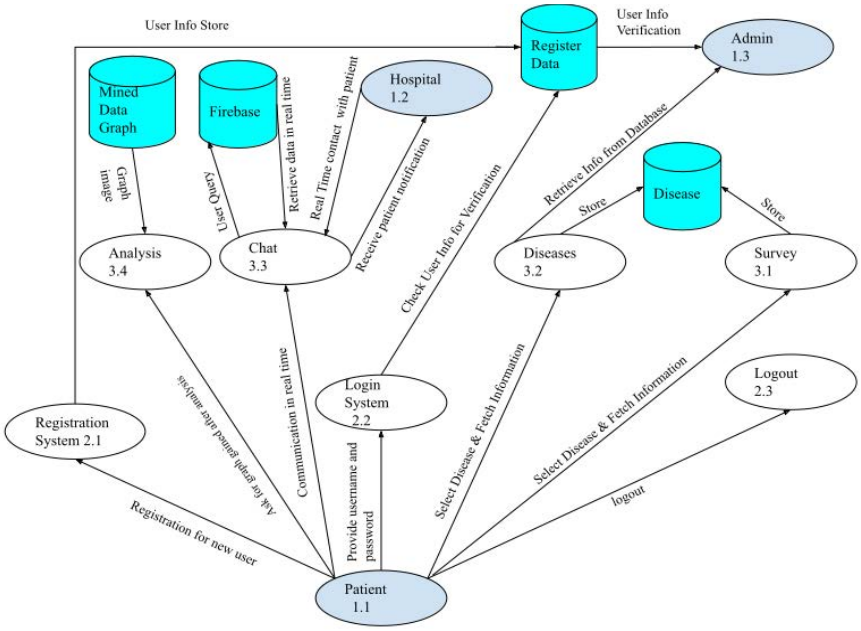

Fig. 2: Level 1 DFD

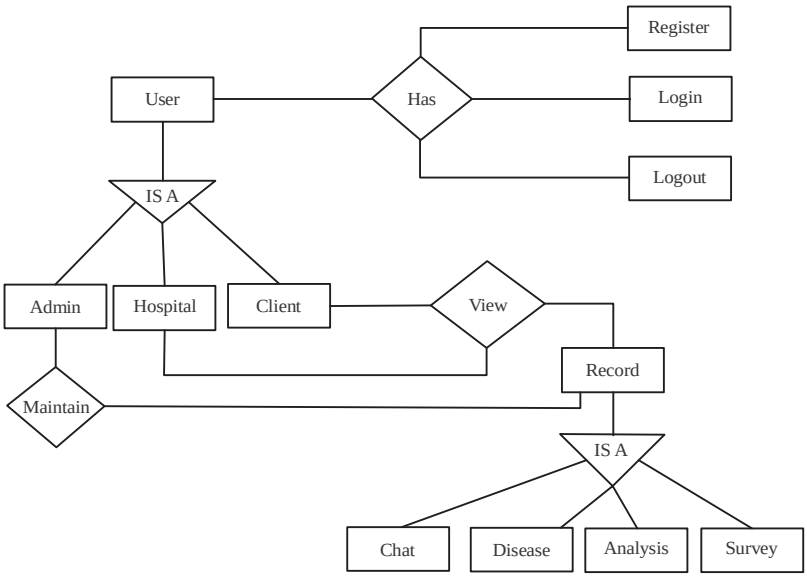

Fig. 3: Entity relationship diagram

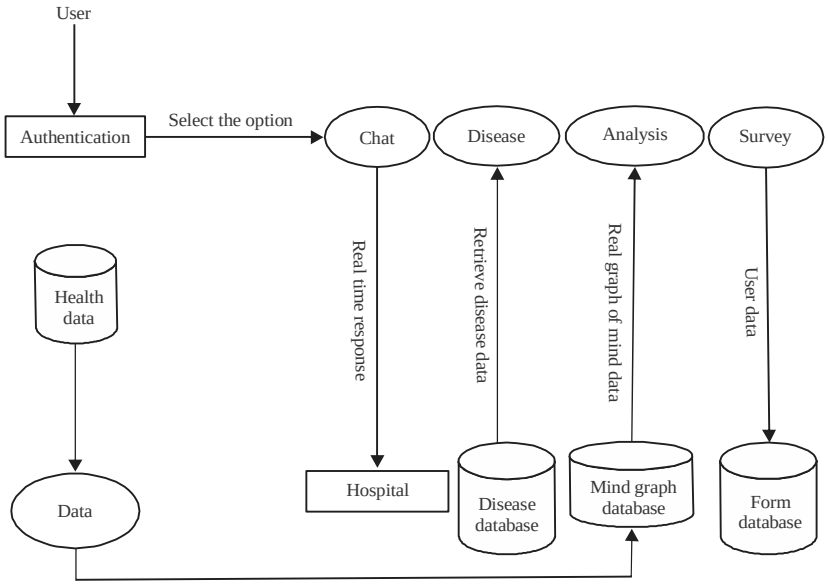

Fig. 4: System diagram

The bottom layer shows the patient and its interaction with the registration, login and logout. The second layer shows the various functionalities which represent the registration, login and log out of the system where a new user is added and registered user login. This layer acts as a barrier for n unregistered users. The third layer shows the services provided by the application and the interaction with the user. The topmost layer shows the database and other entities of the system. The interaction of the other entities and CRUD operation is done in the database is shown in this layer. The overall flow of the diagram can be understood from the numbering provided.

Figure 3 represents the Entity Relationship Diagram. It demonstrates the relationships between entity sets stored in a database In this case, an object is a data component. ER diagrams, in other words, depict the logical form of databases. The three entities, their representations and their interaction with services are shown abstractly and clearly. From Fig. 3. It is seen that the user can register, log in and log out. It acts as an Admin, Hospital, or client. It can view records related to chat, disease, analysis and survey as an admin who maintains the record.

Figure 4 is the overall architecture of the system. It shows the overall functioning of the system and

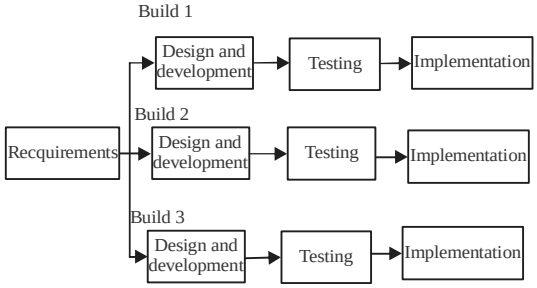

Fig. 5: Incremental model

summarizes all the diagram information. The overall systems follow as per the diagram is shown below:

- The user information is stored and authenticated
- User choose service as per their need:
    - Chatting with a hospital in real-time
    - Retrieve disease data
    - Retrieve a graph of mined data
    - Store Survey Data
- According to the required operation in the database is carried out

Software development approach: The incremental model[8] is a software development process in which the product is planned, introduced and evaluated incrementally (a little more is applied each time) before it is completed. It entails both growth and upkeep. When a product meets all of the specifications, it is said to be completed. This approach incorporates aspects of the waterfall model[9] with the iterative prototyping philosophy. The product is divided into several parts, each of which is planned and developed independently (termed as builds). When each part is done, it is sent to the customer. This allows for partial product use while avoiding a lengthy production period. It also results in a high initial capital outlay thus avoiding the resulting long wait. This architecture paradigm also aids in reducing the traumatic impact of adding a brand new structure all at once.

Figure 5 shows the following of system development in the incremental model. The build number increase until the final product is gained.

RESULTS AND DISCUSSION

The study aims to design and develop an android application that provides health services to people in rural areas. The application can provide end-to-end basic solutions for health care. It can provide information regarding the disease, connect with doctors in rural areas and disseminate information about health-related activities instantly. It is cheap means of spreading crucial information in difficult terrain. The search is the premium service which is not included in this study.

The final system uses firebase, SQLite and Apache servers to store and transfer data. The user credentials are stored in an apache server database when the user registers and later it is checked when the user logins. If the credentials do not match then the user cannot log in.

The blog is used as a medium to share information among doctors, patients and admin. The disease provides information about symptoms and precautions. The survey will provide the user the opportunity to share their local health condition among peoples and data analysis will provide local and national level information about diseases. All these services will provide patients, doctors and admin a complete system to disseminate health-related information.

To gain a better understanding of the usefulness of the application, the final application was presented in a national-level exhibition NSU TECH FEST 2018. The project gained good recognition from experts and other visitors which allowed the developers to win people choice awards. The final application images are shown in Appendix (Fig. A1-A6).

Simple summary: People in the rural areas in a developed country like Nepal don't get proper health facilities. During the period of COVID-19, the situation has become worst, the hospital in urban areas are overwhelmed and the whole medical system is on brink of collapse, providing a basic health facility to people in rural areas has become hard. To mitigate this issue, a mobile-based application is designed that provides various health-related services. The mobile application allows Government, NGOs, INGO, hospitals and peoples to communicate with each other in real-time. Individuals can learn about various diseases: symptoms and precautions through the app. The government knows about the condition of rural areas through surveys and data analysis. To test the efficacy of the mobile application, it is presented in a national-level exhibition. The project gained good recognition from experts and other visitors which allowed the developers to win people choice awards[10].

Author contributions: The application is designed and implemented by Milan Tripathi. He also wrote the whole research paper. Ayush Koirala helped to present the application in the exhibition.

Appendix (Fig. A1-A6)

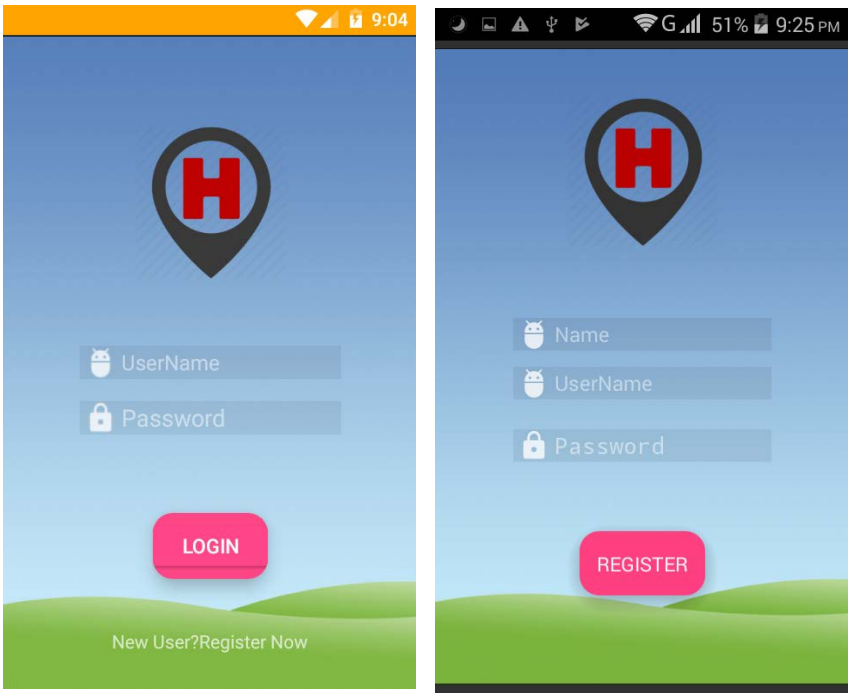

Fig. A1: Login and register

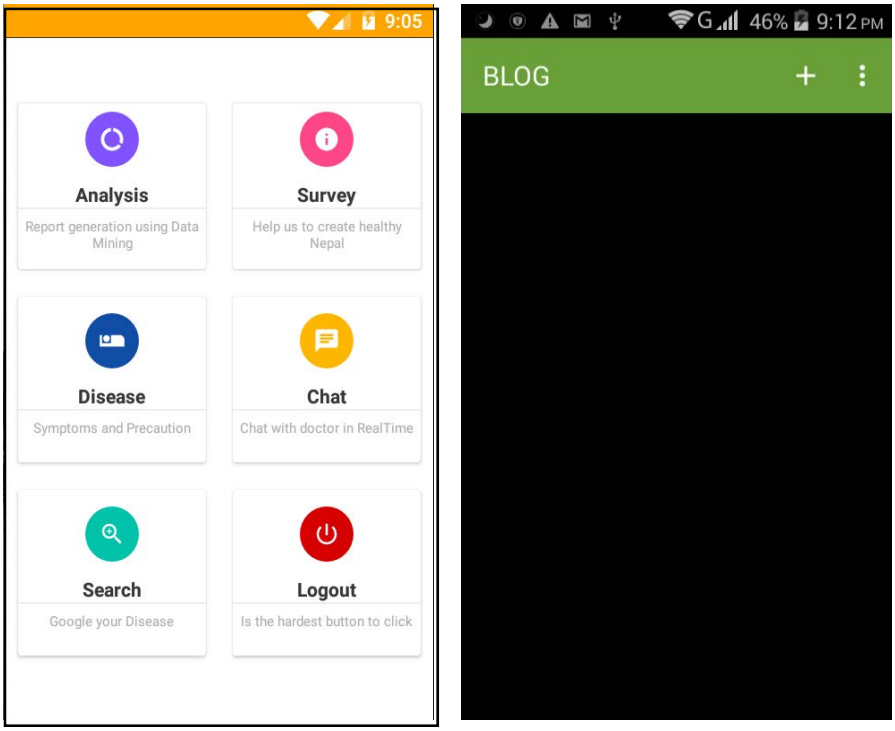

Fig. A2: Services and chat

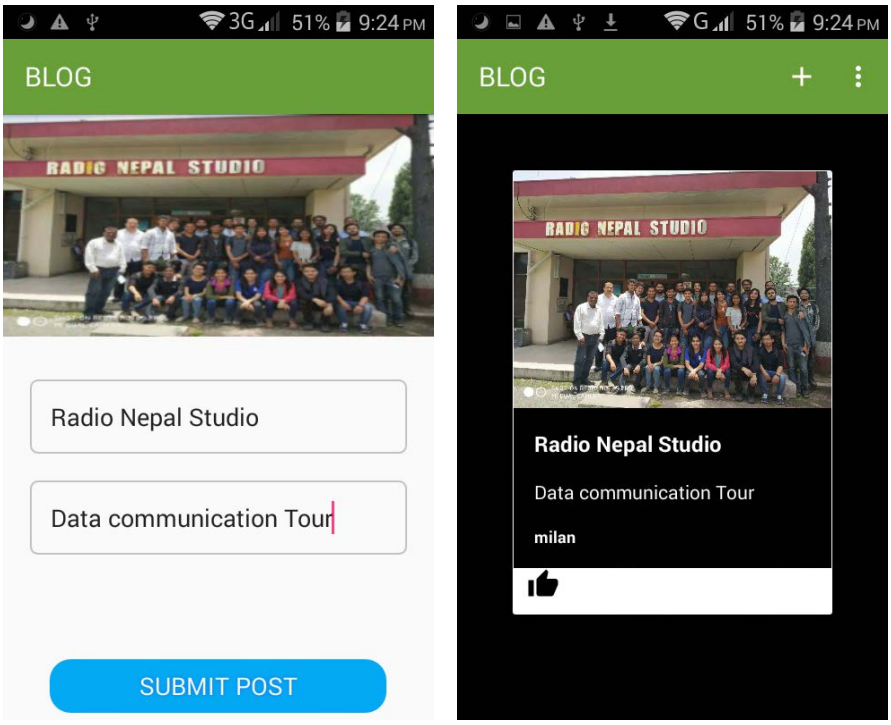

Fig. A3: Blog (Chat)

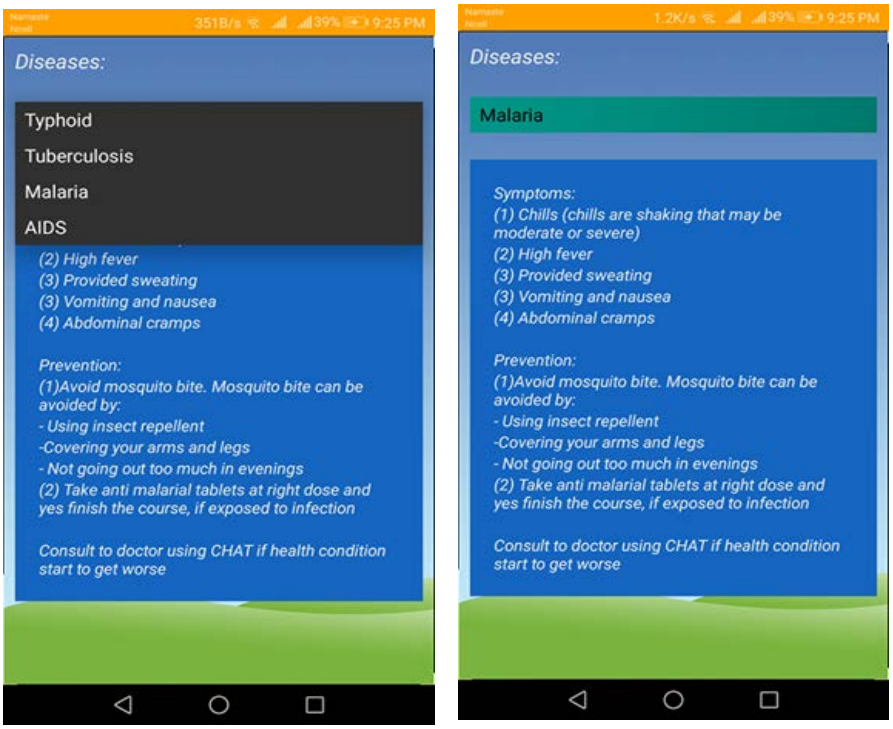

Fig. A4: Disease

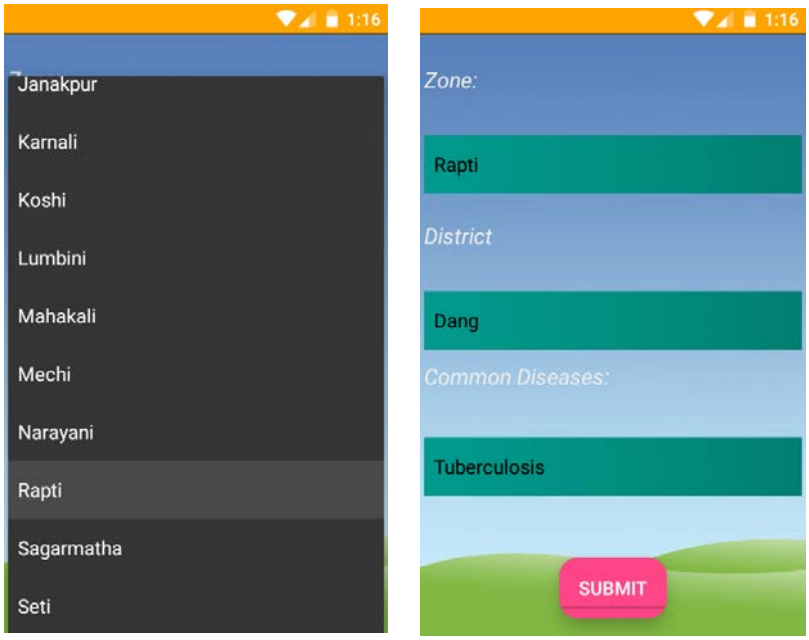

Fig. A5: Survey

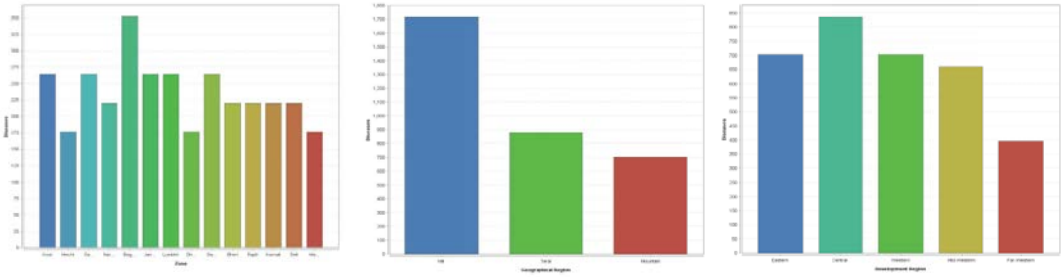

Fig. A6: Data analysis

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