DARN - Disease Avoidance Repository Navigator

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Abstract-- Computers have played a major part in the field of medicine, helping from early spotting to the highest possible diagnosis of a disease. This project relates to computer implemented methods for associating locations with healthcare events based on a person's social security number. It includes a location-aware client device which receives the location data of the person in question, in real time. The location data is updated based on the person's movements. The person's healthcare related information is mapped and stored. Tracking the geographic occurrences of certain diseases with respect to each individual can definitely ascertain and restrict the spread of certain diseases and also help in handling preventive measures when the person wishes to visit another *place*.

I. INTRODUCTION

Healthcare events in one location can affect other locations. Tracking the geographic occurrence and spread of healthcare events can lead to greater understanding of underlying causes and therefore can be beneficial in taking appropriate counter measures. There have been many approaches to track and display the occurrence and spread of healthcare events. For example, the Centre for Disease Control and Prevention (CDC) provides a weekly heat map of influenza activity, based on weekly influenza activities reported by state and territorial epidemiologists. Because such reports are created based on information supplied by a number of medical sources, the reports are inherently out of date. By the time the data is received, compiled, and presented, that data may no longer accurately reflect the actual spread of the disease.

Another approach has been to rely on information voluntarily supplied by consumers. This approach has its own weaknesses. For example, a large number of individuals must affirmatively supply information related to the occurrence of the disease. Furthermore, without an incentive, most people may not participate in such a time consuming activity. Thus it may be desirable to have a system and method for automatically collecting and displaying the occurrence and spread of illnesses. Also, using something as unique as an identifier, gives authorities the perfect opportunity to correctly map each individual's health chart with his current geographic location.

II. PROJECT ARCHITECTURE

In this project, we have designed a 3-tier application which consists of client tier, middle tier and backend tier. The frontend is developed using AngularJS and the user interface is designed using twitter bootstrap. We have used MongoDB to store the details and dependencies between modules, as it provides easy readability and availability. Client requests for resource from the server. REST is used as a middleware technology which joins separate programs together. Node.js technology along with Express framework is used for developing the application, because it is lightweight, gives high performance and is asynchronous in nature.

We have used two models for analyzing the probability of user catching that disease. We have used a model for individual data where we are analyzing the infection status and risk level factor and this is how we come to a conclusion of whether there are chances of a person to get infected by a particular disease.

One view is accepting information from users. City name and Disease name is being accepted by the form that is included in our User Interface. The details are then stored in to our Mongo database. For the other part, the UI form accepts the travel plans of the client in the form of a city name and based on the city we query our database to find out what are the top 3 diseases that city is infected with and to what extent that disease is spreading and what are its boundaries.

Then we perform an analysis on current environmental factor in that city and severity level based on count of people infected with that disease. And the result of this analysis gives us top 3 diseases i.e. Diseases with highest probability of infection and then we are displaying disease name, count and preventive measures that the client should take. We also provide a link where the clients can study the disease and preventive measures in detail.

III. TECHNOLOGIES

- **AWS Cloud Services**

It allows us the flexibility to develop, build and run our code. We used AWS because it supports multiple programming languages and helps us in managing applications on the cloud.

• **Node.js**

Entire business logic is defined in the backend using Node.js, which provides a powerful JavaScript framework and uses asynchronous IO operations.

• **Express**

It is used along with Node.js to handle request with REST integration. It provides better features and security at server layer. Every request coming to the server is validated and then the interaction with database is done.

• **MongoDB**

We have used MongoDB service as a data store for our application on the cloud. MongoDB which is a NoSQL database, stores the data in JSON format. MongoDB queries our documents using a document-based query language. We submitted data in .csv format and have it updated in real time.

• **AngularJS**

AngularJS is a JavaScript framework which reads and interprets the HTML page with additional tag attributes as directives. AngularJS then binds these directives to the model.

• **Google Maps API**

Our service displays the diseases which are mapped to a customer's travel plans and displays the preventive measures the traveler can take before leaving for the trip. Google Maps API is useful in displaying the extent and boundary of the disease threats and is useful in explaining

to the customer how widespread the disease actually is.

IV. PROJECT DESCRIPTION

Our project can be found in the following link: https://github.com/DhirajGurnani/DARN.git

The proposed method provides for associating locations with healthcare events and a person's unique identifier and health related information. The system receives location data from a location-aware client device which is assigned to each user. The system analyzes the received location data to determine a routine travel plan of a particular user associated with a location aware client device. A healthcare event can be a visit to the doctor's office, a pharmacy or a hospital. The information can also be superimposed on a map to visually represent the occurrence, location, and spread of diseases. This representation of location based healthcare events can assist in taking appropriate precautions to a visit or a travel plan. The system can also aide in discerning the geographic location boundaries for a particular infection or disease and can accordingly warn individuals who are planning to go there. It can therefore help in preventive measures. It will also help to localize diseases to specific areas and thereby help in their classification and eradication if possible.

V. SCREENSHOTS

Figure 1. DARN Homepage

Figure 2. Search City page

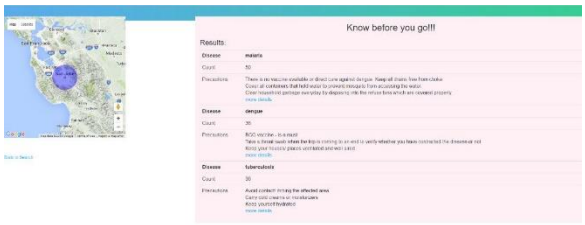

Figure 3. City based detail page

Figure 4. Healthcare information page

Figure 5. User input page

Figure 6. User enters city and disease details

Figure 7. User details input into system

VI. TESTING AND SECURITY

- Encryption

As we are taking client information and mapping it to the disease information of a city so as to create an epidemic tracking and warning system. We need to ensure that the client's device is kept secure as we are accessing location information and also assigning a unique identifier. We proposed to use the MD5 algorithm for this purpose.

- Input Validation

This step is not completely required as most of our information was obtained in real-time from the https://www.cdph.ca.gov/ site which issues disease information and mapping in real time. The report is issued quarterly which is fed into our system to keep the information as accurate as possible.

VII. CHALLENGES

There are many challenges that the project will face namely:

- Validating input taken from users – this is the hardest as currently there is no validation in place
- The system only provides the top 3 diseases of the location. Users therefore will be unaware of the remaining threats.
- Preventive measures are shown but are not full proof so it is advised that clients do not solely depend on it.

VIII. FUTURE SCOPE

The application can be enhanced by overcoming the challenges that the project is dealing with. We can make it more predictive in nature and also add a lot more diseases to warn clients about all possible threats.

IX. REFERENCES

- http://www.w3schools.com
- https://developers.google.com/maps/
- https://developers.facebook.com/
- http://www.tutorialspoint.com/
- https://github.com/DhirajGurnani/DARN.git