# SymMedic - A Disease Detection Mobile Application

Shradhha Chadha, Shreya Shah, LakshmiPrasanna Kona, Tarang Dhulkotia

Dept. of Computer Engineering
San Jose State University, San Jose, California-95192, USA

***Abstract*—We have built a mobile application that offers a personalized diagnosis based on their symptoms and profile. Based on the entered symptoms it tells you what possible diseases you have. It directs you to more medical information and shows you the right doctor for further clarifications. SymMedic application can be integrated via the flexible Apimedic API (Application Programming Interface). Our application was able to identify symptoms from user inputs with an average precision of approximately 90%.**

***Keywords—Symptom, Disease Detection, SymMedic, Application Programming Interface.***

## I. INTRODUCTION

In the United States, healthcare is a highly advanced and rapidly developing field, but Americans face limited and expensive coverage. In 2016, healthcare expenditure exceeded $10,000 per capita. (Keehan et al., 2016) In addition, 4.5% of Americans failed to obtain necessary medical treatments due to high costs. (CDC, 2015) Due to the need for lower costs and easier access to care, the healthcare space holds a lot of opportunity for effective and convenient automated systems. We built a mobile application that diagnoses patients explaining their condition using a web API. The application asks for relevant information, e.g., age and sex, and requests a list of symptoms. The system remembers past responses and asks progressively more specific questions in order to obtain a good diagnosis. The three primary components of our system are (1) identification and extraction of symptoms from the conversation with the user, (2) accurate mapping of extracted (and potentially ambiguous) symptoms to documented symptoms and their corresponding codes in our database, and (3) developing a personalized diagnosis as well as referring the patient to an appropriate specialist if necessary.

A symptom is any subjective evidence of disease, while a sign is any objective evidence of disease. Therefore, a symptom is a phenomenon that is experienced by the individual affected by the disease, while a sign is a phenomenon that can be detected by someone other than the individual affected by the disease. For examples, anxiety, pain, and fatigue are all symptoms. In contrast, a bloody nose is a sign of injured blood vessels in the nose that can be detected by a doctor, a nurse, or another observer.

Health-care professionals use symptoms and signs as clues that can help determine the most likely diagnosis when illness is present. Symptoms and signs are also used to compose a listing of the possible diagnoses.

for users who otherwise find all these things difficult and hard to believe in case of assets transactions.

Our Disease detection tool can be used to handily review a number of possible diseases that you may be experiencing. There are many diseases for any particular symptom, and the causes revealed in this application are not exhaustive. That is, they are not intended to be a listing of all possible diseases for each symptom but are representative of some of the causes that can be underlying various symptoms.

## II. RELATED WORK

[2] The number of healthcare and wellness applications, for both mobile devices and websites, have grown at a huge rate over the last two years. Start-ups focused on healthcare have grown almost as fast. One contributor to this surge in interest may be the imminent implementation of the Affordable Healthcare Act key provisions in 2014. With so much disruption caused by this act, some expect an emergence of non-traditional markets and its related services. You don't have to be a medical expert to take advantage of the opportunity – whether with a start-up, as an independent app developer, or as an extension to your existing company software. Several APIs help you connect your software to existing data sources or integrate medical data into yours, while maintaining privacy and adhering to government regulations.

## III. APIMEDIC AND BETTERDOCTOR APIs

Apimedic API is developed by a Swiss startup with clients in Europe. As you can see by the references on the website above the API is already used by some major healthcare clients. The service is described as follows. ApiMedic offers a medical symptom checker primarily for patients. Based on the entered symptoms it tells you what possible diseases you have. It directs you to more medical information and shows you the right doctor for further clarifications. The symptom checker can be integrated via the flexible API (Application Programming Interface). This is a modular programming interface, which offers the symptom checker functionalities for a main program.

Betterdoctor API has very exhaustive database of more than 1 million doctors, their medical specialties as well as health insurance information.

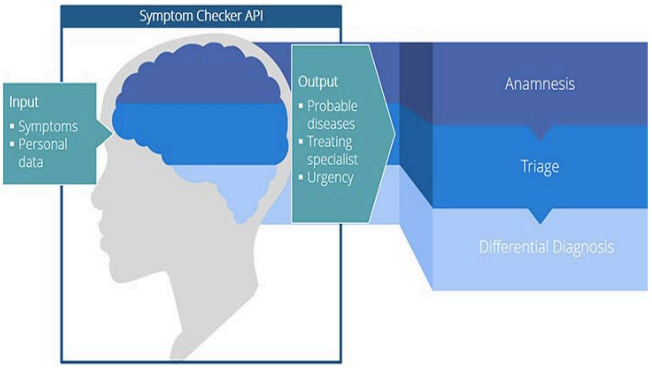


Fig. 1. Function of Apimedic API

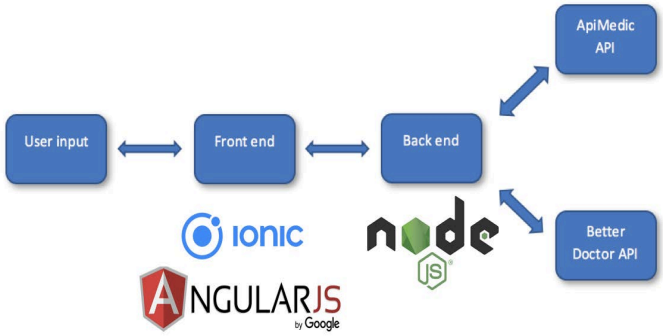


Fig. 2. Architecture Diagram

## IV. DESIGN

*Design Objectives :*

- Create a solution to reduce the hassle of unnecessary visits to doctors and hospital
- Modernize mobile health service by looking into potential ways to improve the service
- Build stronger engagement and trust between local health service by adopting a user centric approach to the solution to deliver a service that is user centric and meets citizens expectations
- Make the solution simple and easy to use

Since the models for diagnosis were outside the scope of this project, we relied on an outside API available through ApiMedic that takes in demographic information and symptom lists as inputs and returns likely diagnoses. The platform provides 420 different diagnoses, and our application outputs the top 1 or 2 most likely diagnoses. In some scenarios, there are unusual combinations of symptoms that yield no diagnosis. As part of the diagnosis step, if there is a specific specialist that would be helpful, e.g., an ophthalmologist or a gynecologist, we suggest the patient request a follow-up appointment with them.

ApiMedic accepts 270 different symptoms, which range from general descriptions, such as “muscle pain”, to very specific conditions, such as “bleeding in the conjunctiva of the eye”. As a result of misspellings and differences in phrasing or word choice, the symptoms users describe do not always map to valid ApiMedic symptoms that can be fed into the diagnosis engine. For example, if a user says, “I’m feeling woozy”, the extracted symptom substring would be “woozy”, which is not a valid input to ApiMedic. Thus, in order to diagnose the user, extracted symptom substrings must be mapped to valid ApiMedic symptoms.

## V. IMPLEMENTATION

We conducted competitive analysis on products available in the market, identified user’s needs, prioritized features and contextualized product vision to drive decision making process. We executed empathy map, work flow, designed the web and native mobile app, created wireframes, prototypes and usability testing to validate the designs.

We have implemented the SymMedic Application using latest technologies in used in Software Development. We are asking user to provide the basic information regarding he/she as in age and sex. We are using Apimedic API to provide use with possible diagnosis according to symptoms.

For the user interface part we created a Ionic based smartphone application which communicates with NodeJS based web server. This web server communicates with Apimedic and BetterDoctor API to for each request. In this application we do not wish to save the data of the users to fetch the required result. So database implementation is not required in this application.

First of all, user provides to the application with the Age/ Sex information. Application then prompts user to provide the main body part with which he/she is suffering the problem. Application further asks user for the body sublocation from a drop down menu. After selecting the body part sublocation,user selects the most relevant symptom provided on the next screen. Gathering all the required information at last Application provides the result with most relevant and most accurate disease. User selects the most relevant symptom provided on the next screen. Gathering all the required information at last Application provides the result with most relevant and most accurate disease.

## VI. Conclusion

Abundance of features is not necessarily the best solution for users. When we first worked on the concept, we listed couple of features that I thought would be important for the users. However, interviewing and testing with users reveals that direct and simple features are the way to go, especially for situations where anxiety and emotional strain are hight. It is important to consider the context and scenarios which the users will interact with the application to build a better product.

Because of the project timeframe and constrains, if I would take the project further the first thing is to take engineers input on the product. For instance, how can we use AI to provide the best possible customized, reliable and accurate results to users? Would NLP enables the product to process complex text inquiries by the users? and how to offer a personalized approach to the experience? Also, would users prefer to connect the information to their health profile? Finally, would health practitioners prefer to have access to that additional health information?

Another thing would be doing more qualitative testing on the product to have better understanding of the experience and how to improve it to users?

## VII. Future Enhancements

Our recent version of the application is a smartphone application with Android and OS support. For future enhancements we are willing to add the Amazon Alexa and Natural Language Processing to this project so that users can directly tell to the device about the required information and get the diagnosis via Alexa.

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