

VaccSeen - Cure Yourself to Secure Nation

Neha Doke¹, Shweta Dundale², Raj Roge³, Shubham Khangutkar⁴, Prof. Suhas Lawand⁵

^{1,2,3,4} UG Student, Dept. of Computer Engineering, Pillai College Of Engineering, New Panvel, India

⁵Assistant Professor, Dept of Computer Engineering, Pillai College Of Engineering, New Panvel, India

Abstract— VaccSeen is basically a Web Application which allows hospitals, independent providers, ancillary providers to get vaccines through our application. In this system we are focused on Vaccine Supply and its Demand forecasting system. The purpose of this system is to develop supply chain strategies to receive, store, distribute and manage vaccines. A Forecasting Algorithm has been implemented to resolve Demand and Supply of vaccines. For forecasting, we will be doing time series analysis using algorithms SARIMAX(Seasonal Auto-Regressive Integrated Moving Average with exogenous factors). In this System you can track Vaccine throughout your entire supply chain, from purchasing to production to end sales. To place a vaccine request, you'll need to know your vaccine Name, the number of doses you want to request, and the date by which you need to receive the request. Then Admin can monitor vaccines available in stock and with help of data it can be possible to predict vaccine needs in future by using forecasting algorithms. The results generate a number of vaccine demands, so that the more suitable and reasonable demand is selected for decision making and this will be beneficial for that organization. The dataset will be prepared by our team, for this we have gone through different health department details about vaccination history.

Keywords: Forecasting, SARIMA, Time Series, Prediction, Vaccine

1. Introduction

By the eve of 2019, a viral flu named Novel Coronavirus was discovered in the Wuhan province of China. The virus which was highly infectious spread all over the globe at an extreme rate. Soon the disease was declared as a worldwide pandemic; last was the Spanish flu in the 1920's. Millions of people were infected and thousands died till the mid-2020. An immediate remedy was required to encounter the virus. Many vaccines namely sputnik, Pfizer, etc. were developed. In India the two main vaccines are covaxin and covishield and the vaccination drive is happening at full force, thousands of residents of India are getting jabbed every day. However there is an inequality in

distribution in rural and urban areas. Many people in metros are already double dosed whereas there are some areas where people are even taking the first dose. Also in areas with surplus vaccines there is a possibility of vaccine wastage. Forecasting on a daily basis is a crucial challenge for revenue managers because of the uncertainty associated between demand and supply. These problems of unequal distribution and vaccine wastage have been encountered in this project.

2. Literature Survey:

e-VaccIMS: The research paper was written by Mariannie A. Rebortera. It is quite necessary to keep an inventory to guarantee continuous, accurate and timely delivery of the supply of vaccine so that quality standards are observed. However, the City Health Office of Panabo City, Davao del Norte Philippines lacks the efficient and systematic way of managing inventory like recording vaccine stocks and dispensing them. Methodology used here is based on the forecasting models for prediction purposes.

VACCINE PREDICTION SYSTEM: The research work described in this paper aims to develop the vaccine prediction system for each health center in the locality of South Tangerang City. The dataset used here is vaccine stock history data at the South Tangerang City Health Center between 2013 and 2017. The method used in this research article is ARIMA (Auto-Regressive Integrated Moving Average) method. There is identification of data to find out whether there are outliers in the data, then stationary test to find out differencing requirements on data, auto-correlation test to determine AR and MA values, fit ARIMA model for testing the most appropriate ARIMA model used, and evaluation it by calculating success rates towards the model

Forecasting Model for Deciding Annual Vaccine Demand: This paper written by Ruey-kei Chiu, Chi-Ming Chang and Yen-Chun Chang presents a computer-based forecasting model for building a decision support system for annual vaccine demand forecasting of a specific vaccine. This model is formatted by employing a combination technique like Neural Network and Auto-Regressive Integrated

Moving Average. The result generated from the system may be taken by the governmental immunization authority to make a better decision for budgeting and purchasing the annual requirement of specific vaccines

EVDHM-ARMA-Based Time Series Forecasting: In this article, a recently developed eigenvalue decomposition of Hankel matrix (EVDHM) along with the autoregressive moving average (ARMA) is applied to develop a forecasting model for nonstationary time series. The Phillips-Perron test (PPT) is used to define the nonstationary of time series. EVDHM is applied over a time series to decompose it into respective subcomponents and reduce the nonstationary. Model based on ARIMA is designed to forecast the future values for each subcomponent. The forecast values of each subcomponent are added to get the final output values.

3. Proposed Work

VaccSeen is a web application which allows easy and controlled supply of vaccines along with minimal wastage to various organizations, NGO's, hospitals etc. This system's prior goal is to supply vaccines and forecast its demand. For forecasting we will be using Time Series Analysis using the SARIMAX (Seasonal Auto-Regressive Integrated Moving Average with eXogenous factors) model.

3.1 System Architecture

The system architecture is represented in Figure 1. Also block wise description of system architecture is included in this Section

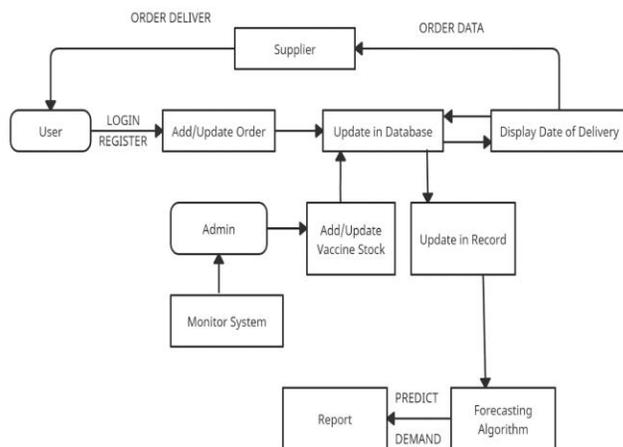


Fig. 1 Proposed system architecture

User: A user can be an organization who wants to buy the doses in bulk. But first that person needs to register, if he/she has already registered then the person will be directed to the home page after providing correct credentials at the login page.

Homepage: The homepage displays all the important details related to the vaccines as well as their availability. The user can buy, alter the quantity of the order at the homepage.

Database: All the orders placed by users need to be stored in the database. Further this database we use for demand forecasting purposes.

SARIMAX: SARIMAX is presented in this paper, in which the SARIMAX model fits and predicts the vaccine demand obtained. SARIMAX is an updated version of the ARIMA model. ARIMA includes a combination of autoregression and moving averages, while SARIMAX includes seasonal effects and eXogenous factors along with the autoregressive and moving average component in the model. Therefore, we can say SARIMAX is a seasonal equivalent model like SARIMA and Auto ARIMA. Another advantage of SARIMAX is it holds the seasonal pattern, it can also deal with external effects. In this way this model is different from other models.

In the SARIMAX models parameter, two kinds of orders are necessary to be provided. The first one is more or less like the ARIMAX model (p, d, q), and the other is to specify the effect of the seasonality; it is a seasonal order in which we are required to provide four numbers.

It can also deal with external effects. This feature of the model differs from other models.

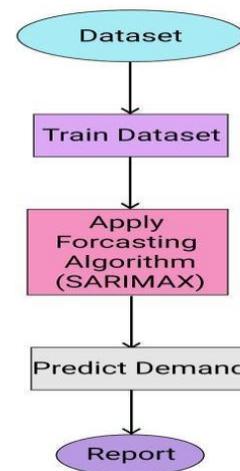


Fig. Forecasting model

Admin: The Admin is responsible for the smooth functioning of the application. Apart from that the admin is responsible for:

- Feeding data to the forecasting model from database
- Approve or decline the request for vaccines from users.
- Generating the forecasting report from the forecasting model.

Supplier: Supplier acts as a middle man between the user and the administration. Supplier is responsible for transporting the vaccines from our organization to the user.

4. Implementation



Fig. Login /Register Page

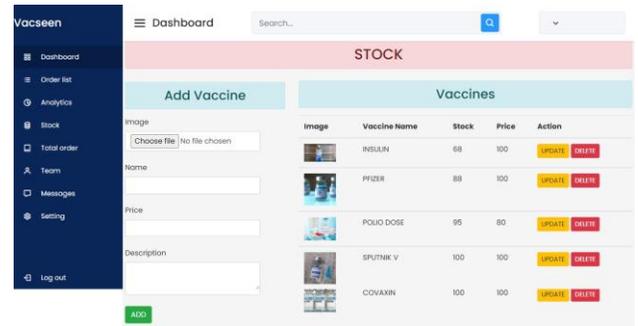


Fig. Stock Page

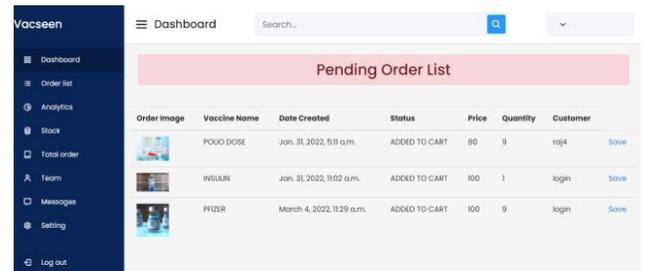


Fig. Order Page

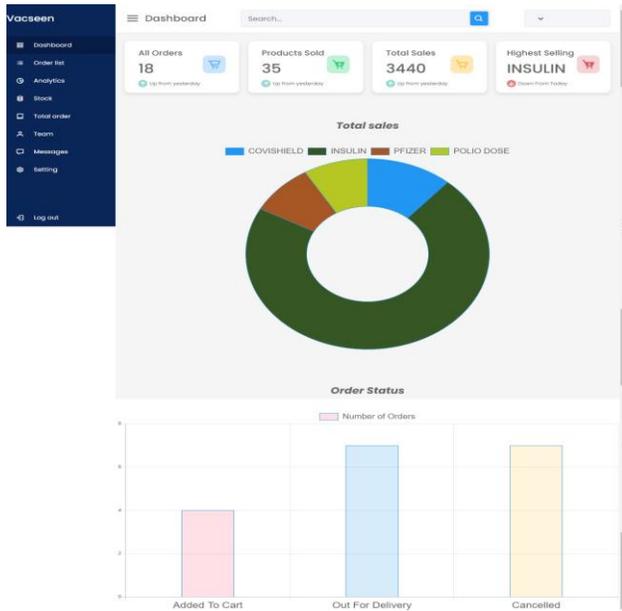


Fig. admin Page

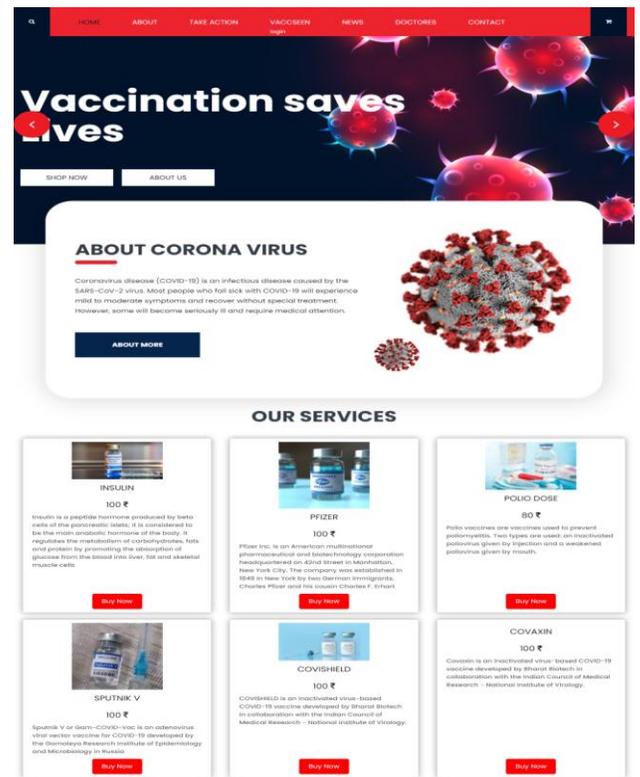


Fig. Home Page

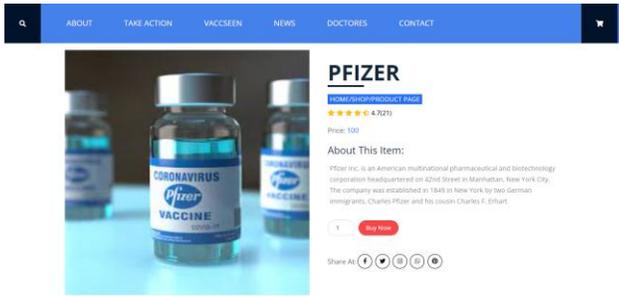


Fig. Product Page

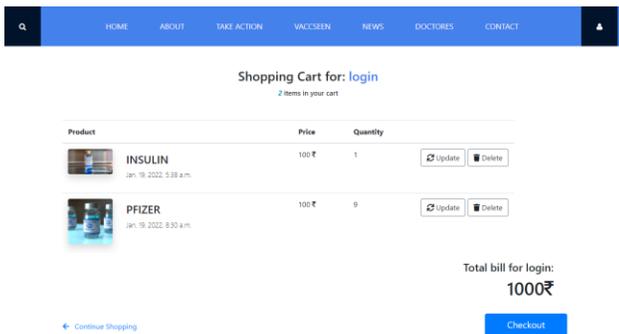


Fig. Cart Page

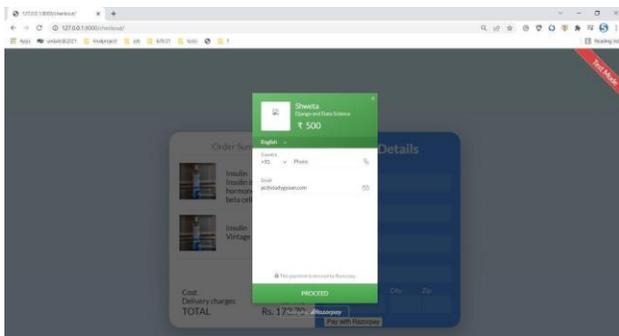


Fig. Checkout/Payment page

Conclusion

To conclude, we would like to depict, This system is fully automated. That is, it does not depend on manual labor for conducting data-driven processes. In this system we are focused on Vaccine Supply and its Demand forecasting system. The purpose of this system is to develop supply chain strategies to store, distribute, receive orders and manage vaccines. A Forecasting Algorithm has been implemented to resolve Demand and Supply of vaccines. Data related to administration and shipments are stored in the system automatically. This system records every single

detail about vaccine stocks. That includes shipments, vaccines orders and stocks. So, it helps in better vaccine management.

Acknowledgement

It is our privilege to have an experienced guide like Professor Suhas Lawand Sir and we sincerely thank you for the valuable inputs, able guidance, encouragement, whole-hearted cooperation and constructive criticism throughout the duration of this work. We wholeheartedly thank our Head of the Department Dr. Sharvari Govilkar and our honorable Principal Dr. Sandeep M. Joshi for motivating and encouraging and allowing us to present this work.

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