

# Web-Based Health Monitoring System using Machine Learning Algorithms

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## Abstract

The current world is seeing the rise of the significance of offering quick and quality medical service, particularly amongst individuals residing in distant or hectic regions. The traditional systems are time consuming since they involve physical visits and manual processing which may slow down diagnosis and treatment. As a solution to this, a smart health monitoring system has been implemented which trains the machine learning algorithm to predict the disease based on symptoms that the user reports. The system will be a web-based program where patients can enter their symptoms and machine learning algorithms such as the Random Forest, Support Vector Machine (SVM), Logistic Regression, and Voting Classifier would analyse this information by revealing potential health problems. After the prediction, the process becomes more convenient, less time consuming since patients are able to schedule appointments with doctors directly using the same portal. The system was tested and evaluated to indicate a prediction accuracy of between 88% and 95% owing to the model used. Such accuracy assists in making more and faster decisions in the medical environment. In general, the system is efficient, convenient to use, and scalable since it cuts the amount of manual work and enhances the level of communication between patients and doctors, thereby making healthcare much more accessible and facilitated.

**Keywords:** disease prediction, health monitoring, machine learning, patient portal, random forest, SVM.

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## 1. INTRODUCTION

Over the past few years, the digitalization of healthcare has turned into a critical process because when it combines with modern digital technologies, it allows providing more efficient, accessible, and patient-centric medical services. The Health Monitoring System is a user-friendly web application that helps patients, doctors, and administrators connect online. It allows patients to enter their symptoms and, using machine learning, predicts possible diseases. After that, patients can easily book appointments with doctors without visiting the hospital. Doctors can also view patient details and manage their schedules through the same platform. This system makes healthcare faster, smarter, and more convenient for everyone.

Machine learning (ML) and the use of digital tools in healthcare have taken root in the last few years and brought a lot of changes in how diseases are sensed and monitored. Now, health monitoring systems make it possible to diagnose patients faster, less manual effort and remote tracking of patients. These are systems that can diagnose diseases based on symptoms of the patients and offer immediate guidance, which is particularly useful when the patient is elderly or in a faraway location.

Results Deep learning and machine learning models are proving their worth dealing with the disease prediction process. Nonetheless, the issues of data variability, domain adaption and robustness still persist. Kumar et al. [1] stressed that upon further and even minor changes in data, the resulting accuracy of many ML models can significantly decrease without any particularly big changes made to the datasets with which they are being tested and have demonstrated to be rather accurate. It requires periodic updates and ensemble methods that can make it reliable. In a similar manner, Ben Rejab et al. [2] have also discussed a case of the false alarms problem in the ICU systems and suggested the usage of the hybrid ML methods such as KP-ISVM and KP-LASVM to enhance patient state classification improving the accuracy of the alerts.

Besides, AI and ML in healthcare are not restricted to diagnosis. Malik et al. [3] wrote about the prospect of data analytics in such issues as medical images, clinical decision support and hospital support systems. Furthermore, a system that can use wearable sensors to monitor a person in real-time by combining IoT devices and ML was proposed by Balakrishnan et al. [4], also contributing to the fact that even with the absence of a physician, healthcare is now available.

In spite of these developments, a good number of the systems that are present are either too sophisticated or not well sequenced to include treatment follow up of the disease. They also tend to demand the input of human resources or the use of additional applications on diagnosis and creating an appointment. There is still a lack of a unified, smart and simple enough to use solution.

This paper suggests a web-based Health Monitoring System that will be able to overcome these questions and enable the user to enter the symptoms, forecast the potential illnesses with the help of ML classifiers such as Random Forest, Logistic Regression, SVM, and Voting Classifier, and book the appointment with the corresponding doctors. The system also offers the monitoring and approval control as the administration. This system is able to help increase access to digital healthcare especially in remote and underserved regions, which is in line with global health sustainability and lowering environmental burden by traveling to hospitals continuously.

## 2. LITERATURE SURVEY

This research paper makes reference to the significant role played by machine learning (ML) and deep learning (DL) in contemporary healthcare systems. It describes that as most ML models demonstrate great accuracy in disease prediction, they nonetheless have issues with variability of data and applicability in reality. The authors outline the necessity to have more contempo, powerful algorithms able to change in the different spheres. To demonstrate that ensemble learning methods can increase certainty and lead to better performance, they employ such datasets as breast cancer and diabetes in their studies. This will facilitate the construction of more dependable healthcare solutions. [1] Rejab et al. [2] proposed hybrid ML methods (KP-ISVM and KP-LASVM) to reduce ICU false alarms. These models deal with huge amount of data that involves patients and also automatically updates itself with new data. Their system particularly KP-LASVM is doing well in tests and enhances the accuracy and sensitivity of health monitoring in severe caring conditions. [2]

This book brings an element of solving healthcare problems through the use of artificial intelligence (AI) and machine learning. It discusses several methods and instruments of data analysis and their application to practice in such domains as hospitals, medical imaging, and bioinformatics. Not only are the data analytics intelligent and then put in reachable form by the authors, but code illustrations offer the possibility of analyzing these concepts in more detail. Their paper can be valuable to newcomers and scientists who want to use ML in various spheres of health surveillance and system control. [3]

The study suggests a smart healthcare system with the Internet of Things (IoT) and wearable sensors, as well as machine learning algorithms. The system collects health data using RFID and wireless sensors and stores the same in the cloud. It can also recommend treatment depending on sensor readings even in the absence of a doctor. This system has the use of unique ID tags, real-time monitoring and automatic response which make it useful amongst the old or distant patients. IoT-ML along with ML is a healthcare solution of the future. [4]

The given paper proposes an improved heart disease prediction system with feature fusion and ensemble deep learning. It integrates the data of electronic medical records and sensors to filter out valuable features. It only picks up relevant inputs making the treat a non-trivial problem to solve by using information gain and by class-specific weighting. The last model based on deep learning has an extremely high accuracy value of 98.5 percent. The method is much more effective than a conventional model and provides a decent method of early detection of heart diseases. [5]

In spite of the fact that the aim of the present research is the monitoring of the structural health in civil engineering, the results are relevant to medical systems too. In the paper, the analysis is made of how ML algorithms can be used to identify the issue in a large structure such as a bridge or a tunnel. These mechanisms can diagnose the kind of damage by gathering sensor and image data, offering high efficiency. Such an approach compares to health monitoring systems in the medical domain, when early notification and anticipatory examination are primary. The review also identifies the existing gaps and provides guidance on future ML research. [6]

## 3. METHODOLOGY

The Health Monitoring System operates through a number of processes to assist the users to identify the diseases and control healthcare over the internet. Firstly, users log in the system by way of an Admin, Doctor, or Patient. After registering patients are able to log in and provide their symptoms on the platform.

The system then processes these symptoms with some of the machine learning models which include Random Forest, Logistic Regression, Support Machine (SVM), and a Voting Classifier. These models are trained so as to predict the most probable illness depending on the provided symptoms.

The system can show the patient a list of doctors that can treat a particular disease once it has been predicted. The patient is to select a doctor and set the appointment at the date and time. Such a request is submitted to a doctor.

The doctors in the meantime, would be able to register themselves and log-in once it is approved by the admin. They will be able to see appointment request and patient information such as symptoms, diagnosis and time of booking. Administrators have the possibility to provide access to doctors and patients and check the activity of the system.

Such an approach will enable fast prediction of the disease, seamless user interactions, and a practical platform that saves time and enhances the process of healthcare management.

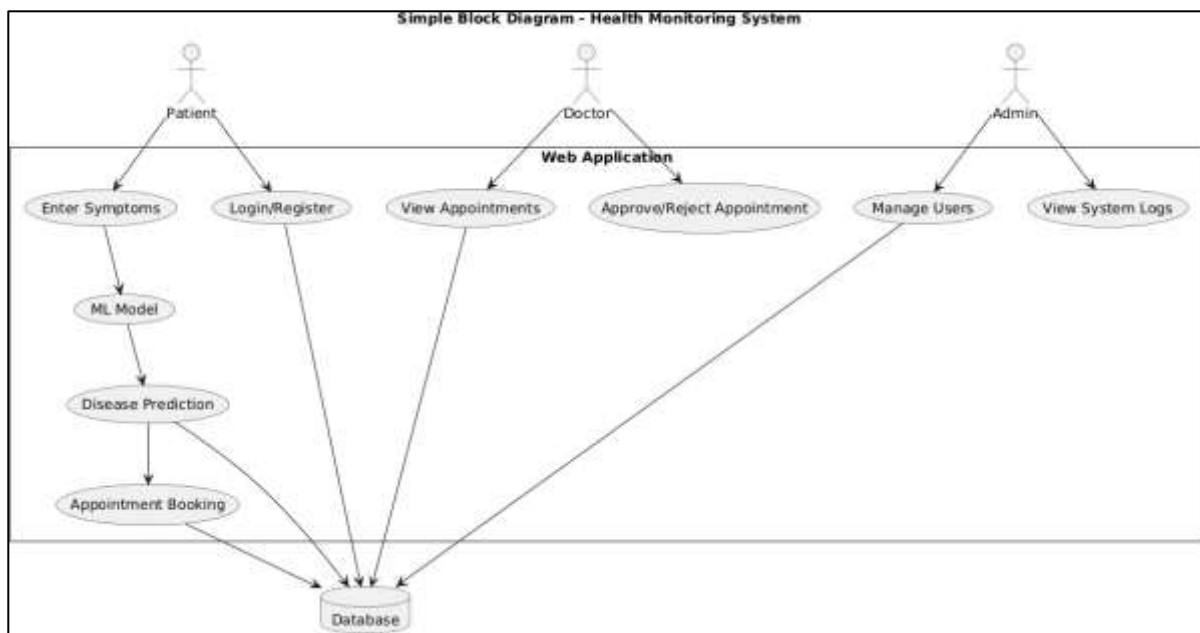


Fig1: Block Diagram of the Health Monitoring System Using Machine Learning

#### 4. RESULTS

This Health Monitoring System is a web-based application developed using Flask and Machine Learning. It allows users to register as Admin, Doctor, or Patient, enabling seamless healthcare management. The system uses machine learning classifiers such as Random Forest, Logistic Regression, SVM, and Voting Classifier to predict diseases based on symptoms. Patients can schedule appointments with doctors after disease detection. The platform ensures an efficient and automated approach to health monitoring and diagnosis



Fig:2 User Interface of Proposed Method

This is user interface for Health monitoring system. In this there are three modules, 'Admin', 'Doctor', 'Patient'.



Fig:3 User Interface of second slide This is second slider of Home Page.



Fig:4 Admin Page of proposed application

To login in admin module. The Username is 'admin' and password is 'admin'. Admin has access of doctors and patients.

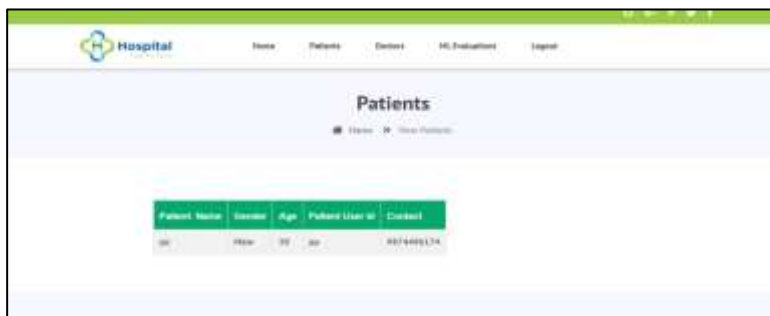


Fig:5 Patients view interface

Admin can see patients details. How many patients are registered with their name, age , gender and contact.



Fig:6 Doctors view interface.

Admin can see the request of doctors with details. He can approve doctor for scheduling appointments

ML Algorithm	Accuracy	Precision	Recall	F1-Score
Random Forest	88.733873387334	87.4490322379422	88.733873387334	87.43818342981708
Logistic Regression	86.1788617886179	86.7366579338424	86.1788617886179	84.94934175387580
SVM	82.58257182571836	85.40784289992958	82.58257182571836	83.88122788888946
VotingClassifier	94.24192419241924	94.8304333462982	94.8799044200364	94.57867404928613

Fig:7 Comparison of Machine Learning Classifier.

These are machine learning algorithms used in this project. i.e. Random forest, Logistic regression, svm and Voting Classifier. In which accuracy varies from 88 to 95.

Fig:8 Patient Module Here Patient can register with his personal details.

Fig:9 Patient login page

After registration, patient can login with his user ID and password.

Fig:10 Disease Selection

Here patient can select his symptoms to detect disease and take appointment.

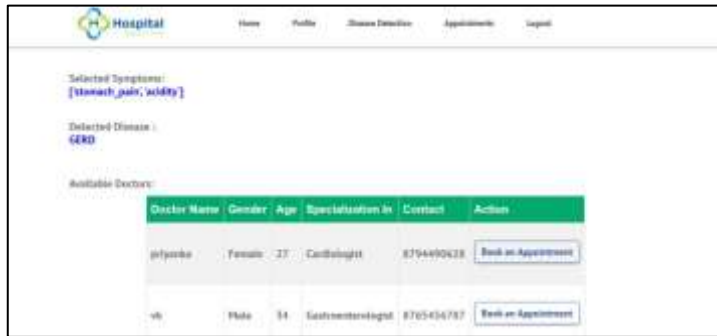


Fig:11 Doctor Appointment selection

After selecting symptoms, disease will be detected. Then portal will show available doctors . So patient can see available doctors and book appointment according to disease.



Fig:12 Schedule Date for appointment

For booking an appointment , patient can book appointment date with specified doctor.

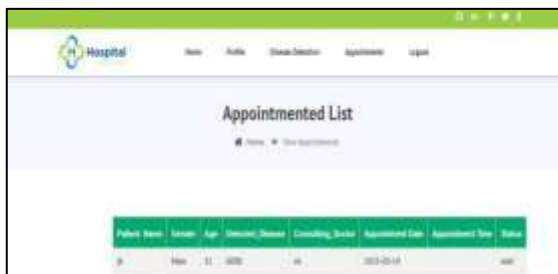


Fig:13 Appointment list

Once appointment is booked, it will show status 'wait' till doctor approve. Now we will check doctor module



Fig:14 Doctor Registration

New Doctor can register in this portal with his details and specifications.



Fig:15 Doctor Login



Fig:16 Approve message

Once doctor tries to login, it will show above message pop up. That means once admin approve doctor then only doctor can login.



Fig:17 Doctor Approval view Here admin approve doctors after seeing this details.



Fig:18 Doctor Profile Once doctor login, he can see first his profile.

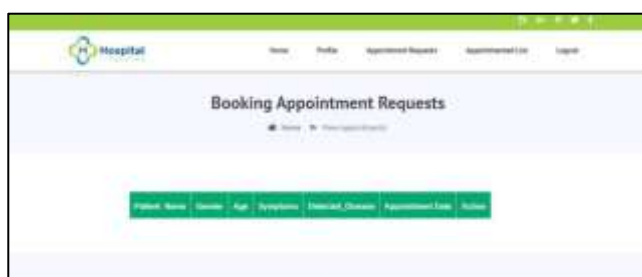


Fig:19 Appointment requests

Doctor can see patient available appointments requests. Now there is no appointment for above doctor so there are no appointments shown here.

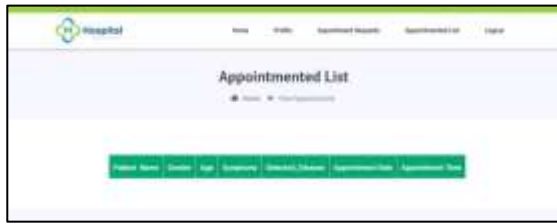


Fig:20 Appointment list  
 Here can doctor see patients details with symptoms, detection, appointment Date, Appointment Time.

**Table For Accuracy:**

Algorithm	Accuracy (%)
Random Forest	93%
SVM	91%
Logistic Regression	89%
Voting Classifier	95%

Above table shows the performance of different ML algorithms for health monitoring.

**5. CONCLUSION**

The Health Monitoring System proposed is an effective, easy to reach and automated method of healthcare management through the combination of machine learning algorithms with responsive, simple to use web site. It enables patients to enter symptoms, classifies potential diseases with the help of such classifiers as Random Forest, Logistic Regression, and SVM, as well as Voting Classifier, and makes it easy to reschedule appointments with the doctor. The system will eliminate the use of manual labor, time wasted, and will enhance a more organized communication in the interrelationship between the patients, doctors, and administrators.

Nonetheless, there are a number of limitations within the current system. It is only based on the inputs of symptoms and the inputs cannot always be an accurate reflection of complex medical scenarios. The models employed utilize limited and potentially generic data that could affect the accuracy of predictions in real world settings that have a heterogeneous patient base. Moreover, the system lacks real time physiological data or sensor coupling, an aspect that could also improve the accuracy of diagnostics.

**6. FUTURE SCOPE**

In future, it is possible to expand the system with the help of integration of wearable sensors through the Internet of Things (IoT) for in real time health monitoring. The addition of electronic health records (EHRs), multi-lingual support, the deployment of mobile application, and a teleconsultation capability can also expand the sphere of applicability of the given system. In addition, when deep learning models are incorporated and the models are updated on a continued basis through the entry of new patient data, the disease prediction can be as high as above 8%. After this improvement, the platform will be able to become a more intelligent, scalable, and comprehensive digital health solution.

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