DOCTOR EFFICIENCY PREDICTION FOR V-PULSE APPLICATION

Project report submitted
in partial fulfillment of the requirement for award of the degree of

Bachelor of Technology
in
Computer Science & Engineering

by

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CHENNAI 600 062, TAMILNADU, INDIA

July, 2020

CERTIFICATE

It is certified that the work contained in the project report titled ”DOCTOR EFFICIENCY PREDICTION FOR V-PULSE APPLICATION” by ”TANGUTURI ABHINAY (16UECD0064) ,B.HARSHA VARDHAN REDDY (16UECS0070) ,HEMA BANDI (16UECS0061)” has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

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DECLARATION

We declare that this written submission represents our ideas in our own words and where other's ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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This project report entitled (DOCTOR EFFICIENCY PREDICTION FOR V-PULSE APPLICATION) by (TANGUTURI ABHINAY (16UECD0064), (B.HARSHA VARDHAN REDDY(16UECS0070) (HEMA BANDI (16UECS0061) is approved for the degree of B.Tech in Computer Science & Engineering.

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ACKNOWLEDGEMENT

We express our deepest gratitude to our respected **Founder Chancellor and President Col. Prof. Dr. R. RANGARAJAN B.E. (EEE), B.E. (MECH), M.S (AUTO). DSc., Foundress President Dr. R. SAGUNTHALA RANGARAJAN M.B.B.S.** Chairperson Managing Trustee and Vice President.

We are very much grateful to our beloved **Vice Chancellor Prof. V. S. S. KUMAR, Ph.D.,** for providing us with an environment to complete our project successfully.

We obligated to our beloved **Registrar Prof Dr. E. KANNAN, Ph.D.,** for providing immense support in all our endeavors.

We thankful to our esteemed **Director Academics Dr. ANNE KOTESWARA RAO, Ph.D.,** providing a wonderful academic environment to complete our project successfully.

We record indebtedness to our **Dean & Head, Department of Computer Science & Engineering Dr. V. SRINIVASA RAO, M.Tech., Ph.D.,** for immense care and encouragement towards us throughout the course of this project.

A special thanks to our **Project Coordinators Mr. V. ASHOK KUMAR, M.Tech., Ms. K. RESHMA, M.E., Ms. C. SHYAMALA KUMARI, M.E.,** for their valuable guidance and support throughout the course of the project.

We also take this opportunity to express a deep sense of gratitude to Our Internal Supervisor **Dr. V. DHILIP KUMAR, M.E.,Ph.D.,** for his cordial support, valuable information and guidance, he helped us in completing this project through various stages.

We thank our department faculty, supporting staff and friends for their help and guidance to complete this project.

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ABSTRACT

World is fully comprised of data. Now a days, data and information rule the world. Data analytics plays a major role in every sector. Predictive analytics a part of data analytics plays a vital role in different sectors of Medicine, Defence, Agriculture, Stock Exchange and many more. Machine learning algorithms are widely used to solve many of these problems. Medicine is essential for every Individual. Patient tracking and disease diagnosis is more important these days. One of the major problem is recommendation of the doctors to patients according to Hospital Management System (HMS). Machine Learning algorithms are trained to solve this problem with higher accuracy. This not only helps Management but also Patients. Python Environment is used for Machine Learning Model whereas Django is used for User Interface(UI) and SQLite for backend Database.

Keywords:Doctor, Django, Hospital Management System(HMS), Python, SQLite, User Interface(UI).

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LIST OF ACRONYMS AND ABBREVIATIONS

AI	**Artificial Intelligence**
DLC	**Disease Level Complexity**
GUI	**Graphical User Interface**
HMS	**Hospital Management System**
ML	**Machine Learning**
NFC	**Near Field Communication**
NLP	**Natural Language Processing**
SQL	**Structured Query Language**
UIN	**Unique Identification Number**
UI	**User Interface**

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Chapter 1

INTRODUCTION

1.1 Introduction

Medicinal field is one of the important and emerging sector in today's world. Hospitals play a vital role in saving many lives and increasing medicinal values. Due to the mechanical life of today's individual drastically change is observed in health issues when compared to past. For hospitals the management of patients with upcoming health issues is huge task to be handled effectively. Hospital Management System is the Software approach used by majority in medical field for maintaining Patient records, Pharmaceutical Records, Doctor Records and many more. V-Pulse is an efficient application developed by VNC Digital Services Pvt LTD for HMS on Spring Boot Platform of JAVA. It is used by many hospitals for the records purpose. It not only works as an Database platform but also an efficient application for Statistical analysis of Data. HMS makes the management's work

easier for maintenance of hospital data. Doctor efficiency is one of the important aspect to be calculated for hospital management to consider doctor for future reference because in a technological world of today people are choosing based upon reviews and successful cases solved by particular doctor or hospital management. So, It is necessary to predict the efficiency of doctor and rank them upon number of cases solved and complexity of each case. The Disease level complexity is defined by the previous study of diseases and references by many of doctors in all aspects.

1.2 Aim of the project

The project is designed for the benefit of hospital management. The objective is to find the efficiency of a doctor based on the number of solved successful cases. It is easy to predict the success rate of a doctor using number of cases he/she deals with but success rate is not the important thing in today's world. The doctor solved cases is taken with the complexity of each case he solves. This approach not only involves doctor's success rate but also the complex rate of each disease.

This prediction is made through Machine Learning algorithms eas-

ier for the problem to be solved. The analytics 4.0 is used where descriptive and diagnostic analytics is used for the disease level complexity prediction by Decision trees and Predictive and Perspective analytics are used for Doctor Efficiency prediction.

1.3 Project Domain

To solve a real-time problem on a computer, we would like an algorithm. An algorithm is a sequence of instructions that should be carried out to transform the raw data input to required output. For example, one can devise an algorithm for sorting. The input may be a set of numbers and therefore the output is their ordered list. For an equivalent task, there could also be various algorithms and that we could also be curious about finding the foremost efficient one, requiring the smallest amount number of instructions or memory or both.

Machine Learning is the way of training the algorithms with different types of data to get more accuracy in the resultant output. In this Project we have used both Supervised Machine Learning techniques in order to get a clear and efficient output. Supervised learning makes training with known output variables with two prominent techniques

namely classification and regression.

It is study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of AI. Machine learning algorithms build a mathematical model supported sample data, mentioned as ”training data”, so on form predictions or decisions without being explicitly programmed to perform the task. Machine learning algorithms are utilized in a good sort of applications, like email filtering and computer vision, where it's difficult or infeasible to develop a standard algorithm for effectively performing the task.

1.4 Scope of the Project

This project has future scope of deploying in server based mechanism for better results. Treatment level complexity is one more case where different levels of treatment for same disease. The future scope of implementing the complexity levels uses Artificial Neural Networks. This implementation can be made as a qualitative approach as it needs high end discipline to work in. The proposed solution is developed depicts the outputs acquired at an higher rate of accuracy.

1.5 Methodology

The Main logic of code for prediction runs in spyder console of anaconda environment written in python language at the backend. Data base acts as middleware where all the data is stored for the process. Database used here is My SQL workbench and SQLite3 as depends upon the system configurations. The User Interface is developed using Django frame work of python in visual studio and UI screen appears in internet explorer using the static uniform resource locator of the Django frame work. The data fed happens through the admin page for the patient record. The data is stored in database and retrieved in ML source code of anaconda frame work. The training and testing of the data happens and validation is checked. The validated and predicted outputs are directly exported to the database. The results are retrieved and displayed in the User Interface Screen according to the user input and specification.

Chapter 2

LITERATURE REVIEW

The author[1] in this paper mainly discusses about mart Hospital Management System (SHS). It is an infrastructure component relies heavily on the actual resources made available to it for its proper functioning, operation and maintenance. This is a solution aimed to present architecture Integration Framework using TOGAF's Architecture Development Method. The TOGAF's Architecture consists mainly of 8 phases namely Architecture Vision, Business Architecture, Information Systems Architecture, Technology Architecture, Opportunities and Solutions, Migration Planning, Implementation Governance, Architecture change Management. The effectiveness of SHS is explained in terms of TOGAF with advantages and disadvantages.

The author[2] discusses about the benefits and problems that can be seen with the use of electronic versions of medical records. They constitute the permanent documentation of patient health, permitting the

medical professional to evaluate symptoms and signs within a broader temporal perspective, contributing to improvements in making diagnoses and providing treatment. The hospital information systems constitute of three levels namely Operational level, Tactical level and Strategic level about three operational areas of Medical area, Administrative area and Hospitality. It also discusses about case study of testing made on HMS of three hospitals in city of São Paulo, Brazil which includes visualization and testing results of HMS.

This author[3] in this discusses about an effective mechanism for chronic disease risk prediction by mining the data containing historical health records and personal life style information. The method outperformed is the traditional mechanism in terms of accuracy, precision and sensitivity for predicting the risk of diabetes. In particular, insightful observations show that the consideration of life-style information can effectively enhance whole performance for risk prediction. The framework described here is divided into three phases. In the first phase, health risk patterns of each item are found from a sequence dataset of each item in a health examination and a lifestyle datasets respectively. The second phase, each health risk pattern is as a feature attribute and constructed a dynamic feature datasets for both Static Dynamic data respectively. The health risk prediction model is

deployed using classification algorithm. Finally, in the third phase the patient's data to be predicted, the examinee's historical data related to health and lifestyle is converted to the suitable dynamic and static data according to the health risk patterns.

The author[4] explains about efficient patient management system based on Near Field Communication (NFC) technique. For registration each NFC tag/ wrist band is identified by a Unique Identification Number (UIN) that can be programmed and can also be protected through password. NFC encoded device can be used to read this information from the patient at any time without causing any inconvenience to them. NFC is mainly introduced to reduce cost and paper work for Hospital Management System (HMS). The system of the NFC based Hospital management system consists of six layers namely physical layer, middle layer, process layer, data access layer, application layer and user interface layer.

In this paper author[5] explains about the Machine learning algorithms are used for effective prediction of chronic disease outbreak in disease-frequent communities. Latent factor model was used to reconstruct the missing data. Convolutional Neural Network-CNN based multimodal disease risk prediction algorithm is used for structured and

unstructured data from hospital. The prediction accuracy was about 98.4 when compared to other models of Big data analytics. The Data used was real-time hospital data stored in cloud from years of 2013-2015 which includes 31919 patients of 20320848 records on the whole. Stocastic Gradient Descent algorithm and CNN-based UNI model disease risk prediction algorithm are used for Structured and Unstructured data respectively.

This author[6] speaks about the Artificial Intelligence (AI) based health physician system that would be able to interact with the patient, do the diagnosis and suggest quick remedy or treatment of their problem. The system uses a questionnaire based approach to query the user (patient) about various Symptoms, based on which a decision is made and a medicine is recommended. The usage of AI is because it make systems behave and work more like humans is gaining popularity. Natural Language Processing (NLP), smart agents, Machine Learning (ML) and knowledge base were used to make Rapid Application model for Smart Doctor. Decision Tree Algorithm is used here for every disease for the medicine prediction and doctor recommendation. This Software acts as efficient chatbot for the patient convenience.

The author[7] discusses about the importance of solutions for im-

proving public health, healthcare providers are required to be fully equipped with appropriate infrastructure to systematically generate and analyze big data, whereas it need an efficient management, analysis, and interpretation. As the data is larger in size is not said to be big data because it should satisfy the conditions of velocity, veracity, volume and variety. The collected data is stored in data warehouse and workflow is progressed by analytics 4.0 namely descriptive analytics(1.0), Diagnostic analytics(2.0), Predictive Analytics(3.0) and prescriptive analytics(4.0) for future usage. The healthcare information mainly consist the of records mainly of Electronic health record, clinical information and patient information. This brought a drastic change in journals publishing in health care associated with big data from 2000 to 2018. The IBM Watson is used here for Natural Language processing and Deep learning process.

In this paper author[8] explains about impact of usage of Big Data analytics in health care. One of the objective in this paper is to address healthcare delivery problems and improve healthcare quality because Pharmaceutical-industry experts and shareholders have begun to routinely analyze big data to obtain insight, but these activities are still in the early stages. Predictive analytics plays a vital role in this analytics where it has been recognized as one of the major business intelligence

approaches, but its real world applications extend far beyond the business context. It not includes text analytics but also multimedia analytics whereas Hadoop architecture is used for health informatics.

Chapter 3

PROJECT DESCRIPTION

3.1 Existing System

Hospital Management System (HMS) is an effective system of all records and statistics are stored explicitly. In this corporate world many IT companies have created many HMS applications which are being used by many hospitals for storing and analyzing their data explicitly. One among the applications is V-Pulse which is created by VNC Digital Services Pvt LTD used by many hospitals has many features like patient, doctor record maintenance, pharmaceutical data analysis with many other features. Other systems have many other features like medicine recommendation system, patient treatment reminder system and many more. Many applications have no module or model of doctor recommendation system for management system or patient purpose.

3.1.1 Disadvantages:

1. Many other systems do not have prediction system or recommendation of doctors.
2. Doctor Efficiency system based on success and failure cases calculation is not feasible.
3. According to Literature survey many reliable approaches has not given better solution to this doctor efficiency prediction system.
4. Doctor recommendation system for particular disease with complexity of disease is no where mentioned and developed.

3.2 Proposed System

The proposed system is an application which recommends doctor for particular disease with number of successful cases solved and efficiency too. This also explore about the top five doctors of particular specialization. This also has Pharmaceutical analysis according to the department wise of the concerned hospital. The HMS of our system named as V-Pulse which was developed under Java platform of Springboot for backend and Angular for front end purpose by VNC Digital Services Pvt LTD. The recommendation system was developed under Python Language. Machine Learning Algorithms are developed using

Anaconda environment in Spyder IDE. This is connected as backend system to middleware database. The Database is either of MySQL workbench and SQLite which depends upon the server configuration used. The front end is the main User Interface which was developed under Django framework in Visual Studio.

3.3 Feasibility Study

The feasibility study of a project is to study about the project which fulfils the needs of today's market stage by considering different complications in development of the project. This feasibility analysis of project depicts a clear view to make project as a business plan as it need to be commissioned. This is to guarantee that the proposed framework isn't a weight to the organization.

Two key considerations involved in the feasibility analysis are:

1. Economic Feasibility.
2. Technical Feasibility.
3. Social Feasibility.

3.3.1 Economic Feasibility

This is study of cost of the project is to be low for the development so that do not the economic situation of the organisation where it is being developed. This project is developed using the software's which are at free of cost. The data is deployed from the company's V-Pulse cloud server. The Economic feasibility is higher for the proposed system.

3.3.2 Technical Feasibility

This is a study of the technological aspects of the project which is acceptable in this era of technological world. This project is developed using the Machine Learning Strategies in python environment which is widely acceptable. The domain of the project is a very much feasible and acceptable widely as it is a trending in this world.

3.3.3 Social Feasibility

This is a study of the socialistic aspects of the project. This explains about the User experience about the project. The proposed system is a user friendly system where the user screens are feasible and easily interpretable. This project has a high range of social feasibility and effective user friendly experience.

3.4 System Specification

3.4.1 Hardware Specification

- Processor - Core i5 or i7 @1.70GHz 2.40GHz
- RAM - 8 GB
- Hard Disk - 500 GB
- Key Board - Standard Windows Keyboard
- Mouse - Two Button Mouse

3.4.2 Software Specification

- Operating System - Windows 7,8,10
- ML source code environment - Python using Anaconda prompt
- Data Base - My SQL workbench or SQLite3 browser
- User Interface code - Microsoft Visual Studio for Django

3.4.3 Standards and Policies

Anaconda Prompt

It is a type of command line interface which explicitly deals with the Machine Learning modules. The navigator is available in Windows, Linux and MacOS. This has a huge number of IDE's which makes

us easier in coding. The User Interface also can be implemented in python.

Standard Used: ISO/IEC 27001

SQLite Database

It is data base prompt which is used to implement all SQL commands. This is used as an middleware system which contacts between the Machine Learning source code and User Interface screens. This can be integrated easily with python IDE and Django interface.

Standard Used: ISO 8601

Microsoft Visual Studio

The Microsoft Visual Studio version 16.0.12 is used for creating the User Interface. In this Django frame work is implemented. UI screens are designed using html and css where the frame work of Django for Integration with database and Machine Learning source code.

Chapter 4

MODULE DESCRIPTION

4.1 General Architecture

The simpler architecture has been designed of Prediction System. This explains about all the phases of Implementation System.

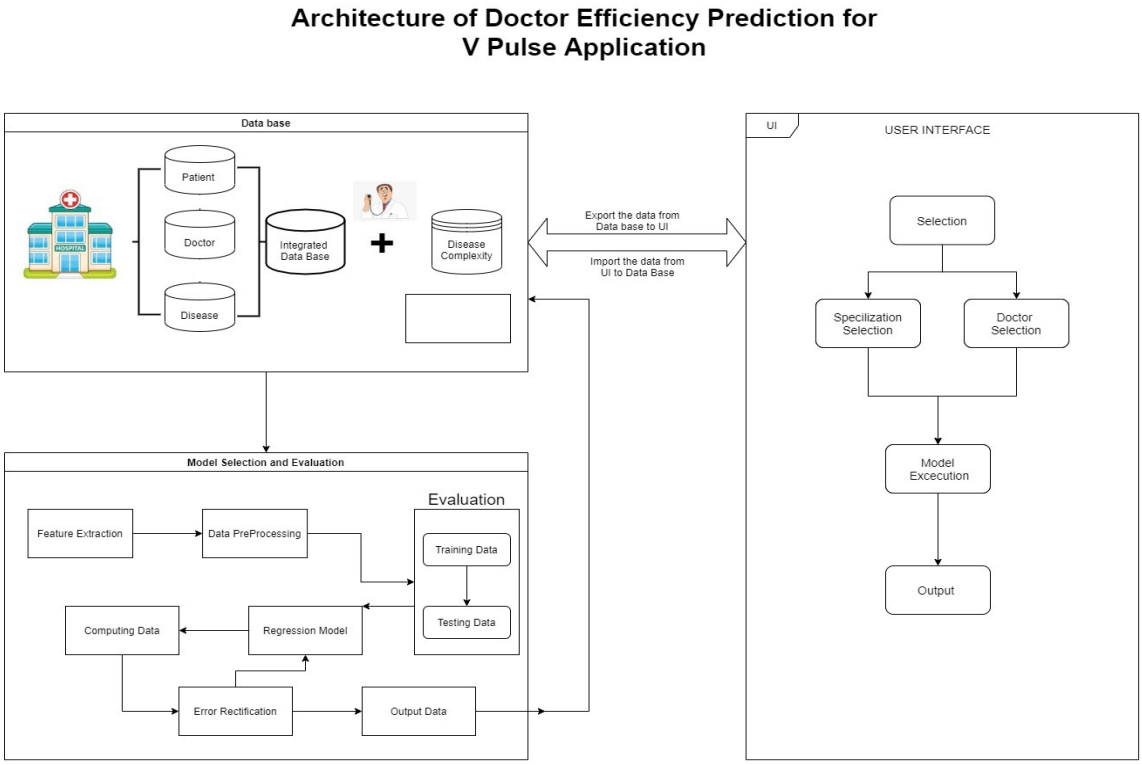

Figure 4.1: Architecture Diagram

The front end is User Interface (UI) which is connected to middle-ware Database integrated with the backend Machine Learning source code. The database is collective repository of Patient records, Doctor Records and Disease records. These three databases are collectively integrated to a single database with many tables. To this database disease complexity is added from doctor's perception and with the factors defining the disease complexity for new diseases is done through Decision Tree Algorithm. This module is for hospital management for the Disease Level Complexity (DLC) calculation purpose. The data from integrated database flows into the main code (or) source code.

In this source code the initially data pre-processing happens where the noise data and irrelevant attributes are dropped. The complexity in raw data acts as tuple it is changed to attribute using pre-processing techniques. Feature Selection and Feature Extraction is done for this data for better algorithm induction. This data is splitted into training and testing data and Linear Regression Algorithm is applied. The predicted data from algorithm is compared with that of original data and checked for accuracy. This final data is stored into database.

These final data is been stored into new table in database so that it is retrieved in UI screens. UI screens are created using Django frame

work in python language. There are four user screens in our UI. The first screen displays doctor efficiency according to the specialisation selected as one need to select the specialization first and list comes accordingly and when doctor name is selected the efficiency is shown. The second screen displays efficiency of doctors using the name of particular doctor specifically. The third screen acts as ranking system where it ranks the top most five doctors for a specific department. The final screen explores about the pharmaceutical data according to department wise. The admin page is used to check with raw data and adding new data to database. The crud operations in database can be applied from UI admin page itself. The number of users and groups can be checked using Admin Page itself.

4.2 Design Phase

4.2.1 Data Flow Diagram

The DFD depicts about the flow of data in the prediction system. This flow happens between all the modules of the prediction system.

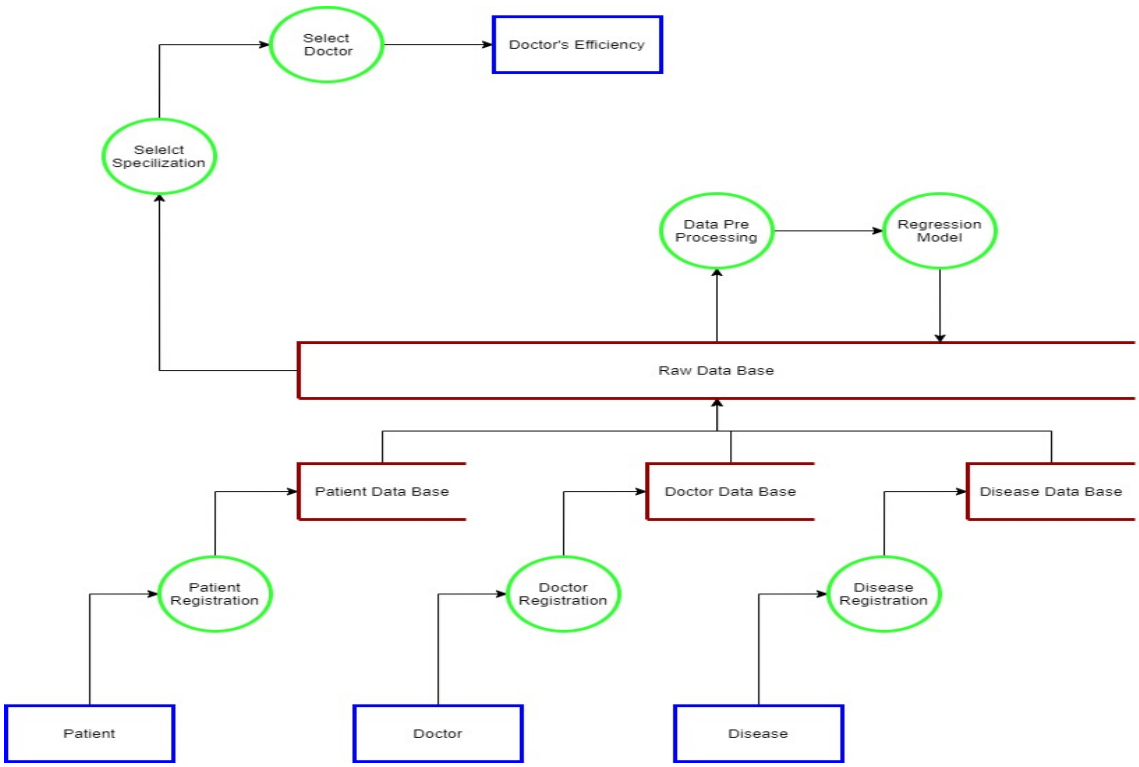

Figure 4.2: Data Flow Diagram

Primary data flow happens between the data flow of registrations. The patient details, doctor details are mainly collected and stored in database. The disease registration happens only if particular disease is not present in database. The DLC classification happen using Decision Tree Algorithm. These databases are integrated to raw database for algorithm prediction purpose.

The predicted data flow next flows back to the same database and stored in new table. This contains values of predicted efficiencies of doctors. The next flow happens from database to UI screens where predicted results are displayed according to selection of management

in all of four screens. The data entered in admin page flows in form of registrations separately in different tables and next stored in database. This data flow happens in transparent manner where no data loss is being happened.

4.2.2 UML Diagram

Unified Modelling Language diagram is used to depict the whole scenario of model. The prediction model has different data interactions and explains them on the whole.

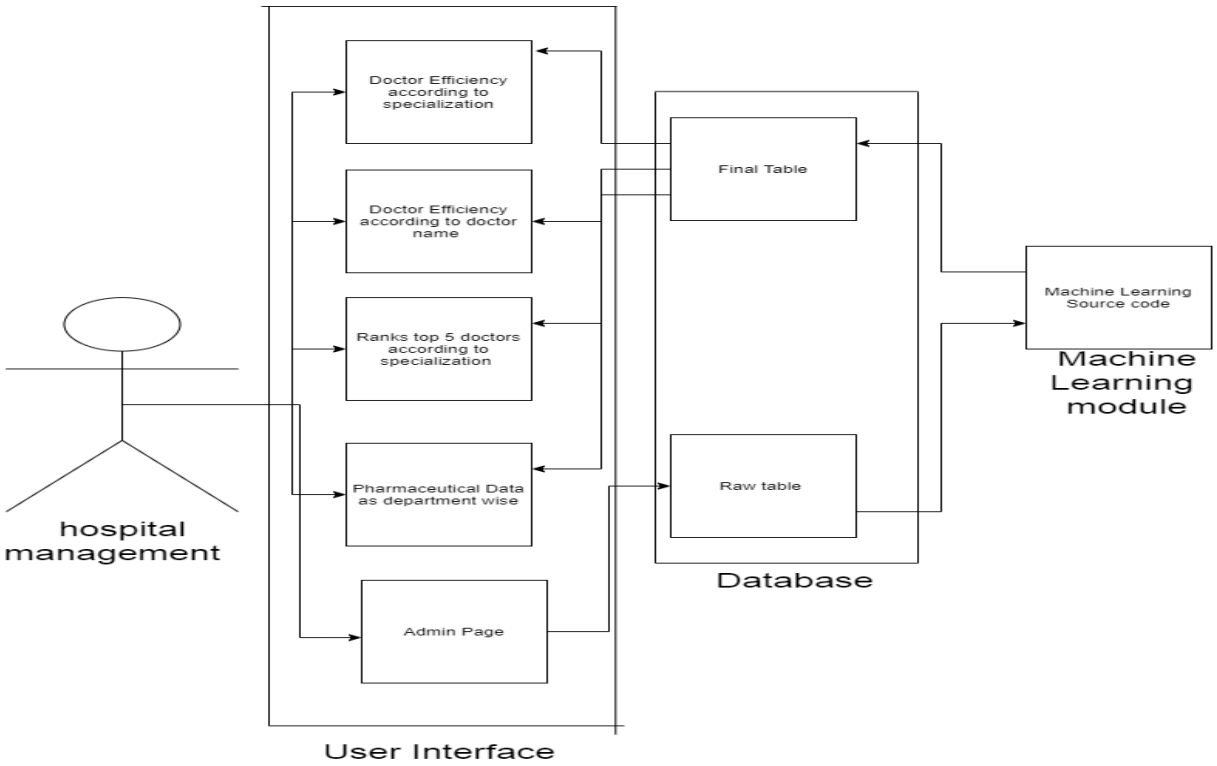

Figure 4.3: UML Diagram

The hospital management is the end user in our prediction system.

They access directly to our application through web server and details can be checked through UI screens according to their particular usage. As mentioned in prior our system has five feasible UI screens which are easily accessible and used. Data from admin page is directly driven to raw table and next to source code.

In source code the prediction system is compiled efficiently and used for efficiency prediction. The predicted efficiency data is stored in final table. Raw table and final table are present in same database. This data is fetched into all screens of UI as per user requirement.

Database used here is My SQL workbench and SQLite3 as depends upon the system configurations. The User Interface is developed using Django frame work of python in visual studio and UI screen appears in internet explorer using the static uniform resource locator of the Django frame work. The data fed happens through the admin page for the patient record. The data is stored in database and retrieved in ML source code of anaconda frame work. The training and testing of the data happens and validation is checked. The validated and predicted outputs are directly exported to the database. The results are retrieved and displayed in the User Interface Screen according to the user input and specification.

4.2.3 Flow Chart

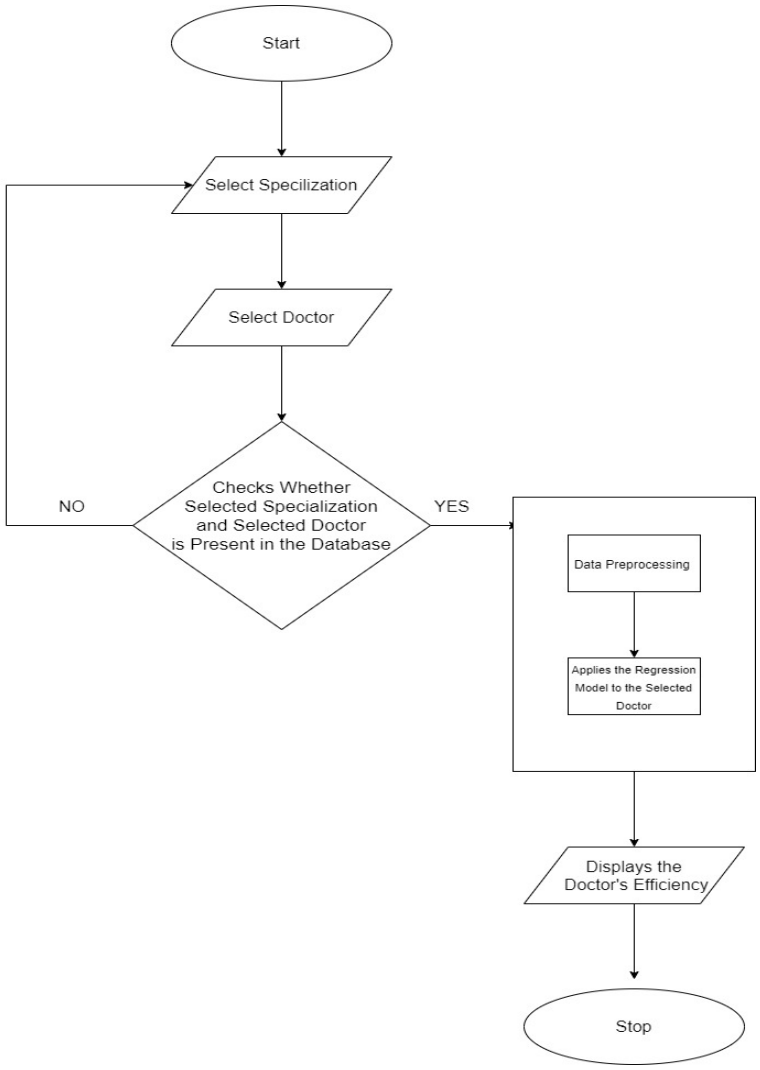

Figure 4.4: Flow Chart

The flow chart explains about how the flow of prediction system is done and what flow is needed to be maintained for efficient usage of prediction system.

Flow Chart starts with UI screens where it is explained form end

user i.e., hospital management side. When end user fetches for a particular doctor efficiency from 1st screen of UI as he/she need to select specialization first and select doctor to know his/her efficiency. If the efficiency is present in database then source code will run and show the output on UI screen but if not present in database recheck with the doctor name. This flow happens to all of UI screens so that dataflow does not drop in middle and no data and path failure occurs.

4.2.4 Sequence Diagram

This pictogram depicts the data flow of system between the modules. Sequence diagram also a type of UML diagram which explains about data sequence.

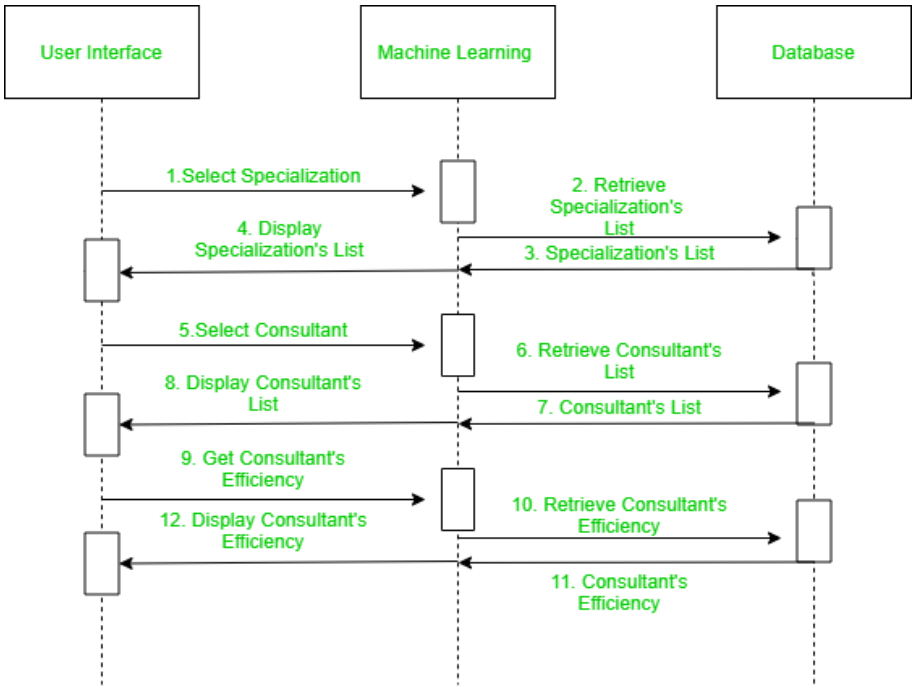

Figure 4.5: Sequence Diagram

The flow of instructions in different modules of data depicts a sequence. In this diagram first instruction namely selecting specialization of doctor moves from UI Screen to ML source code and from source code retrieval of specific data instruction moves to database. Then data is retrieved from database and sent to UI screen as source as middleware component where prediction system comes into play. This data sequence happens for all components of UI screen. The sequential occurrence of data is essential for a better user and developer experience.

Chapter 5

IMPLEMENTATION AND TESTING

Implementation phase is an essential and crucial phase in development of a project. After all the feasibility studies of a project are made and methodologies are studied it is implemented into a project or a working module. The execution includes cautious arranging, examination of the current framework and its requirements on usage, planning of techniques to accomplish changeover and assessment of changeover strategies. All the strategies are taken under similar platforms where modified to better working model.

5.1 Input and Output

5.1.1 Input Design

The input to the model of is different according to system and algorithm performed. In the project two algorithms are implemented.

Disease Name	Cause	Genetic	Repitative Occurance	Success rate	Complexity
APPENDICITIS	GENERAL	NO	NO	HIGH	ONE
BLEEDING GUMS	GENERAL	NO	YES	HIGH	ONE
BODY PAINS	GENERAL	NO	YES	HIGH	ONE
CAVITIES	BACTERIA	NO	YES	HIGH	ONE
COLD	VIRUS	NO	YES	HIGH	ONE
DRY SKIN	GENERAL	NO	YES	HIGH	ONE
HEAD ACHE	GENERAL	NO	YES	HIGH	ONE
INSOMNIA	GENERAL	NO	YES	HIGH	ONE
OBESITY	GENERAL	NO	YES	HIGH	ONE
RICKETS	GENERAL	YES	NO	HIGH	ONE
ROOT CANAL	GENERAL	NO	YES	HIGH	ONE
SOLAR RETINOPATHY	GENERAL	NO	YES	HIGH	ONE
SPRAINED ANKLE	INJURY	NO	YES	HIGH	ONE
STOMACH ACHE	GENERAL	NO	YES	HIGH	ONE
STRESS	GENERAL	NO	YES	HIGH	ONE

Table 5.1: Table for DLC calculation

Firstly data input contains attributes like disease name, genetic, repetitive, success rate and complexity which contribute to DLC calculation using decision tree algorithm.

The second module is to predict the doctor efficiency according to solved number of cases and their complexity. This data table contains attributes of Patient id, Consultant name, Specialization, Disease and Complexity which are used to predict the doctor efficiency using Linear Regression Algorithm.

Patient_ID	Consultant	Specialization	Disease	Complexity
1592	Ajay Kumar	Urologist	blasser prolapse	4
1593	Ajay Kumar	Urologist	postate cancer	5
1594	Ajay Kumar	Urologist	prostatis	1
1595	Ajay Kumar	Urologist	hematuria	3
1596	Ajay Kumar	Urologist	overactive bladder	2
1597	Ajay Kumar	Urologist	blasser prolapse	4
1598	Ajay Kumar	Urologist	prostatis	1
1599	Ajay Kumar	Urologist	hematuria	3
1600	Ajay Kumar	Urologist	overactive bladder	2
1601	Ajay Kumar	Urologist	blasser prolapse	4
1602	Ajay Kumar	Urologist	prostatis	1
1603	Ajay Kumar	Urologist	postate cancer	5
1604	Ajay Kumar	Urologist	overactive bladder	2
1605	Ajay Kumar	Urologist	prostatis	1
1445	Ashok L. Kirpalani	Gynecologist	amenorrhea	3
1446	Ashok L. Kirpalani	Gynecologist	menstrual disorder	4
1447	Ashok L. Kirpalani	Gynecologist	uterine fibroids	2
1448	Ashok L. Kirpalani	Gynecologist	amenorrhea	3
1449	Ashok L. Kirpalani	Gynecologist	pelvic pain	1
1450	Ashok L. Kirpalani	Gynecologist	menstrual disorder	4
1451	Ashok L. Kirpalani	Gynecologist	pelvic pain	1
1452	Ashok L. Kirpalani	Gynecologist	endometriosis	5
1453	Ashok L. Kirpalani	Gynecologist	uterine fibroids	2
1454	Ashok L. Kirpalani	Gynecologist	amenorrhea	3
1455	Ashok L. Kirpalani	Gynecologist	endometriosis	5

Table 5.2: Table for Doctor Efficiency calculation

These both tables and output tables are stored in same database stored in DB SQLite3 version. This database is directly integrated with source code and UI code in Django framework.

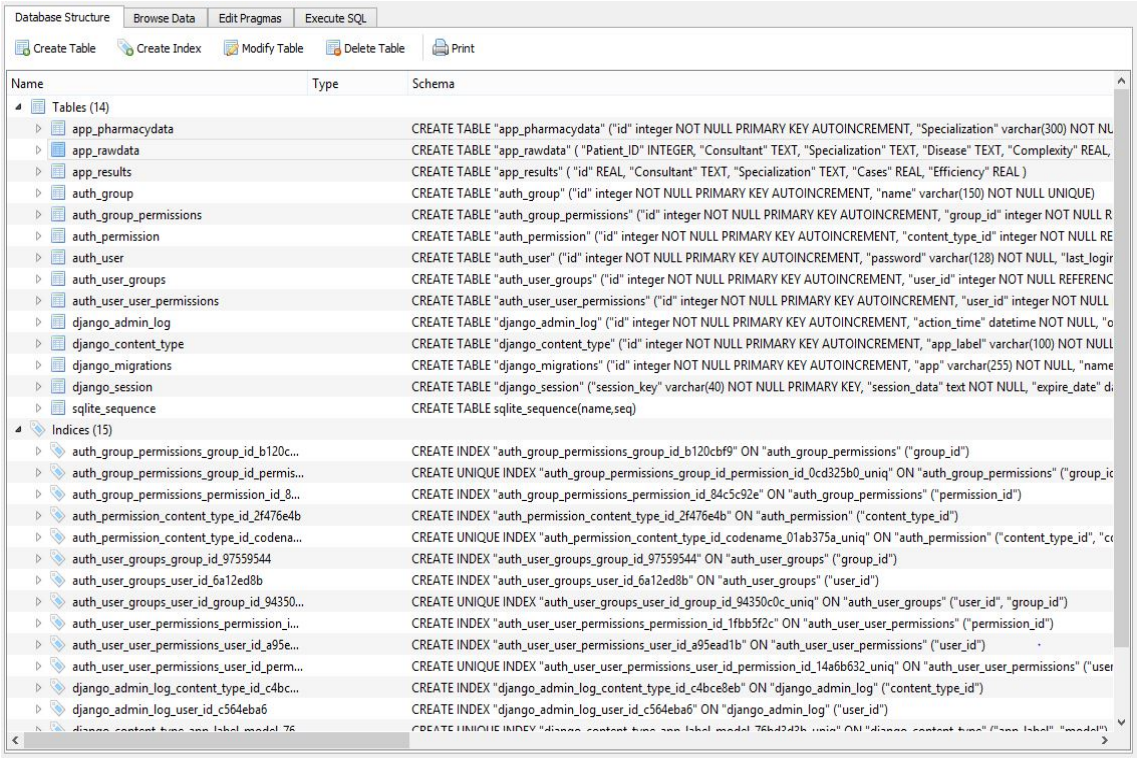

Figure 5.1: DataBase

5.1.2 Output Design

The output is made through UI screens designed using Django framework in python Language. Microsoft Visual Studio is used to create all UI screens. Html and css languages are used to create pages, borders and colours for them. There are four screens of UI and an Admin Page is present in our module. These screens are integrated with database and source code.

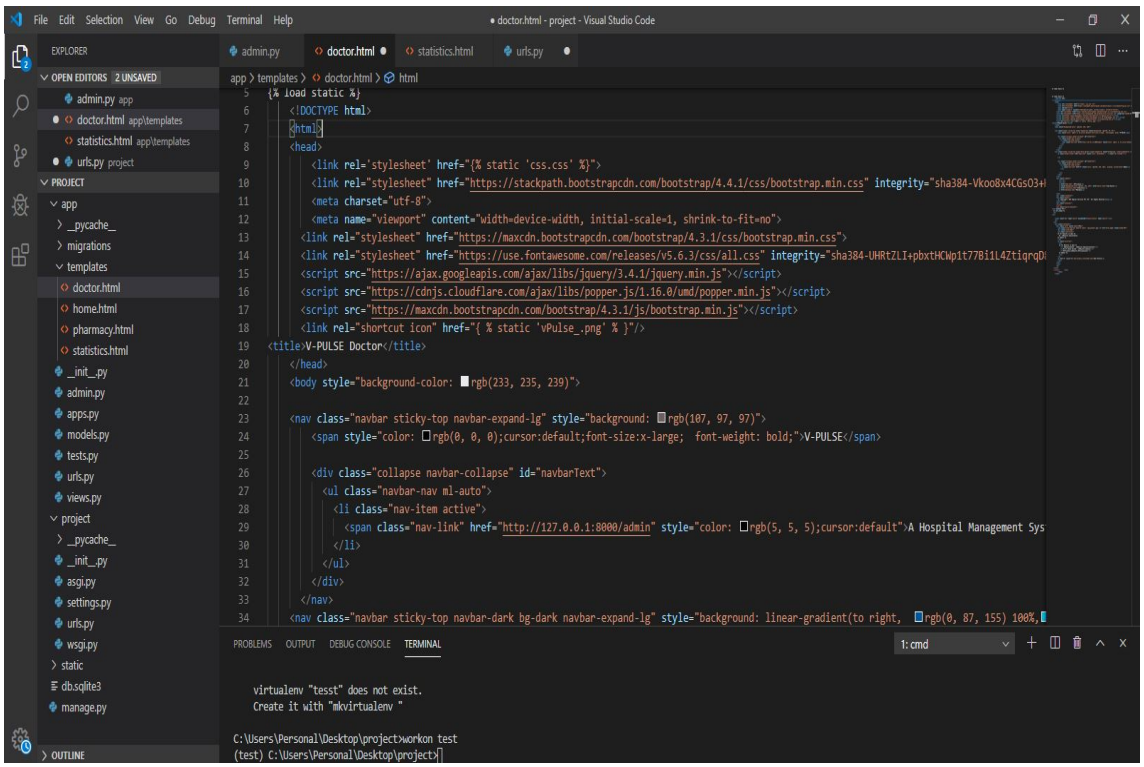

Figure 5.2: Microsoft Visual Studio

5.2 Testing

Testing is an integral part of project where errors are rectified using Manual and Automation testing. . It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product. There are many types of testing used here for error detection in case of integration of application and deployment. User Interface is also tested here for better experience.

5.3 Types of Testing

5.3.1 Unit testing

Source code checking is performed by writing and running test programs against it. The Developers write the test programs according to source code which are executed by testers and are subjected to either pass or fail. This testing is similar to black box testing for Graphical User Interface (GUI) while unit is performed for memory based functioning.

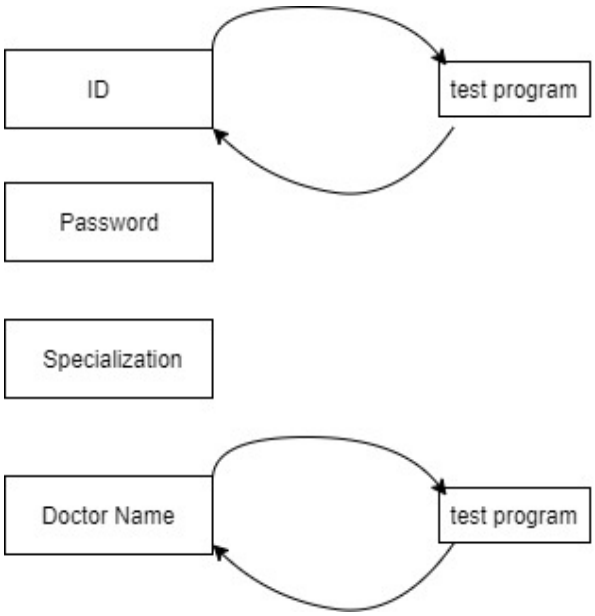

Figure 5.3: Unit testing

Test result

In our Project unit testing is performed for all UI components starting from login page. The ID and password fields are checked here by

running tests programs against them and results are checked for space complexity. This applies for all of cases including admin page too.

5.3.2 Integration testing

Software is said to be a collection of modules where developer integrates two or modules as per requirement of client. In our project integration is done between Database, ML model and User Interface. Firstly Integration is done between database and ML source code in Spyder IDE to check the raw data flow into code and output to be stored in database. The other step of integration is done between User Interface and Database when buttons in UI are clicked data flow is checked for accuracy and performance. Among the types incremental integration testing is applied. Sandwich approach is used to test between modules.

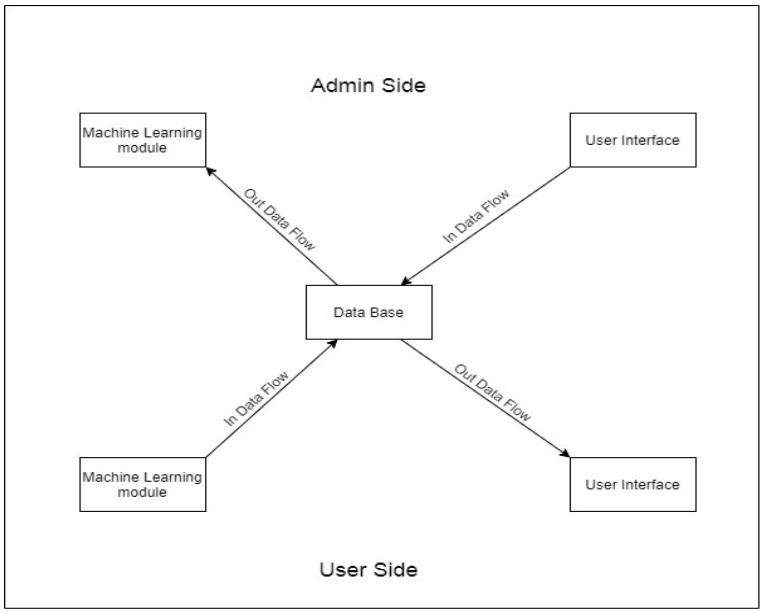

Figure 5.4: Integration testing

Test result

Parent module is Data base where input data for admin and retrieve data for efficiency is done through User Interface which is one child class and after data is in database the flow is from Database to ML module for prediction. ML module is one more child class. Sandwich testing is applied to this clock cycle to check data flow in all these modules. This test result has shown higher accuracy as there is no data lag, redundancy and loss of data in any of these modules. The Sandwich approach diagram depicts clearly about testing approach.

5.3.3 Functional testing

This testing is applied to URL components and functional components where each component of URL is tested. Firstly URL domain is tested for security as of https:// format. If it is not secure data breach may happen. After security pre condition statement is checked namely for visibility and name recommendation. URL components may be static or dynamic based on node of creation but here in our case of prediction it is a static component developed using Django frame work where “http://127.0.0.1:8000/app/” is created as a static component. After URL components are tested functional components are tested for their functionality performance. Initially functions are needed to

be identified and create input data based on functions as test cases are needed to be created for checking accuracy of test case outputs. Comparing test case scenarios with original output makes a clear note of test accuracy and functional accuracy.

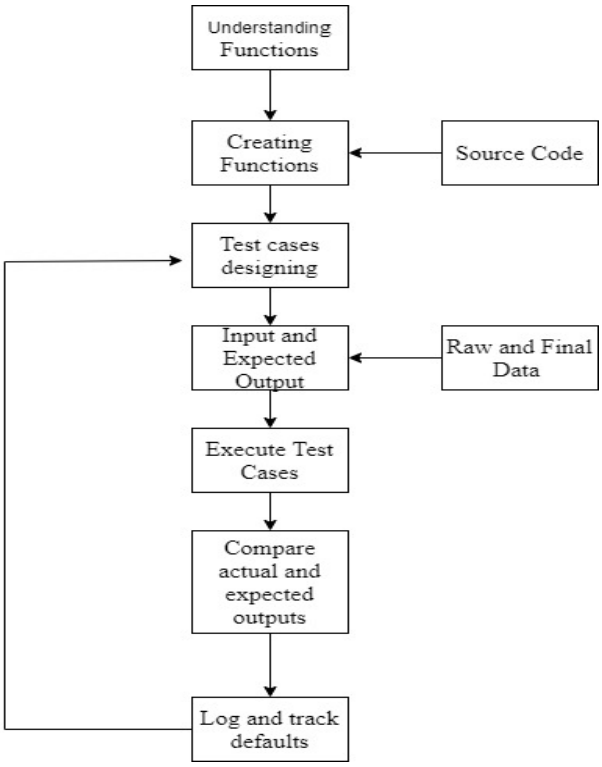

Figure 5.5: Functional testing

Test Result

In our efficiency prediction system functional components are created for source code as of pre-process data and feature extraction data as one function and algorithmic data as another function. Test cases are created for both scenarios and functional components are tested. As pre-process data has a noticeable functional error test case failed in case of that scenario.

5.3.4 White Box Testing

This is also known as Open box testing or Glass Box testing. In this is type of testing where we check the source code which was written for software development. It is performed by the developers. Here in case of our Doctor Efficiency Prediction system the source code is converted in flow chart and test cases are performed for output analysis. For Doctor Efficiency Prediction code does not contain any of loops but only condition here is to check whether doctor name with accuracy present in data for input or not. Path testing here checked only while integrating ML model with Database connection as raw data and output data tables belong to same database. If error occurs database gets locked and Data redundancy occurs.

Statement testing is performed for all statements present in flow chart. It checks all executable control statements and Initializing statements. There are no possibilities of conditional statements in any of our logic related in Decision tree or Regression in source code. So, statement testing is done for input statements in pre-processing and ML Stage.

Path testing is performed for source code where all control flow of code executes once without interrupts and errors. In this System the path as follows from raw data frame to pre-processing code where du-

plicates are removed and complexity and efficiency are added into a new data frame followed by ML algorithm for prediction, as predicted outputs.

Condition testing is performed to check for basic condition and compound condition where all conditions should execute for true or false value's. In our solution for Doctor Efficiency the only condition is the data driven in to algorithm should have an output latent variable as it is supervised learning. Loop testing can also be performed for source code but no loops exist in our code for Doctor Efficiency and Disease complexity.

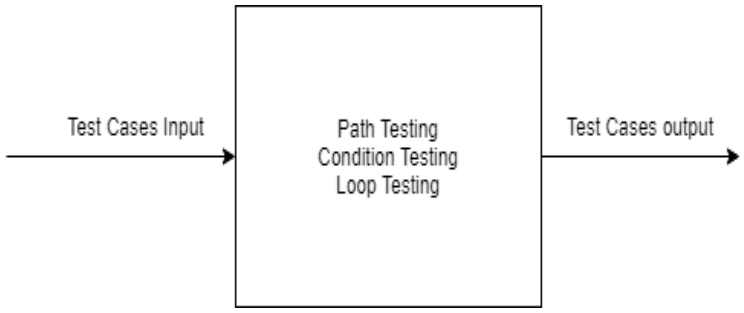

Figure 5.6: White Box Testing

5.3.5 Black Box Testing

This is also known as Non-Structural testing or closed box testing. This not only used for checking Graphical User Interface (GUI) of the System but also Behaviour of software. This is performed by test engineer. Test scenarios are written where all possible ways of testing the Software are mentioned. Templates of test scenarios contain Pre-

condition, procedure and expected output.

The testing scenario starts with pre-condition where the characters of Uniform Resource Locater (URL) in address bar are not only checked for visibility but also editable format. After typing initial letters suggestions are checked correctly like our system which was developed in local host, server name is automatically created by “Django” frame work. Suggestions are not considered in this case.

The procedure follows with check of font size, colour, alignment satisfies requirement completely. This also includes inferring negative scenarios of UI testing. System testing is also performed using the black box testing itself. In this type end to end testing is done from Doctor Efficiency prediction using specialization selection to Pharmaceutical statistics. This involves test of four modules of User interface leaving Admin Page. Admin page is tested separately.

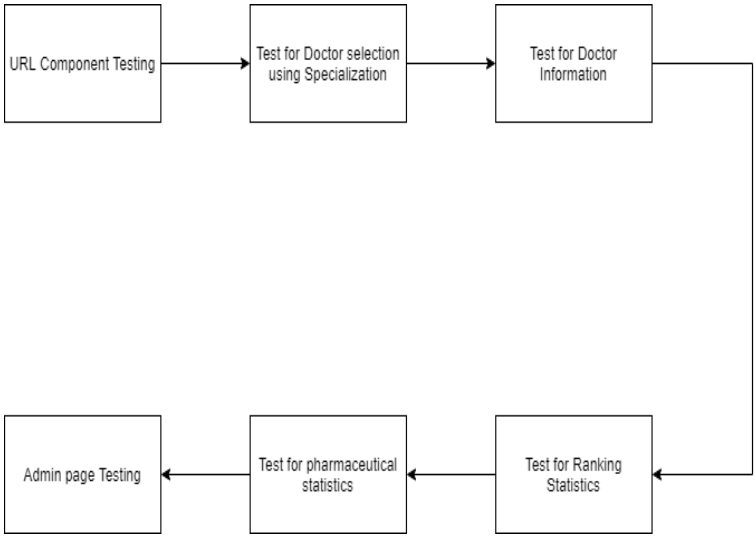

Figure 5.7: Black Box Testing

Chapter 6

RESULTS AND DISCUSSIONS

6.1 Efficiency of the Proposed System

The proposed system is an application which recommends doctor for particular disease with number of successful cases solved and efficiency too. This also explore about the top five doctors of particular specialization. This also has Pharmaceutical analysis according to the department wise of the concerned hospital. The recommendation system was developed under Python Language. Machine Learning Algorithms are developed using Anaconda environment in Spyder IDE. This is connected as backend system to middleware database. The Database is either of MySQL workbench and SQLite which depends upon the server configuration used. The front end is the main User Interface which was developed under Django framework in Visual Studio. The propsed system ML algorithm works more than 90 percentage efficient with negligible error in prediction.

6.2 Advantages of the Proposed System

- The recommendation system is developed using the Regression Algorithms which depicts with least percentage of error.
- The UI screens are user friendly and easily can be interpreted by Management System.
- This approach of proposed solution is developed under an adaptive nature so that can be easily corrected for errors if occurs.

6.3 Sample Code

```
1
2  import sqlite3
3  import pandas as pd
4  import numpy as np
5  from sklearn import linear_model
6  from sklearn.model_selection import train_test_split
7  from sklearn import metrics
8
9  conn = sqlite3.connect(r'C:\Users\Personal\Desktop\project\db.sqlite3')
10 rawdata = pd.read_sql_query('select * from app_rawdata',conn)
11 print(rawdata)
12 rawcopy = rawdata
13 cols = [0,3,5]
14 rawcopy = rawcopy.drop(rawcopy.columns[cols],axis=1)
15 rawcopy["count"] = rawcopy.groupby(['Consultant','Specialization']).transform('
       count')
16 rawcopy['com']=rawcopy['Complexity']
17 rawcopy.groupby(['Consultant','Specialization'])
18 no_of_cases = rawcopy.groupby(['Consultant', 'Specialization'], as_index=False).
       count()
19 no_of_cases.drop_duplicates(subset ="Consultant", keep = False, inplace = True)
```

```
table = pd.pivot_table(rawcopy,index='Consultant',columns='Complexity',values='com',aggfunc="count").reset_index()
table.drop_duplicates(subset ="Consultant", keep = False, inplace = True)
cols=[0,2,4]
no_of_cases.drop(no_of_cases.columns[cols],axis=1,inplace=True)
combined_data=table.join(no_of_cases)
copy_CD=combined_data
print(copy_CD)
d = {'1.0':'C1','2.0':'C2','3.0':'C3','4.0':'C4','5.0':'C5'}
copy_CD =copy_CD.rename(columns=lambda col: d.get(str(col)) if str(col) in d else col)
print(copy_CD)
copy_CD=copy_CD.fillna(0)
copy_CD['efficency'] = 0.2*copy_CD['C1']+0.4*copy_CD['C2']+0.6*copy_CD['C3']+0.8*copy_CD['C4']+1.0*copy_CD['C5']
copy_CD['Total Effeciency'] = copy_CD['efficency']/copy_CD['count']
copy_CD = copy_CD.rename(columns={'count':'Cases_Solved'})
print(copy_CD)
comp1 = copy_CD['C1'].values
comp2 = copy_CD['C2'].values
comp3 = copy_CD['C3'].values
comp4 = copy_CD['C4'].values
comp5 = copy_CD['C5'].values
case = copy_CD['Cases_Solved'].values
total_effeciency = copy_CD['Total Effeciency'].values
Cost_Len = len(comp1)
comp_eff = copy_CD[['C1','C2','C3','C4','C5','Cases_Solved']]
X = comp_eff.values
Y = copy_CD.iloc[:, 8].values
print(X)
print(Y)
X_train, X_test, Y_train, Y_test = train_test_split(X,Y,train_size = 0.75, test_size = 0.25, random_state = 0)
reg = linear_model.LinearRegression()
reg.fit(X_train,Y_train)
print(reg.intercept_)
print(reg.coef_)
y_pred = reg.predict(X_test) ;
z_pred = reg.predict(X_train)
```

```
train_value = 10*(z_pred)
test_value = 10*(y_pred)
print(train_value)
print(test_value)
f = pd.DataFrame({'Actual': Y_train, 'Predicted': z_pred})
r = pd.DataFrame({'Actual': Y_test, 'Predicted':y_pred})
print(f)
print(r)
new_list = list()
new_list.append(train_value)
new_list.append(test_value)
Final_list = np.concatenate(new_list)
print (Final_list)
Final_table = pd.DataFrame({'id':copy_CD.Cases_Solved, 'Consultant':copy_CD.
    Consultant, 'Specialization':copy_CD.Specialization, 'Cases': copy_CD.
    Cases_Solved, 'Efficiency':Final_list.round(2)})
print(Final_table)
train_mean = z_pred.mean()
test_mean = y_pred.mean()
print('Mean of predicted train values:',train_mean)
print('Mean of predicted test values:',test_mean)
train_rms_value = np.sqrt(metrics.mean_squared_error(Y_train, z_pred))
test_rms_value = np.sqrt(metrics.mean_squared_error(Y_test, y_pred))
print('Root Mean Squared value for train data:',train_rms_value)
print('Root Mean Squared value for test data :', test_rms_value)
train_error_per = ((train_rms_value)/(train_mean))*100
test_error_per = ((test_rms_value)/(test_mean))*100
print('Percentage of Error for train data:' ,train_error_per,'%')
print('Percentage of Error for test data:',test_error_per,'%')
```

Output

The first UI screen consists of two buttons which the user will select the specialization first and doctor list will be displayed. On selecting particular doctor their efficiency is displayed.

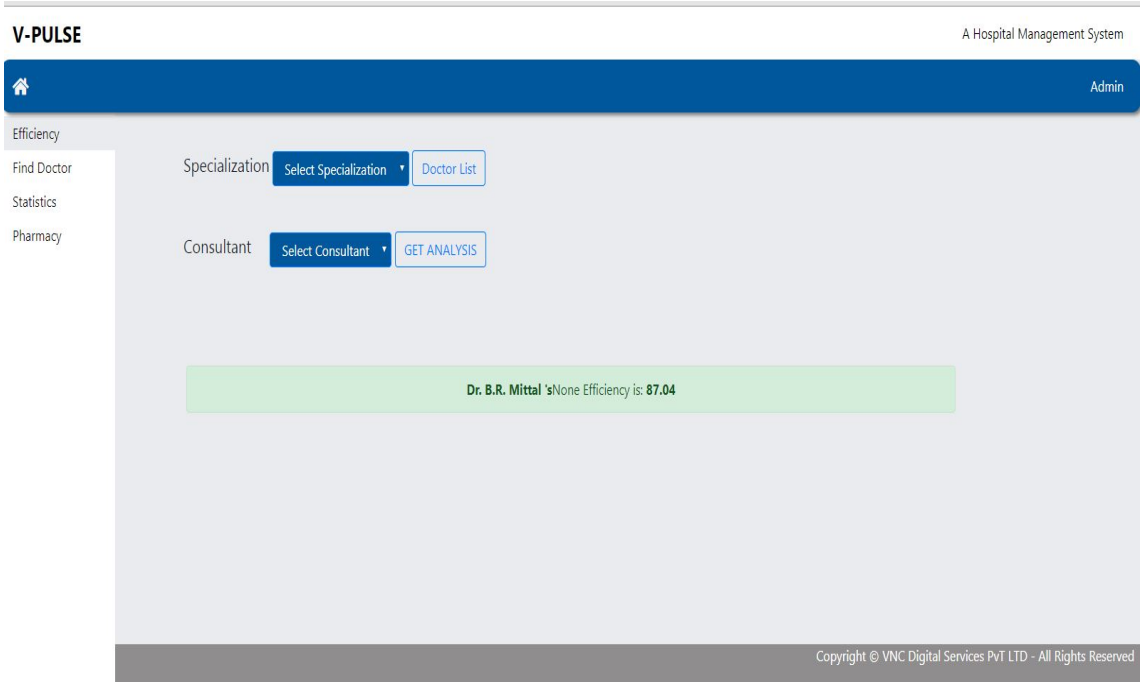

Figure 6.1: Screen 1

The second UI screen consists of a search bar where on typing a particular doctor name it displays efficiency with number of solved cases by the doctor.

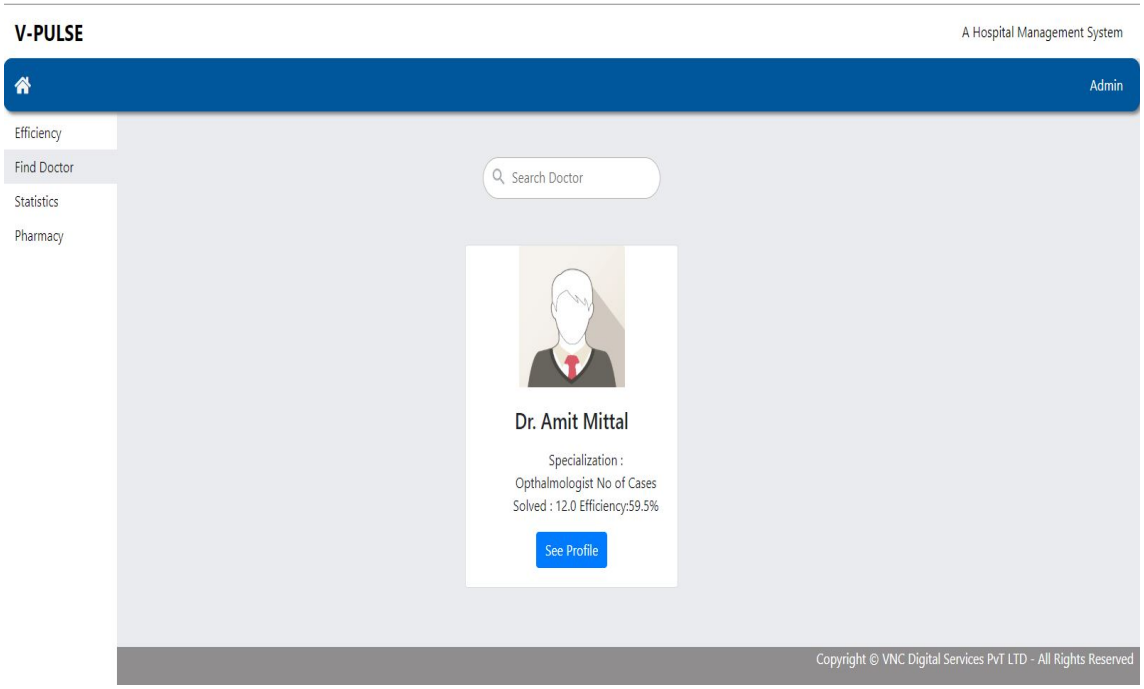

Figure 6.2: Screen 2

The third UI screen consists of a button where different specializations are listed. On selecting particular specialization top five doctors will be listed according to their rank with efficiency and solved number of cases respectively.

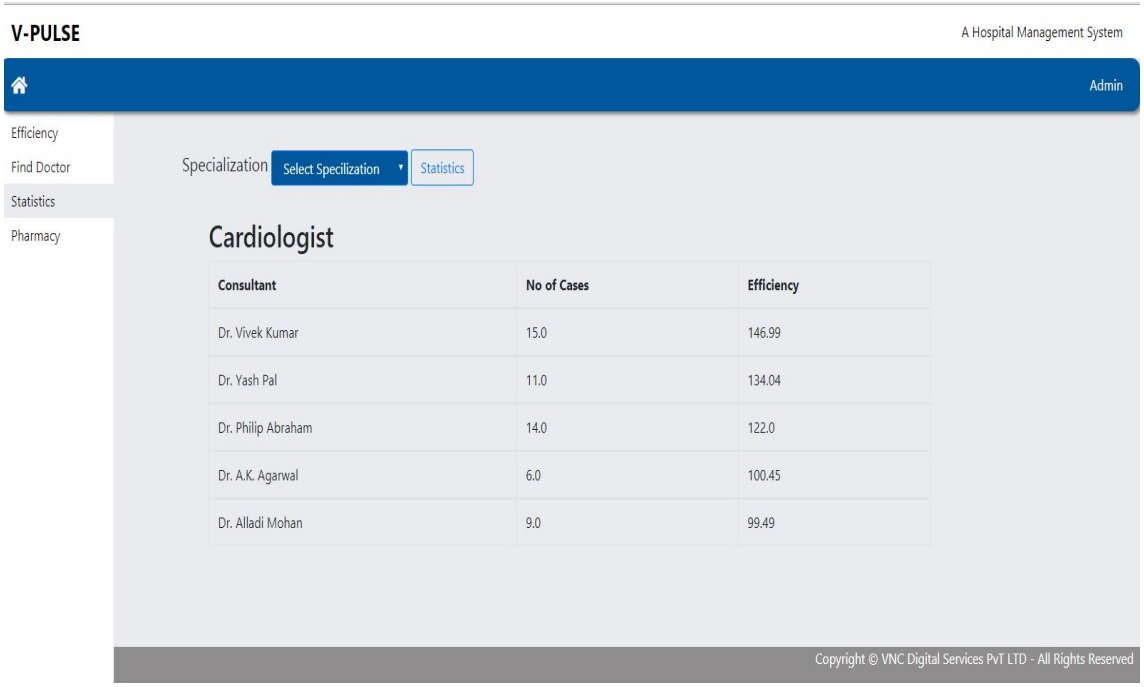

Figure 6.3: Screen 3

The fourth UI screen consists of a button where different departments are listed. On selecting particular department Pharmaceutical medicine list will be generated with in stock and out stock data respectively.

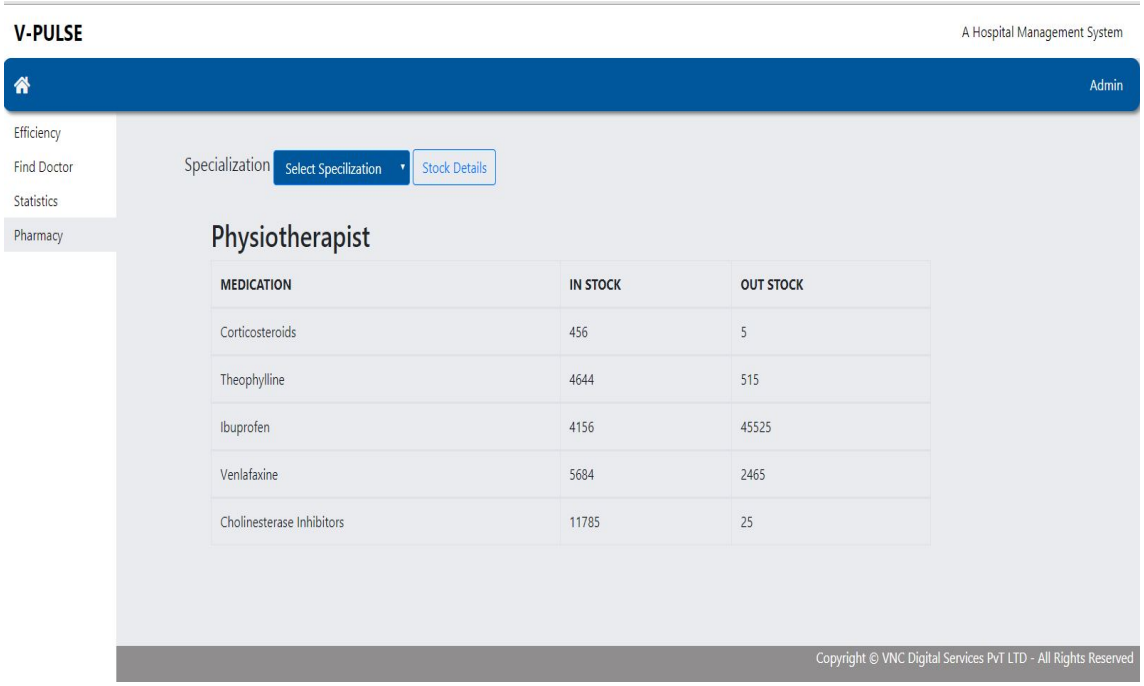

Figure 6.4: Screen 4

The Admin page is logged in using secured I'd and Password where they have access to add raw data to database and check the number of admin users and groups of particular users.

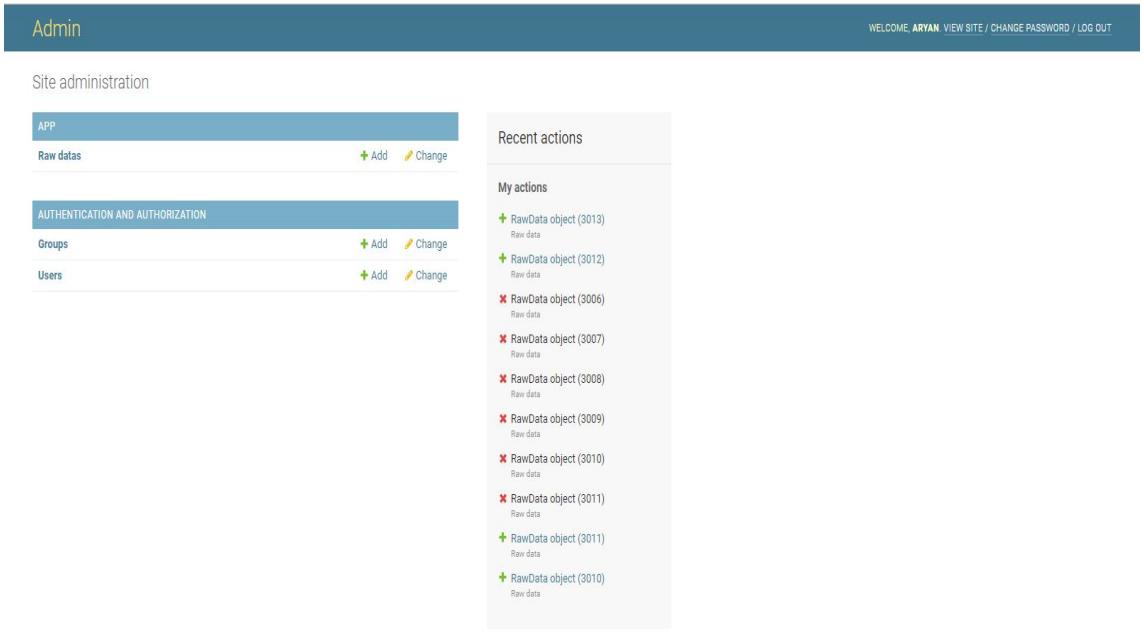

Figure 6.5: ADMIN Page

Chapter 7

CONCLUSION AND FUTURE ENHANCEMENTS

7.1 Conclusion

This project provides a clear, feasible, easily understandable view for any HMS in knowing an efficiency of particular doctor. According to Hospital management view it is more important to now how efficient their doctors in dealing with diseases. This project helps to deal with the problem efficiently. This helps the hospital management in making better decision for future benefits of the hospital. This venture not only helps hospital management but also common people in selecting a better doctor for their problems to be dealt with. Doctor is person who plays in present society where different types of diseases are attacking people. This project uplifts some of the best doctors not only for particular organisation but for society.

7.2 Future Enhancements

Many innovations in health care system are to make a better environment to patients as well as doctors. This project with higher accuracy in algorithm is making a clear view that prediction system in case of efficiency for doctors does not fail and Analytics 4.0 is playing a key role in predicting. This project can be updated to an app also as company is doing it. The possible enhancement is adding treatment level complexity with disease level complexity makes more clearer and system more efficient. As treatment for any disease varies upon patient resistance and symptoms he/she may get. To accomplish this task of treatment level complexity calculation Artificial Neural Networks can be used as they are used to deal with higher data in better environment. Artificial Neural Networks when deployed and trained with great variety of data for a treatment level complexity gives a better result which intensifies the Doctor Efficiency Prediction System so as it makes a great innovation in field of IT Sector. This enhancement can be commissioned under rules of VNC digital Services Pvt LTD as copy rights are taken under company norms.

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We have found him to be a self-starter who is motivated, duty bound and hard-working. His performance was excellent with well behavior and he was punctual at time to report. He worked sincerely on his assignment and his performance was par excellence.

We wish him every success in life.

For VNC Digital Services Pvt Ltd

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We wish him every success in life.

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Maheshwar Reddy Nayani

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(Human Resource)

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