

MEDICAL EXPERT USING ARTIFICIAL INTELLIGENCE

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A Project Report on
**MEDICAL EXPERT USING ARTIFICIAL
INTELLIGENCE**

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In partial fulfillment of the requirements for the degree of
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ABSTRACT

The idea of an expert system as an assistant in rising health care was a thought to remodel industrial robots into exactitude machines for surgery and on the far side. However, in spite of however spectacular, AI in health care remains a system controlled by humans. The important magic of the 21st-century expert system can come back from AI systems which will learn such a lot that the system will outgo the simplest doctors by combining all the accessible data altogether medical repositories. However, most specialists agree that AI won't replace trained medical employees, simply create them additional economical in many areas. Expert System using Artificial Intelligence interacts with the patients with the help of the Natural Language Processing (NLP) and takes the required information or data regarding the disease. The Expert System Then calculates the possible outputs or diseases and their root causes and says those predictions back to the patient.

37

CHAPTER 1

INTRODUCTION

1.1 Problem Statement

The real power of AI lies in detecting the patterns that describe varied conditions by finding out tending records and alternative information. The machine will scan several hundreds of cases and appearances for correlations between many variables, a number of that don't seem to be even listed in existing medical works. Tests thus far have well-tried that expert systems will rival the most effective doctors and even surpass them in some areas. There is a lot of adding a hospital, and not solely doctors will use an aid. Nurses and hospital personnel will like the assistance of expert systems as assistants.

1.2 Existing System

The existing system follows the manual process to collect data from patients. In which the expert system predicts the disease and describes the causes of the disease. But these systems are just collecting information through keyboard and gives the predictions ion the screen. So, the existing system consumes more time to do a piece of work, for this reason, the expert system using artificial

intelligence is used. The proposed system also uses NLP(Natural Language Processing) for the face to face interaction with the user.

1.3 Proposed System

The idea of an expert system as an assistant in up health care was a concept to rework industrial robots into exactitude machines for surgery and on the far side. However, notwithstanding however spectacular, the expert system in health care remains a system controlled by humans. The important magic of the 21st-century expert system can return from AI systems that may learn such a lot that it'll shell the most effective doctors by combining all the offered information all told medical repositories. However, most consultants agree that AI won't replace trained medical employees, simply create them additional economical in many areas.

33 1.4 Objective

The objective of the Expert System using Artificial Intelligence is to interact with the patients with the help of the Natural Language Processing(NLP) and takes the required information or data regarding the disease. The Expert System Then calculates the possible outputs or diseases and their root causes and says those predictions back to the patient.

CHAPTER 2

LITERATURE SURVEY

2 There may be much medication to treat sexual problems in males, based on the originate. Problems that result from trauma, infections, as well as a simple irritation often cured by treatment or for a long time. This applies to several diseases, through sexual contact square measure typically addressing transmitted diseases with drugs, however additionally other problems which will be treated with medicine or surgery. One ought to ask his doctor to search out the foremost effectual treatment for a precise drawback. The proposed expert system [1] performs diagnosis in men's genital problems by asking questions that require True/False answers. The proposed expert system ask user to choose the accurate answer on screen. When finally the diagnosis session ends, the proposed expert system provides the proper diagnosis of the problem and recommends for the proper treatment to the users.

Nausea and forcing out are general in youngsters, and are often component of a gentle, transitory unwellness, commonly caused by microorganism infectivity. For forcing out, nausea, abdomen disorders endured by many youngsters one cause for coming into the food or contaminated air approach Nausea generally, however not in any respect times, takes place before forcing out. The projected knowledgeable system [2] performs diagnosing for the Nausea and forcing out in Infants and kids by questioning which need True/False answers. The projected knowledgeable system can raise the user to decide on the proper answer in every frame. At the top of the diagnosing session, the projected knowledgeable system provides the correct diagnosing of the matter and provides a recommendation of the symptoms to the user.

In the paper [3], the machine learning algorithm is used for the accurate disease prediction for that purpose the hospital data are collected from a particular region. For missing data, the latent factor model is used to achieve incomplete data. In the previous work for disease prediction Convolutional Neural Network Based Unimodel Disease Prediction (CNN-UDRP) Algorithm is used. Convolutional Neural Network Based Multimodal Disease Prediction (CNN-MDRP) algorithm has overcome the drawbacks of the CNN-UDRP algorithm only focus work on structured data but the CNN-MDRP algorithm uses both structured and unstructured data from the hospital. None of the existing work focused on both data types in the area of medical big data analysis. CNN-MDRP algorithm prediction is more accurate than the previous prediction algorithm.

The disease is the major reason for unhealthiness and death in very human life. Diagnosis is a vital important} however sophisticated task that ought to be performed accurately and expeditiously and its automation would be very helpful. All doctors aren't equally versatile in each subspecialty and that they are in several places a scarce resource. A system for automatic diagnosis would enhance medical aid and scale back prices. The projected paper [4] intends to supply a survey of current techniques of information discovery in databases victimization data processing techniques that are in use in today's medical analysis. Artificial intelligence is capable of computing machines to perform with a human in some cognitive tasks. Here the system mainly focuses on hydrocephalus which is a medical condition causing the headache. Various intelligent computing tools from the rule-based expert system and genetic algorithms are used here. The proposed model [5] is a mobile application that collects data of patients with hydrocephalus and provides an accurate result. The system is used to assist clinicians in the diagnosis, analysis, and treatment of hydrocephalus.

There will be a large collection of useful medical data that can be discovered through data mining techniques. The paper [6] gives an idea about various machine learning approaches and techniques used in mining large medical data that can be used for medical prediction and classification of problems. The proposed paper also gives applications of various methods and intelligent data analysis in medicine and pharmacology. Also, the paper [6] describes certain measures for performance evaluation and classification of problems.

CHAPTER 3

SOFTWARE REQUIREMENT ANALYSIS

Software Requirement Analysis within the department of systems engineering and computer code engineering surrounds those tasks that area unit used for deciding the requirements or state to fulfil for a replacement or adapt product or project, taking count of the probably varying needs of the varied stakeholders, analysing, documenting, supportive and taking care of computer code or needs of systems.

3.1 Feasibility Study

The chief aim of the Feasibility Study is to treat the technical, economic, and operational feasibility of expanding the applying. Feasibility is that the intentness of certainly the project is cost doing. The method maintaining in creating this determination is termed a feasibility study. All systems square measure possible, given limitless resources and boundless time. The feasibility study to be performed for this project imply:

- 25
- Technical Feasibility
 - Operational Feasibility
 - Economic Feasibility

3.1.1 Technical Feasibility

It is the life of the precise technical resolution and therefore the availability of the technical assets and experience. It is one of the primary studies that has got to be performed once a project has been known. A technical study of feasibleness is AN assessment of the logistic aspects of business operation. This is often thought-about with describe instrumentation and software packages that may win make certain the user demand. The technical wants of the system might vary significantly however ought to embrace the ability to supply outputs in a very given time, latent period underneath bound state and therefore the potential to method a definite quantity of dealing at a definite speed.

The proposed system is developed by using PHP and XAMPP software. For mining RStudio with R, tools have been used.

3.1.2 Operational Feasibility

Operational practicability is especially involved with problems like certainly the system is going to be used if it's expand and enforced, certainly there'll be resistance from the users which can have an effect on the doable application advantages. It is the power to employ, brace, and carryout the mandatory tasks of a system or program. It includes everybody who produce, handle, or wield the system. It is the measure however well a planned system solves drawbacks and takes benefits of the chance known throughout the scope clarity and problem analysis stages. This method aid in some ways. It reduces the burden of maintaining the bulk of records of all the student's details. Maintenance of the project is additionally simple and perceivable and no major coaching and new skills area unit needed.

3.1.3 Economic Feasibility

Economic feasibility is that bulk often used technique for assessing the efficacy of the new system. Economic feasibility is that the life of the value of efficacy degree system answer. While not a doubt, this calculate is the most frequently and vital one in all the 3. Data systems square measure typically viewed as capital expense for the business, and, as such, ought to be subjected to the constant style of spending analyses as different capital expense.

Economic analysis is used assessing the efficacy for of the proposed system. In economic feasibility, the most important is benefit-cost analysis. 1 This project is very economical as it only hang on to the software components which are freely accessible.

CHAPTER 4

SYSTEM REQUIREMENT SPECIFICATION

The main reason for which the System Requirement Specification is to change the plans in the minds of a client into a official document. Through System Requirement Specification the client distinctly describes what client expects from the proposed system and the developer distinctly understands what potentially are required to build the system. The purpose of the particular document is to serve as a guide to developers and testers who are behind the development of the system.

The project is mainly concentrated on the prediction of multiple disease. The current system is used to find out one or two diseases. But the Medical Expert System can be used for finding multiple

diseases at a time. They finds out the possible diseases and then gives the list of medications. Also the NLP (Natural Language Processor) is used for the interaction between user and the expert system.

4.1 Functional Overview

- User need to give the genuine details.
- The expert system asks certain amount of questions regarding the disease.
11
- User have to answer the questions asked by the expert system.
- The expert system gives the predictions regarding the disease.
- The expert system gives the details of the list of medicines and other things to be done by the user.

4.2 Operating Environment

Operating environment involves minimum software and hardware requirements required by the system.

31

4.2.1 Software Requirements

- Operating System : Windows 10
- Programming Languages : Python
- Arduino : Simulation software

18

4.2.2 Hardware Requirements

- Processor : Any processor above 1.2 GHz.
- RAM : Minimum 8GB RAM.
- Hard Disk 23 : Approximately 20 GB free space in the hard disk
- Input device : Standard Keyboard and Mouse.
- Output device : VGA and High Resolution Monitor.
- Arduino : board model UNO R3
- Sensors : Pulse, Temperature
- Wire : male-male, male-female, female-female

4.3 Functional Requirements

- User need to give the details consisting of name, age, phone number, Blood Group.
- The expert system asks questions regarding the disease.
- With the help of the NLP system and user interaction in the natural language is possible.
- User should provide the data regarding the disease to the expert system.
- Expert System uses certain sensors for checkups.
- The expert system gives details about the possible diseases that the user might be having.
- The expert system also gives the details about the medicines the user should consume with specified quantity and time.
- The expert system also suggests things to be done during the medications and things not to be done.

4.4 Non Functional Requirements

- The system that has been designed is reliable, and the user can use the system anytime.
- By knowing about the possible diseases that the user might face, the user can take precautions.
- The complete details about the user will be stockpile in the database and can be obtained at any time.
- The expert system is very user friendly so any user can understand the application very easily.

4.5 Performance Requirements

The expert system can help the user to avoid to meet doctors. Thus the proposed expert system results in inefficient usage of time. The expert system will come in great use in case of a situation where doctors are not available at all.

4.6 Security Requirements

- This project clear-cuts on put in security concepts for validating the patient.
- Only the authenticated patient is allowed to interact with the Expert System.

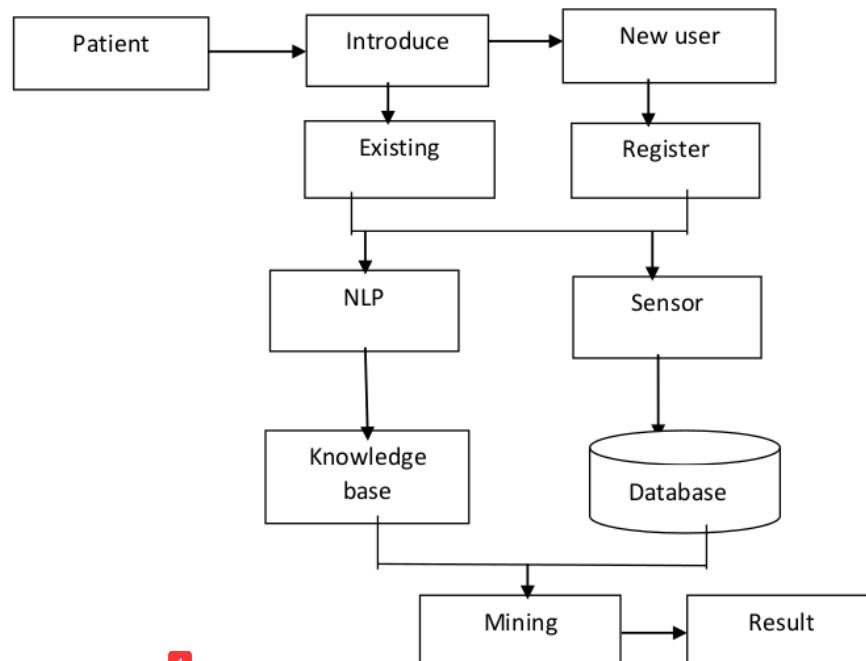
CHAPTER 5

3 SYSTEM DESIGN

The purpose of the System design section is to plan an answer for the specific need of the document. The planning of a system is probably the foremost vital matter touching the quality of the code and encompasses a huge bang on the later stages, in particular testing and maintenance. The output of the system design phase is that the system design document. The design activity usually split into 2 different phases that are system design and feature design.

3 5.1 High-Level Design

A high-level design which is sometimes also called system design aims to naming the element that are vital for the system and should be in the system, the specifications of these element, and how they interact with each other to bring them to the wanted results. At the end of the system design all the crucial data structures, output formats, file formats, as well as the main elements in the system and the statements are decided.



1
Figure 5.1: System Architecture of Expert System

Figure 5.1 shows the system planning of the Expert System. Initially, patients have to introduce to the System. If the patient is new then the patient has to register first otherwise if the patient is existing then the patient can continue with the process. The patient must ¹¹ answer to all the questions asked by the expert system through NLP (Natural Language Processing) and the data is passed to the knowledgebase. Expert System also gets the sensor data from the Patient and stocks in the database. The Knowledgebase and Database pass the NLP data and sensor data respectively to the Mining section. Finally, the patient gets the final prediction from the Result section.

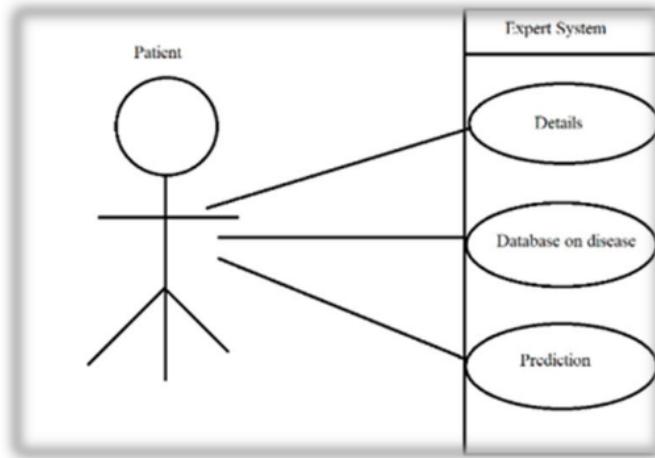
5.2 Detailed Design

During detailed design, the philosophy of each of the element put out in system style is seton. ³ Throughout the careful design part, additional details of the facts structures and algorithmic design of each of the modules is such that. The logic of the element is typically laid out in a high-level design explanation language that is freelance of prey language within which the software package can eventually be applied.

5.2.1 Use Case Diagram of Expert System

A use case diagram at its easily may give a clear picture of a user's interchange with the system and portraying the statements of a use case. A use case diagram will draw the {various} sorts of users of a system and also the different forms in which they move with the system.

Figure 5.2 shows the use case diagram for the Expert System with Mining. There is one patient factor. Patients have to give their details first and the expert system checks whether the patient is new or existing in the database. Then the patient answers all the questions asked by the system through NLP and gets sensor values through various sensors like temperature sensors, pulse sensors. After getting all the required data from the patient, the expert system calculates the final prediction. The expert system says the final prediction is the possible disease with the precautions to be taken.



¹⁹
Figure 5.2: Use Case Diagram for Expert System

5.2.2 Data Flow Diagram of Expert System

A Data Flow Diagram (DFD) may be a graph showing the slides the information values from the sources in objects through processes that rework them to destination in different objects. A DFD ¹⁸ additionally referred to as “bubble chart”, has the aim of elucidative the system needs and attributes major changes which will become programs in system style. So, the place to begin of the look part that functionally decay the essential statement right down to the rock level of detail. The bubbles constitute information changes and also the lines represent information flows within the system. ⁷ A DFD is usually used as a initial step to form an outline of the system while not going into nice detail, which might later be careful.

Figure 5.3 shows the data flow diagram for the Expert System. Expert Systems can ask required questions through NLP (Natural Language Processing) and the patient should answer to the system. Data sensing is done by taking the sensor values through various sensors. The system saves the sensor data in the database. From the database and knowledgebase data is passed to the mining section. From the mining, section the results are passed to the Result section to get the final predictions. The final prediction is said back to the patient through NLP and along with the prediction, the necessary medications are also included.

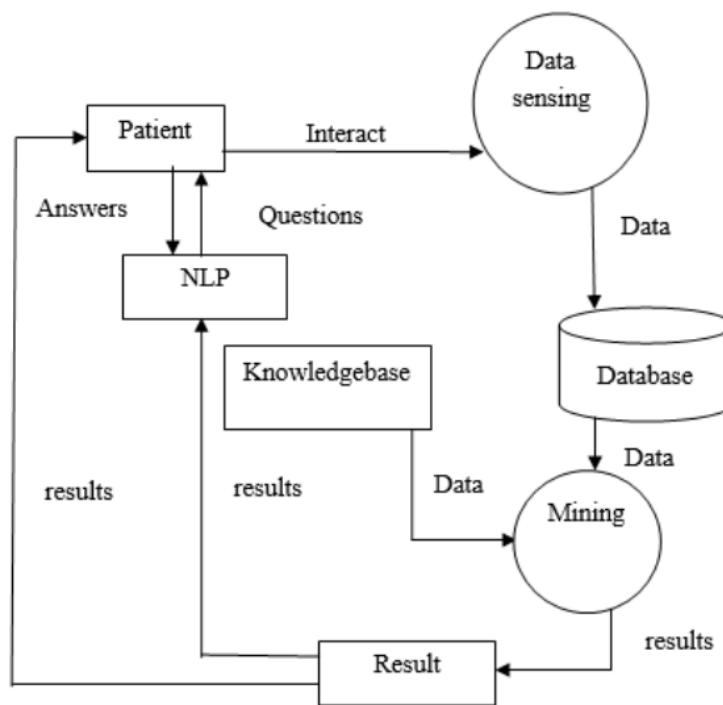


Figure 5.3: Data Flow Diagram for Expert System.

16

5.2.3 Sequence Diagram of Expert System

Figure 5.4 shows the sequence diagram of the Expert System. The patient first enters all the required personal details and then details are passed to the database. From the database verification process is done which shows whether a patient is new or not and a confirmation message is sent back to the patient. Sensor data is stocked in the database and then the data is passed to

knowledgebase to checks the possible diseases that the patient could face in the future. Then the data (NLP) from the patient which shows the symptoms of the disease are passed to the knowledgebase. From the knowledge base, both the data (NLP) and the possibilities are passed to the database and saved as well. After the calculations, the final prediction is passed to the patient.

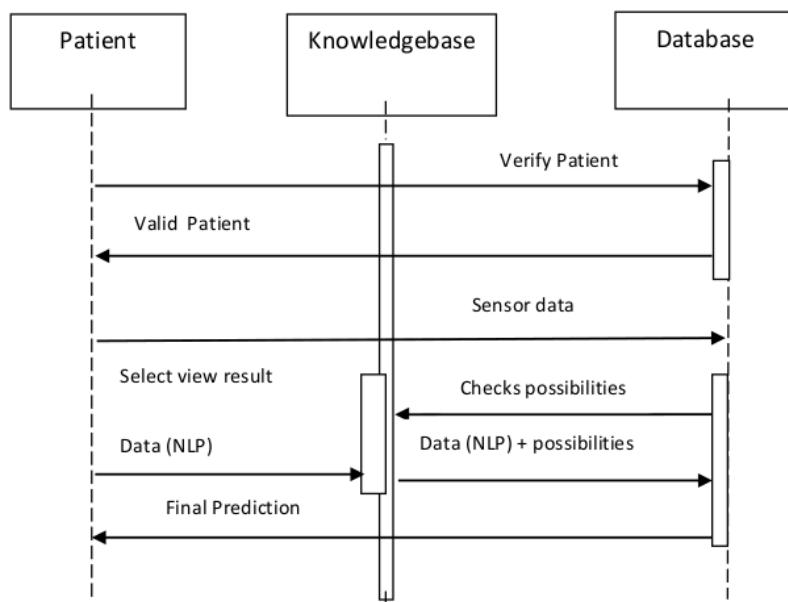


Figure 5.4: Sequence Diagram of Expert System.

5.2.4 Schema Diagram for Expert System

Patient

Patient_name | Fname | Lname | BG | Patient_id | Age | Weight | Hight | Phone_no | Address

Temperature

Date	Patient_id	<u>T_id</u>	P_value
------	------------	-------------	---------

Pulse

Date	Patient_id	<u>P_id</u>	P_value
------	------------	-------------	---------

medicine

<u>M_Id</u>	Disease	Quantity	Medicine
-------------	---------	----------	----------

Prediction

```

    graph TD
      Patient["Patient_name | Fname | Lname | BG | Patient_id | Age | Weight | Hight | Phone_no | Address"] --> Temp["Temperature"]
      Patient --> Pulse["Pulse"]
      Patient --> Medicine["medicine"]
      Temp --> T_id["Date | Patient_id | T_id | P_value"]
      Pulse --> P_id["Date | Patient_id | P_id | P_value"]
      Medicine --> M_Id["M_Id | Disease | Quantity | Medicine"]
  
```

Pr_id	Patient_id	Disease	Date
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Figure 5.5: Schema diagram for Expert System

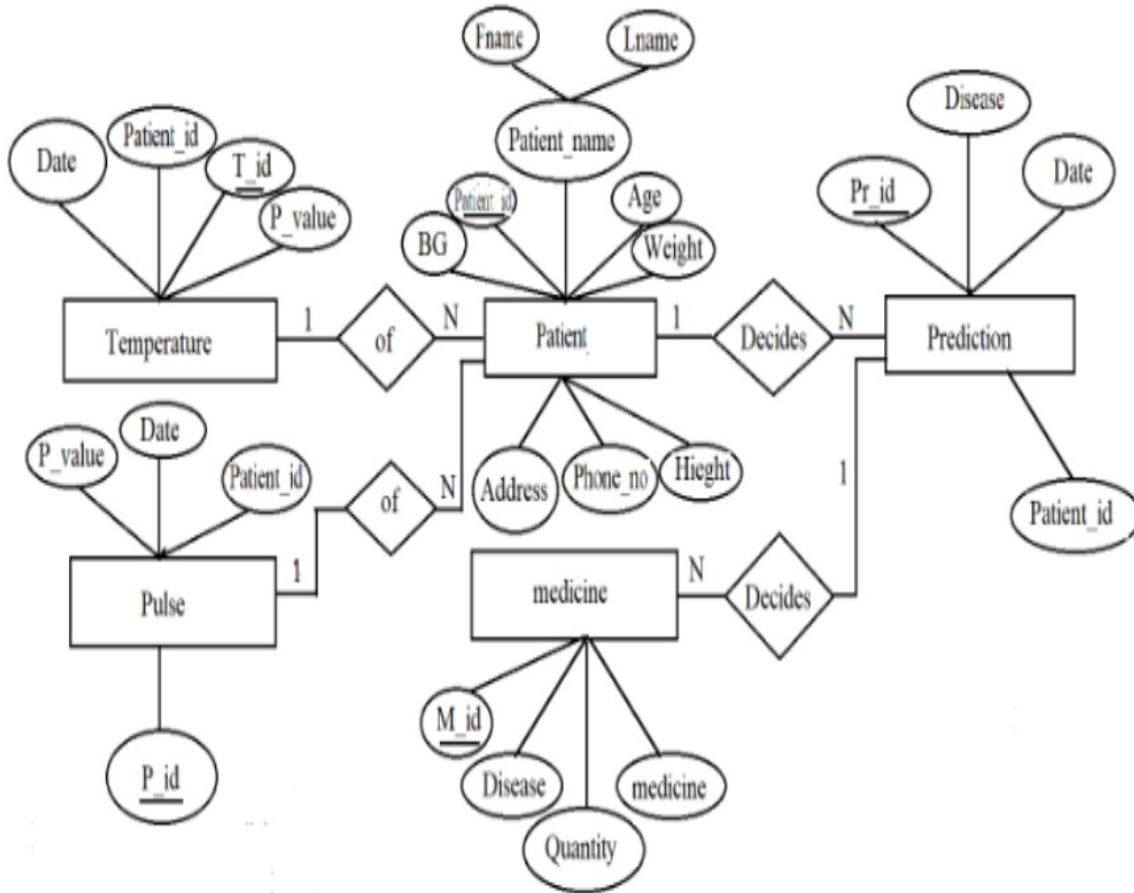
A database schema is that the frame that represents the logical read of the complete info. A schema diagram defines however the information is arranged and the way the connections among them are associated. Schema diagram workouts all the checks that are to be put into the information. A database schema defines the institution and relationships among them. Conjointly contains a expressive detail of the database, which may be represented by means that of schema diagrams. The database contains 5 tables which are Patient, temperature, pulse, prediction, and medicine. Each table contains valid information that is used by the application. The tables contain primary keys that contain a unique value. A foreign key relationship is utilize to recount two different tables. Data in the pulse, temperature, and prediction table are passed to the Patient table. Also, Information in the prediction table is passed to the medicine table.

5.2.5 Entity Relationship Diagram for Expert System

The entity-relationship model reports inter-linked things of heed in a very specific area of data. AN ER model consists of entity varieties (which classify the items of interest) and specifies relationships that will exist between instances of these entity varieties. The ER model becomes AN abstract knowledge model that defines info or information structure which will be enforced in very information, usually an electronic information service. Some ER modelers show super and subtype entities connected by generalization-specialization relationships.

Figure 5.8 shows the Entity-Relationship diagram for the Expert System. There are five tables which are patient, temperature, pulse, prediction, and medicine. Patient tables consist of eight attributes which are Patient_name having two sub-attributes Fname and Lname, Patient_id which is the primary key, BG (Blood Group), Age, Hight, Weight, Phone_no, Address. The temperature table consists of four attributes which are Patient_id, Date, T_id which is the primary

key and P_value. Pulse table contains four attributes which are Patient_id, Date, P_id which is the primary key and P_value. Both the temperature and pulse tables are connected to the patient table. Next is the Prediction table containing four attributes Patient_id, Pr_id which is the primary key, Disease, and Date. Medicine table consists of M_id which is the primary key, Disease, Medicine, and Quantity. The Medicine table is connected to the Prediction table and the Prediction table is connected to the patient table.



20

Figure 5.6: Entity Relationship Diagram for Expert System

5.2.6 Database Table Structure for Expert System

Patient: Patient table stores the information about Patient name, Fname, Lname, blood group, Id, Age, Weight, Height, phone_no, Adress.

Table 5.1: Patient

ATTRIBUTE	DATA TYPE
Patient_name	Varchar
Fname	Varchar
Lname	Varchar
BG	Varchar
<u>Id</u>	Integer
Age	Integer
Weight	Integer
Hight	Integer
Phone_no	Integer
Address	Varchar

Temperature: Temperature table stores information about Date, Patient_is, T_id, P_value.

Table 5.2: Temperature

ATTRIBUTE	DATA TYPE
Date	Date
Patient_id	Integer
<u>T_id</u>	Integer
P_value	Interger

Pulse: Pulse table stores information about Date, Patient_id, T_id, P_value.

Table 5.3: Pulse

ATTRIBUTE	DATA TYPE

Date	Date
Patient_id	Integer
P_id	Integer
P_value	Interger

Medicine: Medicine stores information about id, disease, quantity, medicine.

Table 5.4: medicine

ATTRIBUTE	DATA TYPE
M_Id	Integer
Disease	Varchar
Medicine	Varchar
Quantity	Interger

Prediction: Prediction table stores information about P_id, date, disease, patient_name

Table 5.5: prediction

ATTRIBUTE	DATA TYPE
Pr_id	Integer
Date	Date
Disease	Varchar
Patient_id	Varchar

CHAPTER 6

SYSTEM IMPLEMENTATION

System Implementation is a process in which the theoretical design will be converted to a working system, the new system will be newer, replacing an existing one, or automated system or even it will be a greater modification to an existing system. The system is implemented using Python, TensorFlow, Raspberry Pi 3B+, and Raspbian OS.

Python

Python is an Associate in Nursing taken, high-level, general programming language. It supports different programming paradigms, combined with procedural, object-oriented, and practical programming. Python is mostly delineated as a "batteries included" language because of its comprehensive customary library.⁴ Its high level in built knowledge structure, combined with dynamic typewriting⁴ and also with dynamic binding, built it enticing for rapid Application Development, also used as scripting or glue language that to attach existing elements along. Python's straightforward, simple to be told syntax emphasizes much readability and so it reduces the price of the program maintenance. Python supports lots of modules and packages, which improves program modularity and code recycle. The Python interpreter with the intensive customary library square measure obtainable to supply or binary type for free charges for most of all major platforms, and can also be freely distributed. It's open supply, which implies it's liberated to use, even for business applications. Python will run on a Mackintosh, Windows, and Unix system and has conjointly been ported to Java and .NET VM's. Python is taken into account a scripting language, like Ruby, and is mostly used for creating dynamic web pages and internet applications. It's conjointly supported by a variety of 3D imaging programs, sanctioning users to make custom plug-in and variety of extensions with Python. Scripts written in Python (.PY files) are parsed and can run forthwith. They will even be saved as a compiled programs, that square measure typically used as programming modules that may be documented by different Python programs.

TensorFlow

TensorFlow may be a free package library centered on machine learning created by Google. TensorFlow derives its name from the multidimensional arrays referred to as tensors, that square measure utilized by the neural networks for various operations. in comparison to DistBelief,

TensorFlow is quicker, smarter, and additional versatile and may be simply adaptable to new areas and products. it had been primarily created for deep neural network analysis and for facilitating machine learning, although TensorFlow has been utilized in a large array of alternative areas furthermore. TensorFlow functions by sorting through layers of knowledge as a part of learning. within the 1st layer, the system determines the essential options of the article. As deeper movements occur, it's for additional refined data concerning the article. The sorting of pictures is finished at a quicker rate, so giving users additional valuable data. TensorFlow is out there on completely different in operation systems like UNIX, Windows, macOS, and additionally on mobile in operation platforms like iOS and robot. one in all all the salient options of TensorFlow is that it's capable of running on multiple CPUs and GPUs. The computations in TensorFlow square measure reportable as stateful dataflow graphs. TensorFlow will train and runs neural networks for written digits classification, word embeddings, image recognition, perennial neural networks, Sequence to Sequence models that are used for artificial intelligence, linguistic communication process, and Partial differential equations primarily based simulations. Better of all, TensorFlow also supports production predictions at scale, with identical models that are used for coaching.

Raspberry Pi 3B+

15

The Raspberry Pi 3B+ is the product within the Raspberry Pi three vary, jactitation a 64-bit quad core processor runs at single 4GHz dual band two 4GHz and also 5GHz WLAN, Bluetooth four 2/BLE, quicker local area network and Poe capability that is via a separate Poe HAT. The dual-band Wireless local area network come with standard compliance certification, permitting the board that could be designed into finish merchandise with considerably reduced wireless local area network compliance testing, rising each value and time to plug. The Raspberry Pi 3B+ maintains an equivalent mechanical foot print as each the Raspberry Pi 2B and also the Raspberry Pi 3B+.
5 The Raspberry Pi was designed by the Raspberry Pi foundation that to supply a reasonable platform for experimentations and pro-active education in programming. The Raspberry Pi is often used in several of the items that a traditional desktop laptop will, as well as high-definition video, spreadsheets, word-processing, games, and also programming. USB devices like mouse and keyboards are often connected through the board with four USB ports. Over more than twelve million Raspberry Pi are oversubscribed, and much of raspberry Pi resources are obtainable online.

8

Raspbian OS

Raspbian OS is the “official” package of the Raspberry Pi and since of that, it is the one most people can need to start with. Raspbian is the a version of the UNIX system engineered specifically for the the Raspberry Pi. It comes full of all the packages you will need for each basic tasks with a pc.

6.1 Procedure for Expert System

Step 1: New patients have to enter their personal information first only then they can proceed to medical diagnosis. Patients who already entered their data can log in directly for medical diagnosis.

Step 2: If the patient proceeds with the medical diagnosis then identification of the symptoms is done by asking a set of questions to the patients or might use sensors for the prediction process.

Step 3: Disease is being predicted and again a set of questions could be asked to the Patient for further clarity of the disease.

Step 4: If they continue to do so then they have to answer another set of questions.

Step 5: By answering the questions prediction of the disease is done and again the system could ask more questions for further clarity.

Step 6: If there are no questions are there remaining to be asked then that predicted disease is being passed for final prediction.

Step 7: If the patient does not go through medical diagnosis then they go to step 4.

6.2 Flowchart for Expert System

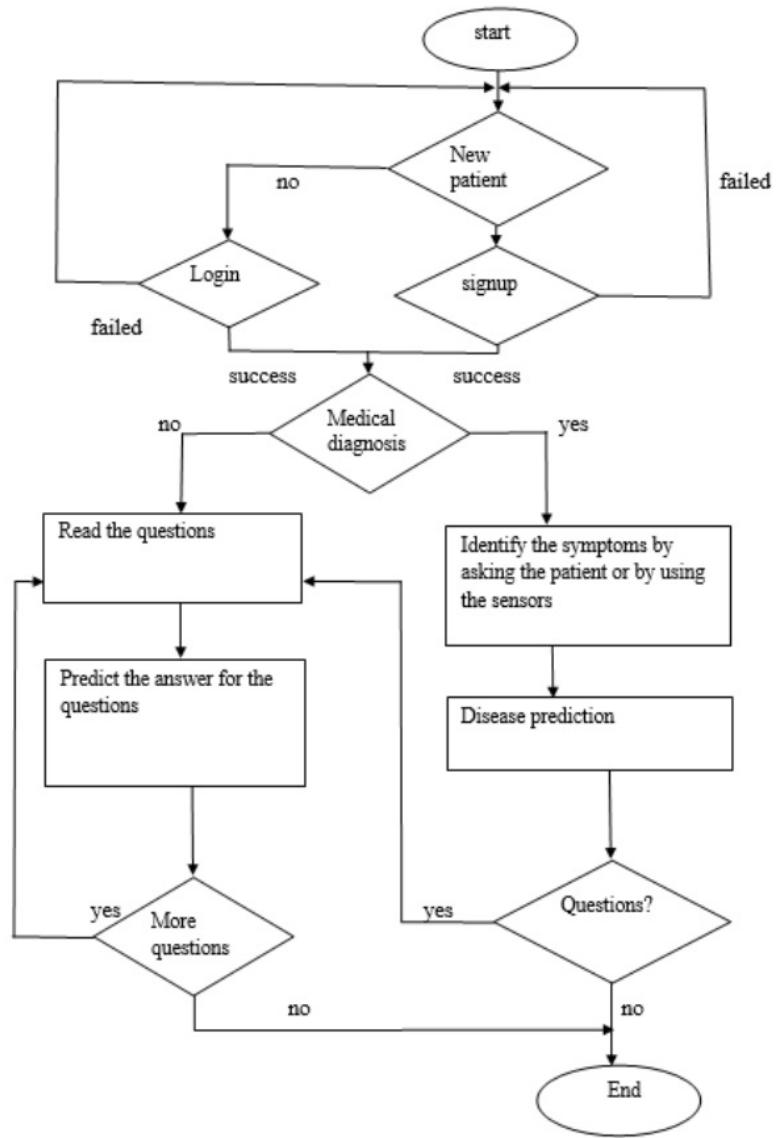


Figure 6.2: Flowchart for Expert System

CHAPTER 7

TESTING

Software testing is that method accustomed facilitates to determine the accuracy, fullness, reliability, and standard of developed laptop code. This includes the method of capital punishment the program or application for finding errors. Standard isn't AN absolute; it's a price to some person. There within thought testing will ne'er fully establish the accuracy of impulsive laptop software; testing enhance a criticism or balancing that compares the state and behaviour of the merchandise against a fulfilment. Testing forms the primary step in finding the errors during a program. The success of checking in disclosing the errors in programs depends on the test cases. As a result of code is that the sole product which will be dead and whose actual conduct is discovered, testing is that the section wherever the errors left out from all the previous cases should be spotted. ⁷ The program to be checked is dead with a group check and also the output of the program for the test cases area unit rated to work out if the programming is activity. Testing forms the primary step in determining errors during a program. The benefit of testing in disclosing the errors in programs depends on the test suit.

1 7.1 Testing Methodologies

The following are the testing methodologies:

- **Unit Testing:** This is the first phase of testing; here different elements are tested separately, usually programmers do this part.
- **Integration Testing:** In this type of testing many units tested elements are merged into subsystems, then these are tested. The goal here is to see whether the elements can be integrated properly ¹⁴
- **System Testing:** The whole software package is tested. The reference document for this method is that demand specification and also the aim is to check whether the code meets the wants. This type of testing is popularly mentioned as recording machine testing.
- **Acceptance Testing:** It is performs as a realistic knowledge of the shopper to illustrate as that the software system is functioning satisfactorily. it takes a look at performed ones to see if the necessities of a demands are met.

7.2 Testing Criteria

Table 7.1: Test cases for Expert System Using Artificial intelligence

Sl. No	Test Procedure	Pre-Condition	Expected Result	Passed/ failed
1	Click on Login without entering username	Enter the username which is specified by the admin	"Some Fields are empty"	Passed
2	Click on Login button without entering password	Enter the password which is specified by the admin	"Some Fields are empty"	Passed
3	Enter wrong username or password	Valid username and passwords are provided to the users	"You have entered wrong username/password"	Passed
4	Student who already given feedback logs in again	Student can give feedback only once	"You have already given your feedback"	Passed
5	Choosing wrong type of user	Don't choose wrong type of user because it will lead to error	"You have entered wrong username/password"	Passed
6	Click on submit without entering all factors	Admin has to fill all text boxes to save factors into database	"Fill the blank field"	Passed
7	Mismatch in new password and confirm password	Entered confirm password must match with new password	"Error try again"	Passed
8	Password with less than 8 characters	Password should have at least 8 characters	"Password must contain at least 8 characters"	Passed

CHAPTER 8

SCREENSHOTS

38 8.1 Raspberry pi 3 Model B+



17
Figure 8.1: Raspberry pi 3 Model B+

17
Figure 8.1 shows the Raspberry pi 3 Model B+ of the Medical Expert System. In the expert system, Raspberry pi 3B+ is used as a mini-computer substituting the use of PC so that it can be used at any time anywhere. The Raspberry Pi 3 Model B+ is that the latest device among the Raspberry Pi three is different, Nursing Associated with speech act updates that it uses 64-bit quad-core processor which is running at one 4GHz with inherent alloy heat sink, a pair of 4GHz and 5GHz 28 wireless computer network, faster(300 Mbps) LAN, and capability via a separate HAT. The 29 Raspberry Pi is used for several of the items that a standard desktop laptop will, as well as word-processing, spreadsheets, high-definition video, games, and programming. USB devices such as 5 keyboards and mice are connected via the board's four USB ports. Over 12 million Raspberry Pi are oversubscribed, and plenty of raspberry Pi resource square measure offered on-line.

36 8.2 Chatbot

The screenshot shows the Spyder Python IDE interface. On the left, there is an Editor window containing Python code for a chatbot. The code includes imports, variable definitions, and logic for loading weights and running the session. On the right, there is a Python console window showing the execution of the code. The console output includes the Python version, copyright information, and the command 'In [1]'. The bottom status bar shows permissions, encoding, line number, column, and memory usage.

```

Spyder (Python 3.6)
File Edit Search Source Run Debug Consoles Projects Tools View Help
Editor - F:\Medical_Expert\the_best_chatbot.py
dataprocess.py the_best_chatbot.py untitled.py
26 # Processing
27 xseq_len = trainX.shape[1]
28 yseq_len = trainY.shape[1]
29 batch_size = 16
30 vocab_size = len(metadata['idx2w'])
31 xvocab_size = len(metadata['idx2v'])
32 yvocab_size = xvocab_size
33 emb_dim = 1024
34 idx2w, w2idx, limit = data_utils_2.get_metadata()
35
36
37
38
39
40 # Building the seq2seq model
41 model = seq2seq_wrapper.Seq2Seq(xseq_len = xseq_len,
42                                 yseq_len = yseq_len,
43                                 xvocab_size = xvocab_size,
44                                 yvocab_size = yvocab_size,
45                                 ckpt_path = './weights',
46                                 emb_dim = emb_dim,
47                                 num_layers = 3)
48
49
50
51
52
53 # Loading the weights and running the session
54 session = model.restore_last_session()
55
56 # Getting the Chatbot predicted answer
57 def respond(question):
58     encoded_question = data_utils_2.encode(question, w2idx, limit['maxq'])
59     answer = model.predict(session, encoded_question)[0]
60     return data_utils_2.decode(answer, idx2w)
61
62 # Setting up the chat
63 engine = pyttsx3.init()

```

Figure 8.2: chatbot

Figure 8.2 shows the chatbot in the Medical Expert System Using Artificial Intelligence. Users can interact with the system using this chatbot. If the user types a text then the chatbot reply with another text message.

8.3 Login Page

The screenshot shows a Microsoft Excel spreadsheet titled 'medicalset.xlsx' with the tab 'medicalset' selected. The data consists of two columns of symptoms: 'itching' and 'skin_rash_nodal_skin_continuous_shivering_chills'. The first column has 1's in rows 1 through 10 and 0's in rows 11 through 28. The second column has 1's in rows 1 through 10 and 0's in rows 11 through 28. The bottom status bar shows permissions, encoding, line number, column, and memory usage.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	itching	skin_rash_nodal_skin_continuous_shivering_chills																			
2																					
3	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 8.3: Dataset for Diseases and Symptoms

Figure 8.3 shows Dataset for Diseases and Symptoms in Medical Expert System Using Artificial Intelligence. The Dataset consists of more than 3000 diseases and symptoms information. In the dataset information is given using 0 and 1 where 0 indicates “yes” and 1 indicates “no”.

8.4 Disease Dataset

The screenshot shows a Microsoft Excel spreadsheet titled "diseases.csv - Excel (Product Activation Failed)". The data is contained in a single column, starting from cell A1. The first few rows of data are:

	disease	value
1	Fungal inf	1
2	Allergy	2
3	GERD	3
4	Chronic ch	4
5	Drug Reac	5
6	Peptic ulc	6
7	AIDS	7
8	Diabetes	8
9	Gastroent	9
10	Bronchial	10
11	Hypertens	11
12	Migraine	12
13	Cervical sp	13
14	Paralysis (14
15	Jaundice	15
16	Malaria	16
17	Chicken p	17
18	Dengue	18
19	Typhoid	19
20	hepatitis (20
21	Hepatitis i	21
22	Hepatitis i	22
23	Hepatitis i	23
24	Hepatitis i	24
25	Alcoholic	25
26	Tuberculo	26
27	Common i	27
28	~	~

Figure 8.4: Disease Dataset

Figure 8.4 shows the Disease Dataset of the Medical Expert System Using Artificial Intelligence. In Disease Dataset, all the diseases are given with a specific numerical value or a number so that these values can be used in the algorithm. Only numerical values can be taken for the comparison process in the system.

8.5 Data process

The screenshot shows the Spyder Python IDE interface. On the left, there is a code editor with a script named 'the_best_chatbot.py'. The code is written in Python and includes imports for pandas, numpy, and various speech processing modules like sr, pyttsx3, and speech_recognition. It defines a function that processes rows from a CSV file, converts them to lowercase, and checks if they are keys in a dictionary. It also handles microphone input and speech recognition. The right side of the interface shows an IPython console window with the Python version (3.6.5), the Anaconda distribution, and the command 'IPython 6.4.0 -- An enhanced Interactive Python.' Below the console is a history log. At the bottom, there are tabs for 'Python console' and 'History log', along with system status indicators like permissions (RW), encoding (UTF-8), and memory usage (65%).

```

110     for row in ss:
111         nutosyme[row[0].replace('_', ' ')] = int(row[1])-1
112     while True:
113         print('Enter your symptoms: ', finalist.keys())
114         small = min(list(finalist.keys()))
115         ind1 = -1
116         engine = pyttsx3.init()
117         engine.say('Do you have any other symptom')
118         engine.runAndWait()
119         print('Do you have any other symptom')
120
121     try:
122         r = sr.Recognizer()
123         mic = sr.Microphone()
124         with mic as source:
125             r.adjust_for_ambient_noise(source)
126             audio = r.listen(source)
127             texter.recognize_google(audio)
128             print(text)
129     except:
130         continue
131
132     sym=text.lower()
133     sym = input('Do you have any other symptom: ')
134     if sym == 'no':
135         break
136     try:
137         sym = nutosyme[sym]
138     except:
139         engine.say('Sorry, It is not recognized as symptom')
140         engine.runAndWait()
141         print('Sorry, It is not recognized as symptom')
142         continue
143     print(sym)
144     symptom.append(sym)
145     for k, v in finalist.items():
146         if v[0] <= sym and v[-1] >= sym:
147             ind1 = k
148             break

```

Figure 8.5: Data process

35

Figure 8.5 shows the Data process part of the Medical Expert System Using Artificial Intelligence. Using the data process program the system asks different questions related to the disease and will mention the symptoms of the diseases. The system then gives information about the disease also prescribes suitable medicines.

CHAPTER 9

USER MANUAL

The project has two types of users. They are patient and admin. All two kinds of users play different roles. The project is mainly used by the patients directly or with the help of another person. The user can interact with the medical expert in the same way how the patients interact with the doctors. The administrator may use the system occasionally to add more information to the system.

9.1 Patient

A proper internet connection is needed for the working of the system. To use the expert system, the patient needs to login by providing a valid ³⁴username and password. If the user is already registered, a new account should be created by providing appropriate details before using the system. The user will be able to communicate with the expert system in the same way how they

communicate with the doctor. The patient can either ask certain questions or they can go for a medical diagnosis. The user should speak in English while doing the medical diagnosis the user may need to use the temperature heartbeat sensor. When measuring your heart rate, ensure the heart like part of the device is placed on your arm above your wrist. To measure your temperature, place the part of the temperature sensor on the surface of the patient's hands. While interacting with the expert system, the user should listen to the system carefully. The user can ask any questions related to the medical field.

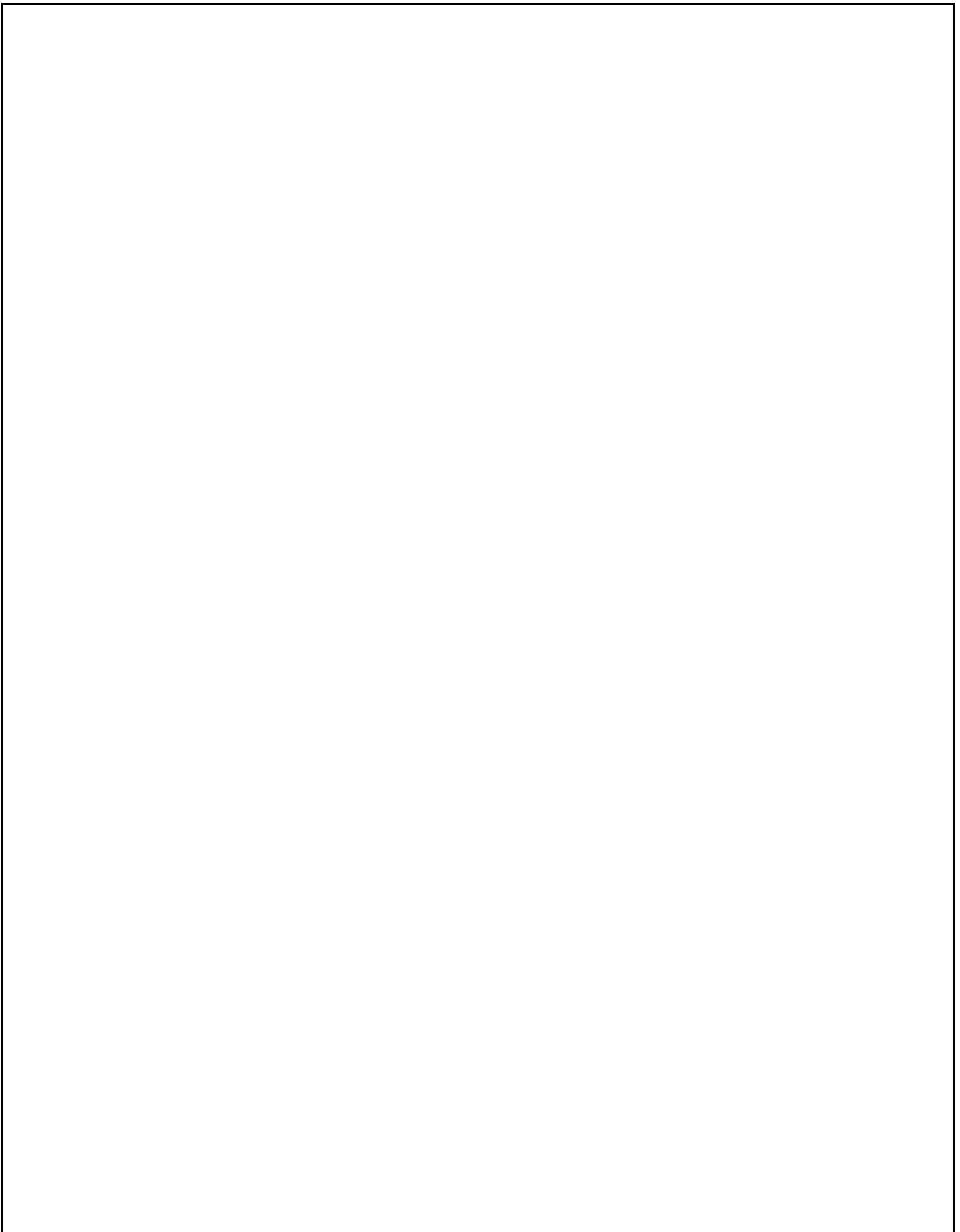
9.2 Admin

To add some more information to the system including new disease data, new medicine data. It should be done by the administrator manually. The administrator should be aware of the structure of the data which is being inserted. Any new details can be added through the modification of the CSV file. After each modification, the system should be restarted.

CONCLUSION AND FUTURE SCOPE

²⁷ Artificial Intelligence is maturing science that has applications in different fields including medical fields. The medical Expert System an intelligent system that uses different concepts of AI which includes machine learning and natural language processing. With the help of the system, it is possible to diagnose any diseases through the interaction ¹¹ with the Expert System. The Expert System will collect a list of systems either by asking the patients or by using various sensors including temperature and heartbeat sensor. Because of the ability to collect real-valued data using sensors, the Expert System will be able to produce more accurate results. The chatbot system is built using the seq2seq model, and it is the most advanced model available in NLP to create a better chatbot, therefore it makes the system more advanced.

The project can be extended further by adding more sensors to identify more disease. It is possible to improve the performance of chatbot by including attention mechanism and word2vec embedding. It will help many users if a web interface of a system is available on the internet so that the users can use the website instead of using google search to identify the disease which will be more accurate and safe.



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