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Virtual Doctor: An Implementation of Disease Detection System by Symptom Analysis

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***Abstract*- This paper explains about implementation of a disease detection system by the help of input symptoms. Virtual Doctor is basically a program which takes inputs of the symptoms, analyze them, and detect the corresponding disease. This paper briefly explains about the program and its working algorithm, test cases, working procedure, flow of program, further targeted implementations for the program and lessons learnt during the development. This program can detect more than 900 diseases covering almost all the major diseases and can analyze more than 85 symptoms accurately. This program can also tell about the drugs used to cure the disease along with their formulation. This program does not suggest the name of the medicines to cure any disease and the amount of their doses because these are variable parameters and vary from person to person belonging from different age groups.**

I. ABOUT THE PROGRAM

This program is developed in C++ and purely follows object oriented approach. Time taken by the program to execute is approximately 10 milliseconds. The main feature of this program is that it is able to handle the whole database of disease, symptoms and their descriptions within the source code itself which makes this program independent of file handling and any accidental damage or modification to the database. So there are no chances of receiving false predictions from the program. The length of the source code is 4760 lines covering 131 kilobytes of space on the disk. The program is developed according to latest C++11 standards and is able to run on various platforms. The program can also be accessed on android devices using C++ compiler, DOS emulator and Android shell emulator.

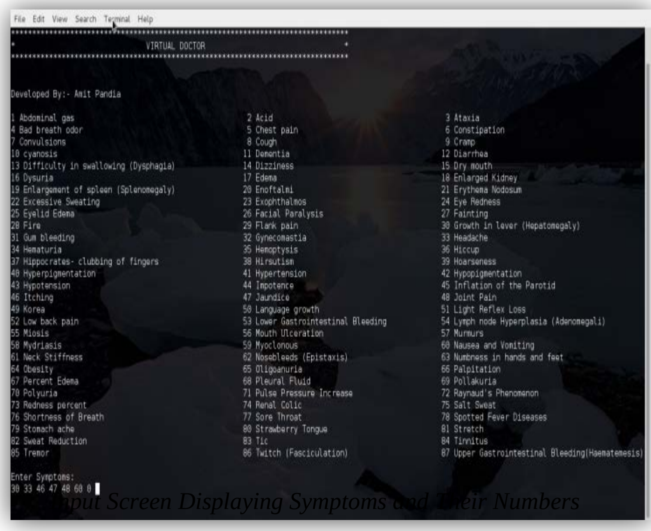
II. INPUT FORMAT

The program takes input in the form of numbers separated by whitespaces (i.e. space, tab or enter) where each number corresponds to a symptom. The symptom list with symptoms and their corresponding numbers is displayed on the input screen so that the operator can refer to the symptom number to be selected.

Input syntax:-

30 33 40 46 47 48 60 0

It is necessary that the last input is always 0 (zero). This zero notifies the program that the user has selected all the desired symptoms.



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****************************************************************************
*                              VIRTUAL DOCTOR                              *
****************************************************************************

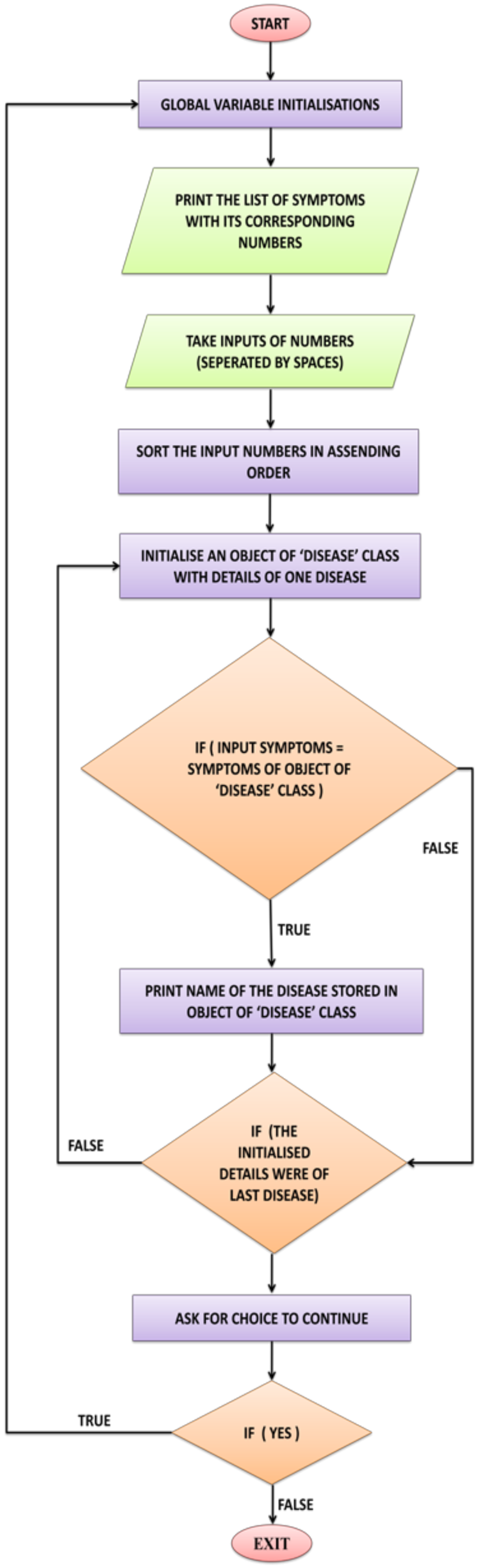

Developed By:- Amit Pandia

1 Abdominal gas                                  2 Acid                                   3 Ataxia
4 Bad breath odor                                5 Chest pain                             6 Constipation
7 Convulsions                                    8 Cough                                  9 Cramp
10 cyanosis                                     11 Dementia                              12 Diarrhea
13 Difficulty in swallowing (Dysphagia)         14 Dizziness                             15 Dry mouth
16 Dysuria                                      17 Edema                                 18 Enlarged Kidney
19 Enlargement of spleen (Splenomegaly)         20 Enoftalmi                             21 Erythema Nodosum
22 Excessive Sweating                           23 Exophthalmos                          24 Eye Redness
25 Eyelid Edema                                 26 Facial Paralysis                      27 Fainting
28 Fire                                         29 Flank pain                            30 Growth in lever (Hepatomegaly)
31 Gum bleeding                                 32 Gynecomastia                          33 Headache
34 Hematuria                                    35 Hemoptysis                            36 Hiccup
37 Hippocrates- clubbing of fingers             38 Hirsutism                             39 Hoarseness
40 Hyperpigmentation                            41 Hypertension                          42 Hypopigmentation
43 Hypotension                                  44 Impotence                             45 Inflation of the Parotid
46 Itching                                      47 Jaundice                              48 Joint Pain
49 Korea                                        50 Language growth                       51 Light Reflex Loss
52 Low back pain                                53 Lower Gastrointestinal Bleeding       54 Lymph node Hyperplasia (Adenomegali)
55 Miosis                                       56 Mouth Ulceration                      57 Murmurs
58 Mydriasis                                    59 Myoclonous                            60 Nausea and Vomiting
61 Neck Stiffness                               62 Nosebleeds (Epistaxis)                63 Numbness in hands and feet
64 Obesity                                      65 Oligoanuria                           66 Palpitation
67 Percent Edema                                68 Pleural Fluid                         69 Pollakuria
70 Polyuria                                     71 Pulse Pressure Increase               72 Raynaud's Phenomenon
73 Redness percent                              74 Renal Colic                           75 Salt Sweat
76 Shortness of Breath                          77 Sore Throat                           78 Spotted Fever Diseases
79 Stomach ache                                 80 Strawberry Tongue                     81 Stretch
82 Sweat Reduction                              83 Tic                                   84 Tinnitus
85 Tremor                                       86 Twitch (Fasciculation)                87 Upper Gastrointestinal Bleeding(Haematemesis)

Enter Symptoms:
30 33 46 47 48 60 0
```

Input Screen Displaying Symptoms and Their Numbers

III. FLOW OF CONTROL AND ALGORITHM


START
GLOBAL VARIABLE INITIALISATIONS
PRINT THE LIST OF SYMPTOMS WITH ITS CORRESPONDING NUMBERS
TAKE INPUTS OF NUMBERS (SEPERATED BY SPACES)
SORT THE INPUT NUMBERS IN ASSENDING ORDER
INITIALISE AN OBJECT OF 'DISEASE' CLASS WITH DETAILS OF ONE DISEASE
IF (INPUT SYMPTOMS = SYMPTOMS OF OBJECT OF 'DISEASE' CLASS)
FALSE
TRUE
PRINT NAME OF THE DISEASE STORED IN OBJECT OF 'DISEASE' CLASS
FALSE
IF (THE INITIALISED DETAILS WERE OF LAST DISEASE)
ASK FOR CHOICE TO CONTINUE
TRUE
IF (YES)
FALSE
EXIT

IV. WORKING

The program follows following steps during the execution.

1. Taking input.
2. Sorting it in ascending order (Algorithm used: Bubble Sort).
3. Matching it with first disease, second disease, third disease… and so on; till it do not traverse the database completely. (Algorithm used for matching and searching is: Linear Search. This is because there is a possibility of more than one disease to have similar symptom list).
4. Displaying the name of matched diseases.
5. If a perfect match is found (i.e. a disease having exactly similar symptoms as that of input symptoms) then the detailed information about the disease is displayed.
6. Asking for the user's choice to continue of exit the program.
7. If user opts to continue, then all the global variables are re initialized with default values and the program gets re-executed.
8. If user opts to exit, the program terminates.

V. TEST CASES AND SAMPLE OUTPUTS

Case 1: When there is no match

Enter Symptoms:

10 32 45 65 69 98 78 45 51 52 56 54 59 98 0

Output: Unknown Disease

Case 2: When there is an Exact Match

Enter Symptoms:

30 33 40 46 47 48 60 0

Output:

These Symptoms indicate towards:

A Hypervitaminosis: Description of disease and related information.

Case 3: When there is a Partial Match

Enter Symptoms:

10 0

Output:

These symptoms indicate towards:

1. Acrocyanosis

2. Vena Cava Left Atrium Shunt

VI. LESSONS LEARNT DURING DEVELOPMENT

Lesson 1: It is a challenging job to handle a large database within the source code itself without help of file handling.

Lesson 2: To keep a balance between space and time complexity of the algorithm so that it could work easily on various devices and platforms.

Lesson 3: It is important to gather knowledge about diseases and conditions from several different experts for the knowledge base to be reliable.

Lesson 4: Thorough testing of this system is very important because incorrect detection of disease may lead to wrong treatment.

Lesson 5: Virtual Doctor has a lot of potential and can help address the shortage of medical doctors, especially in rural areas.

Lesson 6: Sensitization of users is vital for the success of medical diagnosis expert systems. Patients are used to seeing medical doctors in person to have confidence in the diagnosis and treatment. There might be psychological barriers to entrusting one's life to a machine.

VII. STRENGTHS

1. **Fast**- It is faster and accurate as compared to human brain.
2. **Efficient-** It is efficient and makes no mistakes while prediction.
3. **Exact and to the point results-** It never gets confused, so the results obtained are exact and to the point.
4. **Support of multiple platforms-** It can run on multiple platforms. It can run on various operating systems as well as it can run on various devices such as computers, laptops, tablets, smart phones etc.
5. **Less memory consumption-** It requires only 131 kilobytes of disk space to store and 300 bytes of ram space to run.
6. **Portability and Ease of Use-** Easily portable and requires very less knowledge to operate.
7. **No installation needed-** It doesn't need to be installed. Just a simple copy-paste and it will work fine.
8. **Database Handling-** It handles the whole database in the source code itself.

VIII. LIMITATIONS

1. Will always lacks sensation of touch.
2. Cannot perform good for Orthopedic patients.
3. Lacks Experience.
4. Inputs can be given in form of limited symptoms.

IX. AREAS OF APPLICATION

- In Hospitals (as an expert diagnostic system)
- In Rural Areas where there is shortage of doctors.
- During situations of Natural Calamities.
- To train medical students.
- To generate random Multiple Choice Questions for Medical Competitive Examinations.
- It can be used as a quick source of reference during treatment of patient.

X. FUTURE DEVELOPMENT

1. It can be converted into an expert medical diagnostic system.
2. It can capture visual inputs of wounds using HD cameras, analyze them, identify the type of injury and suggest the treatment.
3. It can receive audio inputs of signs and symptoms using microphone and can suggest the treatment and medication.

XI. SIMILAR SYSTEMS AND THEIR DESCRIPTION

1. MYCIN: MYCIN is a medical diagnosis expert system that was developed to capture the expertise of a human expert on blood diseases. Physicians used it to diagnose and treat patients with infectious blood diseases caused by bacteria in the blood and meningitis.
2. ONCOCIN: ONCOCIN is a medical expert system that was developed to capture the expertise of a human expert on cancer. It was designed to assist physicians in the treatment of cancer patients receiving chemotherapy.
3. DAVIAL: DIAVAL is a medical expert system that was developed to diagnose heart diseases through echocardiography and other cardiac anomalies.

XII. REFERENCES

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