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Hybrid Intelligent Decision Support System for Malaria and Typhoid Fever Diagnosis

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Abstract: **Health care facility should be accessible by all at all times. But some of the people that should access these facilities are far removed from these facilities. More so, in the few available facilities, qualified medical personnel are always key issues that need urgent redress. In view of the foregoing, it would be of great necessity to provide an intelligent decision support system that will provide a complementary medical service, such as medical disease diagnosis in places where accessibility is a problem as well as health care facilities where qualified experts are lacking, hence this research will focus on Intelligent Decision Support System for Malaria and Typhoid Fever Diagnosis. The software has been designed to be interactive with audio capability eliciting from the user if they have symptoms of the diseases. The user response helps the Intelligent Decision Support System to determine the level at which the disease is present. The user is further advised on what next to do. This software is implemented in visual basic programming environment.**

Keywords: **Intelligent Decision Support System, Malaria and Typhoid Fever Diagnosis, Subject Matter Experts (SME).**

I. INTRODUCTION

An Intelligent Decision Support System is a software system that attempts to reproduce the performance of one or more human experts, most commonly in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence(Alaoui et al., 1998). A wide variety of methods can be used to simulate the performance of the expert however common to most or all are:

1) The creation of a so-called "knowledgebase" which uses some knowledge representation formalism to capture the Subject Matter Experts (SME) knowledge and

2) A process of gathering that knowledge from the SME and codifying it according to the formalism, which is called knowledge engineering. Intelligent Decision Support Systems may or may not have learning components but a third common element is that once the system is developed it is proven by being placed in the same real world problem solving situation as the human SME, typically as an aid to human workers or a supplement to some information system (Chiu et al., 2004).

As a premiere application of computing and artificial intelligence, Intelligent Decision Support Systems has many points of contact with general systems theory, operations research, business process reengineering and various topics in applied mathematics and management science (Beich, 2006).

Two illustrations of actual Intelligent Decision Support Systems can give an idea of how they work. In one real world case at a chemical refinery a senior employee was about to retire and the company was concerned that the loss of his expertise in managing a fractionating tower would severely impact operations of the plant. A knowledge engineer was assigned to produce an Intelligent Decision Support System reproducing his expertise saving the company the loss of the

valued knowledge asset. Similarly a system called Mycin was developed from the expertise of best diagnosticians of bacterial infections whose performance was found to be as good as or better than the average clinician. An early commercial success and illustration of another typical application (a task generally considered overly complex for a human) was an expert system fielded by DEC in the 1980s to quality check the configurations of their computers prior to delivery(Chaudhury, 2002). The eighties were the time of greatest popularity of expert systems and interest lagged after the onset of the AI Winter (Chun-Liang, 2007).

In like manner, developing one of such system to represent the repository of the knowledge of a medical doctor is as essential as any other expert system(Dai, Gui and Zhu, 2008). To this end, this research, Intelligent Decision Support System on the Diagnosis of non communicable diseases is a necessity.

II. METHODOLGY

This research was achieved by gathering materials from different sources. One of the invaluable sources of data was oral interview, which was conducted with staff of Nnamdi Azikiwe University Teaching Hospital Awka, Nigeria. Consultations were made with doctors and nurses, who assisted by providing some key technical facts, especially on issues that border around treatment of some common diseases.

2.1 The Existing System:

The main objective of the existing system was to be able to determine the level at which a particular disease has grown in a patient, especially malaria and typhoid. Other objectives include the following:

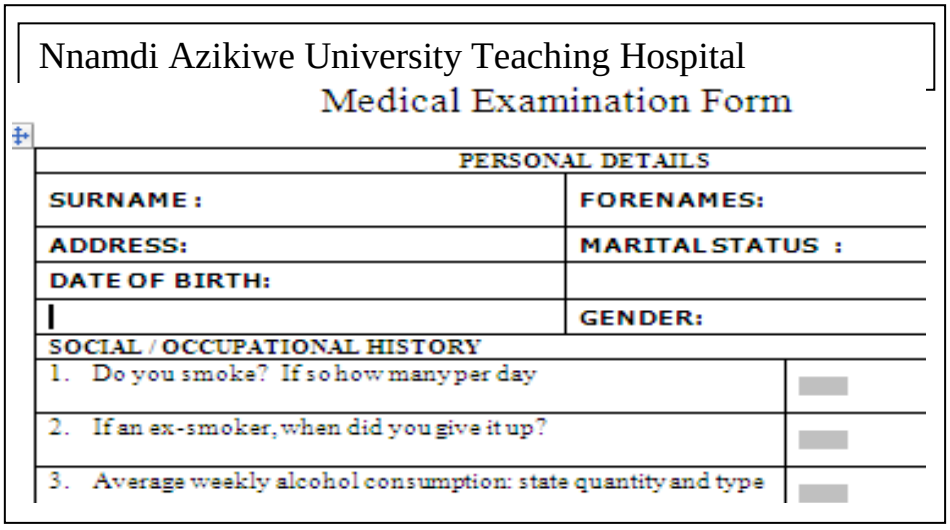
1. Provide a means of examining a patient
2. To create a medical record for a patients health history
3. To provide useful information that will help the doctor make some critical decision concerning a patient's health

2.2 Input Analysis of the Existing System:

The input of the existing system is a note from the medical doctor referring the patient to laboratory test. The note is usually contained in a memo. Other contents of the memo are:

1. The name of the hospital
2. The Doctor's name
3. The Doctor's signature
4. The name of the Laboratory referred to
5. The nature of test to be carried out

Below is a sample Doctor's medical examination form



Nnamdi Azikiwe University Teaching Hospital

Medical Examination Form

PERSONAL DETAILS	
SURNAME :	FORENAMES:
ADDRESS:	MARITAL STATUS :
DATE OF BIRTH:	
	GENDER:
SOCIAL / OCCUPATIONAL HISTORY	
1. Do you smoke? If so how many per day	
2. If an ex-smoker, when did you give it up?	
3. Average weekly alcohol consumption: state quantity and type	

Fig1: Sample medical Examination Form

2.3 Output Analysis of the Existing System:

The output of the existing system is usually a laboratory report on the specified medical test. It is always signed by a qualified lab scientist. The information contained in the report includes the following:

1. The name of the Laboratory
2. The name of the patient
3. The nature of test carried out
4. Observations made during test
5. Summary of test result
6. Etc.

Below is a sample of Lab report:

Fig. 2: Sample of a medical Lab Report

2.4 Information Flow Diagram:

The information flow diagram shows how information flow from one point to another in hospital's Medical Diagnosis system(Bodenheimer, Wagner and Grumbach, 2002). Below is the information flow diagram:

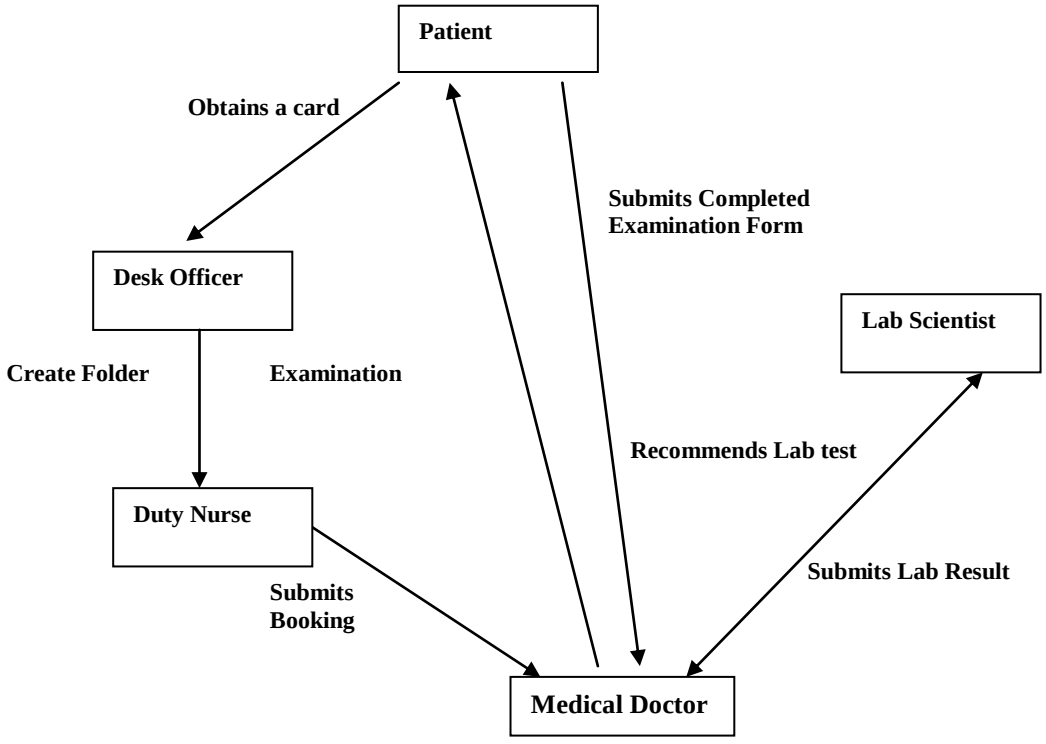


Fig. 3: Information Flow Diagram

2.5 Problems of the Existing System:

The old system is not without its problems. The following information represents some of the problems faced by the existing system.

1. Lack of proper storage system
2. Delay in the provision of result
3. Possibility of human error
4. Distance and Accessibility is a problem
5. Non-availability of the human expert to render the job
6. The death of the human expert will cause a serious disruption n the delivery of health services

2.6 Justification of the New System:

In view of the problems inherent in the existing system, it is important to seek for an improvement. This improvement is computerization of the diagnosis system. This new system will be equipped with the following advantages:

1. Proper backup of the knowledge of the human expert
2. Elimination of possible human error, since several experts are involved in the design of such system
3. Distance and accessibility is not a problem
4. The machine does not die
5. The machine is always there to render services
6. Medical history can always be stored and retrieved with ease.

III. DESIGN, IMPLEMENTATION AND TESTING OF THE NEW SYSTEM

3.1 System Design:

The design and analysis conducted were divided into two sections. These are:

1 User Interface
2 The Database Design

3.2 User Interface Design:

The design of the system involved the driver software environment as well as the interconnection between all other modules. The modules that make up the main system are: Search Engine and Expert Diagnosis.

This form is designed in such a way that users can select from the options the type of medical case they would want to diagnose. In the form the user will need to answer the question the expert will ask him based on the history and symptom of the medical case. The answer is either "Yes" or "No". Again, the form has a provision for the user to learn more about particular disease. The interface is also fitted with audio capability to aid especially visually impaired users. The audio feature reads aloud the question.

When you start diagnosis on this form, each question you answered "Yes" will be scored certain percentage depending on the degree of relevance the symptom is to the disease. At the end of each diagnosis, the level of infection in percentage will be shown. The Intelligent Decision Support System also analyses the case and lets you know whether or not it is a severe case with an advice to confirm the test in a laboratory. This form also has a link to the database. As you keep responding to the question of the expert, the database content will be retrieved.

3.3 The Database Design:

The design of the database was done with Microsoft Access version 7.0. During the design, the following consideration was done: The total number of tables that would be required to store all the tabular data, the table again is designed considering the data items to be stored, with respect to their field names.

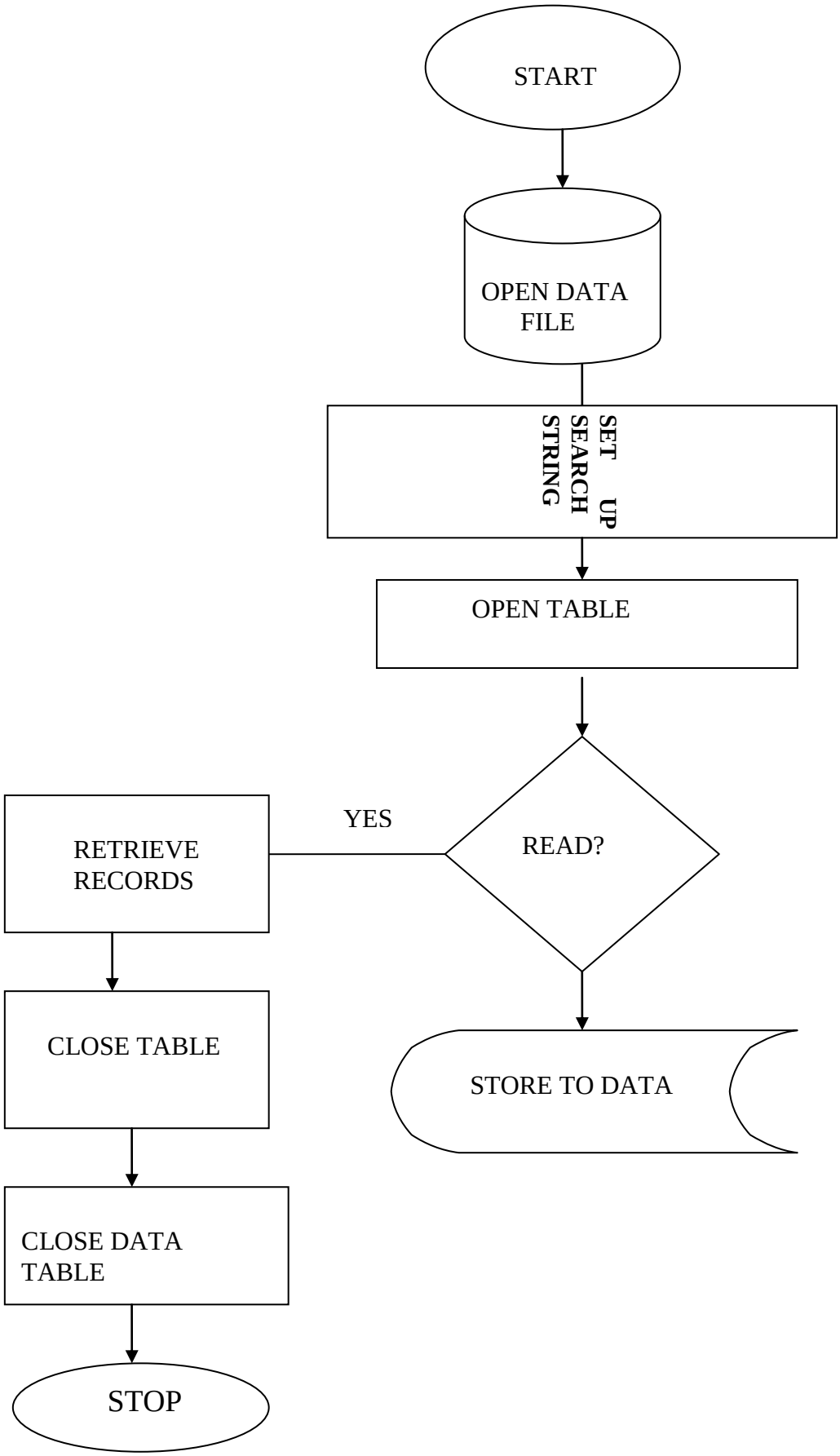


Fig 4: Database Flowchart

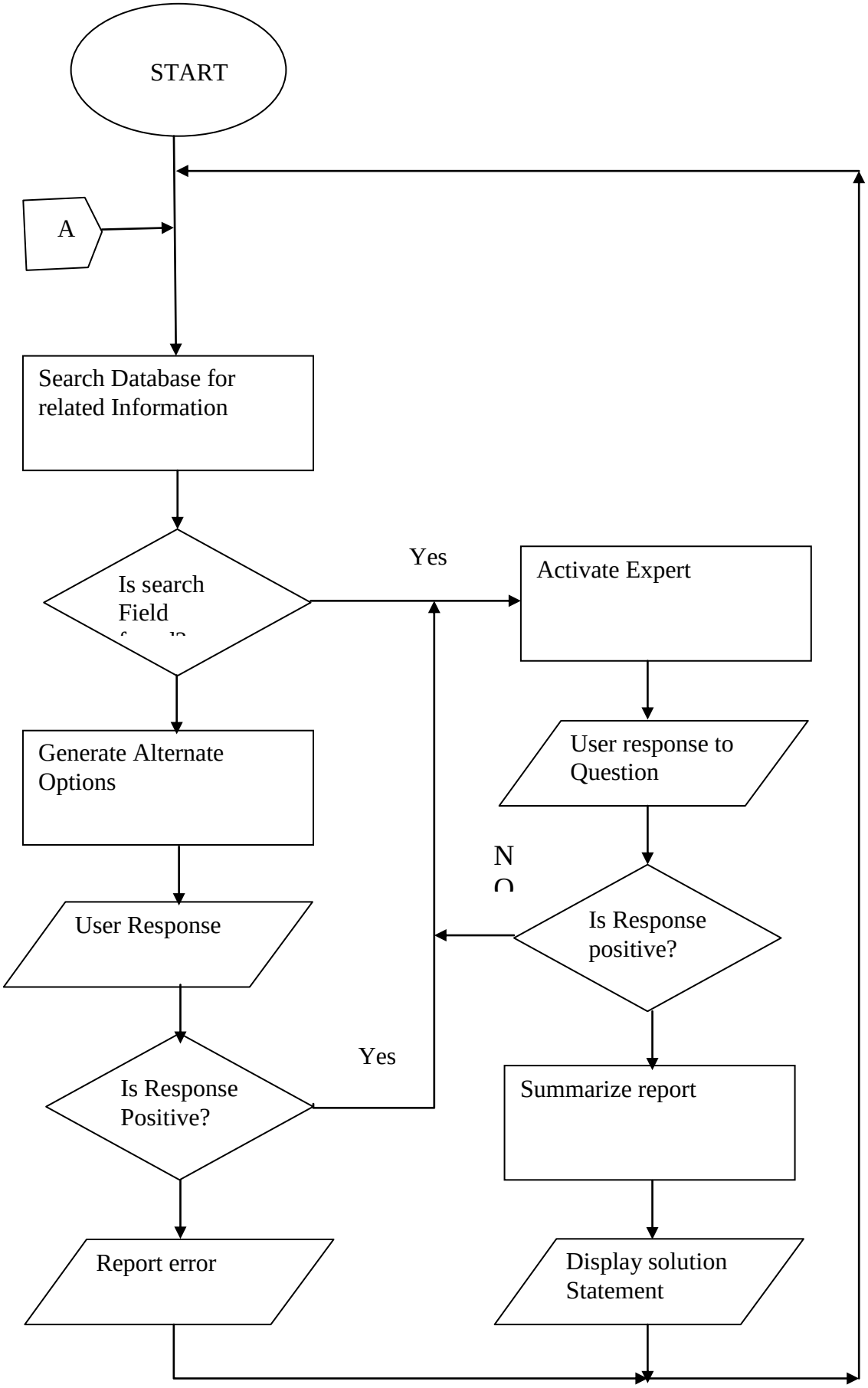


Fig 5: Program Control Flowchart

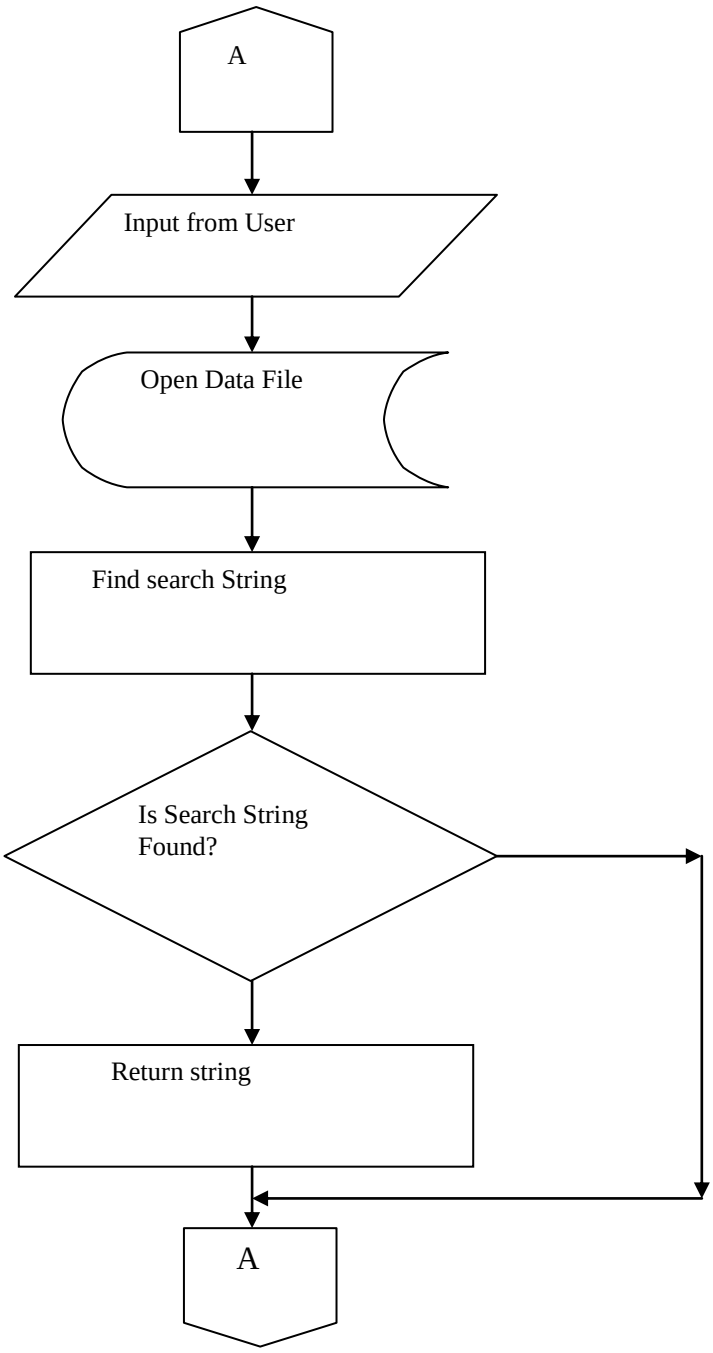


Fig 6: Program Control Flow Chart Cont'd

3.3.1 Language Choice:

The language used for this software was visual basic 6.0. The choice was made based on its flexibility and accessibility.

3.3.2 Choice of Software Environment:

The software environment required includes windows XP operating system or higher versions, Ms Visual Basic, and Ms Access. Hardware requirements are systems with a minimum requirement of 500 MHz, 128 MB RAM, and 10 GB HDD.

3.4 Implementation Details:

3.4.1 Main System Implementation:

The implementation of the main system was done in Visual Basic environment. At first, the forms were built and the codes written in the code window.

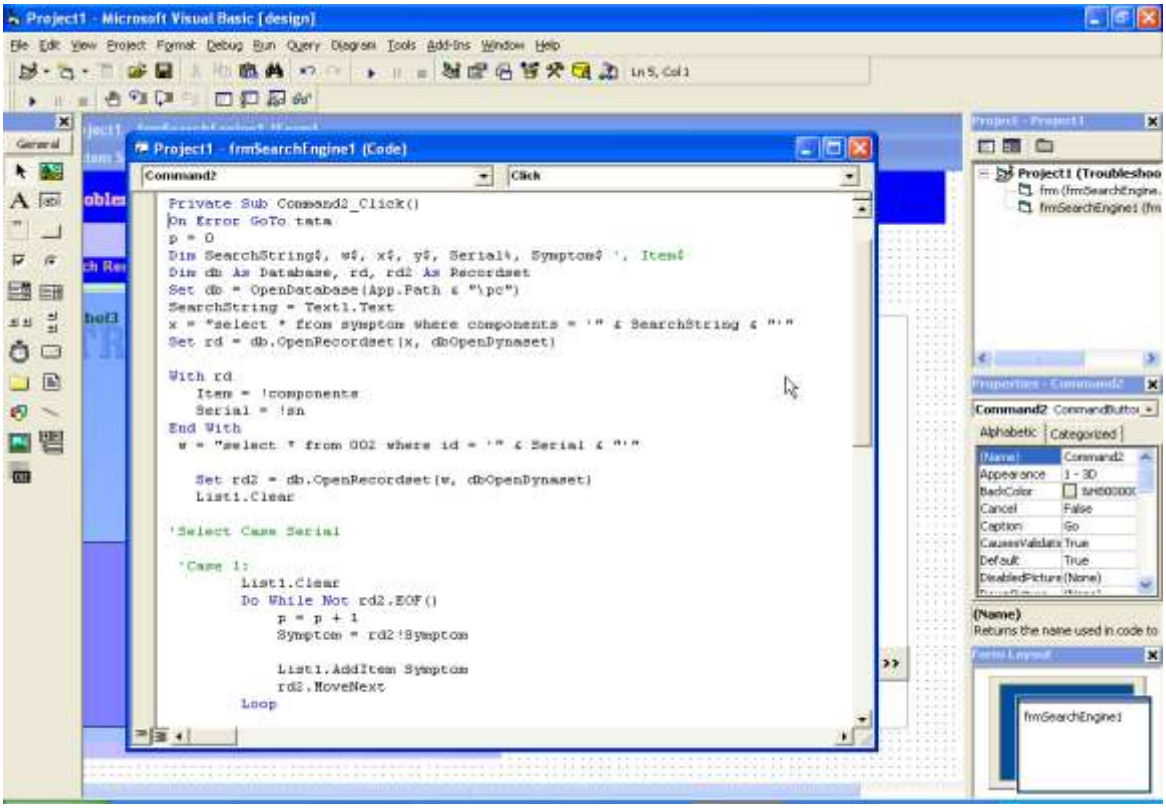


Fig. 7: Main System implementation window

3.4.2 Database Implementation:

Visual Data Manager was the effective tool used for the implementation of the database. Visual data manager has an efficient way of handling connection between visual basic and MS Access. Below shows a sample view of the visual data manager.

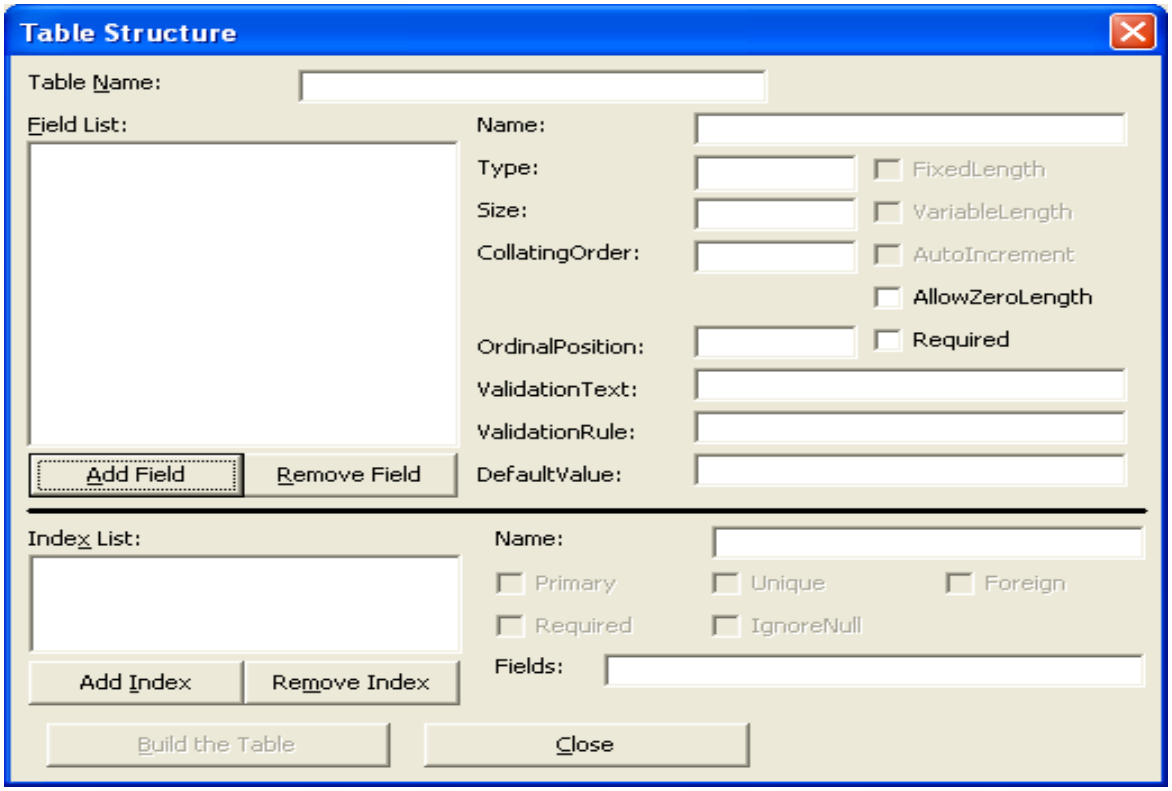


Fig. 8: Table Implementation

IV. SOFTWARE TESTING AND INTEGRATION

4.1 The Test Plan:

The test activities were carried out in stages. Each module was tested after and during Design using visual basic debugger.

4.2 System Testing:

The modules tested include the module discussed earlier previously. Each of these modules was tested with some test data. After each debugging stage, the module would be integrated into the main system.

4.3 Main System Driver Testing:

The main driver, being the diagnosis page was tested for proper connectivity to the database. Improper linkage to database was immediately corrected and assurance was made to see that data were adequately retrieved and presented without errors.

Database Testing:

Database testing was tested basically for connectivity and storage. The test started with the design stage, where efforts were ensured that the correct data representation was made.

V. CONCLUSION

This research, Hybrid Intelligent Decision Support System for Malaria and Typhoid Fever Diagnosis, is a software system tailored for use in the diagnosis of malaria and typhoid diseases. The software is an expert system with a database containing an expert knowledge. The user only uses it to determine whether he or she has any of the diseases within its domain. Intelligent Decision Support Systems have been found to be very useful in our today's world driven by technology. When expert's knowledge is extracted and stored, such knowledge can be used to replace the expert in case of demise. Medical diagnosis will have greater part of the advantages of Intelligent Decision Support System, knowing that only a few specialties exist in the medical field. The knowledge of such specialist can be replicated and made use of in times extreme necessity.

The software has been designed to be interactive with audio capability eliciting from the user if they have symptoms of the diseases. The user response helps the Intelligent Decision Support System to determine the level at which the disease is present. The user is further advised on what next to do. This software is implemented in visual basic programming environment, Health care facility should be accessible by all at all time. But some of the people that should access these facilities are far removed from these facilities. It would be of great necessity to provide a computerized system that will provide a complementary medical service, such as medical disease diagnosis in places where accessibility is a problem as well as health care facilities where qualified experts are lacking, hence this research, Intelligent Decision Support System on Malaria and Typhoid Fever Diagnosis.

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