American Journal of Engineering Research (AJER)
e-ISSN : 2320-0847 p-ISSN : 2320-0936
Volume-03, Issue-01, pp-132-139
www.ajer.org

Research Paper Open Access

Knowledge Based RobotSystem for Diagnosis and Troubleshooting of Personal Computer Using Artificial Intelligence Rete Algorithm

Abrham Debasu Mengistu[1] Dr.Vuda Sreenivasarao[2]
[1]*M.Sc. (Computer Science), School of Computing and Electrical Engineering, IOT, Bahir Dar University, Ethiopia.*
[2]*Professor, School of Computing and Electrical Engineering, IOT, Bahir Dar University, Ethiopia.*

***Abstract*: -** In the information and artificial intelligence age personal computer is the most popular communicating device that can be used in our day to day life. In fact most of the computer users are not skilful enough when it comes to the area of troubleshooting a problem occurred. Using knowledge based robot will save our time and money and also provides a rapid solution and will overcome the need of a computer expert. In this paper,develop a knowledge based robot system that can assists computer users to troubleshoot and maintain their personal computer using artificial intelligence algorithms. After the prototype implemented, ultimately every knowledge-based system must be tested and evaluated to ensure that whether the performance of the system is accurate and the system is usable by the end-users.

Keywords: - *artificial intelligence, knowledge-based system and troubleshoot.*

I. INTRODUCTION

Artificial intelligence can be defined as making an intelegent machine which were previusly done by human beings for example previusly inorder to troubleshoot a computer problem there are things that we identify and it takes time but now a days with the help of artificial intelegence it is easy to identify the problem.Artificial intelligence is a field of since and enginneering mainly concerned with making machine for assisting a day to day activity of humans. But inorder to say an intelegent the following are the basic things.

- Learn or understand from experience.
- Make sense out of ambiguous or contradictory messages.
- Respond quickly and successfully to new situations.
- Use reasoning to solve problems.
- Apply knowledge to manipulate the environment.
- Think and reason.

A robot is a mechanical or virtual agent that contains sensors, control systems, manipulators, power supplies guided by a computer program or software that perform a task which were done previusly by humans guided by a computer program like AI and others.Artificial Intelligence have a direct role in robotics for making the robot to be intellegent. artificial Intelligence addresses the the critical questions of: what knowledge is required in any aspect of thinking; how should that knowledge be represented; and how should that knowledge be used.

Human Intelligence	***Artificial Intelligence***
➢ *Intuition, Common sense, Judgment, Creativity, Beliefs etc*	➢ *Ability to simulate human behavior and cognitive processes*
➢ *The ability to demonstrate their intelligence by communicating effectively*	➢ *Capture and preserve human expertise*
➢ *Plausible Reasoning and Critical thinking*	➢ *Fast Response. The ability to comprehend large amounts of data quickly*

Table I:Human Intelligence VS Artificial Intelligence

❖ We achieve more than we know. We know more than we understand. We understand more than we can explain (Claude Bernard, 19th C French scientific philosopher).

Human Intelligence	***Conventional Computing***
➢ *AI software uses the techniques of search and pattern matching*	➢ *Conventional computer software follow a logical series of steps to reach a conclusion*
➢ *Programmers design AI software to give the computer only the problem, not the steps necessary to solve it*	➢ *Computer programmers originally designed software that accomplished tasks by completing algorithms*

Table II.Artificial Intelligence VS Conventional Computing

II. ARTIFICIAL INTELLIGENCE IN ROBOT

With the enhancement of intelligent technology robot plays an important role in our day to day activity. An artificial intelligent based robot is a machine that has a capability to extract information from its environment and use knowledge about its world to move safely in a meaningful and purposeful manner. With an intelligent technology robot plays an important role in our day to day activity. For the given problem wehave a means for checkinga proposed solution and caused that problem,and then we can solve the problem by testing allpossible answers. But this method this always takes a long period of time to handle the given problem. If we handle the same problem with the help of intelligent machine let's say robot it takes a minimal time because intelligent machine like robots have higher processing speed than that of human beings

2.1. Components of AI for Robots:

A rule-based system of robots is composed of three components: an interpreter (or inference engine), a knowledge base and a fact database.

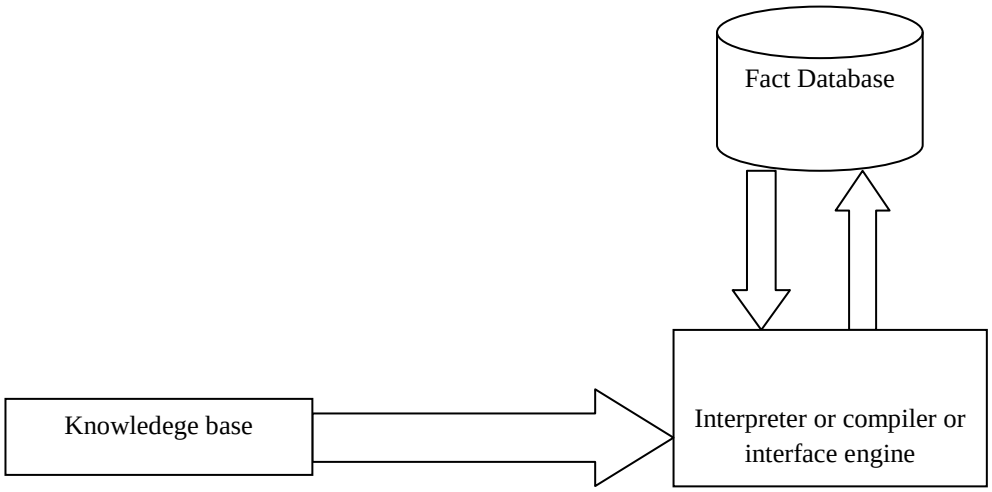


Figure 1. Components of AI robot.

A fact database consists of consists of facts, concepts, theories, heuristic methods, procedures, and relationships and Knowledge base is the collection of knowledge related to a problem used in an AI system Knowledge is also information organized and analyzed for understanding and applicable to problem solving or decision making. The interpreter part is responsible for generating rule depending on the fact and knowledge base and also giving decision.

III. STATEMENT OF THE PROBLEM

A computer system is composed of both hardware and software. Hardware like different subsystems including CPUs, primary and secondary storage, peripherals, and several type of software like general purpose software and application software. Each of these subsystemsprovide their own functionality in order to provide the whole system as oncebut there are only very few maintenance tools and established diagnostic strategieswhich give attention at identifying faults on the system or subsystem level. As a result, identification of single or multiple faults from systemic sign remains a difficult task. The non-specialist field service engineer is trained to use the existing component specific tools and, as a result, is often unable to attack the failure at the systemic level. Expert assistance is then required, increasing both the time and cost required determining and repairing the fault. The design of a knowledge based system reflects the expert's ability to take a systemic

viewpoint on problems and to use that viewpoint to indict specific components, thus making more effective use of the existing maintenance capabilities.

As we know the present period is the information and artificial intelligence age, where faster transfer and retrieval of information is the most important need. However, using an expert system like knowledge based system this scenario will be an economic and rapid solution and will overcome the need of a computer troubleshooting expert. This will help to increase individual's efficiency by reducing the time spend by the expertise.

IV. ARCHITECTURE OF THE SYSTEM

Architecture is a blueprint that shows how the components of the prototype of knowledge Knowledge based Robot for diagnosis and troubleshooting of personal computer using Rete algorithm. The figure shown below illustrates the architecture of the prototype system.

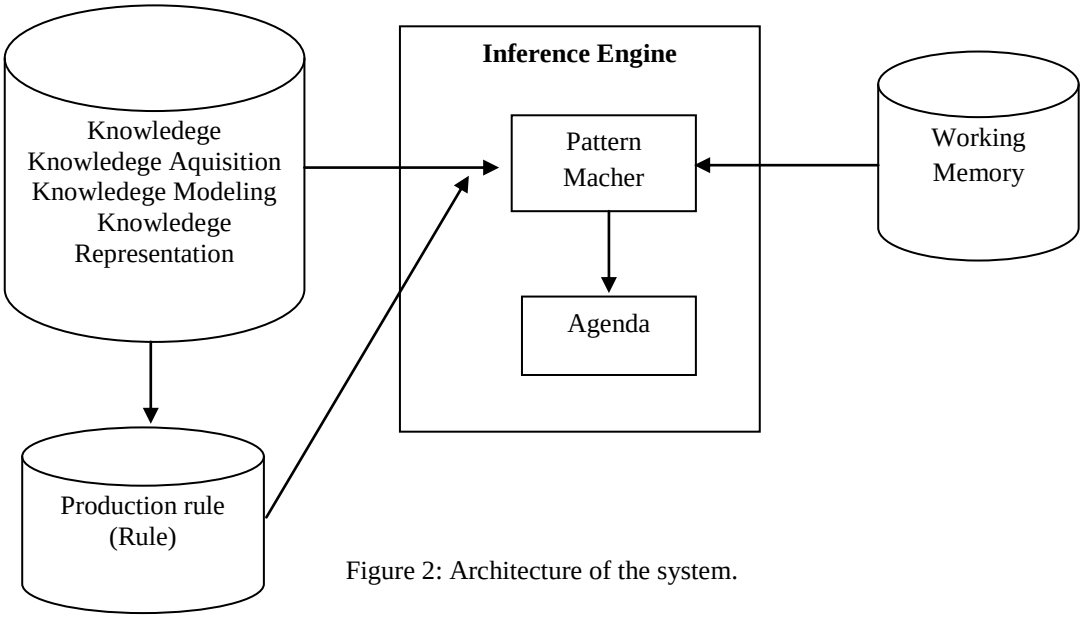


Figure 2: Architecture of the system.

V. PROPOSED METHODOLOGY

The methodology for using Knowledge based Robot for diagnosis and troubleshooting of personal computer is using artificial intelligence by Rete algorithm.The Rete algorithm is a best known pattern matching algorithm which is designed by Dr Charles L. Forgy of Carnegie Mellon University. Rete is a Latin word which has a meaning means net. It is a very efficient algorithm for matching facts against the patterns in rules. Understanding of the Rete algorithm will make one easier to understand why writingrules one way is more efficient than writing them another way.The Rete algorithm is based on the fact that only a few facts are added, changed or removed at every step in the process of inference. Instead of doing all these comparisons every time only new facts added can be taken into consideration which is the approach taken in Rete algorithm. Rete looks for changes to match in each cycle.

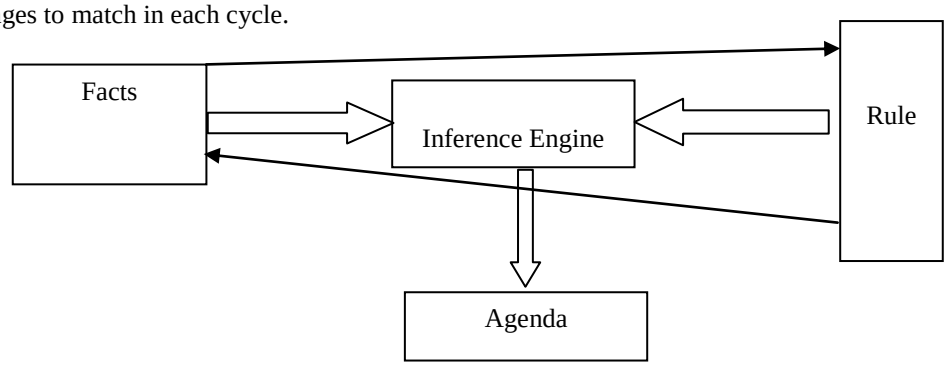


Figure3. Rete algorithm.

If two of the three premises of a rule are satisfied in one cycle, there is no need to check them again in the next cycle. Only the third premise is of interest. The matching process is updated when new facts are added or removed. This will speed up the process of matching if the number of new facts is small. Information about

the premises of each rule which are satisfied partial matches must be stored.The Rete algorithm is implemented by building a network of nodes. It is designed in such a way that it saves the state of the matching process from cycle to cycle and re computes changes only for the modified facts. The state of the matching process is updated only as facts are added and removed. If the facts added or removed are less in number then the matching process will be faster.

For instance, suppose we have one rule on troubleshooting, ifproblem is HDDand Problem is Black screenandsymptom is NTLDR then the following rete network can be created.

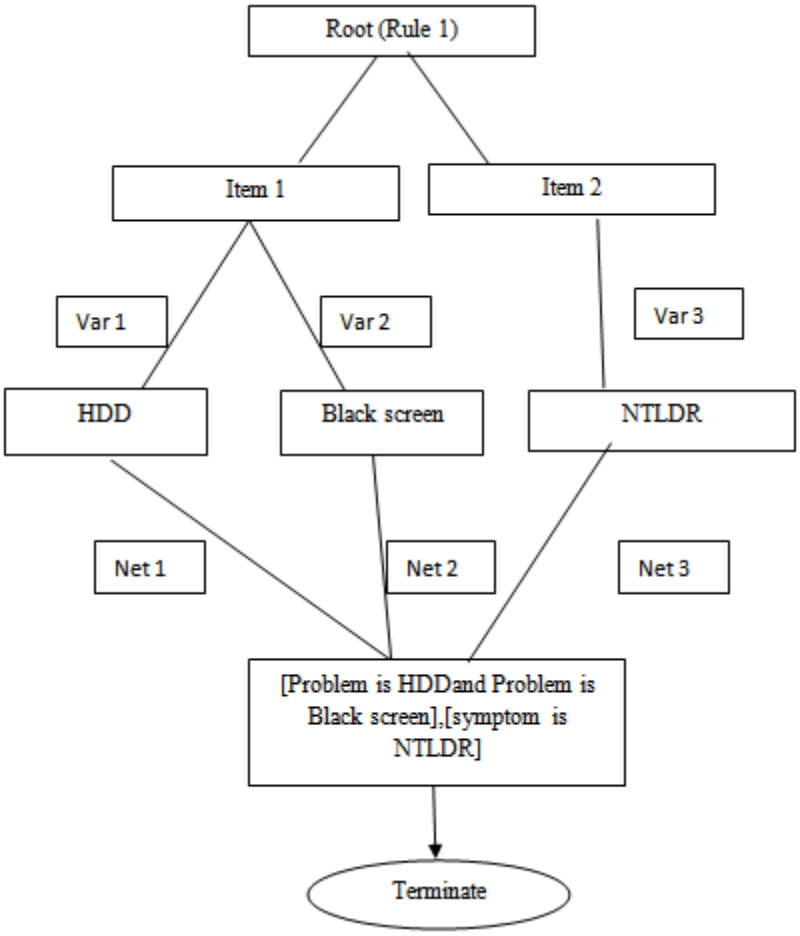


Figure4. A simple Rete network for a single rule.

In the above rete network, there are two kind nodes as there are two types of facts: item 1 type and item 2 type. As there are three patterns:problem is HDDand Problem is Black screenandsymptom is NTLDRthree alpha nodes will be created. var 1 and var 2 representing the first two var nodes are joined by net 1. The third alpha node and beta 1 joined by net 2.

When a value for age enters the root a token will be created. Copies of this token will be passed to item nodes. Item 1 will accept it as the fact type. This token will be passed onto var1 and var 2. If the value satisfies the constraint then the token will be passed onto net1 and then to net2. In the meantime value of symptom enters the root and then accepted by item 2. var 3 receive it and checks if the value satisfies the constraint, symptomis NTLDR. If yes then it allows the token passing onto item 2. If the fact, that is the values, match with the condition in the item2 then the rule will be added to a list for firing.

5.1. Rete Algorithm:

1. Each of these facts is first parsed through the network. The network will then look as in the hand-out.
2. Every time a fact is added or removed the network is updated.
3. Using the network, rules that can execute can be determined quickly in a forward reasoning system using Rete
4. Because sometimes several rules can execute, they will all have to be put on the agenda. Conflict resolution is then necessary to determine the rule to fire or execute.

In order to acquire the desirable knowledge both secondary and primary (documented and undocumented) source of knowledge are used. Primary knowledge is gathered from help desk computer technicians by using interviewing and critiquing knowledge elicitation methods. In the same way secondary source of knowledge are collected by using document analysis. Both unstructured and structured interview were used to collect tacit knowledge from domain experts. In addition critiquing (analyzing) elicitation methods are used to purify the collected knowledge. The acquired knowledge is refined with the consultation of the expert. Moreover, secondary sources of knowledge are gathered from the internet, computer maintenance books, research papers and articles by using document analysis technique.

VI. TESTING AND EVALUATION

After the prototype implemented, ultimately every knowledge-based system must be tested and evaluated to ensure that whether the performance of the system is accurate and the system is usable by the end-users. As the aim of testing and evaluation of the knowledge-based system is to assure that the prototype system does what it is required to do, we can test and evaluate a knowledge-based system as long as we already understand what to expect. Therefore, in this article we try to show the performance testing. In system performance testing section, a number of computers selected in order to test the accuracy of the prototype system. The correct and incorrect outcomes are identified by comparing decisions made by domain experts and with the conclusions of the prototype system.

6.1.Forward chaining rule:

Problem	Algorithms	Solved	Not solved
HDD & Software Related	Forward chaining	7	3
Memory Related	Forward chaining	5	5
Monitor Related	Forward chaining	6	4
Port Related	Forward chaining	6	4
Processor Related	Forward chaining	4	6

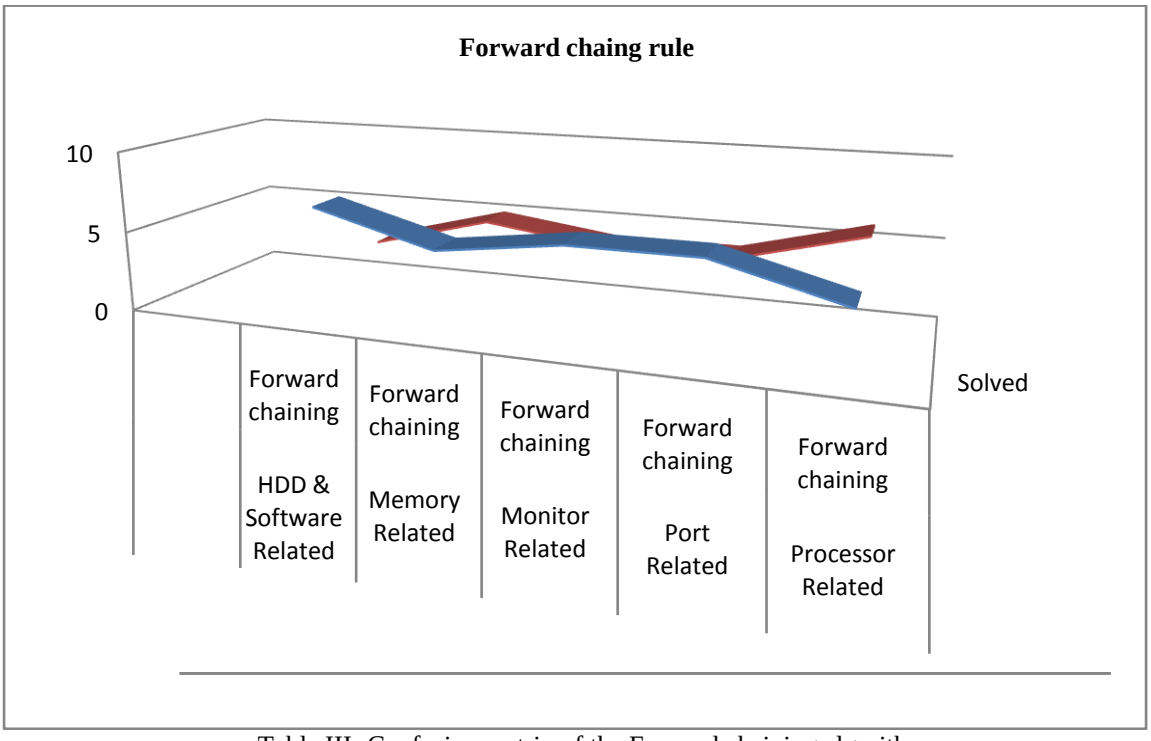
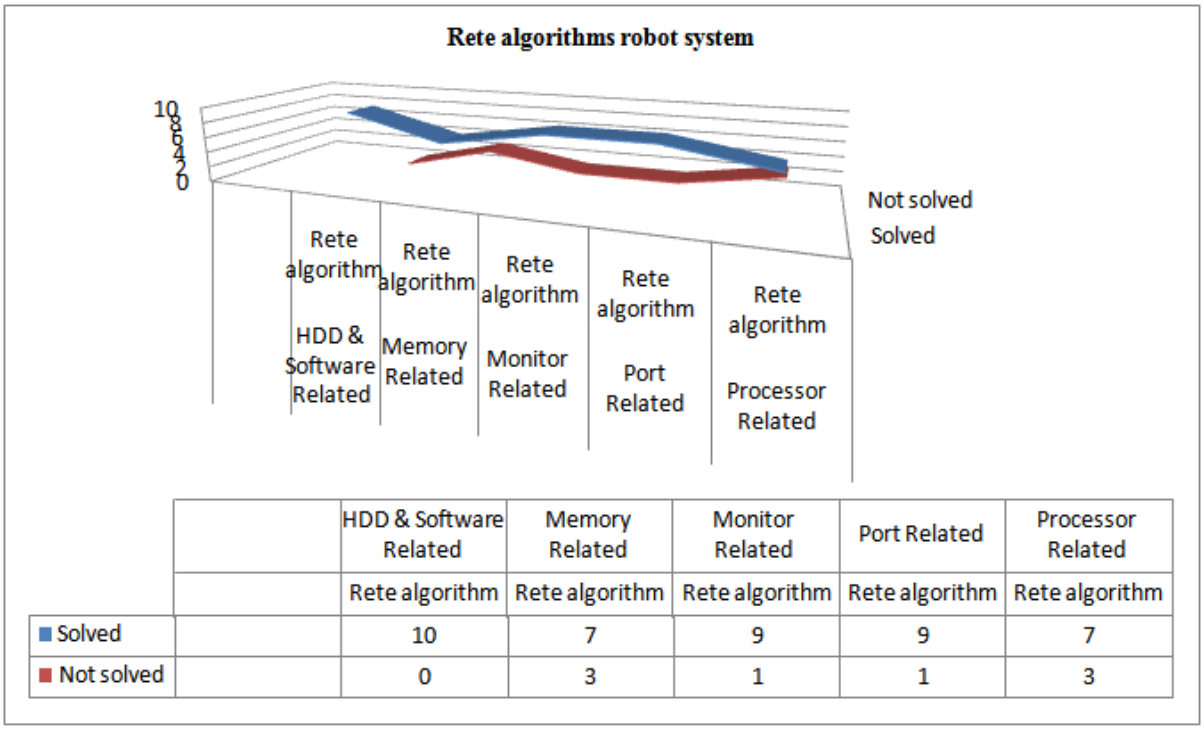


Table III**:** Confusion matrix of the Forward chaining algorithms.

6.2. Rate Algorithms:

Problem	Algorithms	Solved	Not solved
HDD & Software Related	Rete algorithm	10	0
Memory Related	Rete algorithm	7	3
Monitor Related	Rete algorithm	9	1
Port Related	Rete algorithm	9	1
Processor Related	Rete algorithm	7	3



		HDD & Software Related	Memory Related	Monitor Related	Port Related	Processor Related
		Rete algorithm	Rete algorithm	Rete algorithm	Rete algorithm	Rete algorithm
Solved		10	7	9	9	7
Not solved		0	3	1	1	3

Table IV: Confusion matrix of the Rete algorithmsrobot system.

VII. RESULTS:

1.
The first thing that display on the system is menu.

```
  ================================================
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@ NOTE:- whenever write on the system put dot(.) at the end and press enter key

@ ማሳሰቢያ:- የሚፈለገውን ቃል ካስገቡ በኋላ ነጥብ(.) ያስቀምጡና ኢንተር ቁ ይጫኑ።
@          To start the program write ጀምር followed by period(.)at the end and press
ENTER.
@          ፕሮግራሙን ለመጀመር ጀምር የሚፈለገውን ቃል ካስገቡ በኋላ ነጥብ(.)ያስቀምጡና ኢንተር ይጫኑ።
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
% f:/Abrham Debasu/Rete Algorithm implimented.pl compiled 0.00 sec, 76 clauses
1 ?-  start.
                    ሜኑ/MENU CHOICE .
  1 ን ያስገቡ ቅድመ መረጃ ለማግኘት/ Enter 1 to get general information
  2 ን ያስገቡ ቅድመ መከላከል መረጃ ለማግኘት/ Enter 2 to know prevention  mechanism
  3 ን ያስገቡ ጥገና አገልግሎት ለማግኘት/ Enter 3 to get maintenance service
  4 ን የስገቡ ለመውጣት/ Enter 4 to close prolog
```

2. Select any one from the menu for example select number 2 which means that about preventive maintenance.

```
==========================================================================
                  Preventive maintenance
                  ቅድመ ጥንቃቄ
                  ----------------------------------------
Using power protection devices(like UPS)
የፓወር መከላከያ ይጠቀሙ
Ensure  to clean your computer
ኮምፒተርወትን ያፅዱ
Performing back up
ባክፕ ያድርጉ
Install Antivirus and anti-spy ware and scan
አንቲ ቫይረስ ይጫኑ
Install updates
አፕዴት ያድርጉ
Disk clean up
ዲስክ ክለን አፕ ያድርጉ
Disk defragmenter
ዲስክ ዲፍራግመንት ያድርጉ
Examine the operating systems
ኮምፒተርዎን ይፈትሹ
Using Antistatic wrist-grounding strap
አንቲ ስታቲክ ሪስት ትራፕ ይጠቀሙ
Shutdown properly
ኮምፒተርዎን በአግባቡ ይዝጉ
==========================================================================
Do you want to continue ? መቀጠል ይፈልጋሉ ? (yes/no)
```

3. If you want to continue type yes and then press enter this will lead to the main menu that appears before.

```
Do you want to continue ? መቀጠል ይፈልጋሉ ? (yes/no)yes.
                    ሜኑ/MENU CHOICE .
 1 ን ያስገቡ ቅድመ መረጃ ለማግኘት/ Enter 1 to get general information
 2 ን ያስገቡ ቅድመ መከላከል መረጃ ለማግኘት/ Enter 2 to know prevention  mechanism
 3 ን ያስገቡ ጥገና አገልግሎት ለማግኘት/ Enter 3 to get maintenance service
 4 ን የስገቡ ለመውጣት/ Enter 4 to close prolog
 | :
```

VIII. CONCLUSION

Now we are in the age of information and artificial intelegence, and use of computers, fault diagnosis is becoming crucial in the field of computer engineering and information technology, particularly in personal computer troubleshooting; however, acquiring the troubleshooting knowledge from expert computer technicians is limited as it requires continuous learning, training, and practice in maintenance skills which on the long run can dramatically increase organization operating costs, decrease their net productivity, and proliferate their revenue leakage and losses. Basically, PC troubleshooting covers a wide spectrum of problems including hardware problems, software problems, network problems, server problems, operating system problems, and application software problems.

In developing the prototype system, knowledge is acquired using both structured and unstructured interviews with domain experts and from relevant documents by using documents analysis method to find the solution of the problem. The acquired knowledge is modeled using decision tree that represents concepts and procedures involved in diagnosis and troubleshot of computer. Then, the validated knowledge is represented using rule-based representation technique and codified using SWI-Prolog editor tool for building the knowledge-based system

Also in testing and evaluation of the prototype system, ten cases of computer problem are selected using purposive sampling method in order to test the accuracy of the prototype system. The correct and incorrect results are identified by comparing decisions made by the domain experts on the cases of patients and with the conclusions of the prototype system. This permits end-users to test the prototype system by actually using it and evaluating the benefits received from its use. As the testing result show, the overall performance of the prototype system registers 85.9%.

Knowledge based system for troubleshooting personal computer handles computer faults. The knowledge base contains the knowledge about the different causes and solutions of a personal computer.

REFERENCES

[1]. Kaushik, Akhil, and Satvika Manoj Barnela. "Printer Troubleshooting ExpertSystem." *International Journal* 2.10 (2012).

[2]. K.Soundararajan, Dr.S.Sureshkumar, C.Anusuya, Diagnostics Decision Support System for Tuberculosis using Fuzzy Logic,International Journal of Computer Science and Information Technology & Security (IJCSITS), Vivekanandha, June 2012.

[3]. Ahmad Fazrul, Expert system for PC maintenance and troubleshooting, MSc. Thesis , Universti Utara Malysia , 2008.
[4]. AN Ramesh , C Kambhampati, JRT Monson , PJ Drew Artificial intelligence in medicine.
[5]. Peter V. Homeier and Thach C. Le An Extended CLIPS For Backward Chaining and Goal-Directed Reasoning.
[6]. Andrews, Jean. *A+ Guide to Managing & Maintaining Your PC*. Cengage Learning, 2013.
[7]. Eryk Lagun ,Evaluation and Implementation of Match Algorithms for Rule-based Multi-Agent Systems using the Example of Jadex.
[8]. Forgy, C.: Rete: A fast algorithm for the many pattern/many object pattern match problem. Articial Intelligence 19(1), 17-37 (1982).

AUTHORS BIBLIOGRAPHY:

Abrham Debasu Mengistu received his B.Sc. Degree in Computer Science from Bahir Dar University. Currently perusing M.Sc. in Computer Science, School of Computing and Electrical Engineering, IOT, Bahir Dar University, Ethiopia. He has published 01 research papers in international journal(IJSEAT). His main research interest is Image processing and Robotics. He is a life member of professional societies like MSDIWC.

Dr. Vuda Sreenivasarao received his M.Tech degree in computer science and engineering from Sathyabama University from 2007.He received PhD degree in computer science and engineering from Singhania University, Rajasthan, India from 2010. Currently working as Professor in School of Computing and Electrical Engineering, IOT, Bahir Dar University, Ethiopia. His main research interests are Data mining, Fuzzy logic, Mobile communication and Network Security. He has got 13 years of teaching experience. He has published 36 research papers in various international journals and one Springer international conference paper. He has 124 Editorial Board / Reviewers memberships in various international journals. He is a life member of various professional societies like IEEE, ACM, MAIRCC, MCSI, SMIACSIT, MIAENG, MCSTA, MAPSMS, MSDIWC, SMSCIEI, SNMUACEE and MISTE.