IJCSE International Journal of Computer Sciences and Engineering Open Access
Review Paper Volume-5, Issue-6 E-ISSN: 2347-2693

A Study on Neurological Diseases like Alzheimer's, Dementias, its Causes and an attempt To Develop a Rule-Based Expert System

T. M. Girish[1*], Vivek Kumar Sing[2], D.K. Sreekantha[3]

[1]Department of Computer Science, Basaveshwar Science College, Bagalkot, Karnataka INDIA
[2]Dept. of Computer Science, Banaras Hindu University, Varanasii, U.P., India
[3]Department of Computer Science & Engineering, NMAMIT, Nitte, Karnataka INDIA

[*]*Corresponding Author: girishtmath@gmail.com*

Available online at: www.ijcseonline.org

Received: 15/May/2017, Revised: 24/May/2017, Accepted: 17/Jun/2017, Published: 30/Jun/2017

Abstract Dementia is a general term for a gathering of brain disorders. Alzheimer's disease is the most widely recognized sort of dementia, representing 60 to 80 percent of cases. This fact sheet quickly talks about Alzheimer's and some different dementias. A wide range of dementia includes mental decrease that: Influences more than one of the following four core mental abilities Recent memory, Language, Visuospatial function, Executive capacity. The paper likewise introduces a Rule-based Expert System for Memory Loss Disease with the assistance of principles and truths. It is an endeavor to concentrate on some of critical illnesses identified with memory loss like Alzheimer's disease, Parkinson's disease, Huntington's disease and dementia which are among the most widely recognized sorts of memory loss diseases. This Expert System will help the patients to get the required guidance about the diverse issue assault to them because of their nervous system disorders. The expert rules were developed on the symptoms of each type of neurological disease, and they were presented using decision tree and inferred using forward-chaining method. The knowledge base comprises of data about the memory loss and all the diseases related to it identified with it which is gathered from books and specialists (area specialists) about neurology and its disorders.

Keywords- Rule-based Expert System, Alzheimer's, Dementia.

I. Introduction

Dementia is the loss of psychological working, which implies the loss of the capacity to think, recall, or reason, and in addition behavioral capacities, to such a degree, to the point that it meddles with a man's day by day life and exercises. Signs and indications of dementia result when once-sound neurons (nerve cells) in the cerebrum quit working, lose associations with other mind cells, and die. While everybody loses a few neurons as they age, individuals with dementia encounter far greater loss. Analysts are as yet attempting to comprehend the fundamental illness forms required in the disorders. Researchers have a few speculations about components that may prompt distinctive types of dementias, however more research is expected to better comprehend if and how these systems add to the advancement of dementia. While dementia is more common with advanced age (as many as half of all people age 85 or older may have some form of dementia), it is not a normal part of aging. Many individuals live into their 90s and past with no indications of dementia.

Neurology is the branch of medication that arrangements with the sensory system and disarranges influencing it. An Expert System (ES), here and there called an Knowledge Base System (KBS) is a PC program that contains a portion of the subject particular learning of at least one human specialists. Master Framework (ES) robotizes master's errands, which require specific abilities and preparing. Master framework (ES) is one such piece of AI, which is generally utilized as an problem solution provider by Durkin [Durkin, 1994]. ES emerged during early 1970s, has turned out to be a standout amongst the most vital developments of AI. [Maitri Patel, Atul Patel and et each of the, 2013]Disease determination has additionally turned into a key space where these instruments are exceptionally valuable. Rule-based component extraction has been generally utilized for some applications. With the preparing and capacity capacities of PCs, it is exceptionally valuable to build up a expert system, which can help doctors with their conclusion. Master frameworks (ES) can help doctors by educating them about unrecognized data needs of a finding, institutionalizing symptomatic and treatment systems and even as a preparation instrument with point by point data about side effects, conditions and determination. These sort of master frameworks show great outcomes for issues which can't be formalized extremely well [Afshin Ameri and Hessam Moshtaghi]. The significant issue in building up a

therapeutic choice bolster neural system is its reliance on extensive number of preparing cases which are required to pick up a decent demonstrative capacity [L S Goggin, et al.,2007]. These expansive quantities of preparing cases may not generally be accessible.

II. The Fundamentals of Dementia

Dementia is lost aptitudes to think, recall and reason that is sufficiently extreme to influence every day exercises. It is ordinary to need more opportunity to recollect things as we get older. Other thinking and reasoning skills should not change with age. There are diverse reasons for dementia. Some can be dealt with and some can't. Have a restorative exam to take in the reason for dementia. Various disorders and factors contribute to the development of dementia. Neurodegenerative disorders such as AD, frontotemporal disorders, and Lewy body dementia result in a progressive and irreversible loss of neurons and brain functions. As of now, there are no cures for these progressive neurodegenerative disorders. Be that as it may, different sorts of dementia can be stopped or even turned around with treatment. Normal pressure hydrocephalus, for instance, regularly settle when overabundance cerebrospinal liquid in the mind is depleted by means of a shunt and rerouted somewhere else in the body. Cerebral vasculitis reacts to forceful treatment with immunosuppressive medications. In uncommon cases, treatable irresistible issue can bring about dementia. A few medications, vitamin lacks, liquor mishandle, despondency, and cerebrum tumors can bring about neurological shortfalls that look like dementia. The vast majority of these causes react to treatment.

Common Causes of Dementia

Alzheimer's Disease

Alzheimer's is the most common cause of dementia. In spite of the fact that side effects can differ broadly, the primary issue many individuals with Alzheimer's notice is absent mindedness sufficiently serious to influence their work, deep rooted side interests or social life. Different side effects incorporate disarray, issue with sorting out and communicating contemplations, losing things, losing all sense of direction in recognizable places, and changes in identity and conduct. These side effects result from harm to the brain's nerve cells. The illness step by step deteriorates as more cells are harmed and wrecked. Researchers don't yet know why brain cells malfunction and die, but two prime suspects are abnormal microscopic structures called plaques and tangles.

Vascular dementia (VaD)

Numerous specialists consider vascular dementia the second most common type, after Alzheimer's disease. It happens when clumps piece blood stream to parts of the cerebrum, denying nerve cells of nourishment and oxygen. If it develops soon after a single major stroke blocks a large blood vessel, it is sometimes called "post-stroke dementia." It can likewise happen when a progression of little strokes, or infarcts, stop up small veins. Exclusively, these strokes don't bring about real manifestations, yet after some time their joined impact is harming. This sort used to be called "multi-infarct dementia." Side effects of vascular dementia can shift, contingent upon the brain areas included. Distraction might be an unmistakable side effect, contingent upon whether memory areas are influenced. Other normal indications incorporate trouble centering consideration and perplexity. Decrease may happen in "steps," where there is a genuinely sudden change in capacity. Individuals who create vascular dementia may have a background marked by heart attacks. Hypertension or cholesterol, diabetes or other hazard variables for coronary illness are frequently present.

Mixed dementia

In mixed dementia, Alzheimer's ailment and vascular dementia happen in the meantime. Numerous specialists accept mixed dementia grows more regularly than was already acknowledged and that it might turn out to be progressively basic as individual's age. This conviction depends on dissections demonstrating that the brains of up to 45 percent of individuals with dementia have indications of both Alzheimer's and vascular disease. Decrease may take after an example like either Alzheimer's or vascular dementia or a mix of the two. A few specialists prescribe suspecting blended dementia at whatever point a man has both (1) confirmation of cardiovascular ailment and (2) dementia manifestations that deteriorate gradually.

Dementia with Lewy bodies (DLB)

In DLB, unusual stores of a protein called alpha-synuclein form inside the brain's nerve cells. These deposits are called "Lewy bodies" after the researcher who initially depicted them. Lewy bodies have been found in several brain disorders, incorporating dementia with Lewy bodies, Parkinson's disease and a few instances of Alzheimer's.

Symptoms of DLB include:

- Memory problems, poor judgment, confusion and other symptoms that can overlap with Alzheimer's disease
- Movement symptoms are also common, including stiffness, shuffling walk, shakiness, lack of facial expression, problems with balance and falls
- Excessive daytime drowsiness
- Visual hallucinations
- Mental side effects and level of readiness may show signs of improvement or more terrible (change) amid the day or starting with one day then onto the next
- In around 50 percent of cases, DLB is related with a condition called Rapid Eye Movement (REM) sleep disorder. REM rest is the phase where individuals generally dream. Amid ordinary REM rest, body

development is blocked and individuals don't "act out" their fantasies. In REM sleep disorder, developments are not shut and individuals showcase their fantasies, now and then strikingly and brutally.

Parkinson's disease (PD)

Parkinson's is another disease including Lewy bodies. The cells that are harmed and devastated are mainly in a brain territory critical in controlling movement. Side effects incorporate tremors and precariousness; firmness; trouble with walking, muscle control, and adjust; lack of facial expression; and impaired speech. Numerous people with Parkinson's develop dementia in later phases of the disease.
Parkinson's disease influences the part of the brain that controls muscle movement. As Parkinson's deteriorates, a few people develop dementia. Drug, physical therapy and surgery are used to manage signs.

Frontotemporal dementia (FTD)

FTD is an uncommon issue mostly influencing the front and sides of the brain. Since these regions often, yet not generally, shrink, brain imaging can help in conclusion. There is no particular variation from the norm found in the brain in FTD. In one type called Pick's disease, there are in some cases (yet not generally) irregular infinitesimal stores called Pick bodies. FTD advances more rapidly than Alzheimer's illness and has a tendency to happen at a more youthful age. The principal manifestations frequently include changes in identity, judgment, arranging and social abilities. People may make inconsiderate or rotten comments to family or outsiders, or settle on imprudent choices about funds or individual matters. They may demonstrate sentiments disengaged from the circumstance, for example, impassion or over the top fervor. They may have an uncommonly compelling impulse to eat and put on weight therefore.

Creutzfeldt-Jakob disease (CJD)

Creutzfeldt-Jakob disease (articulated CROYZ-felt YAH-cob) is an uncommon, quickly deadly turmoil influencing around 1 in a million people for every year around the world. It usually affects individuals older than 60. CJD is one of the prion (PREE-awn) infections. These disorder happen when prion protein, a protein normally present in the brain, starts to crease into an irregular three-dimensional shape. This shape bit by bit triggers the protein all through the mind to overlap into the same strange shape, prompting expanding harm and annihilation of brain cells. As of late, "variant Creutzfeldt-Jakob disease" (vCJD) was distinguished as the human issue accepted to be brought on by eating meat from steers influenced by "mad cow disease." It has a tendency to happen in substantially more youthful people, now and again as ahead of schedule as their teenagers. The main side effects of CJD may include weakness in memory, thinking and thinking or changes in identity and conduct. Melancholy or tumult likewise have a tendency to happen early. Issues with development might be available from the earliest starting point or show up soon after alternate indications. CJD advances quickly and is typically lethal inside a year.

Normal pressure hydrocephalus (NPH)

Normal pressure hydrocephalus (high-droh-CEFF-a-luss) is another uncommon issue in which liquid encompassing the brain and spinal cord can't deplete ordinarily. The liquid develops, amplifying the ventricles (liquid filled chambers) inside the brain. As the chambers extend, they can pack and harm adjacent tissue. "Normal pressure" refers to the way that the spinal liquid weight frequently, despite the fact that not generally, falls inside the typical range on a spinal tap. The three chief side effects of NPH are (1) trouble strolling, (2) loss of bladder control and (3) mental decrease, for the most part including a general moderating in comprehension and responding to data. A man's reactions are postponed, but they tend to be accurate and appropriate to the situation when they finally come. NPH can once in a while be dealt with by surgically embeddings a long thin tube called a shunt to empty liquid out of the brain to the abdomen. Certain transmissions and advertisements have depicted NPH as an exceedingly treatable condition that is regularly misdiagnosed as Alzheimer's or Parkinson's disease. In any case, most specialists trust it is unlikely that significant numbers of people diagnosed with Alzheimer's or Parkinson's really have NPH that could be revised with surgery. NPH is uncommon, and it looks unique in relation to Alzheimer's or Parkinson's to a doctor with involvement in evaluating brain issue. While shunting surgery is effective, it tends to help more with walking and bladder control than with mental decrease.

Huntington's disease (HD)

HD is a deadly mind issue brought on by acquired changes in a solitary quality. These progressions prompt pulverization of nerve cells in certain brain regions. Anybody with a parent with Huntington's has a 50 percent chance of inheriting the gene, and everybody who acquires it will in the long run develop the disorder. In around 1 to 3 percent of cases, no history of the infection can be found in other relatives. The age when side effects create and the rate of progression vary. Side effects of Huntington's disease incorporate jerks, fits, and other automatic developments; issues with adjust and coordination; personality changes; and trouble with memory, concentration or making decisions.

Wernicke-Korsakoff syndrome

Wernicke-Korsakoff syndrome is a two-stage disorder brought on by an inadequacy of thiamine (vitamin B-1). Thiamine brains cells create vitality from sugar. At the point when levels of the vitamin fall too low, cells can't produce enough vitality to work legitimately. Wernicke

encephalopathy is the primary, intense stage, and Korsakoff psychosis is the dependable, interminable stage. The most widely recognized cause is liquor addiction. Indications of Wernicke-Korsakoff disorder include:

- confusion, permanent gaps in memory and problems with learning new information
- people may tend to "confabulate," or make up data they can't recall
- shakiness, shortcoming and absence of coordination

In the event that the condition is found early and drinking stops, treatment with high-dosage thiamine may invert a few, however for the most part not all, of the harm. In later stages, harm is more serious and does not react to treatment. The Alzheimer's Association is the leading voluntary health organization in Alzheimer care, support and research.

III. Requirement Specification

Functional Requirements

Maintain Cases
This prerequisite was worried about keeping up instances of the patients to give functionalities to seeking existing cases and embeddings, changing and evacuating cases.

Maintain Rules
This prerequisite was worried about building up an element for refreshing the principles of the area. Decides that are in a predefined organization such as, IF symptom THEN disease OR further analysis should be approved before embeddings or altering to check in the event that it is in the suitable arrangement. The components included including rules, changing existing principles and erasing rules.

Provide Expert System Solution This practical necessity clarified that the govern based motor would handle the provided case and the guidelines to touch base at an answer that would give the rundown of ailments and the recommendations for further analysis. It additionally depicted that the case-based motor would analyze the provided body of evidence against the past cases to recover the most comparative cases from the case base.

User Interface
The prerequisite of this usefulness was to furnish offices to connect with the client, gather information, forward them to the back end, get information from the back-end and to show them for the client.

Non-Functional Requirements
Usability
To accomplish adaptability and proficiency, a Graphical UI is progressively sorted out for beginner clients, medium clients and normal clients. Since the framework was being worked for specialists, who utilize programming in customary premise, we concentrated on proficiency more than adaptability. This would build the preparation time yet then spare a considerable measure of time amid general utilization.

Reliability
The necessity was that the framework be accessible constantly. This can be accomplished by facilitating it in a solid server amid establishment. Design of a Rule Based Expert System, knowledge base is a declarative representation of the expertise, regularly in IF THEN rules. Inference engine is the code at the core of the system, which derives recommendations from the knowledge base and problem-specific data in working storage. The information procurement part obtains new decides that can be added to the knowledge base by utilizing the knowledge acquisition sub-system. The explanation sub-system is to clarify its recommendation or proposals, and even to legitimize why a specific activity was suggested.

Security
The prerequisite was that the regulatory components like including and altering standards be enabled just to a few domain experts with administrator rights who are approved through username and password. A considerable lot of the specialists arrived at the conclusion that age is not just the explanation behind memory loss. A large number of the general population with a similar age assemble either can have or can't have memory loss diseases. Ten vast reviews have demonstrated that the danger of Alzheimer's infection is pointedly diminished when inflammation is controlled. How would we control inflammation? The Psychiatry recommends that controlling the Way of life can prompt diminishment of odds of memory loss diseases. So, while people are waiting for a vaccine to come along, researchers suggest that everyone should work on their lifestyle if they are concerned about dementia. Eat solid wild fish as like haddock, cod, sea roost, herring, salmon, sardines, tilapia, trout, whitefish, and bunches of vivid natural vegetables and natural products, and natural grains with some restraint. Skirt the bread, liquor, and cigarettes as well.

Rule-based Expert System
The idea of rule-based systems is to represent domain expert's knowledge in a form called rules. By and large the learning portrayal utilized as a part of the expert system is finished utilizing the if-then rules [M Sasikumar, S Ramani, and et all,2007]. In a typical rule-based expert system, a rule consists of a few premises and a conclusion. In the event that every one of the premises are valid, then the conclusion is viewed as genuine. The components of a rule-based expert system include the knowledge base, inference engine, knowledge acquisition component, and explanation system.

The two broad kinds of inference engines used in rule based expert systems are forward chining and backward chaining system. Forward chaining: It begins with the truths and works forward to achieve the conclusion. It includes checking the condition some portion of the lead to decide if it is valid or false. If the condition is true then the action part of the rule is also true. This technique proceeds until the arrangement is found or a deadlock is come to. Forward chaining is usually alluded to as information driven thinking. In Backward chaining: It is the way toward beginning with the conclusion and working back-ward to the supporting truths. It is the switch of forward tying. In reverse fastening is great when every one of the results are known and the quantity of conceivable result is not extensive. For this situation an objective is indicated, and the expert system tries to figure out what conditions are expected to touch base at the predetermined objective. Consequently in backward chaining is additionally called objective driven thinking.

Case based Expert System

Case-based thinking is frequently utilized where specialists think that its difficult to express their perspectives when taking care of issues. Human case-based thinking is very effective in incorporating, critical thinking and getting the hang of, consolidating diverse critical thinking procedures, using various types of information, and becoming experts for specific areas of responsibility.

IV. Objectives

The kind of sickness among memory loss illnesses can be analyzed utilizing the side effects of specific disease. For the dementia and Alzheimer's disease there can be the essential test on the basis of Mini Mental State Examination (MMSE).

Mini Mental State Examination (MMSE): The MMSE is a quantitative measure of psychological status in grown-ups. It can be utilized to screen for subjective disability, to assess the seriousness of intellectual hindrance at a given point in time, to take after the course of psychological changes in a person over the long haul, and to record a person's reaction to treatment. It is most broadly utilized measure of psychological capacity. The first legitimacy and unwavering quality of the MMSE depended on 206 patients with an assortment of psychiatric issue, the effectively isolating those with dementia, depression, or a blend of the two. The test has a scope of 30 focuses, from ordinary (30) to serious hindrance (0) and is to be performed by the patient himself. A cut-off score of 23 for the nearness of subjective weakness has been proposed, with variety relying upon absence of instruction.

MMSE is anything but difficult to perform at the bedside or on an out-patient premise. The MMSE surveys nine things: Memory, Introduction, Consideration, Verbal Familiarity, Ostensible aphasia, Open aphasia in addition to responsive apraxia, Alexia, Agraphia and Constructional apraxia[Folstein M and et al,1975].

Impediments of MMSE: Instruction levels influence Scaled down Mental State Examination scoring: It might neglect to distinguish gentle/direct intellectual weakness in individuals of high instructive level or premorbid knowledge. Similarly, ineffectively instructed individuals may score seriously essentially on the grounds that they discover the inquiries troublesome. It additionally has floor impacts as far as its failure to identify change in built up extreme Dementia, it might give deceiving brings about the setting of poor instruction or dialect/tactile challenges or poor inspiration (e.g gloom). For the determination of memory loss disease, four sicknesses are secured which are Alzheimer Disease, Dementia, Parkinson Disease, Huntington Disease. The distinctive manifestations are checked against all infections. Despite the fact that each sickness have their own side effect in which a portion of the manifestations are same as other disease of memory loss and a few indications are unique in relation to other ailment side effects. So among every one of the side effects, the indistinguishable manifestations of all diseases are removed and on the premise of that side effects, illness is analyze.

V. Applications

- The development and testing of computerized systems to assist in the diagnostic process is a time honored research activity in medical information science.
- The Proposed system will empower a patient to discover the disease, when no other help is possible.
- Diagnosis expert system can help an incredible arrangement in distinguishing those infections and portraying strategies for treatment to be completed considering the client capacity in order to deal and interact with expert system easily and clearly.
- The proposed system won't just improves undertaking of the specialists additionally helps the patients by giving beginning prescriptions to little sicknesses in crisis.

VI. Conclusion

At present, there are no cures for the basic dementias brought about by dynamic neurodegeneration, including AD, frontotemporal disorders, and Lewy body dementia. However, a few types of dementia are treatable. A better understanding of dementia disorders, as well as their diagnosis and treatment, will make it possible for affected individuals and their caretakers to live their lives more fully and meet daily challenges.

The rule-based and case-based reasoning can be used for designing diagnostic system. Case-based reasoning is often used where experts find it hard to articulate their thought processes when solving problems. Expert system is a PC

program intended to show the capacity of taking care of an issue by a human. In this paper a specialist framework has been acquainted with analyze and propose the medicines for the sort of memory loss diseases. Hence, first the purpose and goals of an expert system were defined and then the relevant research reviewed. The case-based medical expert system prototype that supports diagnosis of common diseases was developed. A few properties of this model stay to be to be explored. It ought to be tried on a few more databases. Unfortunately databases are regularly exclusive and hard to acquire. Future prospects for restorative databases ought to be great since a few clinics are presently utilizing modernized record framework rather than customary paper based. It ought to be genuinely simple to produce information for machine analysis.

Glossary

Alpha-synuclein—a protein that is implicated in abnormal clumps called Lewy bodies, which are found in the brains of individuals with Parkinson's disease and a few dementias. Clutters in which alpha-synuclein accumulates inside nerve cells are called synucleinopathies.

Alzheimer's disease—the most widely recognized reason for dementia in individuals age 65 and older. Nearly all brain functions, including memory, movement, language, judgment, and behavior, are eventually affected.

Amyloid— a protein found in the characteristic clumps of tissue (called plaques) that appear in the brains of people with Alzheimer's disease.

Chronic traumatic encephalopathy— a form of dementia caused by repeated traumatic brain injury.

Corticobasal degeneration— a progressive disorder characterized by nerve cell loss and atrophy in multiple areas of the brain.

Dementia— a term for a collection of symptoms that significantly impair thinking and normal activities and relationships.

Dementia with Lewy bodies—a type of Lewy body dementia that is a common form of progressive dementia.

Frontotemporal disorders—a group of dementias characterized by degeneration of nerve cells, especially those in the frontal and temporal lobes of the brain.

HIV-associated dementia—a dementia that results from infection with the human immunodeficiency virus that causes AIDS.

Lewy body dementia—one of the most common types of progressive dementia, characterized by the presence of abnormal structures called Lewy bodies in the brain.

Mixed dementia—dementia in which one form of dementia and another condition or dementia cause damage to the brain, for example, Alzheimer's disease and small vessel disease or vascular dementia.

Multi-infarct dementia—a type of vascular dementia caused by numerous small strokes in the brain.

Neurofibrillary tangles—bundles of twisted filaments found in nerve cells in the brains of people with Alzheimer's disease. These tangles are largely made up of a protein called tau.

Parkinson's disease dementia—a secondary dementia that sometimes occurs in people with advanced Parkinson's disease. Many people with Parkinson's have the amyloid plaques and neurofibrillary tangles found in Alzheimer's disease, but it is not clear if the diseases are linked.

Tau—a protein that helps the functioning of microtubules, which are part of the cell's structural support and help deliver substances throughout the cell. In Alzheimer's disease, tau twists into filaments that become tangles. Disorders associated with an accumulation of tau, such as frontotemporal dementia, are called tauopathies.

Vascular dementia—a type of dementia caused by brain damage from cerebrovascular or cardiovascular problems, usually strokes.

References

[1]. [Chaitali Suratkar and et all,2011] Chaitali Suratkar and V, Gaikwad, "A Fuzzy Expert System for Cancer Diagnosis", International Journal of Advanced Research in Computer Science, vol2,No.6, December 2011.

[2]. [Durkin, 1994] Durkin, Application of artificial neural networks in the diagnosis of urological dysfunctions", *Expert Systems with Applications, Article in press,*1994.

[3]. [Folstein M and et al,1975] Folstein M, Folstein S, McHugh S, Mini Mental State:a practice method for grading the cognitive status of patients for the clinician. Journal of Psychiatric Research,12:189-198, 1975.

[4]. [Goethe and Bronzino,1995] J W Goethe and J D Bronzino, "An expert system for monitoring psychiatric treatment", *IEEE Engineering in Medicine and Biology*, Nov-Dec 1995.

[5]. [Klaus-Dieter Althoff, 2012] Klaus-Dieter Althoff, "Case- Based Reasoning and Expert Systems", German Research Center for Artificial Intelligence (DFKI), 2012.

[6]. [L S Goggin, et al.,2007] L S Goggin, Robert H Eikelboom, and Marcus D Atlas, "Clinical decision support systems and computer aided diagnosis in otology. Otolaryngology-Head and Neck Surgery, 136:S21,S26, 2007.

[7]. [M Sasikumar, S Ramani, and et all,2007], M Sasikumar, S Ramani,S Muthu Raman, KSR Anjaneyulu, R Chandrasekar. "*A Practical Introduction to Rule Based Expert Systems*." New Delhi : Narosa Publishers, 2007. p. 294 .

[8]. [Maitri Patel, Atul Patel and et all, 2013]Maitri Patel,Atul Patel,Paresh Virparia, "Rule Based Expert System for Viral Infection Diagnosis", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 5, May 2013**.**

[9]. Remzi, Waldert and Djavan,2005] M Remzi, M Waldert,and B Djavan, "Preoperative nomograms and artificial neural networks (anns) for identification of surgical candidates", *EAU Update Series*, 3(2), June 2005.

[10]. 2005 – 2/2010 Health Information Translations Unless otherwise stated, user may print or download information from www.healthinfotranslations.org for personal, non-commercial use only.

[11] Komal R. Hole, Vijay. S. Gulhane. Sipna College of Engineering & research, Amravati. IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 3, May 2014. www.ijiset.com ISSN 2348 - 7968

