A Multi-Agent System (MAS) Based Scheme for Health Care and Medical Diagnosis System

Shibakali Gupta
University Institute of Technology
Burdwan University
Golapbag (north), Burdwan-713104, West Bengal, INDIA
skgupta_81@rediffmail.com

Shiladitya Pujari
University Institute of Technology
Burdwan University
Golapbag (north), Burdwan-713104, West Bengal, INDIA
shiladitya.pujari@gmail.com

Abstract. **In recent era, health care professionals truly belief that the better health care can be provided by developing computerized intelligent health care system. In this paper, we attempted to propose an advanced scheme of agent-based health care and medical diagnosis system using the knowledge base and collaborative as well as co-operative intelligent agents residing on a multi-agent platform, which provides a communicative task-sharing environment. A user-friendly interface of this system will provide high performance, reliability and functionality.**

Keywords: Intelligent agent, multi agent system, knowledge base, health care system.

I. INTRODUCTION

Practical scenario in India says that, a major portion of the total population resides in the remote areas, where proper health care and community medical services are almost beyond the reach of the native people. The problem is due to acute scarcity of medical practitioners as well as proper infrastructure. Shortage of fund is also a major parameter. Keeping the medical diagnosis system in mind, we can notice that the whole system depends on three basic factors: (i) Technical Infrastructure, (ii) Economic condition and (iii) Awareness and user friendly environment/platform. Technical infrastructure means the practitioners, tools, and medicines etc. which are indispensable for every community health centers situated at remote villages as well as at other places. Economic condition plays a major role against frequent and proper treatment of diseases. Most of the people scare for the treatment, even if to see a doctor as it is very expansive in most of the cases. Another major factor besides those two factors is the lack of awareness and callousness of rural people. Lack of user friendly environment also stands there against the proper treatment and diagnosis. Not only those limitations, there persists many other problems that affects the overall situation of our social environment and health situation. Due to the lack of proper medical system, many people go to some local unauthorized practitioners. Those practitioners misuse some medicine on the basis of their guessing. Statistics of the World Health Organization have revealed that such kind of misuse of antibiotics is making bacteria resistant to the first line of drugs and necessitating the use of stronger, more expensive alternatives [1].This is really a threat for our health care system.

Current situation demands a new system. A system which will work beyond the limitations stated above. Research work on Community healthcare System [2] is going on, but those systems are highly expensive to implement. Common telemedicine system [3] [4] is a good option obviously, but it is not better for future expansion of the existing system. Telemedicine system needs a practitioner directly for diagnosis the disease taking the symptoms from the patients. But it lies within the limitations again, i.e. the scarcity of practitioners etc. An agent based system is necessary to improvise the whole medical diagnosis system in the Indian scenario. Intelligent multi agent system based medical diagnosis system is the better solution for both patients as well as the persons who are dealing with the improper infrastructure of the community health centers in India. Many research papers have been published in this field dealt with intelligent and agent-based medical diagnosis system.

It is evident that we actually want to make a system which will take care of the initial check up of the patient, do the treatment and generate the solution or report for the patient. Initial check up of a patient is nothing but the diagnosis of the patient. Now what actually done in the diagnosis process is that, the patient mainly tells his/her problems to the doctor, which in biological term is said as symptom. The doctor gives suggestions to the patient. Similarly, the patient will give his/her symptoms and the operator, who is operating the computer, by observing those symptoms, will tell the patient that what disease he/she may have. The operator will also tell the patient to which specialist he/she must has to go, what tests he/she has to undergo, or if there is any immediate solutions etc. Our goal is to make this entire diagnosis system intelligent and agent oriented, much better to say, multi agent system (MAS) oriented.

II. SIGNIFICANCES OF USING MULTI AGENT SYSTEM

Agent and multi agent system has many definitions. As per Michael Wooldridge [5], an agent is a computer system that is capable of independent action on behalf of its user or owner. In other words, an agent can figure out for itself what it needs to do in order to satisfy its design objectives, rather than having to be told explicitly what to do at any given moment. And a multi-agent system is one that consists of a number of agents, which interact with one another, typically by exchanging messages

through some computer network infrastructure. In the most general case, the agents in a multi agent system will be representing or acting on behalf of users or owners with very different goals and motivations. In order to successfully interact, these agents will thus require the ability to cooperate, coordinate, and negotiate with each other, in much the same way that we cooperate, coordinate, and negotiate with other people in our everyday lives.

Multi agent systems may be considered as the latest software engineering paradigm in the recent era. This kind of systems may be used in those domains which consist of the following features:

- Knowledge is distributed in different locations.
- Several entities, while keeping their autonomous behavior, have to join their problem-solving abilities to be able to solve a complex problem.
- The problems in the domain may be decomposed in different sub-problems, even if they have some kind of inter-dependencies. [6]

If we analyze the medical diagnosis and health care system, we shall find that the knowledge required for solving a problem is spatially distributed in different locations. For example, diagnosis of general diseases differs from eye, or cardiology section. Each specialist doctor uses their own knowledge to solve the problem. Tests are carried on to some different location with the help of some different set of knowledge. Giving solution to a particular case involves better co-ordination between different individuals with their different skills and functionalities. It is obvious that medical diagnosis system is a complex system and there is no straightway software engineering standardization. A multi agent based system may be a better approach at that place.

III. CORE CONCEPT

In our paper, we presented a multi agent system based medical diagnosis system in which an agent called User Agent (UA) is responsible for taking the user inputs i.e. symptoms from the patients with the help of a user interface. The user interface helps the practitioner or any person engaged in taking the symptom to feed the input as measured form and observation. Duty of this UA is to take patient symptoms in the form of raw data. The UA takes the raw input, and to apply some analysis method upon those data with the help of Master Agent (MA) to convert it to knowledge. This analysis is done with the help of the user interface i.e. the patient symptom form. That knowledge is stored in the Global Knowledge base (G KB). Role of the Master Agent (MA) is to select a specialist doctor agent (SDA) for handling the particular case and handover the case to that specific specialist doctor agent (SDA). The MA has the responsibility to give the task and to provide the proper knowledge from the Global Knowledge base (G KB) to the specialist doctor agents. For each SDA, there is individual local knowledge bases (LKB) associated with them. After having the solution, SDA will give the solution to the Master Agent (MA) and that solution will be stored in the Solution knowledge base (S KB). A report agent will be responsible for generating the report after getting the final instruction from the master agent. For instance, if a patient will come with symptoms such as high fever with convulsion, headache and weakness etc, the person will take those symptoms with the help of the user interface i.e. the form. User agent will help the person to refine the queries. After getting the queries or symptoms in the measured way, those inputs will be converted to knowledge and will be kept to the Global knowledge base. That knowledge will tell the master agent that the symptoms are likely to be of malaria. Then on the basis of that knowledge, the master agent will select the proper doctor agent. MA will also help SDA to access the global knowledge base. That SDA will then give the proper solution. That solution will also be kept in the Local knowledge bases of each SDA. After getting the particular solution for a particular case, that solution will be stored in form of knowledge at a different knowledge base called Solution knowledge base (S KB). A Report Agent (RA) can access this knowledge base for generating report with the help of MA. This is the concept we are trying to reflect in our paper.

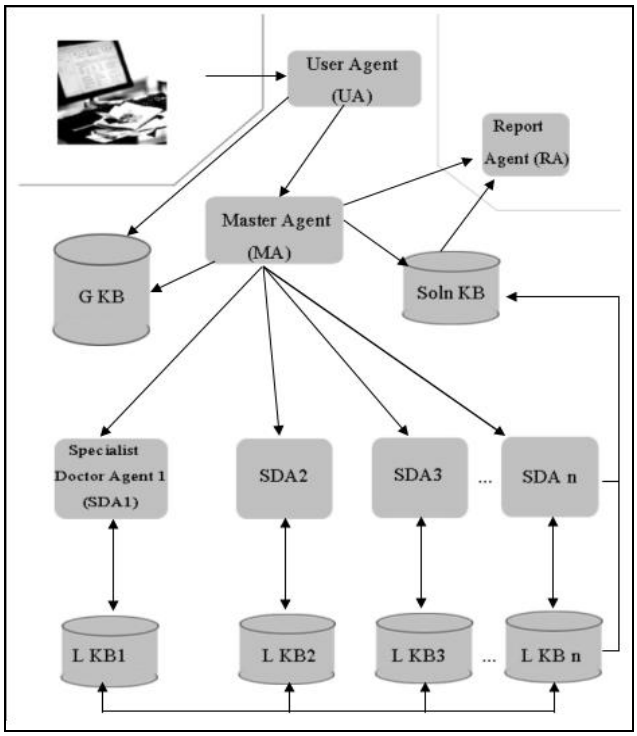

Figure 1

Proposed schematic diagram of the medical diagnosis system

IV. CONCLUSION AND FUTURE SCOPE

This paper has presented a multi agent system oriented Medical Diagnosis and solution system, by the assistance of which we can make the diagnosis and give the solution in much easier and comfortable way. If properly implemented, this system may be one of the better solutions for health centers in India situated in remote places.

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