

Multi Agents in Healthcare System

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Abstract

Healthcare system is one of the most rapidly evolving sectors in government system. This healthcare system is developed for nations for challenging various issues in the population and increasing the demand for it. In this paper we are explaining how multi agents are used and utilized for healthcare system. We took artificial intelligence (AI) for improving the healthcare system performance and we can get efficient solution for health care system for monitoring and controlling patients in pandemic situations. For that sensor node involvement is required to collect data from the dedicated areas and transmitted to desired destinations in the network through mobile sink. In this approach rendezvous nodes act as an agent for communicating and transmitting data from sensor nodes to mobile sink.

Key words: Sensor Nodes, Artificial Intelligence, Healthcare System, Multi-agents.

Introduction

Based on the present situation many nations are evolving and adopting for new trends and technologies which are available in the technical world. Government sectors are showing keen interest in these sectors for solving challenges in the medical problems and aging problems in elderly people. These healthcare systems will help for remote people who, for improving the health of the population government is decided to help those people and give good treatment with less effort. On other hand, number of patients waiting time for treatment is increased, based on this demand Canadian health care system[1] improved their health care system and reduced waiting time compared to well developed nations for quality service. This healthcare system addressed some problems like 1) Knowledge distribution, 2) Coordination effort, 3) Complex/Critical problems, 4) Amount of information. For example, in 2020 is a big crisis for world in medical field. In this pandemic situation doctors are not sufficient to provide treatment to the infected patients. In this covid19 situation patients are in large and doctors are in less number and treatment is provided to the infected people without contacting them. In this scenario, treatment is required for all infected people and coordination is required between the serving people in critical cases. Communication between the rendezvous nodes (Agents) is a challenging task in network.

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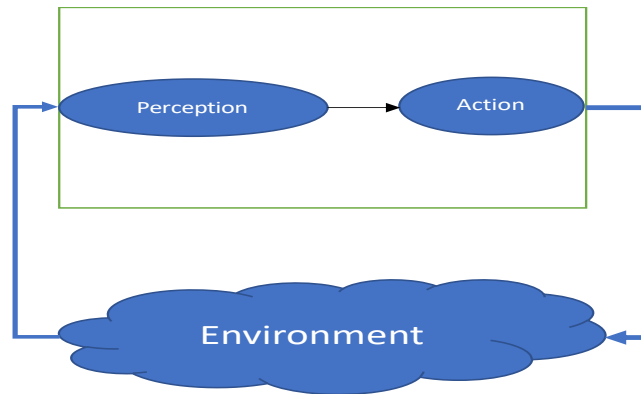


Fig. 1 Agent Architecture

In this paper, we discuss to reduce the waiting time of the patients and provides the good quality treatment to patient in this pandemic situation without losing the patient's life and also solving the health care problems multi agent system (MAS) is used.

Multi Agents System

This MAS is providing a platform to solving and modeling the real-world problems in powerful way. This MAS is used to overcome healthcare system problems to MAS are inherently distributed and can coordinate their task while keeping autonomy and available data in locally. It has capability to solve problems in dynamically and flexible distributed manner using problem solving mechanism skills using personalized techniques [2,3].

MAS has many definitions from various research fields, but in distributed artificial it is a loosely coupled network that should solve problems in the network based on the individual capabilities of each entity. These agents have autonomy to solve problems with unique properties such as behavior of the agent in the environment, data perception through actuators, goals and motivation for achieving task. The most important property of the agents are to remember, agents doesn't have full capability to solve the problem to work with other agents then only goal will be reached [4,5].

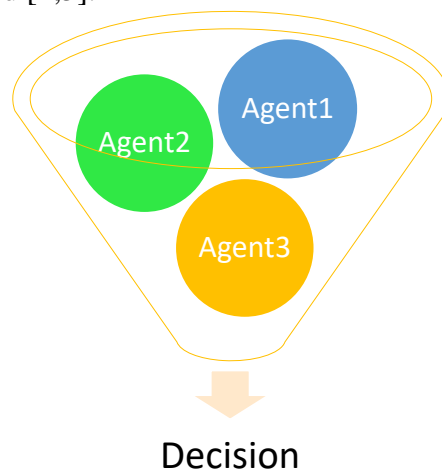


Fig. 2 Collecting information from multiple agents.

These intelligent agents are designed to collect information independently and implement actions automatically. These intelligent agents are deals with huge problems and divide that huge problem/task into sub problem/task and share that task among agents and solve

that task with combination of other agents' information. Here all agents will communicate and solves the task based on available information with agents autonomously. These agents will apply various methodologies for achieving the goal of specific task. These technologies are broadly used in Wireless Sensor Networks and Body Area Sensor Networks for monitoring patient's health conditions and giving them better treatment from remote locations. And used for solving the specific healthcare issues in the healthcare system.

A Wireless Sensor Network is a collection sensor node in a network. These sensor nodes are capable of sensing data from surrounding environment, after data sensing is done data processing will be done after that it will communicate with designed base station in the network. This is subset of MAS [7-9], agents are homogeneous and numerous. These will share same hardware and software structures and ability with a greater number of real-world applications. These nodes will send alert messages for controlling the network like alerting the military for enemy movement events in real time using various methods are equipped with nodes. that information is shared among the agents is shown in the following figure.

Body Area Sensor Network is a specific type of sensors in the WSN. These sensors are used to monitor human body and information is gathered for necessary actions for treatment of the patients. Here number of agents are used to execute specific tasks like monitoring the heart pulse, diabolic, body temperature etc., all this information is shared among the agents for communication, but this should be redundant in size, power consumption for hardware built in for both stimulate. If application is using few numbers of sensors means, there is no room for a greater number of agents for functionalities, and it reduces the power consumption of the hardware, compared to a greater number of sensor nodes [10-13].

Proposed Framework

Present situation so many applications are available in the market which are related to the MAS. In this approach we introduced a MAS which will help to improve the efficiency of healthcare applications. In this approach we used WSN for monitoring the patients in the hospitals. These sensor nodes are assigned a task to monitor patients health continuously and send monitored sensor data to the near mobile sink which is available in location and this mobile sink will collect these sensor data and forwards to the base station which will monitor and alert the doctors about patient's health. Based on this information doctors will do treatment to the patients.

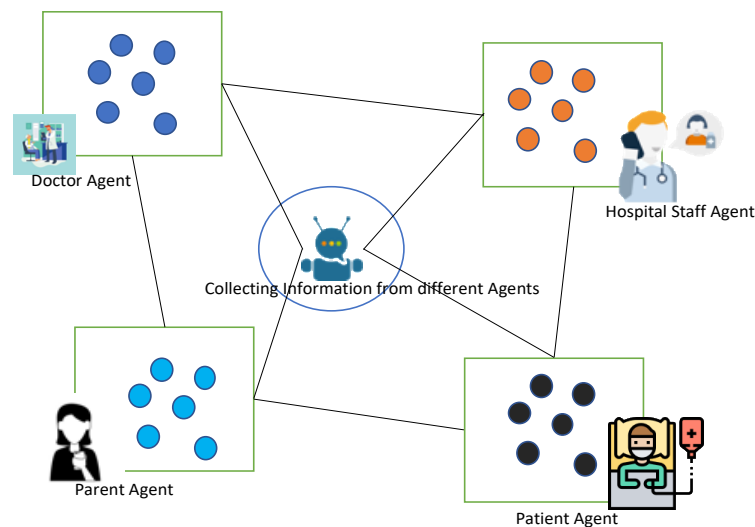


Fig. 3 MAS Collecting information from different agents.

These sensory data can be monitored by robots where doctors are not available or where doctors cannot reach, these robots will give treatment to the patients based on the sensor data. For example, in this pandemic covid19 situation number of cases are increased and number doctors are not sufficient to give treatment to the patients and this disease is spreading quickly in from human to human in this situation robots are used to give treatment to the patients those who are infected with covid19. This can reduce the risk of doctors and patients can get good treatment in right time.

The main goal is how these agents are communicating and sharing the information between the agents and coordination. For this, a hybrid model is designed, this model will collect sensor data from surrounding environment and based on the current state rules are generated with condition for building knowledge for that agent. Based on the condition rule actions are mapped and executed actions through actuators. Here actions are mapped based on the utility of the function and these utility models is mapped to the action model which are derived from the knowledgebase and this knowledgebase information is mapped with environment model for current state. Final action is not only mapped with utility model and it is mapped with goals of the task. If it satisfies the goal of the task, then only it will be considered otherwise decision will be discarded and searching for solution.

Algorithm 1:

Function Table_Driven_Agent(perception)

 Set all initial perception sequence are empty.

 Form sequence of actions based on the perceptions and store in a reference table

 And specify all perceptions with sequence of actions.

 Map action sequence based on perception.

Return action.

Above algorithm 1 uses the table-driven approach for making decisions. Algorithm 2 shows how agents are working in healthcare system.

Algorithm 2:

Input: Sensory Data

Step 1: Each agent will get sensory data from environment.

Step 2: Validate data based on the required parameters.

Step 3: Get goals from Goal oriented agent.

Step 4: Get Utility from utility function from Utility based agent.

Step 5: Get conditional rules from table driven agents.

Step 6: Supply knowledge to all these agents using current state information.

Step 7: Build knowledge from current state sensor information.

Step 8: Execute necessary actions through executor and these actions are supplied from different agents.

Step 9: If any improvements in the learning parameter try to improve or else continue

Step 10: Stop the procedure.

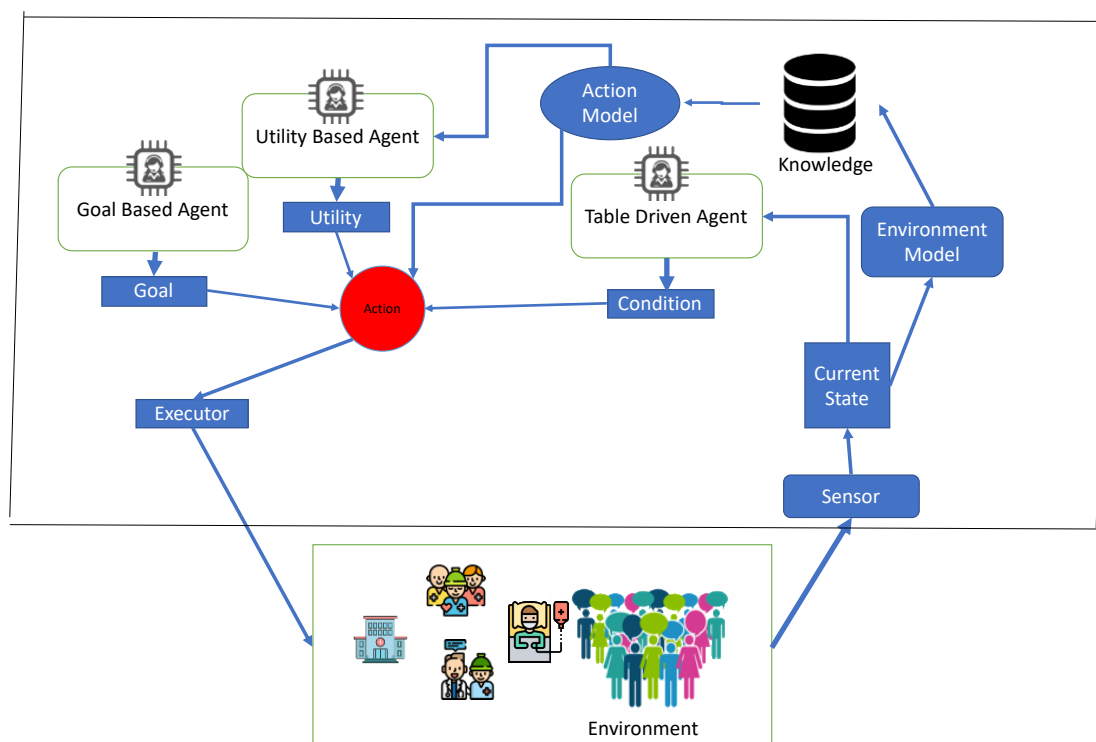


Fig. 4 MA in Healthcare System

These agents can be used for monitoring the patients waiting time in the hospitals, these crowds can be monitored in the hospitals without infecting the others in the hospital. For this information is collected through sensor nodes which are available in the hospitals. Based on the sensor information /environment agents will execute actions to maintain social distance between the patients by alerting them and reducing the patients waiting time by using scheduling slots per doctor. These scheduling slots are useful for giving the treatment to patients by intimating patients through communication media based on the type of cases and emergencies. If any improvements in the learning parameter in the agents that parameter should be improved.

Conclusion

In this paper we discussed a new approach in healthcare system, that will solve issues in healthcare system. With this approach agents will interact with other agents to achieve goal. These agents will monitor patient's health and gives treatment through telepathy, those who unable to reach hospitals and it reduces the waiting time of the patients in the hospitals. For improving healthcare system advanced optimization techniques are used for further improvement of system.

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