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Multi Special Robot Systems for Detection and Rectification of Rescue Units

P.Jayaseelan[1]
Assit Professor, ECE
Prist University-Thanjavur, India

A.Saminathan[2]
Assit Professor, CSE
Prist University-Thanjavur, India

M.Sathish[3]
PG Scholar, CSE
Prist University-Thanjavur, India

Abstract, in this paper we present Multi special robot system with advance communication technologies. Now a day's lot of environmental catastrophes occurred in our world, to meet these challenges is not possible by human being by all time. So we introduce this kind of multi special talented robots (Co-operative) with excellent Algorithm for broad way communication. We focus Search and rescue operations have great importance under disaster situations like earthquakes or terrorist attacks

KeyWords: Multi Special Robot system, Co operative Search Strategy, Robot Communication system & Robot control system.

1. INTRODUCTION

Rescue robotics, or basically the use of autonomous robots in search and rescue operations, is a relatively new field of research. It is a part of the broader field of coordination of a group of mobile robots to achieve a specific objective/goal. In order to achieve cooperative behavior there is a need for effective (direct or indirect) communication methodologies [1]. Search and rescue operations have great importance under disaster situations like earthquakes or terrorist attacks. In such disaster relief missions search and exploration are the initial steps of a larger operation. Traditionally such missions have been performed by human teams; however there are intensive ongoing research efforts for developing multi-robots search teams to be deployed in such missions.

A group of mobile communicating robots [2-3] constitutes by its nature a wireless ad-hoc network. In such a system there are many issues to be resolved for effective operation. First of all, since the agents will be simple, their communication capabilities (such as range, power, processing capability, etc) will also be limited. Therefore, in the case two agents that need to communicate are out of range, they will probably need to communicate through other agents. Therefore, beside the need for development of appropriate message structures and communication protocols, there is a need for development of effective/cooperative routing/networking and service discovery protocols as well. We implement the algorithm on custom designed MULTI SPECIAL robots and compare its performance with the performance of individual-based non-cooperative search (i.e., without a network connection and cooperation between them meaning that all robots carry out the search themselves without being aware of the other robots). The success rates of these two search algorithms can be measured in terms of mission time that is the precise time passed to fulfill a common search. Our experimental results show that the networked strategy is faster and more successful than the individual search strategy with the performance metric chosen [3].

2. MULTI SPECIAL ROBOT SYSTEMS

2.1 DISASTER DETECTION ROBOT

The US Army makes use of two major types of autonomous and semi-autonomous ground vehicles [5]: large vehicles, such as tanks, trucks and HUMVEEs and small vehicles, which may be carried by a soldier in a backpack (such as the PackBot shown in Fig. 2.0a) and move on treads like small tanks [US Dept. Of Defense, 2007]. The PackBot is equipped with cameras and communication equipment and may include manipulators (arms); it is designed to find and detonate IEDs, thus saving lives (both civilian and military), as well as to perform reconnaissance. Its small size enables it to enter buildings, report on possible occupants, and trigger booby traps. Typical armed robot vehicles are (1) the Talon SWORDS (Special Weapons Observation Reconnaissance Detection System) made by Foster-Miller, which can be equipped with machine guns, grenade launchers, or anti-tank rocket launchers as well as cameras and other sensors (see Fig. 2.0b) and (2) the newer MAARS (Modular Advanced Armed Robotic System)

Fig 1.Disaster Detection Robot

2.2 MILITARY ROBOT SYSTEM

While vehicles such as SWORDS ((Special Weapons Observation Reconnaissance Detection System)and the newer MAARS are able to autonomously navigate toward specific targets through its global positioning system (GPS), at present the firing of any on-board weapons is done by a soldier located a safe distance away. Foster-Miller provides a universal control module [8] for use by the war fighter with any of their robots. MAARS (Modular Advanced Armed Robotic System) use a more powerful machine gun than the original SWORDS. While the original SWORDS weighted about 150 lbs., MAARS weighs about 350 lbs. It is equipped with a new manipulator capable of lifting 100 lbs., thus enabling it to replace its weapon platform with an IED identification and neutralization unit

Fig 2. Military Robot system

From the brief descriptions of the state of the art of robotics above, it is clear that the field is highly dynamic. Robotics is inherently interdisciplinary, drawing from advances in computer science, aerospace, electrical and mechanical engineering, as well as biology (to obtain models of sensing, processing and physical action in the animal kingdom), sociology, ergonomics (to provide a basis for the design and deployment of robot colonies), and psychology (to obtain a basis for human-robot interaction). Hence, discoveries in any of these fields will have an effect on the design of future robots and may raise new questions of risk and ethics. It would be useful; then, to anticipate possible future scenarios involving military robotics in order to more completely consider issues in risk and ethics [4, 6, and 7]

Fig 3. SWORDS Robot

2.3 GROUND DETECTION ROBOT

We believe that the US Armed Services have significant programs for the development of autonomous space vehicles: for advanced warning, defense against attacking missiles and possibly offensive action as well. However, there is very little information on these programs in publicly available sources. It is clear that the Air Force is building a major communication system [9] in space, named Transformational Satellite Communication System (TSC). This system will interact with airborne as well as ground-based communication nodes to create a truly global information grid.

Fig 4. Ground Detection Robot

3. CO OPREATIVE SEARCH STRATEGY

In the cooperative search strategy an active multi-hop wireless communication network connecting all the entities (e.g., the robots and the base station) is maintained. The reason for maintaining such a network is to share the information acquired by all the entities in the network. Hence, once a search robot locates the object while searching, it does not need to wait to report until it can traverse all the way back to a sufficiently close distance to the base station [2-4]. Since the effective communication range of a wireless transceiver is limited, therefore time/position varying special care is taken to avoid broken links between the robots. The flowchart for the cooperative search strategy is presented in Figure 5. Once the search operation is started by the base station one of the robots starts its search as if there are no other robots around it (like the non-cooperative search strategy). During the search operation the robot continuously monitors the link between itself and the base station. If the link is active it continues in its normal mode of operation. If it detects a faulty communication [5, 6], this is interpreted as a link failure due to the overextended communication distance

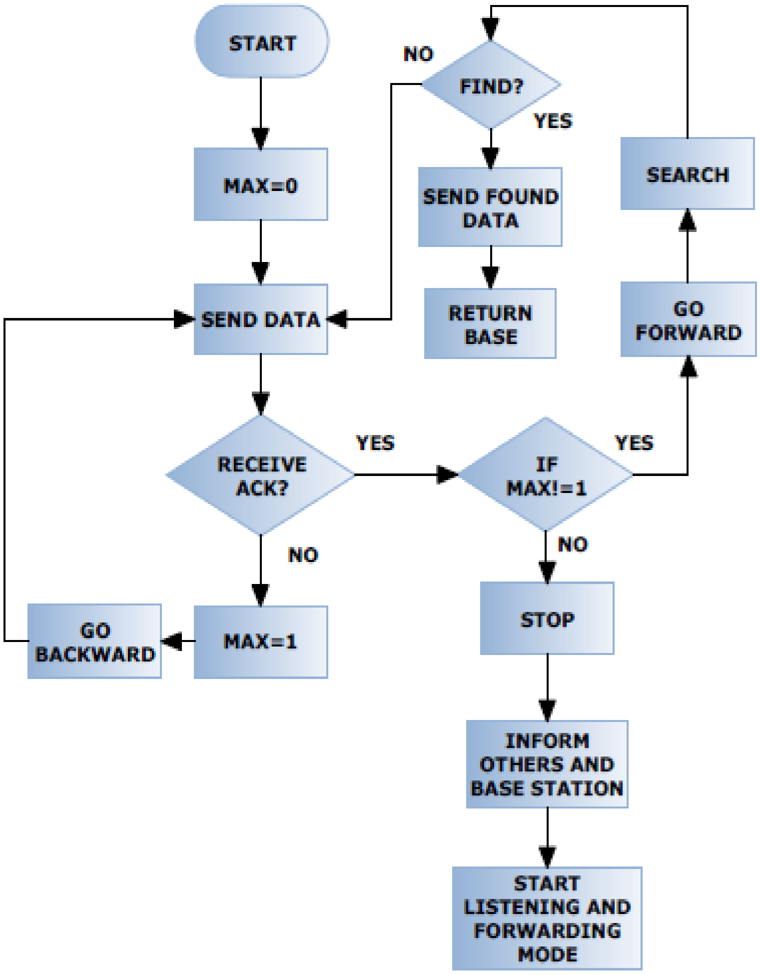

Fig 5. Algorithm of Co operative search strategy

Hence, the robot goes back towards the base station to activate the broken link. Once the link is reactivated the robot goes back in the reverse direction in finer steps to avoid an abrupt link breakage. After a certain number back and forth movements it concludes that the limit of the effective transmission radius is reached he most important advantage of the cooperative search strategy is to shorten the reporting time to the base station when compared to the non-cooperative strategy (i.e., once an object is identified it can instantly be reported back to the base station through the ad-hoc wireless network maintained by the robots acting as relays).

Preamble (3x55h) (3 Bytes)	"Z" (1 Byte)	"#" (1 Byte)	Receiver id (1 Byte)	Sender id (1 Byte)	Data length (n) (1 Byte)	Data (1 to 18 Bytes)	Checksum (1 Byte)

Fig 6. Communication packet format

Fig 5 presents the mission completion time for the cooperative search strategy. As discussed in the previous subsection the mission completion time increases (again almost linearly) with increasing distance between the base station and the object. As can be seen from the figure the mission completion time for case of 20 meters distance of the object from the base station is about 225 seconds, while it is about 410 seconds for the case the object is located at about 40 meters from the base station. This shows that for the 40 m object distance the mission completion time for the cooperative search strategy is about 30 % less than the mission completion time of the non-cooperative search strategy. As the distance and the number of robots increases this may increase even further. The above result shows the effectiveness of the cooperative search strategy and the importance of communication for that purpose. There might be many applications where the communication links to the base station should be kept always on, which may be critical for the performance of the system. However, we would like to emphasize here that we do not by no means claim that the strategy discussed will be more effective in all applications, terrains, and situations. Nevertheless, the study complies with previous results on cooperative search while stresses the importance of dynamic wireless ad-hoc networking in multi-robot system [6]

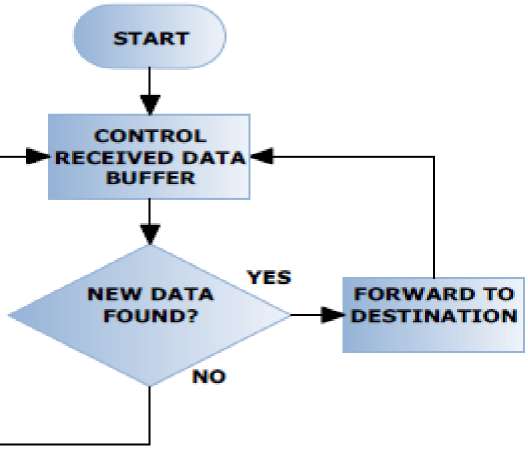

Fig 7. Model Forward Algorithm of Co operative Search

4. ROBOT CONTROL SYSTEM

An important problem for autonomous robots is to ascertain their location in the world and then to generate new maps as they move. A number of probabilistic approaches to this problem have been developed recently .

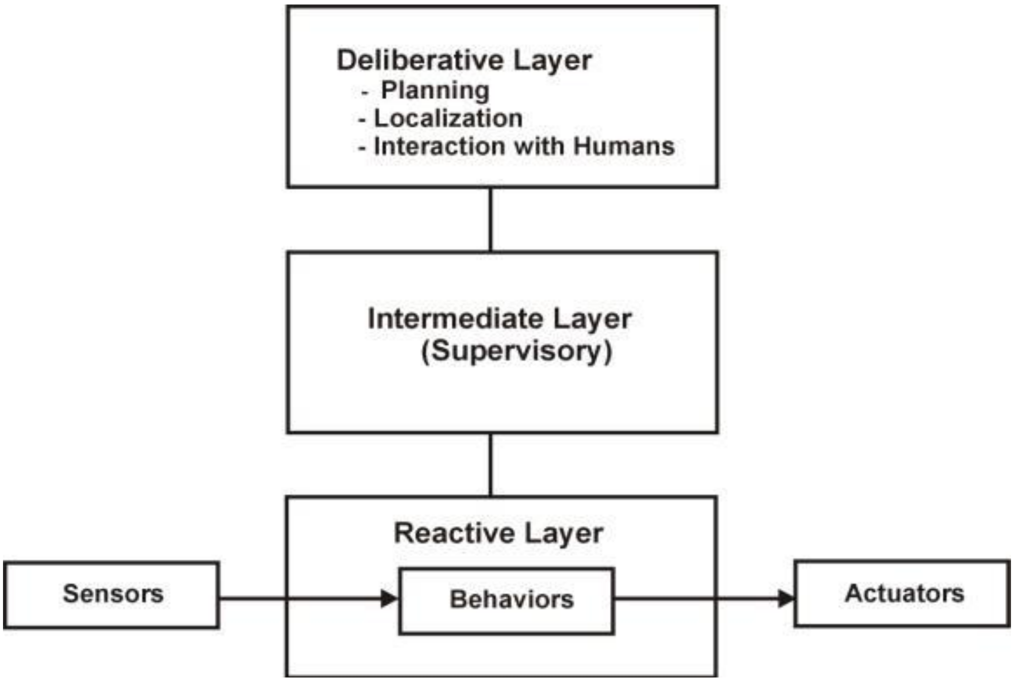

Fig 8.Three level Architecture for Robot Control

Particularly in complex situations it has become clear that robots cannot be programmed for all eventualities [3,4,8]. This is particularly true in military scenarios. Hence, the robot must learn the proper responses to given stimuli, and its performance should improve with practice, increasingly, it will become necessary to deploy multiple robots to accomplish dangerous and complex tasks. The proper architecture for control of such robot groups is still not known. For example, should they be organized hierarchically, along military lines, or should they operate in semi-autonomous sub-groups. In the early days of robotics (and even today in certain industrial applications), robots are enclosed or segregated to ensure that they do not harm humans. However, in an increasing number of applications, humans and robots cooperate and perform tasks jointly. This is currently a major focus of research in the community, and there are several international conference devoted to Human-Robot Interaction (HRI). There is increasing interest (both for military and civilian applications) in developing robots capable of some form of 'shape-shifting.' Thus, in certain scenarios, a robot may be required to move like a snake, while in others it may need legs to step over obstacles. Several labs are developing such systems

5. CONCLUSION

We have presented a cooperative networked dynamic search strategy which can be used in search and rescue operations. Main objective of this project is to make a better and effective communication between Robot systems. This proposed system adapted any type of robot system like military, Ground detection, marine robot & Disaster detection Ext all. And also implemented flexibility movement algorithm, This algorithm is easily handled by Robots in any kind of Situation That strategy combines the aspects of individual search with networked communication. The results of individual search and the results of networked dynamic search are compared with respect to their measured mission time. For the experiments performed the networked search has better timings for larger distances to the searched objects. During the experiments there is a great amount of external electromagnetic noise caused by electronic devices in the building such as the wireless access points located in floors and cell phones. That noise interferes with the communication and sometimes breaks of the network link. As a result the measured maximum communication distances are slightly smaller and the measured times are longer than expected. In a less noisy environment the results will be more accurate and more efficient. In addition with the use of more advanced wireless communication hardware the communication between the robots can be more robust

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