SESSION INITIALIZATION PROTOCOL (SIP) AND BMX6 ROUTING PROTOCOL IMPLEMENTATION FOR SWARM ROBOTICS IN DISASTER MANAGEMENT & RESCUE SYSTEMS

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Abstract- When usual communication system is lost in disastrous situation, it is very difficult to search and rescue people and properties. Coordinated effort of search and rescue robots is very effective when it comes to disaster management & recovery systems. This paper illustrates the coordination between search & rescue robots, how they can react with each other, with the environment, and with the victims to be rescued using swarm robotics. Specially, we have observed and developed patters and communication system using Fire Ants reaction and commutation system when fire breaks-off in their community (how they manage disaster and rescue themselves from the initial damage).

Keywords- Swarm Robotics, Artificial Intelligence, SIP, BMX6, Distance Vector Algorithm, Real-Time Protocol (RTP).

I. INTRODUCTION

Search robots need to explore the areas and send real-time data like video, audio, heat, and other constrains to the control unit for searching disaster victims and finding the environmental conditions. Control unit will continuously analyze the data and setup the priorities among the affected areas to maximize the rescue effort. Rescue robots will be deployed based on these priorities.

II. IP FOR COMMUNICATION PROTOCOL

As it is a non deterministic environment, communication between robots and control unit and between themselves needs to be designed carefully and intelligently so that communication protocol can take care of the search and rescue effort with minimum instruction from the control unit. As a result, application programmers and configuration managers would be able to real-time program the environment form the control unit and in the mean time we need to make sure they can provide real-time data to control unit so that the control agents can analyze the situation and send the instruction set immediately. We have chosen SIP (Session Initiation protocol) based on SCTP to get maximum flexibility and minimum interruption on Hands-off [1] and point-to-point and point-to-multipoint commotion. Wireless Mesh Networks (WMNs) is implemented based on BMX6 routing protocol for dynamic routing establishment so that each of the robots can work as access point and also as point-to-point links between each other.

III. SEARCH ROBOT MECHANISM

Search robots can perform depth first search (DFS) and Custom heuristic search and make priorities among rescue areas so that it can cover minimum areas with maximum victims in order to efficiently perform the rescue effort with minimum rescue robots. Long range point-to-point or point-to-multipoint communication is needed to build a graph where each robot will act like a node to the graph and point-to-point links will also be acting like a node. Control unit will shape this graph to cover maximum area occupied by the victims. And minimum spanning tree will be calculated. Distance between two robots will be maximum distance in terms of point-to-point link without packet loss. In case where point-to-point link cannot be established, robots will be connected through mesh network. Also alternative routes need to be calculated in case where a single link is down. [2]

IV. RESCUE WORKER ROBOT MECHANISM

In order to efficiently perform the rescue effort, the rescue worker must travel and perform rescue effort between the edges/path created by search robots. Within the Edge they will act as groups, each group will be working on a separate SIP conference. And SIP PRESENCE will be implemented so that every robot in the group learns the activity of others in the group which is necessary for coordinated effort.

V. CONTROL UNIT

Control Unit is a combination of Artificial Intelligence, machine learning, neural network, monitoring station, programmer for instant layout, Configuration admin, Watch dogs, Rescue workers and other necessary audience. Robot protocols are implemented on SIP so they can monitor single activity and combine activities at a time.

VI. DEPLOY AND PULL OUT

Robots will be deployed in programmed manner but it is necessary to topple the behaviors as it is a non

deterministic environment, deploy and pull out of certain group need to be triggered. In certain conditions, it is also needed to be regrouped.

VII. CELLULAR HANDOFF

BMX6 routing protocol is the take care of the Cellular Handoff so that movement from one area to another area will occur without hampering the real-time audio and video communication at any time. BMX6 protocol would always calculate the alternative distance vector commutation so that commutation will not break at any point of time. [3]

VIII. MAX FLOW = MIN CUT

Control unit will always calculate Maximum flow of the robots and deploy some robots to protect from Min Cut (Minimum area of communication blockage that hampers maximum flow of the robots).

However, if in unavoidable circumstances some portion get interrupted by signal, search robots of both end would search for the other end signal in a ad hoc network manner.

CONCLUSION

SIP and BMX6 has advantages than any other TCP based protocol for sensitive operation like search & rescue mechanism. Application server for search and secure swam robotics need to be implemented based on the proposal of this paper.

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