Assignment

Paper Title: **Rescue Robots for emergencies**

Course Code: **CSE 444**

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Abstract

The swarm robot was successfully implemented and worked accordingly, As the area, perimeter was given to the robots, they started the search operation by avoiding objects and detecting victims was done by the rescue team by viewing the live feed from the camera. This technique of search and rescue will help in saving time of search operation which is the most crucial part of a search operation. Higher the number of swarm robots used in the field the faster the execution. Due to the hybrid wheel system, it was very easy for the robot to maneuver over several small objects and terrain. For future work the robots can be interconnected via RF pro for better communication when there is no Wi-Fi connectivity in the disaster area, the robots can send data to one another and closest robot to the rescue team or operations team can send the report to the team. Thermal cameras can be utilized to detect survivors instead of detecting it manually.

Background

For next year, we plan to use the lessons learned since 2000 and build the first fully functional robotic rescue swarm. We expect the swarm to consist of at least twelve robots. The robots will be legged and have most of the same sensors that were on the BoeBots in Blue Swarm 2.5. The CMUCam may be replaced with a camera that is capable of sending still frames to the base station. The robots will also have redundant communications channels – both RF and infrared. They will be programmed with a swarm behavior that causes individual robots to be repulsed by other robots and by obstacles that don’t show signs of being a victim, until they only have line-of-sight communications with two neighboring robots. At that point they will stop moving and become part of a dynamic communications network created by the robots in the swarm. The network will be used for creating a map of the area that will be relayed back to the base station receiver. Some initial simulations have been done for this behavior and have shown great promise in all areas of the USR arena. Figure 8 shows a screen shot of one of these simulations that was done in StarLogo and was described in (Stormont 2003). Another objective for the 2004 USR competition is to get more students involved. In past years, the team has varied from one to four students. For next year, we would like to get at least eight students from electrical and computer engineering, mechanical engineering, and computer science involved. The AAAI mobile robot competitions always provide a rewarding experience for students involved in them and the USR competition provides many opportunities for student participation from a wide range of backgrounds. We are looking forward to a productive and interesting challenge in San Jose.

Results

The GUARDIANS project aims to take swarm robotics to the next level by trials in a real-world application. We have selected to apply the robots in the scenario of a warehouse in smoke. We discussed the algorithms that make the robots follow a human fire-fighter. Next, we discussed the wireless communication system consisting of a continuously evolving ad-hoc wireless network. In thick smoke most conventional sensors fail. The radio communication network, although very coarse provides a means to locate the robots and humans. The interaction from the human to the robots is very distinct from the interaction of the robots with the human. The robots spread out around and follow the firefighter; by moving on the human being directs the robots. Thus, we have designed a human–robots swarm interface requiring very little cognitive effort. The robots can transfer guidance information to the human. In collaboration with the fire-fighters we have designed and tested several interfaces for obtaining guidance from the surrounding robot swarm. An outstanding issue is whether a feel of confidence can be created. When searching a fire ground, the fire-fighters follow walls for position and bearing. Our experimentation with the fire-fighters showed that it is against their sense of good practice to give up the bearing of walls, etc. We have discussed tragic examples of human fire-fighters who got lost in such circumstances. Overseeing our work, the hardest problem seems to be localization and mapping under smoke conditions causing poor visibility. A swarm of robots bringing in a variety of sensors and communication equipment provides advances. However, although the loss of a single robot could be acceptable, chances of losing the whole group would undermine the reliability of the solution. To reduce risks and to enable localization and mapping under the worst conditions we decided to copy current practice of the fire-fighters and utilize, wherever possible, building walls for orientation and bearing.

Algorithms:

Step 1: Input area perimeter to the swarm robot

Step 2: Robot divides the area and start searching

Step 3: If obstacle detected change direction

Step 4: If edge detected change direction

Step 5: Find temperature of area and transmitit to the firebase cloud database.

Step 6: Find live location of robot and transmitlocation to the firebase cloud database.

Step 7: If robot damaged assign nearest robot the task of damaged robot.

Step 8: If human survivor found in camera retrieve live tracking location.

Addition Algorithm

```
Input:    integer n
Output:   integer m, where m = n + n
Method:   n + n is computed by doing a lot of convoluted
          steps in order to show how an algorithm can be
          presented.

input(n);

m = 0;         /* m is an integer */

/* After the following “for” loop, m has the value n */

for i=1 to n
      m = m+1;   /* indent to make code readable */
end;

/* Try to avoid page breaks in an algorithm ….    */
/* If you cannot avoid, break at a logical point  */

m = add(m, n);

/* At this point, m = n + n */

print(m);

end;

function add(integer x, integer y) return integer

      return(x + y);

end add;
```

Conclusions:

This system developed for the mobile search and rescue robots are being tested indoor in a laboratory between tables, chairs and miscellaneous obstacles. Within the environment there are uncontrolled RF interferences of different sorts, including Wi-Fi routers, mobile phones, activated The suppression indices from the suppressor cells have priority over all others, it is being evaluated first to see whether the estimation based on encoders, sensor network, and compasses comply with each other. If the suppression index is low, meaning the estimation from sensor network agree with additional sources (encoder and compass) the suppressor modulator will not react strongly. If the Affinity Index is low, meaning the RSSI data is sable, the system will behave in tolerant International Journal of Advanced Science and Technology Vol. 3, February, 2009 77 mode. Otherwise, the suppression index is high or the affinity index is high, the system will switch to aggressive mode. RFID systems, Bluetooth devices (keyboard and mouse), and EMF from various mechanical devices. Despite the abundant sources of interferences, the test environment is far from practical for what this system is designed for. Long term work is to develop methods to evaluate accuracy of sensor network estimated position against actual position in obstructed environment, i.e. in rubble. This work would provide a base to compare and evaluate results of different control and tracking algorithms. In addition, technologies and methods that can help to setup the system quickly for emergency application is another important area to make the system truly applicable.

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