RoboCupRescue

Robot League Competition

Padua, Italy

July 4-11, 2003

PARTICIPANT INFORMATION SHEET

TEAM NAME: Naji	ORGANIZATION: Islamic azad university of qazvin
CONTACT NAME: Dr. Ali M. Shahri Reza Mirani	COUNTRY: Iran
TOTAL NUMBER OF TEAM PERSONNEL: 9 students	EMAIL: Shahri@just.ac.ir , rezamirani@yahoo.com
ROBOT NAMES: Nejat	TELEPHONE: +98 2813341017,+98 281 2554175
WIRELESS FREQUENCIES (PER ROBOT): 2GHz,200KHz per robot	FAX NUMBER: +98 281 3341017

☑ PRE-REGISTERED ☐ REGISTERED ☐ ARRIVED ON SITE ☐ COMPETITION READY

PLEASE DISCUSS YOUR APPROACH TOWARD KEY DESIGN CHARACTERISTICS (WITH EMBEDDED PICTURES):

Locomotion:

As we are working on two different robots, the first one is based on wheels and the second one is based on a special design using wheel-chain, which is shown in Figure 1.

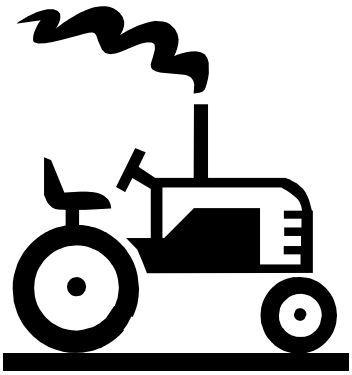

Figure 1: Robot with wheel-chain mechanism

We have used two identical dc servomotors to drive each robot. The robot may travel forward or backward by driving two motors in CW or ACW direction and it may rotate around its center of gravity by driving motors in reverse directions. The second robot is designed somehow to be able to climb hills and stairs, with about 40 cm of height.

It should be mentioned that all the mechanical design process are carried out by our team members using AutoCAD2002 and simulated by 3D-WORKINGMODEL. All the robot parts are built by CNC machines.

The servomechanism control system is based on an embedded microcontroller and H-bridge driver using PWM method. The velocity and position of the servomechanism are controlled using both optical encoder and dc tachometer.

Sensors for navigation:

In order to navigate the robot in an unknown environment, a set of two cameras are used to help the operator to command/guide the robot and also a set of ultrasonic sensors to detect unknown obstacles which can be used in an automatic collision avoidance algorithm. As we have used digital compass and optical encoder for localization, these sensors can also be used for navigation as well.

Sensors for victim identification:

We are planning to detect victims using a sensor fusion technique with logical combinations of camera images, chemical, audio, and tactile sensors. The camera and other sensors data collected and managed by the operator are also processed using sensor fusion technique.

Sensors for localization:

The localization in both robots is carried out by different methods to increase the precision and certainty. Conventional Dead Reckoning in conjunction with a digital compass decrease the error associated with this method.

We are also working on an ultrasonic based active beacon method to locate the robot. In this method a few ultrasonic transmitters are located around a field and receiver is on the robot. Having the correct location of each transmitter, the location of the robot can be calculated.

Control scheme:

The control scheme is partial autonomy. It means that camera images are sent to the computer are processed by operator to guide the robot while lower level control systems such as collision avoidance algorithm

Communications:

The robot location, speed, and other data collected by the applied sensors are sent to the computer using a RF wireless communication system. The communication protocol is PDW with FSK modulation using a 200 KHz carrier signal, which different sampled parameters, are multiplexed. A 400 KHz pulse signal is used as a synchronized signal.

In order to send video images a commercial video sender with 2 GHz career signal is used.

Map generation/printing:

Map generation method is based on the operator assessment in conjunction with the collected data and a GUI program, which enables operator to locate and register different object such as victims, obstacles, walls and doors. As the robot proceeds to search and identify the field, the map of the environment will be developed which might be printed at the end of the robot mission. This map might be memorized in the robot embedded control system to be utilized in automatic navigation algorithm.