Abstract

INTELLIGENT CONTROL SYSTEM FOR A MOBILE ROBOT VIA INTERNET

Intelligent control and tele-operation of mobile robots are fundamentally important in robotics. In this thesis, neural network dynamics and robot-vision fuzzy based approaches are proposed for real-time path planning and control of mobile robots systems, with the advantages of internet monitoring and control. The biological inspiration and the theoretical background of the neural network models used in this thesis are proposed. Comprehensive parameter sensitivity analysis of these models are introduced. It shows in details how each of the models' parameters affect on the model's output.

Novel virtual instrumentation based systems for real-time collision-free motion planning and tracking control are proposed, they are computationally simple and eff cient in comparison to other approaches which act as a new soft-computing platform to implement a biologically-inspired neural network. This neural network is topologically arranged with only local lateral connections among neurons. The dynamics of each neuron is described by either Grossberg's shunting equation or gated dipole model with both excitatory and inhibitory connections to introduce safety to the motion planning. The dynamical behavior of the shunting neural network for the real-time motion planning in non-stationary environments when the robot has limited onboard sensors is also considered.

Gated dipole neuro-dynamics approach is proposed for real-time collision-free path planning in dynamic environment. The motion is planned through the dynamic activity landscape of a neural network. A comparison study between the results obtained by the shunting-based and the gated dipole-based neural networks is proposed, It shows that the gated dipole model is less sensitive to the changes of the model parameters.

A novel vision-based fuzzy controller for autonomous mobile robot navigation to track a colored moving target is developed. This controller can be monitored and con-