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# Collision Avoiding Motion Planning of Autonomous Robots with MANETs

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**Keywords:** multi robot, networked robots, motion planning, real time, large scale testbed, emulation, simulation.

In disaster area or office building or home, multiple autonomous networked mobile robots so as to act insted of human beings. Rescue robots enable to accomplish many tasks in dengerous places where humans cannot enter, such as sites where harmful gases or high temperature are present, the hard environment for human. Cleaning robots can work automatically and save costs by performing various routine tasks. In all these examples robots have to move to their destination in order to perform their function. For this purpose they need to be able to recognize the changes of environment around them and equip a motion-planning method in order to avoid other robots and obstacles which have probability making collision with them in real time.

In this research topic, the experiments for evaluating such research are difficult, since the cost of these real autonomous robots is high. This is particularly true if researchers want to make experiments more than a few robots, and need to test systems with tens or even hundreds of robots. Then many researchers try to experiment or evaluate their algorithms or methods on software simulators. But the results from these simulators may not be reliable. The defference between real system and simulators may be much big. In real environment, many kinds of noise affects conditions. For example, the connection on real environment is affected by electric

waves and magnetic field and so on. Researchers can not always obtain good results on real system, even if they have once obtained good results from experiments on simulators. Then the system needs some solutions on purpose of covering this difference.

In this paper, on purpose of constructing the system of large scale autonomous networked mobile robots, two main topic are menthioned. One is the motion planning method of these robots. And second one is the experiment platform of these system.

The motion planning method is based on PRM (Probabilistic Roadmap) method. The environment is assumed to changing dynamic in real time, the proposed method makes a point of the speed. The method is divided into *Expansion* and *Connection*. Expansion expands the roadmap and afterward Connection check whether the roadmap and the destination can connect or not. By repeating above methods, the path to the destination is found. The proposed motion-planning method is implemented and evaluated on folloing system.

The experiment platform is fulfilled by *Emulation*. Emulation is different of *Simulation* by modeling, it means that imitate the objects. For constructing the experiment environment, StarBED which is a large scale testbed is suitable. StarBED equips more than 700 PCs and switches which connect them. The hardware structure assumed to real of robots is emulated by the communication with *Map Manager* which administrate all of robots. The communication assumed WLAN between robots are emulated by configured wired network. This configuration is realized by applying the configuration parameters from QOMET (WLAN emulator) to dummynet. These communications are separated on *Management Network* and *Experiment Network*. Finally RUNE which integrate large scale experiment environment controls this system.

By the experiment with proposed experiment platform with proposed motion planning algorithm, it enable to construct large scale autonomous networked mobile robots system.