The aim of the work presented in the dissertation, is the development of an open-source software tool, Rana, which enables real-time constrained simulation of multi-agent systems. Multi-agent systems research is a branch in the field of AI where focus is not on single agents, but rather on the emergent properties that arises from societies of agents.

Rana represents the event driven simulation. This means that it has a focus on representation of perceivable agent actions, called events. The Rana event is a flexible information construct that can be set to propagate across the environment in simulated physical time.

Rana's modelling paradigm offers flexible design of agent behaviour, which allows for separation of behavioural definitions for event handling and internal agent actions, both of which can be constrained by a real-time precision level. Each agent has a number af Rana specific modules at its disposal, these enable, collision detection, environment interaction, event generation and more. A number of demonstration agents is developed to illustrate the different facets of Rana agent design.

As a further expansion to the modelling paradigm an event processing function is introduced. Its purpose is to provide a common interface for defining the nature of an events propagation. This provides an interface for determination of event relevance during a simulation, and for visualization of a simulations event-scape. Two different simulations are presented that demonstrate event-processing functionality in agent design and for visualization.

As a tool Rana offers a graphic user interface for live event visualization, agent feedback and simulation configuration.

To establish Rana as an end-user tool, it is evaluated against the existing state of the art for multi-agent systems simulation tools and three different Rana models are presented: traffic, mining robotics and acoustic driven male chorusing.