SWARM INTELLIGENCE BASED SOLUTION FOR NAVIGATION OF UNMANNED GROUND VEHICLES

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Declaration

I declare that this dissertation does not incorporate, without acknowledgment, any material previously submitted for a Degree or a Diploma in any University and to the best of my knowledge and belief, it does not contain any material previously published or written by another person or myself except where due reference is made in the text. I also hereby give consent for my dissertation, if accepted, to be made available for photocopying and for interlibrary loans, and for the title and summary to be made available to outside organization.

Name of Student — Signature of Student

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Supervised by

Name of Supervisor(s) — Signature of Supervisor(s)

Prof. Asoka S. Karunananda — Date:

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Abstract

There are many circumstances where involvement of a human driver to control vehicles is not feasible. The best examples for the above mentioned scenarios are the applications based on Astrology. As a solution to this problem, researchers are trying to create unmanned autonomous vehicles. Most of these researches have been conducted using the power of artificial intelligence. Nevertheless unmanned autonomous vehicle navigation is one of the biggest problems in the current era of artificial intelligence. It is more difficult when vehicles are navigating dynamically changing environment. This thesis presents a swarm intelligent based solution for the navigation of unmanned ground vehicles within dynamically changing environment.

The proposed solution uses only local information around the vehicle, as in reality human driver also getting decisions based on the partially observable environment. System then uses current positions of unmanned vehicles as inputs and provides future positions of unmanned vehicles as the output. Also this proposed system consists of three main modules called data acquisition module, data processing and decision making module and decision execution module. Data acquisition module collects data from other agents and from the environment. Data processing and decision making module acts as the brain of the system and decision execution module executes the output of the decision making module.

Evolutionary computing and machine learning are main techniques which were used behind this proposed system. System initially uses evolutionary computing technique to navigate in an unknown environment. But when system familiarize with the environment, it tries to work with its prior knowledge by using machine learning techniques. Ultimately vehicles will navigate as swarms of vehicles to the targets. Evaluation illustrates swap mutation is more efficient than Gaussian mutation in evolutionary computing approach. Neural network works 98% accurately when we use 25000 training samples in the machine learning module. Final evaluation uses both computer simulated environment and small real toy vehicles to demonstrate the solution. Upon completion of the final system, we can observe a successful target oriented navigation of vehicles in a partially observable environment using swarm intelligence based approach.

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