Decentralized Autonomous Rovers

*Freedom Rover Units

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***Abstract*—The state of the art in autonomous swarms employs a decentralized model consisting of multi-agent networks. These multi-agent systems hold the potential to adapt to new environments and optimize individual performance to specific tasks without having to deal with global systems prone to single points of failure. Our team's focus lies therein in developing a decentralized multi-agent system. The decentralized multi-agent system will incorporate three to five two-wheel drive rovers interfaced through the Robot Operating System (ROS) by raspberry pi 4 companion computers for edge-computing specifications. A central system is still beneficial for the assignment of global objectives; thus, our proposed decentralized system will employ a central bay station to communicate objectives for the agents to complete (carefully designed demos). LiDAR, simple infrared sensors, and low-resolution cameras will be procured to facilitate real-time (RT) decision-making by the agent(s) in response to the environment. Our development stack will leverage ROS for project management, simulation capabilities, navigation libraries, and native server-client model in robotics applications. The rovers AI will incorporate simultaneous localization and mapping (SLAM) techniques for RT positioning based on a priori grid or map; thus, facilitating navigation through improved state space mapping. Decentralized swarms allow for a set of agents to act as more than distributed actuators: i.e., more like your white blood cells rather than your limb as observed by central systems. Furthermore, drone Swarms hold the potential to gather large quantities of data for monitoring and area mapping that would otherwise prove too costly to collect, and can greatly simplify and reduce manpower in search-and-rescue, disaster recovery, or security scenarios. Swarms essentially hold the capability to replace humans in potentially dangerous and normally costly tasks.**

***Index Terms*—Decentralized Communication, Swarm Communication, Multi-agent, ROS, Gazebo**

I. Introduction

This document is a model and instructions for LaTeX. Please observe the conference page limits.

II. Background

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TABLE I
TABLE TYPE STYLES

Table Head	Table Column Head		
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[a]Sample of a Table footnote.

Fig. 1. Example of a figure caption.

"Temperature/K".

IV. Discussion

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V. Demo Description

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Acknowledgment

References

Please number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use "Ref. [3]" or "reference [3]" except at the beginning of a sentence: "Reference [3] was the first ..."

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For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

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