Alternate *ACM* SIG Proceedings Paper in LaTeX Format*

[Extended Abstract] †

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ABSTRACT

In this paper we present Autonomous high-level control system for modular robots Perception-informed control synthesis for autonomous An autonomous robotic system that synthesizes controls to accomplish manipulation and locomotion tasks in a way that is informed by on-board sensing Perception-informed autonomous system for modular robots that SAVES THE WORLD!!! #Unicorns #DonkeyWithTrafficCone

CCS Concepts

•**Computer systems organization** → **Embedded systems;** *Redundancy;* Robotics; •**Networks** → Network reliability;

Keywords

ACM proceedings; LaTeX; text tagging

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‡Dr. Trovato insisted his name be first.

§The secretary disavows any knowledge of this author's actions.

¶This author is the one who did all the really hard work.

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1. INTRODUCTION

2. SMORES-EP MODULAR ROBOT

Our system is built around the SMORES-EP robot, but could easily be adapted to work with other hardware platforms. In this section, we provide a brief introduction to the technical capabilities of SMORES-EP.

Each module has four DoF - three continuously rotating faces (left, right, and pan) and one central hinge (tilt) with a 180° range of motion (Fig. 1). The DoF marked left, right, and tilt have rotational axes that are parallel and coincident. A single module can use its left and right wheels to drive around as a two-wheel differential drive robot. All four faces of the SMORES-EP module have electro-permanent (EP) magnets that serve as low-power, hermaphroditic connector for self-reconfiguration . Any face of one module can connect to any face of another.

Some of the motions a SMORES-EP cluster can perform are limited by the strength of the magnetic connectors, which can support the weight of at most three modules cantilevered horizontally against gravity. This limitation is alleviated in some cases by using rigid connector plates, which are screwed into the faces of two modules to create a strong permanent connection between them. Using connector plates, up to four modules can be cantilevered before exceeding the torque limits of the motors. However, because the connector plates must be manually screwed into place, modules with connector plates cannot self-reconfigure.

Each module has an onboard battery, microcontroller, and 802.11b wireless module to send and receive UDP packets. In this work, clusters of SMORES modules were controlled by a central computer running a Python program that sends wireless commands to control the four DoF and magnets of each module. Battery life is about one hour (depending on motor, magnet, and radio usage), and commands to a single module can be received at a rate of about 20hz. Wireless networking was provided by a standard off-the-shelf router, with a range of about 100 feet.

The cluster is localized using AprilTags [**?**] mounted on one or more modules. In our experiments, AprilTags were also mounted on objects of interest in the environment. The AprilTag tracking software, high-level planner, and SMORES-EP cluster control software were all run simultaneously on a Dell laptop (2.4GHz, 4Gb of RAM) with an overall control loop time of about 4Hz (limited by the AprilTag detection software).

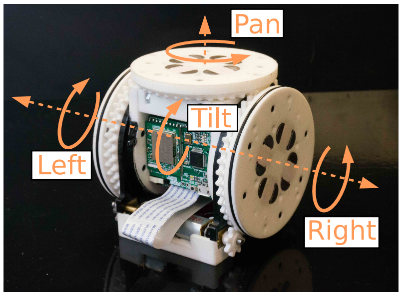

Figure 1: SMORES-EP module

3. RECONFIGURATION

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5. REFERENCES