Modular Robotics: Molucube

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INTERFACE CONTROL DOCUMENT

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Interface Control Document
FOR
Modular Robotics Molucube

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1. Overview

This document will provide information on how each module will interface with other modules, as well as how the user will interface with the robot itself. It also contains information on the expected size of modules as well as how the robot will be powered.

2. References and Definitions

2.1. References

Multiple object detection using OpenCV on an embedded platform (14867857)
22 Oct 2014

Real Time Object Detection and Tracking Using Deep Learning and OpenCV (18357982)
12 Jul 2018

New object detection features in the OpenCV library (384)
10 Sep 2011

2.2. Definitions

LiPo	Lithium Polymer
OpenCV	Open Source Library for Computer Vision
SSH	Secure Shell
TBD	To Be Determined
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus
YOLO	You Only Look Once
PCB	Printed Circuit Board

3. Physical Interface

3.1. Weight

The weight of the robot is still TBD, as no weight requirement has been set.

3.2. Dimensions

The overall dimensions of the robot may vary depending on the application and the configuration for the task we want to accomplish. However, generally each module's dimensions should be 4"x4"x3" (LxWxH).

3.3. Mounting Locations

One of the main features and characteristics of the modular robot is that it can be reconfigured and mounted differently based on the task at hand.

4. Thermal Interface

To prevent the Raspberry Pi from thermal throttling or potentially being damaged from overheating, it will be equipped with a heat sink.

5. Electrical Interface

5.1. Primary Input Power

Primary input power will be 22.2v DC provided by 2 x 22.2v lipo batteries placed in parallel with each other. This will be connected to the battery management system to ensure battery safety and proper charging and discharging. Then voltage will be dropped by using buck converters to obtain 12v, 5v and 3.3v outputs that would then be distributed to the rest of the robot.

5.2. Current Levels and Voltages

The voltages required by the Wheel motors, Gripper Linear Actuator, Gripper Servo and Raspberry Pi are 12v, 12v, 5v and 5v respectively. The current draw from the motors at max (stall) will be 9A but we will run them safely at 5A as well as the linear actuator. The others don't draw as much current since they have low resistances. The Buck converters would be able to produce a max output of 2A on the 3.3v and 5v outputs and 5A on the 12v output rail.

5.3. Signal Interfaces

The Raspberry Pi will communicate with other modules via the UART serial communication standard. Communication with the camera will be done via USB.

5.4. User Control Interface

There will be no specific user interface with the robot, as it is intended to be autonomous. Users can interact with the robot either through directly editing the SD card to add user-created programs, or through an SSH connection via either WIFI or Bluetooth to transfer or write new programs to control the robot.

6. Communications / Device Interface Protocols

6.1. Wireless Communications

The Raspberry pi will have a WiFi module using IEEE 802.11 standards, and/or a Bluetooth module using Bluetooth 5.0 for remote configuration of the controller module.

6.2. Video Interface

The camera module will be responsible for providing the video footage real-time to the controller module, through a USB connection, where the video will be processed and objects will be identified.

6.3. Device Peripheral Interface

Intermodule communication will be handled by a UART serial connection, and the camera will be connected via USB.