RoboEdu: Unlocking the Magic of Robots for Everyone

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Introduction

As robots become increasingly integrated into our society, the need for robotics education grows more urgent. However, teaching robotics can be challenging, particularly when it comes to making complex concepts accessible to both entry-level and advanced students. Our project aims to address this challenge by providing a modular web framework for building and sharing robotics tools and visualizations. Our framework offers a crucial building block for creating functional and interactive robotics coursework, particularly in the area of robot data visualization and graphical robot interaction. The hope is that this tool will help lower the barrier to entry for educators by providing a simple, easy to deploy system for their robots.

Current Challenges

- Robots are expensive – Development of educational robotic systems are expensive. While large institutions can afford to develop systems for robotics coursework, smaller institutions (e.g. minority serving institutions), face larger barriers to entry due to the expense of such systems.
- Maintaining a robot is difficult – Robots love to break. That's why it's important that fundamental systems just work. Current solutions for interactive robot control via web-based systems face constant set-backs and require constant maintenance.

Our Solution

Despite being designed to solve a small-scale challenge, the M-Bot Web App Toolkit offers several unique features that make developing robots for robotics education more accessible. Below are some of the features that the RoboEdu toolkit provides:

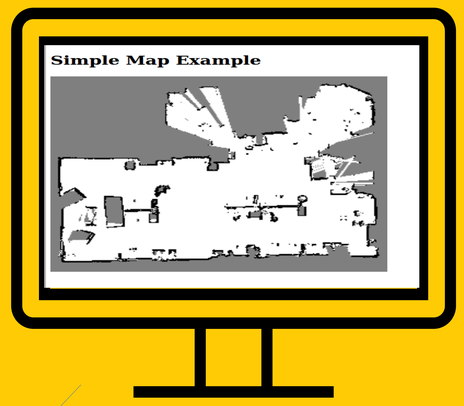
•**Interactive Web Application**: The toolkit offers an interactive web application that allows users to program robots with ease and simplicity.
•**Easy Installation**: The toolkit provide a one-liner for installation and configuration on your robot.
•**Powerful CLI**: The toolkit provides a command-line interface (CLI) that enables users to manage the web application.
•**Modular Framework**: The toolkit's modular design allows users to easily develop and share custom tools and visualizations for their robot.
•**Git-Powered Tool Installation**: The web application offers a git-powered installation tool to quickly install open-source tools to your robot.
•**NPM Packages**: The toolkit offers NPM packages that enable users to develop and deploy their open-source robot tools, promoting collaboration and innovation in robotics education.
•**Open-Source:** The entire toolkit is available for free on GitHub

Moving Forward

Despite the progress made in developing the M-Bot Web App Toolkit, there are still some areas that need improvement. Here are some of the features that we would like to add in the future:

1.Comprehensive Set of Pre-made Packages and Tools
2.Website Showcasing the Application and Available Tools
3.Comprehensive Guides for Using and Extending the Web Application

The future of educational robotics tools is RoboEdu. Experience our open-source robotics platform now.



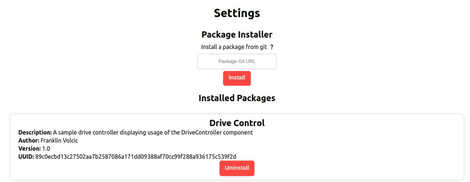


Image 1: A screenshot of the settings page, where you can view, install, and remove packages

Sample Drive Controller and Map package

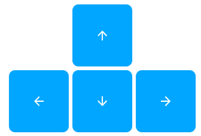


Image 2: An example of a ros2 connected drive controller which is provided as an open source package

Provided Tools

Web Application
Easy Installation
Powerful CLI
Modular Framework
Git-Powered Tool Installation
NPM Packages

Technical Details

• **Web Application**: built using React as the framework of choice
• **API**: The robot comes with an API built using Flask and is served using waitress, WSGI server
• **CLI**: A python-based application which only requires python to be installed on the user's system
• **Server**: Nginx is the backend tool that serves content to the front-end
• **Ubuntu:** Developed for Ubuntu specifically

Next Steps and Future Goals

- Provide Pre-built tools
- Build a website to showcase the tools
- Create guides
- Deploy web application on all M-Bots at Michigan
- Help other schools integrate the M-Bot into their robotics education solutions

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