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MECHATRONIC SOLUTIONS

WMR-HILS

Advanced Mechatronics Laboratory
Hardware In the Loop Simulation

With the WMR-HLS as a mechatronics testbed you can experiment a set of different indoors robot navigation based on Hardware-in-the-Loop Simulation fast prototyping approach with less time and cost compared to traditional prototyping approach

Topics covered in *UML-HILS:*

- System identification and modelling
- State Space Feedback
- Non-Linear Control
- Real-Time Embedded Control
- Hardware-In-the Loop Simulation
- Vehicle Navigation
- Obstacle avoidance
- Motion planning
- Sensor fusion
- Multi-agent formation and cooperation of WMRs Teleoperation
- Virtual Instrument
- Labview HMI

HILS Advantages:

HILS have many advantages including:
Real-time tuning of system parameters which greatly reduces the time spent for developing embedded control systems, **Ease of modifying control** algorithms using well-known industry proven software like **Simulink** and utilizing the real hardware and mechanical architecture in the development process hence enabling a more accurate system modeling.

WMR-HILS as an e-Laboratory

A remote laboratory is an experiment, demonstration, or process running locally but with the ability to be monitored and controlled over the Internet from within a Web browser.
WMR-HILS is interfaced to a PC via Zigbee. This PC is configured as a LabVIEW 7 Web server which might be accessed through internet by students.

Since the Mobile Robot of the UML-HILS design is ROS compatible so it comes with special ROS stack which contains all necessary drivers for initiating the Mobile Robot with ROS platform, you may easily test other ROS stacks on this platform such as:
navigation, mapping, vision, path planning and etc.

This stack also contains special simulator which simulate real flight data while the WMR-HILS platform stand steady, so you can safely and easily test your control and navigation algorithm before Moving the Mobile Robot in real world.

ROS Enabled
SIMULINK Enabled
LabVIEW

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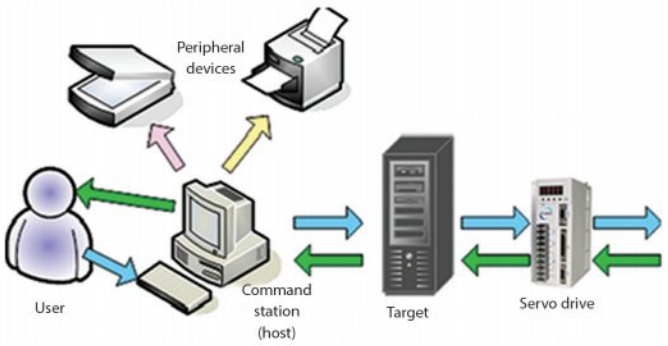
Wheeled Mobile Robot Hardware In the Loop Simulation
WMR-HILS



WMR-HILS package includes complete online course/handout materials making Lab. experiments straightforward.

- *WMR-HILS is a two differential wheeled Mobile Robot platform which is designed for research and education purposes.*
- *WMR-HILS is a portable standalone experimental trainer which only needs a PC or a laptop to control onsite or online (remote) through the internet.*
- *WMR-HILS system covers digital, nonlinear, adaptive and robust control.*
- *The plug-and-play feature makes WMR-HILS easy to setup and perform experiments quickly.*
- *WMR-HILS Trainers are suitable for a variety of Control Engineering, Mechatronics, Robotics and Mechanical Engineering disciplines.*
- *WMR-HILS Trainers are suitable for Virtual Universities.*
- *WMR-HILS as a hardware-in-the-loop facility is a good setup to experience novel aspects of Realtime Embedded control and Robotics.*

Why use HILS?

In many cases, the most effective way to develop an embedded system is to connect the embedded system to the real plant. In other cases, HILS is more efficient. The metric of development and test efficiency is typically a formula that includes the following factors:
- Cost
- Duration
- Safety
- Feasibility

HILS is a technique that is used in the development and test of complex real-time embedded systems. HIL simulation provides an effective platform by adding the complexity of the plant under control to the test platform.

The Robot used in WMR-HILS is a differential two wheeled Mobile Robot platform suitable for a wide variety of Mobile Robot research and education purposes. The Mobile Robot is locomated by two wheels/motors. The differential wheeled Mobile Robot is a 2-DOF platform suitable for testing and calibrating the odometery, pose and heading angle of the Mobile Robot. As the caster wheel of the robot could be removed the mobile robot act as a balancing robot. This will prepare a complex situation to control and stabilize the robot.

The onboard sensors including IMU (3 axis Gyro, 3 axis Accelerometer and 3 axis Compass), two wheel encoders, Camera/Stereo Camera (optional), Laser Scanner (optional), 16 sonars and 16 IR range sensors measure the required data for control algorithm in target computer while they are sent to the host computer via w-Lan for monitoring and navigation scenarios run on the Matlab or Gazebo Simulation.

WMR-HIL PRE

The Preliminary model is designed for mostly educational purposes rather than research purposes. It is an ideal tool for teaching Advanced Mechatronics; Embedded Control Systems and Robotics.
So the price of this model for a group of 14 students (7 robots) is equal to one Professional model.

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