# AB_HILS

## Air Ball

### Hardware In the Loop Simulation

The AB_HILS is a Hardware In the Loop Simulation system for student to understand how to design and implement a real-time embedded control algorithm rapidly. In this experimental setup the height of a ball is stabilized by speed control of a DC fan. The fan blow the air in a tube to overcome the gravity of the ball. A set of IR and ultrasonic sensors is used to measure the height of the ball and define the desired level of the ball.

A motorized mechanism is also used to generate air disturbance to measure the robustness of the applied control algorithm. In the HILS structure MATLAB and Simulink are used as the simulation environment in order to simulate some parts of the hardware and control the system by changing the control parameter online. LABVIEW is also used as the GUI to monitor the system. AB_HILS and LABVIEW HMI works well with Hardware In the Loop Simulation.

It is possible to design any kind of controller in MATLAB Simulink like:

- PID Control
- LEAD & LAG Control
- NN and Fuzzy Control
- Adaptive Control
- Non-Linear Control
- …

Why we 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

## Topics Covered :

- Hardware-In-the-Loop-Simulation
- System Modeling & Identification
- State Space analysis
- Real-Time Embedded Control
- Virtual Instrument
- PID control
- Arduino Base Board
- Step response
- Gravity effect
- Labview & Matlab GUI
- Teleoperation
- Disturbance effect
- Frequency Response
- Non-Linear Control
- Height Control

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