Capstone Design Expo Posters                    College of Engineering

2016

# Fluid Routing System: Industrial Automation and Simulation

Sean De Arras
*Virginia Commonwealth University*

Andy Fabian
*Virginia Commonwealth University*

Shellie Lundquist
*Virginia Commonwealth University*

**Team Members: Sean De Arras, Andy Fabian, Shellie Lundquist**

**Faculty Adviser: Dr. Vennie Filippas**

**Sponsor: Newport News Shipbuilding**

**Sponsor Mentors: Wayne Cribb, Paul Summa, Andrew Limbaugh, Walter Rose**

ELECTRICAL AND COMPUTER

# Fluid Routing System
## Industrial Automation and Simulation

CAPSTONE DESIGN EXPO 2016
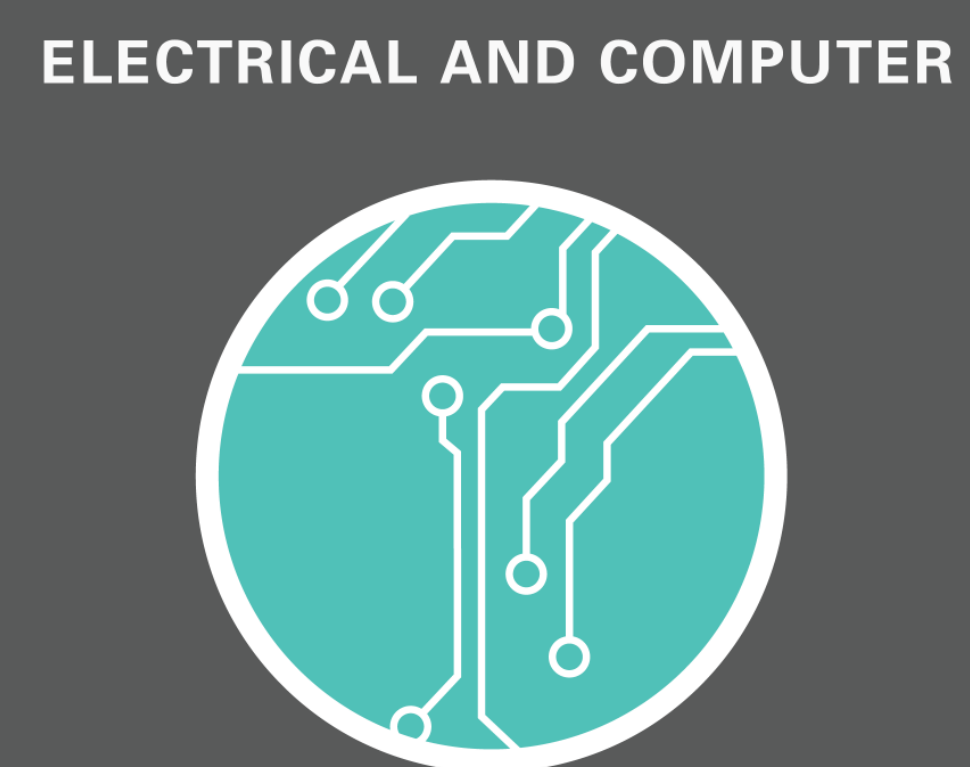
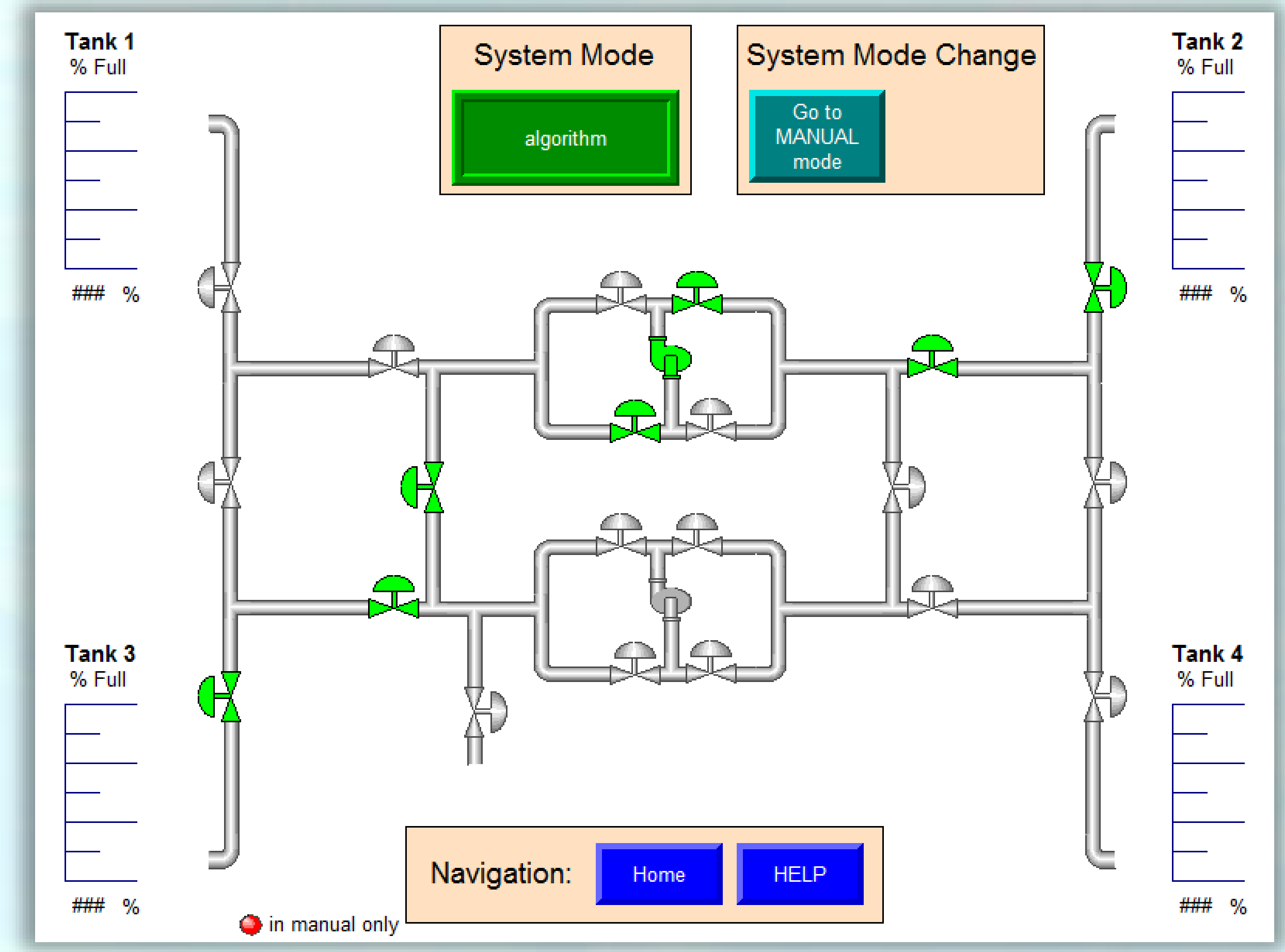## Overview

### Automatic Routing of Complex Fluid Networks

Newport News Shipbuilding builds the biggest ships in the world. These ships store and deliver millions of gallons of fluids via computer-controlled networks of pipes, valves, pumps, and tanks.

Given a need to demonstrate these systems on a small scale, we designed a fluid network that not only can show how shipboard systems work, but also how an added routing algorithm can help increase efficiency in such a network.



Tank 1 % Full

Tank 2 % Full

### %

System Mode

algorithm

System Mode Change

Go to MANUAL mode

Tank 3 % Full

Tank 4 % Full

### %

### %

Navigation: Home | HELP

in manual only

## System Diagrams



HMI — Display & Touch Panel

Custom AC Switched DC Power Board — Powers Pumps & Valves

Demonstration System

PLC — Standard Industrial Controller
- Custom PLC Software
- Routing Algorithm
- Output Modules
- Input Modules

Simulator Interface Boards — Logic-Level Conversion

Simulator

**Hardware Connections**

New Command?

No

Yes

Command Setup

Auto Control

Switch to Auto

Switch to Manual

Clear Sytem

Manual Control

No

Keep Current State?

Yes

**Operational Workflow**

## Areas of Effort

**Core Task** | Mandatory for Project
Build a working physical model of a fluid network

**Core Task** | Mandatory for Project
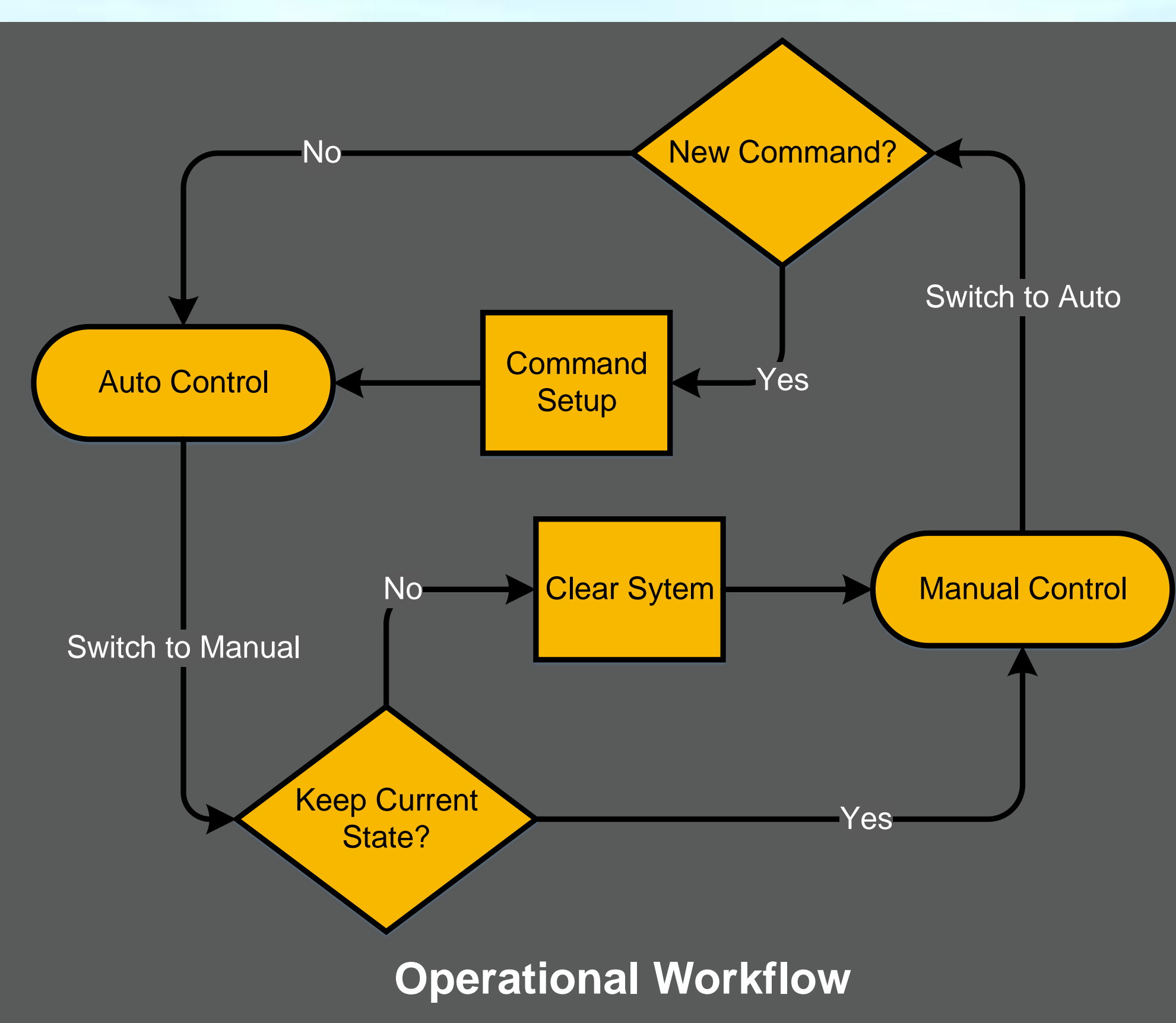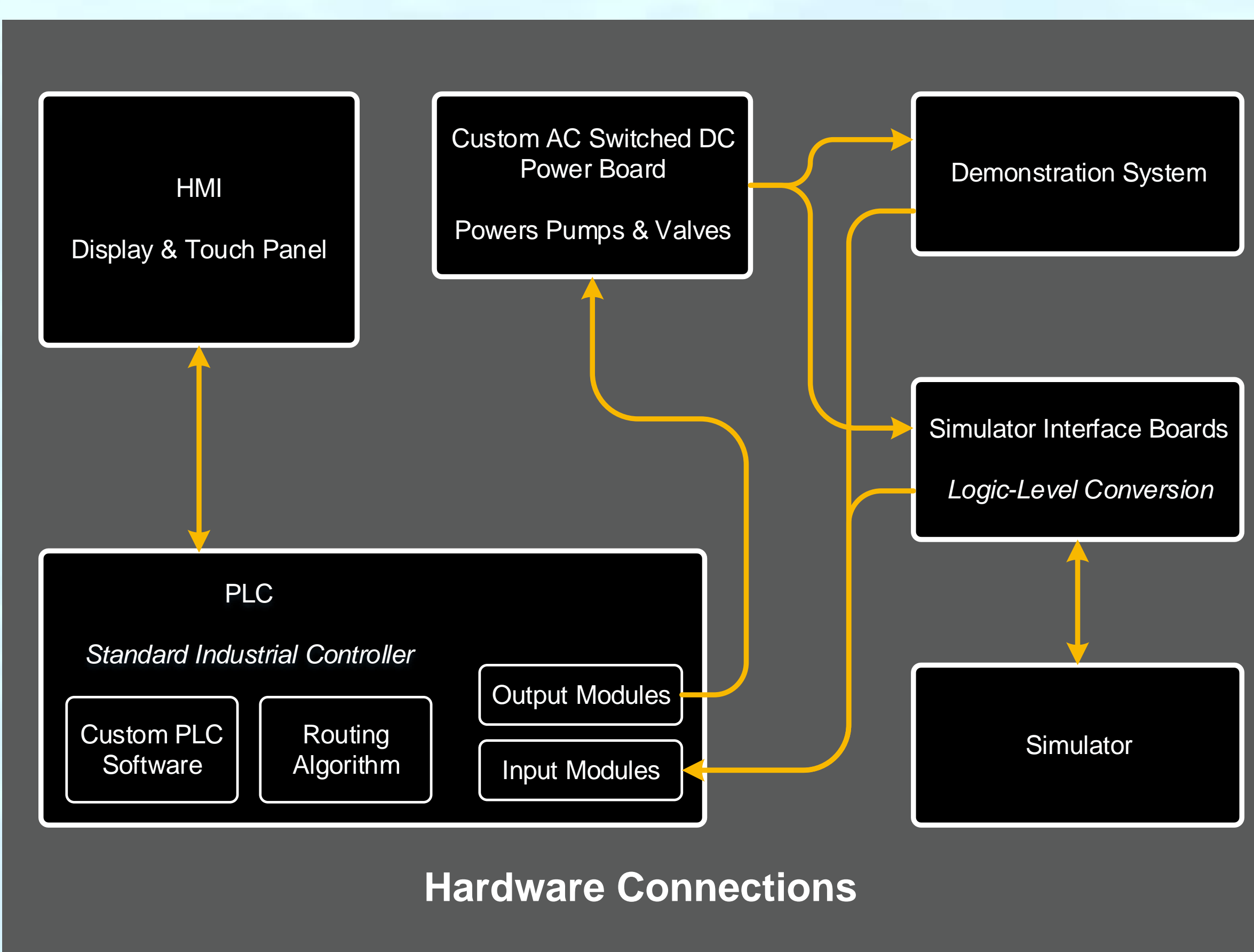Develop electrical interfaces to connect the model to a PLC

**Core Task** | Mandatory for Project
Write PLC code to control the system

**Core Task** | Mandatory for Project
Develop a remote operator display

**Student-Driven Task** | Extra Tasks from Student Interests
Simulate the hardware layer

**Student-Driven Task** | Extra Tasks from Student Interests
Develop an automatic route decision-making module

VCU School of Engineering

Newport News Shipbuilding — A Division of Huntington Ingalls Industries

Huntington Ingalls Industries

Make it real.

VIRGINIA COMMONWEALTH UNIVERSITY