Production Supporting Systems in Factories

ระบบสนับสนุนการผลิตในโรงงานอุตสาหกรรม

Topic

- อุปกรณ์ตรวจวัดอัจฉริยะ
- ระบบสารสนเทศ
- **Industrial Control System (ICS)**
  - SCADA (Supervisory control and data acquisition)
  - DCS (Distributed control systems)

SCADA

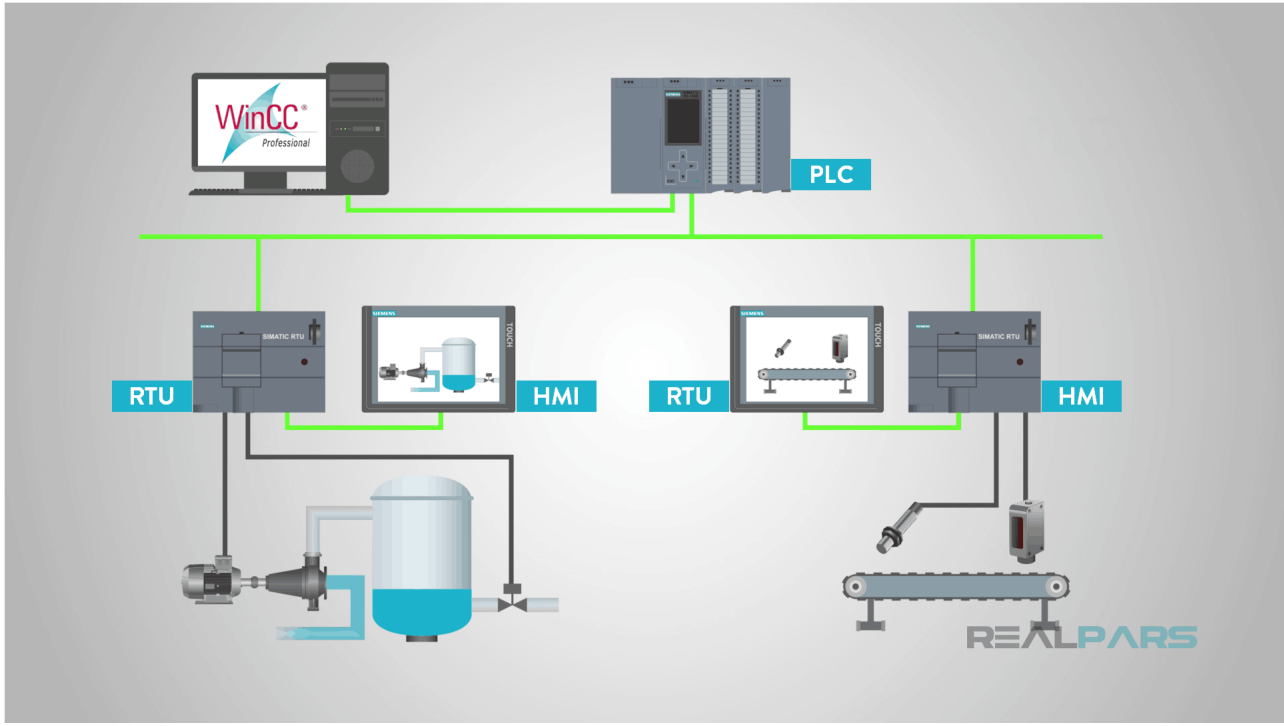
Supervisory control and data acquisition

SCADA

- A system of software and hardware elements that allows industrial organizations to:
  - **Control** industrial processes locally or at remote locations
  - Directly **interact** with devices such as sensors, valves, pumps, motors, and more through human-machine interface (HMI) software
  - **Monitor**, gather, and process real-time data
  - **Record** events into a permanent storage.

Architecture

- **PLC** (Programmable Logic Controller) and/or **RTU** (Remote Terminal Units)
- **HMI** (Human Machine Interface)
- **Field devices** - sensors and actuators
- **SCADA computer**



We will come back to this topic later.

- Now, let's learn about a control system by making a DIY "SCADA".

Project Demo

https://prod-sup.herokuapp.com/ui

Diagram

Link

Components

- `Node-Red App` running on a cloud server (Heroku Cloud)
  - Collect sensor data
  - Displaying sensor data
  - Notifying operator of the incident through `Line App` (on a desktop computer)
  - Writing and reading from `Database` (on Google Firestore)

Components (cont)

- `Node-Red App` runnign on mobile
  - Receive command to toogle a `flashlight`
  - Process and send `accelerometer` data
- `Mosquitto App` running on a cloud server (Google VM)
  - Receiving and broadcasting data from and to both `Node-Red App`.

Protocol

- HTTP (Hypertext Transfer Protocol)
  - Basically the "internet" protocol
- MQTT (MQ Telemetry Transport)
  - Leading open source protocol for connecting internet of things (IoT) and **industrial IoT (IIoT)** devices.

Comparison to SCADA components

Component	Function	SCADA Equiv.
`Node-Red` (Heroku)	Collect data	PLC / RTU
	Display data	SCADA computer
	Notify to `Line`	SCADA computer
	Write to `Database`	SCADA computer

Comparison to SCADA components

Component	Function	SCADA Equiv.
`Node-Red` (Mobile)	Control sensors	PLC / RTU
`Accelerometer`	Measure acceleration	Sensor
`Flashlight`	Light	Actuator

Enough talk. Let's get started.

Module 1-1: Setting up `Node-Red`

- Install Node.js
- Install Visual Studio Code
  - (Winsows) Change `Terminal: Select Default Profile` to `cmd`
- Create a project folder and install `Node-Red`
  - `npm init -y`
  - `npm install node-red`
- Create a directory called `local`

- Change `package.json`
  - Add this line `"start": "npx node-red -u ./local -p 1880"`

```
{
  // ...
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1",
    // Add a new line here
    // Don't forget to add the extra "," above.
    "start": "npx node-red -u ./local -p 1880"
  }
  // ...
}
```

- Start `Node-Red`
  - `npm start`
- Visit the web browser at
  - `http://127.0.0.1:1880` or
  - `http://localhost:1880`

Module 1-2: Navigating around `Node-Red`

Create flows to

- Show timestamp in the `debug` panel.
- Show date and time using `function` node. (See code on the other page.)
- Send continuous random numbers. (Use `Math.random()`)
- Use `switch` and `change`.

```
const payload = msg.payload;
const date = new Date(payload);
const dateString = date.toLocaleDateString();
const timeString = date.toLocaleTimeString();
msg.payload = dateString;
// msg.payload = timeString
// msg.payload = dateString + " " + timeString;
return msg;
```

Module 1-3: HTTP `Get` Request

- Send a `get` request to `http://google.com`.
- Display a response to a `debug` panel.
- Write a response to `index.html`

Module 1-4: HTTP Server

- Create a server that responses to the `GET` request to `/hello` with a string message.
- Reponse to `/home` with an HTML document.

Module 1-5: Public server

- Create an account at `https://ngrok.com/`
- Download the program.
- Copy the `authtoken`
- Run `./ngrok authtoken <YOUR AUTHTOKEN>`
- Run `./ngrok http 1880`
- Copy the URLs to the web browser.

Module 1-6

- Create a server that receives `POST` requests.
- Send the transformed message back.
- Try sending the post requests to your friends public address.