

SCADA

Supervisory Control And Data Acquisition

Ramtin Raji Kermani
Fall 2005

Computer Sciences & Engineering Department
Shiraz University



SCADA

Supervisory Control And Data Acquisition



Road Map:

- What is a Control System?
- What is SCADA ?
- Where and why SCADA is used?
- SCADA architecture
- Components of SCADA
- Security issues
- Modern features

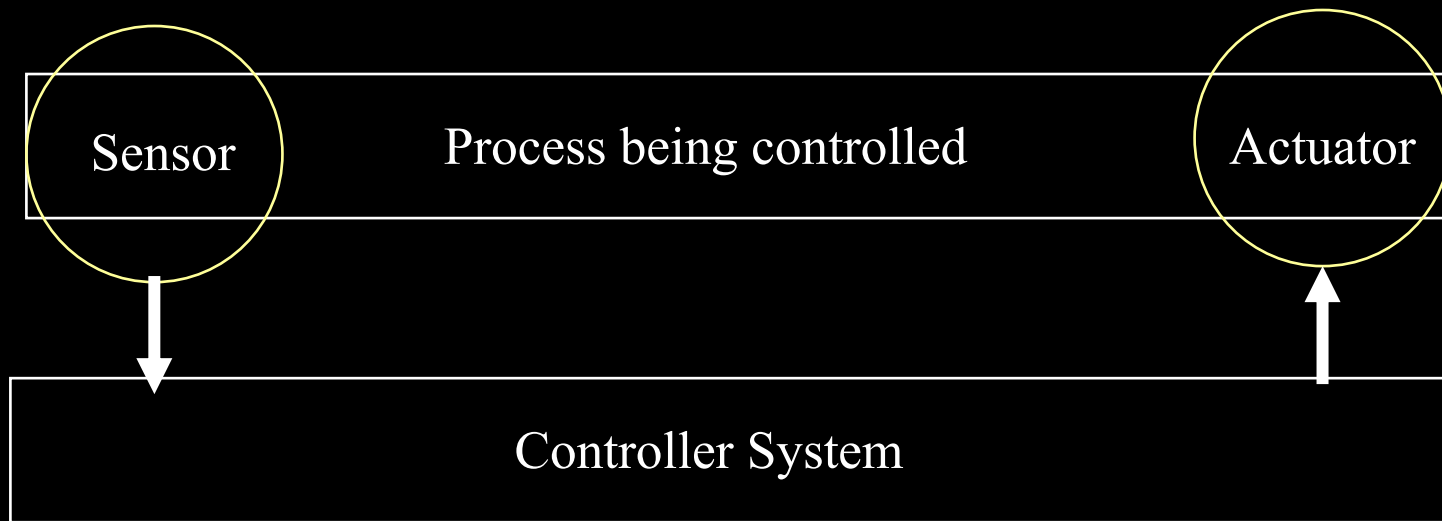
SCADA

Supervisory Control And Data Acquisition

First of all, Lets see what is a Control System ?

A control system, is a system that holds responsible in top of another system (being controlled system) for setting and stabling the system in a predefined state.

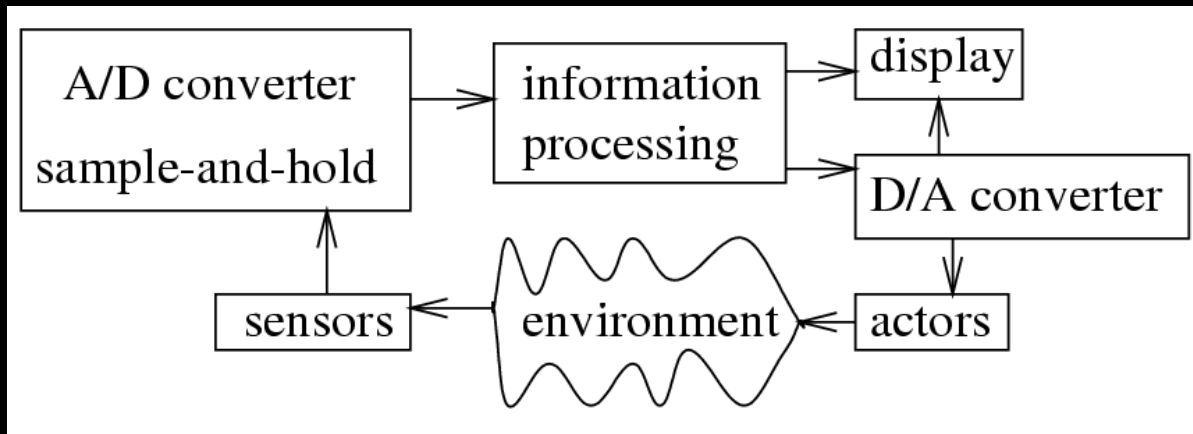
Nowadays control systems are mostly microprocessor based. (Microcontrollers, PLCs, PC-Based Control systems).



SCADA

Supervisory Control And Data Acquisition

Example of a monitoring and control system is a system which monitors temperature and switches heaters on and off.



SCADA

Supervisory Control And Data Acquisition



What is SCADA?

SCADA is “Supervisory Control And Data Acquisition”.

Real-time industrial process control systems used to centrally monitor and control remote or local industrial equipment such as motors, valves, pumps, relays, sensors, etc.

SCADA is Combination of telemetry and Data Acquisition.

SCADA is not just a hardware, neither a software. It’s a concept, it’s a system as a combination of special hardware, software and protocols.

SCADA is used to control chemical plant processes, oil and gas pipelines, electrical generation and transmission equipment, manufacturing facilities, water purification and distribution infrastructure, etc.

SCADA

Supervisory Control And Data Acquisition



Why SCADA is needed ?

The Ability to Remotely collect different plants on different places.

The Ability to control process from a distance.

The Ability to create logs and reports about system's current and past state.

The Ability to send necessary information to Engineers and operators in real-time using Instant Messaging and SMS.

SCADA

Supervisory Control And Data Acquisition



Where SCADA is used ?

- Electrical generation/distribution,
- Natural gas distribution
- Fuel Oil storage & flow
- Water storage & flow
- Lighting
- Heating, cooling, ventilation
- Fire alarms & suppression
- Elevators & escalators
- Gates & doors, alarms
- Video security cameras
- Traffic signals
- Process Line Control

SCADA

Supervisory Control And Data Acquisition



SCADA is not a new stuff !

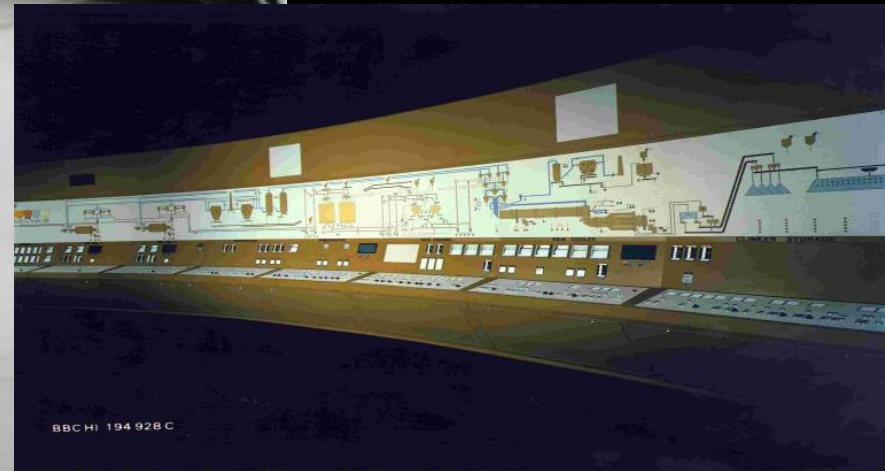
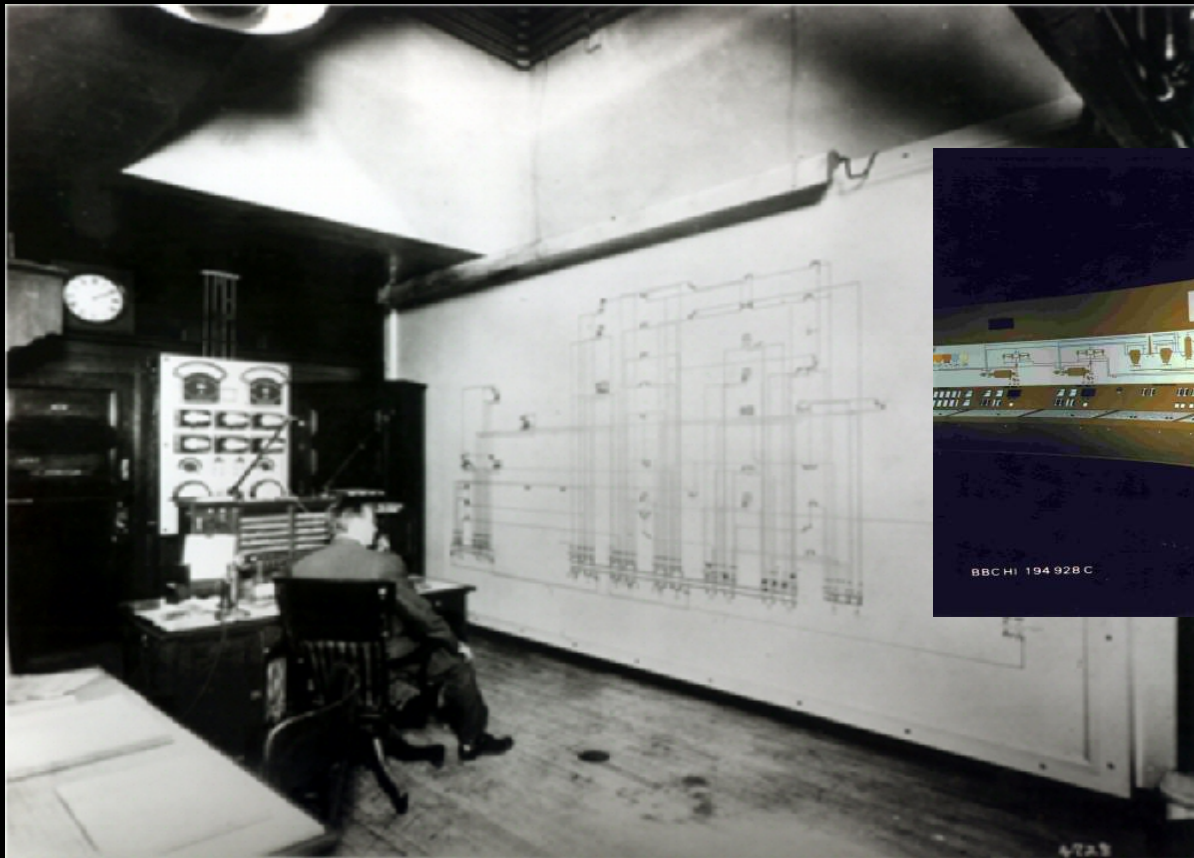
It has been used since the early days of control systems to remotely Control and Monitor current and past state of being controlled system (our plant, factory, etc.)

SCADA

Supervisory Control And Data Acquisition



Early Power System Control (in 1919)



Control room
(mimic wall)
1970's

formerly, all instruments were directly wired to the control room

SCADA

Supervisory Control And Data Acquisition

Late 1990's Control Centers



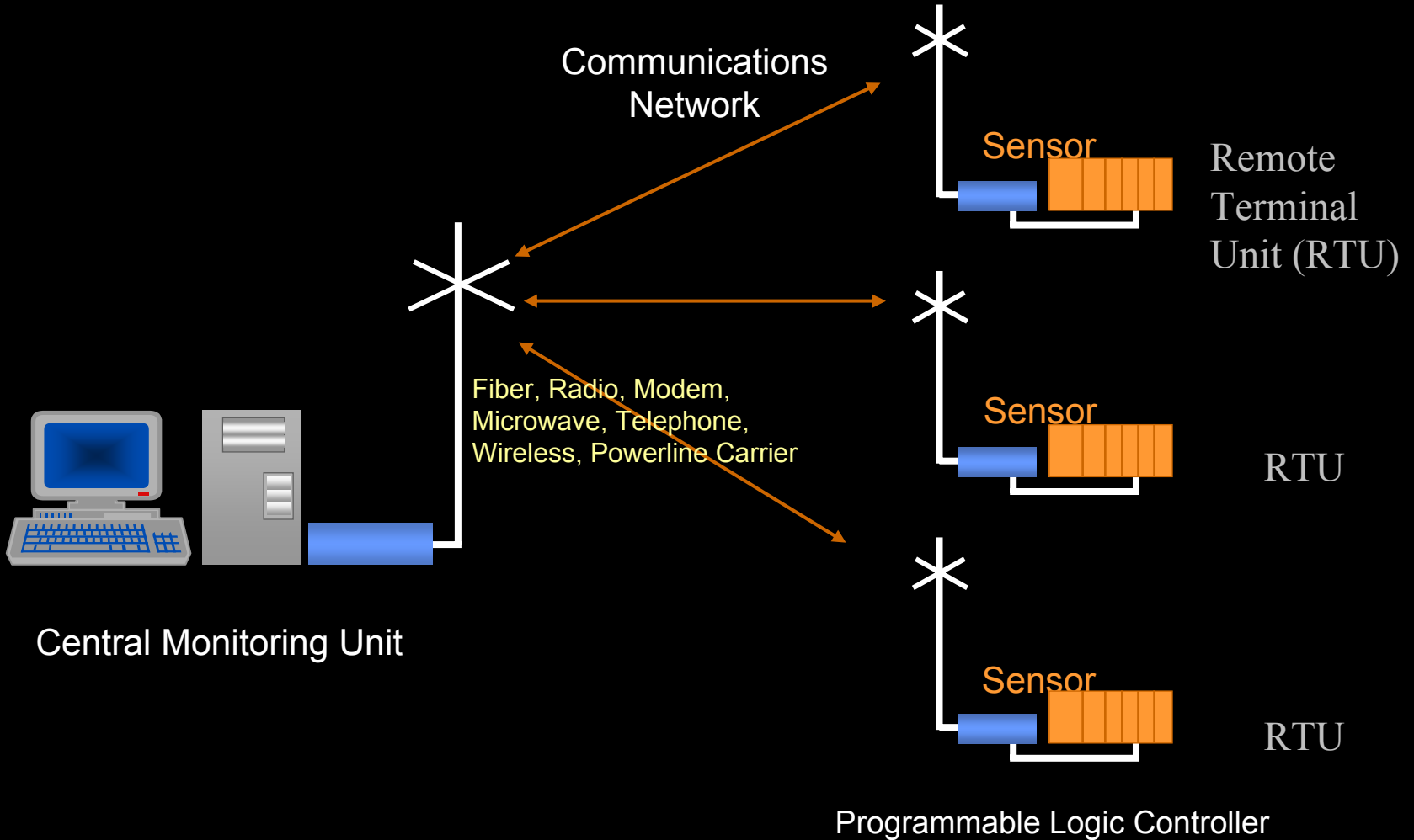
SCADA

Supervisory Control And Data Acquisition

A little Confused ?!?!
Lets SEE what it is !

SCADA

Supervisory Control And Data Acquisition



SCADA

Supervisory Control And Data Acquisition



SCADA Hardware

- Field level instrumentation and control devices
Sensing field variables, controlling the process and
- Remote Terminal Units (RTUs)
Send control and monitoring data to MTU. (could be a PLC)
- Master Terminal Unit or MTU (Also called The Master Station)
gathering information from RTUs, Monitoring and processing,
sending necessary control actions to RTUs.
- Communication System

SCADA

Supervisory Control And Data Acquisition

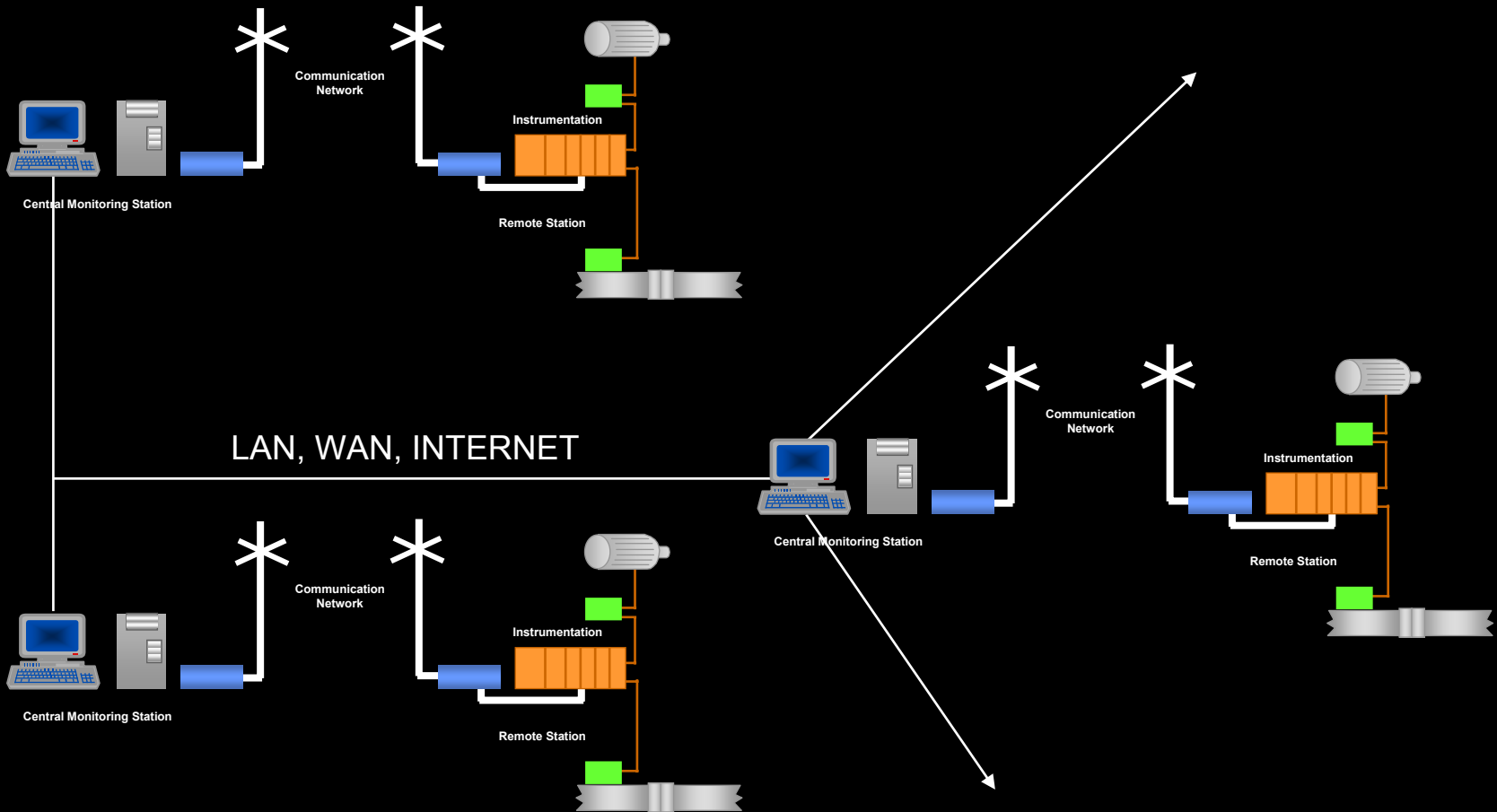


Going a little more in details ...

SCADA

Supervisory Control And Data Acquisition

Corporate Architecture



SCADA

Supervisory Control And Data Acquisition



What are the concerns ?

Physical Plant

- Focus
 - Safety
 - 100% Availability
 - Electro-mechanical
 - No updating, Aged equipment
- The Language
 - RTUs, PLCs, IEDs
 - DNP, Modbus
 - Low Bandwidth
 - Analog & Digital
- The Vendors
 - Allen Bradley(AB)/Rockwell, Honeywell, Siemens, Johnson Controls

Computer Networking

- Focus
 - Security
 - 99.5% Availability
 - Electronic
 - Continuous Updating, New
- The Language
 - Routers, Switches, Servers
 - IP, Ethernet
 - High Bandwidth
 - All Digital
- The Vendors
 - IBM, Microsoft, CISCO, Dell

SCADA

Supervisory Control And Data Acquisition



Protocols used in SCADA Systems:

Mostly Open Protocol are used in SCADA systems.

The most popular protocols are as follows:

DNP (Distributed Network Protocol)

Modbus

DeviceNet

SCADA

Supervisory Control And Data Acquisition



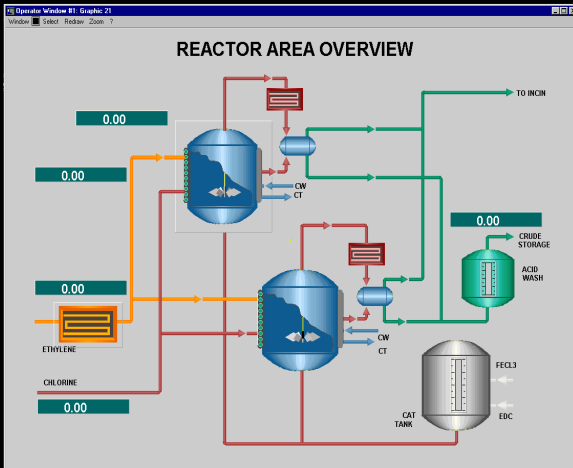
SCADA Functionality:

- Data acquisition and display
 - store binary & analog data into process data base
- Alarm & Events
 - record important changes and operator actions
- History data base
 - keep a record of the process values
- Measured processing
 - calculate derived values (limit supervision, trending)
- Logging & reporting
- Human Machine Interface (HMI):
 - graphical object state presentation, lists, reports
- Operator Command handling
 - binary commands, set points
 - recipes, batches, scripts (command procedures)

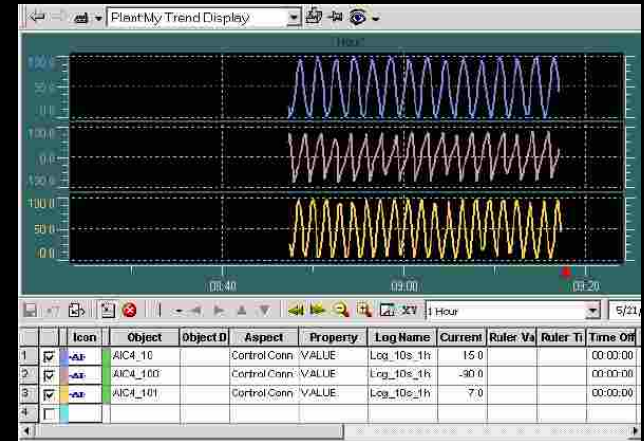
SCADA

Supervisory Control And Data Acquisition

Remote Monitoring including:

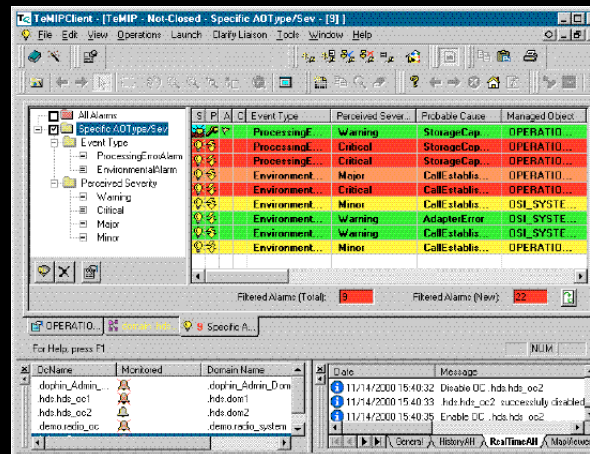


Current state



Alarms and events

Trends and history



SCADA

Supervisory Control And Data Acquisition

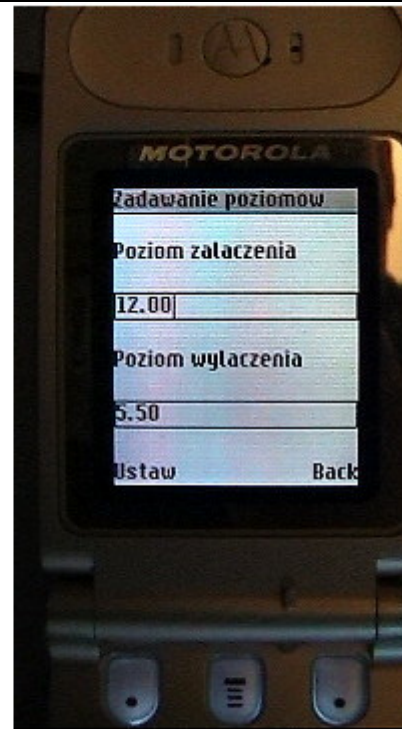
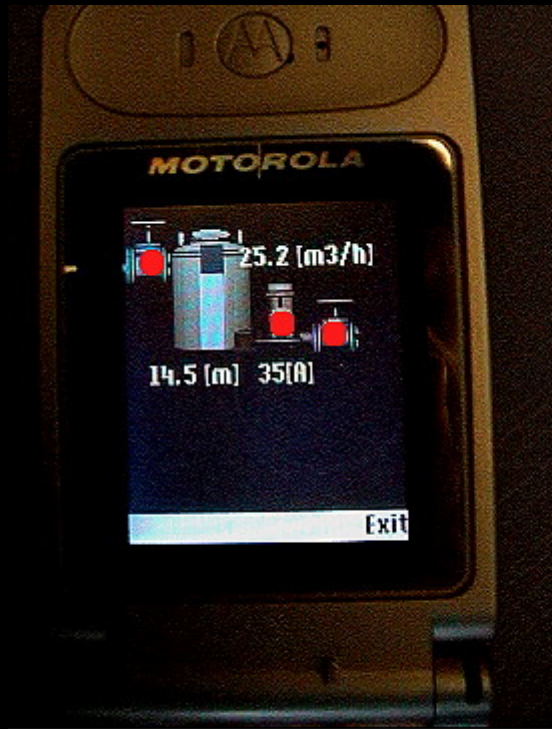


New Trends in SCADA

- Web-Based SCADA systems
 - Connecting SCADA system to Internet
 - Gives more functionality to our system
 - Security issues should be covered
- Using Instant Messaging to report systems status (implemented)
 - Giving more functionality
 - Using a reliable instant messaging service
- Using Short Message Service to report critical situations (implemented)
 - A kind of instant messaging, using Mobile Telecommunication network
 - Using SMS Server, connecting a cell to PC, setting up a web server and using WAP

SCADA

Supervisory Control And Data Acquisition



SCADA

Supervisory Control And Data Acquisition



Last words on SCADA

With new trends and technologies of Computer and Electrical Engineering, there are lots of functionalities available, that we can add to our SCADA system.

You saw that SCADA covers different fields of Computer Engineering like Computer networking, Control, Programming, Embedded Systems, Operating Systems, Real-time Systems and

SCADA is a very fast growing technology which is widely used in plants and factories and makes good job opportunities for you in the industry, in computer engineering field..

SCADA

Supervisory Control And Data Acquisition

References:

www.google.com

www.wikipedia.com

www.whatis.com

Modern SCADA protocols, Elsevier, newness publication

DESY SCADA Experience, EPICS Workshop - Oak Ridge

www.modbus.com

www.DNP.org

Engineering The Architecture Of Distributed Control Systems, Eric Runnerstrom

MPR Associates

Joint Program Office for Special Technology Countermeasures, National Defense

Industrial Association

15-17 July 2003

SCADA

Supervisory Control And Data Acquisition



Questions ?
Comments?

Thanks for coming ...

Ramtin Raji Kermani, Fall 2005
ramtinraji@cse.shirazu.ac.ir