Asian Institute of Technology

58 Moo 9, Paholyothin Highway, Km.42, Klongluang
Pathumthani 12120, Thailand
http://www.ait.ac.th

Office of Procurement, Inventory and Assets (OPIA)
Tel: (66) 02 524 5027-9
Fax: (66) 02-524-5001
purchasing@ait.ac.th

INVITATION TO BID

Date :	18 November 2019
Re:	**Procurement of Control System and SCADA for Learning Future Factory Laboratory**

Term of Reference (TOR)/ Product Specification: see section 4

Designated contact person for further information

➢ For Bid Information and Submission	Pakkamol Dherapongsthada	pakkamol@ait.ac.th	02-5245029 084-678 8103
	Vasvan Songpitakcahi	vasvan@ait.ac.th	02-5245027 081-646 7272
➢ For Technical Specification	Hoang Hung Manh	manh@ait.ac.th	02-524 5695 089-615 2806

Bid submission: **Date**: **No later than 16.30 hrs. on 04 December 2019**
Place: Office of Procurement, Inventory and Assets (OPIA)
Administration Building, Asian Institute of Technology.

The following documentation must be included in the Bid Envelope;

- Proposed price
- Copy of Company's certificate of commercial registration
- Copy of VAT registration certificate

Bids received after the dates and hours stated above will not be accepted and will be returned unopened to the sender.

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Product name: Control System and SCADA for Learning Future Factory Laboratory

1.Background

MSIE-CBHE is an Erasmus+ **Curriculum Development of Master's Degree Program in Industrial Engineering** for Thailand Sustainable Smart Industry (MSIE4.0) funded by the European Commission. The project team is formed from a collaborative partnership among 9 universities, three from Europe and 6 from Thailand, who believe strongly in the power of education and innovation to transform lives. They are University of Minho (Portugal), Czestochowa University of Technology (Poland), University Politehnica of Bucharest (Romania), Chiang Mai University, Khon Kaen University, King Mongkut's University of Technology North Bangkok, Prince of Songkhla University, Thammasat University and Asian Institute of Technology.

Curriculum Development of Master's Degree Program in Industrial Engineering for Thailand Sustainable Smart Industry (MSIE4.0) has been selected for EU co-funding for Erasmus+ Capacity Building in Higher Education. More information about the project is at: **https://msie4.ait.ac.th**

THE LABORATORY

The purpose is to develop a laboratory to serve the developed courses in the curriculum. This laboratory locates at the Chalerm Prakiat building, Industrial Systems Engineering, Asian Institute of Technology. The laboratory will **serve the educational purpose only** and will be accessed and used by students and faculty members from 09 members and other new associated partner universities.

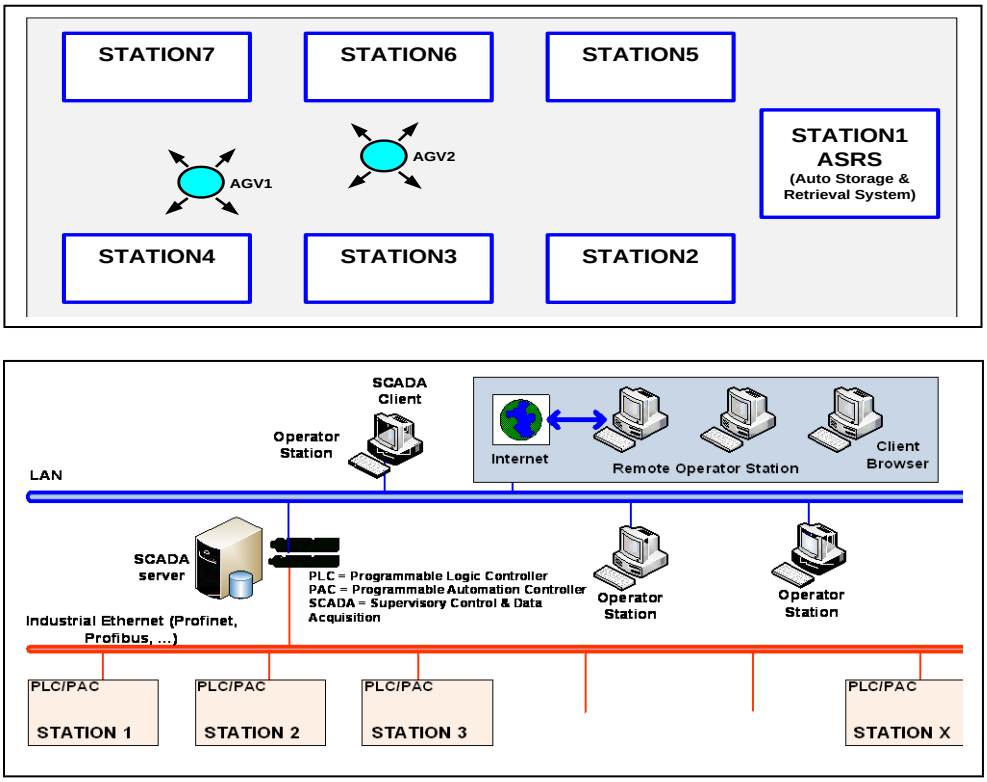

Figure 1. Simplified Horizontal and Vertical Layout of the Laboratory

The LAB will have a warehouse (automatic storage & retrieval system) and several manufacturing stations (figure 1). Most of stations are equipped with a controller serving as the master of the station. All of them will be communicate to each other via modern industrial Ethernet such as PROFINET. Some stations will have their own local operator panel. The warehouse station will use 02 gantry sets with servo motors for storage and retrieval of containers. A Radio Frequency Identification (RFID) system is integrated in the system (via the same industrial Ethernet network) will provide the information about containers.
The supervise control and data acquisition (SCADA) package running in a PC will provide the human machine interfaces (HMI), data archive, remote accesses.

2.Objective

Students and faculties who are inside and outside AIT campus can access to use all lab stations. With provided rights (username and password), these users can monitor and control the system via remote operators which are normal PCs with any web browsers. Users can collect the archived data to serve their learning purpose. The

movement of physical machines can be observed via the webcam screens integrated in the Human Machine Interfaces (HMIs). It is important things and benefits to students for working in the future factory of Industrial 4.0.

3.Vendor qualification

Vendors shall have experience at least 05 years in service and sales of automation equipment such as Programmable Logic Controllers (PLC) or Programmable Automation Controllers (PAC), motion control devices, servo motors and drives, supervisor control and data acquisition (SCADA) systems, identification systems (Radio Frequency Identification or RFID). Vendors must have professional teams that are able to provide advice, consulting, installation and programing of their products. Vendors must be the authorized distributors of the mentioned products from famous manufacturers which provide products with good quality under USA, European, or Japanese brand and standard.

4.Specification

4.1 Logical Control System

4.1.1 Controllers: 05 sets

One controller set must include the CPU, power supply (220VAC-24V/8A), rack, programming software, communication cable. Technical Specifications of the CPU are as the followings.

- Processing times: about 50ns for bit operations and 300ns for floating point arithmetic.
- Work memory (integrated memory): at least 250 Kbyte for program and 1 Mbyte for data.
- Load memory (plug-in memory): about 32 Gbyte.
- 16 Kbyte flag memory, 32 Kbyte process image input and 32 Kbyte process image output.
- Numbers of counters and timers: about 2000 counters and 2000 timers.
- Integrated technological functions: high-speed counter, frequency measurement, pulse-width modulation (PWM), pulse-train output (PTO), frequency output (least up to 100kHz), closed-loop control.
- Integrated motion control functionalities for controlling speed-controlled and positioning axes, support external encoders, output cams/cam tracks and probes.
- PROFINET interface; IP protocol; webserver protocol
- PROFINET IO controller for operating distributed I/O on PROFINET.
- PROFINET IO Device to connect to other devices on PROFINET.
- OPC UA client and OPC UA server with functions OPC UA Data Access, method call, custom address space.

- Programming software must be run on Windows 10 and must consist of all IEC 1131-3 standard languages: ladder diagram(LD), function block diagram (FBD), structured text (ST), instruction list (IL), and sequential function chart (SFC).

4.1.2 Input and Outputs for Controllers: 544 digital inputs (24VDC); 326 digital outputs (24VDC); 20 analog inputs (can be configured either as voltage or current); 10 analog outputs (can be configured as either voltage or current).

4.1.3 PROFINET Distributed I/O Interface Station (with power supply, rack): 04

4.2 Servo System: 04 sets (single axis)
04 servo drives (220 VAC input); 04 servo motors with feedbacks with power and feedback cables. The feedback cables are connected to the servo drives. Motor requirements: 0.5-1KW, 3-5NM, 3000-5000 RPM. 02 motors have break. The drive systems are connected via PROFINET to one PLC controller and are controlled by this one.

4.3 Identification Systems: 10 readers
The system must be RFID or Radio-Frequency Identification System. The readers(/writers) with integrated antennas must be able to communicate with the PLC controllers on PROFINET. Reading/writing operations are done by the PLC controllers. The RF technology is passive with about 14MHz with reading distance of about 600mm. One reading set must include all the signal/power cables, and configuration software. Numbers of readers: 10.
Transponders (RFID tag) must have round shape with diameter about 50mm and thickness about 4mm. They are about 14 MHz passive and with at least 2 Kbytes FRAM (or EEPROM). The number of transponders is about 300 units.

4.4 HMI/SCADA (Human Machine Interface / Supervisory Control and Data Acquisition) System
The package must have the following characteristics:

4.4.1 Operating Systems.
The package must be able to run on PC with latest Microsoft Windows OS such as:
- Windows 10 Professional, Enterprise (64-bit)
- Windows 10 Enterprise LTSB (64-bit)
- Windows 2012 Server R2 (64-bit)
- Windows 2016 Server (64-bit)
- Windows 7 Professional, Enterprise, Ultimate (32-/64-bit)

4.4.2 Industry-standard HMI (Human Machine Interface)
The package must be able to create the industry HMI as the followings:
- Pixel-graphics visualization of the process sequences and statuses

- Operating the machine or plant via an individually configurable operator interface with its own menus and toolbars
- Reporting and acknowledging of events
- Archiving of measured values and messages in a process
- Database
- Logging of current process data and acquired archive data
- User administration including their access rights

4.4.3 Main Features

High-performance data archiving

Process values and messages (historical process information) should be archived in the integrated, high-performance database (such as MS SQL server). Memory requirements could be optimized through powerful, loss-free compression functions.

Efficient analysis of process values (trends)

Process values can be displayed as a table or analyzed using a trend display. The display is either predefined or can be adjusted individually by the operator, if authorized. Numerous means of representation guarantee the best possible overview. There should be also the option of performing statistical calculations online without the need for programming. The relevant statistics – maximum and minimum value, average value, (weighted) mean, integral and total – are displayed without delay for a time range selected in the Trend Control.

Efficient analysis of messages

The display of the message information can be adapted precisely to the requirements of the operator. There should be integrated statistics functions to allow a comprehensive analysis of process states. It can show how long certain messages were pending on average and in total (message duration) and similarly the average and the total acknowledgment time. The messages can be filtered out by relevant events, message locations and time intervals. This will indicate quickly where critical points and bottlenecks in the production are located.

Efficient Web-based reporting

Created target-group-oriented reports and evaluation using historical data should be available as Web-based dashboards or on tablets and can be automatically forwarded as emails and transparent data access should be possible with standard office tools as MS Word, MS Excel or MS PowerPoint.

Efficient management of data records (recipes)

Related data, such as machine parameter assignments or production data should be able to be grouped together in user archives. Such archives are characterized by a fixed data structure that is predefined during the configuration. The individual parameters can be specified by the operator in runtime or directly exchanged with the

automation partner. The data records can be further processed with other tools (such as MS Excel) via the import/export function.

Scalability
To be able to meet the growing requirements, the visualization must be expandable at any time without causing technology incompatibilities or requiring completely new configurations. The scalability should be integrated in the package to provide not only small single-user solution but also the client/server solution. In this case, several coordinated operator control and monitoring stations can be operated together with networked automation systems.

Web solutions
It should be possible to control and monitor the whole plant via the Internet or intranet without having to make changes to the project. In this way, the operator stations can be Web-based.

It should offer flexible operator control and monitoring of plant processes via the Internet especially using mobile devices (table PCs or smart phones). All devices with HTML5-capable browser should be supported. Depending on the application area it is possible to monitor only as well as to control process. Because of the individual access to process data using mobile devices, the user will be informed about all the data of a plant which is important to him by a fast, cheap and target-oriented way.

Connectivity
It should be possible for the system to transfer pre-processed process and production data to higher level systems for information conditioning (e.g. Manufacturing Execution Systems, Enterprise Resource Planning systems or simply office packages). The system should have standard interfaces such as OPC XML DA, OPC HAD, OPC A&E, OLE-DB. The system let others access to all the online values and in the other hand can as a client read data from other application (across the Web too).

Data Connection to the Cloud
With Industry 4.0, the “Cloud" is also becoming increasingly important for industry. Data is sent from sensors and actuators of the machine to the cloud where it is reused and processed for analysis purposes. This is useful, among other things, for troubleshooting and machine optimization. E.g. Variables from data server should be able to be sent to the Amazon Web Services or AWS.

4.4.4 Other requirements
Number of external tags: about 2,000
Number of clients accessing via web browser at the same time: 10; Number of clients accessing via mobile devices at the same time: 10 (only for the package used with the control system).

Quantity of packages: 06 (01 is used for the control system, other 5 are used for off-line training)

5. Place and date of deliver

Place

-Vendor shall deliver the product to Chalerm-Prakiat building, Asian Institute of Technology (AIT), Pathumthani, Thailand.

Delivery

-The time of delivery is approximately 30 days after the date of receipt of purchase order.

-Product shall is good and new condition or last year manufacturing. It must never use for testing or demonstration with many times at anywhere before.

-Vendor shall provide soft copy or hard copy of operation manual, programing and interface manual and maintenance manual in English language to AIT staff.

6. Warranty period

The period of warranty is at least 12 months after the product is installed and tested at AIT Lab.

Technical Support Conditions: Providing unlimited telephone and email technical support assistance; Providing On-line and Hot-line technical support.

AIT reserves the right of the final decision.