# 안드로이드 스마트폰을 이용한 SCADA 시스템 기반의 제어및모니터링 과정산업자동화

프라요가 부디, 이스난도, 김정훈, 박성준
전남대 학교

# Control and Monitoring Process Industrial Automation based on SCADA system using Android Smartphone

Prayoga Budhi, Isnanto, Jeong-Hun Kim, Sung-Jun Park
Chonnam National University

## ABSTRACT

In industry, Supervisory Control and Data Acquisition (SCADA) system plays critical role to ensure production is monitored and controlled rigorously and in timely manner. Having a cost saving yet still effective SCADA system would be much desired by Industry. SCADA itself is a field with constant development and research like how this paper investigates on creating an extremely low cost device, which can be adapted to many different SCADA applications through some very basic programming when combined with relevant peripherals. Much of the process in some expensive SCADA application based on smartphone application is due to specialized communication infrastructure. This paper addresses the needs by developing low cost and integrated wireless SCADA system. The system features capability on accessing the performance of remotely situated device parameter, such as temperature, control analog or digital input output on real time basis. We use existing mobile network capability through Bluetooth communication channel.

## 1. Introduction

Nowadays, with the advancement of technology, particularly in the field of computers as well as micro controllers, all activities in our day living have become parts of information and we find computer and programmable interface controller (PIC micro) in every application. Thus, the trend is directing towards computer-based works. In SCADA, most works deal with the basic signal processing of temperature and pulse width modulation (PWM). When measuring various parameter values, various transducers are used while the outputs of these transducers are converted to control the parameters. The control circuit is designed using PIC micro 24 Family. The output PIC is used to drive the analog or digital display and will be sent by Bluetooth to android smartphone with a display that would show us data logging, graph of temperature sensor and PWM real time based.

## 2. Contents

### 2.1 The Proposed System and flowchart mobile scada

Figure 1 shows the configuration of the overall SCADA system. This system is divided into three stages, which are master station, control unit and motor control.

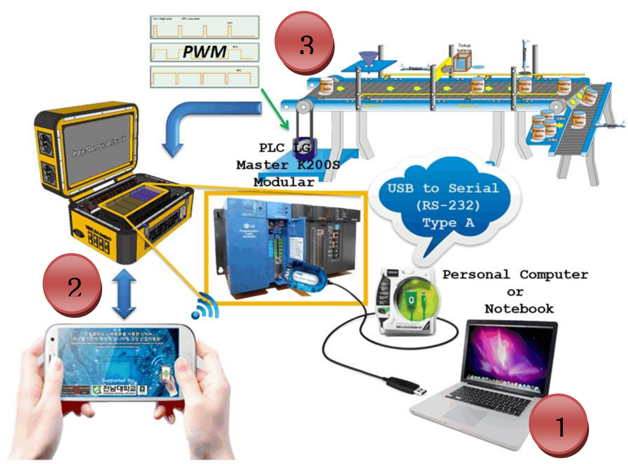


Fig 1 Configuration of overall SCADA system

The master station communicates with PLC through RS232 cable. LG Master K200S modular PLC is used as a control unit to communicate with SCADA. Besides, it also receives and sends a data to the PIC24F256DA210 as shown in Figure 2 that has board module with Bluetooth communication between PLC to android smartphone.

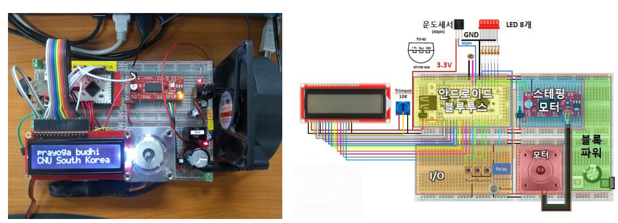

Fig 2 Photograph prototype android bluetooth (left) block diagram (right)

### 2.1.1 Charging algorithm and Experimental Result

$$\bar{y} = \frac{1}{T}\int_0^T f(t)dt \qquad (1)$$

As $f(t)$ is a pulse wave whose value $y_{max}$ for $0 < t < D \cdot T$ and $D \cdot T < t < T$.
Expression (1) then becomes:

$$\bar{y} = \frac{1}{T}\left(\int_0^{DT} y_{max}dt + \int_{DT}^{T} y_{min}dt\right)$$

$$= \frac{D \cdot T \cdot y_{max} + T(1-D)y_{min}}{T}$$

$$= D \cdot y_{max} + (1-D)y_{min} \qquad (2)$$

That expression can be fairly simplified in many cases where $D \cdot y_{max}$. From (2), it is obvious that the average value of the signal ($\bar{y}$) is directly dependent

Table 1 experimental result (frequency 10-50Hz, Duty Cycle 70)

| F | Duty Cycle | Pulse Width | Periode | Amplitude | Vout |
|---|---|---|---|---|---|
| Hz | % | ms | ms | Volt | Volt |
| 10 | 70 | 70 | 100 | 3.2 | 2.3 |
| 20 | 70 | 35 | 50 | 3.2 | 2.3 |
| 30 | 70 | 23.3 | 33.3 | 3.2 | 2.3 |
| 40 | 70 | 17.5 | 25 | 3.2 | 2.3 |
| 50 | 70 | 14 | 20 | 3.2 | 2.3 |

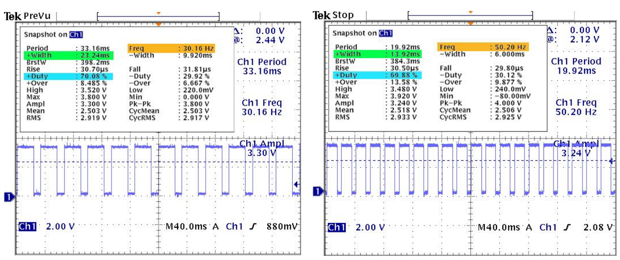

Fig 3 Graph according table 1 30Hz (left) 50Hz (right)

Table 2 experimental result (frequency 60Hz,Duty Cycle 10-50%)

| F | Duty Cycle | Pulse Width | Periode | Amplitude | Vout |
|---|---|---|---|---|---|
| Hz | % | ms | ms | Volt | Volt |
| 60 | 10 | 1.7 | 16.7 | 3.2 | 0.5 |
| 60 | 20 | 3.3 | 16.7 | 3.2 | 0.83 |
| 60 | 30 | 5.0 | 16.7 | 3.2 | 1.16 |
| 60 | 40 | 6.7 | 16.7 | 3.2 | 1.49 |
| 60 | 50 | 8.3 | 16.7 | 3.2 | 1.82 |

Table 3 Proposed mobile SCADA system vs. conventional SCADA

| | Proposed system | Conventional system |
|---|---|---|
| Component | Includes most of the conventional SCADA system but uses wireless communication instead of lines | SCADA system include input output signal hardware controller, human machines interface(HMI), networks, communication, databases and software |
| Mobility | Yes | No |
| Power Requirement | No need a lot of power | Normal |
| Budget | low | Requires a lot of money for maintenance and communications |

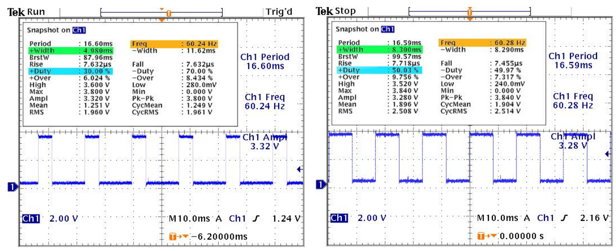

Fig 4 Graph Duty Cycle according table 2 30% (left) and 50% (right)

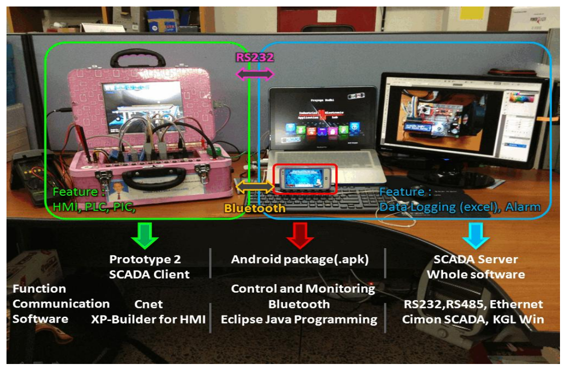


Fig 5 Photograph proposed Mobile SCADA system architecture

## 3. Conclusion

Our system's response time is less than 1 sec. In addition, the user can also get information of SCADA plant whenever user wants while walking around the plant floor. Hence, the mobile phone-based SCADA automation provides a low cost effective solution to control and automate of the flow of information for small to medium size process plant.

## References

[1] Ozdemir, E., Karacor, M., "Mobile phone based SCADA for Industrial Automation", Proceedings of ISA Transactions, Vol. 45, No. 1, pp. 67-75, 2006, May.

[2] Abu Bakar, A., Hashim, H., Zarafi Ahmad, Md., "Implementation of SCADA System for DC Motor Control", Proceedings of ICCCE, Kuala Lumpur, Malaysia, pp. 11-13, 2010, May