

# Study on a Smart Phone Application Controlling Agricultural Chemical Spray System with Bluetooth Communication

Kyung Mog Lee

**Abstract**—A smart phone application of an agricultural chemical spray system was developed with Bluetooth communication. The application could control the system at remote by a smart phone to setup the peripheral devices such as a water pump, a stirrer, a high pressure pump and five solenoid valves. The spraying system consisted of three parts: a smart phone, a device control module and peripheral solenoid valves. The smart phone was programmed to set the peripheral devices by touching the buttons on its screen. The device control module was built on an electric circuit board with an ATMEGA's 89C51 microcontroller. It was much more convenient using a smart phone than manually controlling electronic switches.

**Index Terms**— android program application, Bluetooth communication, chemical spray device, microcontroller, remote smart phone controller

## I. INTRODUCTION

RECENTLY, the global warming causes serious weather problems around the world, such as sudden temperature rise and dry weather. Dry weather causes the population of farm damaging insects, such as aphid and leaf mite, increased rapidly in Korea during dry seasons. To kill those harmful insects, more deadly poison chemical should be used. Those agricultural chemical is also harmful to the human health[1]. At least 20,000 farm workers in U.S. are poisoned by pesticides each year, according to data from the US Environmental Protection Agency (EPA) [1].

The explosive spread of the smart phone and the rapid development of the Information Technology have caused the smart phone's applications widely developed in variety fields, such as smart farming systems[2][3][4][5], games[6][7], and industry applications. The information technology is also applied in some applications of the farm protecting system from wild animals [8].

And, the Bluetooth communication was used in some researches on the connection of the phone and some environment devices[9][10][11][12].

In this paper a smart phone's application was developed for the agricultural chemical spray system, which could be controlled remotely by a smart phone. This research consisted of three parts, a smart phone, a control module and peripheral devices. On the screen of the smartphone, the

peripheral devices setting buttons were displayed touchable and the statuses of the peripheral devices shown.

## II. BODY OF PAPER

In this paper, an agricultural chemical spray system was developed to be managed by a smart phone. The system consists of a smart phone, a device control module, and peripheral physical devices such as a water pump and five solenoid valves. A microcontroller was used in building the device controlling module.

Fig. 1 shows an agricultural chemical spray system using a smart phone as a remote controller. The device control module was equipped with a Bluetooth communication module, a Micro-processor, a water pump, five solenoid valves. The communication specification between the Smart phone and the device control module was in 9600 bps Bluetooth communication. The distance between the phone and the device control circuit board was within 10 m so that the phone and the control board could keep the connected state. The device control module could power up five solenoid valves, and a water pump. The water pump made the chemical sprayed out into the field.

The screen of the phone showed the information of the setting conditions of the peripheral devices.

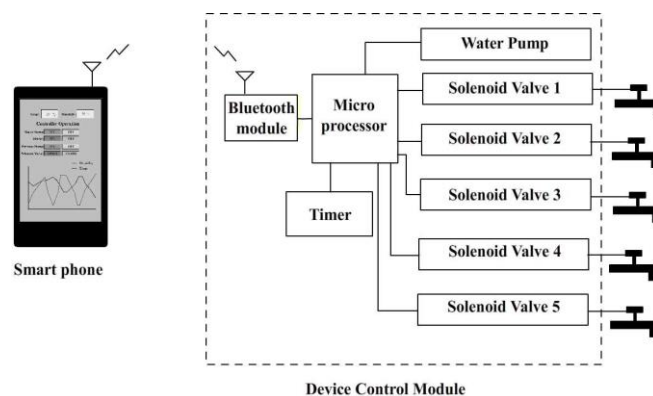


Fig. 1. An agricultural chemical spray system using a smart phone as a remote controller.

Manuscript received July 2, 2017; revised July 30, 2017.

KyungMog Lee. Author is with the E-commerce Department, Semyung University, Jecheon ChungBuk, South Korea (phone: 82-10-9418-4310; fax: 82-43-649-1740; e-mail: ahkml11@gmail.com).

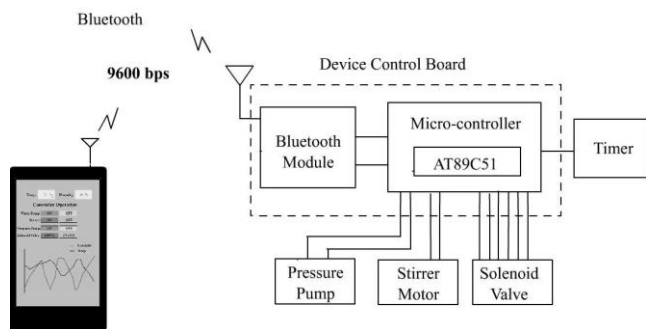


Fig. 2. Detailed system connection of a device control module and a smart phone remote controller.

Fig. 2 shows the detailed system connection of a device control module and a smart phone remote controller. The device control module consisted of a Bluetooth module and a Micro-controller. This controller was built on an electric circuit board with ATMEGA's 89C51 microcontroller.

Fig. 3 shows the screen image of the remote control smart phone. The screen showed all the controlling buttons and all the devices' setting conditions, and the timer's setting times. The operating schedule of peripheral devices can be programmed into the smart phone. Some devices should work during night only.

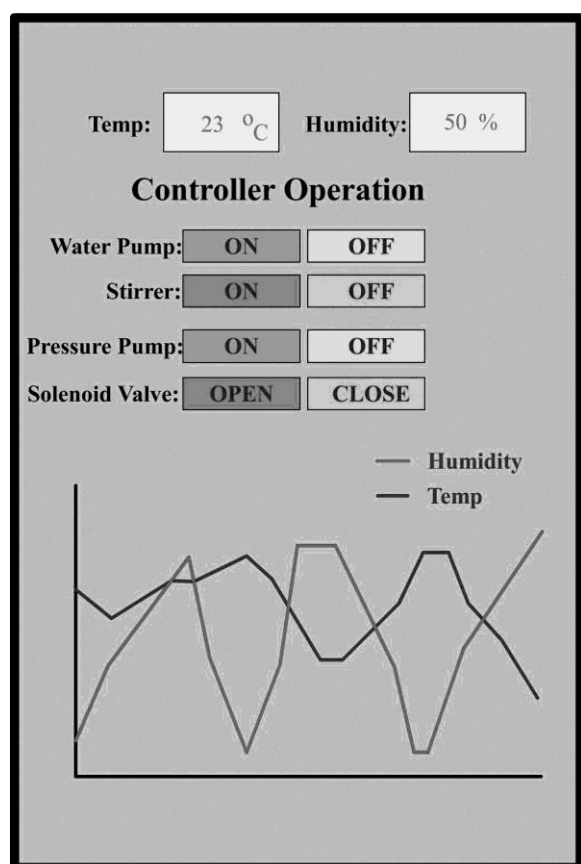


Fig. 3. The screen image of the remote control smart phone.

Fig. 4 shows the configuration of an agricultural chemical spraying system controlled by a remote control smart phone. The Bluetooth control module was controlling the chemical spraying time and selecting the solenoid valve which induced the chemical into the field. The end solenoid valve must be

selected last in order to make sure the chemical expelled completely from the induce horse. The misty nozzle was used to spray out the chemical into the field. And the distance between two nozzles was about 2 m apart on the same hose. The inducing hoses were separated off about 5 meter in distance. The diameter of the inducing hose was 20 mm. The solenoid valve, HPW2150 model, was made by Hyoshin Mechatronics company. The diameter and the operating voltage of the valve were 20 mm and 220 Volt each.

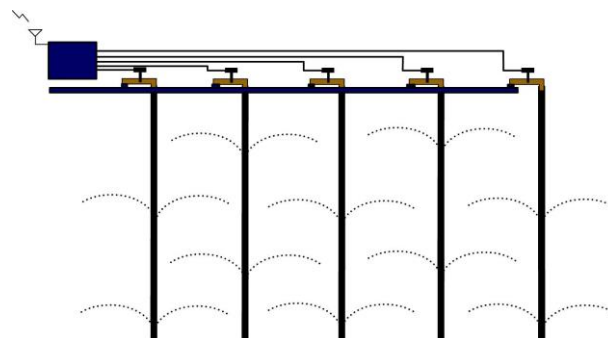


Fig. 4. The configuration of an agricultural chemical spraying system controlled by a remote control smart phone.

Fig. 5 shows the diagram of the program blocks of the constructed system. The remote controller smart phone was a Samsung's Galaxy of which model Number was SHV-E210K. The android build number was KitKat, and Firmware version 4.4.4.

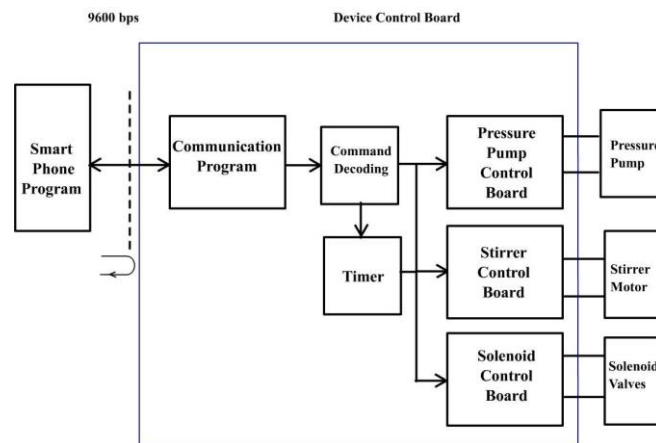


Fig. 5. Diagram of the program blocks of the constructed system.

### III. CONCLUSION

In this paper, an agricultural chemical spray system was constructed to be controlled remotely by an android smart phone. The system consisted of a smart phone, a control module, and peripheral devices. The smart phone was programmed in Android to recognize control button commands, and to send the proper signal to the control module in Bluetooth communication of 9600 bps data rate. The control module was built on an electrical circuit board with ATMEGA 89C51 microprocessor. The smart phone was

programed to show on the screen all the setting statuses of the peripheral devices. As a remote control smart phone, Samsung Galaxy SHV-E210K model was used. And an android program was developed on the KitKat version for the phone to be able to be used as a remote setting and controlling device. It was much more convenient controlling the peripheral devices by the remote control smart phone than by the manually controlled electronic switches.

#### REFERENCES

- [1] United States Environmental Protection Agency, "The Agricultural Sector Study: Impacts of Environmental Regulations on Agriculture", [https://yosemite.epa.gov/ee/epa/erm.nsf/vwan/ee-0307b-02.pdf/\\$file/ee-0307b-02.pdf](https://yosemite.epa.gov/ee/epa/erm.nsf/vwan/ee-0307b-02.pdf/$file/ee-0307b-02.pdf), 2009
- [2] Tae-Hwa Yeom, Sung-Mi Park, Hye-In Kwon, Duck-Kyu Hwang, and Jeongchang Kim, "A Smart Farming System Based on Visible Light Communications", The Journal of Korea Information and Communications Society, Vol. 38C, No. 5, 2013, pp 479-485
- [3] J. Yang, C.D. Chung, Yousik Hong, B.I. Ahn, S.I. Hwang, and Y.H. Choi, "Implementation of Greenhouse Environmental Control Systems using Intelligence", Journal of the Institute of Electronics Engineers of Korea, Vol. 49, No. 2, 2012, pp 29-37
- [4] Namhyun Yoo, Giljong Song, Juhyun Yoo, Suyeong Yang, Cheolsu Son, Jingwang Koh, and Wonjung Kim, "Design and Implementation of the Management System of Cultivation and Tracking for Agricultural Products using USN", Journal of KIISE, Vol. 15, No. 9, 2009, pp 661-674
- [5] Jong Jun Choi, Sang Ho Park, and Young Kiy Choi, "Development of a Remote Control Equipment For Farm Automation", Journal of the Institute of Electronics Engineers of Korea, Vol. 45, No. 4, 2008, pp 19-26
- [6] Kyung Mog Lee, "Implementation of a Computer Game Voice Command Board With a Speaker-dependent Recognition Chip", *Journal of Convergence Information Technology*, Vol.8, No.14, 2013, pp238-244
- [7] Lee Kyung Mog Lee, "Voice-game Controller Via Bluetooth Communication With a Speaker-dependent Recognition Chip", *Research Notes in Information Science(RNIS): Advance Institute of Convergence Information Technology*, Vo.14, Jun, 2013, pp61-66
- [8] Abhinav V. Deshpande, "Design and Implementation of an Intelligent Security System for Farm Protection from Wild Animals", *International Journal of Science and Research*, ISSN (Online): 2319-7064, Vol. 5, Issue 2, February, 2016, pp956-959
- [9] Dean A. Gratton, "Bluetooth Profiles.", *Upper Saddle River, NJ*: Prentice Hall, 2003
- [10] M.F.L. Abdullah, Lee Mei Poh, "Mobile Robot Temperature Sensing Application via Bluetooth", *International of Smart Home*, Vol.5, No.3, July, 2011, pp39-48
- [11] KyungMog Lee, "Voice-game Controller Via Bluetooth Communication With A Speaker-dependent Recognition Chip", *Research Notes in Information Science(RNIS)*, International Conferences, ISSDM2013 and ICCM2013), Jeju Island, Republic of Korea, Volume 14, June, 2013, pp61-66
- [12] Kyung Mog Lee, "Voice-game Controller Via Bluetooth Communication With a Speaker-dependent Recognition Chip", *Research Notes in Information Science(RNIS): Advance Institute of Convergence Information Technology*, Vo.14, 2013, pp61-66