

## Design and Implementation of Smart Home Security System

Young-Il Kwong, Jun-Yeong Park and Sam-Jin Jeong  
Division of Information & Communication Engineering, Baekseok University,  
310-65 Cheonan,, Korea

**Abstract:** We aim to respond efficiently to crime by using arduino and smartphone applications in response to increasingly increasing number of house-breaking crimes. With the rapidly aging population and single-family surge, crime prevention and disaster prevention for the certain population are becoming weaker. Using the home security system to improve crime prevention crime every year, helping prevent crime is expected to help prevent crime and develop research and development. Home security system using arduino connected with smartphone application and various sensors have been system designed and implemented. It receives the signal of the sensor installed in the house and connects it with the application of the smartphone. To use the application, you can download the application from the user's smartphone, launch the application and run the operation outside the home, not only inside the house by linking the executed application. Among the sensors installed in the house, the movement detection sensor is used to enhance the security and the gas leakage sensor and the flame detection sensor can be used to easily detect the risk of fire and to prevent the fire early. Security is further enhanced by the ability to remotely control the front door with smartphone.

**Key word:** Home security, computer security, arduino, mobile application, Android, Bluetooth, security, weaker

### INTRODUCTION

We live in an era called the smart age, an advanced information society. With the rapid development of information and telecommunications, smart phones which are expected to enjoy only a certain level have become commonplace and have taken root in society as a whole (Jose and Malekian, 2015). With the rapidly aging population and single family surge, crime prevention and disaster prevention for the certain population are becoming weaker. Incursions of housing invasions are also being highlighted, increasing the importance of security such as escalated exposure to outsiders, theft of valuables and protection of important materials from disasters (Jang and Jeon, 2012). Using the home security system to improve crime prevention crime every year, helping prevent crime is expected to help prevent crime and develop research and development (Seung-Soo *et al.*, 2015).

As the distribution rate and usage of smartphone increase, it is possible to manage the inside and outside of the house with smartphone by interlocking between smartphone and home security. Research on home security system using smart phone was conducted, such as home lighting system control, mobile monitoring system, home automatic control system, home network system and home security system (Kamelia *et al.*, 2014; Gim *et al.*, 2016; Lee *et al.*, 2015). In addition, challenges

such as efficient home security monitoring system based on arduino, smart phone notification system using LED matrix, home security system based on DLNA, home automation based on IoT and home automation using Bluetooth have been developed (Lee and Lin, 2016), (Hwang and Park, 2016). Research and development such as home security system and home automation by using Bluetooth are actively performed (Ramlee *et al.*, 2013), (Naresh *et al.*, 2013). Research and development such as home security system and home automation by using Bluetooth are actively performed. Since, everyone has access to a smartphone nowadays, smartphone, arduino and various sensors can be used for your security system effectively by using various functions through application. Therefore, in this study, we propose an efficient home security system that can prevent home intrusion crimes and disasters anytime and anywhere by linking smartphone application and various sensors connected with arduino.

### MATERIALS AND METHODS

#### Design and implementation of smart home security system

**Home security system diagram:** The overall configuration of the home security system is shown in Fig. 1 and can be roughly divided into two modules as an arduino module and an application module. The main function of the

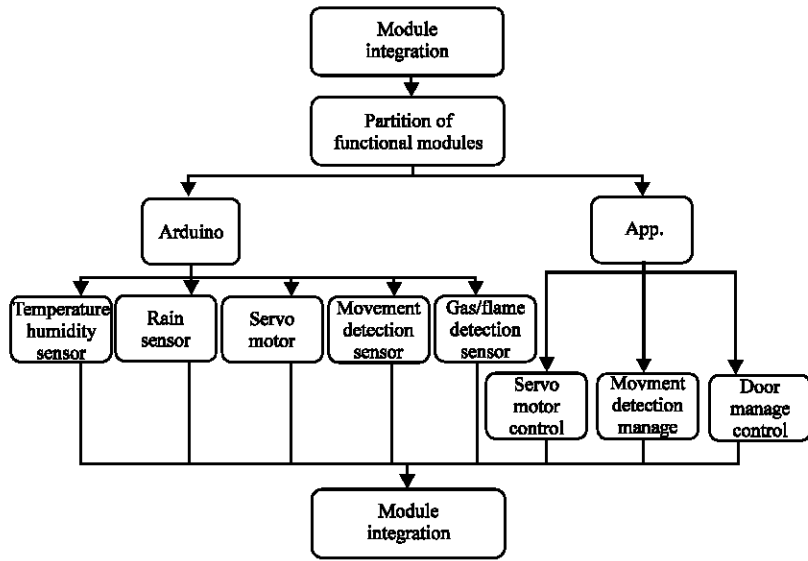


Fig. 1: Home security system diagram

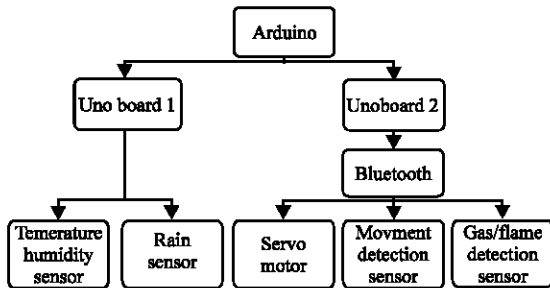


Fig. 2: Arduino system diagram

smartphone application is to connect the Bluetooth device and configure the front door control function and the functions of various sensors. The application aims to control the sensors connected to the Uno board or accept signals to inform the user. Each function consists of: main screen, door control, motion detection, fire detection and gas detection.

**Arduino system diagram:** The Arduino system is shown in Fig. 2 and is composed of two Uno boards. A temperature/humidity sensor and a rain sensor that do not require Bluetooth communication are implemented in one Uno board 1; a servo motor, a motion sensor and a gas/flame sensor that require Bluetooth communication are implemented in another Uno board 2.

**Uno board 1 implementation:** The rain sensor application and the temperature/humidity sensor that do not require Bluetooth communication with the smartphone application are shown in Fig. 3, the LED color changes

according to the danger level when the respective sensors read values that are out of the certain range set. The analog signal (0-1024) of the sensor is assigned from 0-2 according to the numerical value using the mapping function. The lowest green LED is lit to 0, the yellow LED is at 1.2 uses a red LED lighting algorithm with a lot of rainfall. In the case of the temperature/humidity sensor, the sensor value of the temperature sensor and the humidity sensor is received. In Summer, 1 is assigned when the temperature is 25°C or less, 2 is assigned when the temperature is 25°C or more and 30°C or less. 3 is assigned when temperature hits above 30°C. In the case of a humidity sensor, 1 is assigned when the humidity is 25% or less, 2 is allocated when the humidity is 25% to 50% and 3 is designated when the humidity is 50% or more. When the sum of the assigned constants through the temperature sensor and the humidity sensor is 3, the green LED indicating normal is turned on. When the sum is 5, the yellow LED indicating warning is turned on. When the sum is 6 an algorithm is used to light the LED. When the sum of the assigned constants through the temperature sensor and the humidity sensor is 3, the green LED indicating normal is turned on. When the sum is 5, the yellow LED indicating warning is turned on. When the sum is 6 an algorithm is used to light the LED.

**Uno board 2 implementation:** In case of motion detection sensor, flame detection sensor and gas detection sensor that require Bluetooth communication with smartphone application are shown in Fig. 4. After activating the Bluetooth module for communication with the mobile

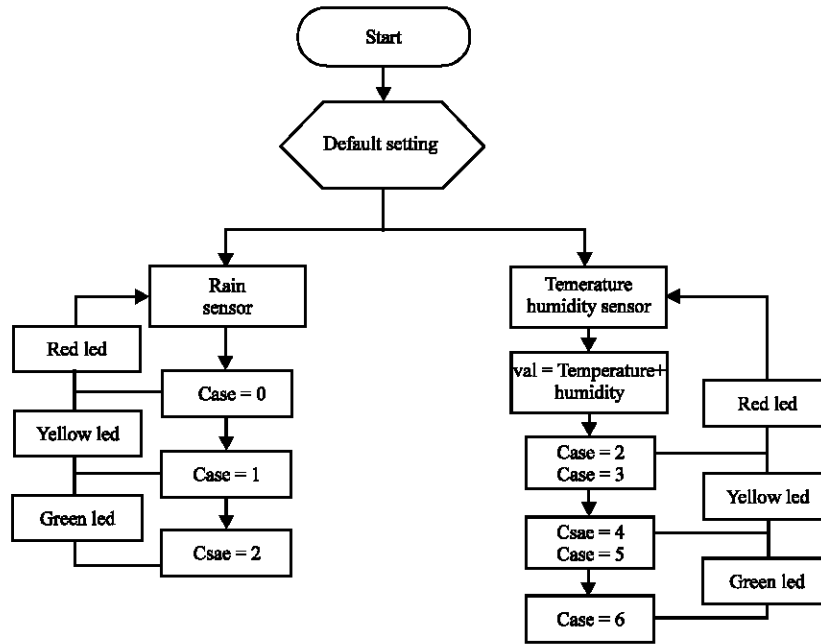


Fig. 3: Rain/temperature/humidity sensor flow chart

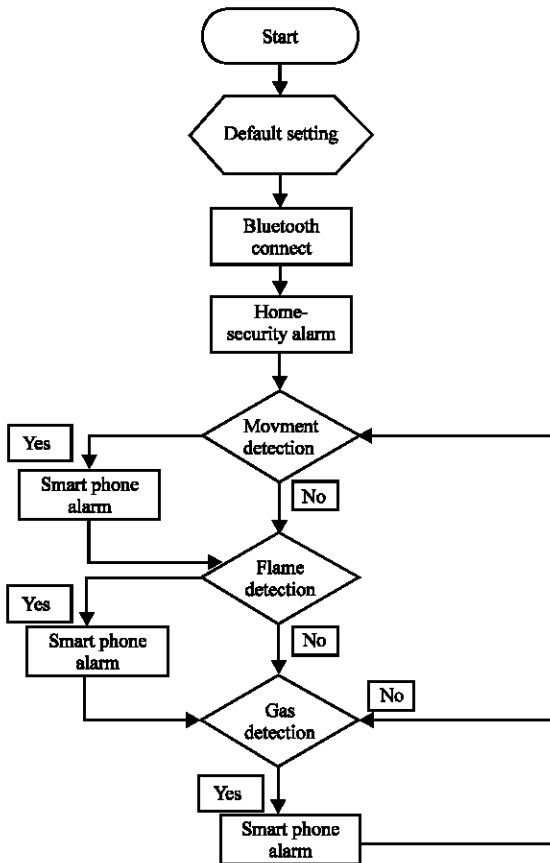


Fig. 4: Movement/flame/gas sensor flow chart

phone, the risk message is transmitted to the mobile phone when the value read from the sensor is out of a certain range.

**Bluetooth connection:** A Bluetooth device selection pop-up window is generated after a message of a Bluetooth approval request is generated. Select a Bluetooth device connected to the Uno board among the Bluetooth devices that receive the signal and connect.

**Home security:** Configure the open button, close button, and Back button on the front door. When the Open button is pressed, a signal is sent to the servo motor connected to the Uno board to open the door lock device, when the close button is pressed, the door lock device is locked. Press the back button to return to the main screen. A popup message is generated by receiving the detection signals of the motion sensor, the flame sensor and the gas sensor.

**Android system diagram:** The configuration of the android system is shown in Fig. 5. Bluetooth access request and Bluetooth device selection process is performed after accessing the main page. Then, the process is divided into front door control, motion detection, fire detection and gas detection.

**Implementing the android system:** The process of implementing the android system is as follows. When you

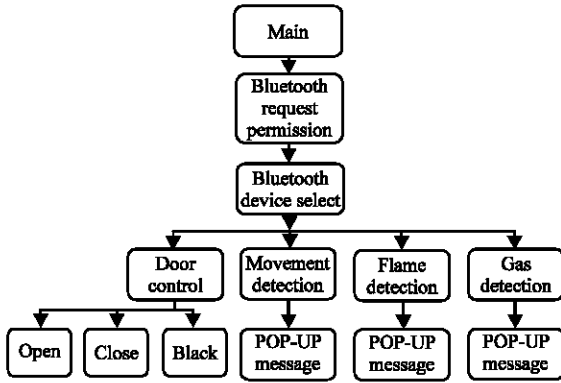


Fig. 5: Android system diagram

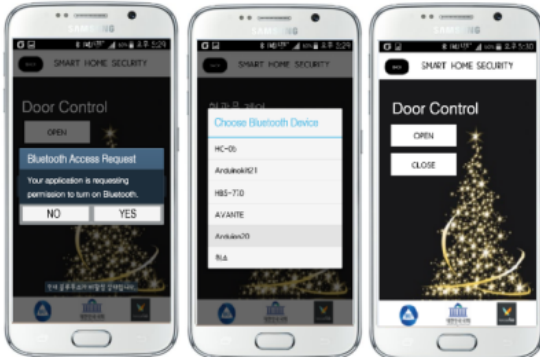


Fig. 6: Bluetooth interlocking process and door control

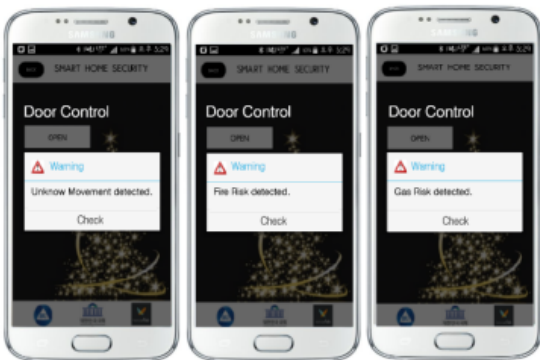


Fig. 7: Movement/flame/gas detection pop-up

run the Bluetooth interlocking process as shown in Fig. 6, touch ‘Yes’ on the request to execute Bluetooth permission page in order to select a Bluetooth device. You can work with arduino by selecting a Uno board in device selection. When arduino and Bluetooth are connected, the front door control page is activated as shown in Fig. 6. The front door is controlled with the open and close buttons. If the value received through the arduino for motion detection, flame detection or gas detection

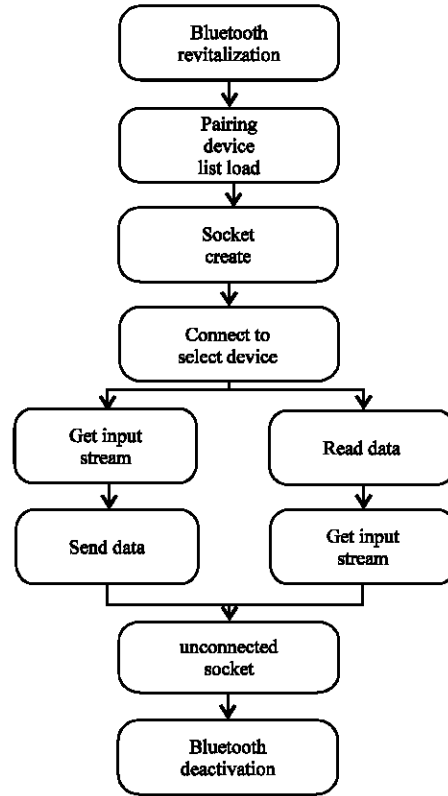


Fig. 8: Bluetooth system diagram

sensor is out of a certain range, shown in Fig. 7, a warning message pops up in the android application (Yoon *et al.*, 2016).

**Bluetooth system:** The configuration of the Bluetooth system is shown in Fig. 8. First of all, activate Bluetooth, and then load the list of devices that can be paired. If the device to be connected to is selected from the list of loaded devices, it creates a socket to communicate with the remote Bluetooth device (Lee and Lee, 2015; Kang, 2015). When a socket is created, the actual data is obtained from the socket and transmitted/received using the input/output stream. If data communication is finished and a Bluetooth connection is not needed, close the I/O stream socket and disable Bluetooth.

### CONCLUSION

Home security system using mobile application which can manage and control inside/outside the house easily and efficiently in real time through Bluetooth communication of smartphone application and home security system using arduino connected with smartphone application and various sensors have been system designed and implemented. The home security

system implemented in this study can cope with crime and natural disaster through the five sensors inside and outside the house and can remote control the front door and detect the inside of the house using the smartphone application. The currently implemented system is a system that controls "Sensor- Uno board-Mobile" by Bluetooth connection, this is constrained by distance.

### **RECOMMENDATION**

Future research will focus on the development of a system that can be monitored and controlled remotely through Wi-Fi module and server construction. In addition, various sensors can be added to enhance security and a database can be applied to the system to collect contextual data. These can be used to develop a real-time unattended system by adding big data analysis technology and learning technology.

### **ACKNOWLEDGEMENT**

This research is supported by 2018 Baekseok University Research fund.

### **REFERENCES**

- Gim, C.Y., O. Yoon-Hawn and K. Seung-Keyum, 2016. Implementation of home automatic control system using smartphone. Proc. Symposium Korean Inst. Commun. Inf. Sci., 11: 434-435.
- Hwang, S.Y. and S.H. Park, 2016. An IoT based architecture for home automation. Intl. Conf. Korea Inst. Inf. Commun. Eng., 8: 369-370.
- Jang, Y.J. and Y.T. Jeon, 2012. Technology trend of smart-home security system. Korean Secur. Sci. Rev., 30: 117-138.
- Jose, A.C. and R. Malekian, 2015. Smart home automation security. Smart Comput. Rev., 5: 269-285.
- Kamelia, L., S.R.A. Noorhassan, M. Sanjaya and E.M. WS, 2014. Door automation system using bluetooth-based android for mobile phone. ARPN. J. Eng. Appl. Sci., 9: 1759-1762.
- Kang, H.R., 2015. A study on multi-object control method using smartphone bluetooth communication and the methodologies of convergence research. J. Digital Convergence, 13: 341-347.
- Lee, H.R. and C.H. Lin, 2016. Design and implementation of arduino-based efficient home security monitoring system. J. Inst. Internet, Broadcasting Commun., 16: 49-54.
- Lee, J.H., D.W. Ryu, C.S. Han and S.H. Kim, 2015. Home security system using smartphone. Proc. KIIT. Summer Conf., 6: 365-367.
- Lee, K.J. and K.H. Lee, 2015. A study of security threats in bluetooth v4.1 beacon based coupon convergence service. J. Korea Convergence Soc., 6: 65-70.
- Naresh, D., B. Chakradhar and S. Krishnaveni, 2013. Bluetooth based home automation and security system using ARM9. Intl. J. Eng. Trends Technol., 4: 4052-4058.
- Ramlee, R.A., M.H. Leong, R.S.A.S. Singh, M.M. Ismail and M.A. Othman et al., 2013. Bluetooth remote home automation system using android application. Int. J. Eng. Sci., 2: 149-153.
- Seung-Soo S., C. Gyoo-Soo and L. Tae-Hyun, 2015. An investigation study to reduce security threat in the internet of things environment. J. IT Convergence Soc. SMB., 5: 31-36.
- Yoon, M.S., K.R. Park and C.B. Ko, 2016. A design and implementation temperature test equipment malfunction monitoring system using the arduino. J. Digital Convergence, 14: 317-323.