Design and Implementation of a Home Access Control System Based on Multiple Wireless Identification Technologies

Hui-Kai Su[*], Member, IEEE, and Jia-Wei Liou

Department of Electrical Engineering, National Formosa University, Huwei 632, Taiwan
[*]hksu@nfu.edu.tw

Abstract—With the advance of technologies, the wireless identification technology and biometrics has been integrated into the Home Access Control System (HACS). In the current common Identification technologies, such as RFID (Radio Frequency Identification), Wi-Fi (Wireless Fidelity), Bluetooth, NFC (Near Field Communication) and fingerprint, each technology would be applied to a suitable occasion according to its characteristics. However, different rooms have different security levels. How to provide a class of access control based on security requirements is very significant. Therefore, this paper proposes a concept of Security Identification Combination (SIC) for a home access control system. The SCI is determined by the characteristics of identification technologies and the needs of each region security. Finally, the prototype is implemented and the control delay is acceptable for actual HACS.

I. System Architecture

This system is divided into the Home Gateway (HG) and Door Controller (DC) and shown in Fig. 1. One HG can manage multiple DCs. The door locker, webcam, and multiple Security Identification Combination (SIC) is designed in the DC. If the user passes the SIC check, the door locker will be released and the door will be opened. The HG includes the database for storing identification record, user information and SIC; moreover, it also provides a graphics-oriented interface for administrators and users to manage and control system-related functions.

In our HACS, Wi-Fi, Bluetooth and NFC/RFID are used. The NFC/RFID checks the NFC/RFID tag bring in users. The Wi-Fi and Bluetooth checks the MAC address information of users' smart phone or other mobile devices. An HACS app is designed and performed to broadcast the smart phone information, i.e., MAC address, etc. Moreover, the DC is running in monitor mode. If the MAC address of Wi-Fi or Bluetooth is sniffed, the access permission will be checked, and the access log will be stored back to the database of HG.

II. System Prototype

In our implementation, the functionality of HACS According was complete. In the performance analysis, each identification of Wi-Fi, Bluetooth and NFC/RFID tested ten times. The control delay is defined from receiving the identification information to finishing the access decision. The average control delays of Wi-Fi, Bluetooth and NFC/RFID are 27.5ms, 28.15ms and 27.15ms severally. All of the delays are less than 29ms. It is acceptable for actual door control application.
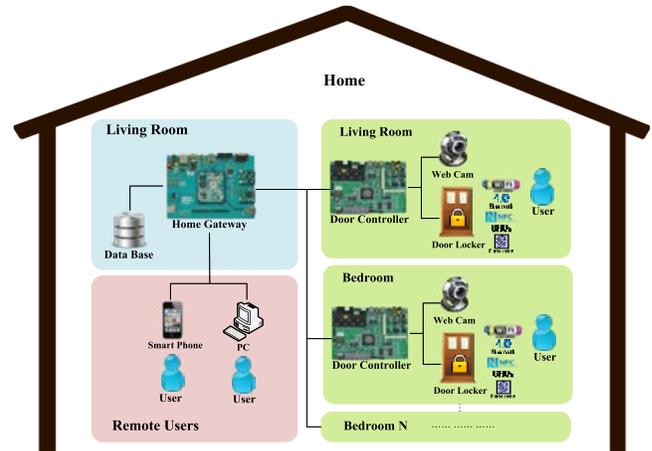

Figure 1.   The system architecture.

III. Conclusion

This paper proposes a concept of Security Identification Combination (SIC) for a home access control system. The SCI is determined by the characteristics of identification technologies and the needs of each region security. Based on the multiple SICs, the system flexibility and home security are enhanced. Finally, the prototype is implemented and the control delay is acceptable for actual HACS.

References

[1] S.-H. Seo, and T. Cho, "An Access Control Mechanism for Remote Control of Home Security System," 2012 Sixth International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 4-6 July, 2012, pp.93-98.

[2] R.A Ramlee, M.A. Othman, M.H. Leong, M.M. Ismailm, and S.S.S. Ranjit, "Smart home system using android application," 2013 International Conference of Information and Communication Technology (ICoICT),20-22 March, 2013, pp.277-280.

[3] Y. Wardhana, B. Hardian, G. Guarddin, and H. Rasyidi, "Context aware door access control on private room using fuzzy logic: Case study of smart home," 2013 International Conference on Advanced Computer Science and Information Systems (ICACSIS), 28-29 Sept., 2013, pp.155-159.