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Smart Building Control System Emulation Platform for Security Testing

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Smart buildings play a critical role in advancing the smartness of cities. With the continuous development of technology, the application of technologies such as automated control, smart sensors and communication networks in smart buildings is becoming increasingly complex. Smart buildings realize efficient management of equipment in buildings by integrating advanced automation control systems. At the same time, the application of smart sensors, elevators, robots and other devices enable buildings to respond to environmental changes in real time, optimize energy, reduce resource waste and bring much convenience to people's lives. However, in order to ensure the effectiveness and reliability of these technologies, continuous testing and system upgrades are required.

Testing and evaluating these technologies using real building environments often faces a number of challenges, such as the accompanying high testing costs, the risk of system crashes, limited resources, and lack of adaptability. In addition, the communication network, as the nerve center of smart buildings, ensures the control and information exchange between devices. However, along with the development of cyberattack techniques and the acceleration of digital transformation, the security threats to networks in smart buildings are increasing. Cyber attacks against smart buildings may threaten the data security and privacy of users, as well as cause damage to physical equipment in the building leading to disruption of operational services. These threats not only cause economic losses to building operators, but also have an impact on corporate reputation.

To address these challenges, we created the Smart Building Control System Emulator (SBCSE). SBCSE is a platform that emulates smart building control systems and was designed and developed based on real smart building log data. SBCSE simulates control systems and the movement of IoT devices such as robots and elevators, and uses an implementation of actual communication protocols, thus enabling emulation testing and evaluation of control systems and information interactions between devices in smart buildings. SBCSE also supports the emulation of various security scenarios, and analyzes and proposes countermeasures against potential threats, and verifies the effectiveness of the security measures.

Through this research, we aim to propose an innovative solution to the shortcomings of the current simulation platform for smart building control systems. By developing an smart building emulator, it provides an effective tool for testing and evaluating smart building systems. The simulator

can not only provide users with an intuitive user interface and simplify the operation process, but also better help users conduct tests in different scenarios and help improve the reliability and performance of smart building systems. In this way, we attempt to solve the problem of the current lack of control system simulation platform for smart buildings. At the same time, for the network security problems existing in smart buildings, this study has specially designed a security test module, which can emulate a variety of attack scenarios and conduct a comprehensive security test. The module helps to identify potential security vulnerabilities in the smart building system and timely detect risks that may lead to system crash or data leakage. We have also analyzed relevant security measures that can be used to cope with the risks, which can provide effective protection solutions for the system. Through these simulations and tests, we can help designers and developers to identify and fix the security risks in the system, so as to avoid unnecessary losses in practical applications.

SBCSE not only improves the efficiency and security of smart building system testing, but also significantly reduces testing costs and provides powerful support for system design, optimization and maintenance. In addition, by emulating various cybersecurity attack scenarios, our security model helps to test and develop effective countermeasures against potential risks in smart building systems. SBCSE is a versatile and cost-effective tool for improving the reliability and security of smart buildings that facilitates the testing and application of new technologies in the growing field of smart cities.