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授与した学位	博士		
専攻分野の名称	工学		
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学位授与の要件	自然科学研究科	産業創成工学専攻 (学位規則第4条第1項該当)	
学位論文の題目	A Study of Fingerprint-based Indoor Localization System Using IEEE 802.15.4 (IEEE802.15.4 プロトコルを用いた指紋方式での屋内位置検知システムに関する研究)		
論文審査委員	教授 船曳 信生	教授 田野 哲	教授 野上 保之
<b>学位論文内容の要旨</b>			
<p>This thesis presents the proposal of a <i>fingerprint-based indoor localization system</i> using the <i>IEEE 802.15.4</i> protocol, which is named <i>FILS15.4</i> for convenience. In <i>FILS15.4</i>, a user carries a small transmitter powered with a coin battery that can last for several months. The signal is then simultaneously received by multiple receivers that are allocated and fixed at the target field. The goal of <i>FILS15.4</i> is to provide a robust, low-power, and low-cost indoor localization for continuous positioning.</p> <p>Firstly, I present the system architecture of <i>FILS15.4</i> that consists of transmitters, receivers connected with <i>Raspberry Pi</i> by USB, and a server PC. Secondly, I present the investigation of the detection accuracy improvement of <i>FILS15.4</i> when the number of receivers in the field and the number of fingerprints to one room are increased. Thirdly, I present the implementation of <i>FILS15.4</i> in two-floor environments and the detection accuracy results as the basis of multi-floors environments. Finally, I present the investigation of the detection accuracy of <i>FILS15.4</i> when multiple users carry the transmitters and move around on the two-floor field.</p> <p>In summary, I present extensive studies of the fingerprint-based indoor localization system using the IEEE 802.15.4 wireless standard. I implement the system by adopting devices from <i>Monowireless</i>, <i>Raspberry Pi</i>, and a server PC, and by using Python as the programming language and <i>MQTT</i> as the device-to-device communication protocol. The investigations of <i>FILS15.4</i> in various scenarios verify its high ability in detecting the room where a user is currently staying.</p> <p>This thesis is organized as follows: Chapter 1 introduces the background, motivation, and the contributions of the study in this thesis. Chapter 2 reviews wireless technologies and localization techniques for indoor localization systems as preliminaries. Chapter 3 presents the design and the implementation of <i>FILS15.4</i>. Chapter 4 presents the investigations for the detection accuracy improvement in <i>FILS15.4</i>. Chapter 5 presents the application of <i>FILS15.4</i> to the two-floor environment. Chapter 6 presents the accuracy investigation for practical situations where multiple users carry the transmitters and move around in the two-floor field. Chapter 7 reviews relevant works in literature. Finally, Chapter 8 concludes this thesis with some future works.</p>			

## 論文審査結果の要旨

This thesis presented the study of a fingerprint-based indoor localization system using the IEEE 802.15.4 protocol, named FILS15.4 for convenience. In FILS15.4, a user carries a small transmitter powered with a coin battery that can last for several months. The signal is then simultaneously received by multiple receivers that are allocated and fixed at the target field. The goal of FILS15.4 is to provide a robust, low-power, and low-cost indoor localization for continuous positioning.

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In summary, the applicant presented extensive studies of the fingerprint-based indoor localization system using the IEEE 802.15.4 wireless standard. I implemented the system by adopting devices from Monowireless, Raspberry Pi, and a server PC, and by using Python as the programming language and MQTT as the device-to-device communication protocol. The investigations of FILS15.4 in various scenarios verify its high ability in detecting the room where a user is currently staying.

The applicant has published one journal paper, three international conference papers, and two domestic conference papers to present the contributions.

From the overall evaluation of this thesis, the applicant has satisfied the qualification condition for the doctor degree in Engineering from the Graduate School of Natural Science and Technology at Okayama University.