

氏名	KYAW SOE LWIN		
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学位論文の題目	A Study of Minimax Access-Point Setup Optimization Approach in IEEE 802.11n Wireless Local-Area Network (IEEE802.11n 無線 LAN でのミニマックスによるアクセスポイント設置最適化手法に関する研究)		
論文審査委員	教授 船曳 信生	教授 田野 哲	教授 野上 保之
学位論文内容の要旨			
<p>In this thesis, we propose the <i>minimax AP setup optimization approach</i> to improve the throughput performance of WLAN. First, we present throughput measurement results for IEEE 802.11n devices under various placement heights and orientations in outdoor and indoor environments. Next, we propose the <i>minimax AP setup optimization approach</i> to improve the throughput performance of WLAN. Third, we propose the <i>throughput estimation model</i> to detect a bottleneck host in the network field correctly. Fourth, we propose the <i>parameter optimization tool</i> to find the optimal values of the model parameters from the measurement results. With using this model, we also propose the <i>throughput measurement minimization procedure</i> to minimize the number of throughput measurement points to reduce the labor cost. Finally, we evaluated the minimax AP setup optimization approach through experiments in three network fields using various AP devices from several vendors, and confirmed the effectiveness of this proposal.</p> <p>The thesis is organized as follows;</p> <p>In Chapter 1, we introduce the background and the contribution of the study in this thesis.</p> <p>In Chapter 2, we introduce wireless network technologies related to this study, such as IEEE 802.11n protocol, the channel bonding, the multiple-input-multiple output (MIMO), antennas in MIMO, and the signal propagation.</p> <p>In Chapter 3, we provide the throughput measurement results with various heights and orientations of an AP.</p> <p>In Chapter 4, we propose the minimax AP setup optimization approach.</p> <p>In Chapter 5, we propose the throughput estimation model.</p> <p>In Chapter 6, we present the parameter optimization tool for the throughput estimation model.</p> <p>In Chapter 7, we evaluate the throughput estimation model with the parameter optimization tool in three network fields.</p> <p>In Chapter 8, we provide the evaluation results for the proposals.</p> <p>Finally, in Chapter 9, we conclude this thesis and show some future works.</p>			

論文審査結果の要旨

In this thesis, he studies the minimax access-point (AP) setup optimization approach in IEEE 802.11 wireless local-area network (WLAN). First, he presents throughput measurement results under various conditions in the placement height and orientation of an AP both in outdoor and indoor environments. The results show that throughput is greatly affected by the height and orientation of the AP due to the non-uniformity of the signal radiation along the horizontal and vertical planes, and confirm the significance of the AP setup optimization.

Second, he proposes the minimax AP setup optimization approach to improve the throughput performance of WLAN. In this approach, first, he detects a bottleneck host that receives the weakest signal from the AP in the field using the throughput estimation model. Then, he optimizes the AP setup by changing the height, the orientation, and the coordinate to maximize the throughput of this bottleneck host against the AP.

Third, he presents the throughput estimation model that consists of the log-distance path loss model and the sigmoid function. The first model estimates the receiving signal strength (RSS) at the receiving node. The second function converts RSS to the throughput. Besides, to further improve the accuracy in the field with several rooms, we introduce the simple model for the multipath effect.

Fourth, he presents the parameter optimization tool, which can be used for various applications in addition to the throughput estimation model, to find the optimal values of the parameters from the measurement results. It seeks the optimal values of the parameters such that the total error between the measured and estimated throughputs is minimized. He also presents the throughput measurement minimization procedure to minimize the number of throughput measurement points to reduce the labor cost.

Finally, he evaluates the accuracy of the throughput estimation model with the parameter optimization tool by comparing the measured and estimated throughputs in the three network fields. Then, he evaluates the minimax AP setup optimization approach through extensive measurements in three network fields, and confirm the effectiveness of this proposal.

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.