

論文内容の要旨 Abstract of Dissertation

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It is well known in communication engineering that the radio wave intensity is greatly affected by the propagation environment. Recently Long-range (LoRa) wireless communication technology has been widely used in many Internet-of-Things (IoT) applications in different industries and academia. By contrast, to ensure reliability of wireless communication network there is a growing need for investigate the radio wave propagation characteristics in various environment and accurate path loss prediction model. Radio wave propagation characteristics in forested areas are important to ensure communication quality in forest IoT applications. In this study, 920 MHz band propagation characteristics in forested areas and tree canopy openness and heights were investigated for the Takakuma experimental forest in Kagoshima, Japan.

The dissertation first chapter discuss about the background study of radio wave propagation through forest.

Chapter two presents a review of relevant existing research works. This was made to include existing empirical model. Here research gap was identified, and our research objective was stated.

In chapter three, evaluated with the distance characteristic and sky view factor were calculated from 360 panoramic image data captured from the beginning of the experiment until the end of the experiment, to better understand the environment and the effect of canopy-openness on radio wave propagation. We compared the experimental value with the theoretical value with the distance to evaluate the performance of the LoRa 920MHz communication system. Furthermore, we discussed the radio wave propagation environmental condition and obstacle height.

In chapter four, to develop a simple and accurate model based on the combination of an empirical path loss model and a free-space path loss (FSPL) model to improve the overall prediction accuracy in a forested environment. We proposed a model in which the total signal path loss between the transmitter and receiver is divided into two parts: free space loss and forested space loss. In addition, the proposed model was evaluated using field experiment data.

Finally, chapter five focuses on the overall conclusion and discussion of results. Based on the results authors have been suggested the possible improvement for future works.