Department of Electrical, Electronics, and Communication Engineering
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Extended Abstract PROJ3999 (Major Project)

Title : Channel Estimation with Interference in OFDM modulation using GNU Radio

Project Supervisor : Ramesha M

Cluster Name : Communication

Project Coordinator: Ambar Bajpai

Mini Project (PROJ2999) Outcome :

➢ Developed an OFDM transceiver using GNU Radio and Software-Defined Radio (SDR), enabling robust digital communication.

➢ Successfully implemented real-time transmission and reception of signals with effective synchronization and channel estimation techniques.

➢ Demonstrated system robustness by analyzing performance metrics such as Bit Error Rate (BER) and Signal-to-Noise Ratio (SNR) under various channel conditions.

➢ Explored and implemented PAPR reduction methods to improve signal transmission efficiency.

➢ Utilized open-source tools for cost-effective and flexible prototyping of communication systems, paving the way for future research in advanced wireless communication.

Extended Project Abstract :

OFDM is one of the most important modem modulation scheme for modern wireless communication systems because it yields high spectral efficiency and also provides resistance against multipath fading. Nonetheless, real wireless channel signals are interfered with by nearby signals and noise which are formidable in establishing exact channel estimate—a vital stage in conserving the legitimacy of OFDM. In this research, the authors consider using GNU Radio, an open –source software defined radio platform to identify and evaluate channel estimation under interference. This work examines the effects of interference on pilot based channel estimation techniques which forms the basis for most estimators used in OFDM systems including the Least Squares (LS) and the Minimum Mean Square Error (MMSE) estimators. Finally, by means of simulation and real-time operation, we assess the interference owing to co-channel interference and adjacent channel interference. The experimental setup takes advantage of the multiplicity of GNU Radio in realizing an OFDM system, injection of interference and self-developed algorithms for combating the interference. The BER, MSE of channel

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estimate, and the SNR are considered as performance parameters in the low SNR condition to evaluate the performance of the proposed methods. These results show that interference degrades the accuracy of the channel estimation but the filtering and interpolation algorithms enhance the performance of the system. This study offers understanding on resilient OFDM system that can work in aggressive interference scenario, helping in continuing improvement of future wireless system including 5G and future off-communications. The results of this research stress the importance of a favorable channel estimation for faithful communication overlooking different methods of interference cancellation within the context of GNU Radio framework.

Extended Project Objectives :

> Develop and Implement Channel Estimation Techniques: This page provides an overview of what this project is all about and what it entails, including the development of pilot-based channel estimation methods like LS and MMSE for OFDM using the GNU Radio.
> Analyze the Impact of Interference: Discuss on co-channel and adjacent channel interference on channel estimation accuracy and total system performance in OFDM schemes.
> Propose and Test Mitigation Strategies: Design and implement new methods of filtering and estimation of interference as well as improving the channel estimation in the environments that prone to interferences.
> Assess System Performance: Provide BER, MSE, and SNR as performance measures with which the effectiveness of the proposed methods will be quantified under different interference scenario

Ghent chart for Extended Project PROJ3999 :

Week	Task
1-2	Project Planning and Setup
3-4	Literature Review and Research
5-6	System Design in GNU Radio
7-8	Interference Modeling
9-10	Implementation of Estimation Techniques
11-12	Testing and Interference Mitigation
13-14	Performance Analysis
15-16	Documentation and Reporting

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Suggest 2 IEEE Conference targets-

➢ IEEE International Conference on Communications (ICC) 2025

➢ IEEE Global Communications Conference (GLOBECOM) 2025

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Sign with date 24/12/2024