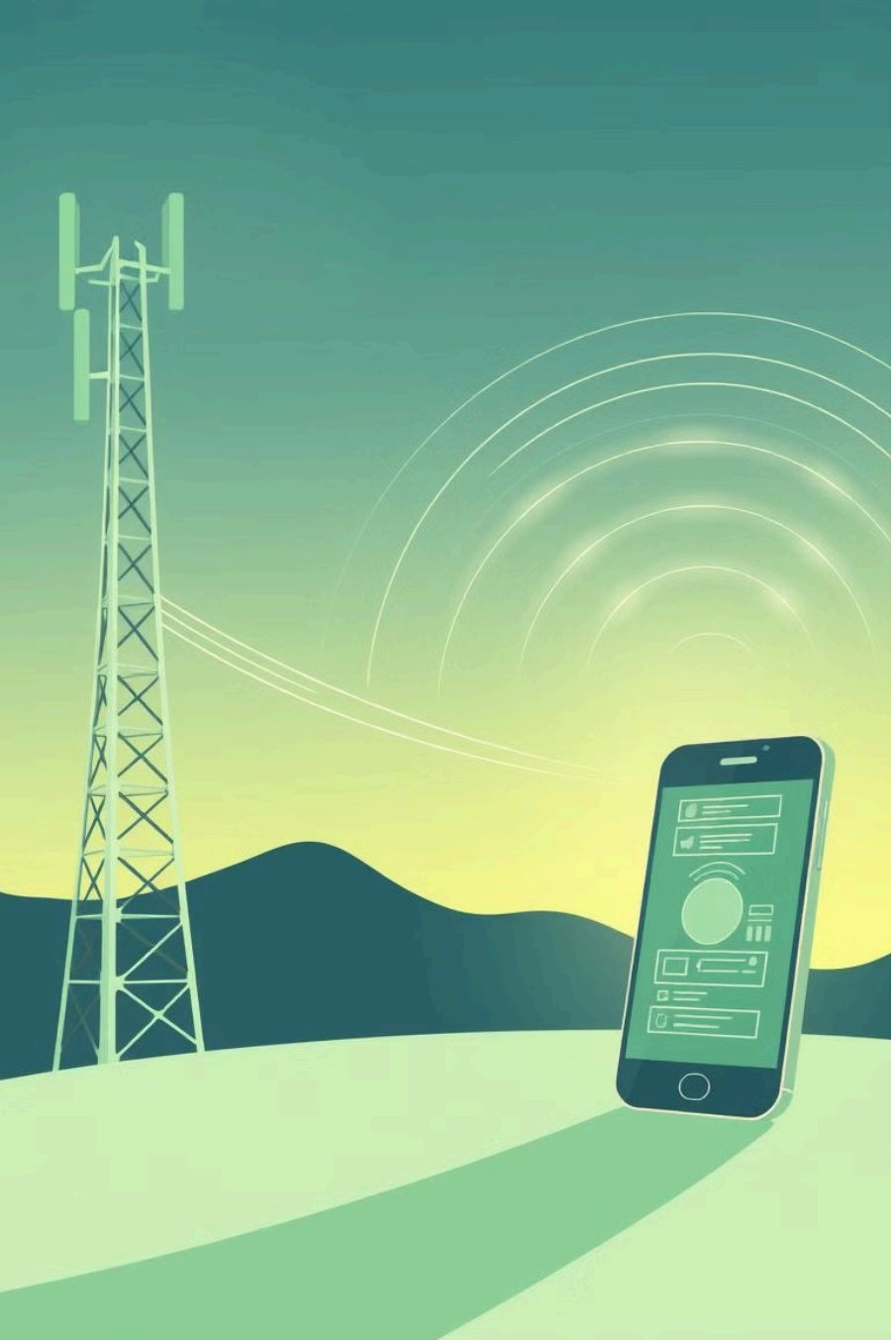


Dynamic Modulation Scheme Selection Based on SNR

This project focuses on developing a wireless communication system that dynamically selects different modulation schemes based on the signal-to-noise ratio (SNR). By adapting to varying channel conditions, this system optimizes data transmission and minimizes errors.

by Priyansh Khasdev

Introduction

1 **Dynamic Modulation**

Adaptive modulation optimizes communication performance by dynamically selecting the appropriate modulation scheme based on the SNR.

2 **Wireless Communication**

Wireless communication faces the challenge of varying signal strengths, requiring efficient modulation techniques to ensure reliable data transmission.

Problem Statement

1

Varying SNR

Fluctuating signal-to-noise ratios in wireless channels pose a significant challenge for reliable data transmission.

2

Efficient Modulation

Selecting the right modulation technique is crucial to maximizing data transmission rates and minimizing errors in the presence of noise.

3

Adaptive Modulation

Dynamic modulation scheme selection based on SNR allows the system to adapt to changing channel conditions and optimize performance.

Modulation Schemes

BPSK

Binary Phase Shift Keying (BPSK) is a robust modulation scheme suitable for low SNR environments, transmitting one bit per symbol.

QPSK

Quadrature Phase Shift Keying (QPSK) transmits two bits per symbol, offering a higher data rate than BPSK, suitable for moderate SNR conditions.

16-QAM

16-Quadrature Amplitude Modulation (16-QAM) transmits four bits per symbol, achieving the highest data rate but requiring high SNR for reliable operation.

System Design

1

SNR Measurement

The system continuously monitors the SNR level in the wireless channel.

2

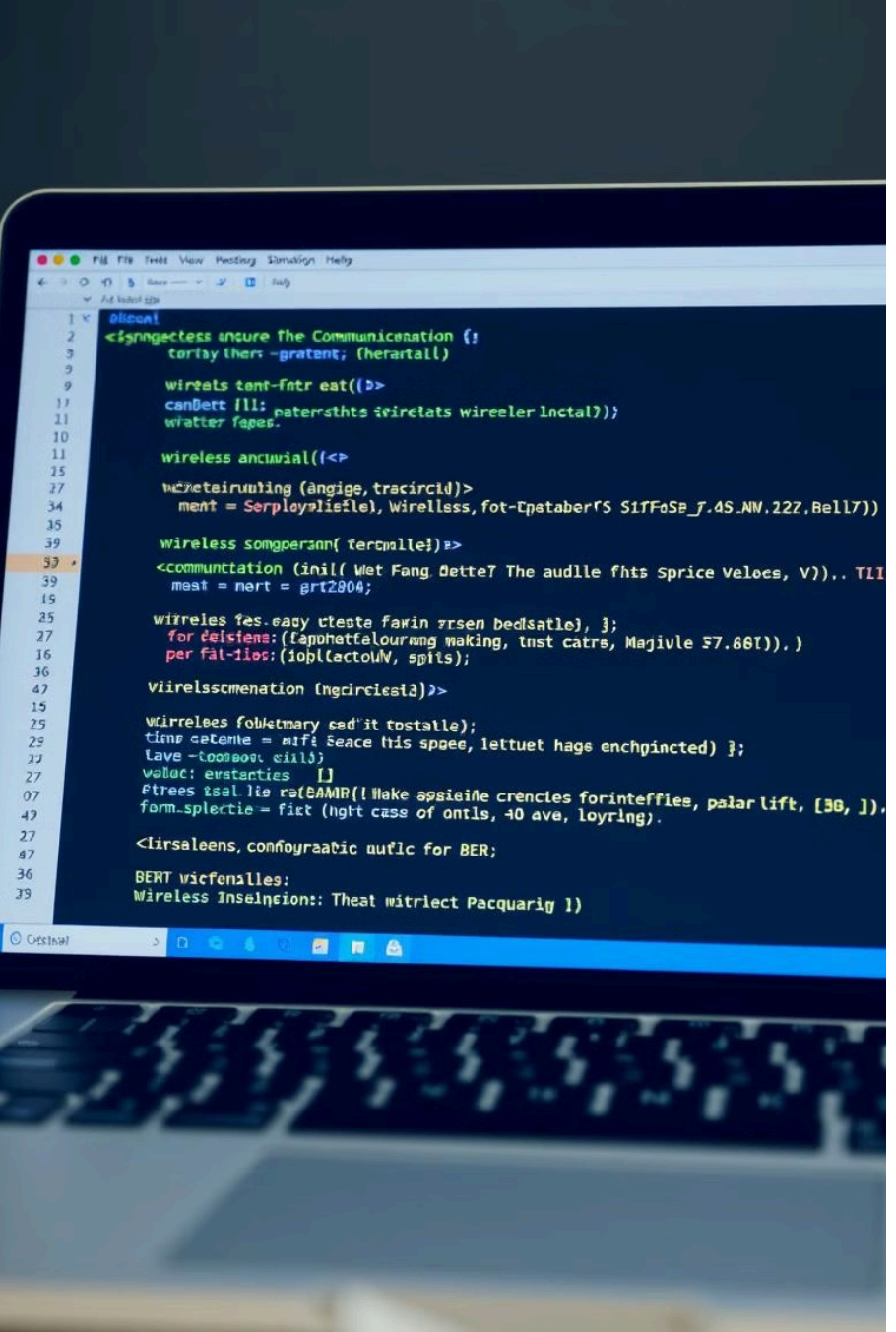
Modulation Selection

Based on the measured SNR, the system dynamically selects the most suitable modulation scheme from BPSK, QPSK, or 16-QAM.

3

Data Transmission

The selected modulation scheme is applied to the input data, and the modulated signal is transmitted over the wireless channel.



Methodology

MATLAB Simulation

The system is implemented and simulated using MATLAB, a powerful tool for wireless communication system design.

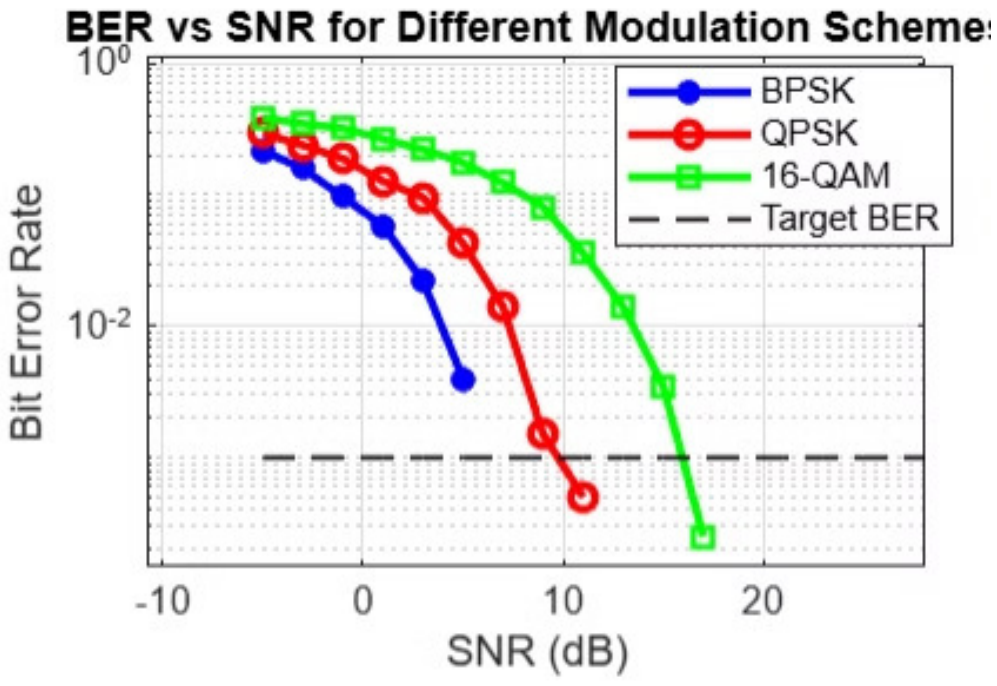
Bit Error Rate (BER) Calculation

The MATLAB code calculates the BER for each modulation scheme across different SNR levels, evaluating the system's performance.

Performance Evaluation

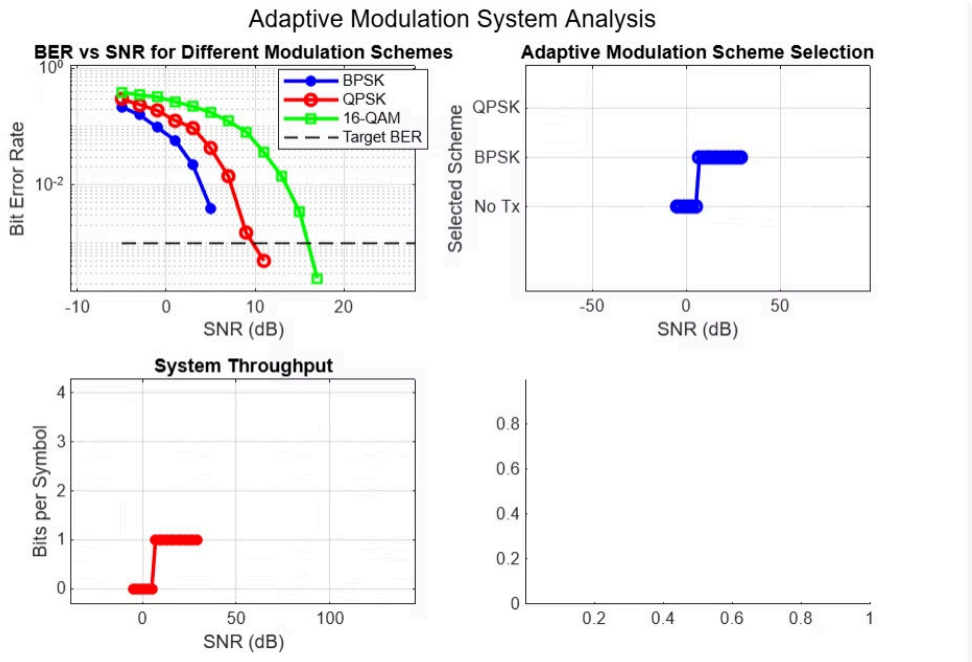
The simulation results are analyzed to assess the performance of the dynamic modulation scheme selection approach in terms of BER and data rate.

GRAPHS



ER vs. SNR for Different Modulation Schemes

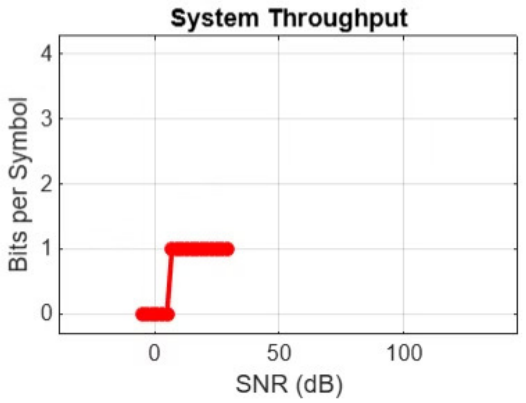
The BER curves demonstrate the performance of each modulation scheme in terms of error rate as SNR increases.



Modulation Scheme vs. SNR

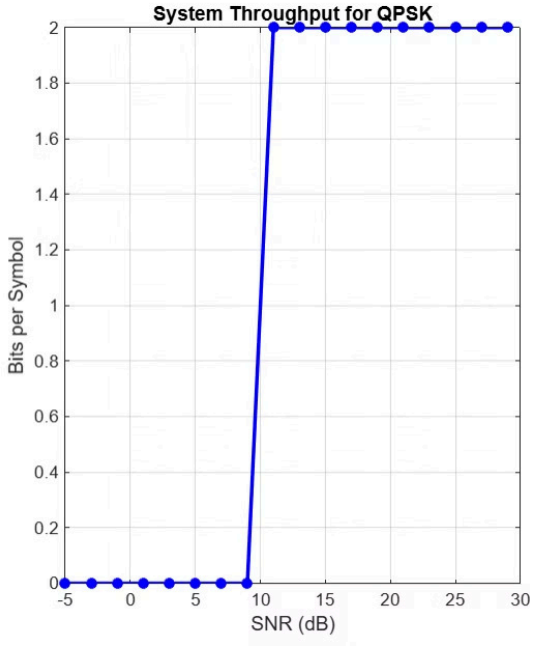
The system dynamically selects the modulation scheme based on the SNR, utilizing BPSK for low SNR, QPSK for medium SNR, and 16-QAM for high SNR.

Dynamically Selected Modulation Curves



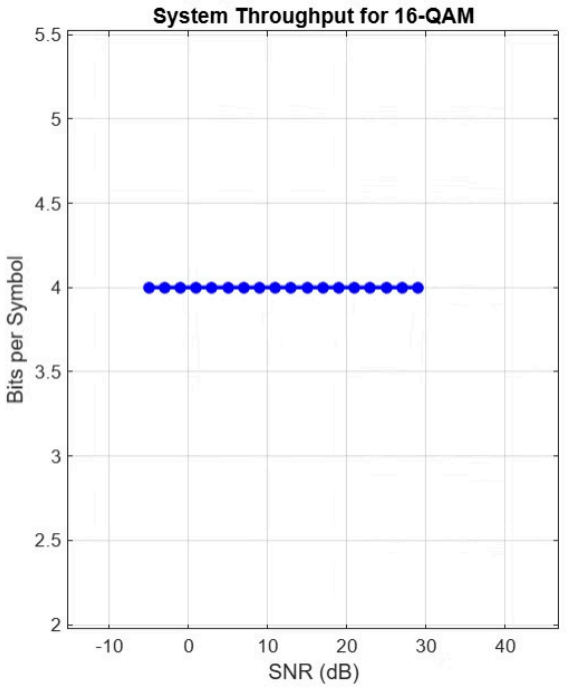
BPSK

When SNR is low BPSK Modulation Scheme is selected for transmission of information.



QPSK

When SNR is at moderate level QPSK Modulation Scheme is selected.



16-QAM

When SNR is at higher level 16-QAM Modulation Scheme is selected.

Conclusion

Enhanced Performance

Dynamic modulation selection significantly improves the performance of wireless communication systems by adapting to changing channel conditions.

Real-World Applications

This system has potential applications in 5G networks, IoT devices, and other advanced wireless communication technologies.