

**Department of Computer Engineering**

**CUI, Lahore Campus**

**Complex Engineering Problem**

Microprocessor Systems & Interfacing (CPE342)

**Project Title**

**Wireless Dual Joystick Controller using Arduino and NRF24L01**

**Group Members:**

1. Name: Abdullah Laeeq\_ \_\_\_ \_\_ | Roll No: FA22-BCE-026
2. Name: M Faizan Shurjeel\_\_\_\_\_\_ | Roll No: FA22-BCE-086
3. Name: Ali Hamza\_ \_\_\_\_\_\_\_\_\_\_\_ | Roll No: FA22-BCE-071

**Project Scope:** This project aims to design and implement a microcontroller-based embedded system that delivers a portable, wireless control solution for real-world applications. It addresses the demand for intuitive, real-time interaction in environments where wired systems or direct contact are impractical—such as navigating a drone in low-visibility zones or directing a robotic arm in hazardous settings. The focus will be on blending theoretical concepts with hands-on skills in firmware development, hardware interfacing, and system integration to create a reliable and adaptable control platform.

**Brief Description of the Project:** This project develops a wireless control system comprising a handheld transmitter and a receiver, both driven by Arduino Nano microcontrollers and linked via NRF24L01 2.4GHz RF transceivers. The transmitter integrates two analogue joysticks—each delivering X and Y axis inputs through potentiometers—plus a digital button for added versatility. Powered by batteries, the system ensures mobility and practicality across diverse scenarios.

* **Transmitter Operation**: The Arduino Nano reads joystick analogue values and button states, processes them, and sends the data wirelessly via the NRF24L01 module using unique pipe IDs to prevent interference.
* **Receiver Operation**: A second Arduino Nano paired with an NRF24L01 decodes the incoming data, enabling control of external devices like rovers, robotic limbs, or gaming platforms.
* **Technical Challenges**:
  + Achieving low-latency communication for real-time responsiveness.
  + Optimizing power usage to extend battery life without compromising performance.
  + Ensuring robust error handling to maintain reliability in noisy or obstructed environments.
* **Applications**: Ideal for scenarios requiring remote precision, such as steering a rover through rough terrain or manipulating machinery in unsafe conditions.

This design offers a compact, user-friendly alternative to traditional wired controllers, with potential for future expansion (e.g., adding sensors or multi-device pairing).

**Major Components Used:**

* **Microcontrollers:** 2 x Arduino Nano
* **Input Devices**: 2 x Analog Joysticks (each with X and Y potentiometers and a digital button)
* **Communication Modules**: 2 x NRF24L01 2.4GHz RF Transceivers
* **Power Supply Units**: Batteries for the controller and receiver

**Software Tools Used:**

* **Programming Language:** C/C++
* **IDE:** Arduino IDE

**Deliverables:**

* Fully working prototype for project demonstration and presentation
* Complete report (template shall be shared later)