Embedded Systems Development Course Outline

Course Progress Overview

Week	Date	Content
Week 1	11/18 - 11/22	MOIL System Introduction Linux Basics
Week 2	11/25 - 11/29	Yocto Project Development Practice
Week 3	12/02 - 12/06	GStreamer Multimedia Framework
Week 4	12/09 - 12/11	Qt Graphical Interface Development Course Discussion and Summary

Detailed explanation of course units

Basic environment construction

Introduction to Development Environment

- MOIL system introduction
- Development environment architecture description
- Course learning path description

Ubuntu system and Linux basics

Basic settings and operations

- Ubuntu Server installation and configuration
- Basic Linux command operations
- Practical exercises and problem solving

Ubuntu related resources

- Ubuntu Server Installation Guide
- Create a bootable USB stick tutorial
- OpenSSH Server Settings
- Taiwan Mirror Station Settings

Containerization technology practice

Docker Infrastructure

- Introduction to Docker architecture
- Docker installation and configuration
- Docker container management

- Practical exercises and problem solving

Docker reference resources

- Docker Engine Installation Guide
- Linux environment Docker post-installation settings
- Container Run Management

WSL development environment configuration

WSL system settings

- Introduction to WSL 2 architecture
- WSL installation and configuration
- WSL instance management
- Practical exercises and problem solving

WSL Technical Resources

- WSL Installation Guide
- WSL Advanced Settings Configuration
- WSL Web Application Access Settings
- WSL's D3D12 GPU video acceleration function

Development tool integration environment

IDE and version control settings

- VSCode installation and basic configuration
- VSCode remote development environment settings
- SSH connection configuration
- WSL development environment integration
- Docker container development settings
- Git version control and GitHub collaboration

Development tool resources

- Git version control
- VSCode Environment Setup Guide
- VSCode remote development
- VSCode Git version control

Technical Document Management System

Docusaurus Document Platform

- Docusaurus installation and configuration
- Markdown file writing

- File deployment and version management
- Practical exercises and problem solving

File system resources

- Node.js Installation Guide
- Docusaurus installation tutorial
- Docusaurus Configuration Instructions
- Docusaurus User Guide
- Document deployment process

Embedded system development

Yocto Linux system setup

Development environment preparation steps

- Yocto development environment setup
  - Docker container environment configuration
  - Installation and settings of related tools
- Yocto system customization
  - Add the required meta levels
  - Recipe file modification
  - System configuration file adjustment
- System construction and deployment
  - BitBake build process instructions
  - Customized Linux image file generation
  - SD card burning and system startup
  - Development board function verification

Yocto Development Resources

- Yocto Project Quick Setup Guide
- RZ/G2L Development Kit Description
- RZ/G2L Evaluation Board Quick Start Guide
- RZ/G Linux Verification Kit
- Renesas Technology Wiki
- balenaEtcher burning tool

GStreamer application practice

GStreamer basic concepts

- Architecture introduction
- Commonly used commands and tool operations

- Pipeline design principles

Cross-platform development and performance comparison

- PC development
    - GStreamer Development Kit Installation and Settings
    - Pipeline implementation and testing
- RZ/G2L development board integration
    - Yocto recipe modification
    - Rebuild system image file
    - SD card writing and development board startup
    - Pipeline implementation and testing
- Performance analysis and optimization
    - Performance data collection methods
    - Performance comparison between PC and RZ/G2L
    - System resource usage analysis
    - Performance tuning suggestions

GStreamer technical resources

- GStreamer Installation Guide
- Basic Teaching Series
- Plug-in development documents
- Renesas GStreamer technical documentation

Graphical interface application development

Qt framework integration

- Qt development environment setup
- Qt application development
- RZ/G2L Qt integrated development

Qt development resources

- Renesas Qt Graphics Technical Documents

Hardware interface control development

GPIO system programming

- Development environment preparation
- Qt GPIO program development
- RZ/G2L GPIO control implementation

GPIO Technical Resources

- Renesas Core GPIO File

Basic course requirements

Necessary skills background

- Basics of programming languages
    - C/C++ programming basics
    - Python programming basics
- Linux system operating experience
    - Basic command operations
    - File system management
    - Permission setting concept

Course Evaluation Items

1. Environmental construction project

- Complete development environment configuration
- Development tool installation and settings
- Basic operation files

2. Linux system development project

- Customized Linux system
- Development board startup test
- Build process documentation

3. Multimedia application project

- Pipeline design files
- Functional test report
- Performance analysis report

4. User interface project

- User interface design
- Function implementation code
- Application documents

5. Hardware control project

- Hardware control program
- Test verification report
- Technical documents

6. Technical Documentation Project

- Development environment setup guide
- Application manual
- Troubleshooting guide