



Q1 - Embedded GUIs with Qt

Embedded GUIs with Qt

Objectives

- Installing Qt 5 and the needed components on an embedded platform
- Writing Qt applications
- Discovering Qt key components
- Understanding the proper use of threads in Qt applications

Labs are conducted on target boards, that can be:

Quad Cortex/A9-based "Sabre" boards from NXP, with Lauterbach JTAG probes.

Dual Cortex/A9-based "Panda ES" boards from Texas Instruments, with Lauterbach JTAG probes.

Atmel ARM9-based boards, with Lauterbach JTAG probes.

Course environment

- Printed course material (in English)
- One Linux PC for two trainees.
- One target platform (i.MX6 Sabre or PandaBoard ES) for two trainees

Prerequisite

- Good knowledge of C++ language

Target Audience

- Any embedded systems engineer or technician with the above prerequisites.

Course Outline

FIRST DAY

Introduction

- History
- Versions
- Licenses
- Components
- Qt Quick

Qt basics

- Hello world application
- Compiling and cross-compiling a Qt application
- The main mechanisms of Qt
 - MOC (Meta Object Compiler)
 - Main loop
 - Signals and slots
 - Introspection
 - Asynchronous calls

- Creation of a Qt application on Linux
 - Creation of Qt projects
 - Compiling
- Main classes
 - Base classes
 - Main widgets
 - Utilities
- The development tools for Qt
 - QT Designer
 - QtCreator
 - Qmake

Exercise: Hello world application

Qt widgets

- Basic widgets
 - Labels, buttons, ...
- Layouts
- Dialogs
 - Custom dialogs
 - Standard dialogs

Exercise: Writing an application combining various widgets

Exercise: Writing a custom dialog

SECOND DAY

Threading

- Threading model
- Launching a worker thread
- Synchronization
- Queuing work to the GUI thread
- Timers

Exercise: Writing a multi-threaded application

Custom widget

- 2D drawing
- Handling mouse, touch screen and keyboard events

Exercise: Moving an image on screen

Model/view

- Model/View concept
- Model/View widget vs Standard Widget
- Standard models
- Writing a custom model
- Views

Exercise: Using a QListView

THIRD DAY

Install

- Low-level graphics
 - Frame buffer
 - Open GL ES and EGL

- X Server
- Wayland
- Qt platform plugins
 - EGLFS
 - LinuxFB
 - XCB (X server)
 - Wayland
- Low-level input subsystem
 - Input drivers
 - Tslib
 - Multi-touch protocol
- Configuring input in Qt
- Cross-compiling and installing Qt
 - Build system
 - Main options

Exercise: cross-compiling and installing Qt5 on an embedded board

Open GL ES 1.1 and 2.0

- Presentation of Open GL
 - Various Open GL versions
- Base concepts
 - Notion of state in OpenGL
 - Vertices and Triangles
 - Transformations
 - Drawing
 - Textures
 - Shaders
- OpenGL and OpenGL/ES
- Drawing in OpenGL
 - Vertices and index arrays
 - Drawing items
 - Projections
 - Viewpoints
- Transformation matrixes
 - Loading and initialization
 - Translations and rotations
 - Save and restore (Matrix stack)
- OpenGL shaders
 - OpenGL Shading Language (GLSL)
 - Vertex shaders
 - Fragment shaders
 - Applying transformations
- OpenGL rendering model
 - Surfaces
 - Rendering operators
 - Offscreen rendering
- OpenGL in Qt 5
 - Raw OpenGL with Qt OpenGL module (QGLWidget class)
 - Qt wrappers above OpenGL ES of Qt GUI module (QOpenGLContext)

Exercise: Rotating cube

FOURTH DAY

Multimedia support

- Multimedia in Linux

- Gstreamer
- Multimedia in Qt 5
 - QtMultimedia module
 - Audio, Video Camera, MediaPlayer and Radio

Exercise: Playing a video file

Qt Quick

- QML
 - Elements and properties
 - Javascript
- Main elements and properties
 - User input, state, model and views, ...
- Interactions between C++ and QML

Exercise: Hello world application with Qt Quick