

# نرم افزار اجرای زنده موسیقی و lightshow با استفاده از دستگاه Launchpad Mini MK2 - MIDI Controller



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## 1. Introduction

### Concept:

A Launchpad is a MIDI controller device used with digital audio workstation applications for music production. However it's also used for live performances because of its unique design as a digital instrument.



### Problem:

The native applications used with a Launchpad, such as Ableton or FL Studio, are not user friendly at all. They're designed for the usage of expert producers with years of experience in this field. They're also designed with the goal of music production not live performance with a Launchpad device. It's also a very time consuming and tedious task to set LED lightshows for a Launchpad.

### Project Goal:

Our plan is to design and develop a software, optimized for live music performance and lightshow settings with a Launchpad combined with ease of usage for all users with different levels of experience, with minimum playback latency and acceptable learning curve.

## 2. System Design

### User Requirements:

The first step of designing a software is to determine what the user actually wants and how it should be implemented. We've gathered all the necessary functional and non-functional requirements which laid the foundation of this project. We found that users need to perform lightshow related tasks quickly which results in a need of high development extensibility of features.

### Architecture:

Based on the requirements the architecture was decided. This software uses a microkernel architecture, with its core designed as a layered one. This combination results in a low cost but high extensibility which is an important characteristic aspect of this software.

### Use cases and important sequences:

After designing the architecture, the use cases of each component became clear. We also found some paths that their design and implementation have high priority in terms of performance and optimization.

## 3. Implementation

### Software:

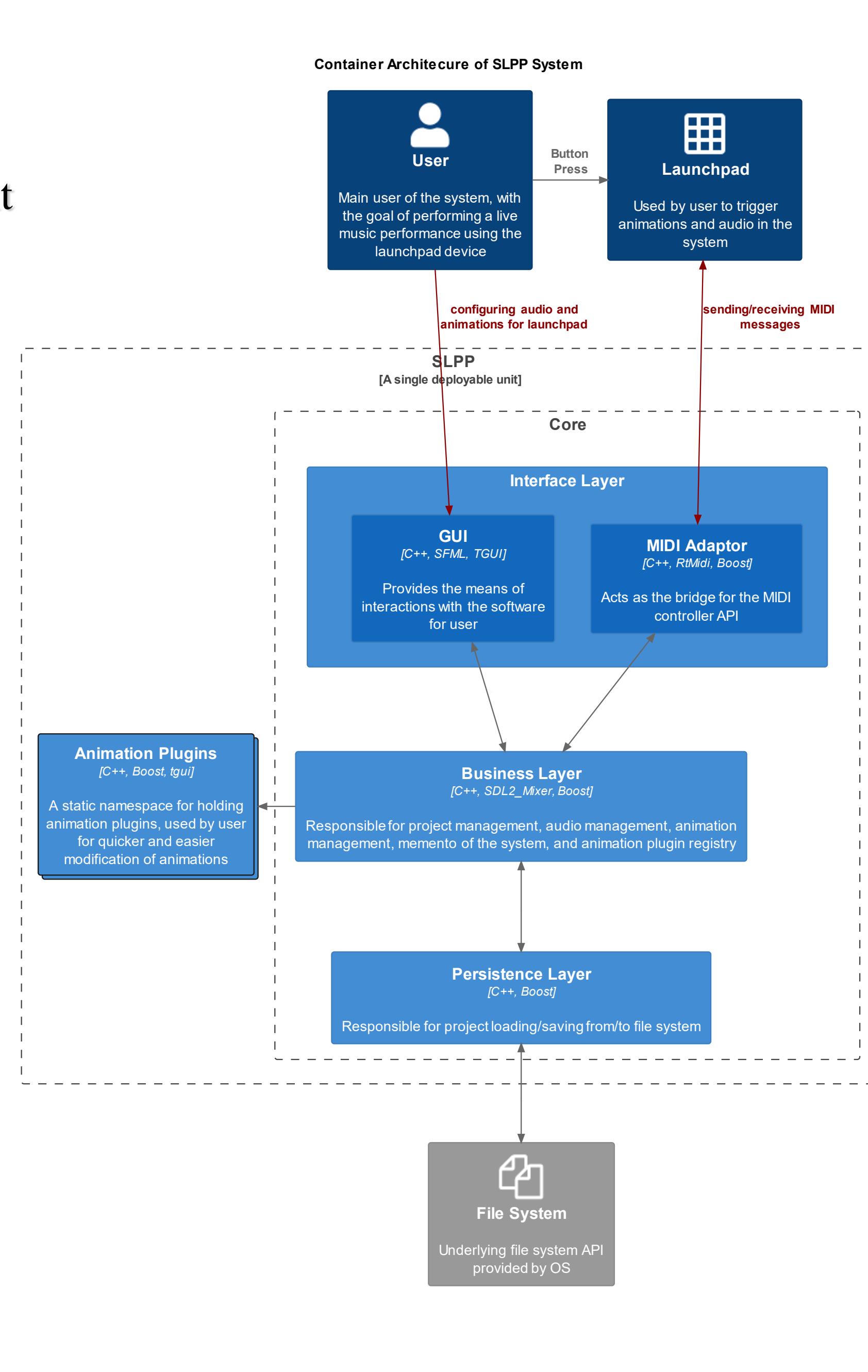
For the implementation of this software, different technologies were used. For the actual codebase we used C++ because of its high performance nature. SFML and TGUI, two libraries used for graphics and GUI implementation were used for the user interface. The library RtMidi was used for the implementation of Launchpad interface and MIDI messaging. For audio processing and playback, SDL2\_mixer and its parent, SDL2 were used. Throughout this project a few libraries from the Boost C++ library package were for different purposes, to name a few: Chrono, Thread, Serialization.

### Plugins:

As noted before, this system uses microkernel as its main architecture. This design utilizes plugins for task management which results in high extensibility. In this system, plugins are designed and developed to increase the productivity of users when working with and designing lightshow animations. So far more than 20 plugins are developed which can easily increase because of the microkernel structure.

### Testing:

For testing the correctness of this system, we developed and conducted tests using GoogleTest Framework. 4 different categories of tests are used: Unit and logic tests, integration tests, MIDI tests and Plugin tests. MIDI tests not only assesses the correctness of midi components, they also measure the delay and latency of critical paths in the system.



## 4. Conclusions:

The result of this project is a software with a user-friendly design and well optimized for the purpose of live music performance and lightshow with the Mini Mk2 Launchpad device. During this project, the performance efficiency of the software, communication and user experience with this program were the most important priorities, the result of which is a suitable user environment, especially compared to other software in this field.

