Software Requirements Specifications

LED Animation

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1.0 Overview

1.1 Purpose

The purpose of this project is to display a YouTube video on a 32x32 LED panel running off of a Raspberry Pi. It is a proof of concept for potential future projects and development.

1.2 Sponsor

The sponsor, and client, of this project is Dr. Robert Rinker, an Associate Professor in the Computer Science Department of the University of Idaho's College of Engineering. Animating an LED panel, using a Raspberry Pi, is a continuation on a project Dr. Rinker sponsored last semester, which developed drivers to displayed text on the LED screen.

1.3 Document Overview

This document describes the minimum software requirements laid out for team Automaten in the development of their project. The following sections and sub sections lay out a brief description, basic architecture, and probable use cases for this project; A glossary of terms, list of figures, and a list of references can be found in the appendix at the end of the document. For more detailed information about the implementation and design, refer to this project's SDD.

2.0 Project Description

2.1 Background

This project builds off of the framework created last semester by team RPLD (Raspberry Pi LED Display). Team RPLD developed display drivers for the Pi's serial port, and manufactured a custom 16-to-26 pin serial connector needed for connecting the LED Panel to the Pi. This framework will be the touchstone for which team Automaten's LED Animation project will build from.

2.2 Problem Statement

This project has been separated into primary and secondary objectives. The primary objectives are those that are expected to be complete in order to have a successful project that meet the desired goals of the project. Secondary objectives are additional goals that would improve the projects quality, but are not necessary for successful implementation of

the final product.

The primary objective is to develop software for the Raspberry Pi that will:

- Download a YouTube video
- Decode the video stream frame by frame
- Convert each frame to a representative 32x32 matrix, and
- Display frames on a 32x32 LED panel with a reasonable frame rate

Secondary objectives include:

- Providing synchronized audio output along with video
- Provide support for four daisy chained LED Panels making a 64x64 LED display
- Allow video stream to correctly display on an arbitrary arrangement of daisy chained LED displays (i.e. 32x64, 96x32, etc.)

2.3 Hardware Specifications

Raspberry PI

- Debian Operating System
- RM1176JZF-S 700 MHz processor
- 512MB RAM
- 26 pin IDC socket connector

LED Display

- 32x32 RGB LED matrix panel (acquired from adafruit.com)
- 5” square panel
- 16 pin IDC socket connector
- Custom 16-to-26 pin IDC adaptor, connecting Raspberry Pi and LED display

3.0 Project Architecture

3.1 Architecture Overview

The basic architecture for this project is separated into two general sections:

- Front end, and
- Back end

The front end will be the interface that the user can interact with the backend through. The

backend will do all of the processing behind the scenes. The backend should have three basic modules to achieve the desired outcome:

- Downloading YouTube video's
- Processing data stream, converting to an appropriate format for display, and
- Displaying video stream on LED panel

3.2 Architecture Description

The three modules listed above and their basic interaction are depicted in Figure 1.

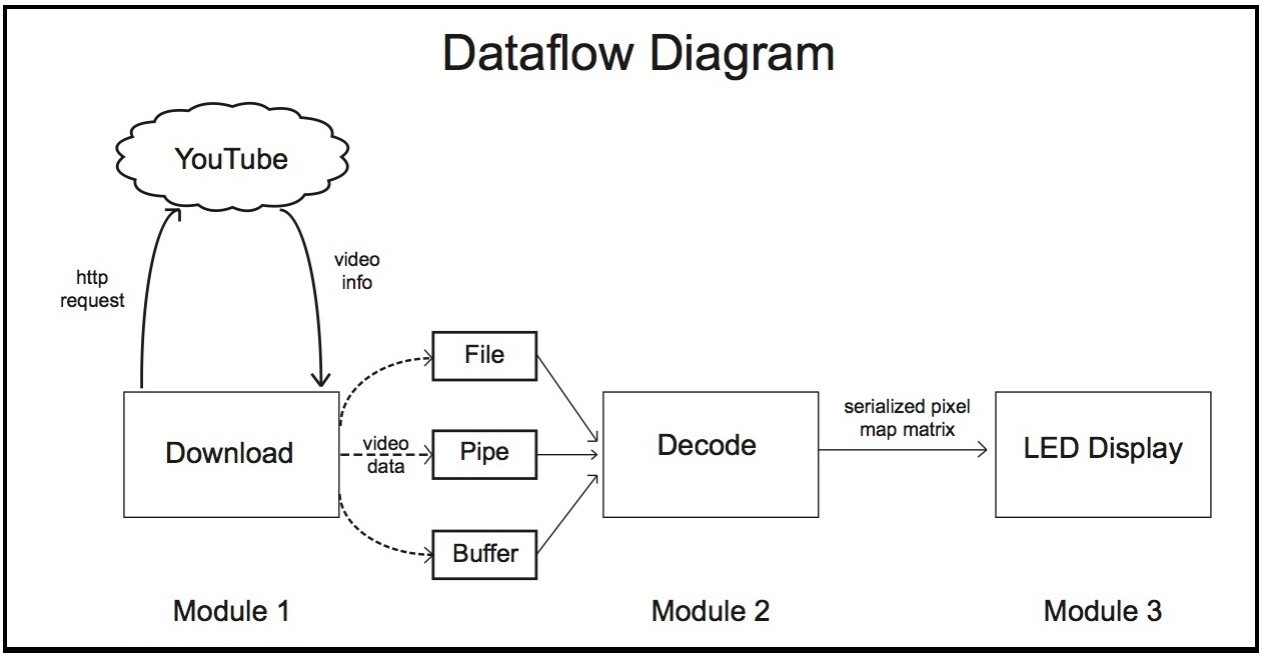

Figure 1: Basic Dataflow Diagram

As can be seen, in Module 1 we will download a YouTube video using an http request, from here we will need to buffer the video data in a file, pipe, or data buffer. Then Module 2 will take the buffered video data and decode it, translating it into a format that the LED panel will be able to see. Finally, Module 3 will take the converted video and display it on the LED panel (for more details see the project's SDD).

4.0 Assumptions and Dependencies

A large portion of this project is dependant on the state of the previous project's work. The assumption is that team RPLD's display drivers and 16-to-26 pin adaptor function as described. So any bugs related to the display drivers will be assumed to be due to new code, not the framework that the code is being built off of.

Another dependency for this project is the assumption that the hardware and any viable software / firmware on the Raspberry Pi, and the LED panel are functioning correctly. Again, any discrepancy between expected and actual output will be assumed to be caused by new code, and not a result of malfunctioning hardware.

5.0 Use Cases

The general use case for this project is to entertain and inspire. Potential use cases include, but are not restricted to:

- Inspiring new students
- Entertaining users, and
- Providing portable animation (i.e. for the University of Idaho marching band)

This project is a proof of concept that will hopefully inspire future development of either this specific product or others of a similar nature.

Appendix A: Glossary

Debian: A free, open source, Unix-like computer operating system.

IDC: (Insulation-displacement connector) A serial port connector that allows for serialized I/O between the Raspberry Pi and the LED panel.

LED: (Light Emitting Diode) An electronic device that lights up when electricity passes through it.

Raspberry Pi: The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools.

RPLD: (Raspberry Pi LED Display) The team from the previous semester that worked on this project. Specifically they created display drivers for displaying text on the LED panel.

SRS: (Software Requirements Specification) The document that describes the software requirements for this project.

SDD: (Software Design Document) The document that describes the design and implementation decisions for this project.

Appendix B: List of Figures

Appendix C: References

http://en.wikipedia.org/wiki/Insulation-displacement_connector
http://en.wikipedia.org/wiki/Raspberry_Pi
http://www.adafruit.com/products/607