RCA Design and Development Plan

Introduction

This device will be created as a tool for anyone who needs to record or otherwise utilize video footage of devices with RCA outputs. Our target demographics are enthusiasts who record footage for private or commercial use, as well as archivists who seek to store and record footage from obsolete or otherwise difficult-to-record technology. It can be applicable to many scenarios, including carrying audio and video information to devices that cannot normally interact with RCA inputs (e.g., computers with USB), bypassing the need of console emulators in favor of existing hardware, or any case where better audio/video quality is needed (e.g., converting to HDMI).

There are no schematics available to the public; however, there is research regarding a framework for image and video processing on a field-programmable gate array (FPGA), which took a high-level look at modifying an input stream from a video camera and outputting it to a monitor via VGA (Hadhri et al., 2010). Some commercial options for RCA capture cards are available and made by Elgato, Ezcap, and AverMedia, though they are closed source.

The main feature that differentiates our converter is that our RCA converter source code will be open-source. This will allow anyone who wants to edit the converter to their own specifications. HD-quality capture cards are relatively expensive in the current market, and this product will allow people to capture video and audio inputs for free. Our product will also feature both RCA and HDMI inputs, converting capability between the two, and the option to pass the input through to an additional display. Additionally, assuming these products use microcontrollers internally, our implementation using an FPGA would be more efficient in both power and speed since the circuit is designed for just conversion and pass-through, and doesn't have the same overhead when running as a microcontroller.

Statement of Work

For our final product, we will output the footage from the device to both outputs at original resolution and sound quality, and with consistent, low delay on the footage. The hardware our project will be implemented on is an FPGA, with connectors for an RCA input, an HDMI output, and a USB power port and output port. It should only require small amounts of power drawn through the USB port, though we have not chosen our FPGA yet to define that power draw. The software our project will be based in is the Very High Speed Integrated Circuit (VHSIC) Hardware Description Language (VHDL). It will link the input of the RCA, convert to both HDMI and USB output, and lastly link to the corresponding connected output devices.

Major Feature Calendar

Milestone	Research	Implementation	Optimization

Code	Feature	Date	Person
	Project Mock-Up	10/14/22	ALL
	HDMI Research	10/21/22	[Emily, Richard]
	USB Research	10/21/22	[Anthony, Gio]
	RCA Research	10/21/22	[Dakota, Richard, Gio]
	Pre-Alpha Build	10/31/22	ALL
	Begin HDMI Implementation	11/1/23	[Emily, Richard]
	Begin USB Implementation	11/1/23	[Anthony, Gio]
	Begin RCA Implementation	11/1/23	[Dakota, Richard, Gio]
	Design Prototype	11/19/22	ALL
	Status Presentation	12/4/22	ALL
	HDMI Implementation and Testing	1/20/23	[Emily, Richard]

Code	Feature	Date	Person
	USB Implementation and Testing	1/20/23	[Anthony, Gio]
	RCA Implementation and Testing	1/20/23	[Dakota, Richard, Gio]
	Refined Prototype	1/23/23	ALL
	Vertical Slice	2/6/23	ALL
	Progress Presentation	2/13/23	ALL
	Optimization: Reduce Delay	2/27/23	[Gio, Dakota, Anthony]
	Optimization: Resource Usage	2/27/23	[Emily, Richard]
	Preliminary Report	3/6/23	ALL
	Release Candidate	3/10/23	ALL
	Final Report	3/27/23	ALL
	Production Release	3/31/23	ALL
	Final Presentation	4/3/23	ALL

Deliverable Artifacts

Our hardware deliverable will be the programmed FPGA, which will act as our main product. We will supply both the schematics for the FPGA, as well as the device itself and any prototypes we have on the way. The deliverable will include a plastic case for the device to improve portability, durability, and solidify the aesthetic.

For our software artifact, we will deliver the source code used by the FPGA to process the video and send it over the USB output, as well as conduct a passthrough of the RCA to an HDMI. This will be formatted in the original source file form as well as the synthesized result, and hosted on GitHub as an open source repository to be free to access and modify for personal purposes.

For our documentation, due to the device itself being a fairly simple ‘plug-and-play’ utility, documentation will be more limited, however for the device’s code, it will be well-commented to make sure end-users will be able to understand and modify the code with ease.

Works Cited

Hadhri, Z. E., Valderrama, C., & da Cunha Possa, P. (2010). Image and video processing on fpgas: An exploration framework for real-time applications. *IFAC Proceedings Volumes*, *43*(24), 54–59. https://doi.org/10.3182/20101006-2-pl-4019.00012