

CEng 491 – Project KickOff Document

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End to End HDR KickOff Document

1 Description

Conventional image and video acquisition methods cannot capture the dynamic range of real world scenes. Such devices will output content with missing information such as saturated or completely dark pixels in bright and dark regions of the scene, respectively. High dynamic range imaging aims to overcome these limitations and capture the full content in a scene. HDR imaging poses mainly two challenges: acquiring and displaying HDR content.

There are several existing commercial products that operate on HDR content. However, these hardware are often inaccessible by researchers or end-users due to their extremely high price tag.

Our project aims to implement a real time HDR imaging pipeline (capture and display) using off the shelf products such as regular cameras and LCD displays, which will arguably cost only a fraction of a dedicated hardware solution.

2 Workpackages

In this section of the kick-off document major work packages are listed.

WP	Term	WP Title	# Man-months
1	491	Control DSLR Cameras	3
2	491	Acquire & Sync LDR Video Stream From Cameras	4
3	491	LDR Image Registration in GPU	5
4	491	Camera Response Curve Recovery	4
5	491 & 492	OpenGL GUI	3
6	491	Generate HDR Frames	2
7	491	Real Time Video Tone Mapping	3
8	492	Breakdown HDR Frames Into Projector and LCD Streams	4
9	492	Post process The Streams	4
10	492	HDR Calibration & Display Set-up	4

Detailed Descriptions of High-Level Work packages

2.1 WP1 - Control DSLR Cameras

In this work package, the following functionalities will be implemented.

- Exposure: Shutter speed, manual focus, ISO control for DSLR cameras
- Preview control

2.2 WP2 - Acquire and Sync LDR Video Stream From Cameras

In this work package, the following functionalities will be implemented.

- Acquisition LDR video stream using gPhoto2
- Acquisition LDR video stream using Canon SDK

2.3 WP3 - LDR Image Registration in GPU

In this work package, the following functionalities will be implemented.

- Comparative testing of algorithms
- Improvement of efficiency

2.4 WP4 - Camera Response Curve Recovery

In this work package, the following functionalities will be implemented.

- Implementation of Debevec or Mitsunaga Algorithm on GPU
- Offline response curve recovery

2.5 WP5 - OpenGL GUI

In this work package, the following functionalities will be implemented.

- Display parameters
- Debug information

2.6 WP6 - Generate HDR Frames

In this workpackage, the following functionalities will be implemented.

- Comparative testing of algorithms

2.7 WP7 - Real Time Video Tone Mapping

In this workpackage, the following functionalities will be implemented.

- Comparative testing of algorithms

2.8 WP8 - Breakdown HDR Frames Into Projector and LCD Streams

In this work package, the following functionalities will be implemented.

- Extract luminance map to the projector
- Extract chromaticity map to LCD streams

2.9 WP9 - Post process The Streams

In this work package, the following functionalities will be implemented.

- Smoothing the luminance map for background
- Sharpening the chromaticity map for foreground

2.10 WP10 - HDR Calibration & Display Set-up

In this work package, the following functionalities will be implemented.

- Setting up the hardware
- Fine adjustment

3 Bonus Workpackages

The following bonus work packages will be implemented if all mandatory ones are finished in the first semester.

- Support more DSLR cameras
- Smaller form factor
- Edge prediction

4 Risk Assessment

Risk #	Description	Possible Solution(s)
1	Low Dynamic Range with 2 cameras	Support more DSLR cameras
2	Low Resolution	Support IP cameras or more DSLR cameras