Computational Photography

HelloCamera

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CS 478 Lecture
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Overview

- You are handed:
  - a functional camera app, minus autofocus.

- You are to hand in:
  - an implementation of autofocus algo.
  - some extensions.
Meet FCamera
Meet TADP
Tegra Android Developer Pack
Organization

JAVA
Class
FCameraPROActivity

C++
API
FCam

API
Low-level hardware control
Organization

JAVA

Class

FCameraPROActivity

Class

CameraFragment
CameraView ...

C++

API

FCam

API

Low-level hardware control

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Organization

JAVA

Class

FCameraPROActivity

Class

CameraFragment
CameraView ...

Class

Image
ImageStack
ImageStackManager

C++

API

FCam
Components

Java

Class

FCameraPROActivity

“main” class

• Initialization
• Build UI

C++

Class

FCamInterface

API

FCam

Class

FCamInterface

Class

CameraFragment

CameraView ...

Class

Image

ImageStack

ImageStackManager

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Components

- CameraFragment: UI for camera mode
- CameraView: UI for viewfinder
- ViewerFragment: UI for viewer mode
Components

JAVA

Class
FCameraPROActivity

Class
CameraFragment
CameraView ...

Class

Data structures, File I/O, etc

Class

C++

API
FCam

Class
FCamInterface

Class
FCamInterface

Class
FCamInterface

Class
FCam
Components

JAVA

Class

FCameraPROActivity

Class

CameraFragment
CameraView ...

Class

Image
ImageStack
ImageStackManager

JNI (JAVA side)

FCamInterface

Class

FCamInterface

C++

Class

FCamInterface

Class

API

FCam

• Gateway to accessing FCam
Components

JAVA

Class

FCameraPROActivity

Class

CameraFragment
CameraView ...

Class

Image
ImageStack
ImageStackManager

JNI (C++ side)

Class

FCamInterface

Class

FCamInterface

C++

API

FCam

• Gateway to accessing FCam
FCamInterface
• C++ side runs a work thread

• Three tasks in infinite loop

Parse any pending requests.
Apply the parsed requests (via FCam)
Retrieve image from FCam and process.
• JAVA side asks the C++ side to enqueue new requests.

• Calls the appropriate native method that create and enqueues a message.

• Each request carries an int specifying the type.
• If your Android app wants to talk to FCam,
  • Call the right `FCamInterface` method to put in the right request,

OR

• Make a new request type and add code to parse it in `FCamInterface`. 
Take a look at `MyAutoFocus.h`.

Two functions defined

- `void startSweep()`
- `void update(...)`

Implement these, and call them appropriately from the work loop.
Example Flow
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• The SeekBar instance alerts its listener: a CameraFragment instance.
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- CameraFragment.onProgressChanged(...) is called.
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• The **SeekBar** instance alerts its listener: a **CameraFragment** instance.
• **CameraFragment.onProgressChanged(...)** is called.
• This method in turn calls a method of **FCamInterface** called **setPreviewParam**(PREVIEW_GAIN, gain).
Example Flow

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- The **SeekBar** instance alerts its listener: a **CameraFragment** instance.
- **CameraFragment.onProgressChanged(...)** is called.
- This method in turn calls a method of **FCamInterface** called **setPreviewParam(PREVIEW_GAIN, gain)**.
- This method in turn calls a method of **FCamInterface** called **setParamInt(PARAM_PREVIEW_GAIN, (int)gain)**.
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- **setParamInt** creates a new message, and adds it to the queue.
Example Flow

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- The **work thread** processes the queue, and sees this message.
Example Flow

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- The work thread updates the gain of the next shot, and requests that the sensor starts streaming shots with the new parameter.
Example Flow

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- `setParamInt` creates a new message, and adds it to the queue.
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- The work thread updates the gain of the next shot, and requests that the sensor starts streaming shots with the new parameter.
- The sensor begins returning frames with new gain.
Example Flow
(Summary Slide)

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- The SeekBar instance alerts its listener: a CameraFragment instance.
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- setParamInt creates a new message, and adds it to the queue.
- The work thread processes the queue, and sees this message.
- The work thread updates the gain of the next shot, and requests that the sensor starts streaming shots with the new parameter.
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Demo