O'Reilly Where 2.0 Online Conference – 12/3/2009

COMPUTER VISION AND THE IPHONE CAMERA + Q&A

Jeffrey Powers, Co-Founder, Occipital

- **Overview:** Computer Vision
- **Getting started** with iPhone Camera Development
  - Basic picture taking
- **Advanced** Development with the camera
  - Manipulating the live feed
  - Digging into the pixels
- **Future** of iPhone Computer Vision
- Q&A

Part 1/4

Overview

Computer Vision on iPhone

Computer Vision on iPhone

www.weeklyreader.com

Paramount Pictures

» Overview

Iron Man Vision

Not yet available on iPhone ☺

Paramount Pictures

» Overview

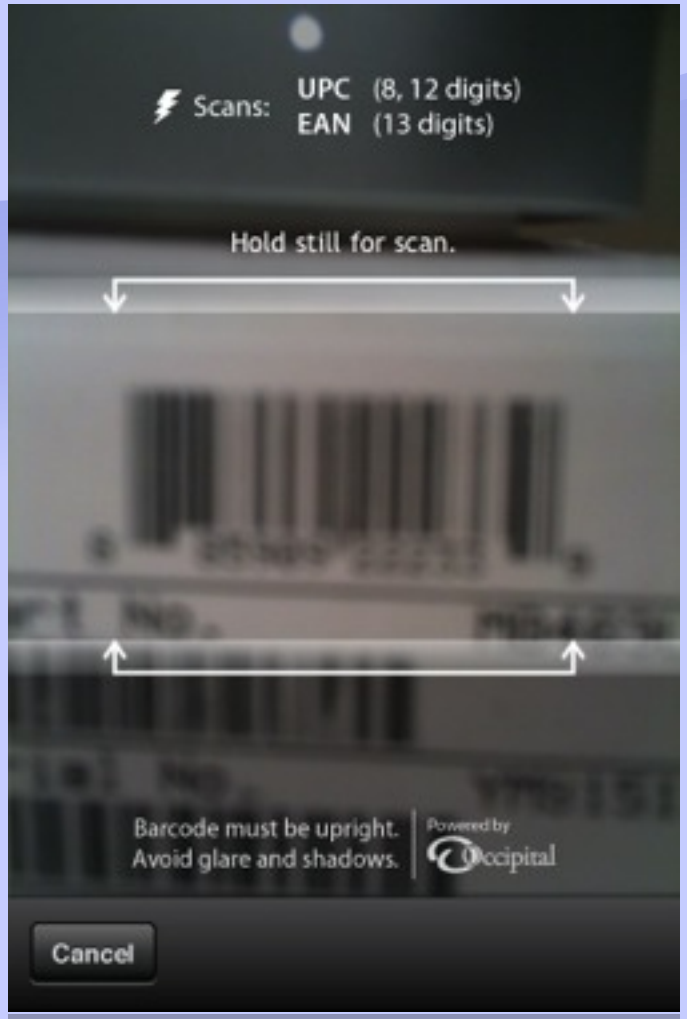
Iron Man Vision

Not yet available on iPhone ☺

Paramount Pictures

Our stuff on iPhone Today

- RedLaser
  - A barcode scanner based on computer vision.



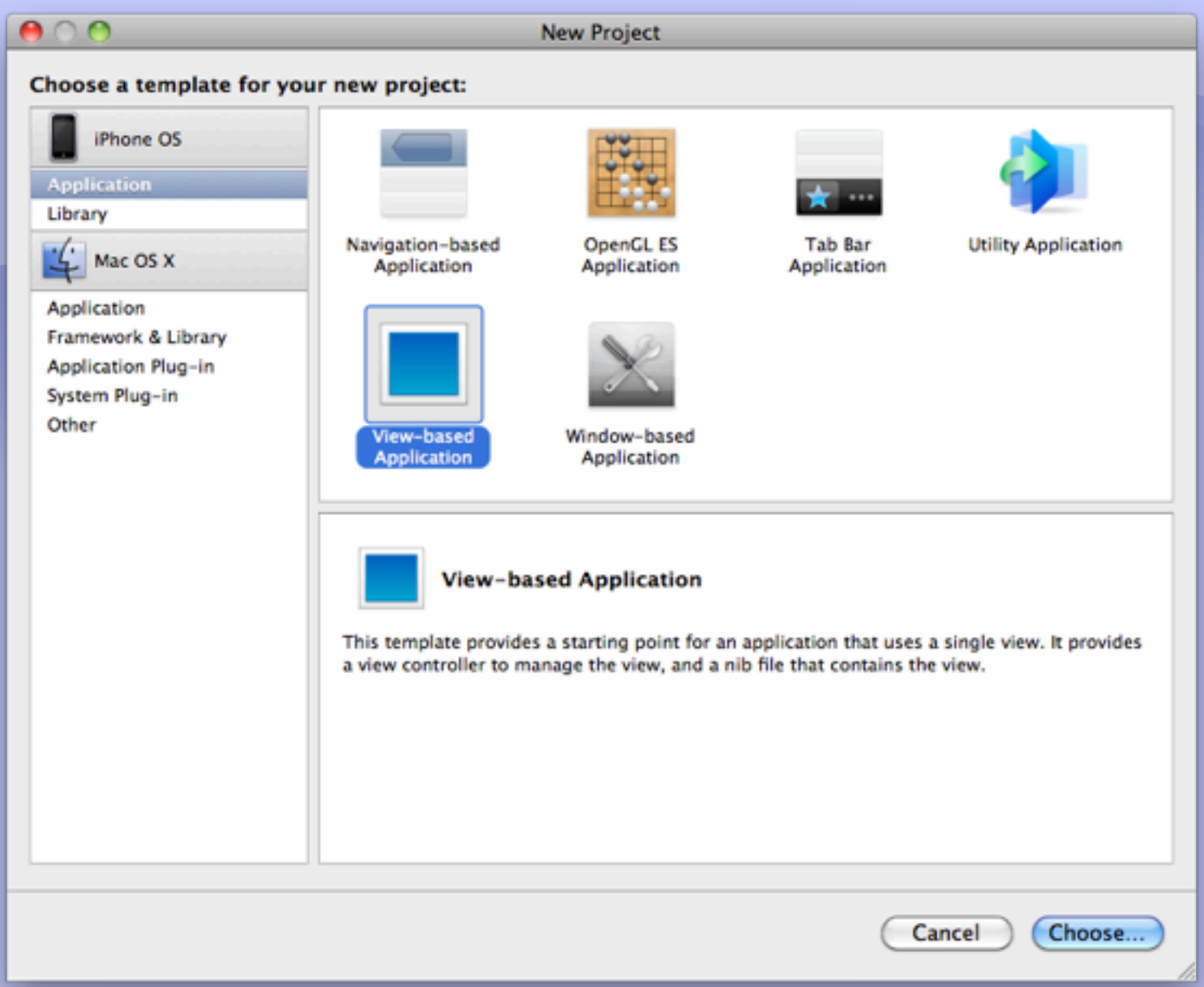
Raw pixels

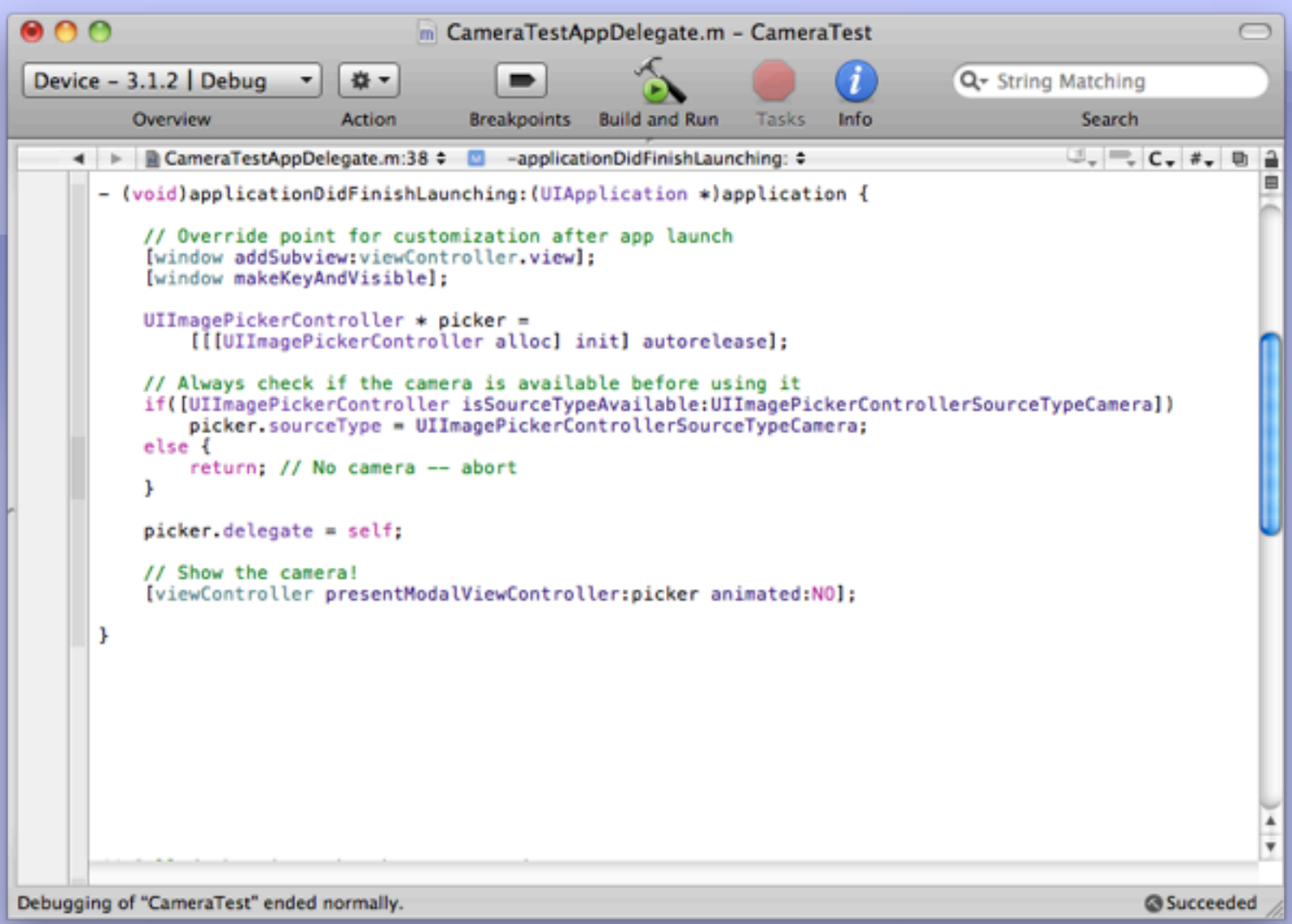
» Overview

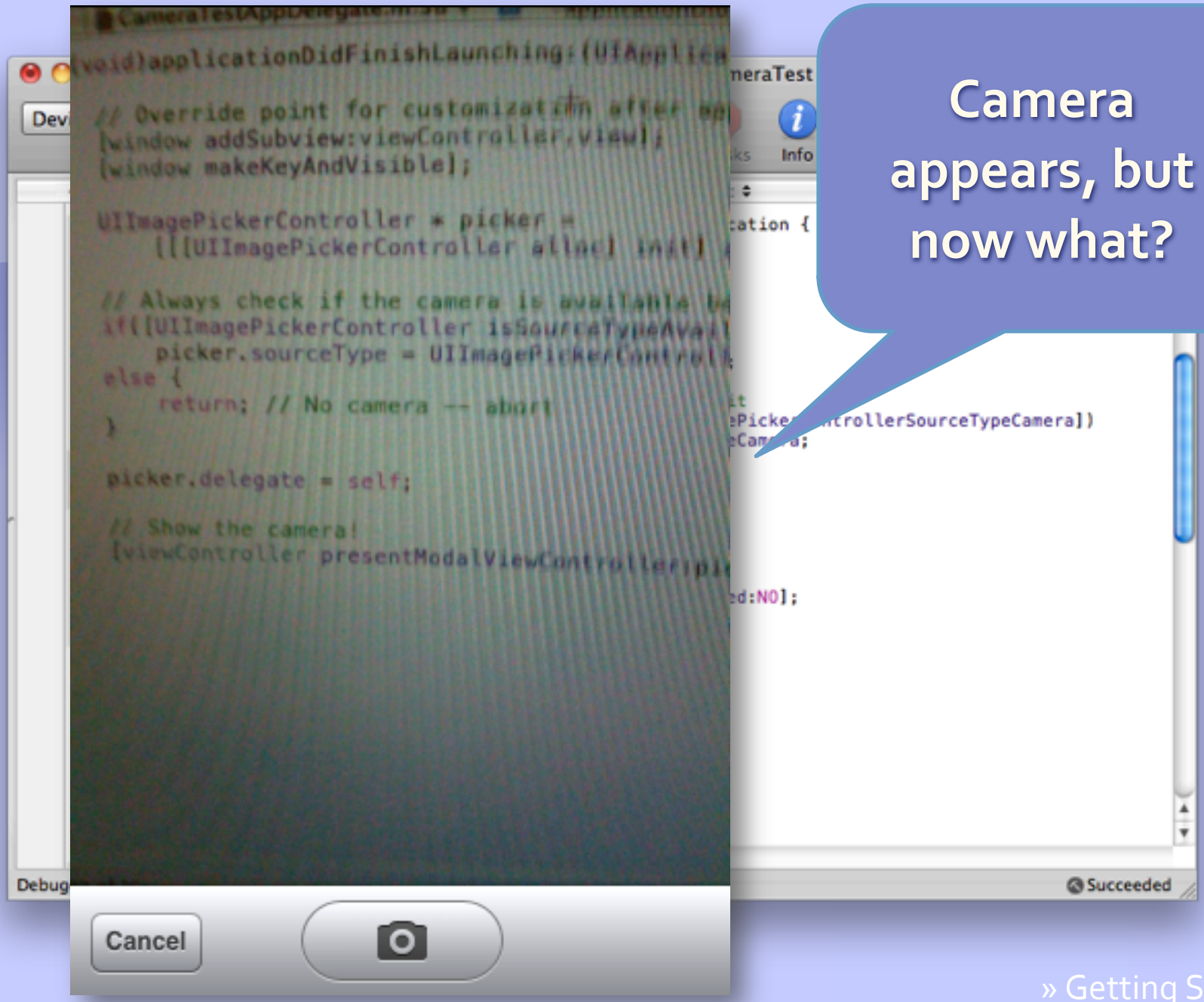
Part 2/4

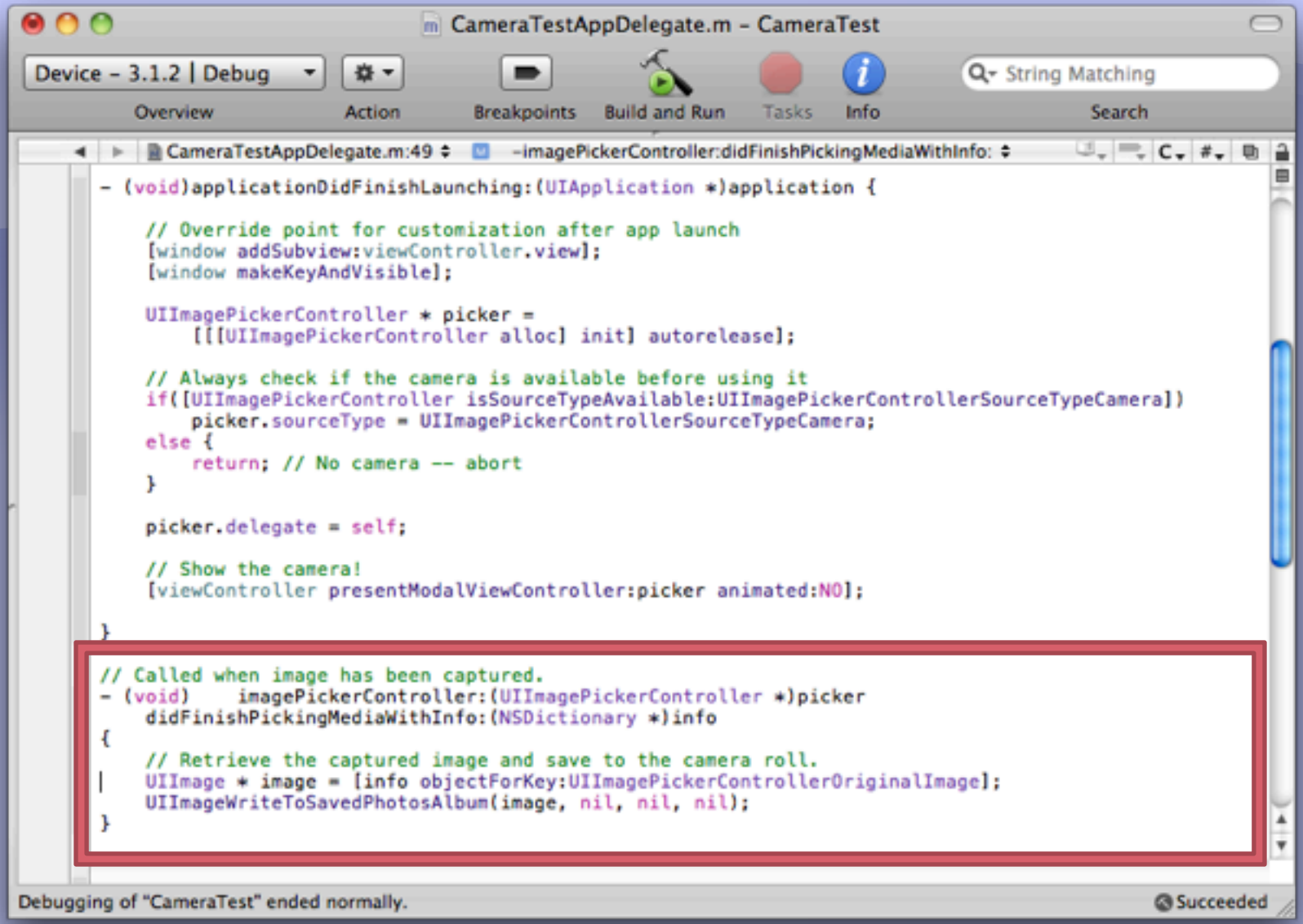
Getting Started

with iPhone Camera Development


New Project
Choose a template for your new project:
iPhone OS
Application
Library
Mac OS X
Application
Framework & Library
Application Plug-in
System Plug-in
Other
Navigation-based Application
OpenGL ES Application
Tab Bar Application
Utility Application
View-based Application
Window-based Application
View-based Application
This template provides a starting point for an application that uses a single view. It provides a view controller to manage the view, and a nib file that contains the view.
Cancel
Choose...


CameraTestAppDelegate.m – CameraTest
Device – 3.1.2 | Debug
Overview
Action
Breakpoints
Build and Run
Tasks
Info
String Matching
Search
CameraTestAppDelegate.m:38
-applicationDidFinishLaunching:
- (void)applicationDidFinishLaunching:(UIApplication *)application {
// Override point for customization after app launch
[window addSubview:viewController.view];
[window makeKeyAndVisible];
UIImagePickerController * picker =
[[[UIImagePickerController alloc] init] autorelease];
// Always check if the camera is available before using it
if([UIImagePickerController isSourceTypeAvailable:UIImagePickerControllerSourceTypeCamera])
picker.sourceType = UIImagePickerControllerSourceTypeCamera;
else {
return; // No camera -- abort
}
picker.delegate = self;
// Show the camera!
[viewController presentModalViewController:picker animated:NO];
}
Debugging of "CameraTest" ended normally.
Succeeded


Camera appears, but now what?
Cancel
Info
Debug
Succeeded


CameraTestAppDelegate.m – CameraTest
Device – 3.1.2 | Debug
Overview
Action
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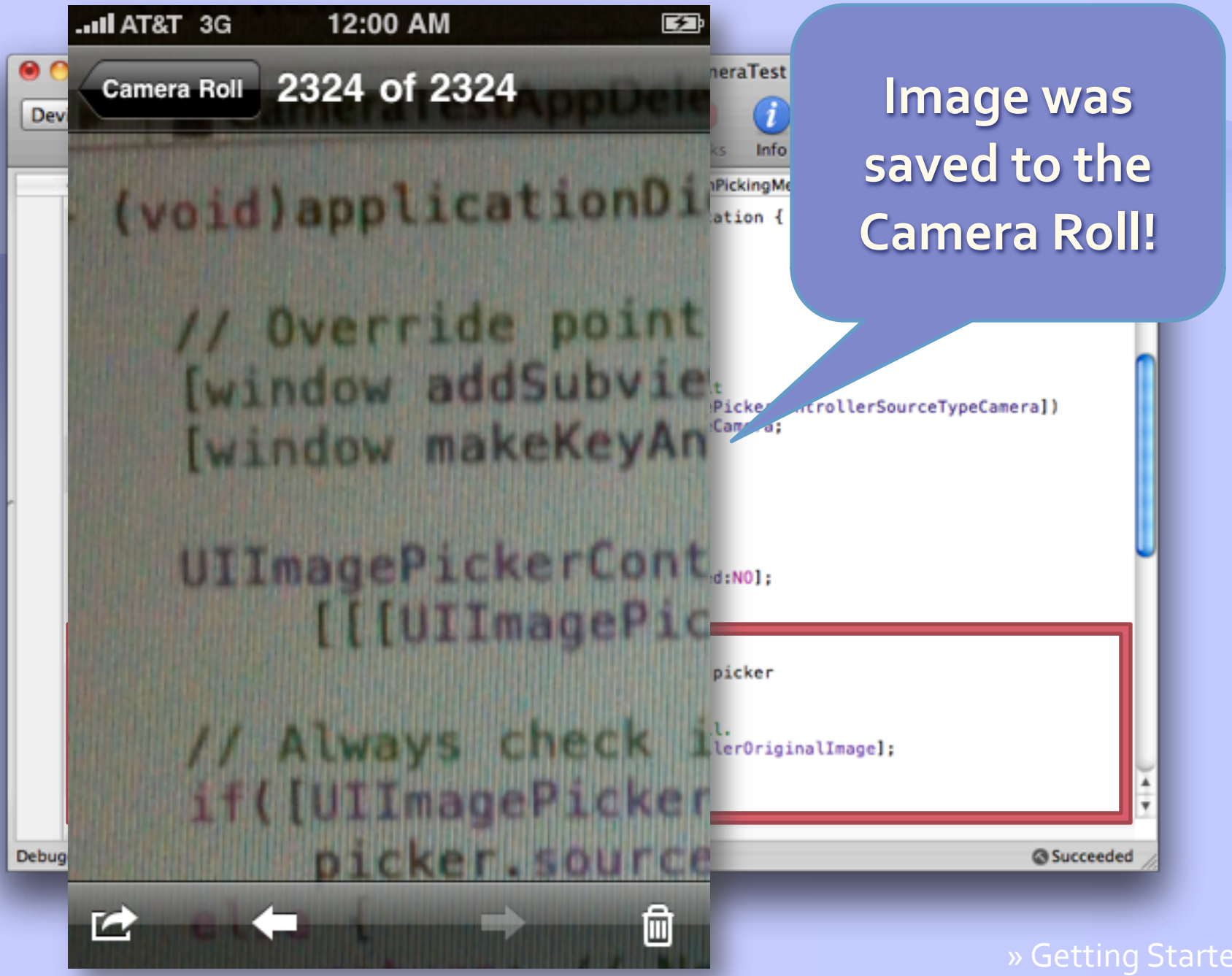
String Matching
Search
CameraTestAppDelegate.m:49
-imagePickerController:didFinishPickingMediaWithInfo:
- (void)applicationDidFinishLaunching:(UIApplication *)application {
// Override point for customization after app launch
[window addSubview:viewController.view];
[window makeKeyAndVisible];
UIImagePickerController * picker =
[[[UIImagePickerController alloc] init] autorelease];
// Always check if the camera is available before using it
if([UIImagePickerController isSourceTypeAvailable:UIImagePickerControllerSourceTypeCamera])
picker.sourceType = UIImagePickerControllerSourceTypeCamera;
else {
return; // No camera -- abort
}
picker.delegate = self;
// Show the camera!
[viewController presentModalViewController:picker animated:NO];
}
// Called when image has been captured.
- (void) imagePickerController:(UIImagePickerController *)picker
didFinishPickingMediaWithInfo:(NSDictionary *)info
{
// Retrieve the captured image and save to the camera roll.
UIImage * image = [info objectForKey:UIImagePickerControllerOriginalImage];
UIImageWriteToSavedPhotosAlbum(image, nil, nil, nil);
}
Debugging of "CameraTest" ended normally.
Succeeded


AT&T 3G
12:00 AM
Camera Roll
2324 of 2324
Image was saved to the Camera Roll!
Succeeded

Part 3/4

Advanced Development with the iPhone Camera

Zoom in on the clock!

A multi-touch interface built using new APIs in iPhone OS 3.1.

Inverse-pinch to zoom in.

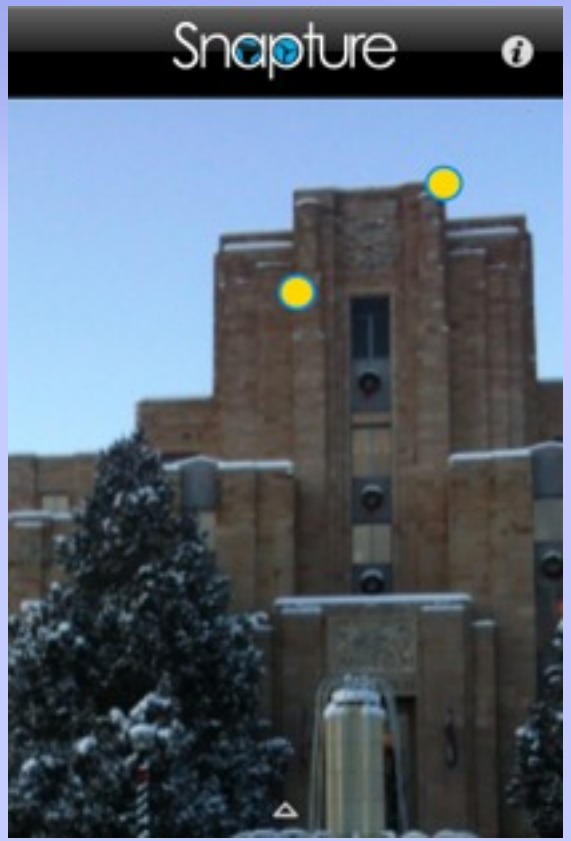
Zoom is applied to the live feed.

» **Advanced:** Manipulating the live feed (3.1+)

Zoom in on the clock!

A multi-touch interface built using new APIs in iPhone OS 3.1.

Inverse-pinch to zoom in.



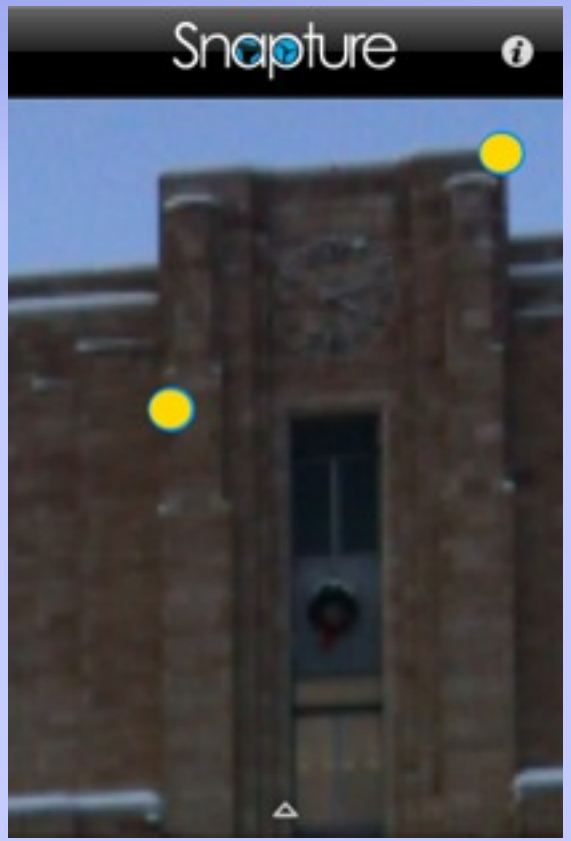
Zoom is applied to the live feed.

» **Advanced:** Manipulating the live feed (3.1+)

Zoom in on the clock!

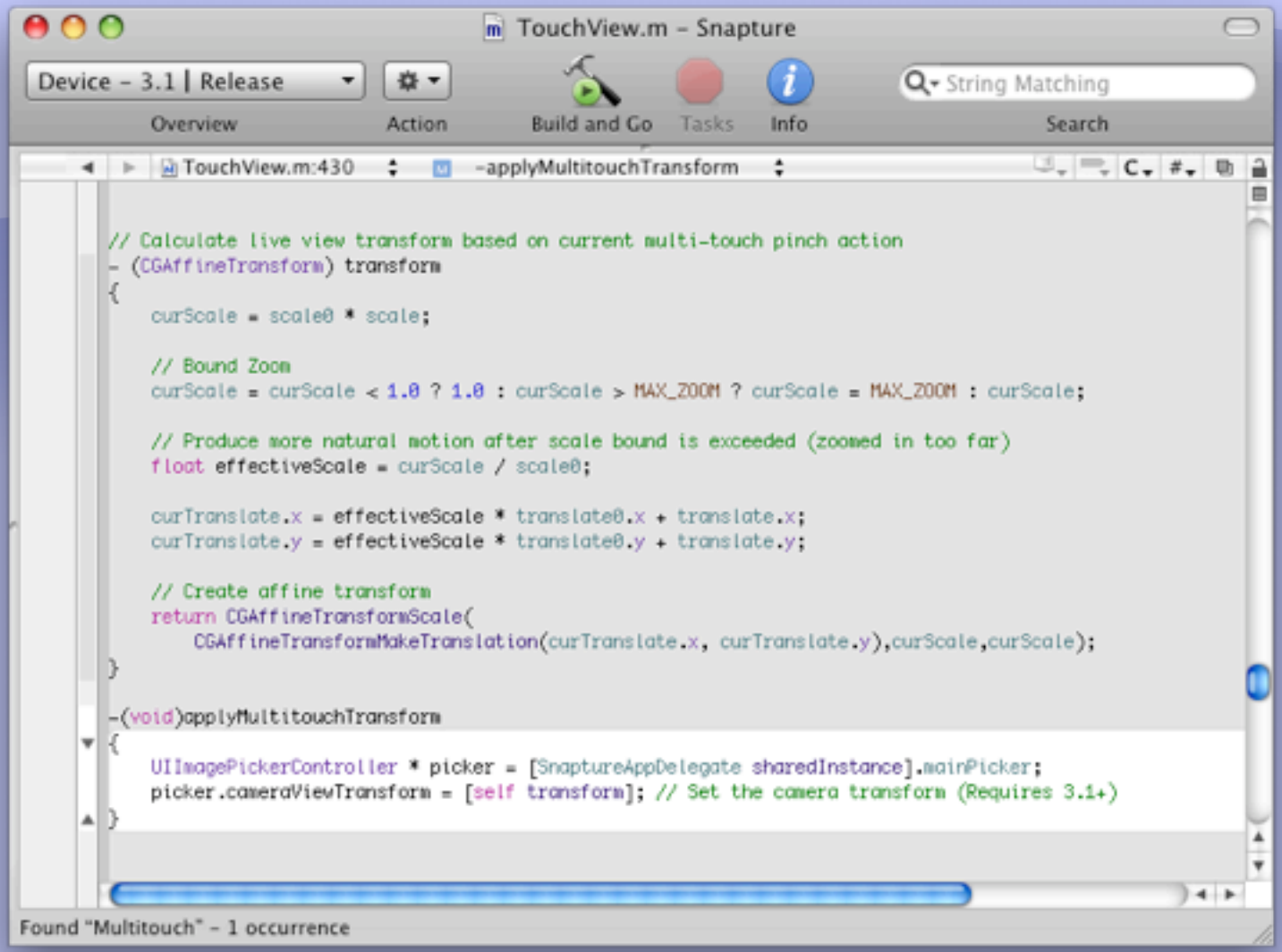
A multi-touch interface built using new APIs in iPhone OS 3.1.

Let's see how it works…



Zoom is applied to the live feed.

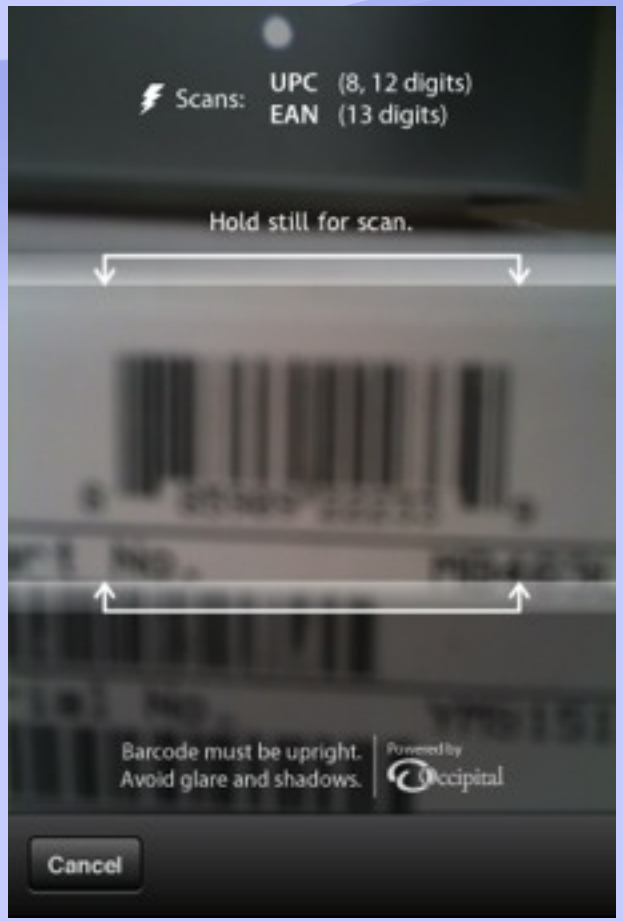
» **Advanced:** Manipulating the live feed (3.1+)



» **Advanced:** Manipulating the live feed (3.1+)

Reading blurry barcodes.

So blurry that people can't even read them.



How it works **(we'll get into these next)**

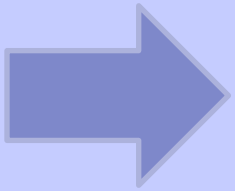
- Custom overlay.
- Rapid screenshots.
- Image processing (computer vision).

» **Advanced:** Custom overlays and image processing.

Reading blurry barcodes.

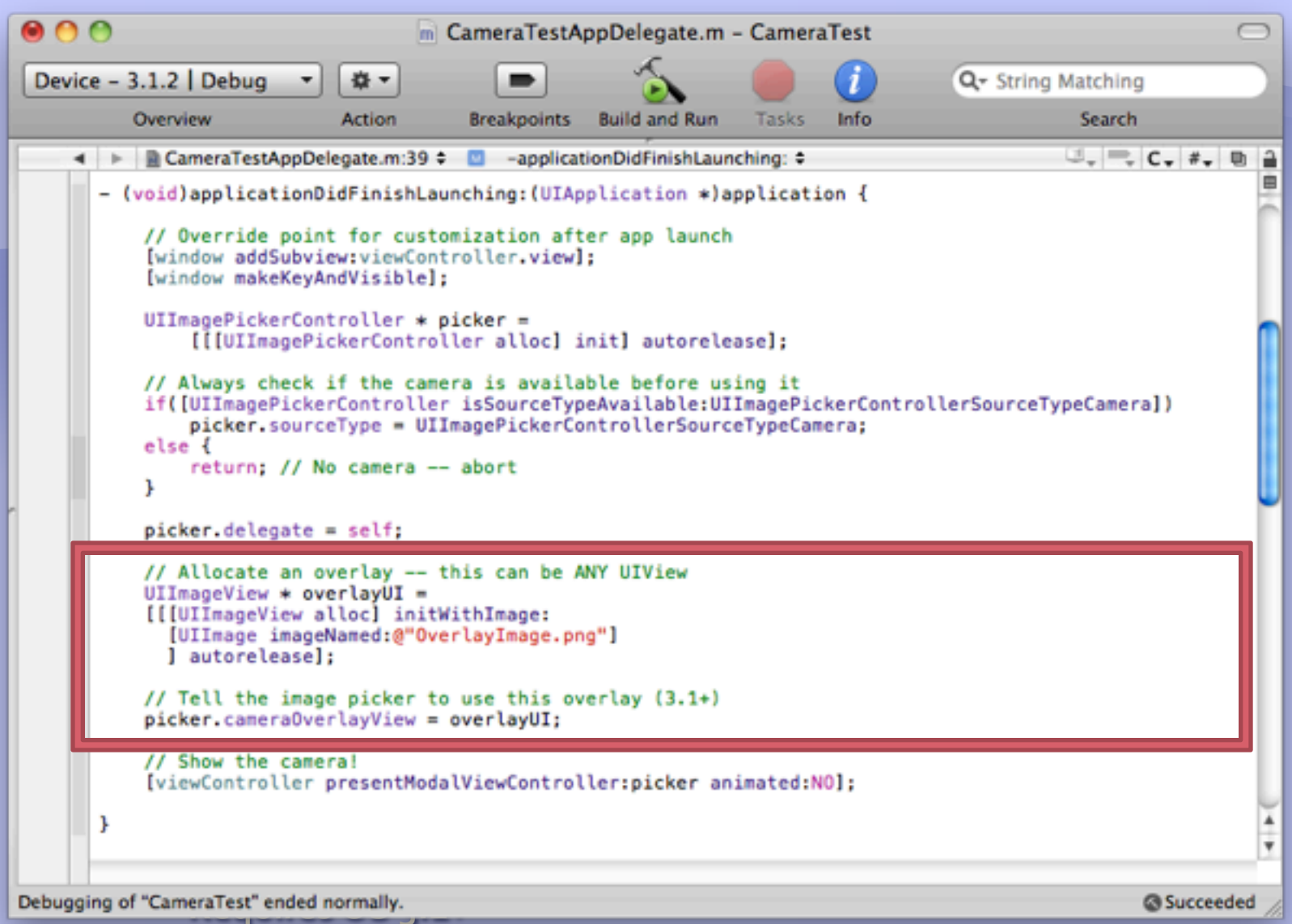
First ingredient: A custom camera overlay

Default UI:
not suitable in this case.



Helpful custom UI.

» **Advanced:** (Custom overlays) and image processing.



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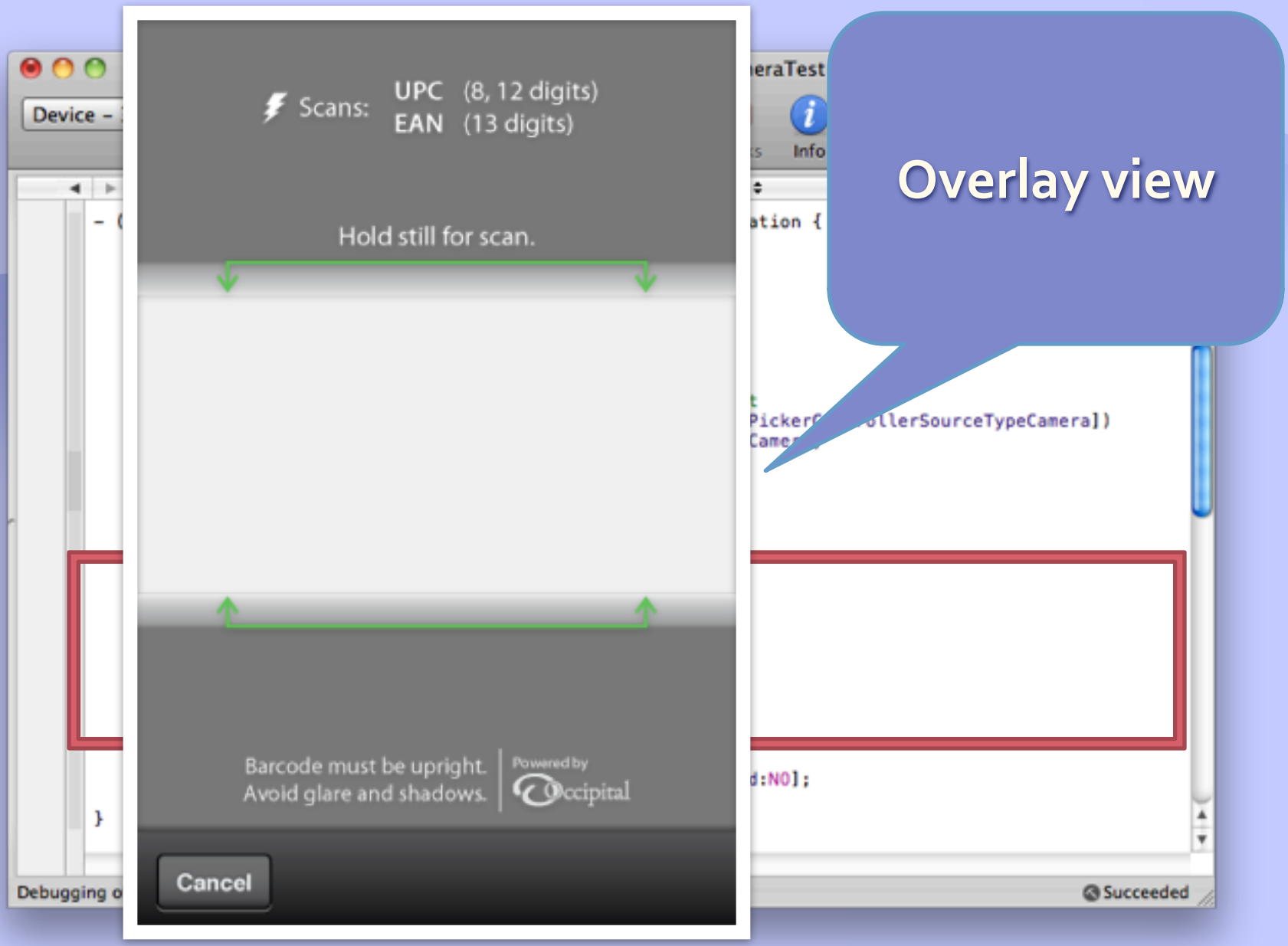
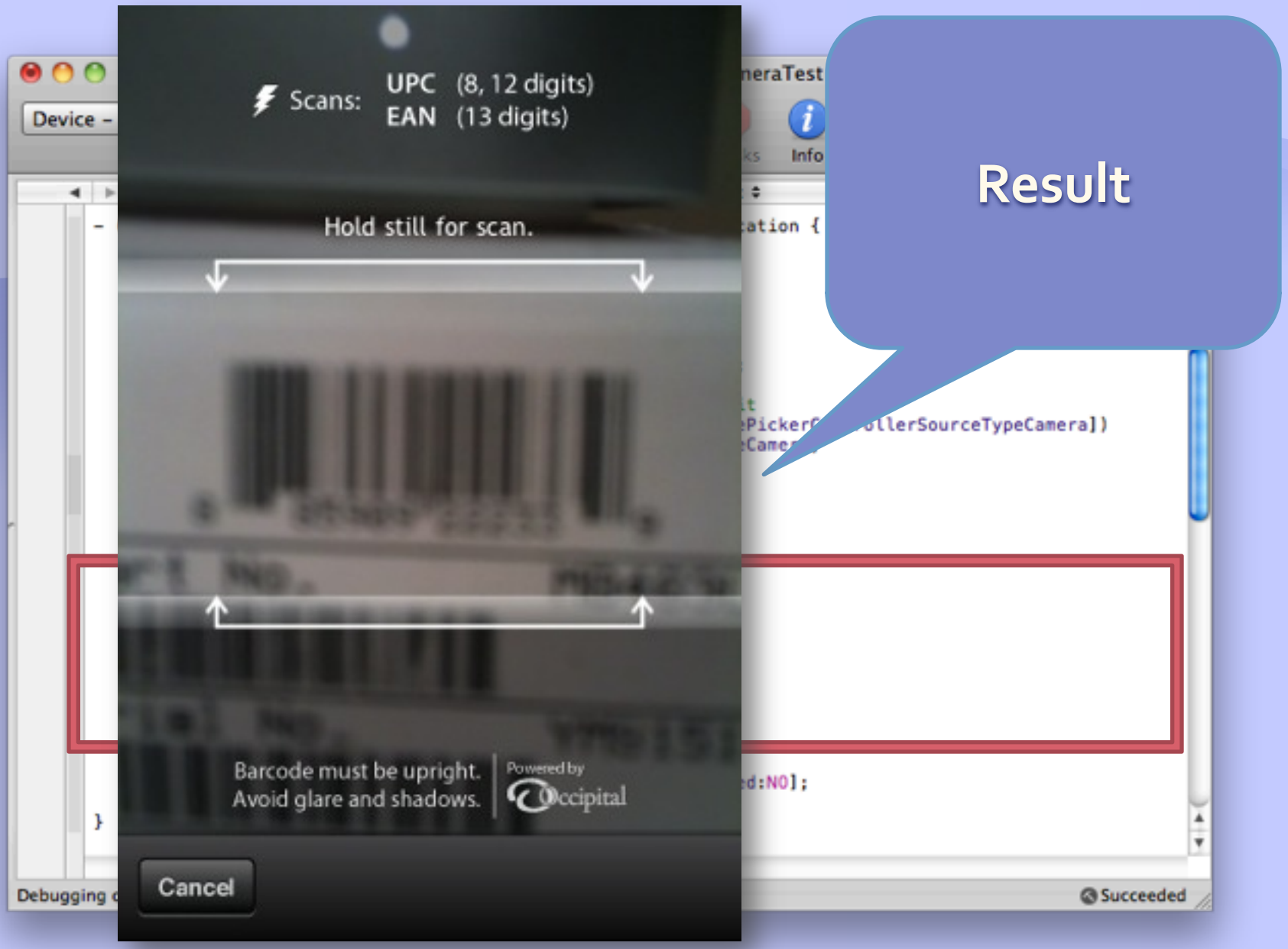


» **Advanced:** (Custom overlays) and image processing.



» **Advanced:** (Custom overlays) and image processing.

Reading blurry barcodes.

Second ingredient: Rapid screenshots.

Currently requires a function that's not published.

» **Advanced:** Custom overlays and image processing.

Reading blurry barcodes.

Last ingredient: Image processing (Computer vision)

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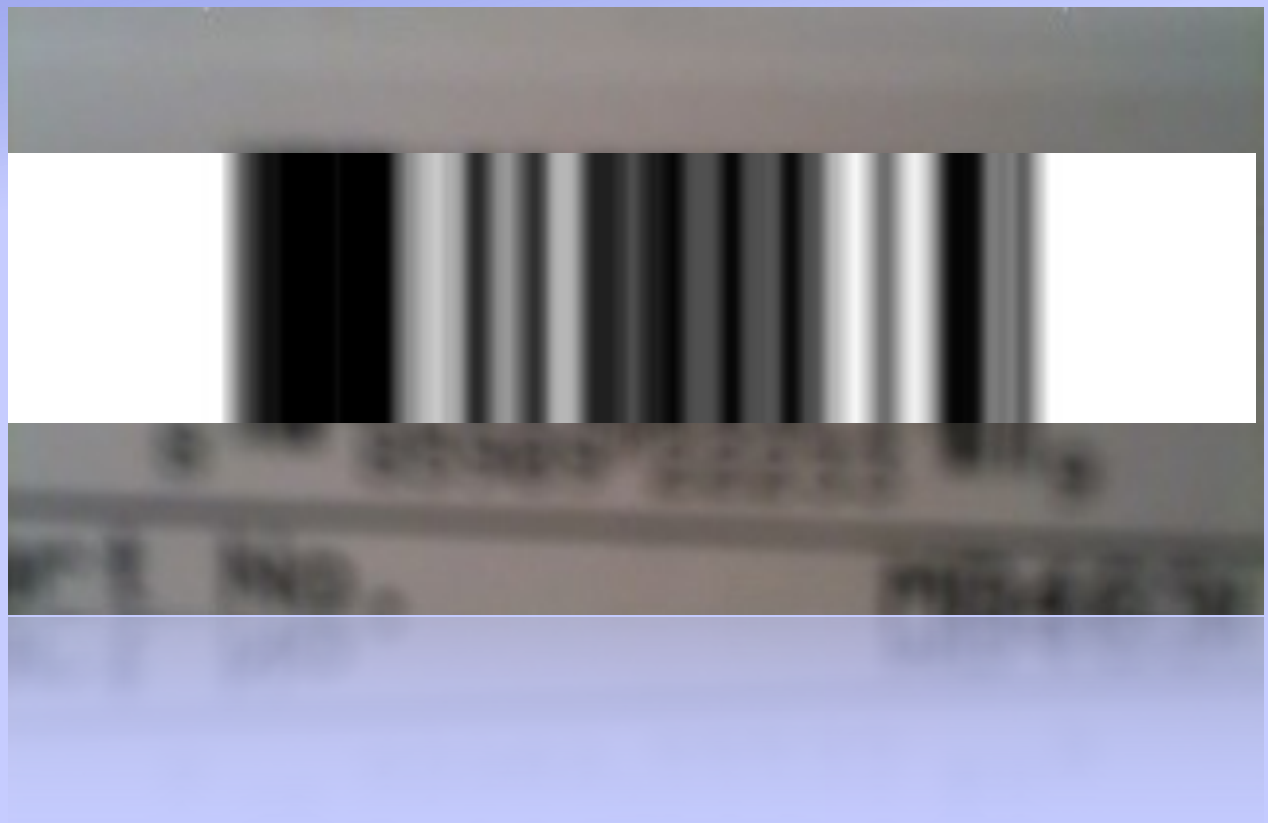

» **Advanced:** Custom overlays and (image processing).

Reading blurry barcodes.

Last ingredient: Image processing (Computer vision)

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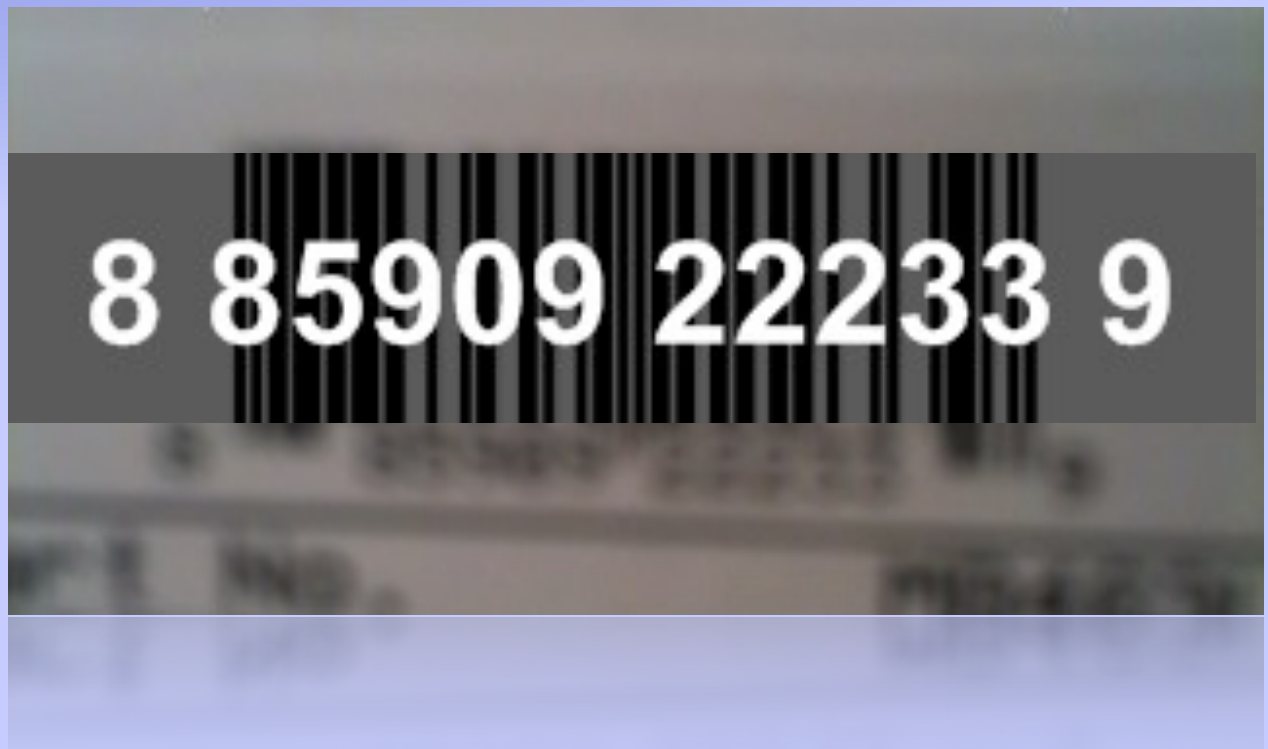
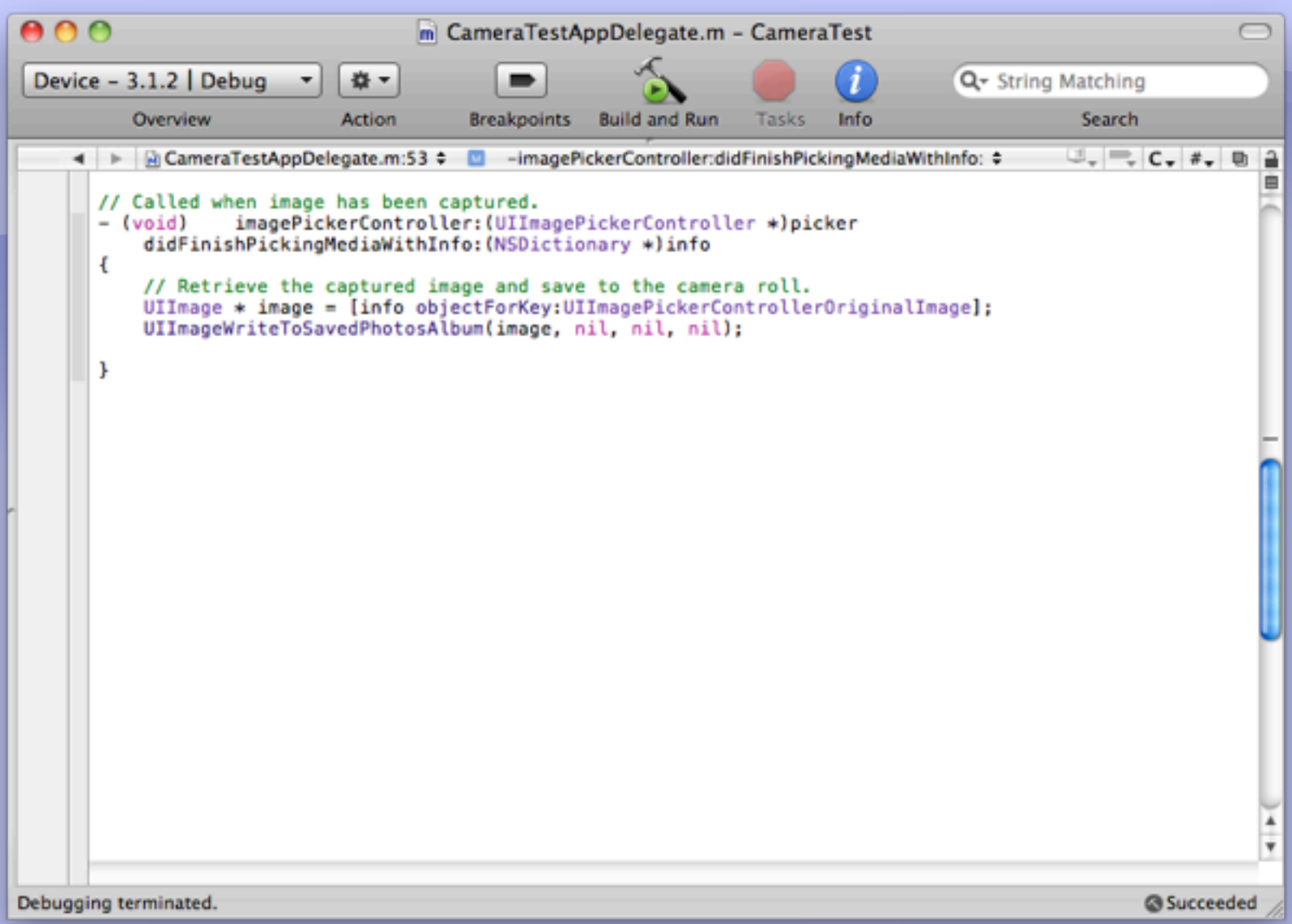


Let's take a look at how to access raw pixels.

» **Advanced:** Custom overlays and (image processing).



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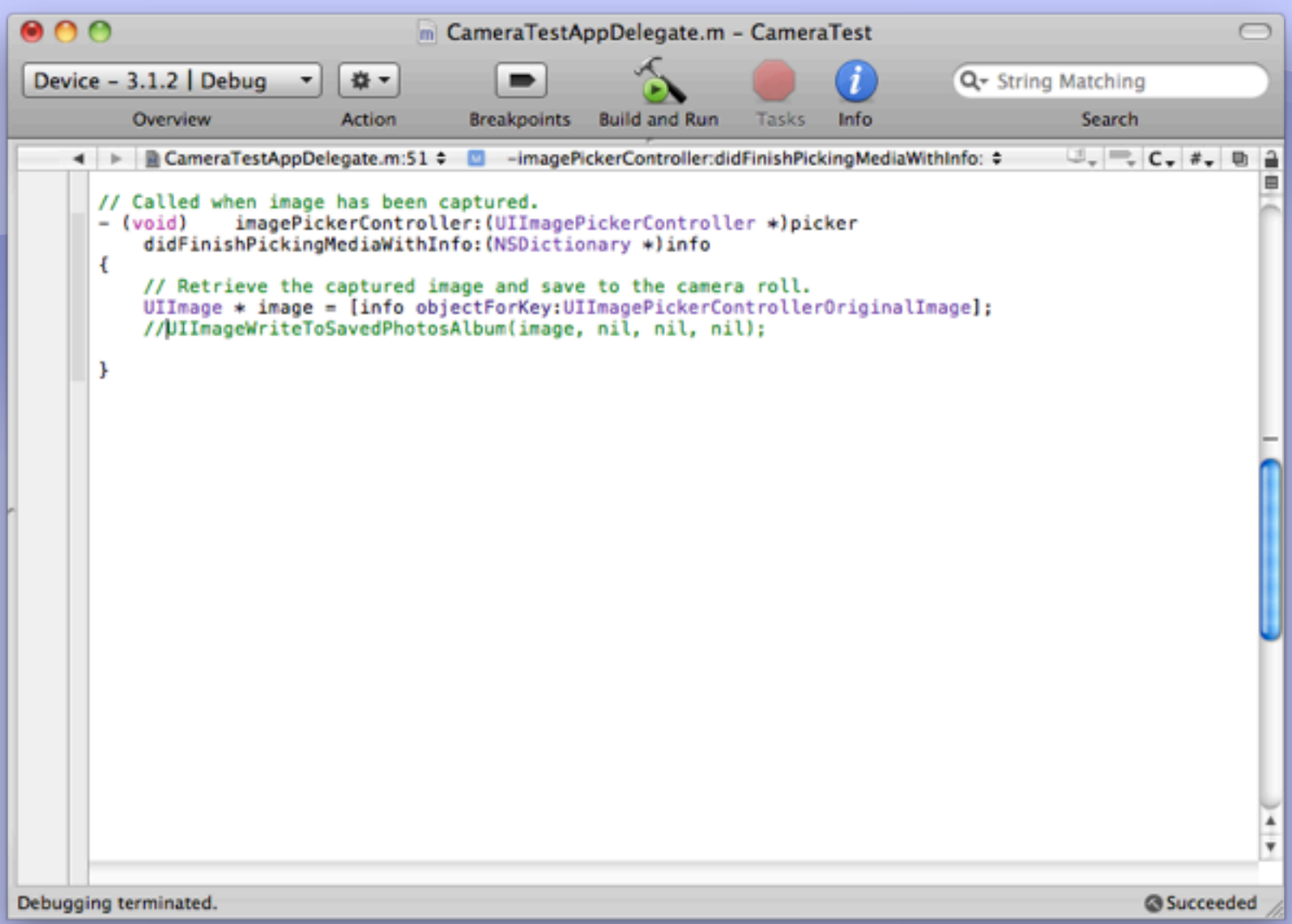

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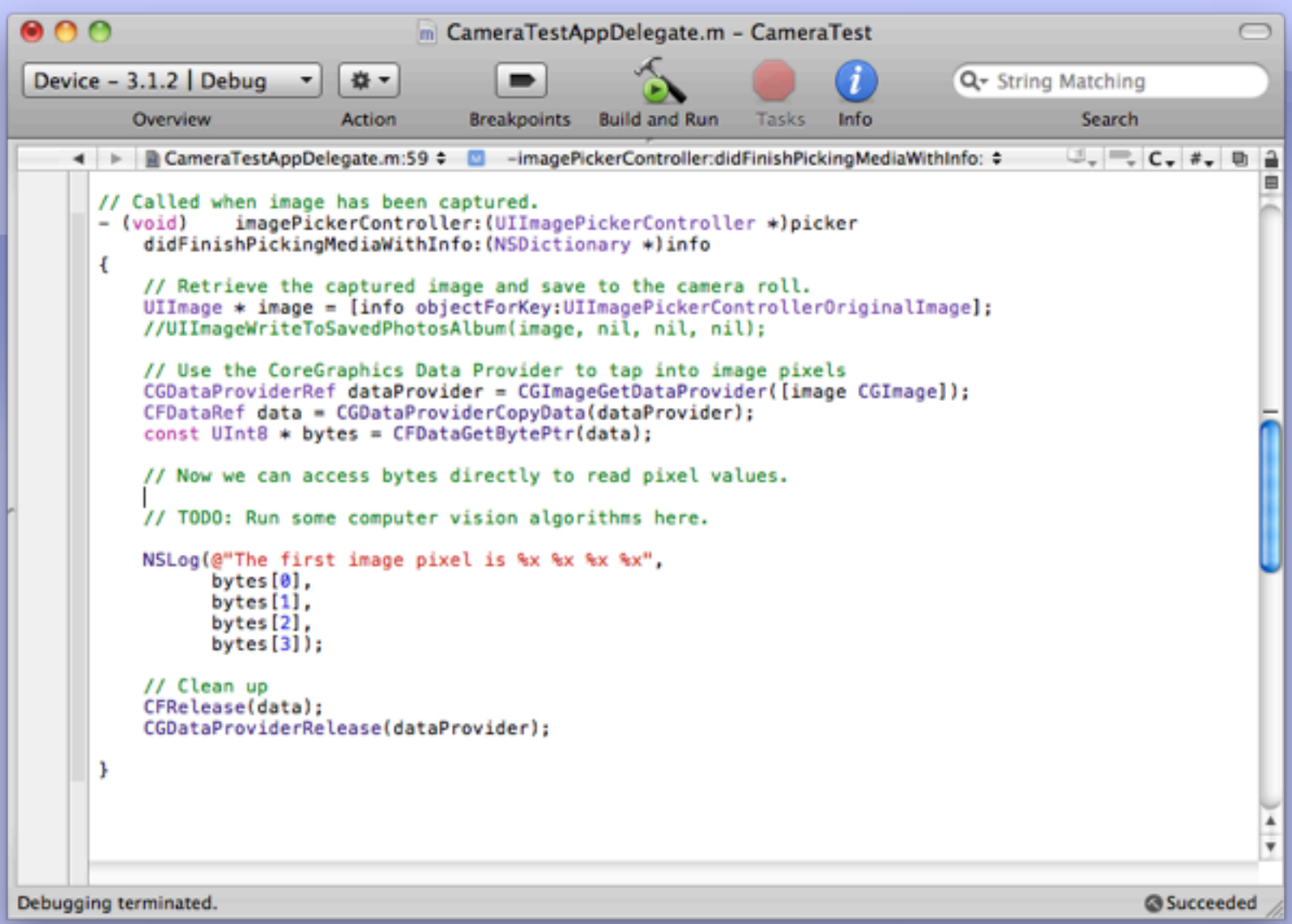

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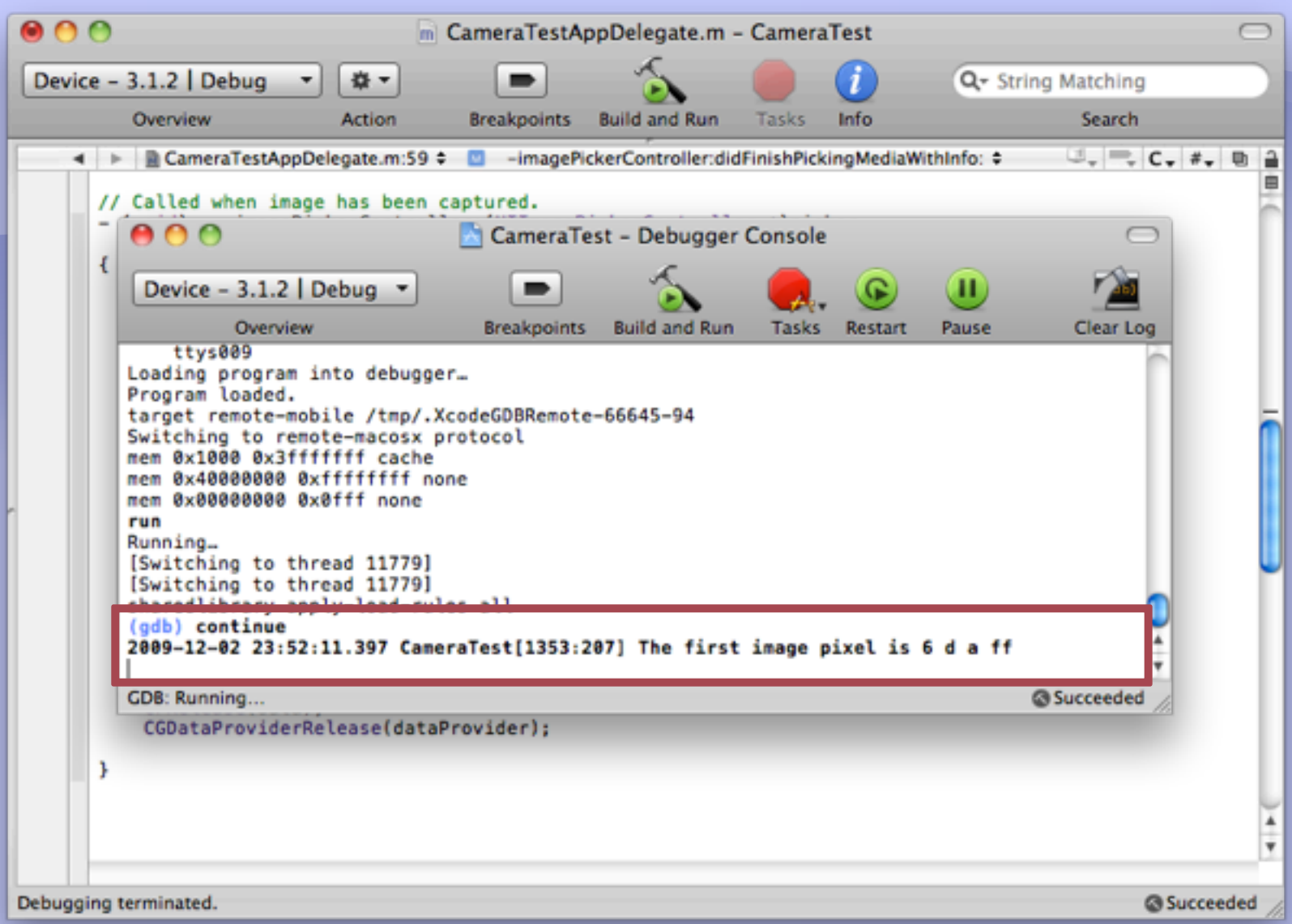

» **Advanced:** Custom overlays and (image processing).

Part 4/4

Future of iPhone Computer Vision

What's *not* possible today?

- Vision-based augmented reality
  - Marker-based
  - Marker-less

morethantechnical.com

What's *not* possible today?

Paramount Pictures

What's *not* possible today?

Orion Pictures

Terminator Vision: 1984

Mobile computer vision will eventually become a part of most applications we already use today.

Q&A

P.S. Check us out in Newsweek this week! (page 17)

Jeffrey Powers, Co-Founder, Occipital