Stanford CS193p

Developing Applications for iOS
Fall 2011

Today

- NSTimer and "perform after delay"
  Two delayed-action alternatives.
- More View Animation
  Continuation of Kitchen Sink demo
- Alerts and Action Sheets
  Notifying the user and getting modal answers to questions.
- UIImagePickerController
  Getting images from the camera or photo library.
- Core Motion
  Measuring the device's movement.

NSTimer

- Scheduled invocation of a method in the main queue

```
NSTimer *timer = [NSTimer scheduledTimerWithTimeInterval:(NSTimeInterval)seconds
                                                  target:self
                                                selector:@selector(doSomething:)
                                                userInfo:(id)anyObject
                                                 repeats:(BOOL)yesOrNo];
```

- Not "real time" since it can run only each time around run loop

  Setting the time interval too short will essentially block the main thread.
  Taking too long each time you're called could also essentially block the main thread.
  Do any time consuming stuff in a thread and just use the timer to update state quickly.

- Stopping the timer

  `- (void)invalidate;`
  You probably want to `nil`-out your pointers to the timer after this!

Perform after Delay

- Alternative to NSTimer

  NSObject method:

```
- (void)performSelector:(SEL)aSelector
             withObject:(id)argument
             afterDelay:(NSTimeInterval)seconds;
```

- Executes on the run loop (if any) of the current thread

  Only call this on the main thread (other threads possible, but not straightforward).

  Not real time (just like NSTimer is not).

  Does not execute immediately, even if seconds is 0 (executes "very very soon" in that case).

  Can reschedule itself.

  Be careful that it stops calling itself when your view controller goes off screen, though.

- Example

```
[self.tableView performSelector:@selector(reloadData) withObject:nil afterDelay:0];
```

  Gives the UITableView a chance to "settle down" (by finishing this turn of the event loop).

Perform after Delay

- Canceling

  NSObject <u>class</u> method:

```
+ (void)cancelPreviousPerformRequestsWithTarget:(id)target
                                       selector:(SEL)aSelector
                                         object:(id)object;
+ (void)cancelPreviousPerformRequestsWithTarget:(id)target;
```

- There is no way to query what requests are outstanding

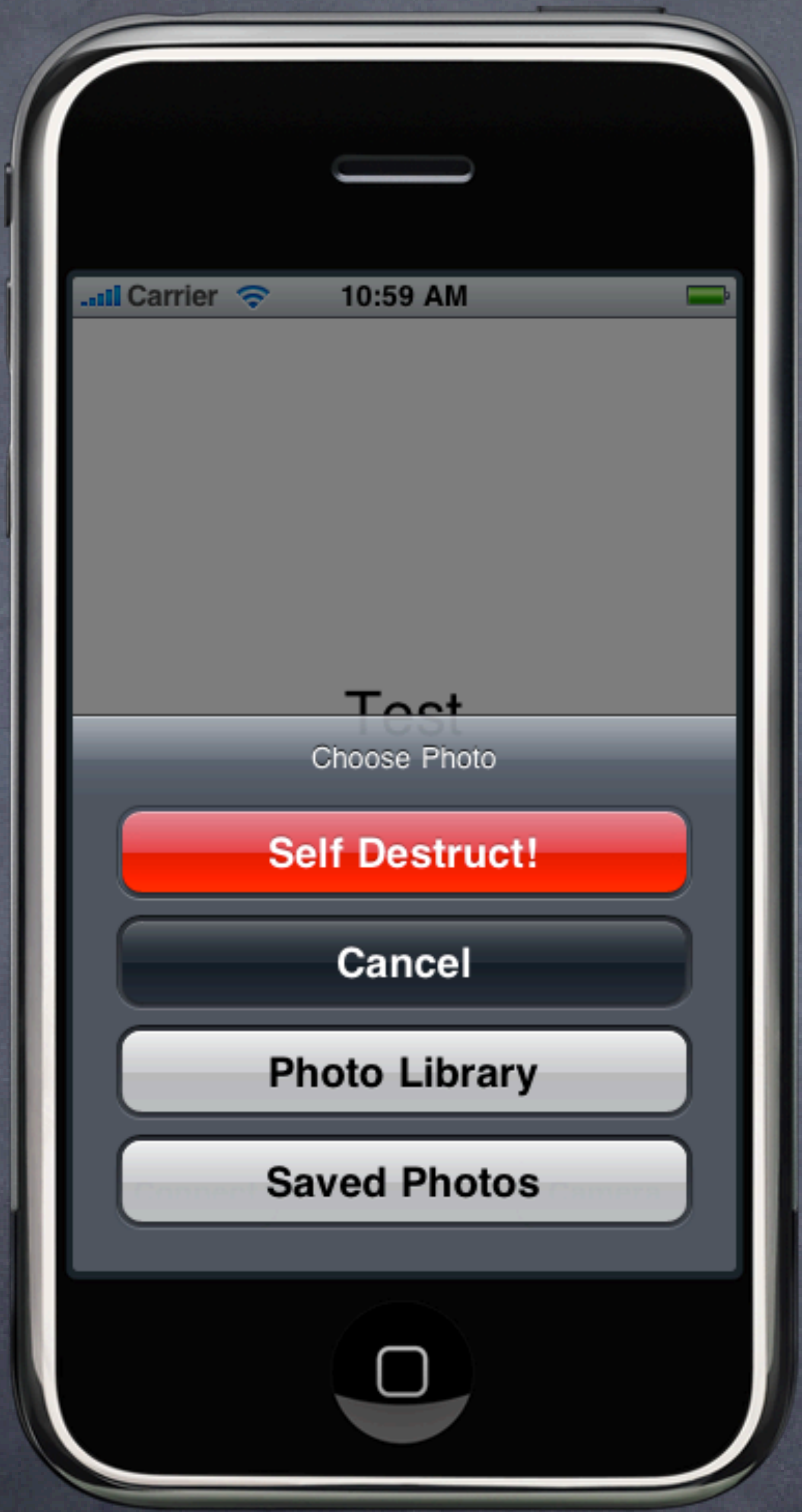
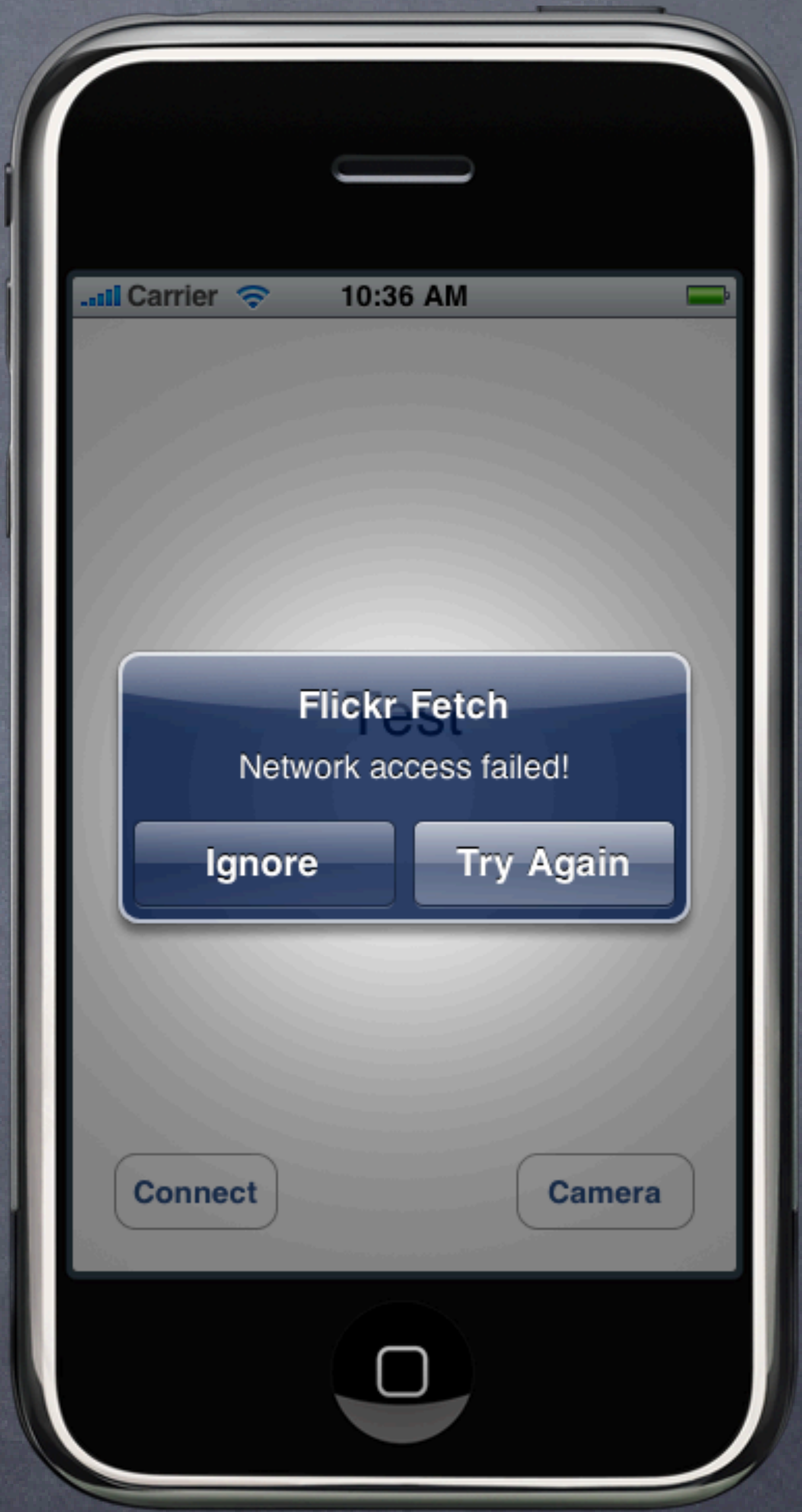
  At best, you can cancel and repost to be sure (but it will reset timing, of course).

Demo

- Kitchen Sink
  - More sophisticated `UIView` animation
  - `NSTimer`
  - `performSelector:withObject:afterDelay:`

Alerts

- Two kinds of "pop up and ask the user something" mechanisms
  - Action Sheets
  - Alerts
- Action Sheets
  - Slides up from the bottom of the screen on iPhone/iPod Touch, and in a popover on iPad.
  - Can be displayed from a tab bar, toolbar, bar button item or from a rectangular area in a view.
  - Usually asks questions that have more than two answers.
- Alerts
  - Pop up in the middle of the screen.
  - Usually ask questions with only two (or one) answers (e.g. OK/Cancel, Yes/No, etc.).
  - Very disruptive to your user-interface, so use carefully.
  - Often used for "asynchronous" problems ("connection reset" or "network fetch failed").


Carrier
10:59 AM
Test
Choose Photo
Self Destruct!
Cancel
Photo Library
Saved Photos

Carrier
10:36 AM
Flickr Fetch
Network access failed!
Ignore
Try Again
Connect
Camera

UIActionSheet

- Initializer

```
      -(id)initWithTitle:(NSString *)title
                delegate:(id <UIActionSheetDelegate>)delegate
       cancelButtonTitle:(NSString *)cancelButtonTitle
  destructiveButtonTitle:(NSString *)destructiveButtonTitle
       otherButtonTitles:(NSString *)otherButtonTitles, …;
```

- And you can add more buttons programmatically

```
- (void)addButtonWithTitle:(NSString *)buttonTitle;
```

- Displaying the Action Sheet

```
UIActionSheet *actionSheet = [[UIActionSheet alloc] initWithTitle:…];
[actionSheet showInView:(UIView *)];  // centers the view on iPad (don't use this on iPad)
[actionSheet showFromRect:(CGRect) inView:(UIView *) animated:(BOOL)];   // good on iPad
[actionSheet showFromBarButtonItem:(UIBarButtonItem *) animated:(BOOL)]; // good on iPad
```

Universal apps require care here (though some can work on both platforms, e.g., showFromRect:).

UIActionSheet

- Finding out what the user has chosen via the delegate

  `- (void)actionSheet:(UIActionSheet *)sender clickedButtonAtIndex:(NSInteger)index;`

- Remember from initializer that Cancel/Destructive are special

  ```
  @property NSInteger cancelButtonIndex;      // don't set this if you set it in initializer
  @property NSInteger destructiveButtonIndex; // don't set this if you set it in initializer
  ```

- Other indexes

  ```
  @property (readonly) NSInteger firstOtherButtonIndex;
  @property (readonly) NSInteger numberOfButtons;
  - (NSString *)buttonTitleAtIndex:(NSInteger)index;
  ```

  The "other button" indexes are in the order you specified them in initializer and/or added them

- You can programmatically dismiss the action sheet as well

  `- (void)dismissWithClickedButtonIndex:(NSInteger)index animated:(BOOL)animated;`

  It is generally recommended to call this on `UIApplicationDidEnterBackgroundNotification`.
  Remember also that you might be terminated while you are in the background, so be ready.

UIActionSheet

- Special popover considerations: no Cancel button
  An action sheet in a popover (that is not inside a popover) does not show the cancel button.
  It does not need one because clicking outside the popover dismisses it.
  It will automatically not show the Cancel button (just don't be surprised that it's not there).
- Special popover considerations: the popover's `passthroughViews`
  If you `showFromBarButtonItem:animated:`, it adds the toolbar to popover's `passthroughViews`.
  This is annoying because repeated touches on the bar button item give multiple action sheets!
  Also, other buttons in your toolbar will work (which might or might not make sense).
  Unfortunately, you just have to handle this in all of your bar buttons, including the action sheet's.
- Special popover considerations: bar button item handling
  Have a `weak` `@property` in your class that points to the `UIActionSheet`.
  Set it right after you show the action sheet.
  Check that `@property` at the start of your bar button item's action method.
  If it is not-`nil` (since it is `weak`, it will only be non-`nil` if it's still on-screen), just dismiss it.
  If it is `nil`, prepare and show your action sheet.

UIAlertView

- Very similar to Action Sheet …

```
    -(id)initWithTitle:(NSString *)title
               message:(NSString *)message // different from UIActionSheet
              delegate:(id <UIActionSheetDelegate>)delegate
     cancelButtonTitle:(NSString *)cancelButtonTitle
     otherButtonTitles:(NSString *)otherButtonTitles, …;
```

- And you can add more buttons programmatically

```
- (void)addButtonWithTitle:(NSString *)buttonTitle;
```

- Displaying the Action Sheet

```
UIAlertView *alertView = [[UIAlertView alloc] initWithTitle:…];
[alertView show];   // different from UIActionSheet, always appears in center of screen
```

- Rest of the mechanism is the same as UIActionSheet

Demo

- Kitchen Sink

  Putting a stopper in our drain.

  Action Sheet

UIImagePickerController

- Modal view to get media from camera or photo library

  Modal means you put it up with `presentViewController:animated:completion:`.

  On iPad, you put it up in a `UIPopoverController`.

- Usage

  1. Create it with `alloc/init` and set `delegate`.
  2. Configure it (source, kind of media, user editability).
  3. Present it.
  4. Respond to delegate method when user is done picking the media.

- What the user can do depends on the platform

  Some devices have cameras, some do not, some can record video, some can not.

  Also, you can only offer camera OR photo library on iPad (not both together at the same time).

  As with all device-dependent API, we want to start by check what's available.

  `+ (BOOL)isSourceTypeAvailable:(UIImagePickerControllerSourceType)sourceType;`

  Source type is `UIImagePickerControllerSourceTypePhotoLibrary/Camera/SavedPhotosAlbum`

UIImagePickerController

- But don't forget that not every source type can give video

  So, you then want to check ...

  `+ (NSArray *)availableMediaTypesForSourceType:(UIImagePickerControllerSourceType)sourceType;`

  Returns an array of strings you check against constants.

  Check documentation for all possible, but there are two key ones ...

  `kUTTypeImage` // pretty much all sources provide this

  `kUTTypeMovie` // audio and video together, only some sources provide this

UIImagePickerController

- But don't forget that not every source type can give video

So, you then want to check ...

`+ (NSArray *)availableMediaTy`

Returns an array of strings yo

Check documentation for al

These are declared in the `MobileCoreServices` framework.

`#import <MobileCoreServices/MobileCoreServices.h>`

and add `MobileCoreServices` to your list of linked frameworks.

`kUTTypeImage` // pretty much all sources provide this

`kUTTypeMovie` // audio and video together, only some sources provide this

UIImagePickerController

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  `kUTTypeMovie` // audio and video together, only some sources provide this

- You can get even more specific about front/rear cameras

  (Though usually this is not necessary.)

  `+ (BOOL)isCameraDeviceAvailable:(UIImagePickerControllerCameraDevice)cameraDevice;`

  Either `UIImagePickerControllerCameraDeviceFront` or `UIImagePickerControllerCameraDeviceRear`.

  Then check out more about each available camera:

  `+ (BOOL)isFlashAvailableForCameraDevice:(UIImagePickerControllerCameraDevice);`

  `+ (NSArray *)availableCaptureModesForCameraDevice:(UIImagePickerControllerCameraDevice);`

  This array contains `NSNumber` objects with constants `UIImagePic...lerCaptureModePhoto/Video`.

UIImagePickerController

- Set the source and media type you want in the picker

(From here out, UIImagePickerController will be abbreviated UIIPC for space reasons.)

```
UIIPC *picker = [[UIIPC alloc] init];
picker.delegate = self;  // self has to say it implements UINavigationControllerDelegate too :(
if ([UIIPC isSourceTypeAvailable:UIIPCSourceTypeCamera]) {
     picker.sourceType = UIIPCSourceTypeCamera;
} // else we'll take what we can get (photo library by default)
NSString *desired = (NSString *)kUTTypeMovie;  // e.g., could be kUTTypeImage
if ([[UIIPC availableMediaTypesForSourceType:picker.sourceType]  containsObject:desired]) {
     picker.mediaTypes = [NSArray arrayWithObject:desired];
     // proceed to put the picker up
} else {
     // fail, we can't get the type of media we want from the source we want
}
```

Notice the cast to NSString here.
kUTTypeMovie (and kUTTypeImage) are CFStrings (Core Foundation strings).
Unfortunately, the cast is required to avoid a warning here.

UIImagePickerController

- Editability

```
@property BOOL allowsEditing;
```

If YES, then user will have opportunity to edit the image/video inside the picker.
When your delegate is notified that the user is done, you'll get both raw and edited versions.

- Limiting Video Capture

```
@property UIIPCQualityType videoQuality;
UIIPCQualityTypeMedium    // default
UIIPCQualityTypeHigh
UIIPCQualityType640x480
UIIPCQualityTypeLow
UIPCQualityTypeIFrame1280x720     // native on some devices
UIPCQualityTypeIFrame960x540      // native on some devices
@property NSTimeInterval videoMaximumDuration;
```

- Other

You can control which camera is used, how flash is used, etc., as well (or user can choose).

UIImagePickerController

- Present the picker

  Note that on iPad, if you are not offering Camera, you must present with popover.
  If you are offering the Camera on iPad, then popover or full-screen modal is okay.
  Remember: on iPad, it's Camera OR Photo Library (not both at the same time).

- Delegate will be notified when user is done

```
- (void)imagePickerController:(UIImagePickerController *)picker
didFinishPickingMediaWithInfo:(NSDictionary *)info
{
    // extract image/movie data/metadata here, more on the next slide
    [self dismissModalViewControllerAnimated:YES]; // or popover dismissal
}
```

- Also dismiss it when cancel happens

```
- (void)imagePickerControllerDidCancel:(UIImagePickerController *)picker
{
    [self dismissModalViewControllerAnimated:YES]; // or popover dismissal
}
```

UIImagePickerController

- What is in that info dictionary?

```
UIImagePickerControllerMediaType          // kUTTypeImage or kUTTypeMovie
UIImagePickerControllerOriginalImage      // UIImage
UIImagePickerControllerEditedImage        // UIImage
UIImagePickerControllerCropRect           // CGRect (in an NSValue)
UIImagePickerControllerMediaMetadata      // NSDictionary info about the image to save later
UIImagePickerControllerMediaURL           // NSURL edited video
UIImagePickerControllerReferenceURL       // NSURL original (unedited) video
```

UIImagePickerController

- Overlay View
  `@property UIView *cameraOverlayView;`
  Be sure to set this view's `frame` properly.
  Camera is always full screen (modal only, iPhone/iPod Touch only), `[[UIScreen mainScreen] bounds]`.
  But if you use the built-in controls at the bottom, you might want your view to be smaller.
- Hiding the normal camera controls (at the bottom)
  `@property BOOL showsCameraControls;`
  Will leave a blank area at the bottom of the screen (camera's aspect 4:3, not same as screen's).
  With no controls, you'll need an overlay view with a "take picture" (at least) button.
  That button should send `- (void)takePicture` to the picker.
  Don't forget to `dismissModalViewController:` when you are done taking pictures.
- You can zoom or translate the image while capturing
  `@property CGAffineTransform cameraViewTransform;`
  For example, you might want to scale the image up to full screen (some of it will get clipped).

Demo

- Kitchen Sink

  Dropping images into our sink.

  `UIImagePickerController`

Core Motion

- API to access motion sensing hardware on your device
- Primary inputs: Accelerometer, Gyro, Magnetometer
  Not all devices have all inputs (e.g. only iPhone4 and newest iPod Touch and iPad 2 have a gyro).
- Primary class used to get input is `CMMotionManager`
  Create with `alloc/init`, but use only one instance per application (else performance hit).
  It is a "global resource," so getting one via an application delegate method or class method is okay.
- Usage
  1. Check to see what hardware is available.
  2. Start the sampling going and poll the motion manager for the latest sample it has.
  … or …
  1. Check to see what hardware is available.
  2. Set the rate at which you want data to be reported from the hardware,
  3. Register a block (and a dispatch queue to run it on) each time a sample is taken.

Core Motion

- Checking availability of hardware sensors

  `@property (readonly) BOOL {accelerometer,gyro,magnetometer,deviceMotion}Available;`

  The "device motion" is a combination of all available (accelerometer, magnetometer, gyro).
  We'll talk more about that in a couple of slides.

- Starting the hardware sensors collecting data

  You only need to do this if you are going to poll for data.

  `- (void)start{Accelerometer,Gyro,Magnetometer,DeviceMotion}Updates;`

- Is the hardware currently collecting data?

  `@property (readonly) BOOL {accelerometer,gyro,magnetometer,deviceMotion}Active;`

- Stop the hardware collecting data

  It is a performance hit to be collecting data, so stop during times you don't need the data.

  `- (void)stop{Accelerometer,Gyro,Magnetometer,DeviceMotion}Updates;`

Core Motion

- Checking the data (polling not recommended, more later)

`@property (readonly) CMAccelerometerData *accelerometerData;`
`CMAccelerometerData` object provides `@property (readonly) CMAcceleration acceleration;`
`typedef struct { double x; double y; double z; } CMAcceleration; //` x, y, z in "g"
This raw data includes acceleration due to gravity.

`@property (readonly) CMGyroData *gyroData;`
`CMGyroData` object has one property `@property (readonly) CMRotationRate rotationRate;`
`typedef struct { double x; double y; double z; } CMRotationRate; //` x, y, z in radians/second
Sign of rotation rate follows right hand rule. This raw data will be biased.

`@property (readonly) CMMagnetometerData *magnetometerData;`
`CMMagnetometerData` object has one property `@property (readonly) CMMagneticField magneticField;`
`typedef struct { double x; double y; double z; } CMMagneticField; //` x, y, z in microteslas
This raw data will be biased.

`@property (readonly) CMDeviceMotion *deviceMotion;`
`CMDeviceMotion` is an intelligent combination of gyro and acceleration.
If you have multiple detection hardware, you can report better information about each.

CMDeviceMotion

- Acceleration Data in `CMDeviceMotion`

```
@property (readonly) CMAcceleration gravity;
@property (readonly) CMAcceleration userAcceleration;   // gravity factored out using gyro
typedef struct { double x; double y; double z; } CMAcceleration; // x, y, z in "g"
```

- Rotation Data in `CMDeviceMotion`

```
@property CMRotationRate rotationRate;   // bias removed from raw data using accelerometer
typedef struct { double x; double y; double z; } CMRotationRate; // x, y, z in radians/second

@property CMAttitude *attitude;   // device's attitude (orientation) in 3D space

@interface CMAttitude : NSObject       // roll, pitch and yaw are in radians
@property (readonly) double roll;      // around longitudinal axis passing through top/bottom
@property (readonly) double pitch;     // around lateral axis passing through sides
@property (readonly) double yaw;       // around axis with origin at center of gravity and
                                       // perpendicular to screen directed down
   // other mathematical representations of the device's attitude also available
@end
```

CMDeviceMotion

- Magnetic Field Data in CMDeviceMotion

```
@property (readonly) CMCalibratedMagneticField magneticField;
struct {
    CMMagneticField field;
    CMMagneticFieldCalibrationAccuracy accuracy;
} CMCalibratedMagneticField;
enum {
    CMMagneticFieldCalibrationAccuracyUncalibrated,
                                      Low,
                                      Medium,
                                      High
} CMMagneticFieldCalibrationAccuracy;
```

Core Motion

- Registering a block to receive Accelerometer data

```
- (void)startAccelerometerUpdatesToQueue:(NSOperationQueue *)queue
                             withHandler:(CMAccelerometerHandler)handler;
typedef void (^CMAccelerationHandler)(CMAccelerometerData *data, NSError *error);
```

  We haven't talked about `NSOperationQueue`, but think of it as an OO `dispatch_queue_t`.
  Use `[[NSOperationQueue alloc] init]` or `[NSOperation mainQueue` (or `currentQueue`)`]`.

- Registering a block to receive Gyro data

```
- (void)startGyroUpdatesToQueue:(NSOperationQueue *)queue
                    withHandler:(CMGyroHandler)handler;
typedef void (^CMGyroHandler)(CMGyroData *data, NSError *error)
```

- Registering a block to receive Magnetometer data

```
- (void)startMagnetometerUpdatesToQueue:(NSOperationQueue *)queue
                            withHandler:(CMMagnetometerHandler)handler;
typedef void (^CMMagnetometerHandler)(CMMagnetometerData *data, NSError *error)
```

Core Motion

- Registering a block to receive (intelligently) combined data

```
- (void)startDeviceMotionUpdatesToQueue:(NSOperationQueue *)queue
                            withHandler:(CMDeviceMotionHandler)handler;
typedef void (^CMDeviceMotionHandler)(CMDeviceMotion *motion, NSError *error);
```

Interesting `NSError` types: `CMErrorDeviceRequiresMovement`/`CMErrorTrueNorthNotAvailable`

```
- (void)startDeviceMotionUpdatesUsingReferenceFrame:(CMAttitudeReferenceFrame)frame
                                            toQueue:(NSOperationQueue *)queue
                                        withHandler:(CMDeviceMotionHandler)handler;
enum {
    CMAttitudeReferenceFrameXArbitraryZVertical,
                            XArbitraryCorrectedZVertical,  // needs magnetometer; more CPU
                            XMagneticZVertical,            // above + device movement
                            XTrueNorthZVertical            // requires GPS + magnetometer
}
@property (nonatomic) BOOL showsDeviceMovementDisplay;  // whether to put up UI if required
```

Core Motion

- Setting the rate at which your block gets executed

```
@property NSTimeInterval accelerometerUpdateInterval;
@property NSTimeInterval gyroUpdateInterval;
@property NSTimeInterval magnetometerUpdateInterval;
@property NSTimeInterval deviceMotionUpdateInterval;
```

- It is okay to add multiple handler blocks

  Even though you are only allowed one CMMotionManager.
  However, each of the blocks will receive the data at the same rate (as set above).
  (Multiple objects are allowed to poll at the same time as well, of course.)

Coming Up

- Friday Section
  Ge Wang, Smule
- Thanksgiving Break
  Gobble, gobble!