MOBILE COMPUTING

CSE 40814/60814
Spring 2021

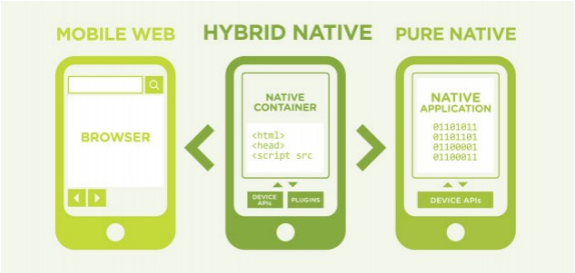
Today: Course Project Details

- Warm-up: couple of mini-projects to learn basics of mobile development
- ½-semester (group) project: project of your choosing
- If help needed identifying team members, let me know!
- Teams are expected to “produce more” than individuals!
- Project can align with your doctoral, MS, honor’s thesis, or other projects (e.g., participation in coding competition), but this must be disclosed in proposal and approved by instructor!
- Collaboration among students/teams encouraged, but extend of collaboration must be disclosed in reports!

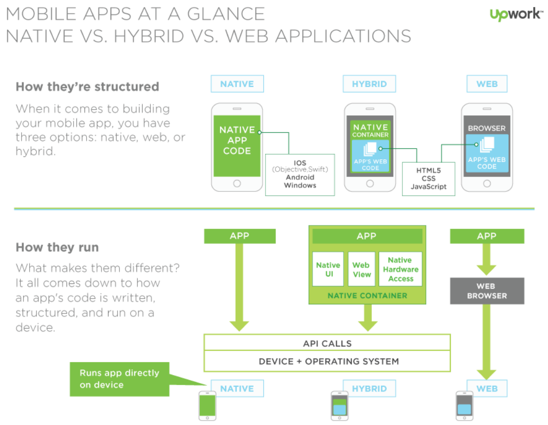
“Platforms”

- Which platform to develop on?
- Answer: all of them!

Native vs. Web vs. Hybrid



Native vs. Web vs. Hybrid



MOBILE APPS AT A GLANCE
NATIVE VS. HYBRID VS. WEB APPLICATIONS

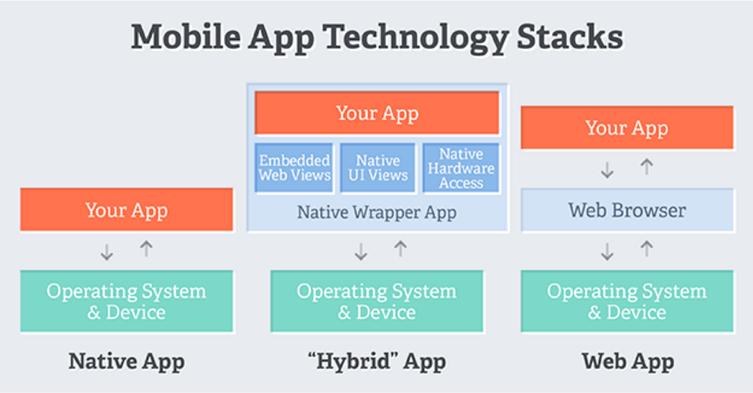
How they're structured

When it comes to building your mobile app, you have three options: native, web, or hybrid.

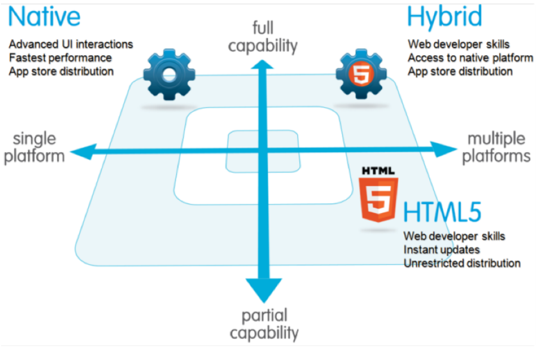
How they run

What makes them different? It all comes down to how an app's code is written, structured, and run on a device.

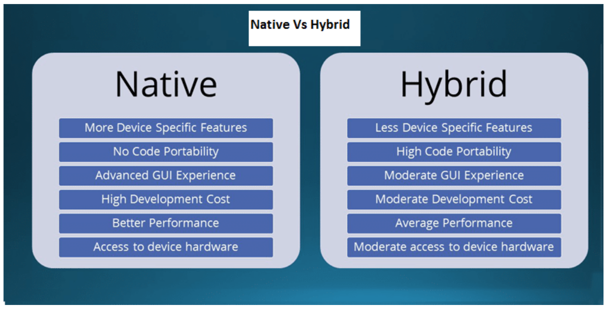
Native vs. Web vs. Hybrid



Native vs. Web vs. Hybrid



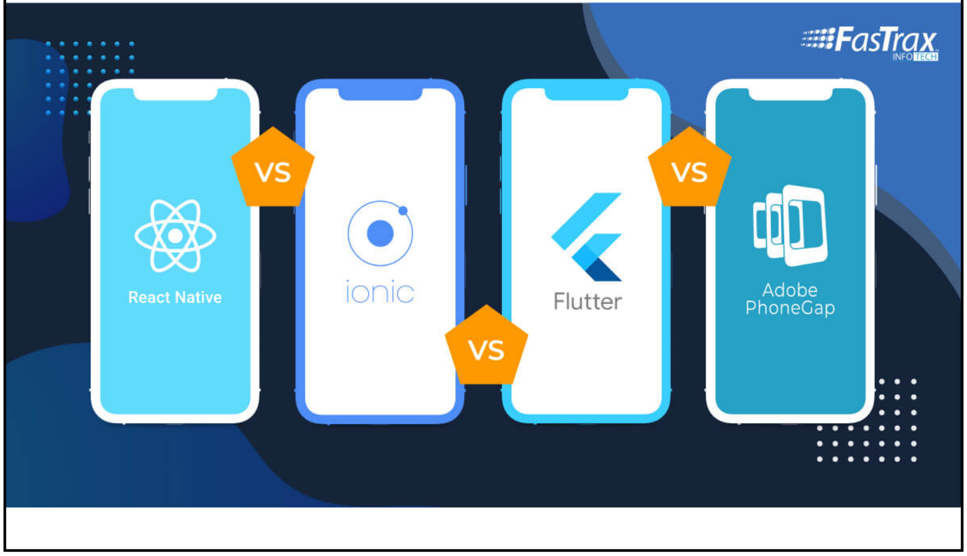
Native vs. Web vs. Hybrid



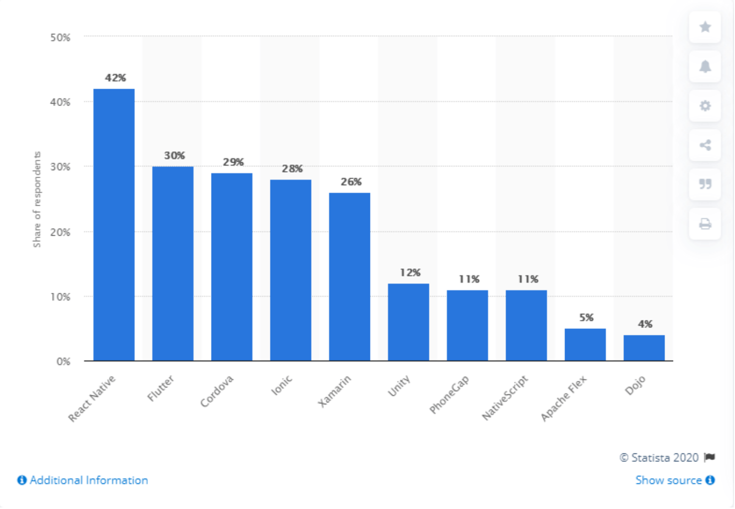
Native Vs Hybrid

Native	Hybrid
More Device Specific Features	Less Device Specific Features
No Code Portability	High Code Portability
Advanced GUI Experience	Moderate GUI Experience
High Development Cost	Moderate Development Cost
Better Performance	Average Performance
Access to device hardware	Moderate access to device hardware

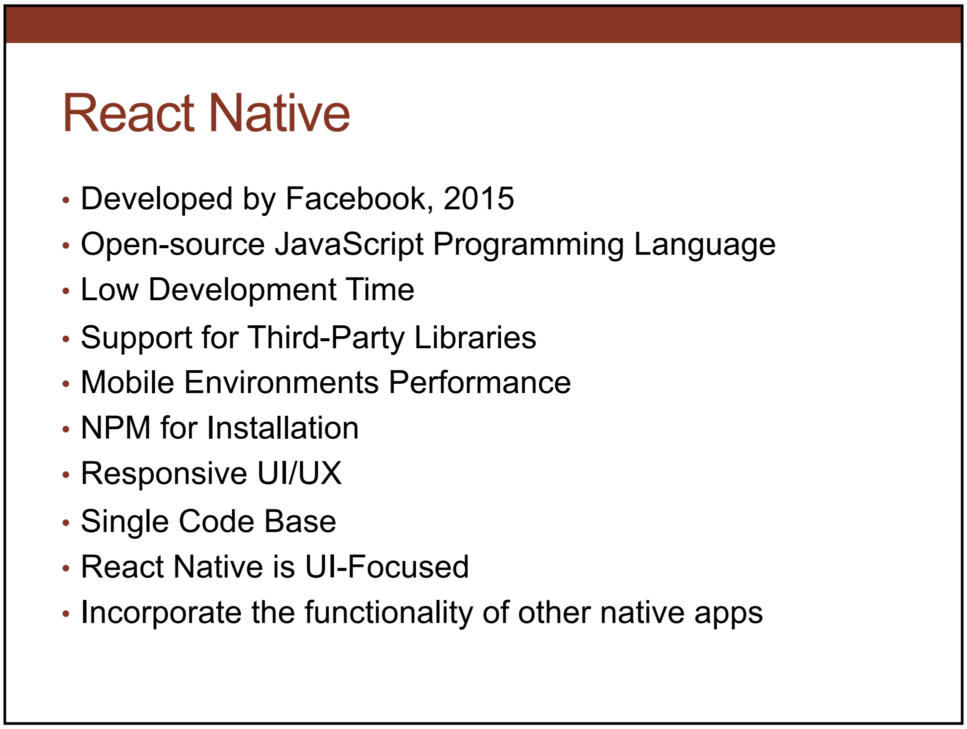
Options



Options

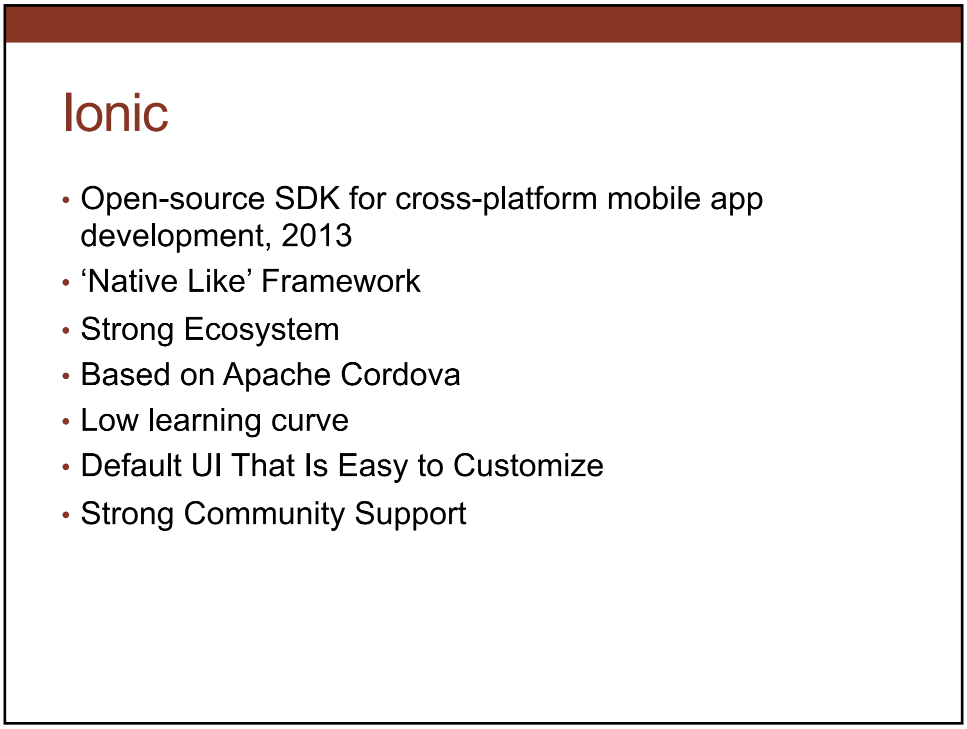


© Statista 2020



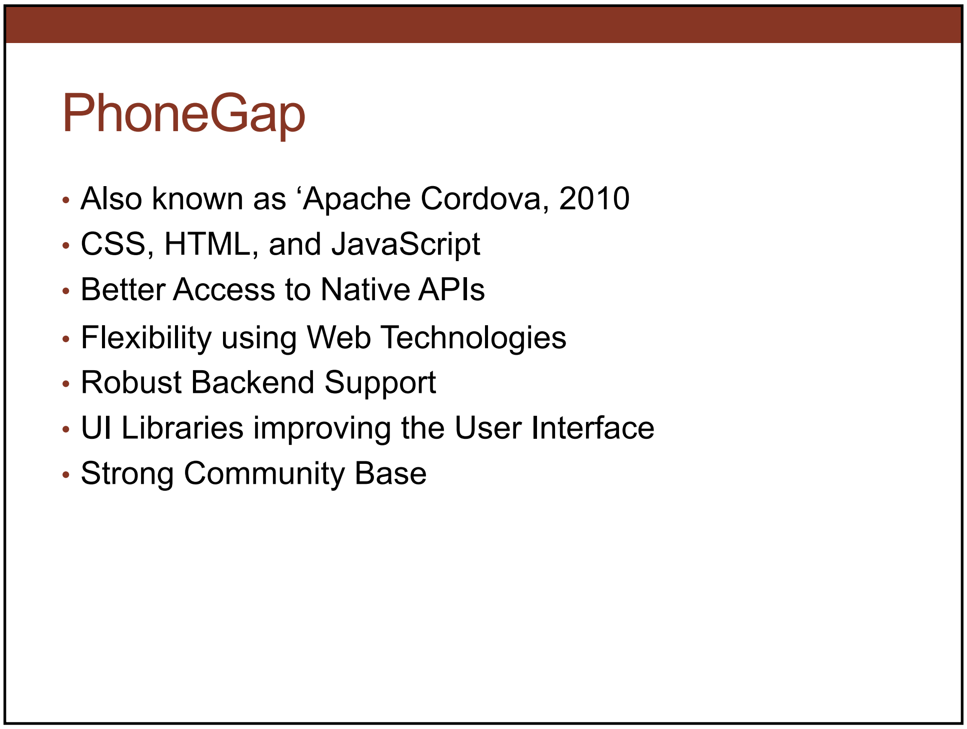
React Native

- Developed by Facebook, 2015
- Open-source JavaScript Programming Language
- Low Development Time
- Support for Third-Party Libraries
- Mobile Environments Performance
- NPM for Installation
- Responsive UI/UX
- Single Code Base
- React Native is UI-Focused
- Incorporate the functionality of other native apps



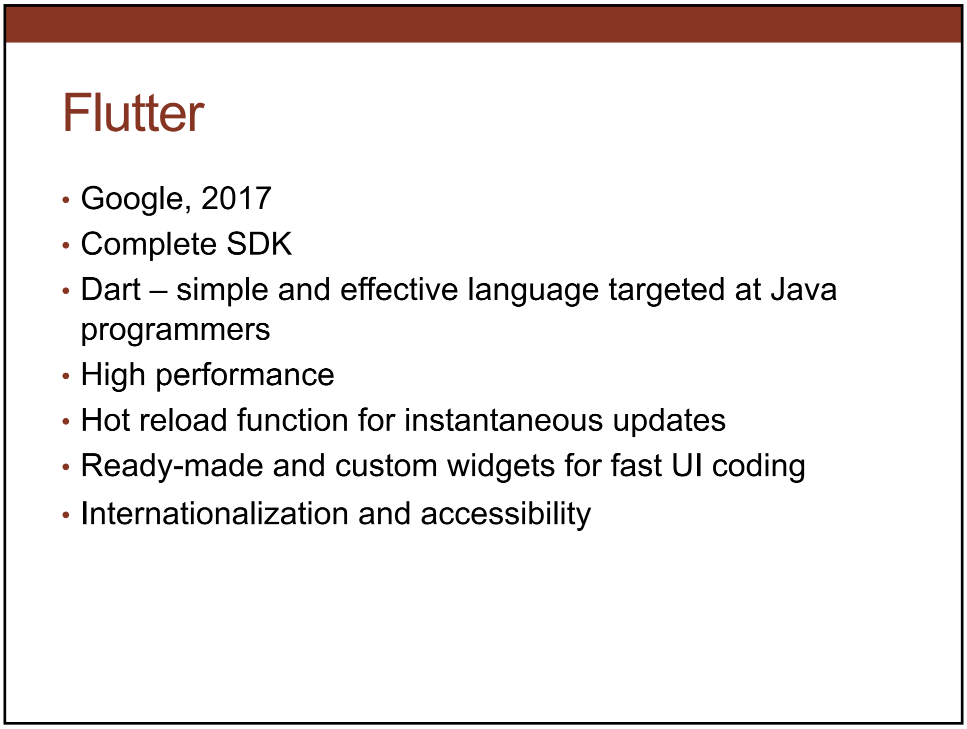
Ionic

- Open-source SDK for cross-platform mobile app development, 2013
- ‘Native Like’ Framework
- Strong Ecosystem
- Based on Apache Cordova
- Low learning curve
- Default UI That Is Easy to Customize
- Strong Community Support



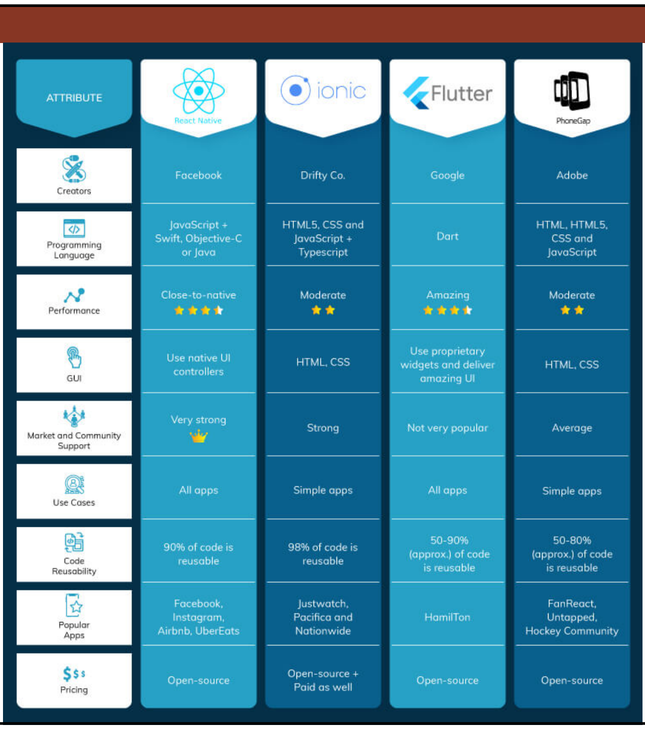
PhoneGap

- Also known as ‘Apache Cordova, 2010
- CSS, HTML, and JavaScript
- Better Access to Native APIs
- Flexibility using Web Technologies
- Robust Backend Support
- UI Libraries improving the User Interface
- Strong Community Base



Flutter

- Google, 2017
- Complete SDK
- Dart – simple and effective language targeted at Java programmers
- High performance
- Hot reload function for instantaneous updates
- Ready-made and custom widgets for fast UI coding
- Internationalization and accessibility



ATTRIBUTE	React Native	ionic	Flutter	PhoneGap
Creators	Facebook	Drifty Co.	Google	Adobe
Programming Language	JavaScript + Swift, Objective-C or Java	HTML5, CSS and JavaScript + Typescript	Dart	HTML, HTML5, CSS and JavaScript
Performance	Close-to-native ★★★½	Moderate ★★	Amazing ★★★½	Moderate ★★
GUI	Use native UI controllers	HTML, CSS	Use proprietary widgets and deliver amazing UI	HTML, CSS
Market and Community Support	Very strong 👑	Strong	Not very popular	Average
Use Cases	All apps	Simple apps	All apps	Simple apps
Code Reusability	90% of code is reusable	98% of code is reusable	50-90% (approx.) of code is reusable	50-80% (approx.) of code is reusable
Popular Apps	Facebook, Instagram, Airbnb, UberEats	Justwatch, Pacifica and Nationwide	HamilTon	FanReact, Untapped, Hockey Community
Pricing	Open-source	Open-source + Paid as well	Open-source	Open-source

Flutter Overview

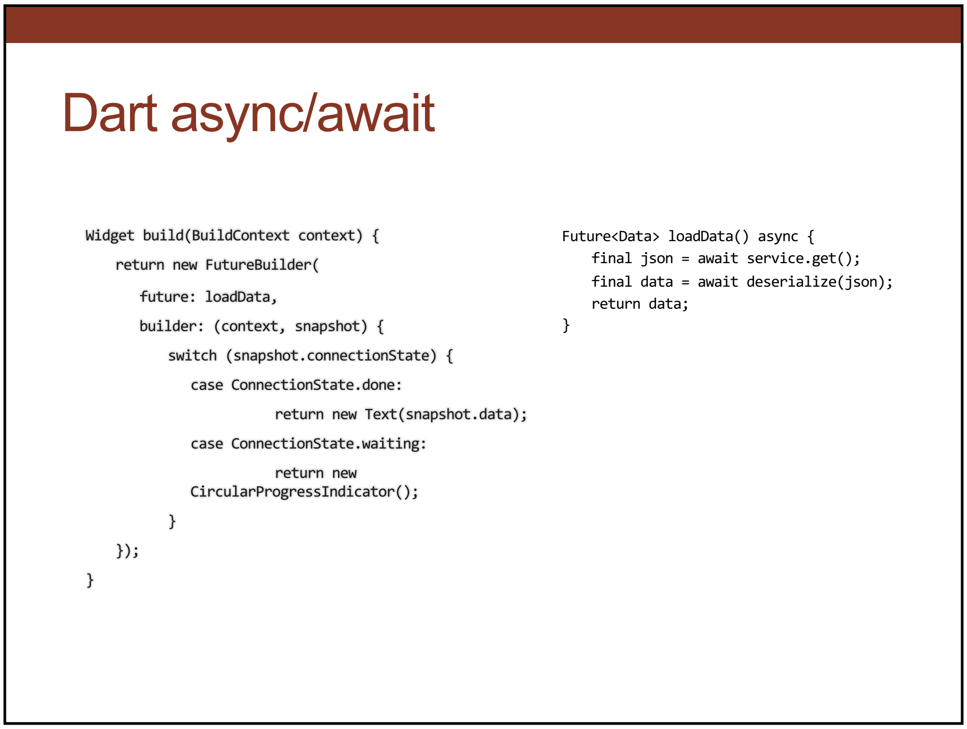
- Flutter is a free and open-source mobile UI framework
- Created by Google and released in May 2017
- Native mobile app with only one codebase (no need to develop different apps for different platforms)
- High performance:
  - Dart compiles your code into native code
  - Flutter has its own widgets, avoids using OEM widgets (leads to reduced communication between app and platform, fewer compatibility issues, will work on future OS versions)
  - Hot reload
- Rapidly growing community of developers

Flutter Overview

- Easy way to build elegant, native apps for Android and Apple iOS
- Dart is (relatively) easy to learn
- Plenty of examples for almost every situation on the web (Google search)
- Plenty of software tools and cloud tools available for free from Google
- Good documentation and plenty of material on the web
- You can see your code at work almost simultaneously

Flutter is Declarative

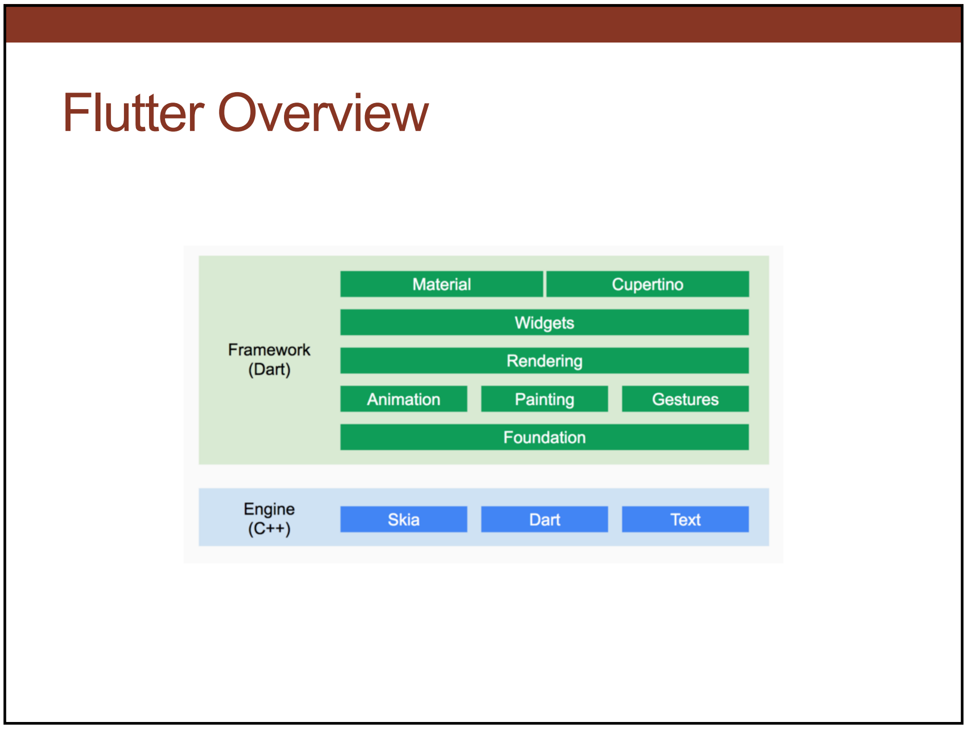
```
Widget build(BuildContext context) {
    return new Container(
       height: 400.0,
       padding: const EdgeInsets.all(8.0),
       child: todos.isEmpty
          ? new Text("empty, try to add something")
          : new ListView(
             children:
                todos.map<Widget>((todo) => new Text(todo)).toList()));
}
```



Dart async/await

```
Widget build(BuildContext context) {
    return new FutureBuilder(
       future: loadData,
       builder: (context, snapshot) {
          switch (snapshot.connectionState) {
             case ConnectionState.done:
                        return new Text(snapshot.data);
             case ConnectionState.waiting:
                        return new
             CircularProgressIndicator();
          }
    });
}
```

```
Future<Data> loadData() async {
    final json = await service.get();
    final data = await deserialize(json);
    return data;
}
```



Flutter Overview

Framework (Dart)

Material | Cupertino

Widgets

Rendering

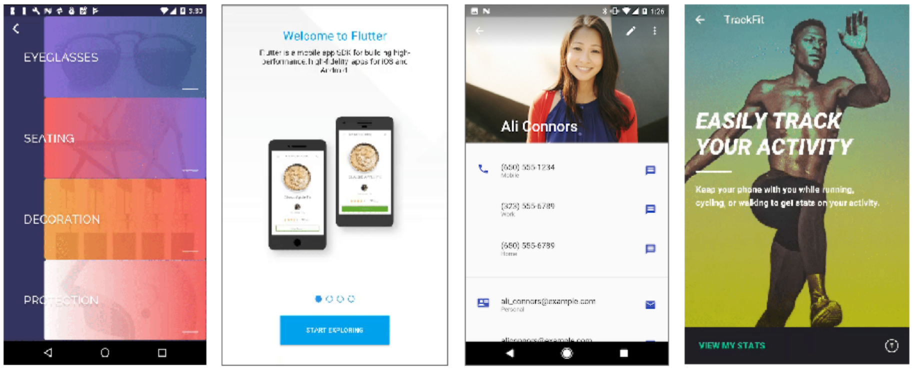
Animation | Painting | Gestures

Foundation

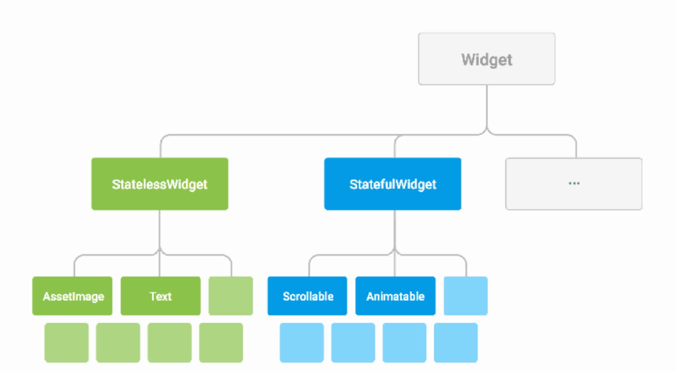
Engine (C++)

Skia | Dart | Text

Everything is a Widget

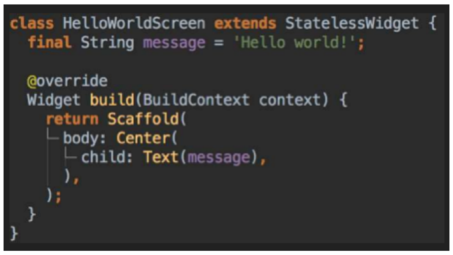

EYEGLASSES
SEATING
DECORATION
PROTECTION
Welcome to Flutter
START EXPLORING
Ali Connors
TrackFit
EASILY TRACK YOUR ACTIVITY
Keep your phone with you while running, cycling, or walking to get stats on your activity.
VIEW MY STATS

Everything is a Widget



Stateless Widget

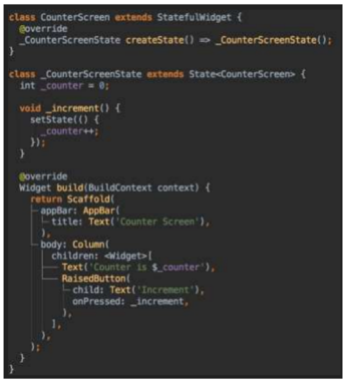
- Immutable
- Once created, it doesn’t change



```
class HelloWorldScreen extends StatelessWidget {
  final String message = 'Hello world!';

  @override
  Widget build(BuildContext context) {
    return Scaffold(
      body: Center(
        child: Text(message),
      ),
    );
  }
}
```

Stateful Widget

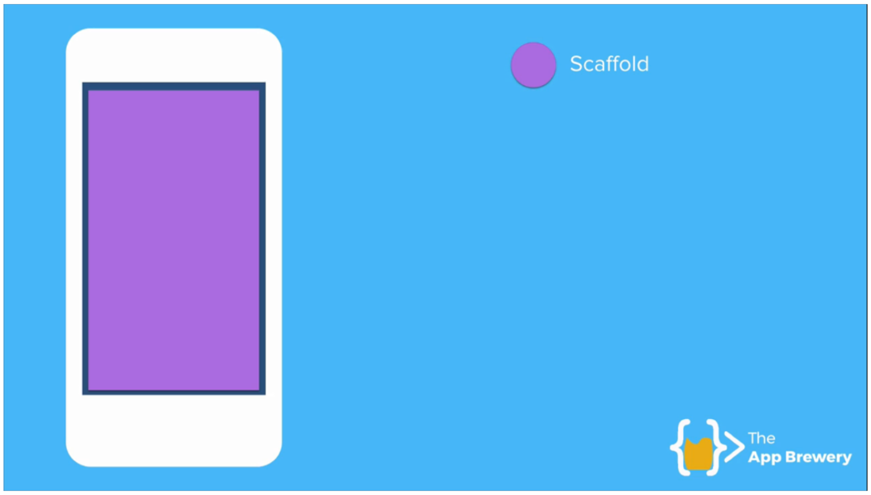
- Have a “State”
- State - set of data held by a widget that can change in its lifetime



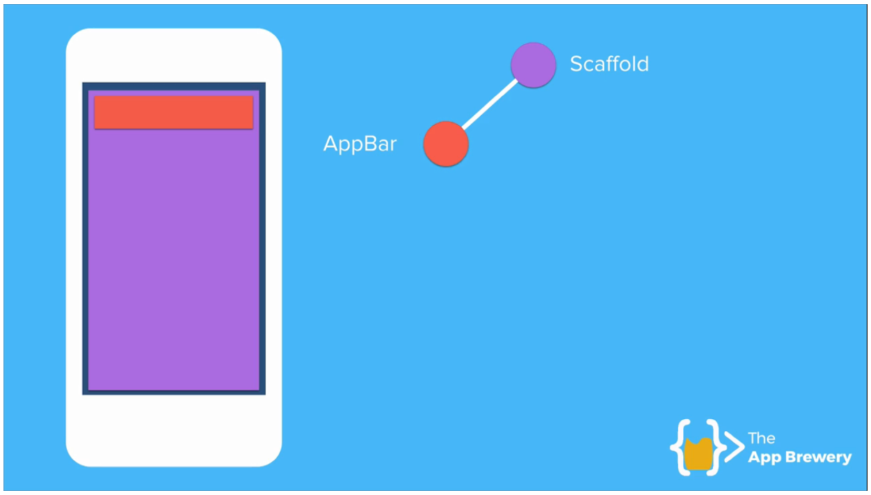
```
class CounterScreen extends StatefulWidget {
  @override
  _CounterScreenState createState() => _CounterScreenState();
}

class _CounterScreenState extends State<CounterScreen> {
  int _counter = 0;

  void _increment() {
    setState(() {
      _counter++;
    });
  }

  @override
  Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(
        title: Text('Counter Screen'),
      ),
      body: Column(
        children: <Widget>[
          Text('Counter is $_counter'),
          RaisedButton(
            child: Text('Increment'),
            onPressed: _increment,
          ),
        ],
      ),
    );
  }
}
```

Anatomy of Flutter

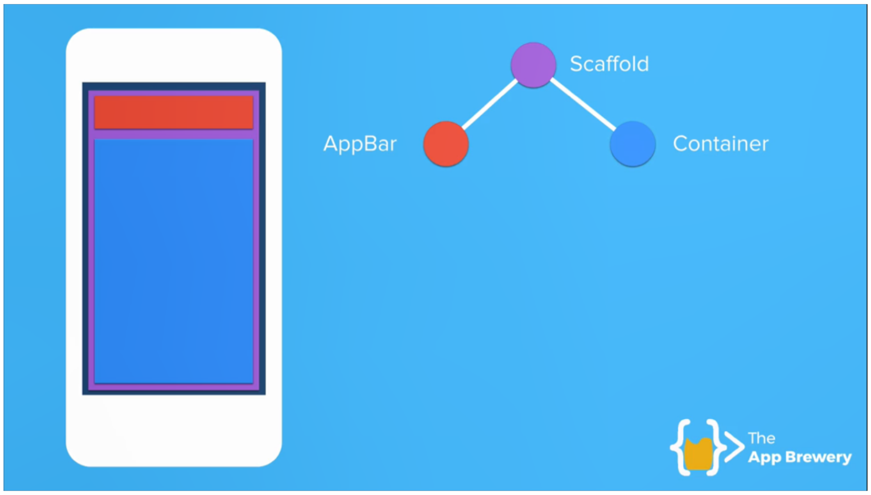
Anatomy of Flutter



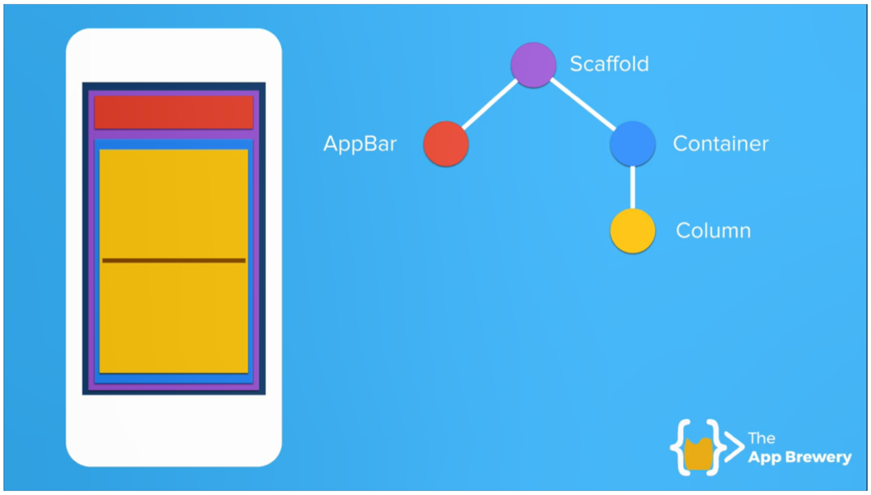
Anatomy of Flutter



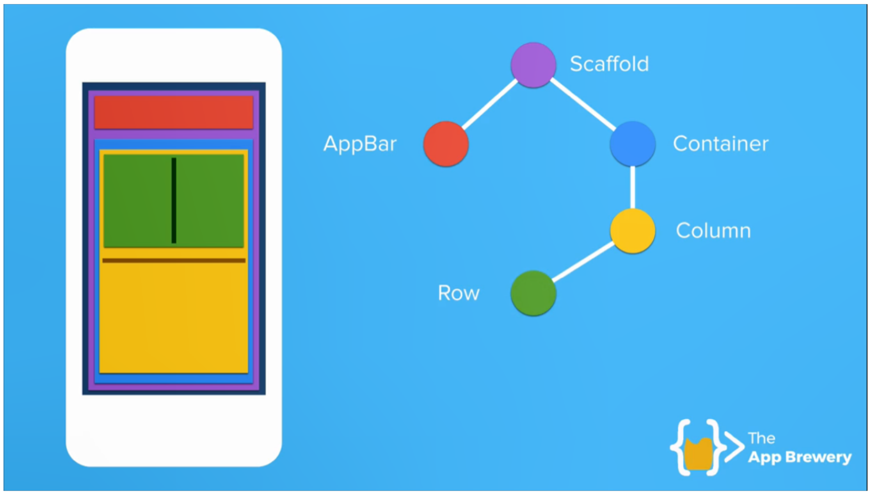
Anatomy of Flutter



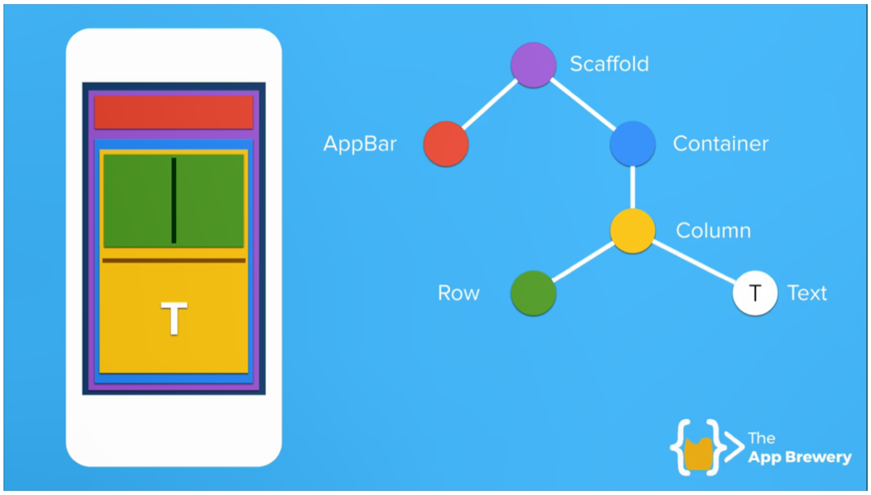
Anatomy of Flutter



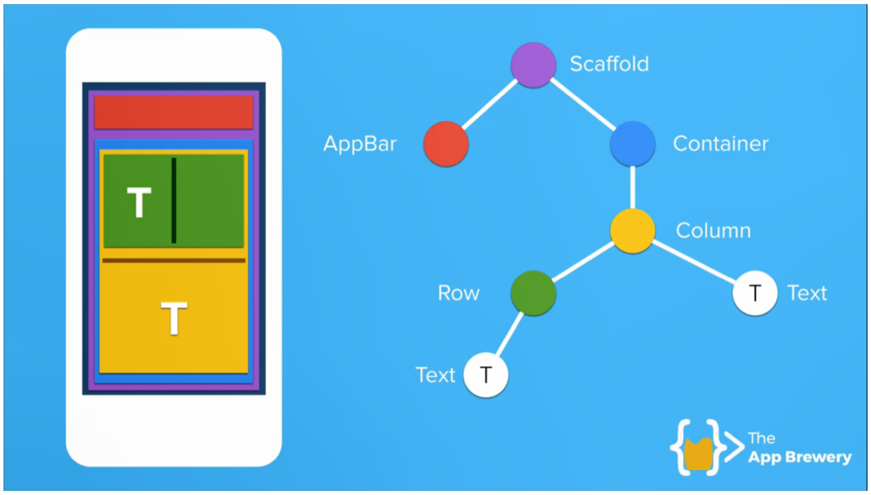
Anatomy of Flutter



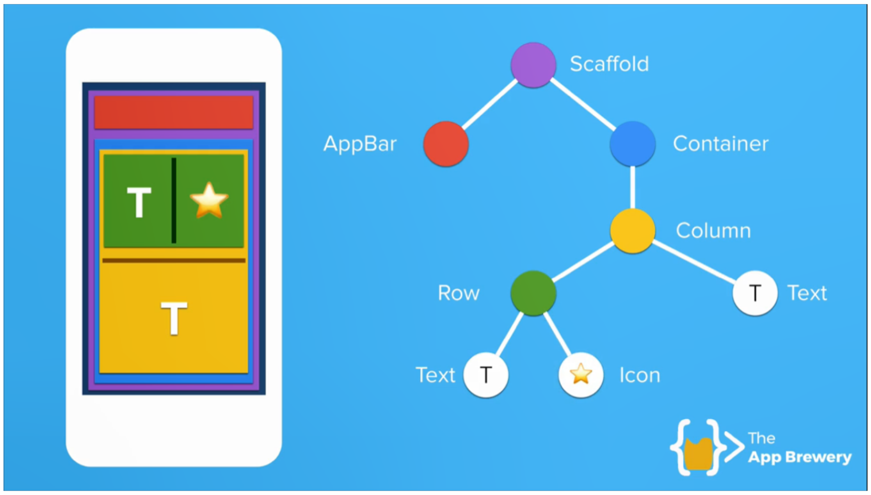
Anatomy of Flutter



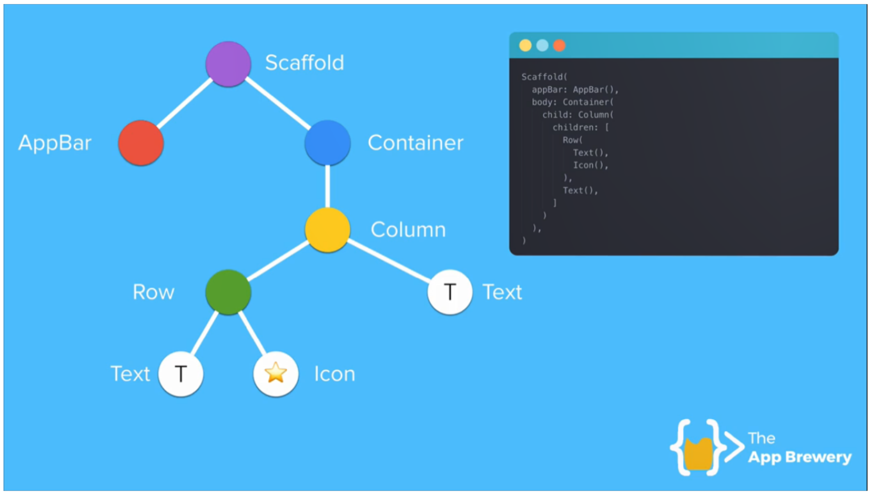
Anatomy of Flutter



Anatomy of Flutter



Anatomy of Flutter



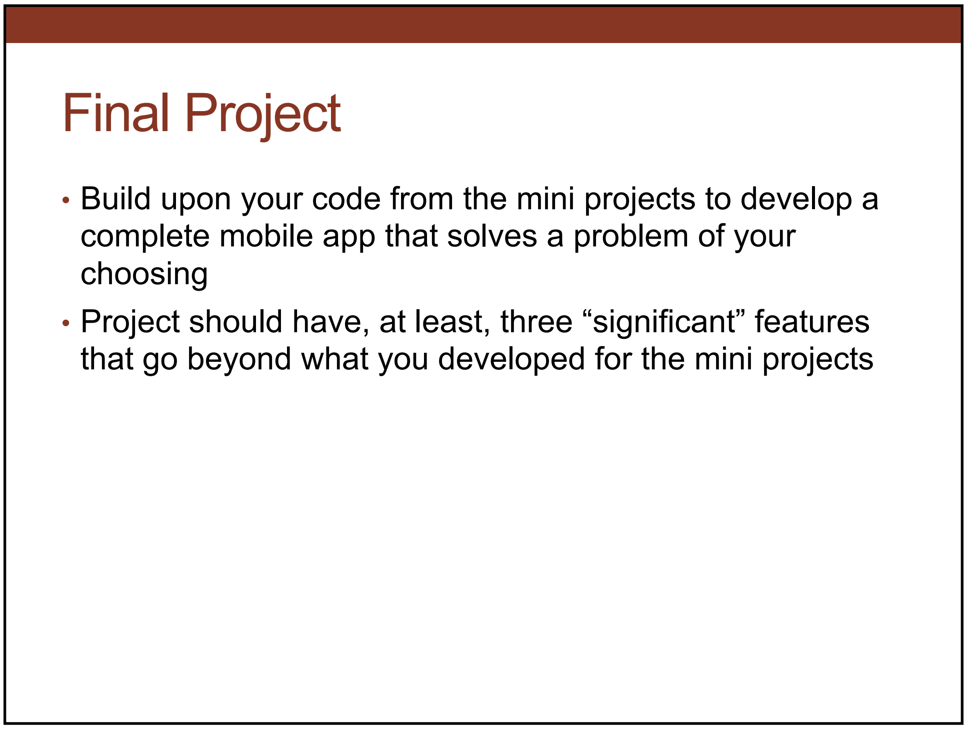
```
Scaffold(
  appBar: AppBar(),
  body: Container(
    child: Column(
      children: [
        Row(
          Text(),
          Icon(),
        ),
        Text(),
      ]
    )
  ),
)
```

My First Flutter App

- Install Flutter:
  - https://flutter.dev/docs/get-started/install
- Install your favorite editor:
  - https://flutter.dev/docs/get-started/editor?tab=vscode
- Test drive:
  - https://flutter.dev/docs/get-started/test-drive?tab=vscode
- My first app:
  - https://flutter.dev/docs/get-started/codelab
- Optional readings:
  - https://flutter.dev/docs/get-started/learn-more

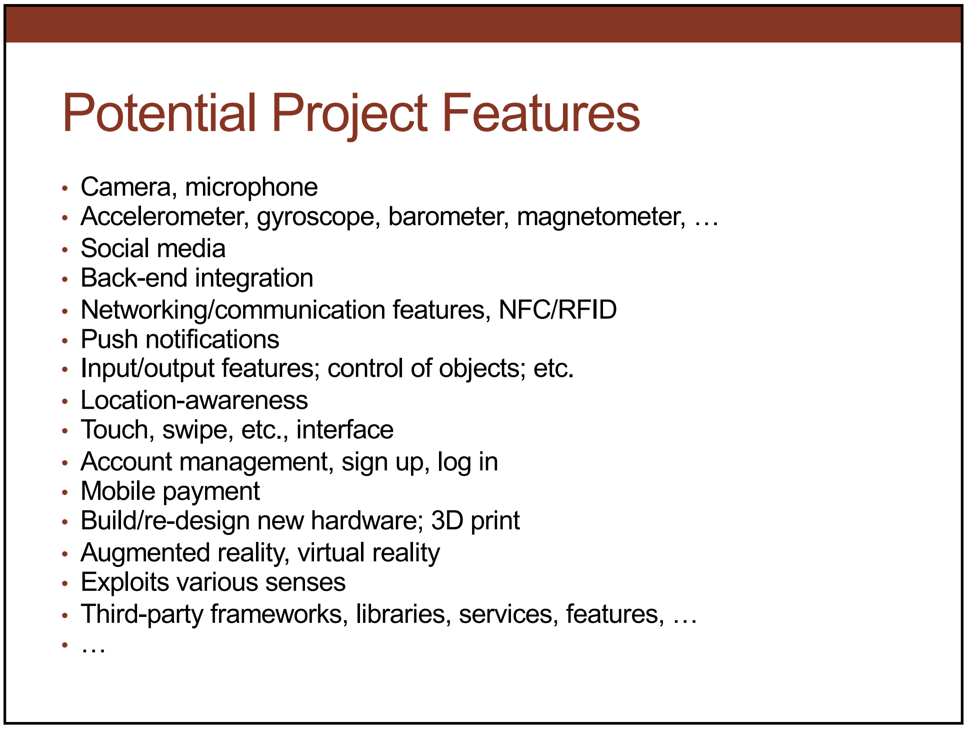
My First Flutter App

- Deliverable:
  - Submit brief video (< 30 seconds) of your app in action (emulator or device) via Sakai
  - Submit brief document (max. 1 page, pdf), stating your name, people you worked with (and how), and describe any aspects of this project that caused you unusual difficulties (if appropriate); also describe if the project is incomplete or faulty (provide specifics about why you weren't able to complete the assignment)
  - Deadline: 2/17 11.59pm EST



Final Project

- Build upon your code from the mini projects to develop a complete mobile app that solves a problem of your choosing
- Project should have, at least, three “significant” features that go beyond what you developed for the mini projects



Potential Project Features

- Camera, microphone
- Accelerometer, gyroscope, barometer, magnetometer, …
- Social media
- Back-end integration
- Networking/communication features, NFC/RFID
- Push notifications
- Input/output features; control of objects; etc.
- Location-awareness
- Touch, swipe, etc., interface
- Account management, sign up, log in
- Mobile payment
- Build/re-design new hardware; 3D print
- Augmented reality, virtual reality
- Exploits various senses
- Third-party frameworks, libraries, services, features, …
- …

Project Structure

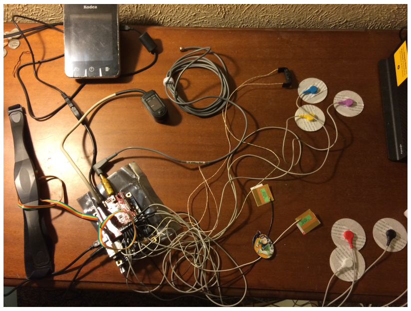
- Project proposal
- 2 written progress reports
  - Reports can also be used to adjust proposal if needed
- Final report, delivered with code
- Brief in-class demo/presentation of project

Project Samples

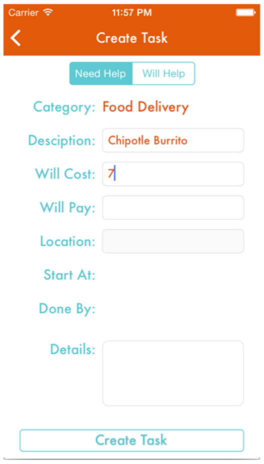
- The following slides show examples from previous years' courses on Mobile Computing, Pervasive Computing, Smart Health, etc. (so not examples are purely software and none of them was built using Flutter!)

Biometrics Sensing

- Electrocardiography
- Electromyography
- Galvanic skin response
- Blood pressure
- Body position
- Air flow
- Temperature
- Blood sugar



HelpHub



Category: Food Delivery

Desciption: Chipotle Burrito

Will Cost: 7

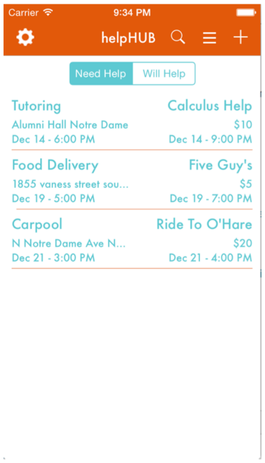
Will Pay:

Location:

Start At:

Done By:

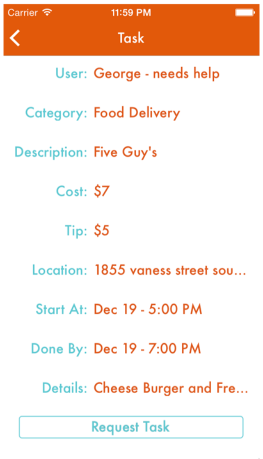
Details:



Tutoring — Calculus Help
Alumni Hall Notre Dame — $10
Dec 14 - 6:00 PM — Dec 14 - 9:00 PM

Food Delivery — Five Guy's
1855 vaness street sou... — $5
Dec 19 - 5:00 PM — Dec 19 - 7:00 PM

Carpool — Ride To O'Hare
N Notre Dame Ave N... — $20
Dec 21 - 3:00 PM — Dec 21 - 4:00 PM



User: George - needs help

Category: Food Delivery

Description: Five Guy's

Cost: $7

Tip: $5

Location: 1855 vaness street sou...

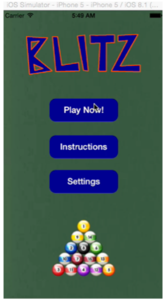
Start At: Dec 19 - 5:00 PM

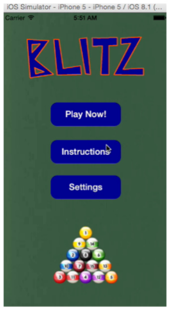
Done By: Dec 19 - 7:00 PM

Details: Cheese Burger and Fre...

BlitzPool

- Game engine
- Physics libraries
- Real-time features
- Game center

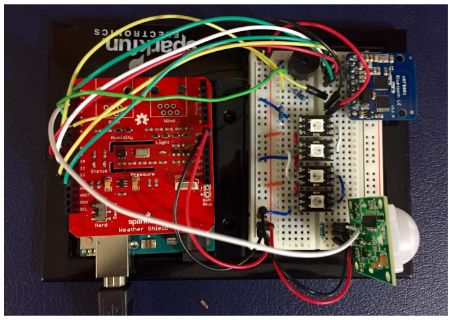


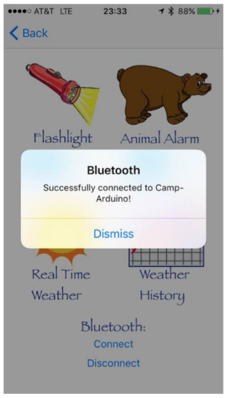


ND Sporter

- https://www.youtube.com/watch?v=KxeTRTN0t10

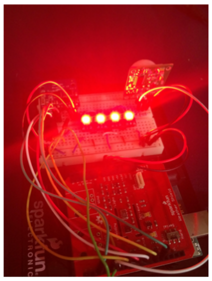
Camp-Arduino



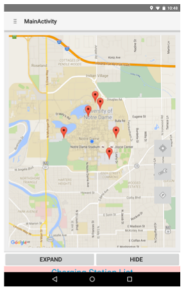


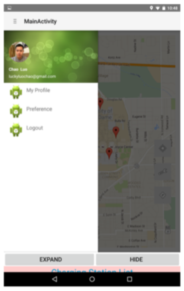
Bluetooth

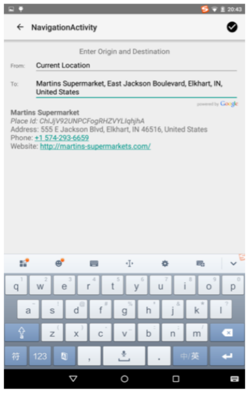
Successfully connected to Camp-Arduino!



ChargeButler





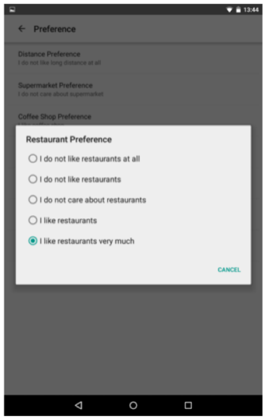


Enter Origin and Destination

From: Current Location

To: Martins Supermarket, East Jackson Boulevard, Elkhart, IN, United States

Martins Supermarket
Place Id: ChIJjV92UNPCFogRHZVYLIqhjhA
Address: 555 E Jackson Blvd, Elkhart, IN 46516, United States
Phone: +1 574-293-6659
Website: http://martins-supermarkets.com/



Distance Preference
I do not like long distance at all

Supermarket Preference
I do not care about supermarket

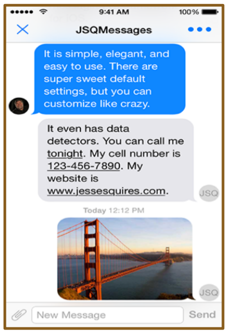
Coffee Shop Preference

Restaurant Preference

○ I do not like restaurants at all
○ I do not like restaurants
○ I do not care about restaurants
○ I like restaurants
● I like restaurants very much

Pen Pal

- Anonymous communication anytime based on location and/or interest.



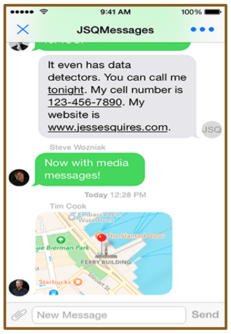
9:41 AM 100%

JSQMessages

It is simple, elegant, and easy to use. There are super sweet default settings, but you can customize like crazy.

It even has data detectors. You can call me tonight. My cell number is 123-456-7890. My website is www.jessesquires.com.

Today 12:12 PM



9:41 AM 100%

JSQMessages

It even has data detectors. You can call me tonight. My cell number is 123-456-7890. My website is www.jessesquires.com.

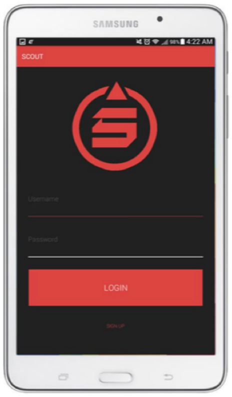
Steve Wozniak

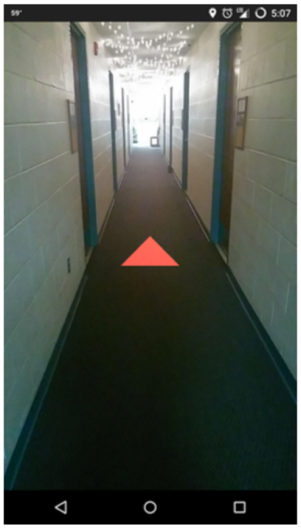
Now with media messages!

Today 12:28 PM

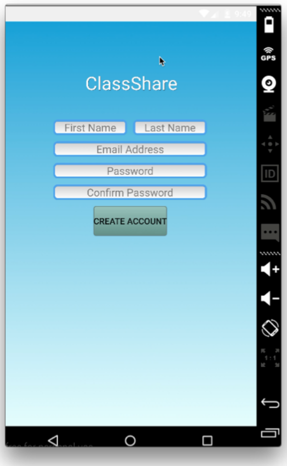
Tim Cook

Scout





ClassShare

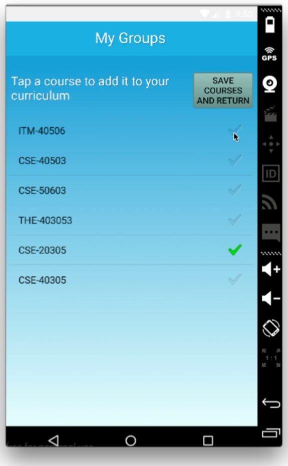

ClassShare

First Name | Last Name

Email Address

Password

Confirm Password


My Groups

Tap a course to add it to your curriculum

ITM-40506

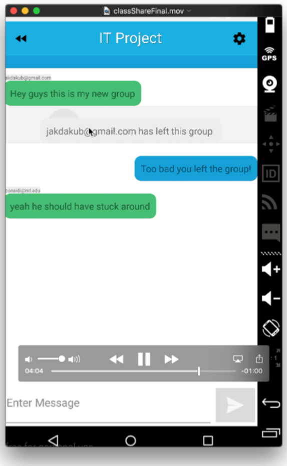
CSE-40503

CSE-50603

THE-403053

CSE-20305 ✓

CSE-40305



IT Project

jakdakub@gmail.com

Hey guys this is my new group

jakdakub@gmail.com has left this group

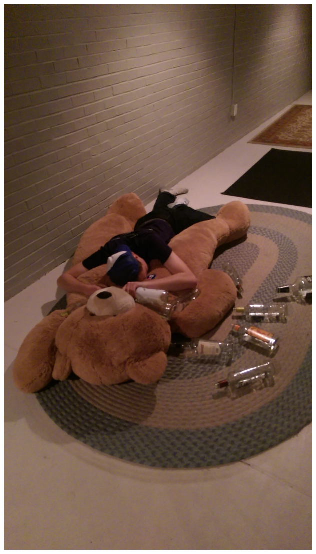
Too bad you left the group!

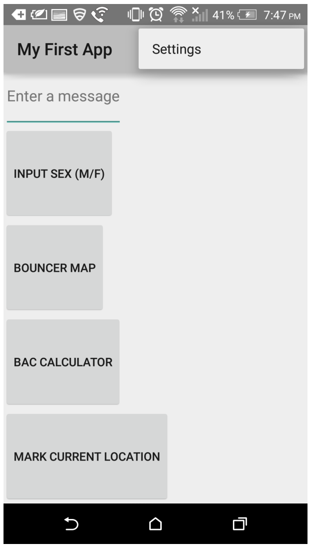
considi@nd.edu

yeah he should have stuck around

Enter Message

Bouncer

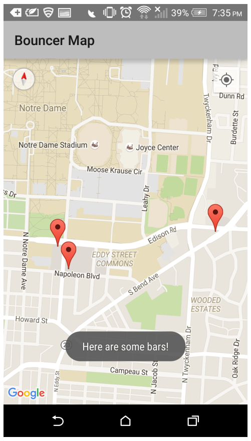




My First App

Settings

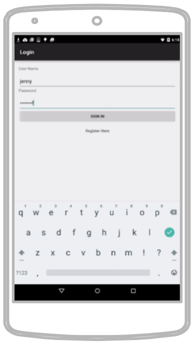
Enter a message



Bouncer Map

Here are some bars!

Hello App



Login

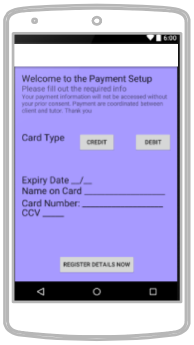
User Name

jenny

Password

SIGN IN

Register Here



Welcome to the Payment Setup

Please fill out the required info

Your payment information will not be accessed without your prior consent. Payment are coordinated between client and tutor. Thank you

Card Type CREDIT DEBIT

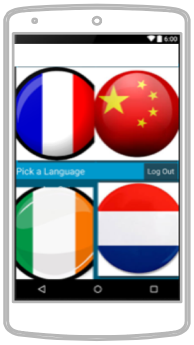
Expiry Date __/__

Name on Card ______________

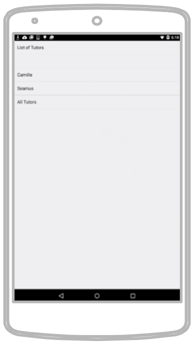
Card Number: ______________

CCV ____

REGISTER DETAILS NOW



Pick a Language Log Out



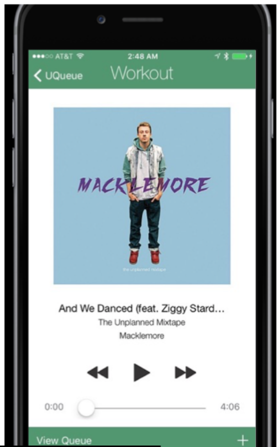
List of Tutors

Camille

Seamus

All Tutors

UQueue



UQueue Workout

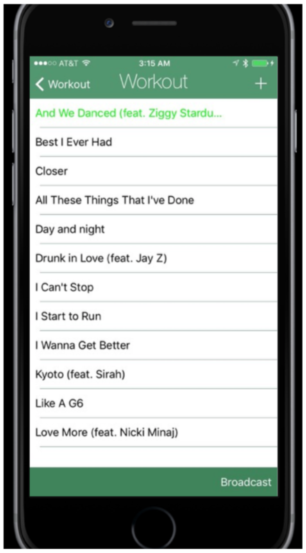
And We Danced (feat. Ziggy Stard...

The Unplanned Mixtape

Macklemore

0:00 4:06

View Queue +



Workout Workout +

And We Danced (feat. Ziggy Stardu...

Best I Ever Had

Closer

All These Things That I've Done

Day and night

Drunk in Love (feat. Jay Z)

I Can't Stop

I Start to Run

I Wanna Get Better

Kyoto (feat. Sirah)

Like A G6

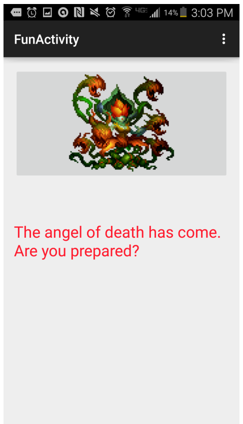
Love More (feat. Nicki Minaj)

Broadcast

UQueue

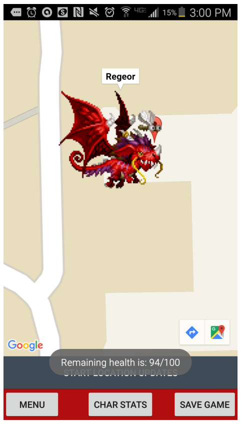
- Broadcasting
- Likes/Dislikes
- Requests

Monster Hunter



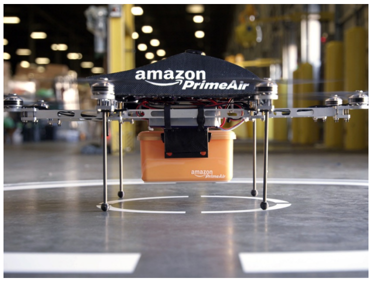
FunActivity

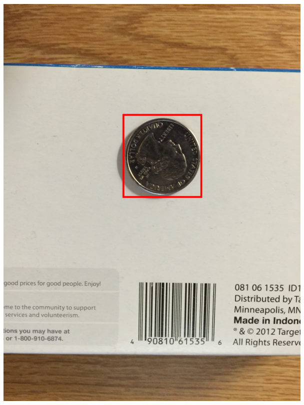
The angel of death has come. Are you prepared?



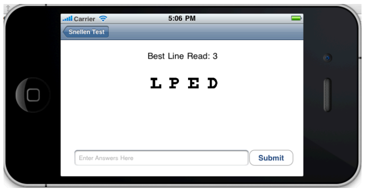
Remaining health is: 94/100

UAV Tracker



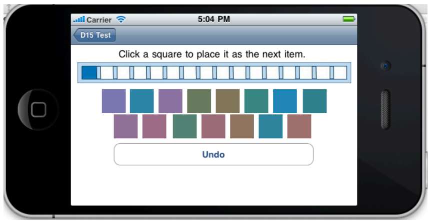


iPhone Doctor

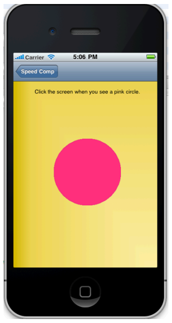


Best Line Read: 3

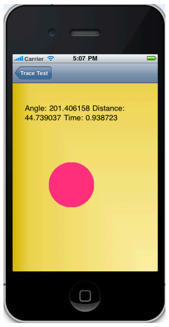
L P E D



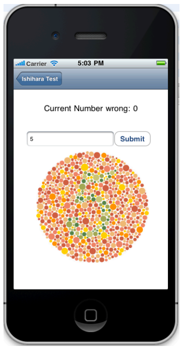
Click a square to place it as the next item.



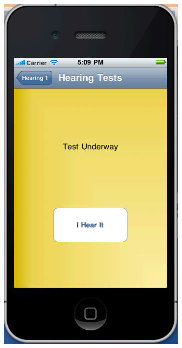
Click the screen when you see a pink circle.



Angle: 201.406158 Distance: 44.739037 Time: 0.938723

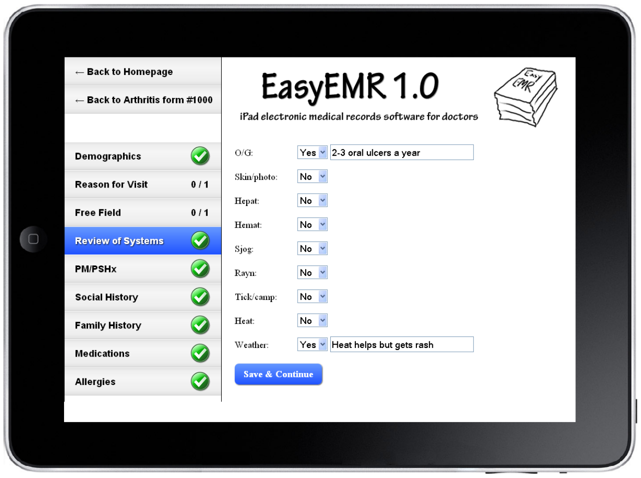


Current Number wrong: 0



Test Underway

EasyEMR

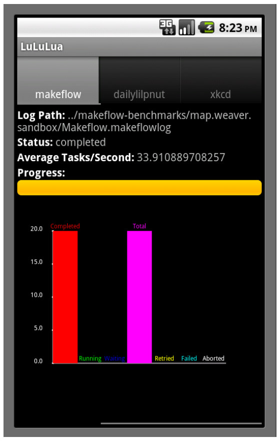


EasyEMR 1.0

iPad electronic medical records software for doctors

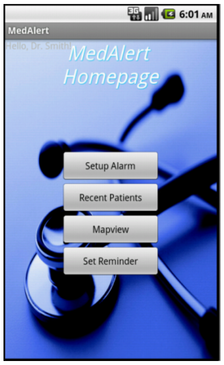
O/G:	Yes	2-3 oral ulcers a year
Skin/photo:	No	
Hepat:	No	
Hemat:	No	
Sjog:	No	
Rayn:	No	
Tick/camp:	No	
Heat:	No	
Weather:	Yes	Heat helps but gets rash

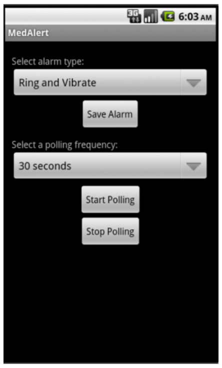
Data Visualization



Log Path: ../makeflow-benchmarks/map.weaver.sandbox/Makeflow.makeflowlog
Status: completed
Average Tasks/Second: 33.910889708257
Progress:

MedAlert for Doctors

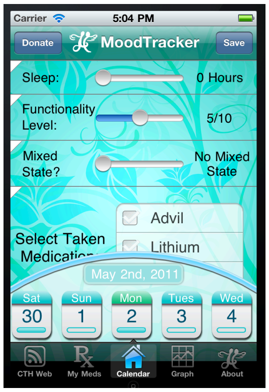




Select alarm type: Ring and Vibrate

Select a polling frequency: 30 seconds

MoodTracker



Sleep: 0 Hours

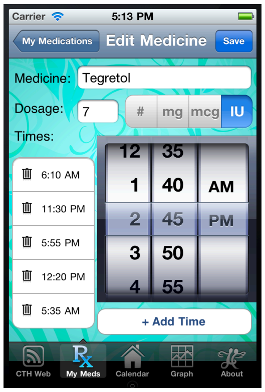
Functionality Level: 5/10

Mixed State? No Mixed State

Select Taken Medication: Advil, Lithium

May 2nd, 2011

Sat	Sun	Mon	Tues	Wed
30	1	2	3	4



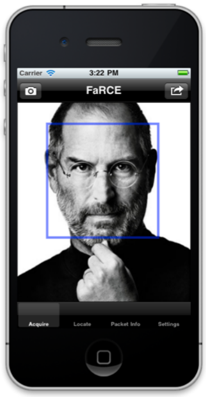
Medicine: Tegretol

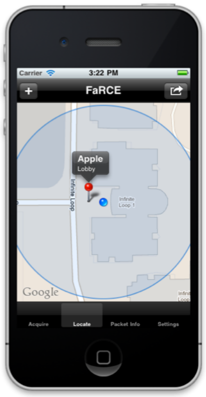
Dosage: 7 # mg mcg IU

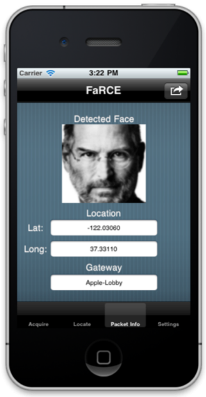
Times:
- 6:10 AM
- 11:30 PM
- 5:55 PM
- 12:20 PM
- 5:35 AM

12	35	
1	40	AM
2	45	PM
3	50	
4	55	

FaRCE







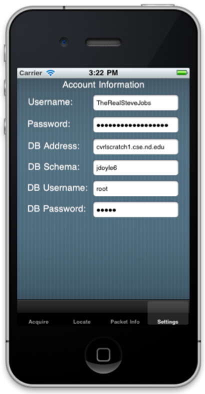
Detected Face

Location

Lat: -122.03060

Long: 37.33110

Gateway: Apple-Lobby



Account Information

Username: TheRealSteveJobs

Password: ••••••••••••••••••

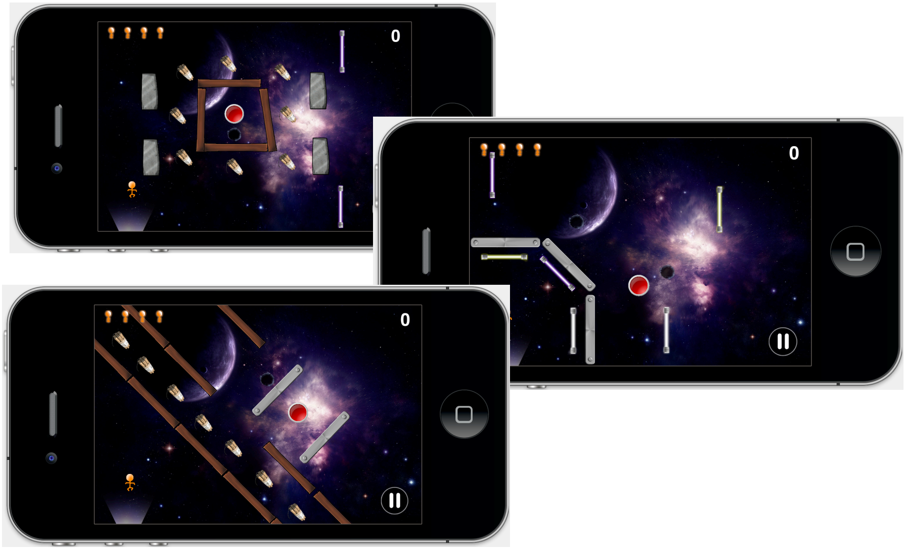
DB Address: cvrlscratch1.cse.nd.edu

DB Schema: jdoyle6

DB Username: root

DB Password: •••••

Portal



RideAlong

Solution: RideAlong

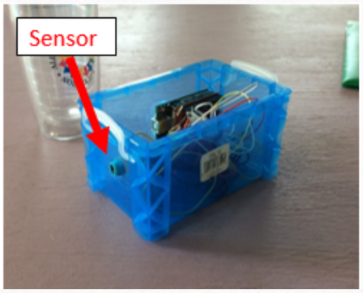
- Ride-sharing app specific to Notre Dame
- Can directly connect students who have cars with students who do not have cars
  - More specific than the Notre Dame Facebook groups
  - More likely to be used for shorter trips (e.g. to the store, rather than only to the airport)
- Students can both offer and request rides

RideAlong

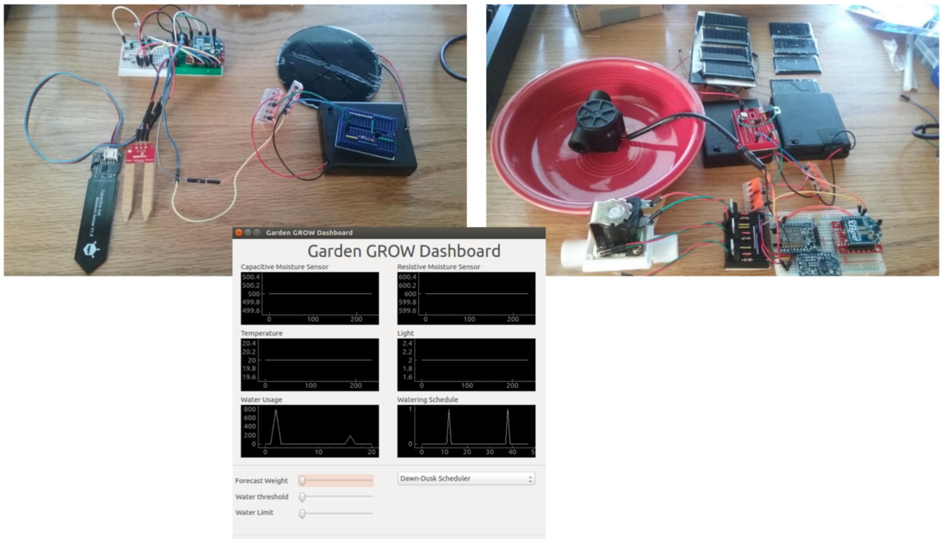
De-Icing Sensors

Automatic Infrared Temperature Sensors

- Long Range IR Temp. Measurements (30ft)
- Low Cost
- Accurate
- Real Time Monitoring



Garden GROW



Forecast Weight

Water threshold

Water Limit

Dawn-Dusk Scheduler

Other Projects

- Book Club
- Parking Space Finder
- Movie Finder
- Pick Up Sports Organizer
- LYNX Taxi Service
- Hearing Assessment App
- MySquirrel
- Occupational Therapy Exercises
- Stress Detector
- SnapnSpray
- Twext: Learning Betwixt Texts

That's it for today…

- Next up: Mobile app development, tools, best practices

IT MIGHT LOOK AS IF I'M IN A DEAD-END JOB, BUT I'M DEVELOPING AN APP IN MY SPARE TIME.
Dilbert.com DilbertCartoonist@gmail.com
HERE'S A LOTTERY TICKET. I JUST DOUBLED YOUR ODDS OF SUCCESS.
2-12-11 ©2011 Scott Adams, Inc./Dist. by UFS, Inc.
I BOUGHT TWO FOR MYSELF SO I DON'T NEED TO MAKE AN APP.