

Mobile Applications for Sensing and Control

Professional Master's Program in
Electrical and Computer Engineering

Instructor: **Laura Arjona**



Research Associate
UWIN Fellow

Teaching Assistant: **Vineetha Thomas**

Master's student, ECE

Tips for working remotely

- Do not work from bed
- Do not work from bed
- Do not work from bed
- Have ready your computer/laptop, a microphone and headphones, tools to write notes, a webcam (if you want to share video)
- Lecture is just once a week!! – pay attention and make the most of it :D

Remote classes logistics

- **Synchronous** classes: Thursdays 6-9:30pm
(2x 15min breaks)
- All lectures are recorded, and videos will be available after the class (Zoom)
- Join with video is optional

Poll



Break



Group activity



Interacting live in the course

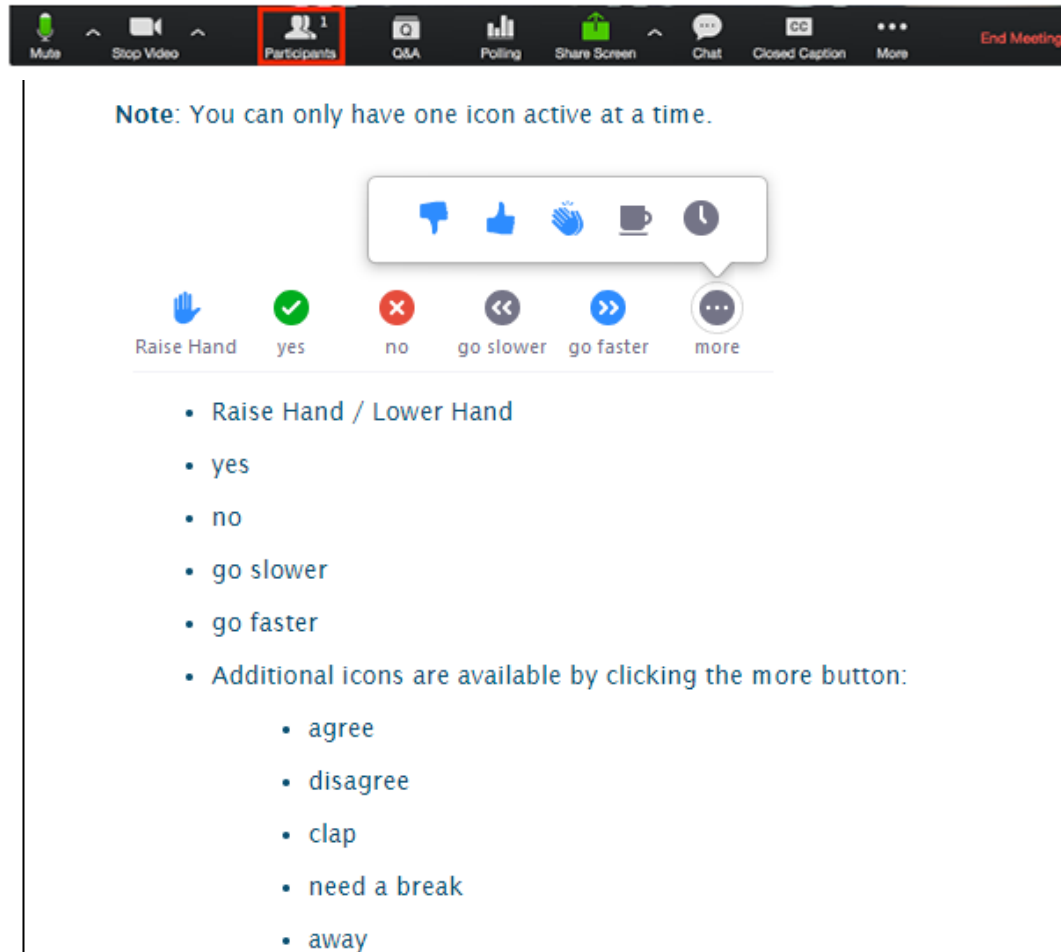
- Have a question within the lecture?
 - a) Just interrupt me and speak out! (preferred)
 - b) “*raise your hand*” feature in zoom
- Need to talk to me (Laura) after class?
 - We will use breakout rooms.
Write your name in this shared document, I will meet one by one in a breakout room.

Document link is shared in the general chat

<https://docs.google.com/document/d/1Z4WZ17ZtIWnhUMezhjAh4I2ySjNxtwh9LyIsa57URfg/edit?usp=sharing>

- No microphone?: use email or Zoom chat

Providing feedback during lecture



Note: You can only have one icon active at a time.

Icons available for feedback:

- Raise Hand
- yes
- no
- go slower
- go faster
- more

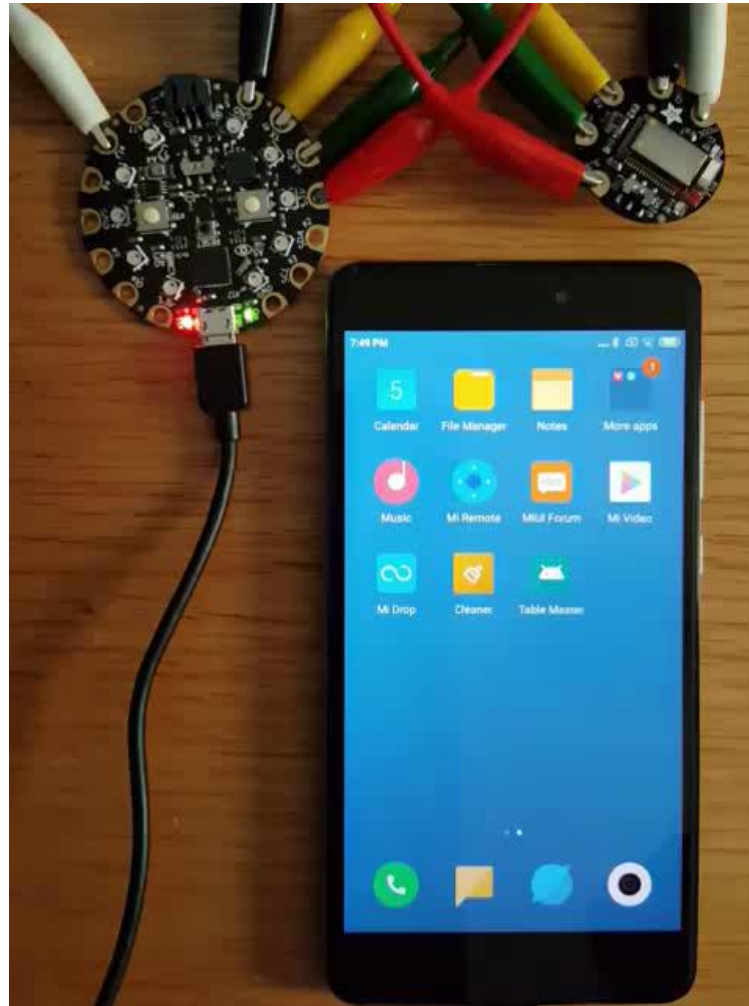
- Raise Hand / Lower Hand
- yes
- no
- go slower
- go faster
- Additional icons are available by clicking the more button:
 - agree
 - disagree
 - clap
 - need a break
 - away

Final projects from Spring 2019

Table Master

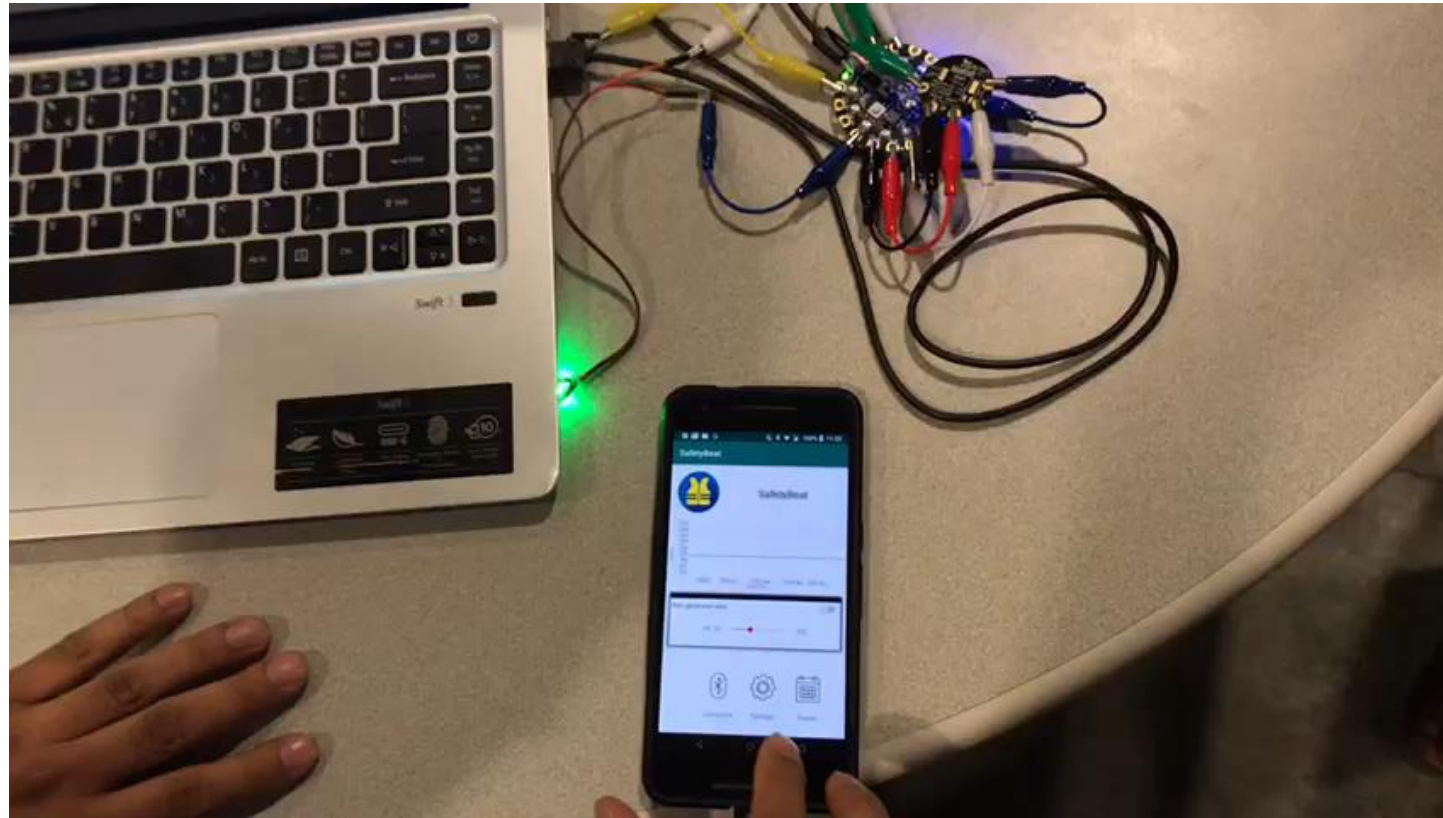


Best project award



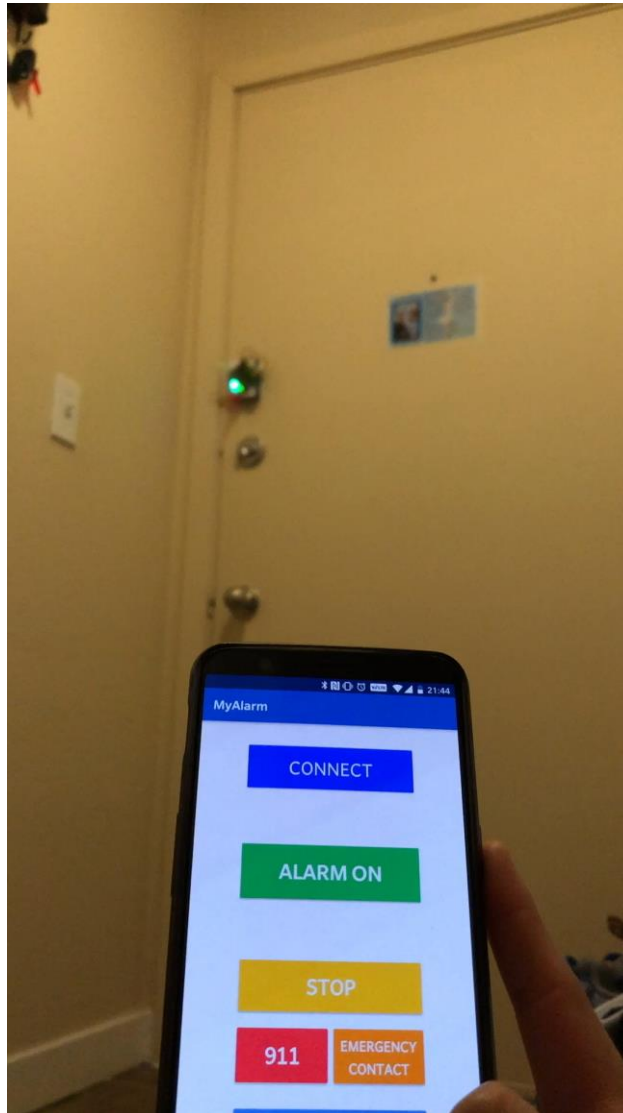
Final projects from Spring 2019

SafetyBeats



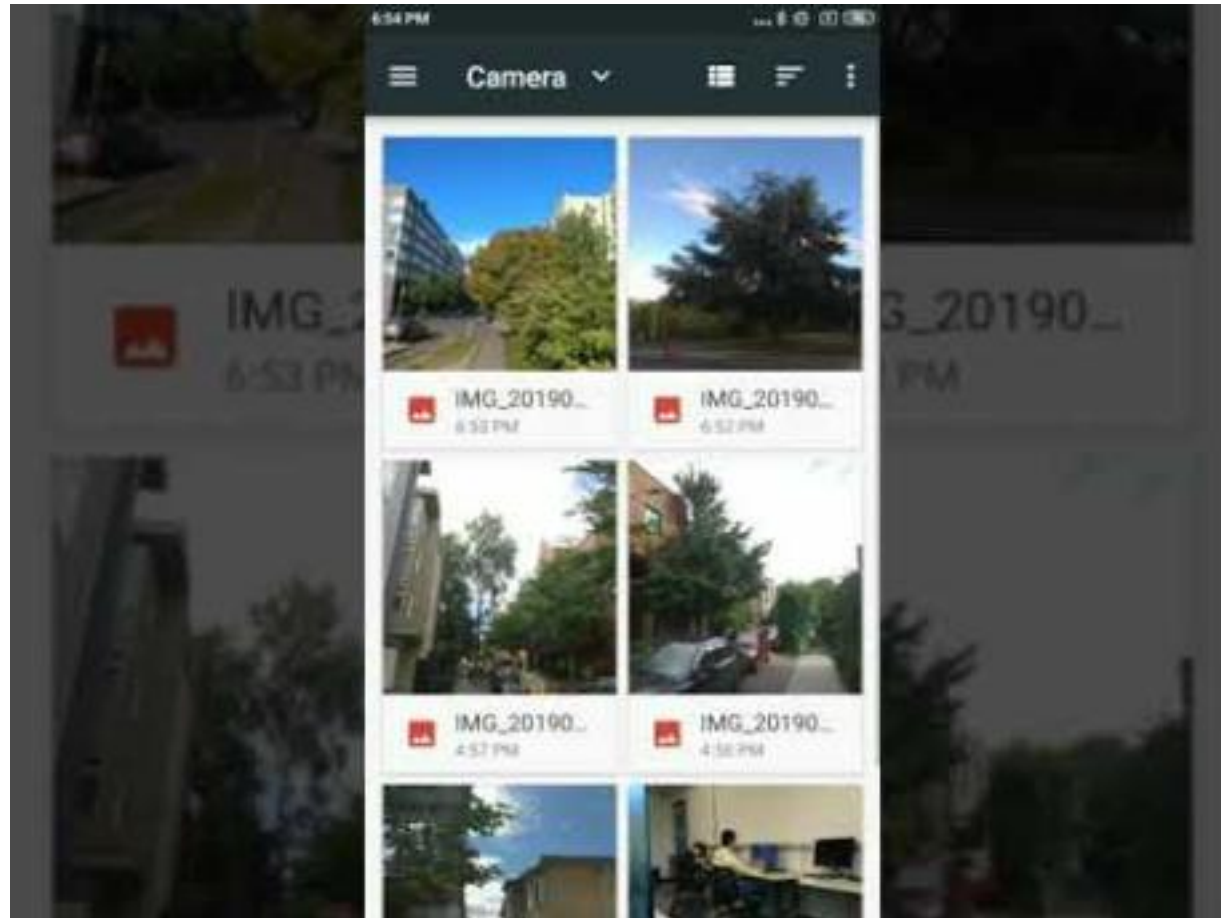
Final projects from Spring 2019

MyAlarm



Final projects from Spring 2019

TravKer



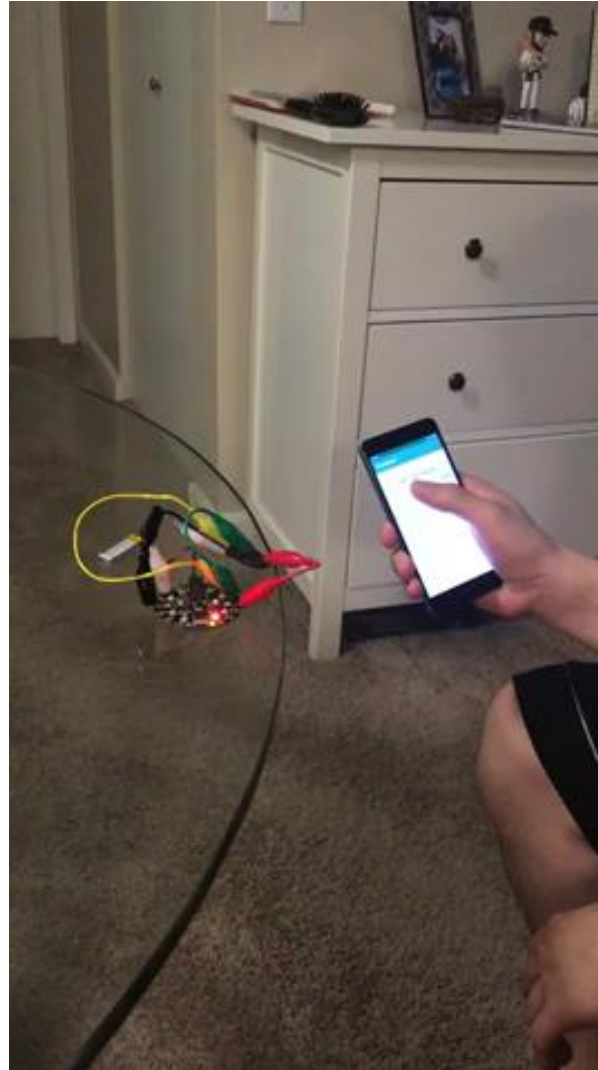
Final projects from Spring 2019

TreatsDispenser




Final projects from Spring 2019

GuitarHero



Final projects from Spring 2019



RPG Dice Roller - Original

Fialas Fiasco Role Playing

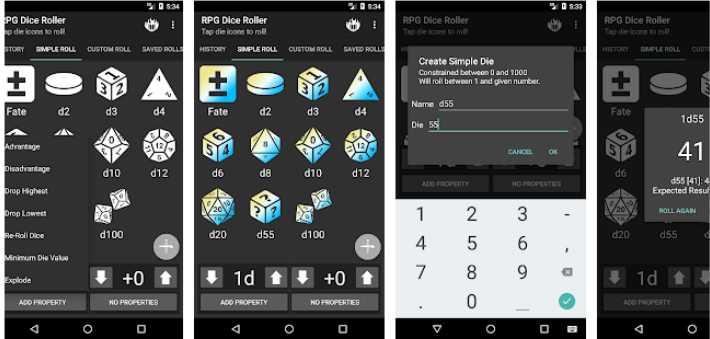
★★★★★ 168

Everyone


You don't have any devices.

Add to Wishlist

Install



More by Fialas Fiasco



RPG Dice Roller
Fialas Fiasco


Roll dice from the standard set, or make your own! Its the easy way.


★★★★★

\$0.99

ADDITIONAL INFORMATION

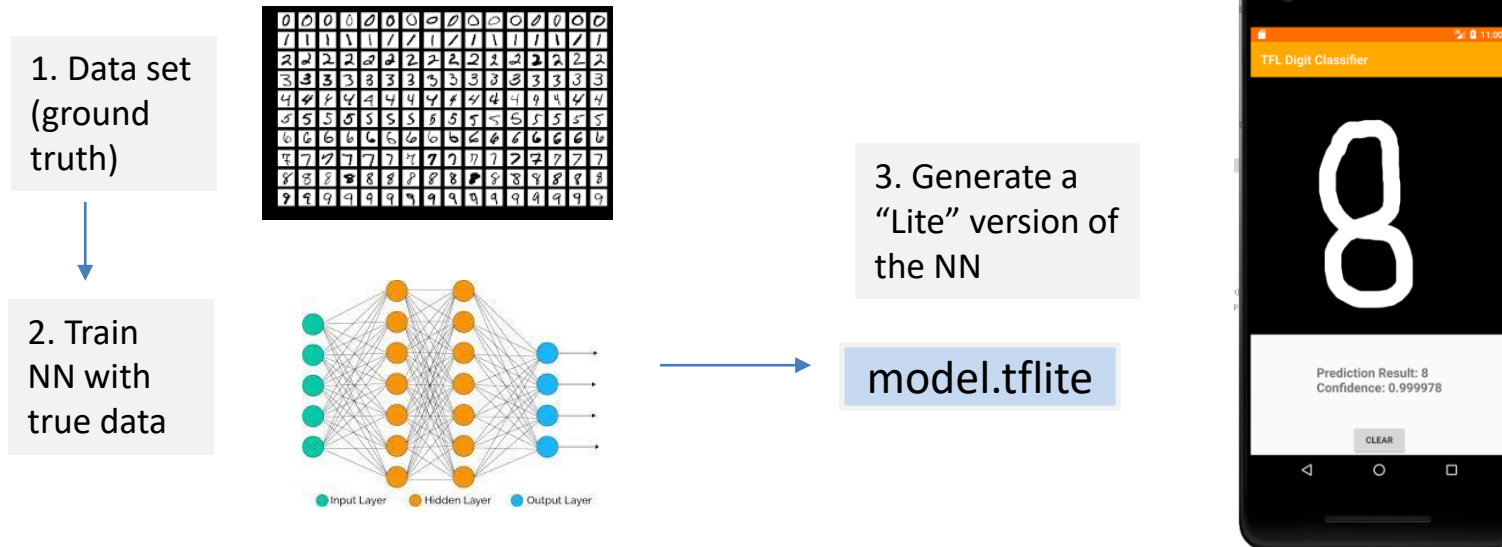
Updated	Size	Installs
February 7, 2020	2.9M	10,000+
Current Version	Requires Android	Content Rating
1.8.18	5.1 and up	Everyone
		Learn More
Permissions	Report	Offered By
View details	Flag as inappropriate	Fialas Fiasco
Developer		
support@fialasfiasco.com		
1615 75th Street		
Southwest Suite 100		
Everett, WA 98203, USA		



WEEK	Topics	Assignments
1 April 2 nd	Introduction My first Android App	Assign. #0 (not-graded)
2 April 9 th	Android Programming (I)	Assign. #1
3 April 16 th	Android Programming (II)	Assign. #2
4 April 23 th	Smartphone Sensors	Assign. #3
5 April 30 th	 TinyML	Assign. #4
6 May 7 th	Arduino programming (I)	Assign. #5 (a)
7 May 14 nd	Arduino programming (II) Android-Arduino Interaction	Assign. #5 (b) <i>Final project proposal deadline</i>
8 May 21 st	Databases/??? Remote data bases, Firebase, Web services	--
9 May 28 th	Special topics - Web services - Hybrid Mobile App Frameworks	--
10, 11 June 4 th , 11 th	Final projects presentation	<i>Final project deadline</i>

Why Deep Learning ?

- Classification/Regression



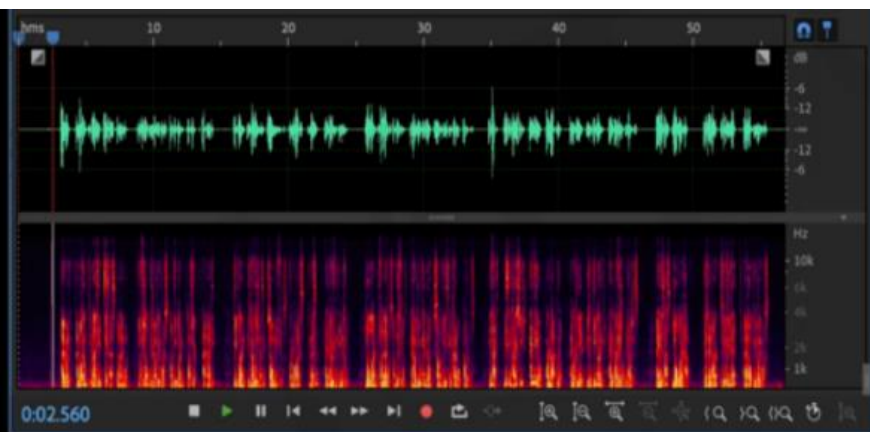
- Generate new data

Why Machine Learning ?

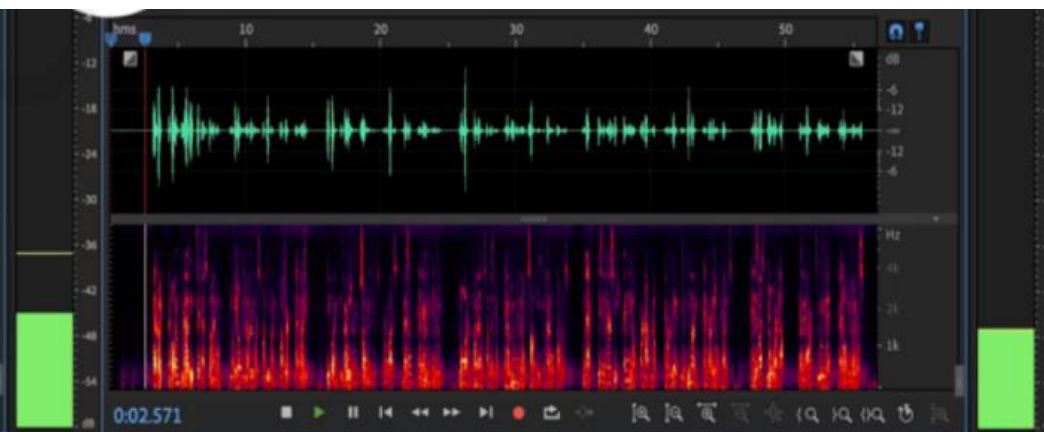


Why Machine Learning ?

Instructor speech



DL generated speech



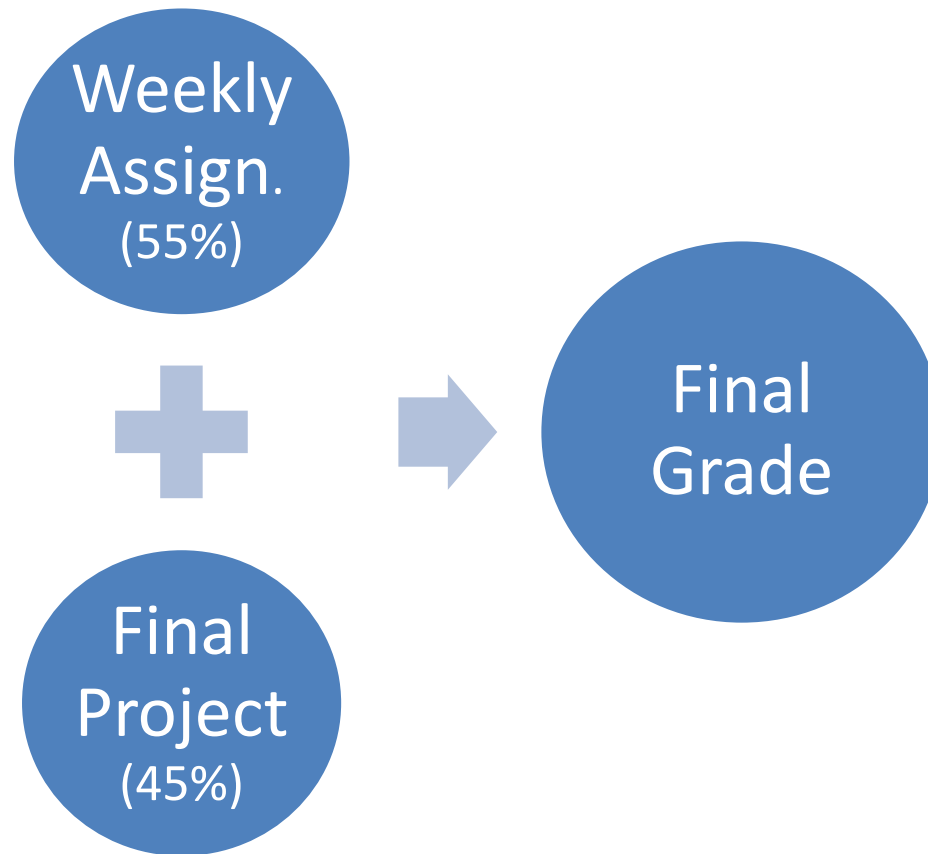
6.S191 Introduction to Deep Learning

introtodeeplearning.com

[@MITDeepLearning](https://twitter.com/MITDeepLearning)



Evaluation



Weekly Assignments

- Upload to Canvas before Thursday at noon (11:59am)
 - No late assignment accepted without “justification”.
- Assignments descriptions will be posted every Thursday after class.
- Upload source code (**we will compile and run the code !**)
 - we won't grade based on coding style
- For Arduino projects: upload video with demo (+source code)
 - Optional for android-only apps (recommended)

Final Project

Submission deadline: June 4th at 11:59 am

- Individual or Teams (2 or 3 people)
- Proposal submission-> May 14th
- Class presentations on June 4th and June 11th (weeks 10 and 11)
 - Instructions to be posted on Canvas soon
 - ~10 min presentation + up to 5 min questions
 - Live demo mandatory
 - Video recording presentation if non remote attendance justified
 - Presentations conducted in Zoom

Challenges

- Small tasks at the end of every lecture.
- Will contribute to the corresponding weekly assignment grade.

Getting Help after class

- **Help on the assignments/final project/challenges**
 - Office hours in Zoom (TA) (Vineetha) – 2 days a week
 - Canvas
 - Piazza
- **Zoom meeting with instructor (Laura):** upon request
- **Email**
 - arjonal@cs.washington.edu (Laura-instructor)
 - vthoma@uw.edu (Vineetha – TA)





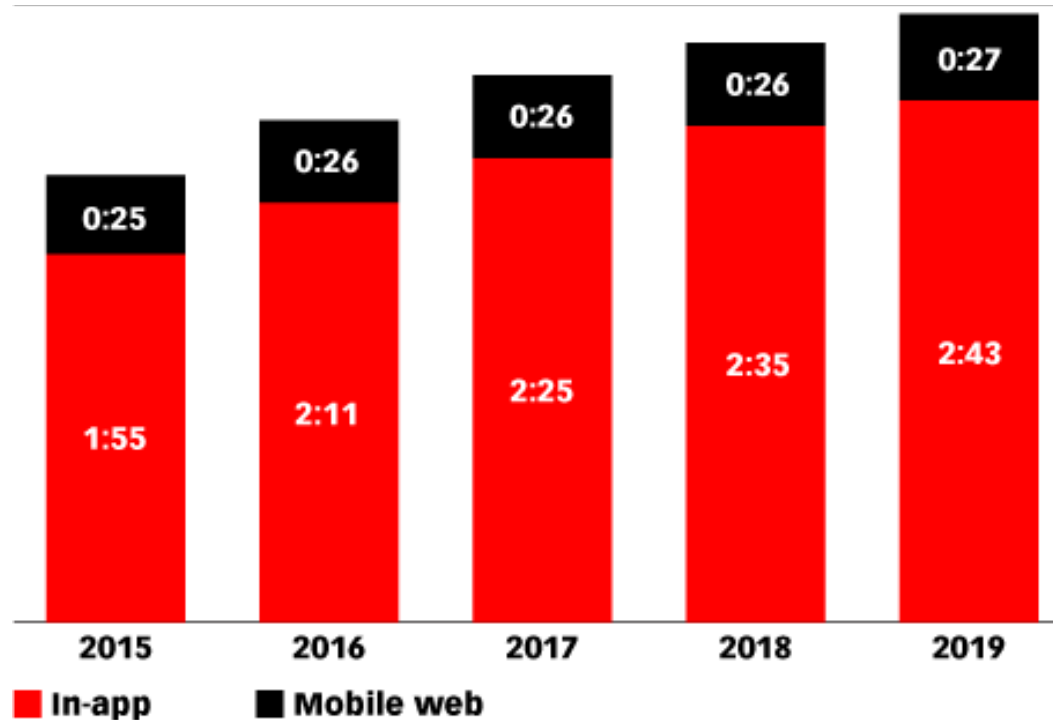
Phantom-Vibration Syndrome

Study shows 2/3 of users report
“feeling their phone vibrate when in fact
nothing is happening”*



It's an App World !!

US Adults Average Time per Day



Note: ages 18+; time spent with each device includes all time spent with that device, regardless of multitasking; for example, 1 hour of multitasking on an app while on the mobile web is counted as 1 hour for apps and 1 hour for mobile web

Source: eMarketer, April 2017

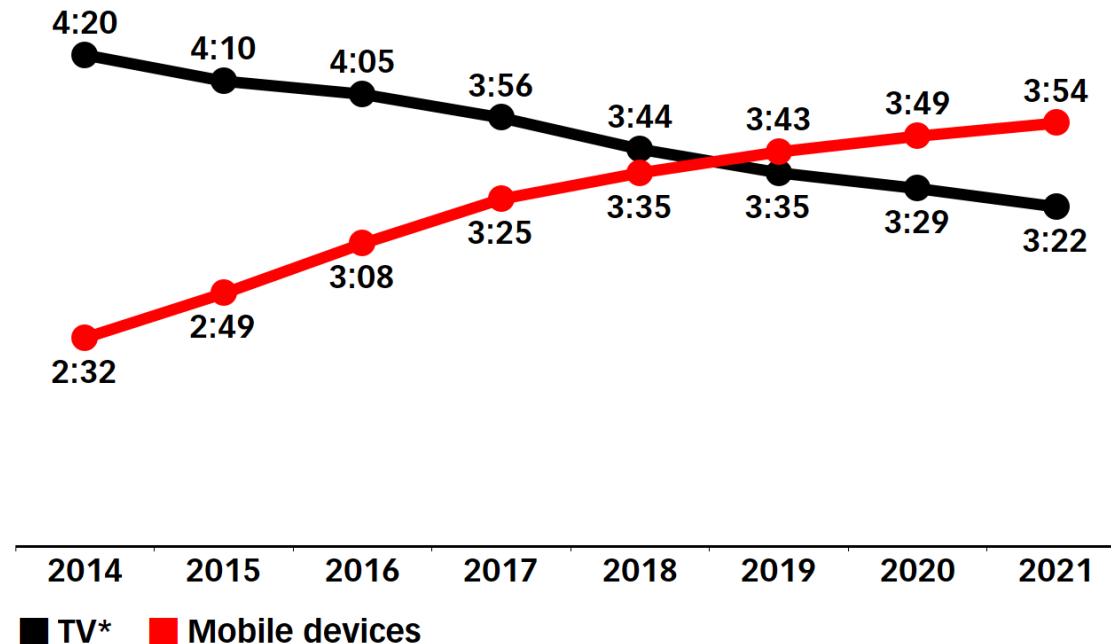
225369

www.eMarketer.com

It's an App World !!

TV and Mobile Devices: Average Time Spent in the US, 2014-2021

hrs:mins per day among population



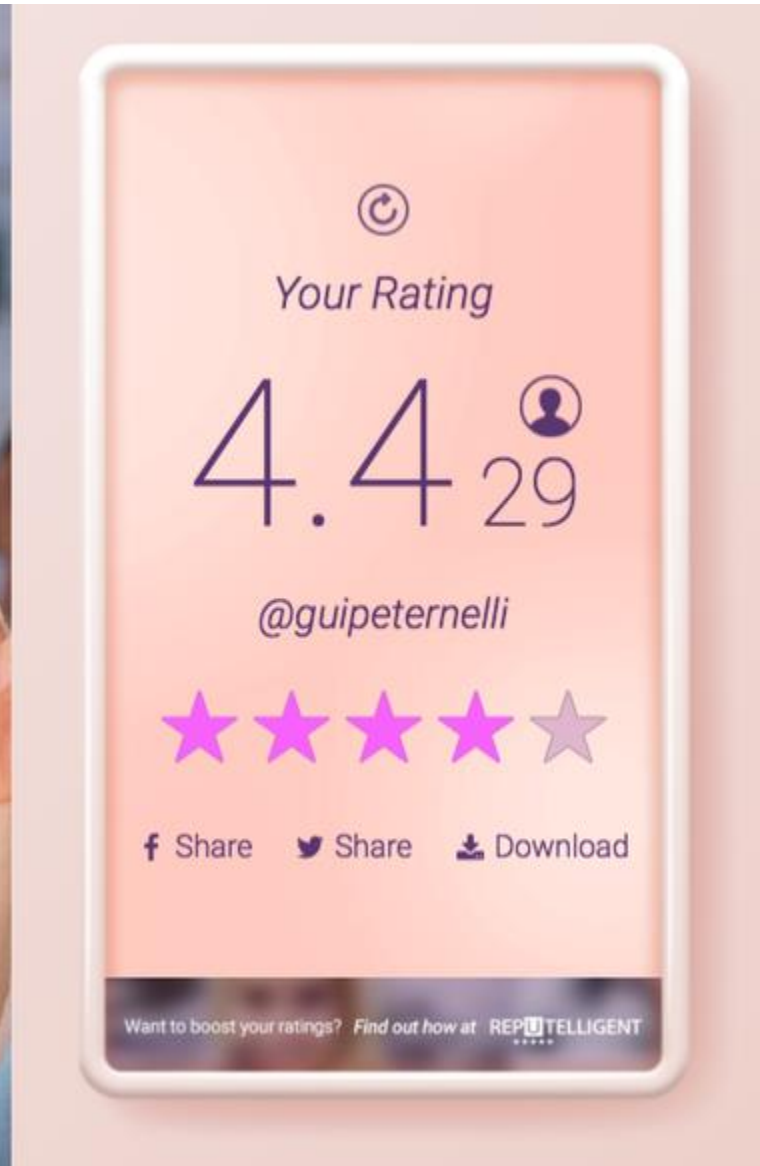
*Note: ages 18+; time spent with each medium includes all time spent with that medium, regardless of multitasking; for example, 1 hour of multitasking on desktop/laptop while watching TV is counted as 1 hour for TV and 1 hour for desktop/laptop; *excludes digital*
Source: eMarketer, April 2019

T10195

www.eMarketer.com

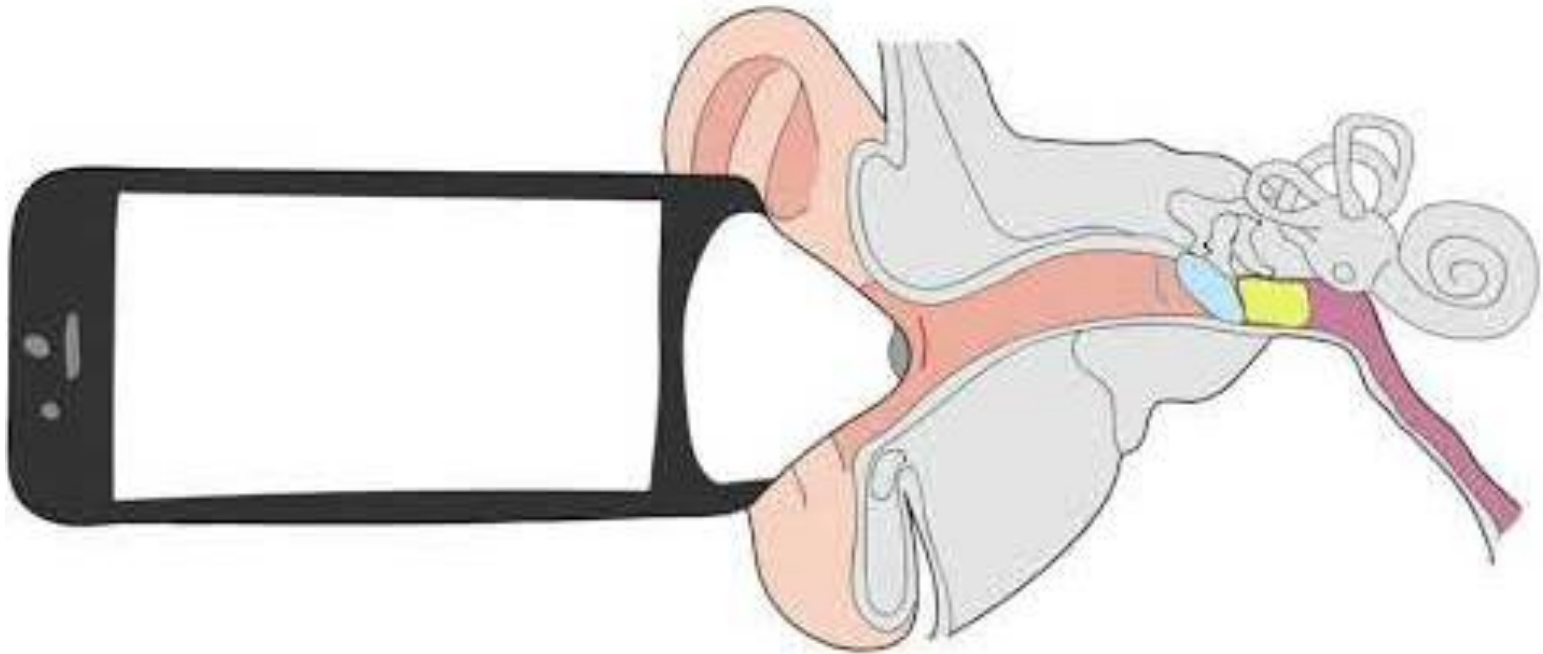


Pokemon Go trainers on the hunt at Green Lake in Seattle. (GeekWire Photo / John Cook). December 2018



Smartphones beyond recreation

App for ear infection detection



Smartphones beyond recreation

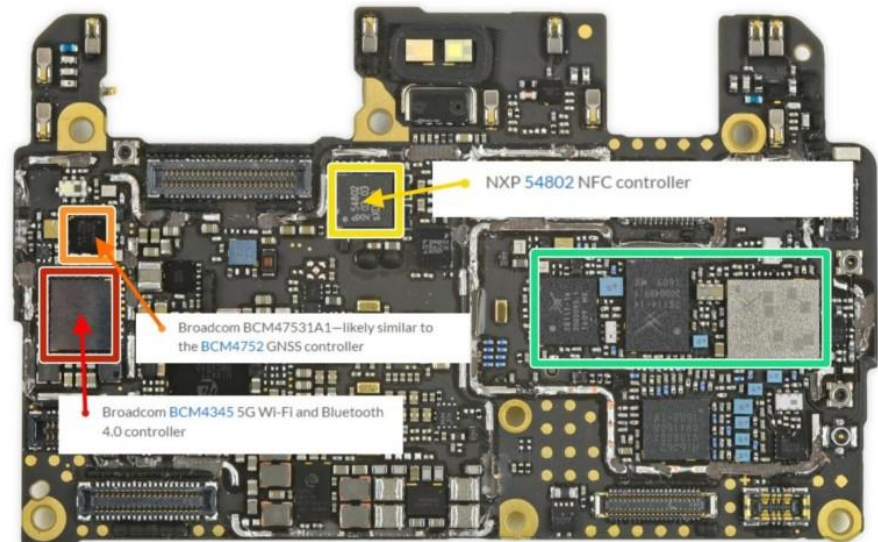
App to help improving ergonomics at work



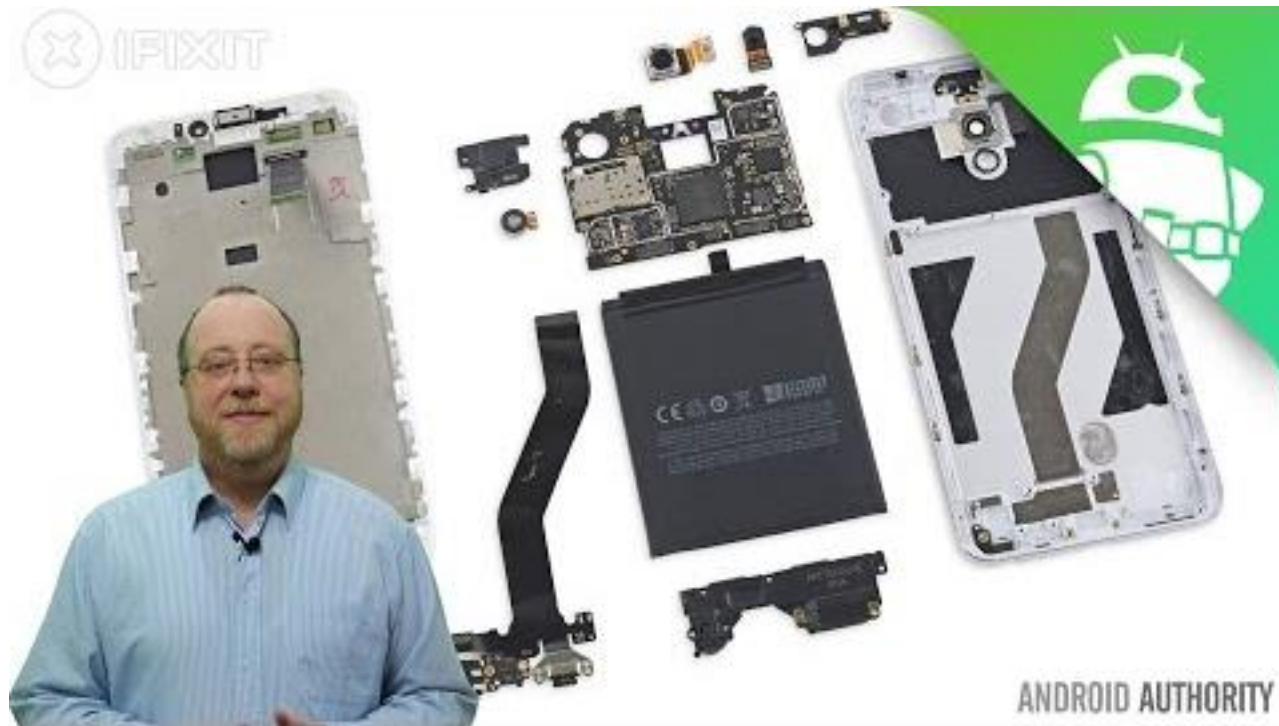
Sensors: Before and After



Sensor A converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument ...



What's inside a smartphone?



Smartphones sensors

- Sensors have been used in cellphones since they were invented ...
Microphone, number keys, etc
- **What made smartphones smart?** *Touchscreens, accelerometers, gyroscopes, GPS, cameras, etc ...*
Allowed cellphones explode into different markets R.I.P. Garmin, Tomtom, Kodak Intel?
- Instead of carrying around 10 separate devices, now you just need 1

Android supports:

Accelerometer, Ambient Temperature,
Gravity, Gyroscope, Light, Linear
Acceleration, Magnetic Field, Orientation,
Pressure, Proximity, Relative Humidity,
Rotation Vector

Lot's of Hardware, so what?

Now that you can collect all this data,
how do you use it?

- Application Programming Interfaces (APIs) expose a smartphone's sensors and sensor data to the smartphone programmer (you!)
- The Android Accessory Development Kit (ADK) even provides the ability to add external sensors in a standard way

Smartphone limitations

- Not all sensors are present in all phones
- What about *LEDs / NFC /ultrasound /moisture/ other?*
- What about *actuators, motors?*
- May want a remote sensor separate from your phone

Use External sensors with Android

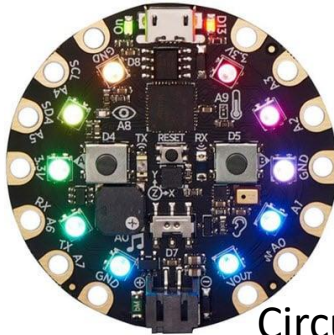
- Single-board microcontroller
- Extend smartphone functionalities (wireless) : motors, sensors, actuators, etc



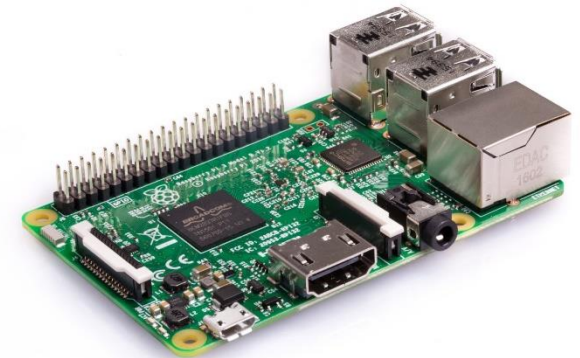
Arduino uno
\$17



HUZZAH32 –
ESP32 Feather
\$20

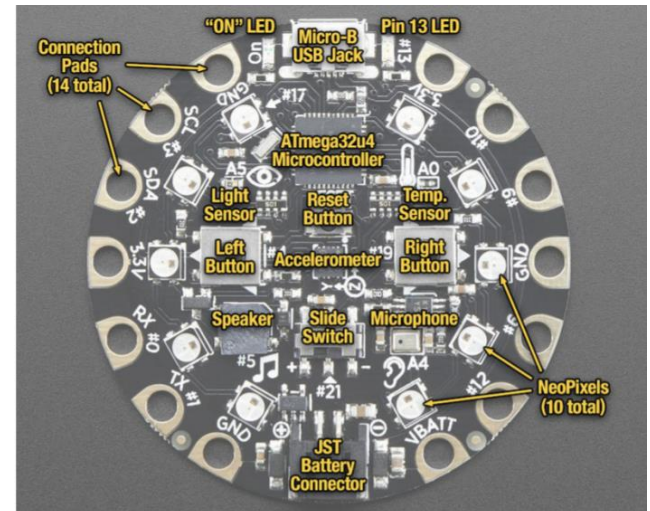
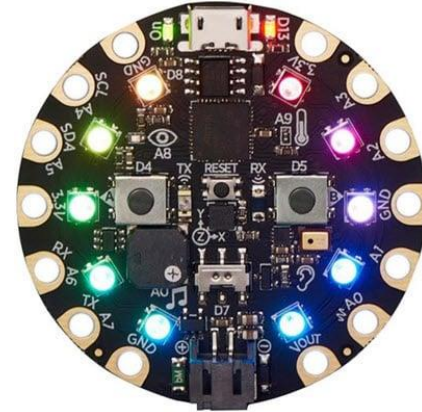


Circuit Playground
\$25 + \$18 BLE



Raspberry Pi
\$35

Connect your phone to Arduino



Connect your phone to Arduino



Brainstorming





Papers discussion + Brainstorming

In groups (20 minutes):

- Groups assigned randomly in a breakout room in Zoom
- Only one team member needs to complete the quiz

1. Read assigned paper and answer these questions

Papers are in [Canvas: Files/In-class-activities/Lecture_1](#) ->download the one that corresponds to your room's number

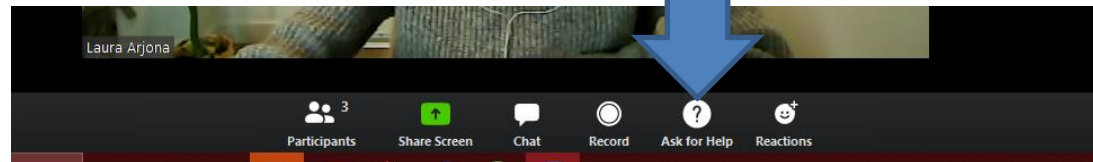
Open link from Zoom chat

<https://pollev.com/surveys/jQ0WD7CzberG8qkqcQPvX/respond>

2. App brainstorming

Open link from Zoom chat:

<https://pollev.com/discourses/9sp1zgPuRLMIxJFtCaFph/respond>





15min Break

ONE PER WORKING HOUR
TO KEEP YOU MOVING

