Future Greenhouse

PROFESSOR: ROY KRAVITZ

JOSHUA BLAZEK . DAVID CRAFT

Problem Statement

- Frequent observation
- Humidity requirements
- Soil moisture
- Lighting duration and luminosity
- Air circulation
- Disease

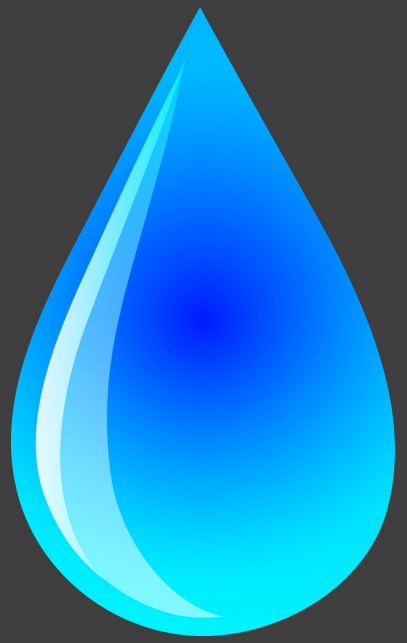
Video

Objective

- Android application
- Monitor
- Water
- Warm
- Light
- Circulate
- Inspect

Water wisely

- App controlled drip irrigation by schedule and/or moisture sensor. It's important to keep soil consistently moist, but avoid overwatering, which promotes diseases. Maintain consistent moisture. Once seedlings are growing, reduce watering so soil partially dries.



http://www.clipartbest.com/

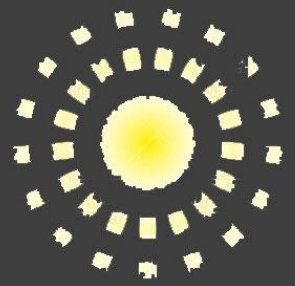
Keep soil warm

- Heat mat controller. Seeds need warm soil to germinate. They germinate slower, or not at all, in soils that are too cool. Most seeds will germinate at around 78°F.

https://media.istockphoto.com

Give seedlings enough light

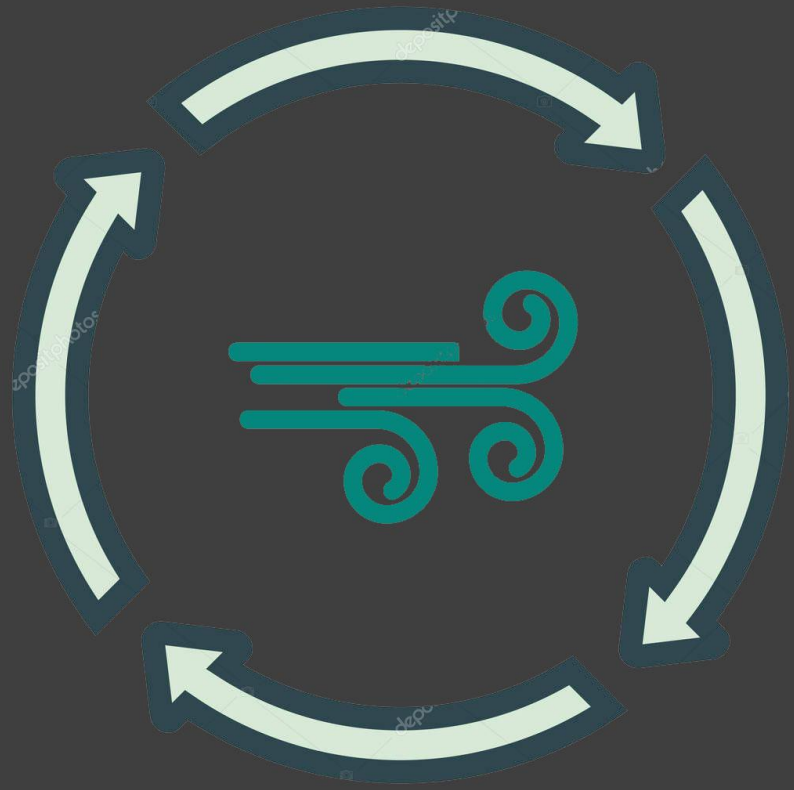
- Timer for light source. Not enough light leads to leggy, tall seedlings that will struggle once transplanted outdoors. Ideally, seedlings need 14-16 hours of direct light per day for healthiest growth.



https://clipground.com/

Circulate the air

- App/sensor fan control. Circulating air helps prevent disease and encourages the development of strong stems.



https://st3.depositphotos.com

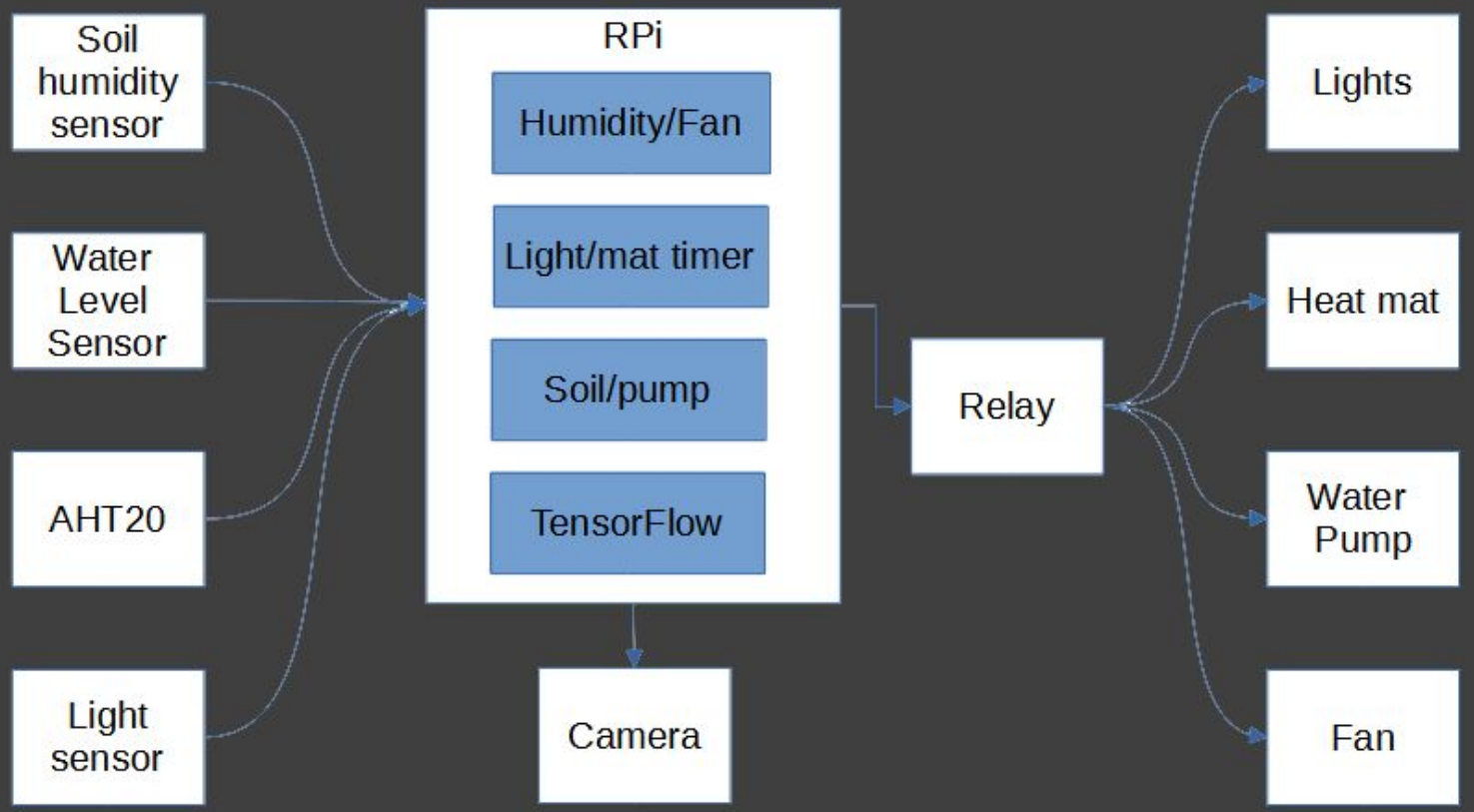
Inspect for disease

- RPi camera/monitoring with disease image recognition and app alert. The moist environment needed for the plants is also a good environment for the formation of powdery mildew.

https://www.kindpng.com

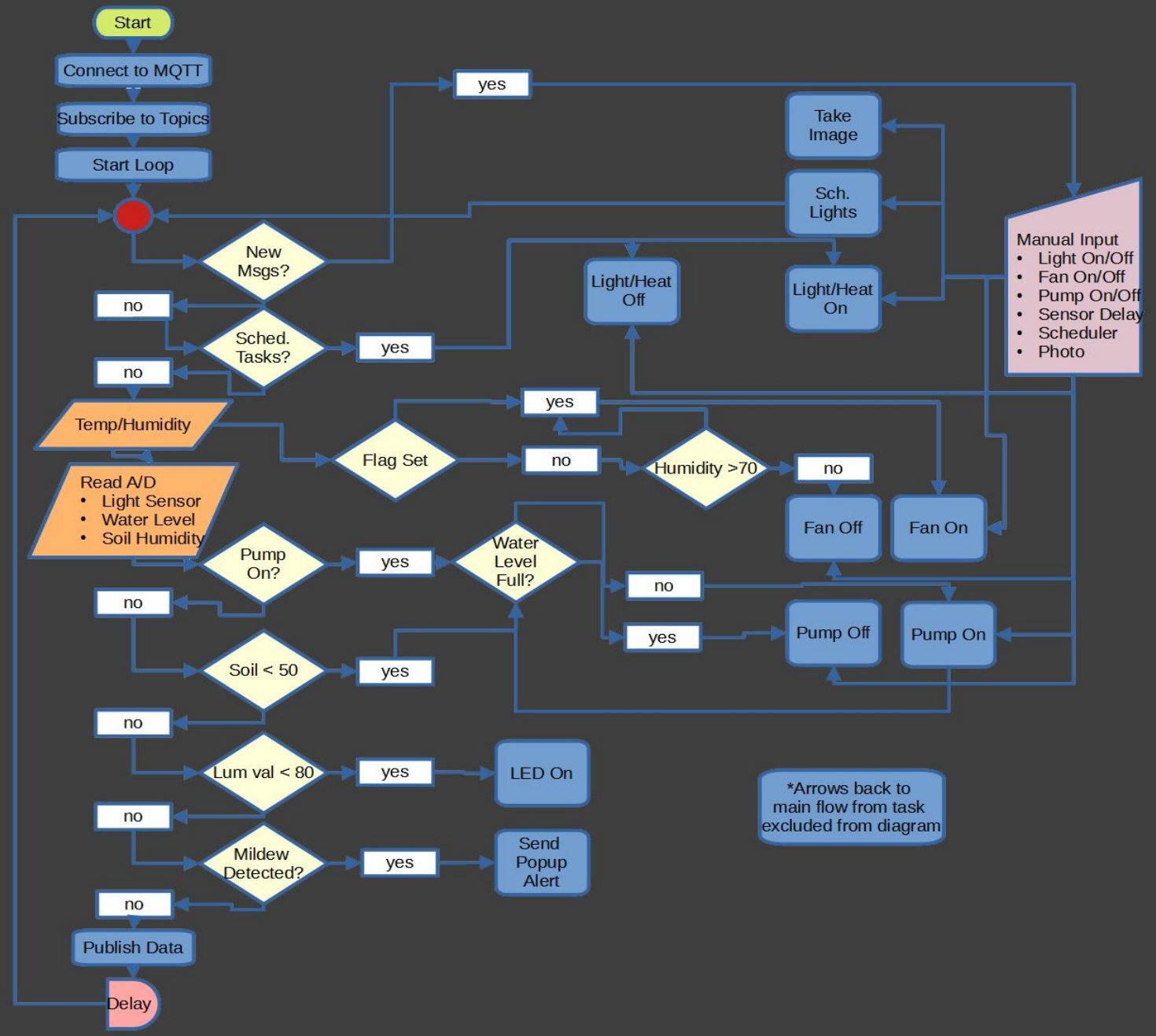
RPi Block Diagram

- Android application
- Monitor
- Water
- Warm
- Light
- Circulate
- Inspect



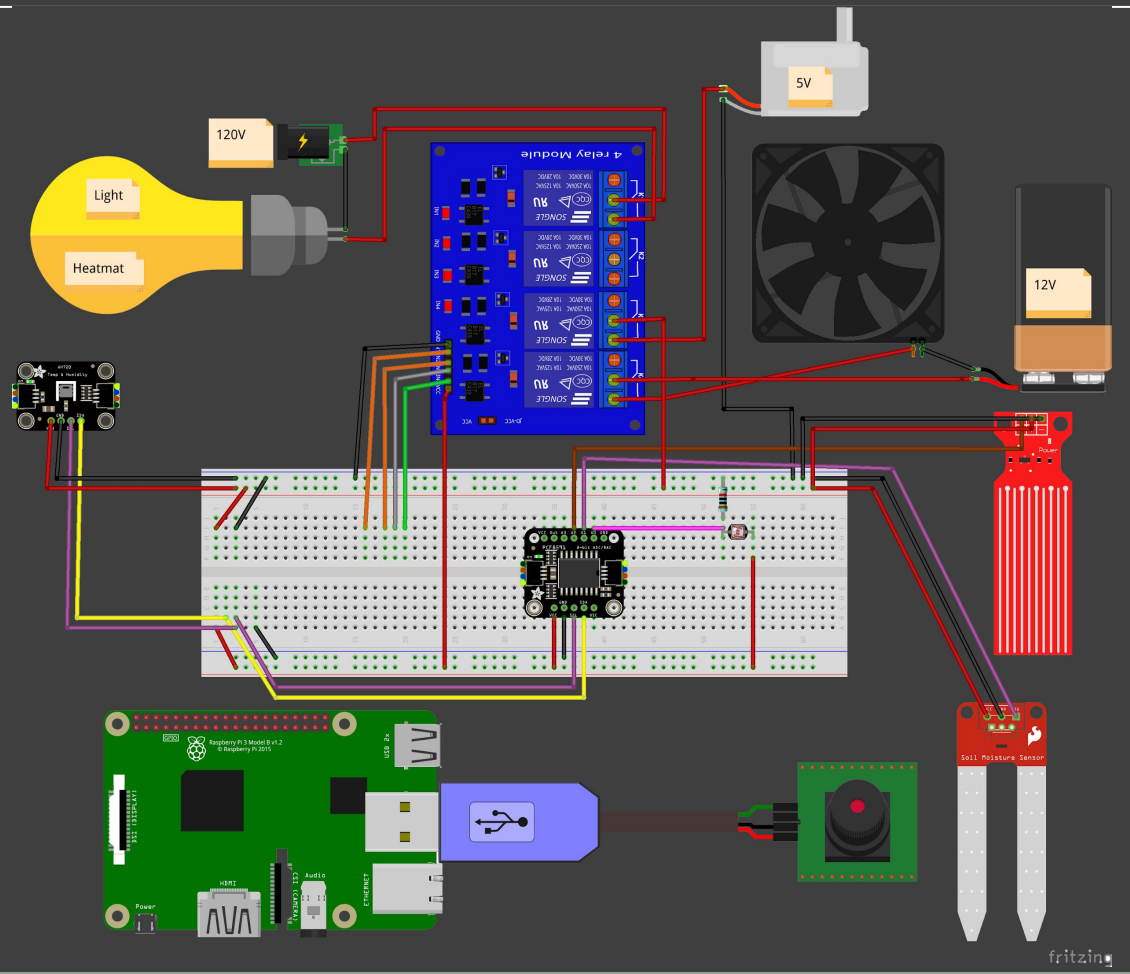
RPi Flow Chart

- Android application
- Monitor
- Water
- Warm
- Light
- Circulate
- Inspect

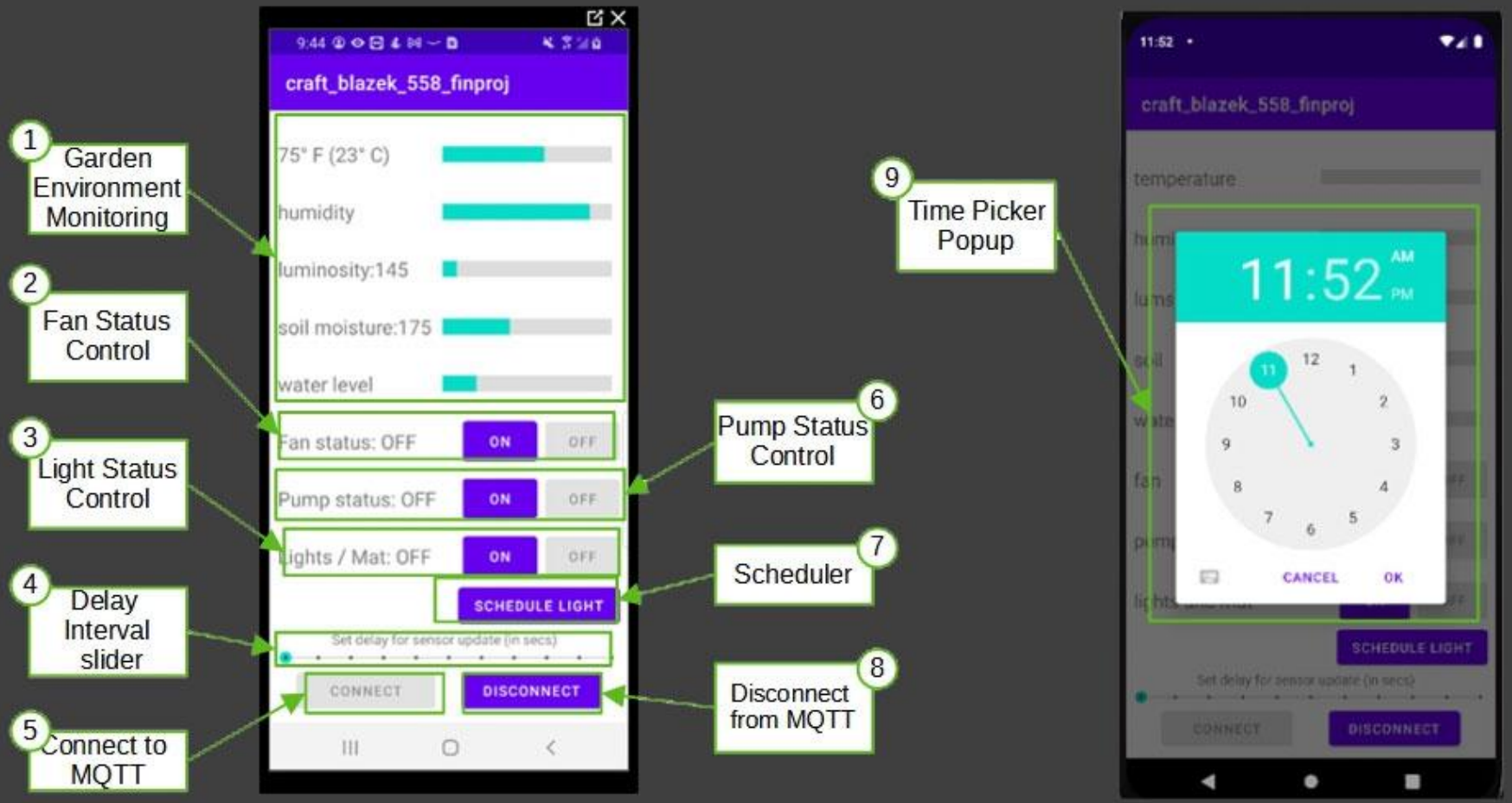


System Architecture

- Android application
- Monitor
- Water
- Warm
- Light
- Circulate
- Inspect

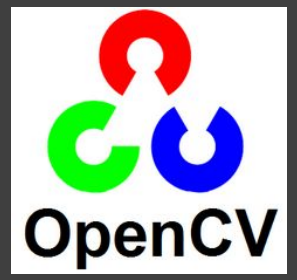


Android Layout



Implementation

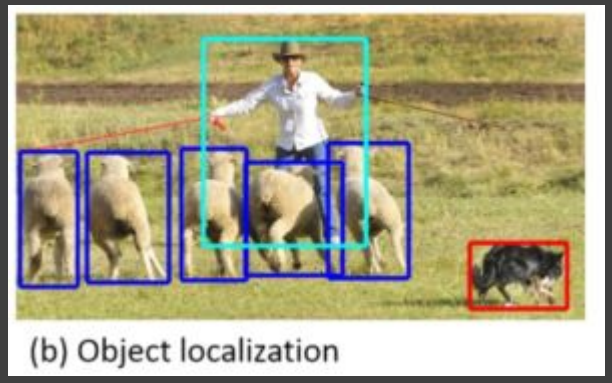
- python 3.7:
  - opencv
  - MTCNN
  - TensorFlow
- Collaboration Site
  - Github



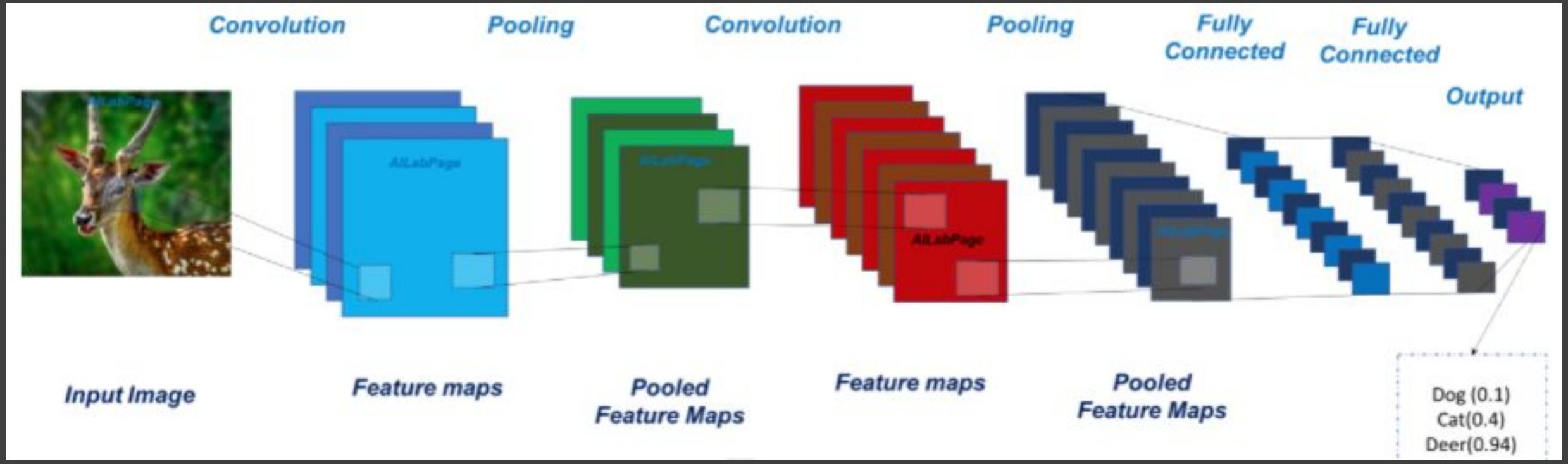
Road to “Object Detection”

Object Detection

(a) Image classification


(b) Object localization

Convolution Neural Networks

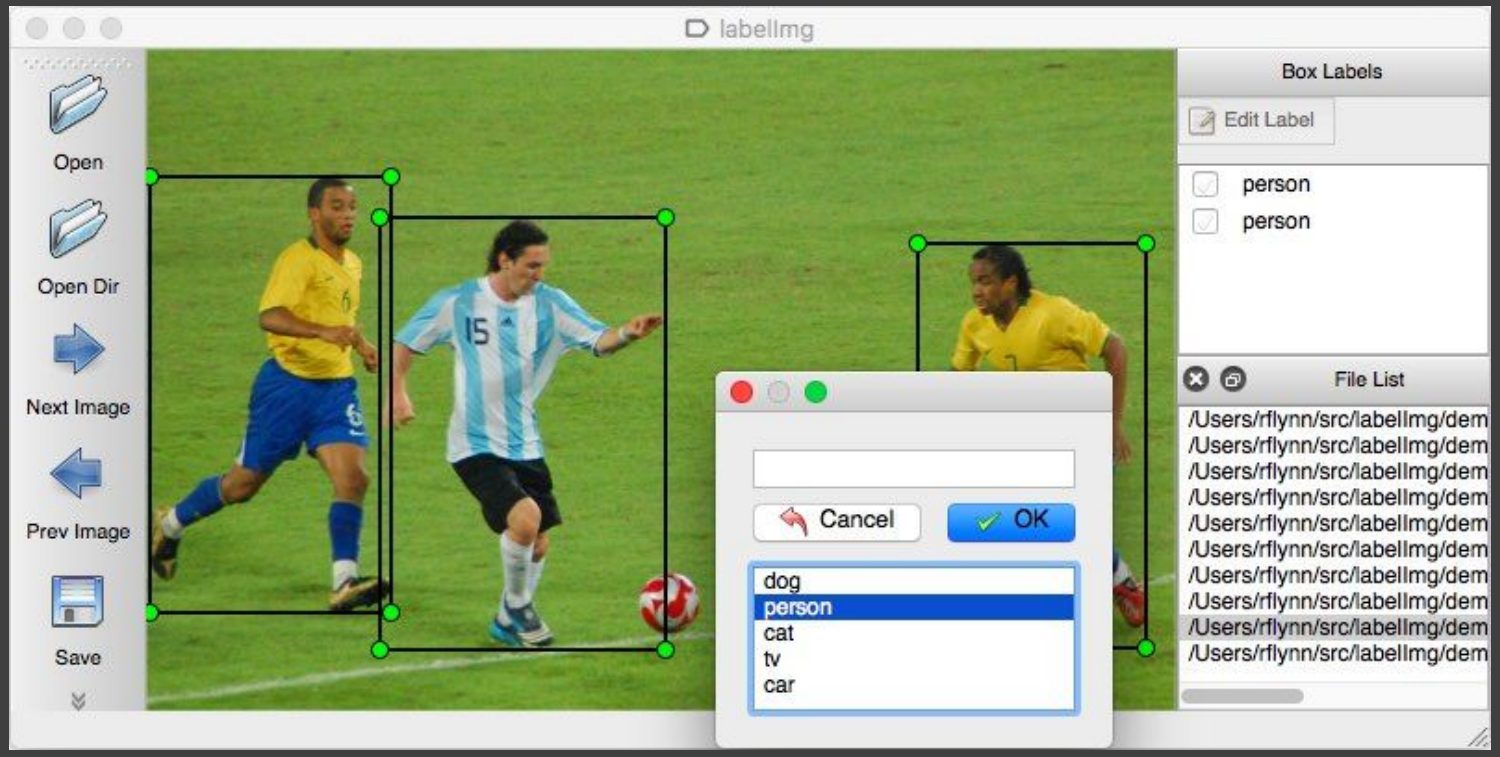


Implementation

- 100 images of mildewy plants
- 100 images of ostriches




Annotation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Open
Open Dir
Next Image
Prev Image
Save
Box Labels
Edit Label
person
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File List
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Cancel
OK
dog
person
cat
tv
car

Image Classification

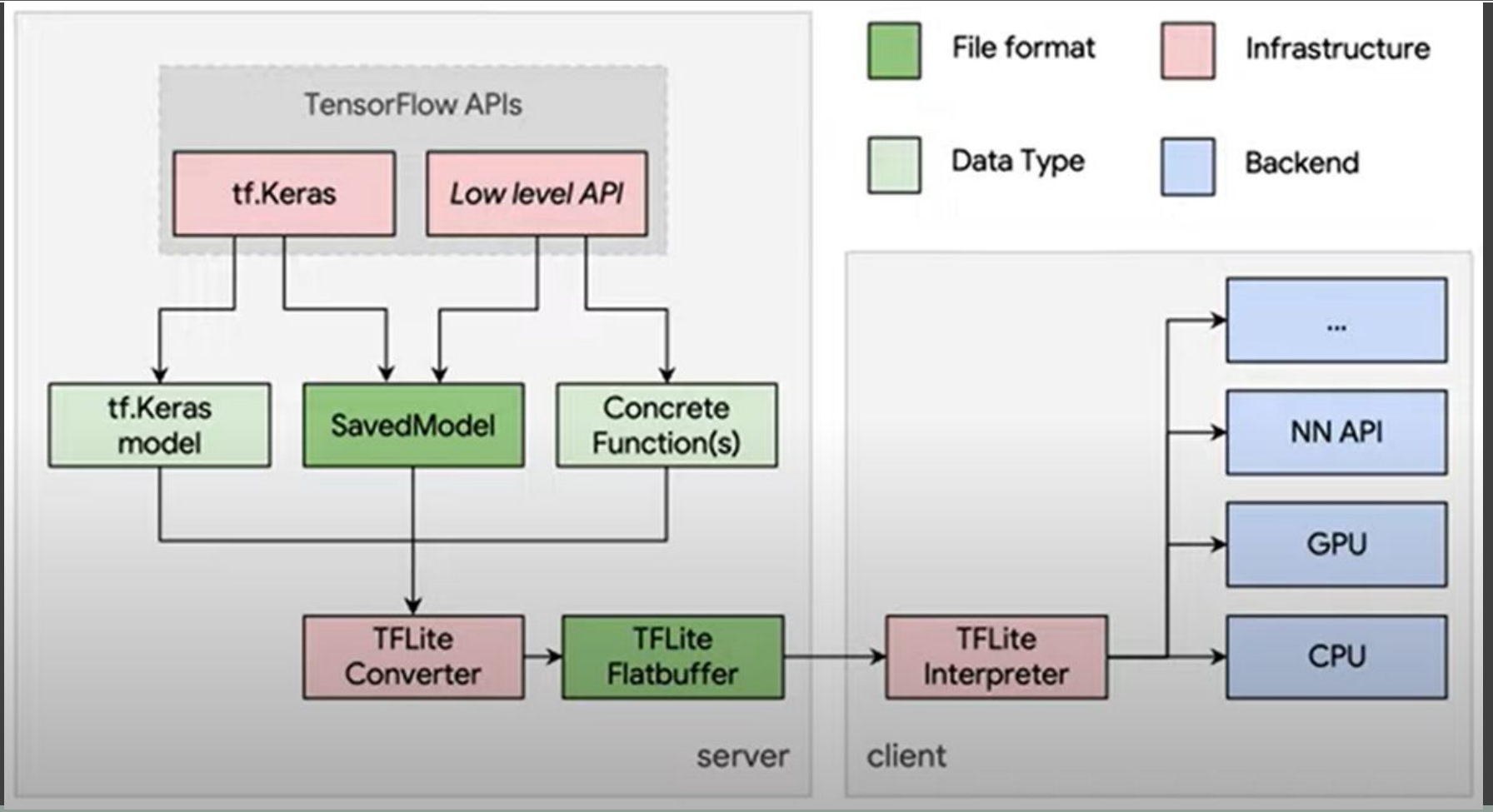
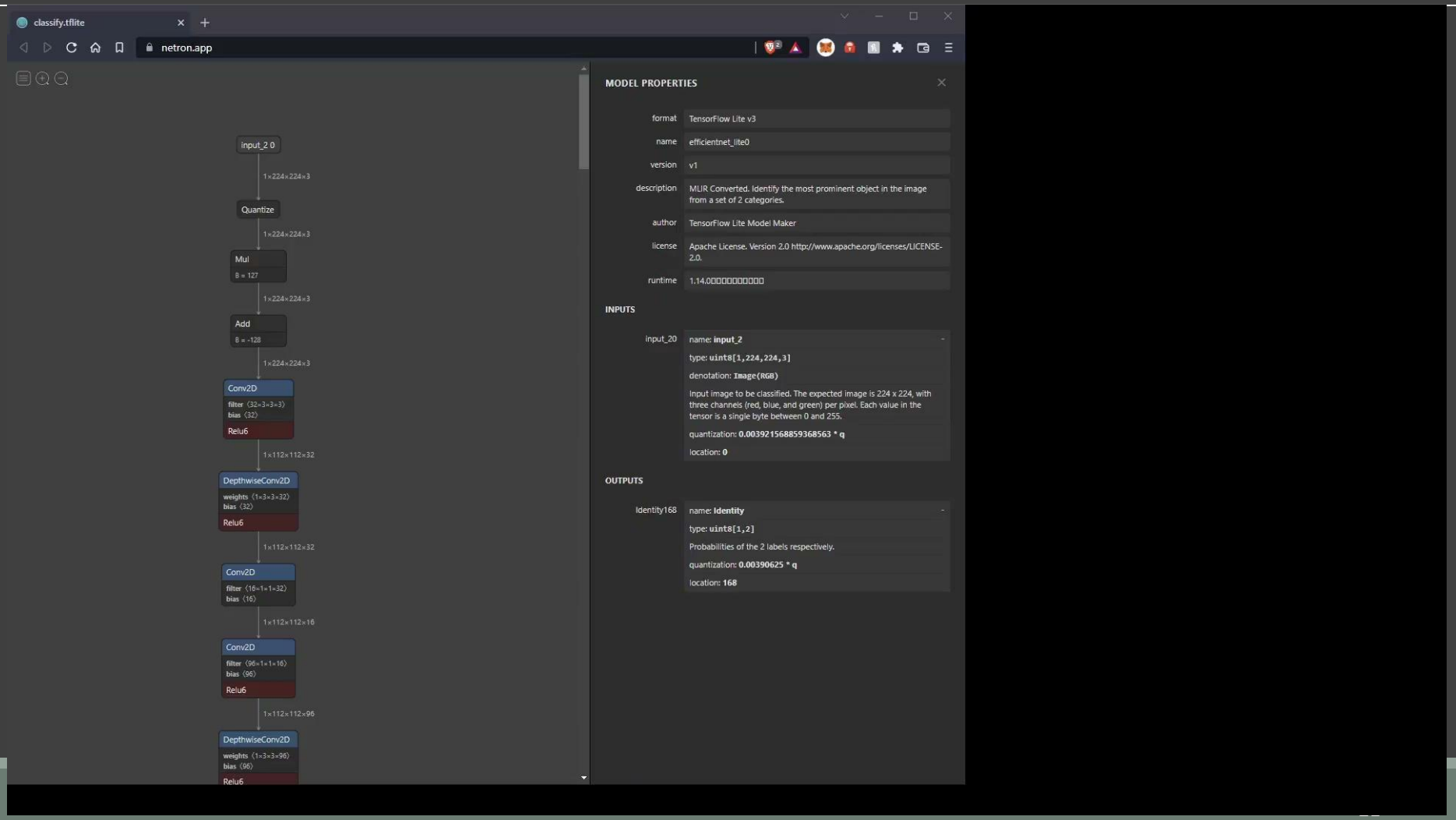
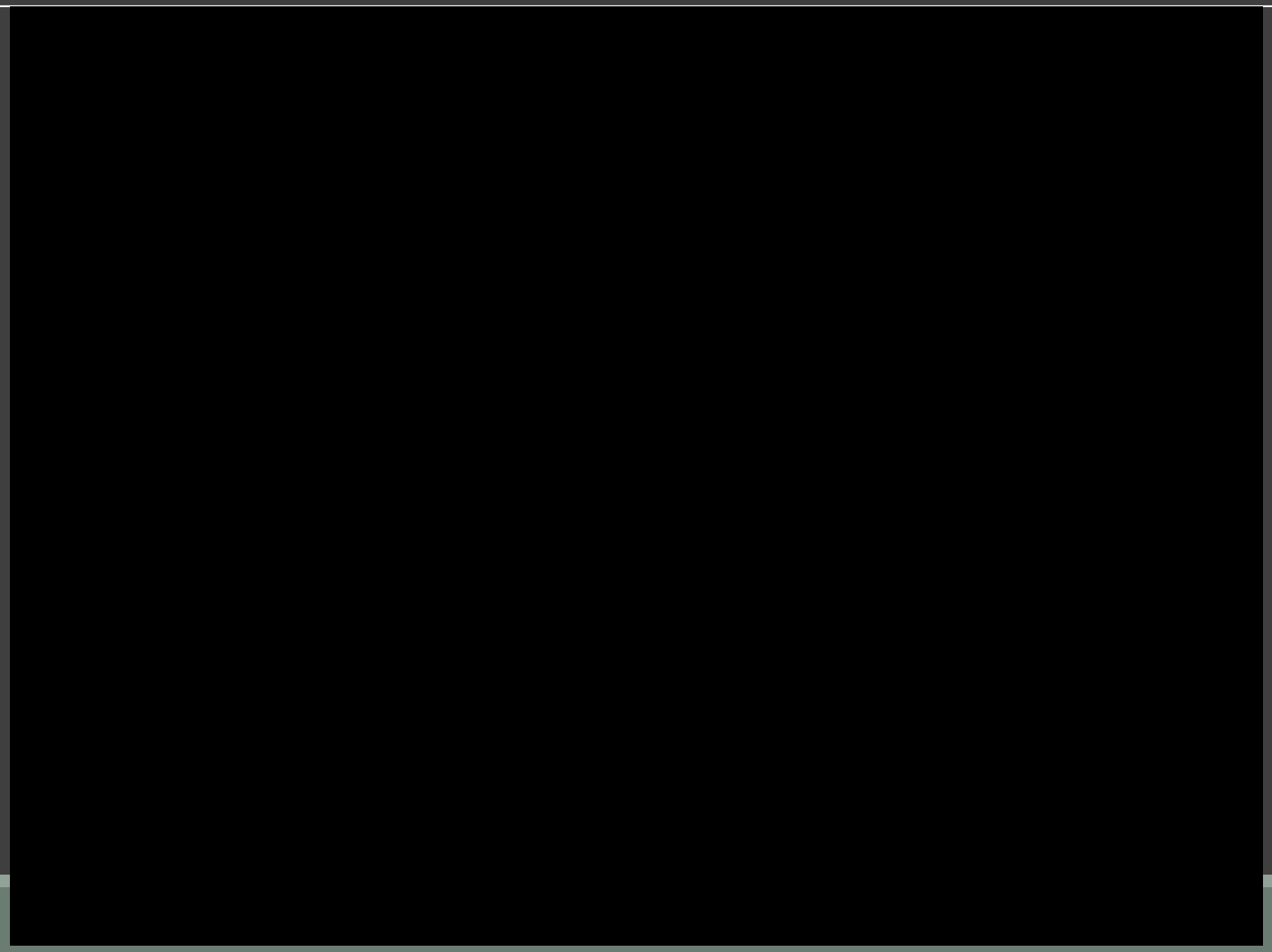


Image Classification



Object Detection



Road to “Object Detection”

I'm 66% certain that freaken ostrich is back.

I'm 86% sure I saw powdery mildew!!!!

Contributions

- Joshua Blazek: Android programming, Tensorflow model building and RPi deployment
- David Craft: Android programming, relays, lights, sensors, water, heatmat, moisture, lumens

Questions?