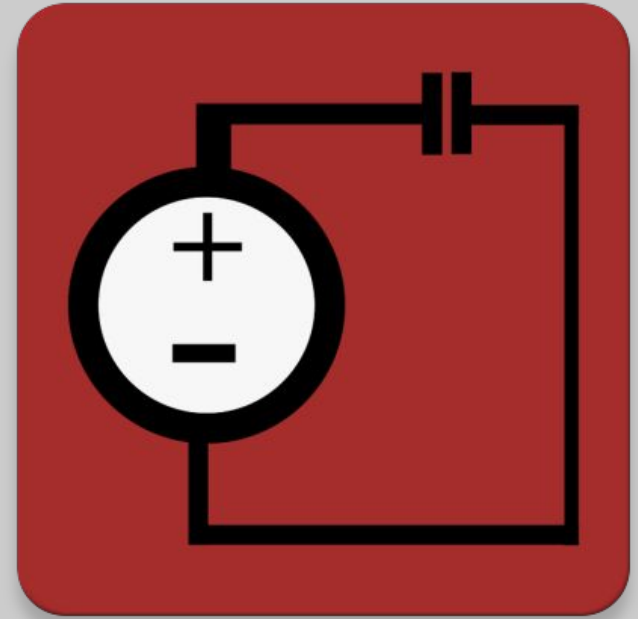
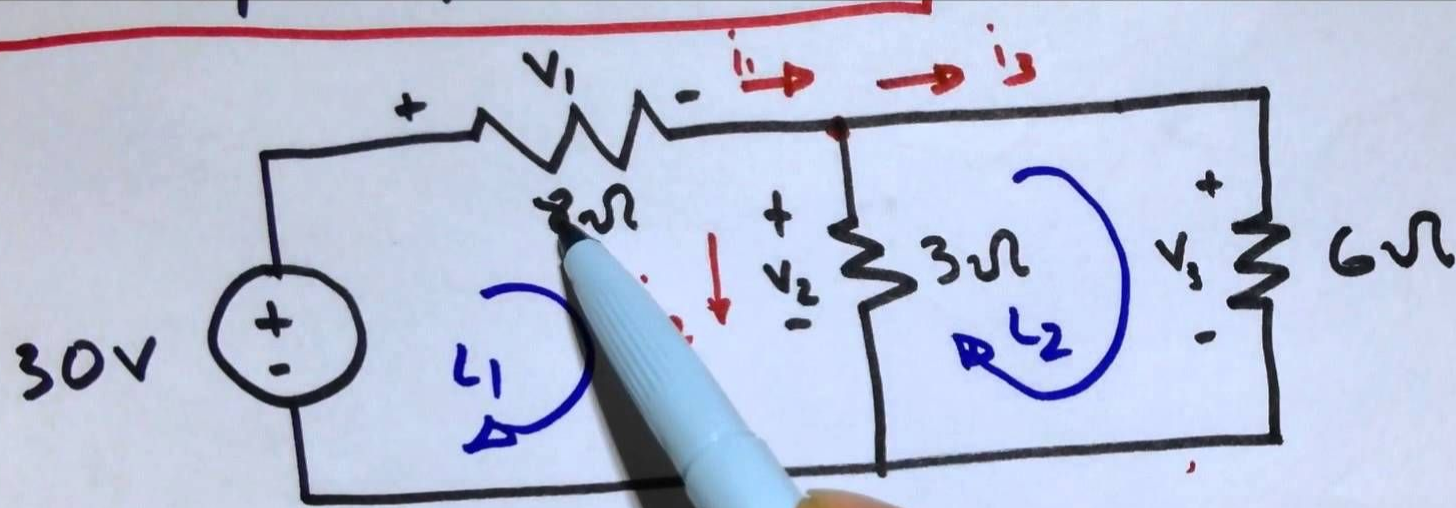


# Circuit Solver

*Lam Jennifer  
Goossen Neil  
Haupt Cornelis  
Fenn Lotus  
Zhang Bruce  
Haefeli Simon*



14<sup>th</sup> december 2016



voltages  $v_1, v_2, v_3$

① KCL

② KVL

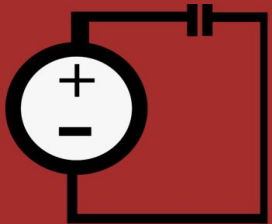
③ Ohm's Law

# Circuit Analysis

## ➤ General Concept

- The features
  - Image Processing
  - Tensorflow
  - Drawing and editing
  - Solving the circuit
- Testing
- End word

### Circuit Solver



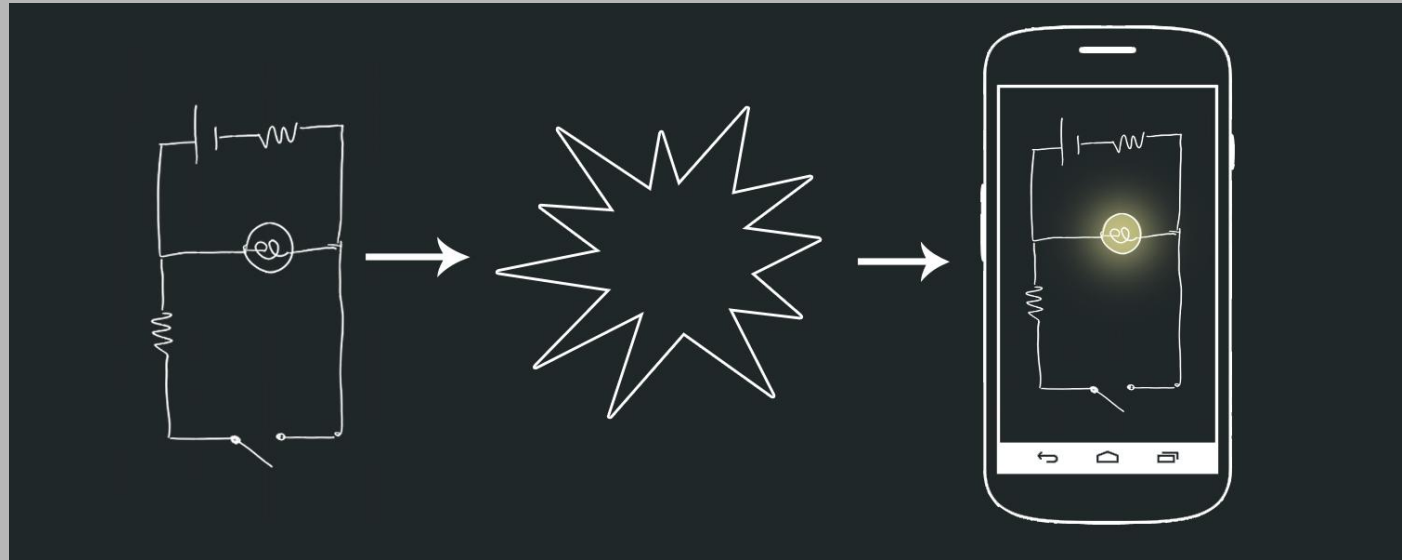
# Solve Circuits Faster

General concept

1) Draw

2) Snap

3) Solve

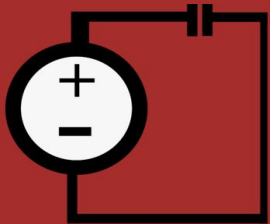


# Corner and Component detection

- Input image passed through a processing pipeline to detect the position of the components and the corners
- How do we begin ???

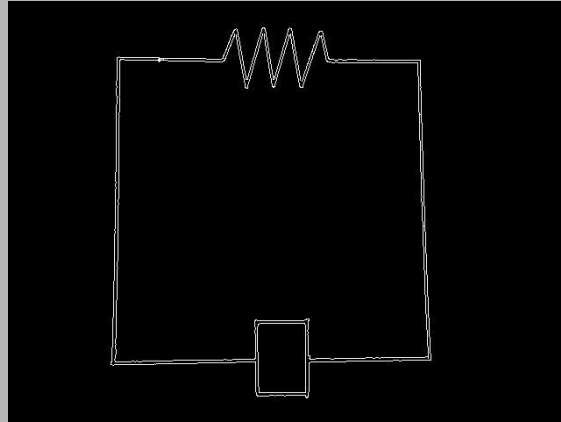


Circuit Solver

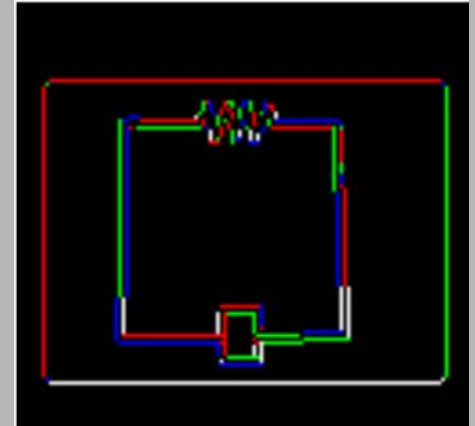


# OpenCv functions to begin

## Canny edge detection



## Hough transform (find lines)



=>

- General Concept

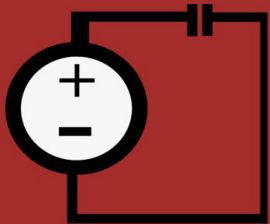
### ➤ The features

- Image Processing

- Tensorflow
- Drawing and editing
- Solving the circuit

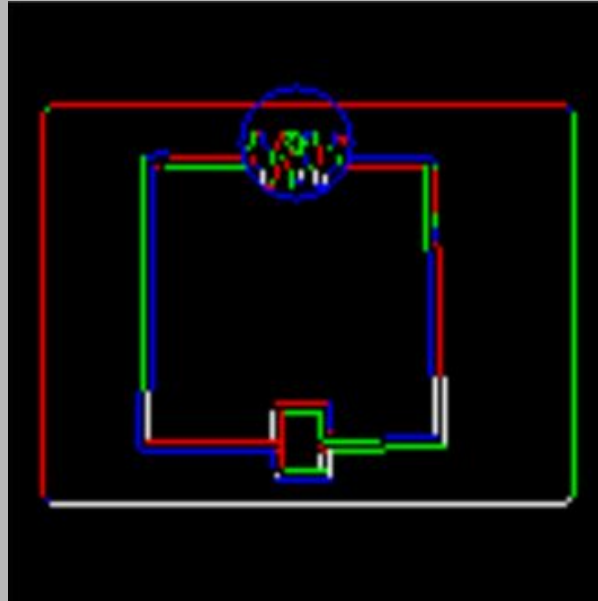
- Testing
- End word

### Circuit Solver



# DBscan clustering algorithm

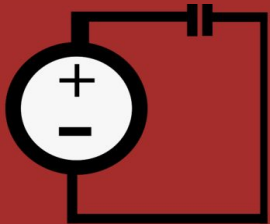
After smoothing horizontal lines:



Fix parameters :

- ❖ Min points
- ❖ Radius

Circuit Solver



# Detect wires for drawing

→ Begin at one corner, recursively find another corner on the same horizontal or vertical



{??, startCoord, endCoord}

=>

{Wire, startCoord, endCoord}

- General Concept

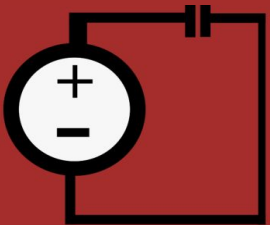
## ➤ The features

- Image Processing

- Tensorflow
- Drawing and editing
- Solving the circuit

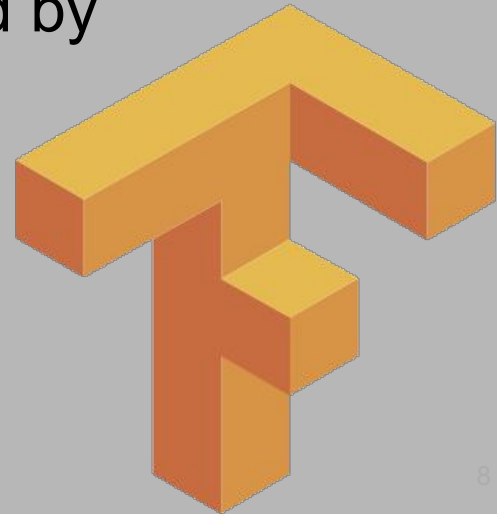
- Testing
- End word

### Circuit Solver



# TensorFlow

- Open source machine learning library by Google
- Recognize components found by OpenCV

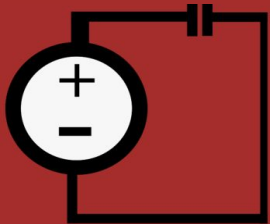


- General Concept

## ➤ The features

- Image Processing
  - **Tensorflow**
  - Drawing and editing
  - Solving the circuit
- Testing
- End word

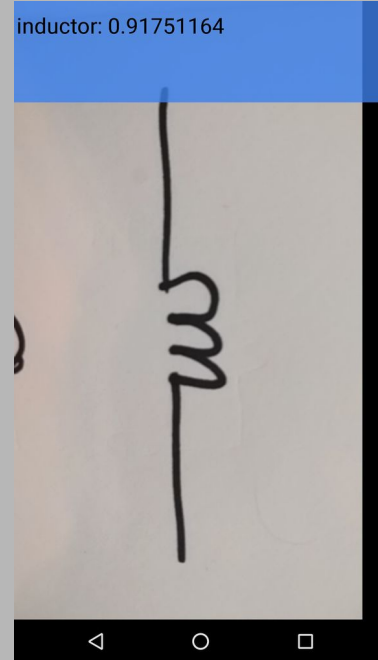
Circuit Solver



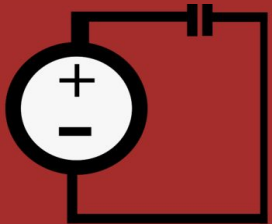


# TensorFlow Challenges

- Dependencies
- Number of sample images required
- Computational power and time required
- Mobile storage and platform limitations



Circuit Solver

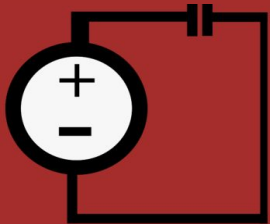


- General Concept
- The features
  - Image Processing
  - **Tensorflow**
  - Drawing and editing
  - Solving the circuit
- Testing
- End word

# Draw screen features

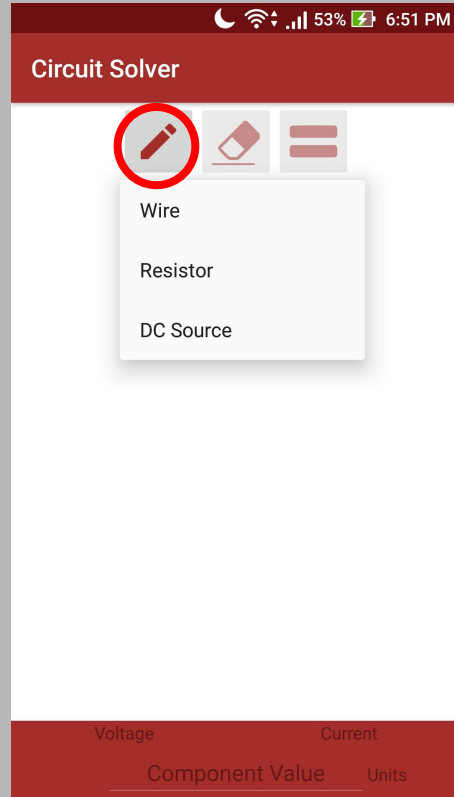
- Draw wires, resistors, DC sources
- Select a component to Erase, Switch, Edit
- Pinch zoom
- Solve

**Circuit Solver**

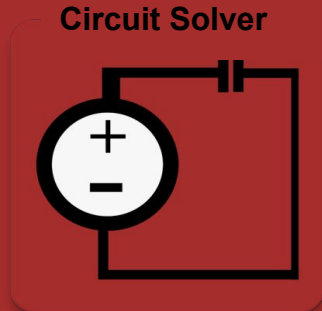


# Draw screen features

- General Concept
- The features
  - Image Processing
  - Tensorflow
  - Drawing and editing
    - Solving the circuit
- Testing
- End word



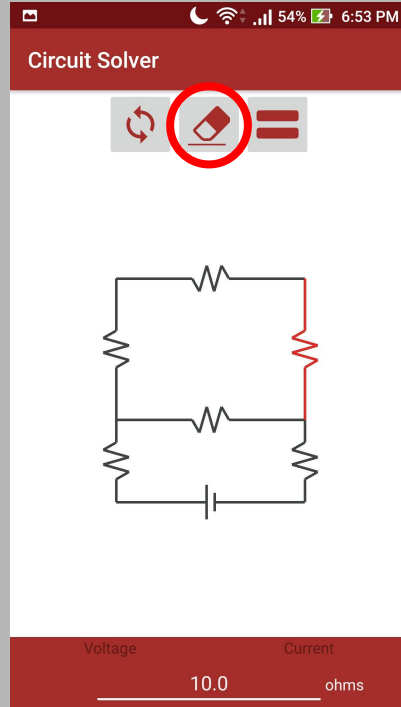
- Draw wires, resistors, & DC sources



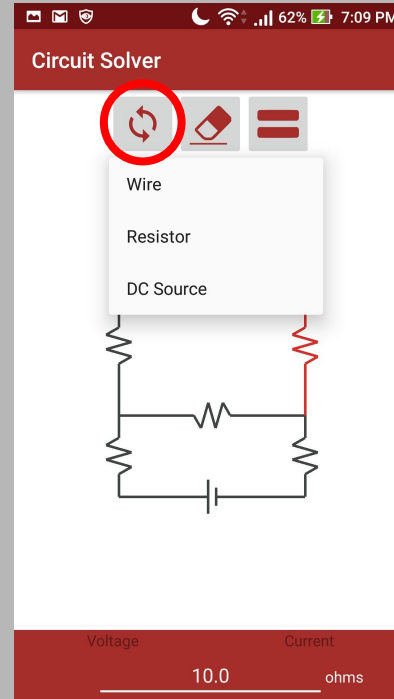
- General Concept
- **The features**
  - Image Processing
  - Tensorflow
  - **Drawing and editing**
  - Solving the circuit
- Testing
- End word

# Draw screen features

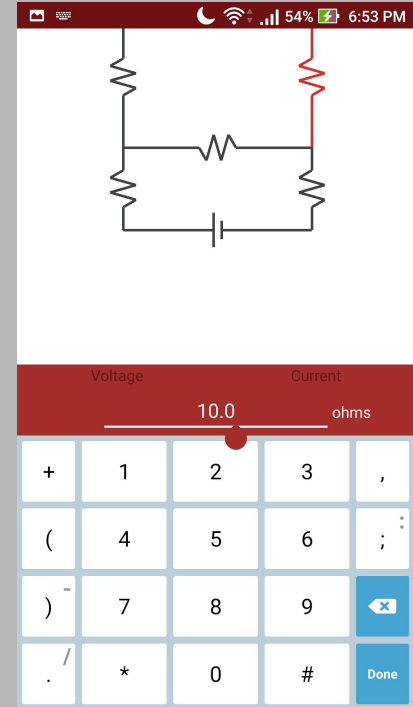
The features  
Drawing and editing



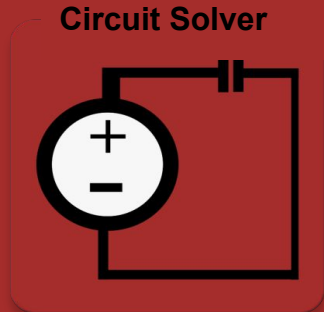
Erase



Switch

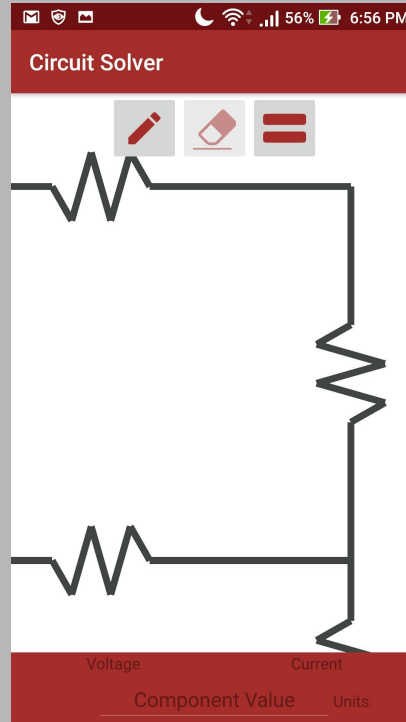


Edit

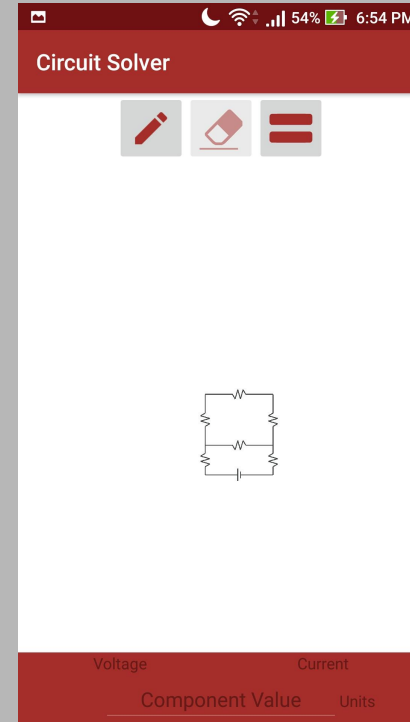


# Draw screen features

- General Concept
- The features
  - Image Processing
  - Tensorflow
  - Drawing and editing
  - Solving the circuit
- Testing
- End word

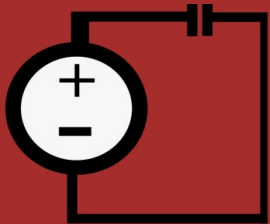


Zoom In



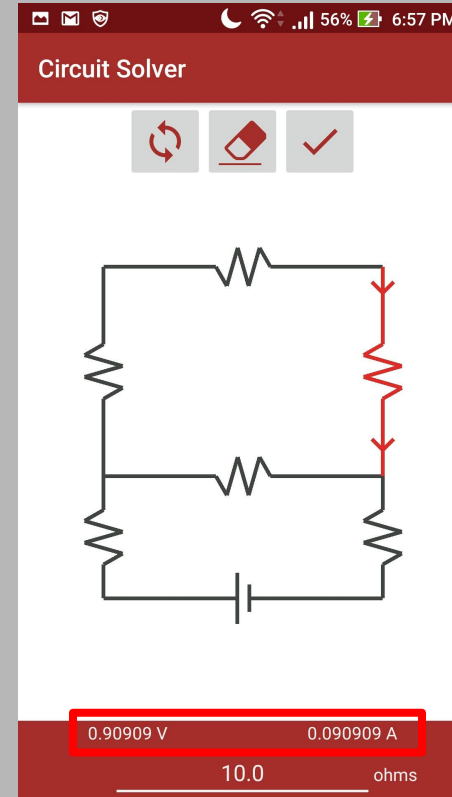
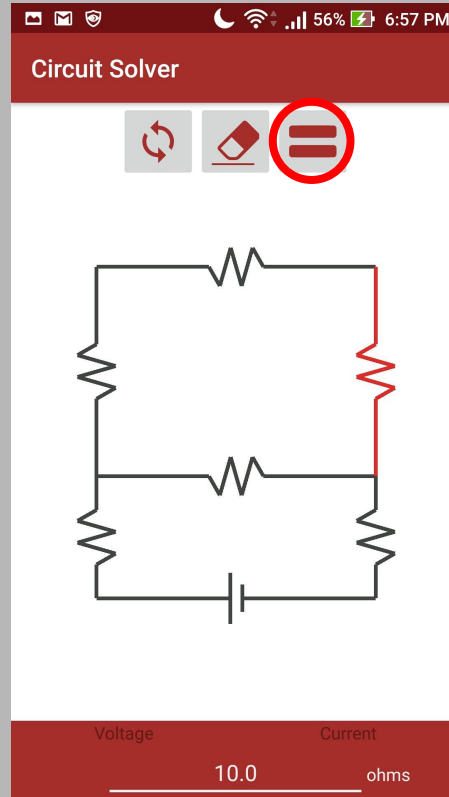
Zoom Out

## Circuit Solver



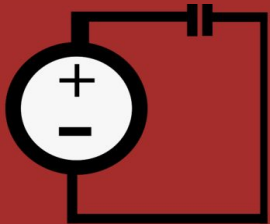
# Draw screen features

- General Concept
- The features
  - Image
  - Processing
  - Tensorflow
  - Drawing and editing
    - Solving the circuit
- Testing
- End word



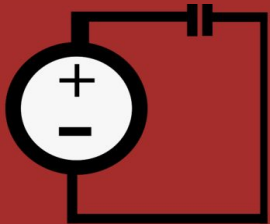
and finally Solve!

Circuit Solver



- General Concept
- **The features**
  - Image Processing
  - Tensorflow
  - Drawing and editing
  - **Solving the circuit**
- Testing
- End word

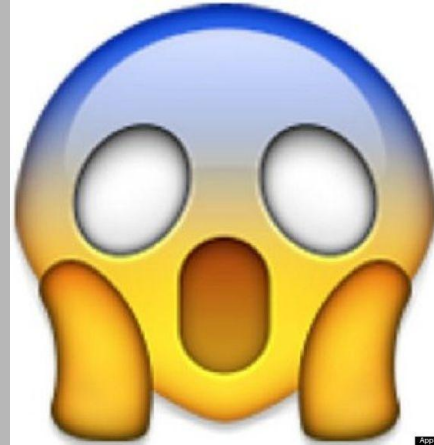
### Circuit Solver



# Challenge

**The features**  
Solving the circuit

We couldn't find much online about existing code we could use for solving circuits in Android.



- General Concept

## ➤ The features

- Image Processing
- Tensorflow
- Drawing and editing

### ■ Solving the circuit

- Testing
- End word

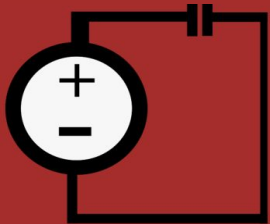
# NgSpice

**The features**  
Solving the circuit

An open source circuit simulator written in C.



## Circuit Solver





- General Concept

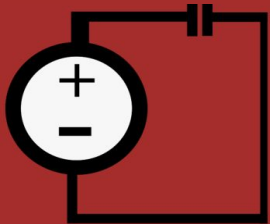
## ➤ The features

- Image Processing
- Tensorflow
- Drawing and editing

### ■ Solving the circuit

- Testing
- End word

#### Circuit Solver



# Android NDK

**The features**  
Solving the circuit

“The Android NDK is a toolset that lets you implement parts of your app using native-code languages such as C and C++. For certain types of apps, this can help you reuse code libraries written in those languages.”



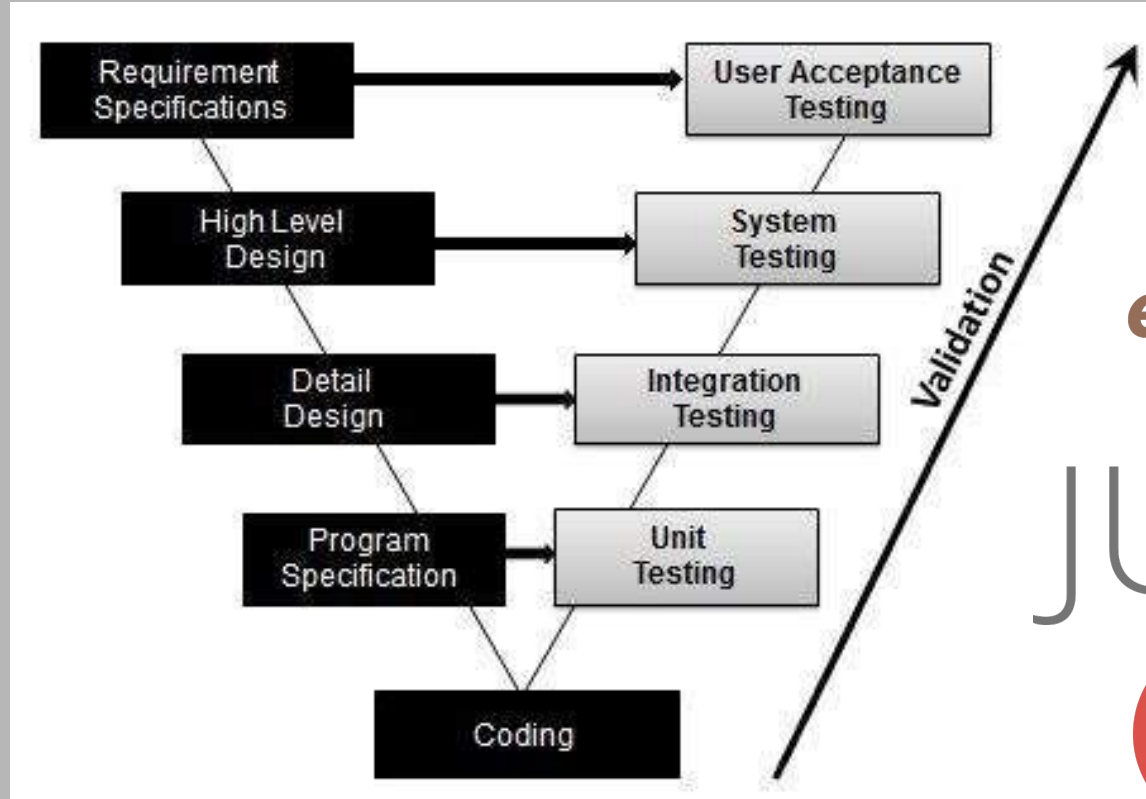
- General Concept
- The features
  - Image Processing
  - Tensorflow
  - Drawing and editing
  - Solving the circuit

## ➤ Testing

- End word

Espresso - <https://giphy.com/gifs/10MYCh8Yecsv0hz3y/html5>

Testing



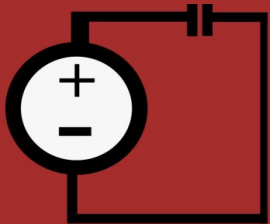
UI TESTING FOR ANDROID

**espresso**

JUnit

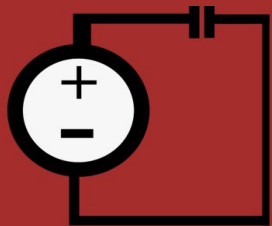


Circuit Solver



- **Testing**
  - End word

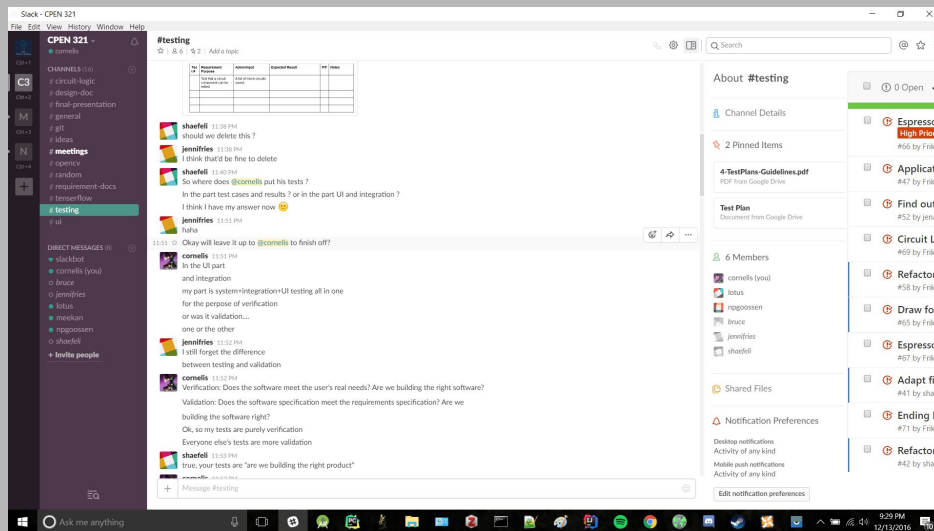
# Circuit Solver



# Challenge = Time!

Tests were left till the very end! (as is usually the case... poor neglected tests)  
To overcome this effective **communication** was key!

## Testing



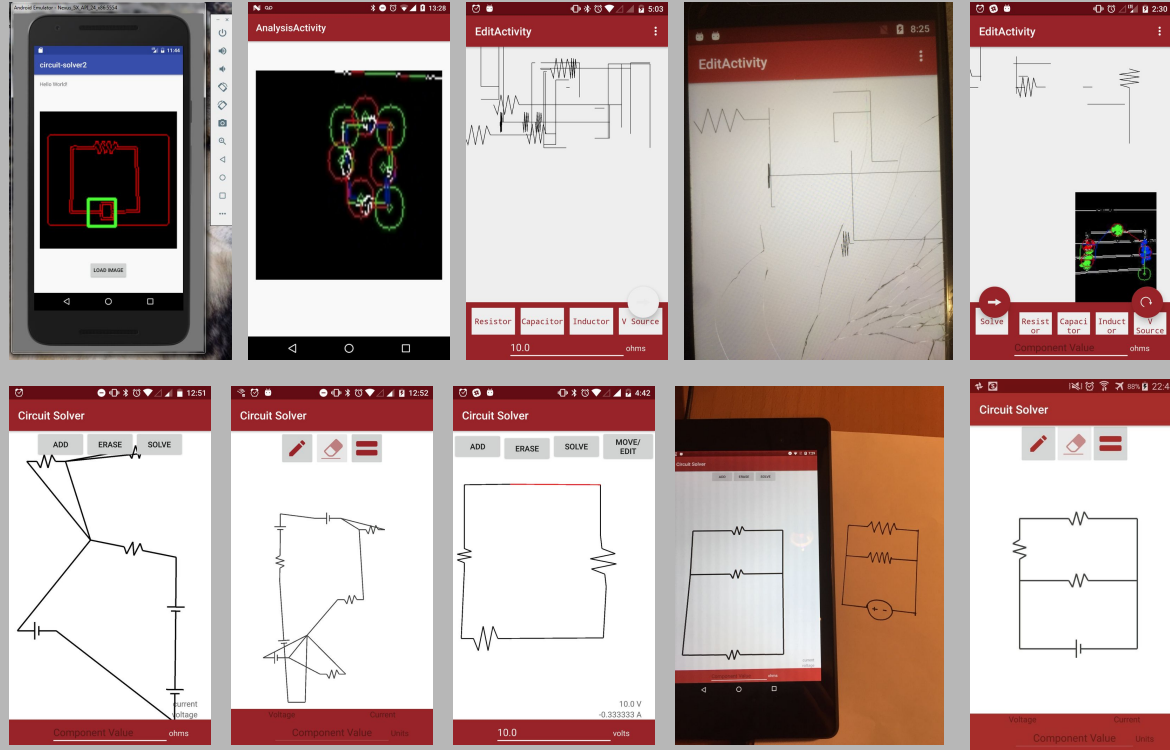
- General Concept
- The features
  - Image Processing
  - Tensorflow
  - Drawing and editing
  - Solving the circuit
- Testing



**End word**

End word

# Thank you for listening



**Circuit Solver**

