



**& ThoughtWorks®**

---

# **AGILE HARDWARE INNOVATION**

---

**How we created a great device in only 5 weeks !**

John-Ross Barresi & Chen Zhu

# ABOUT GUIDE DOGS VICTORIA

---

ThoughtWorks®

*We are not just guide dogs.*

*We love our pups, but 70% of our client activity is not dog related!*

*We are not just for people who are completely blind.*





# OUR SERVICES

ThoughtWorks®





# WHAT IS ORIENTATION & MOBILITY

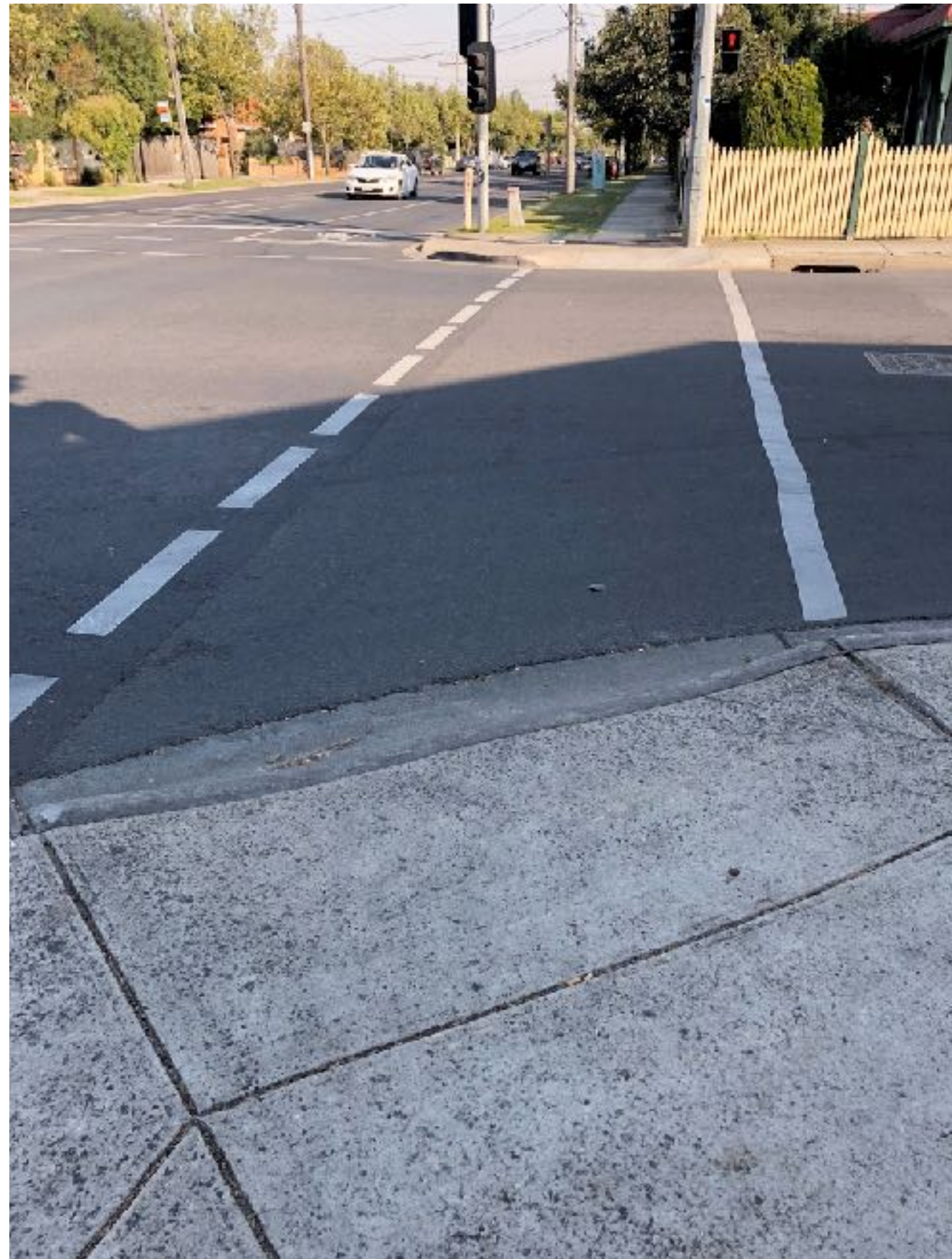
**Our training includes all aspects of daily travel, utilizing:**

- Long cane training
- Wayfinding technology
- Public Transport training
- Orientation to local travel routes
- Safe road crossings





## Kerb Design





# ROAD CROSSING STRATEGIES AND THEIR ISSUES

## Tactile Ground Surface Indicators (TGSI's)





## Audio Signals

*Some clients use the sound of the audio signal as a spot to aim for:*

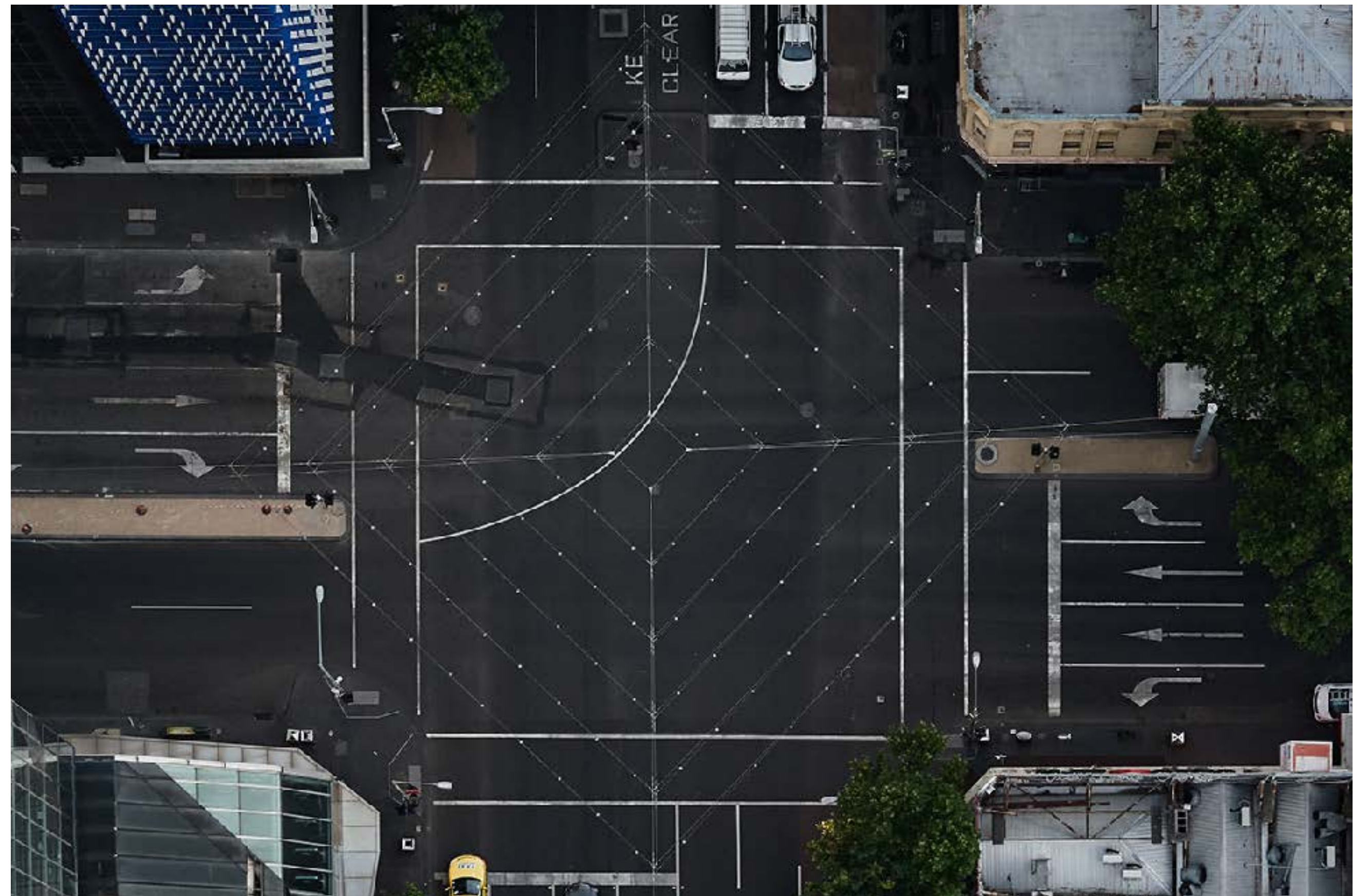
- Not always loud enough to hear from the other side*
- Not all intersections are fitted with an audio output*
- Not useful to clients with a hearing loss.*





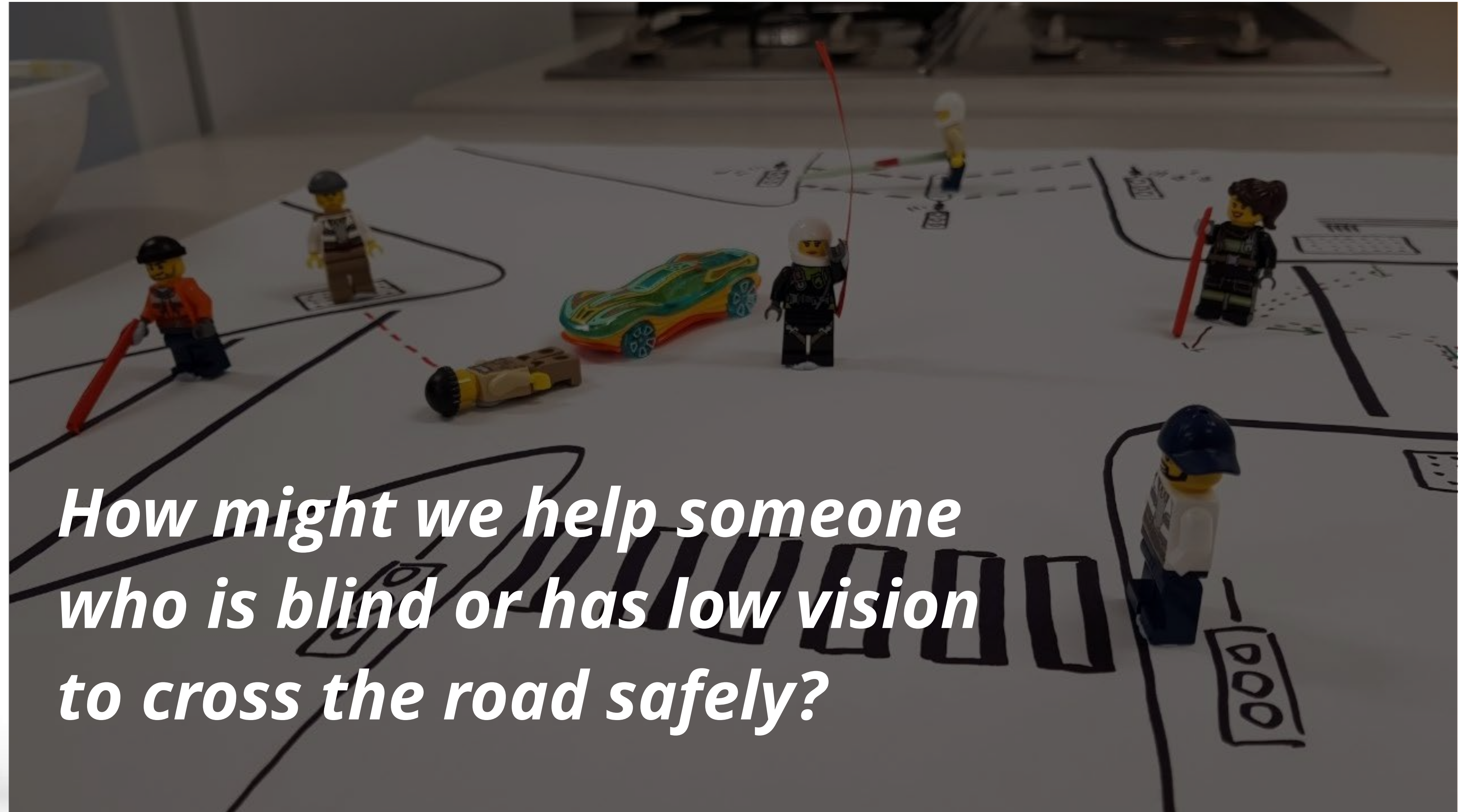
## Straight line walking

- A major issue for any independent traveller.
- Very hard to correct, even with intensive training.
- Something that can be easily demonstrated.....





# HOW MIGHT WE



*How might we help someone who is blind or has low vision to cross the road safely?*



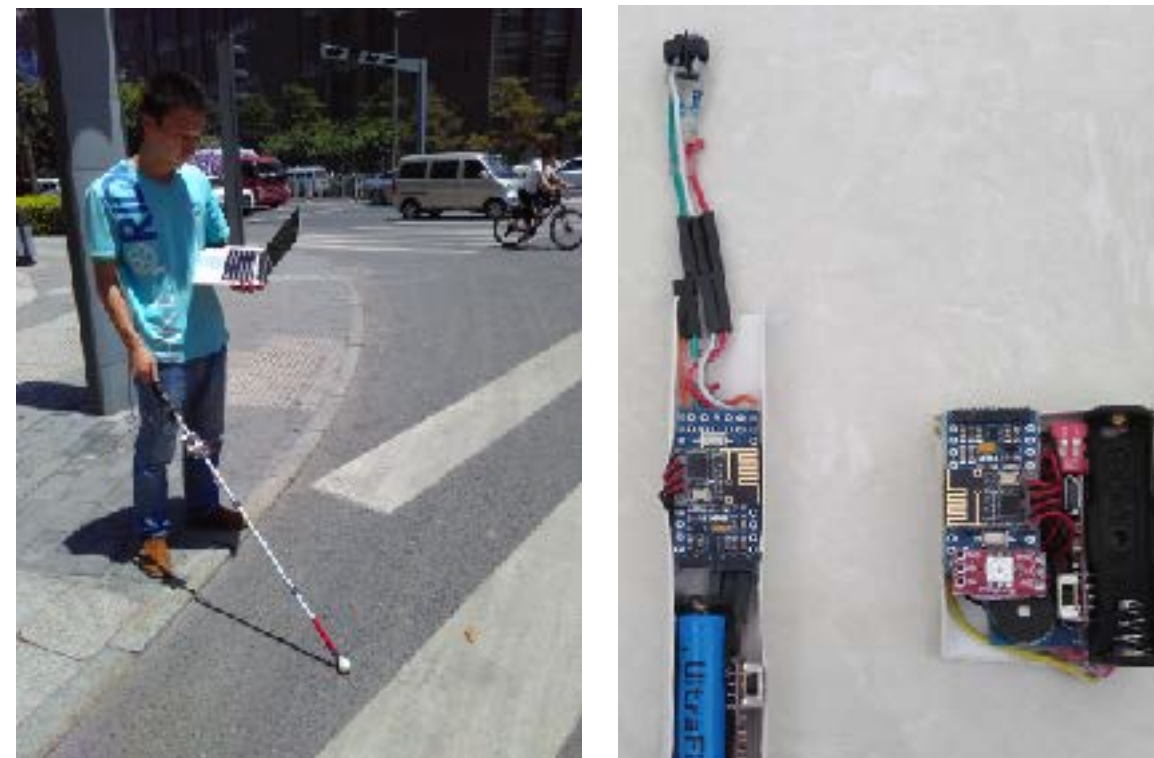
# CRAZY 5 WEEKS

---

## *Discovery* *1 week*



## *Delivery* *3 weeks*



## *Validation* *1 week*





# IN FIELD DISCOVERY



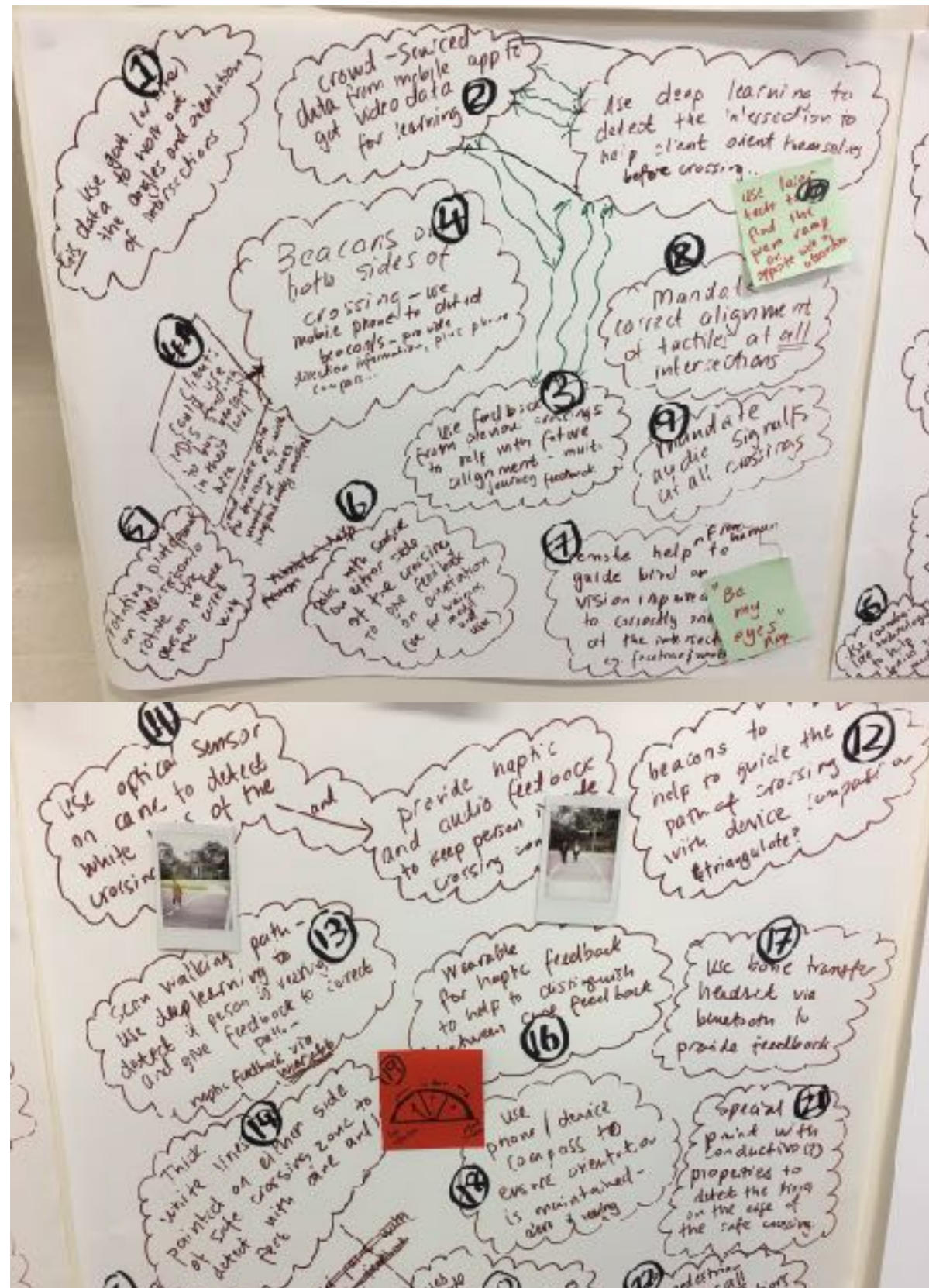






## How might we help the blind to avoid veering off when crossing road ?

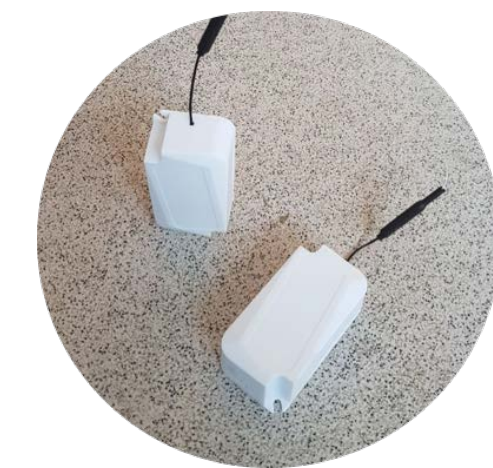
### Ideated 26 ideas



### Ranking

AFFORDABLE	EASY TO USE	RELIABLE	NOT TOO MANY DEVICES	FREE HANGING	UNOBTRUSIVE NOT BULKY
<del>X</del> V	V	?	V		V
V	V	X - V	V		V
V	V	X ? V	V		V
?	V	?	V		V
X	V	X	V		V
X	V/X	?	V		V
V	V	V/?	V		?
X	V	V	V		V
X	X/V	X	V		V
V	X/V	X	V		V
V	V	?/V	V		X
?	?/V	?	V		V

### Top3 ideas



Beacon & Compass



Machine Learning



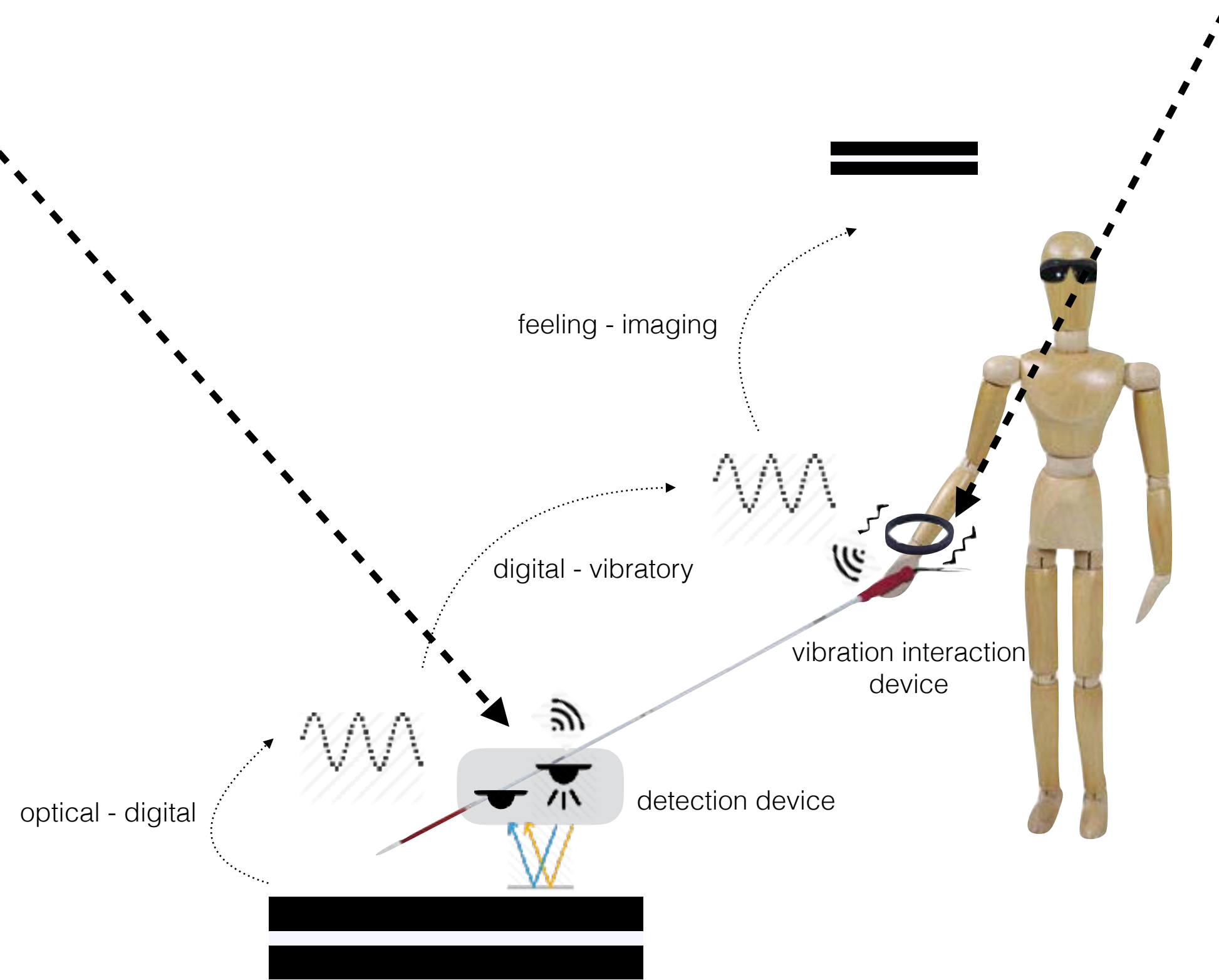
Optical Sensor



# SOLUTION - OPTICAL SENSOR

*Detection device*

*Interaction Device*

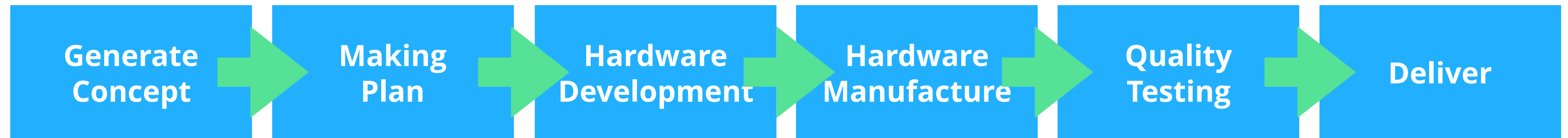


● SW ● HW



# CHALLENGE OF MAKING HARDWARE

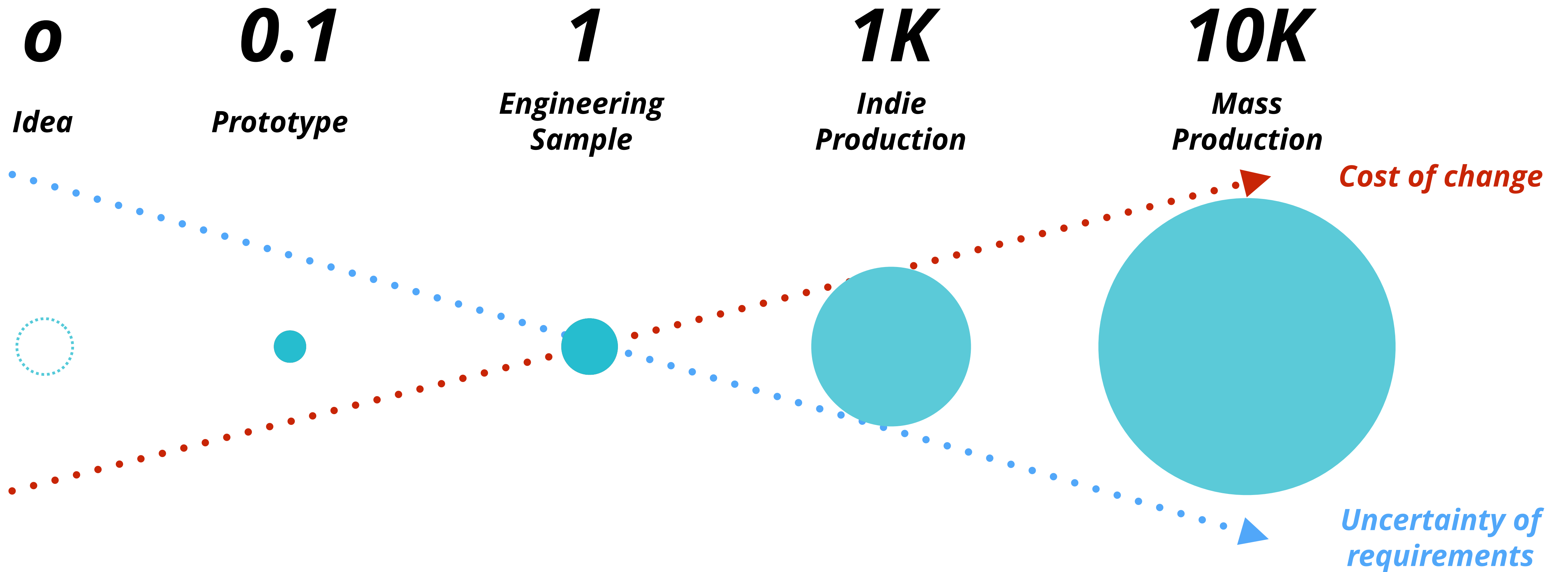
## THE COST OF CHANGING A HARDWARE IS HUGE



← *Months to Years* →



# AGILE HARDWARE DEVELOPMENT





# OPEN SOURCE MODULES FOR PROTOTYPES

---



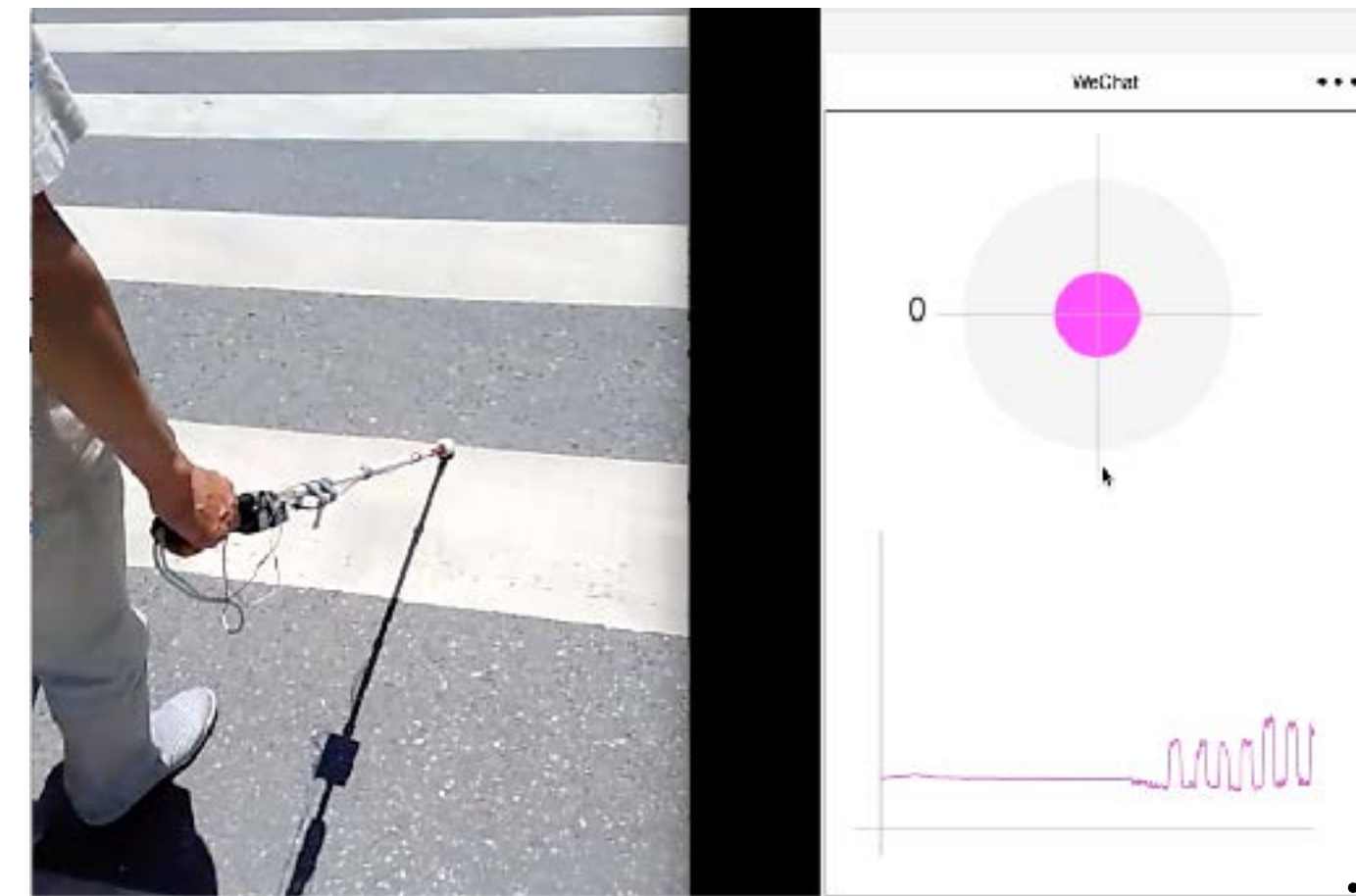


# WEEK 1 - BUILD OPTICAL SENSOR AND OBTAIN MEASUREMENT DATA

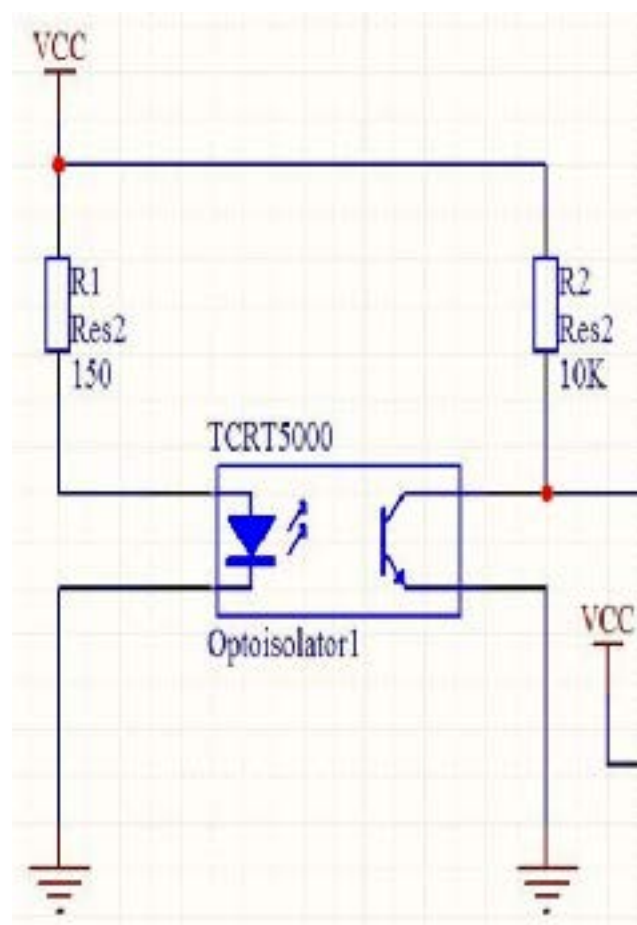
**A. Select infrared receiver and emitter**



**D. Build test app  
& data transferring with bluetooth**



**B. Build measurement circuit & firmware**

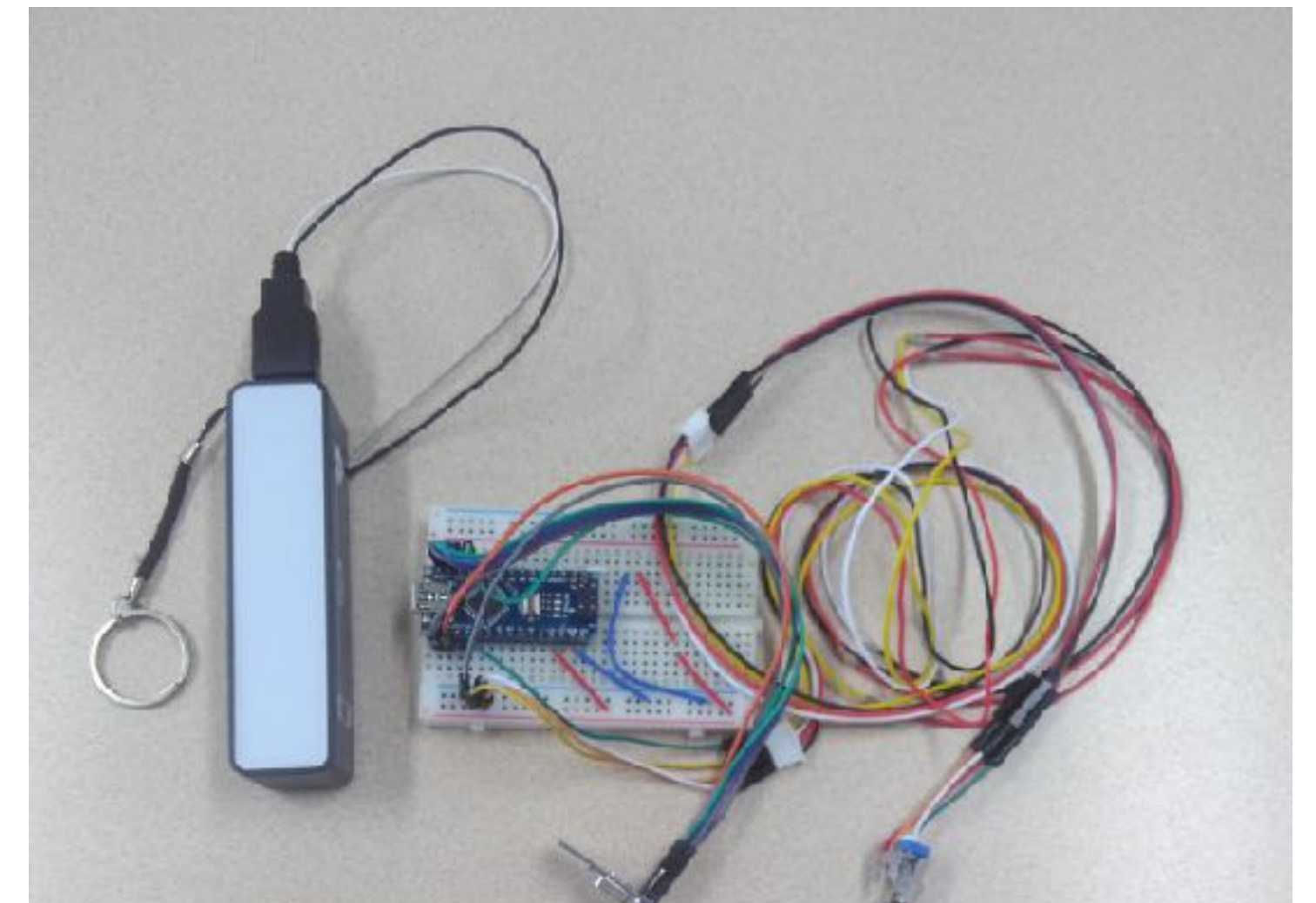
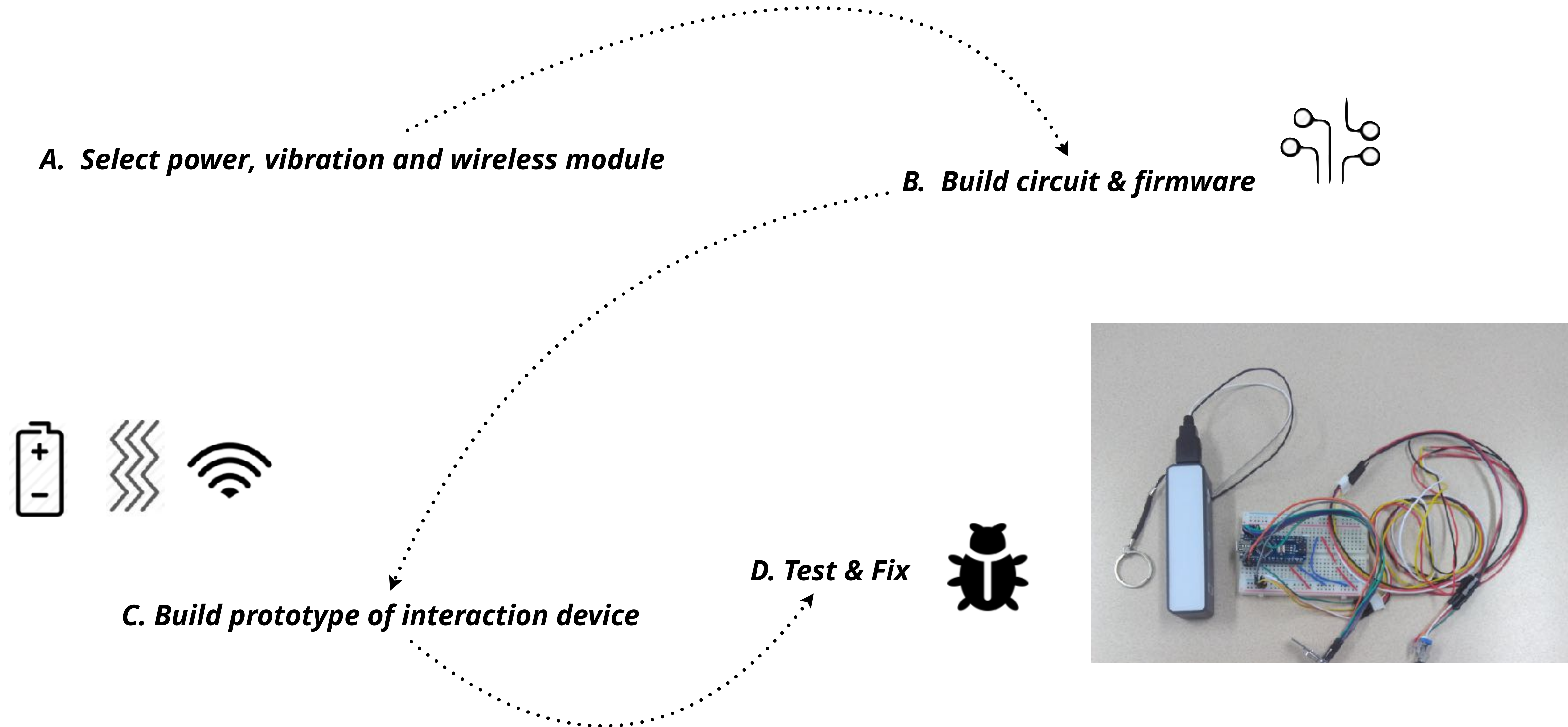


**C. Build prototype of detection device**



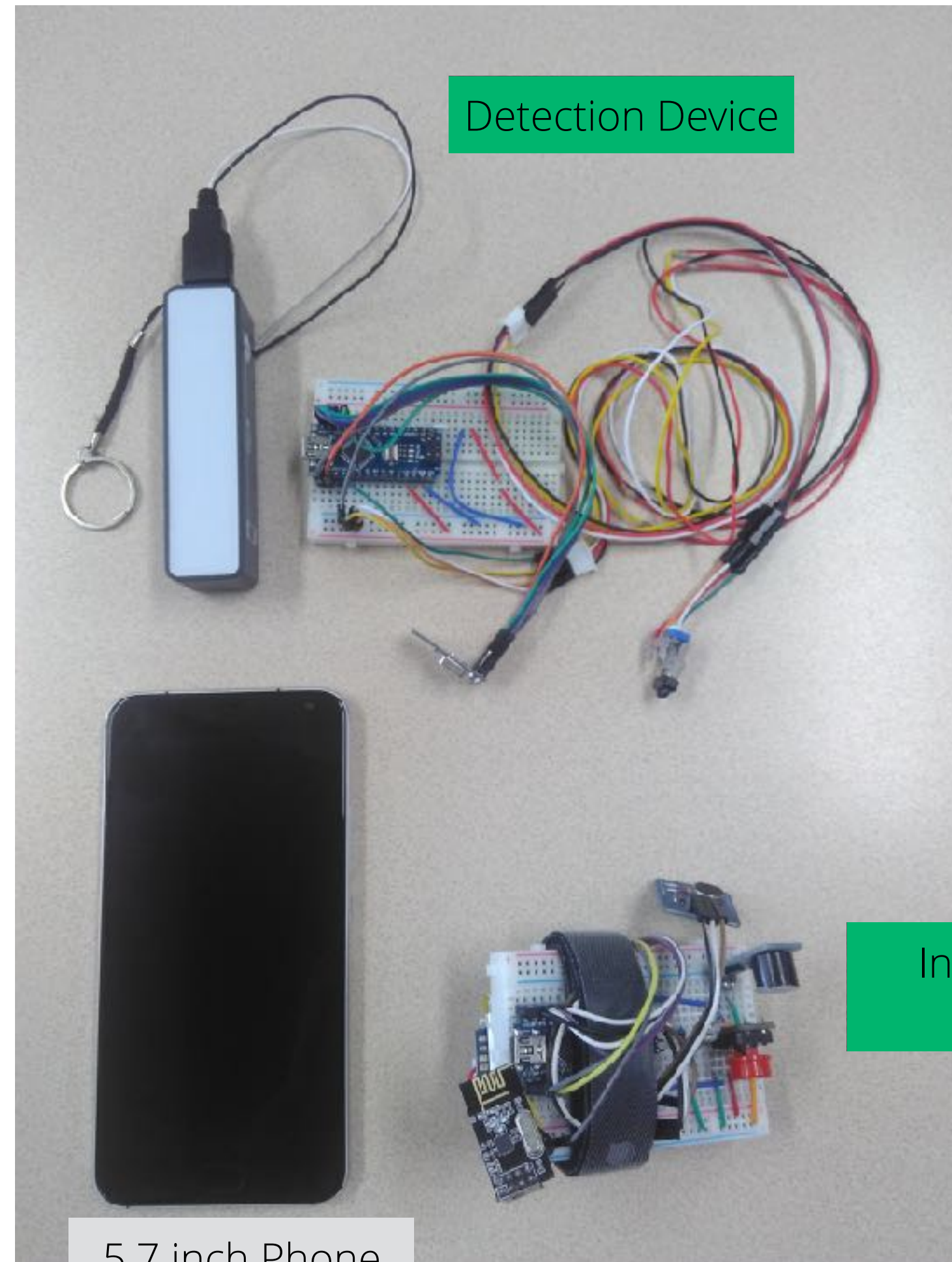


# WEEK 2 - BUILD PROTOTYPE OF INTERACTION DEVICE





# WEEK 3 - MAKE IT COMPACT AND SMALL, PROTOTYPE V2

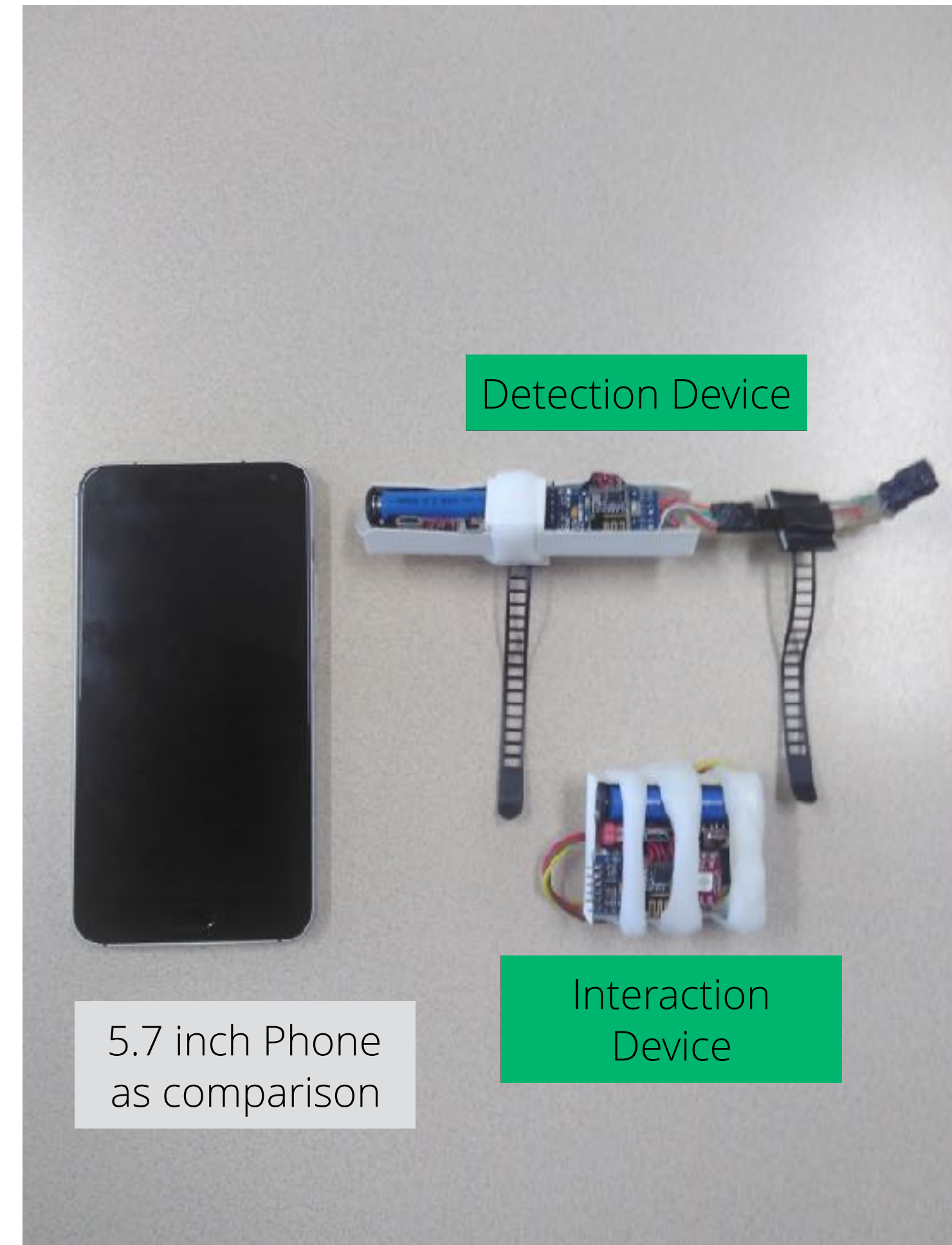


Detection Device

Interaction Device

5.7 inch Phone as comparison

**Prototype V1**



Detection Device

Interaction Device

5.7 inch Phone as comparison

**Prototype V2**



## Detection device

### Hardware

Reflective Infrared Sensor

Arduino Pro Mini (5V)

Mini NRF24L01 2.4GHz wireless module

Li-ion 10440 3.7V Battery

Power Regulator, Output 5v & 3.3v & Battery Charging circuit

Power Switch

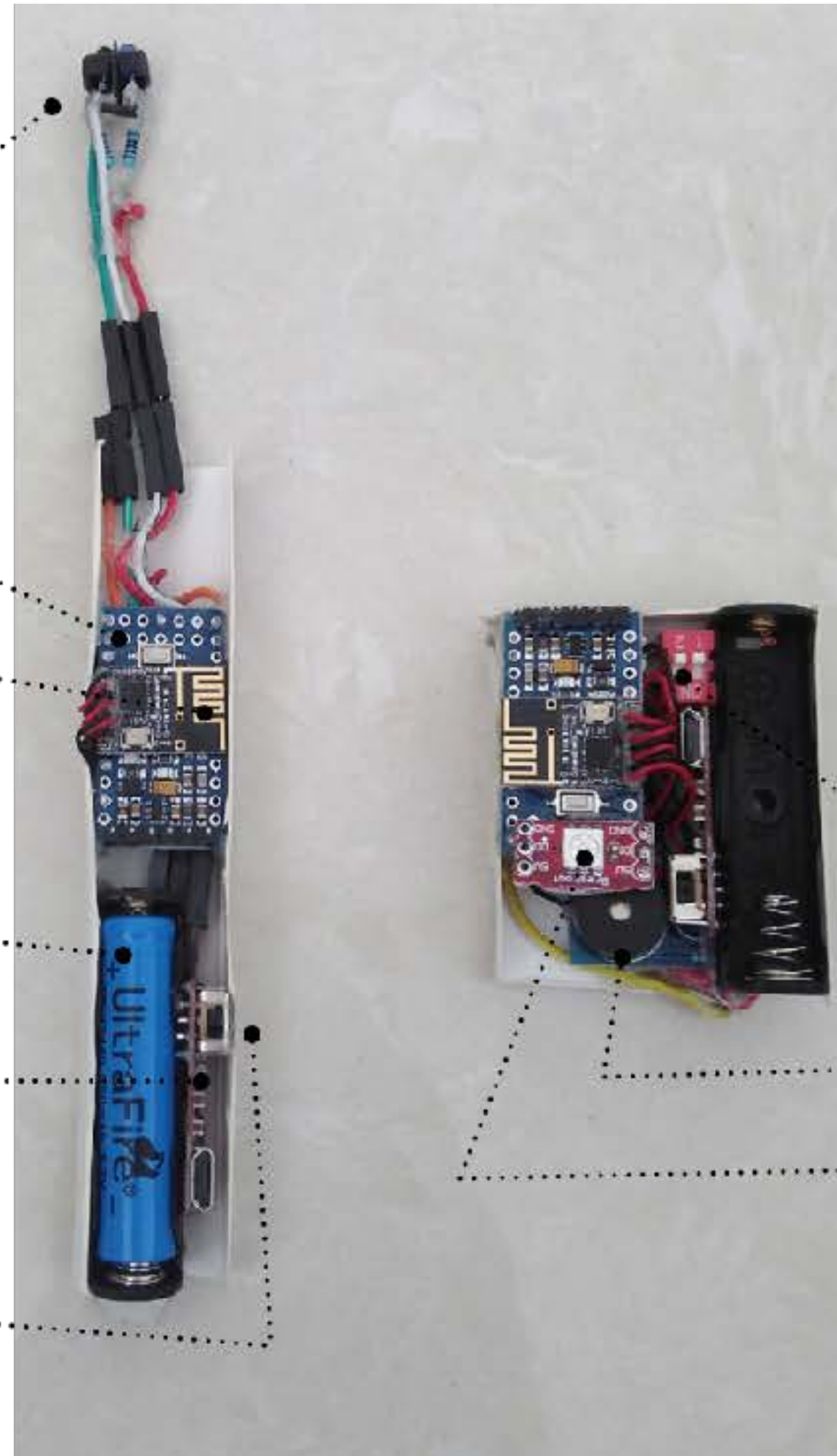
## Interaction Device

Vibration Mode Switch & Buzzer Switch

Buzzer

WS2812 Color LED

( Vibration motor is on the back of device )

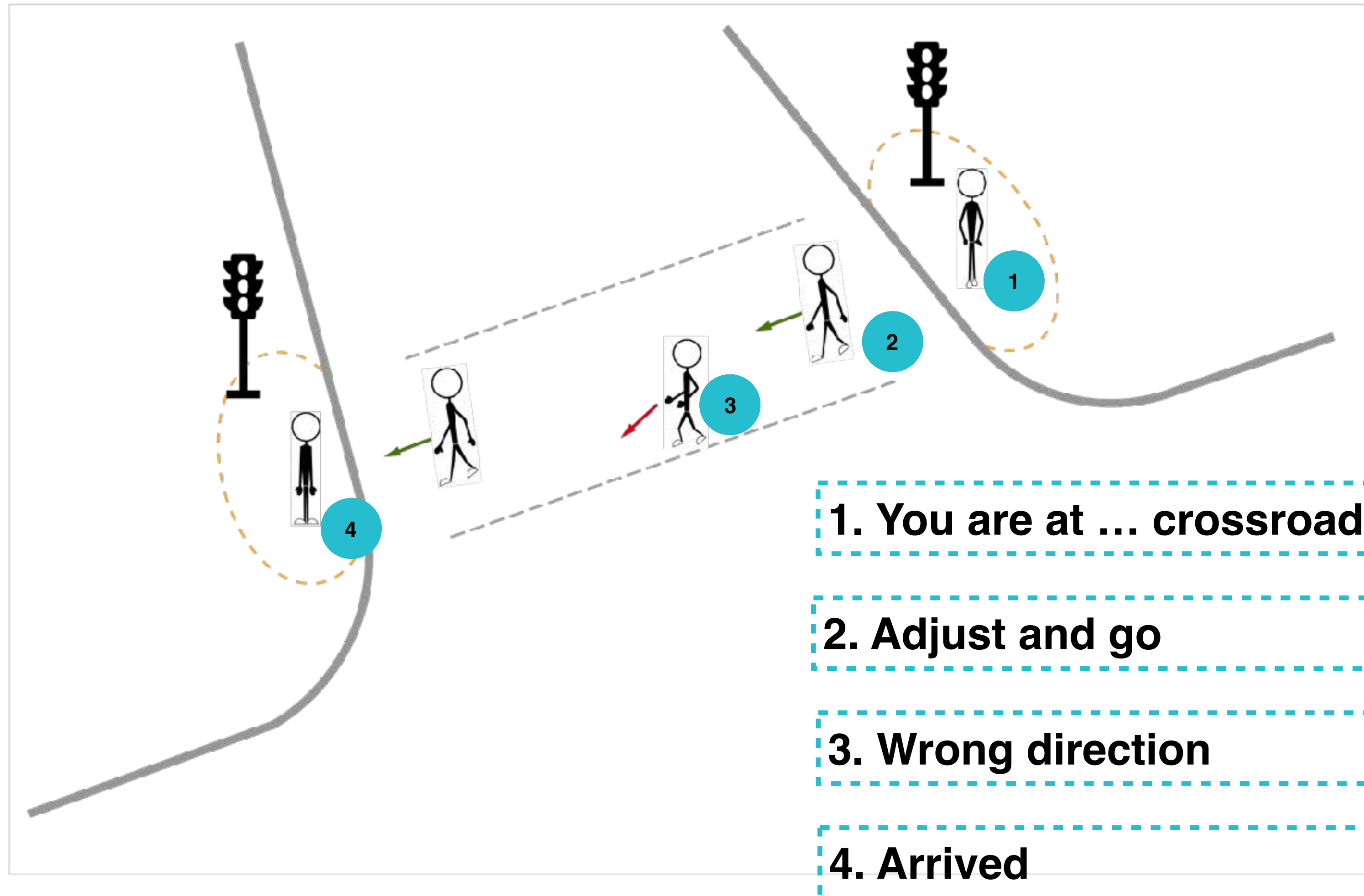






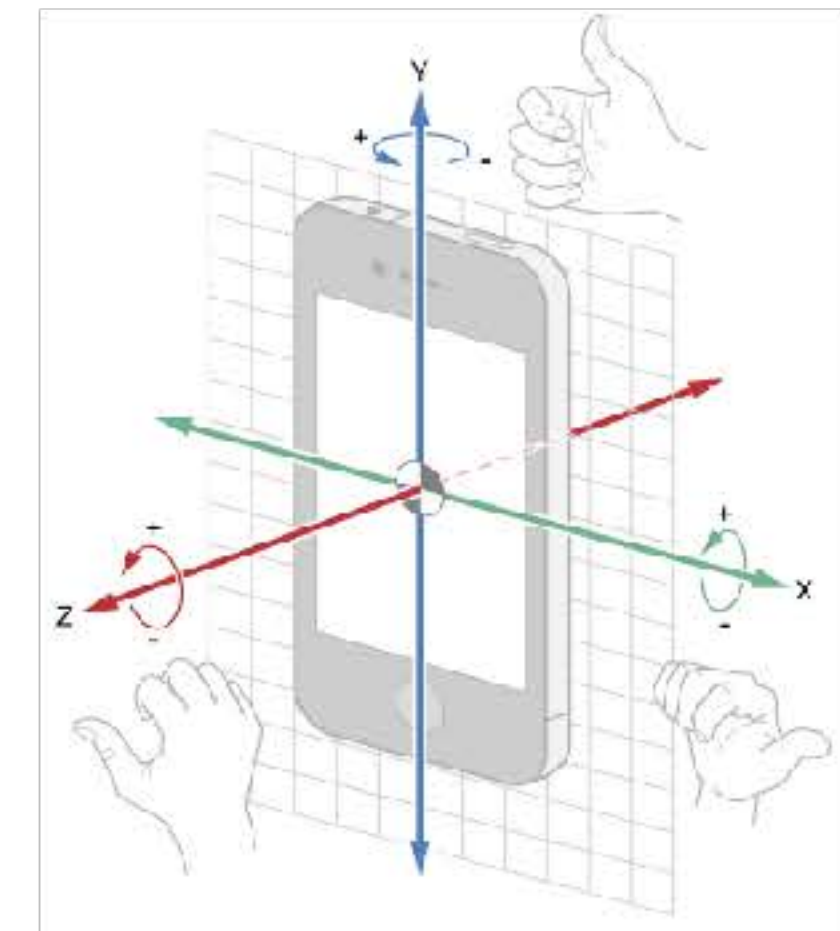
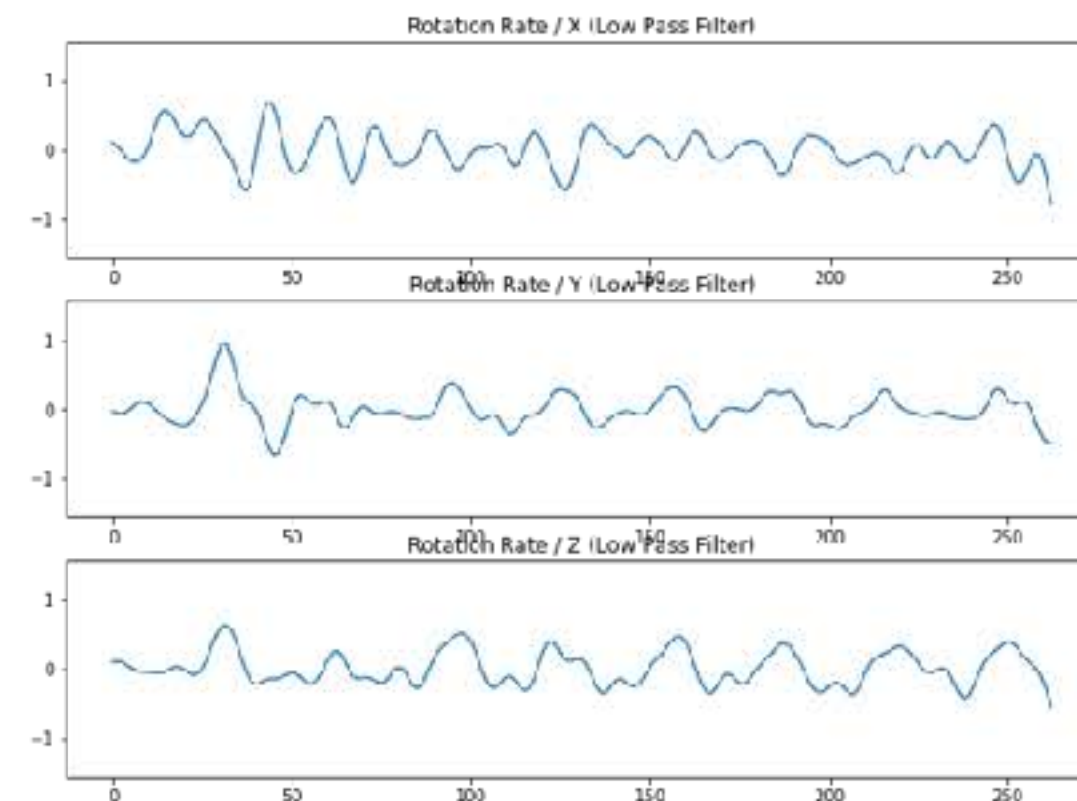
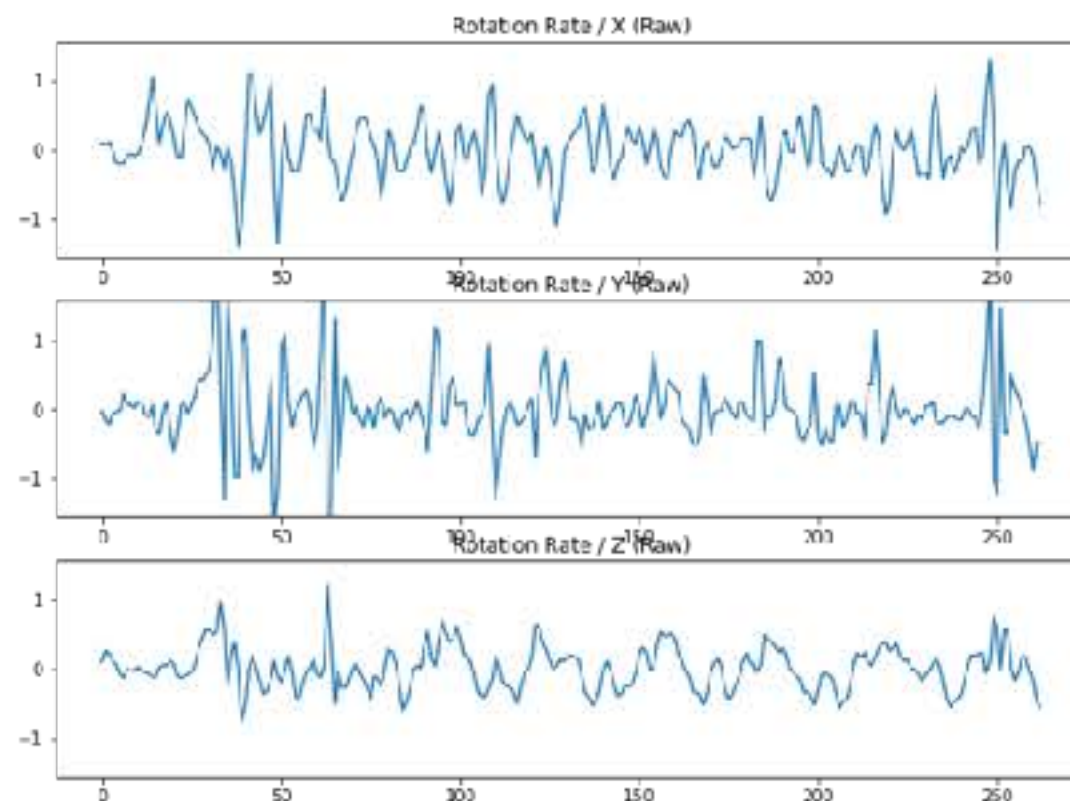


# SOLUTION - BEACON & COMPASS



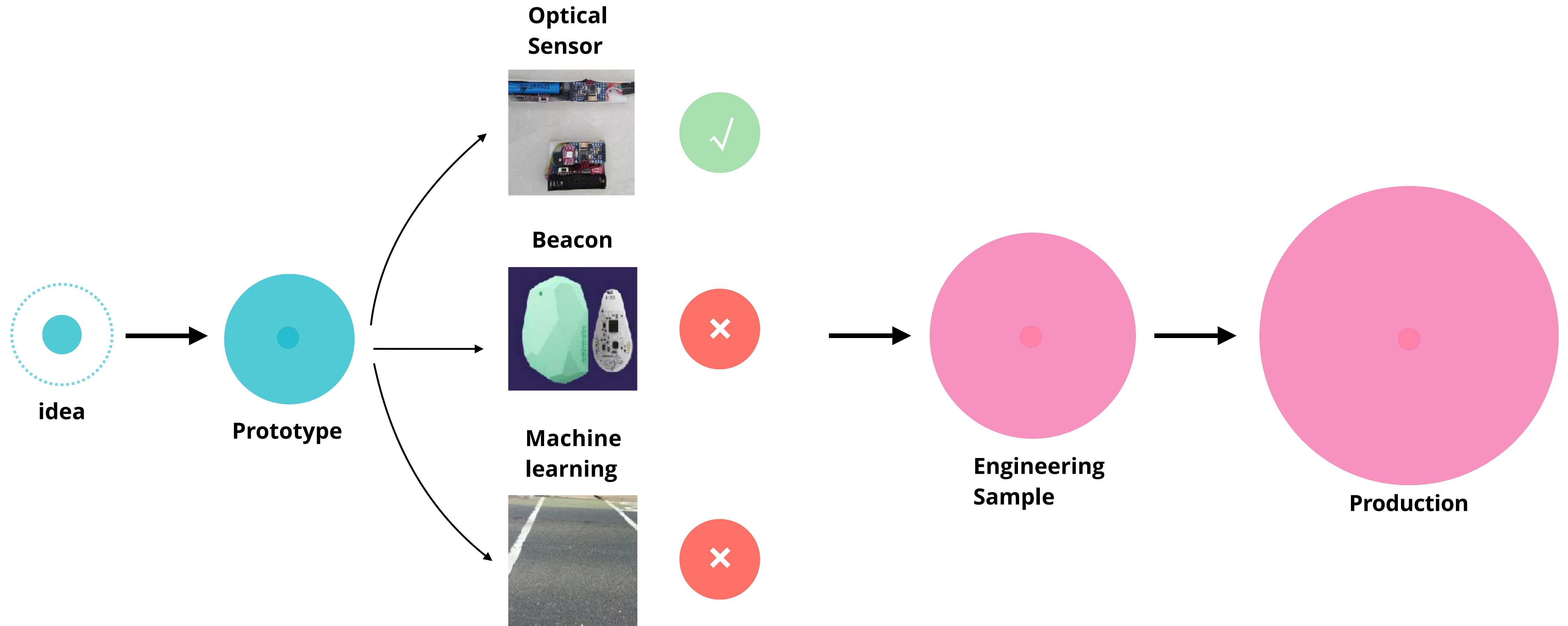


# SOLUTION - MACHINE LEARNING





# THE RESULT OF TESTING





# HOW CAN YOU HELP?

---

- Are you a developer?
- Do you have experience in product development?
- If you think you can get in anyway please contact us at [www.guidedogsvictoria.com.au](http://www.guidedogsvictoria.com.au)
- You can always donate!





# THANKS

---

*Chen Zhu & John-Ross*

---

**ThoughtWorks®**