



The Internet of (Lego) Trains

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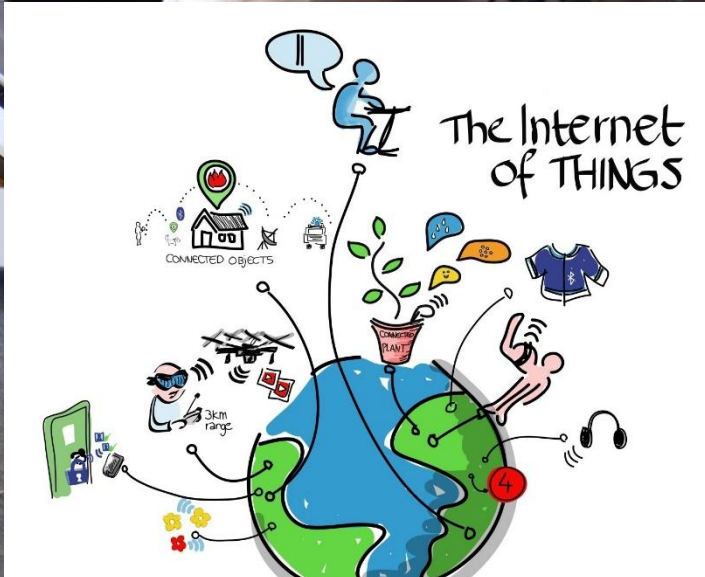
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Disclaimer:
No Lego was harmed beyond
repair during the project.



CONTENT

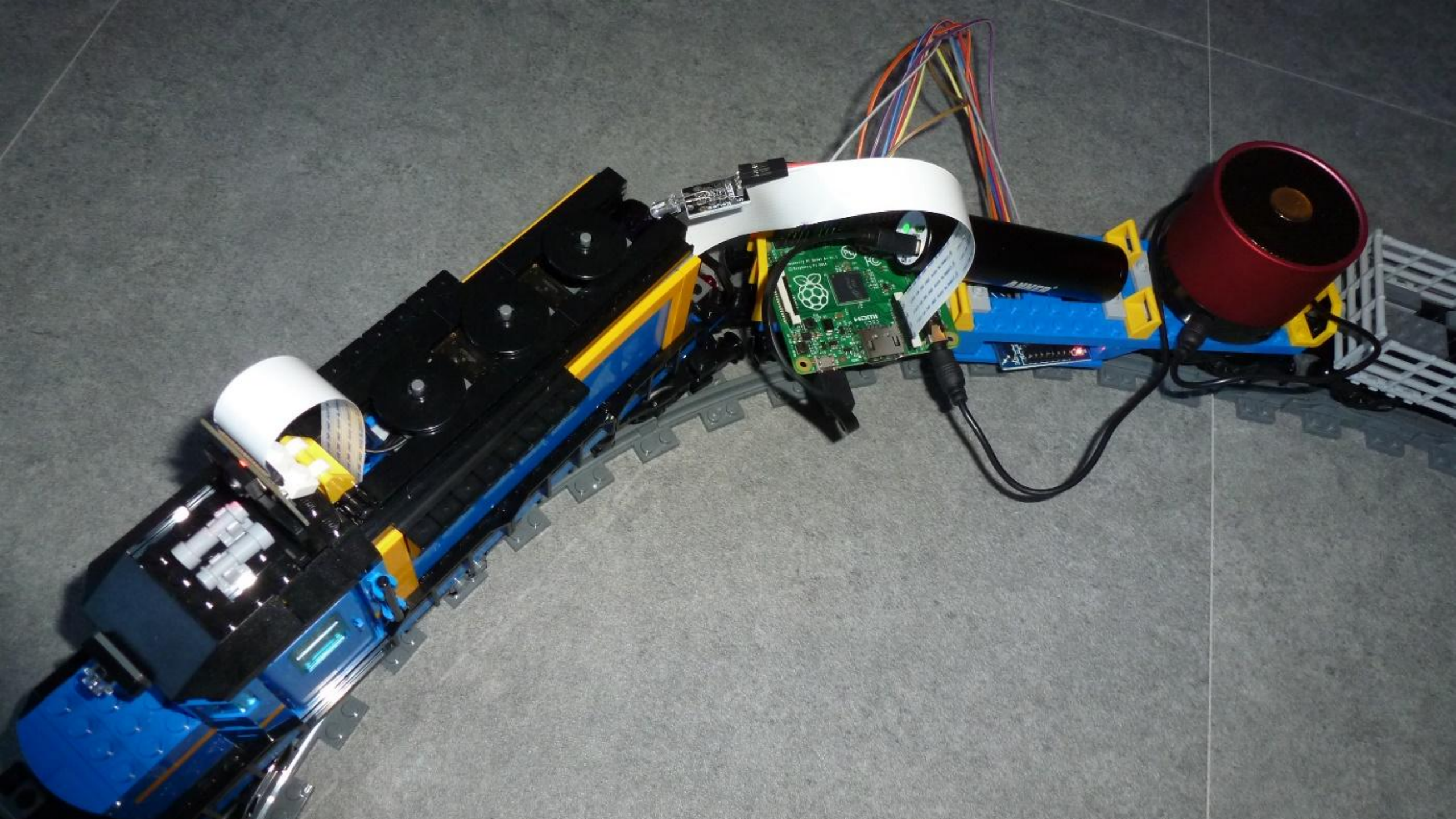
- Why?
- Ingredients
- Architecture
- Hardware
- Application
- Challenges
- Scala and Akka
- Future
- Conclusion
- Questions



MINIMAL INGREDIENTS FOR 1 TRAIN

ABOUT € 50

- Raspberry Pi A+
- Wifi dongle
 - EDUP Ultra-Mini Nano USB 2.0 802.11n
- USB battery pack
 - Anker® 2. Gen Astro Mini 3200mAh
- Infrared transmitter
 - Keyes 38KHz IR Infrared Transmitter Module for Arduino



OTHER INGREDIENTS

- Lego trains with power functions and tracks
- RFID-RC522 RF IC Card Sensor Module
- Mini Portable Speaker for the Raspberry Pi
- Raspberry Pi's and Raspberry Pi camera's
- Cables like Breadboard wires/USB
- Electronics like servo's etcetera

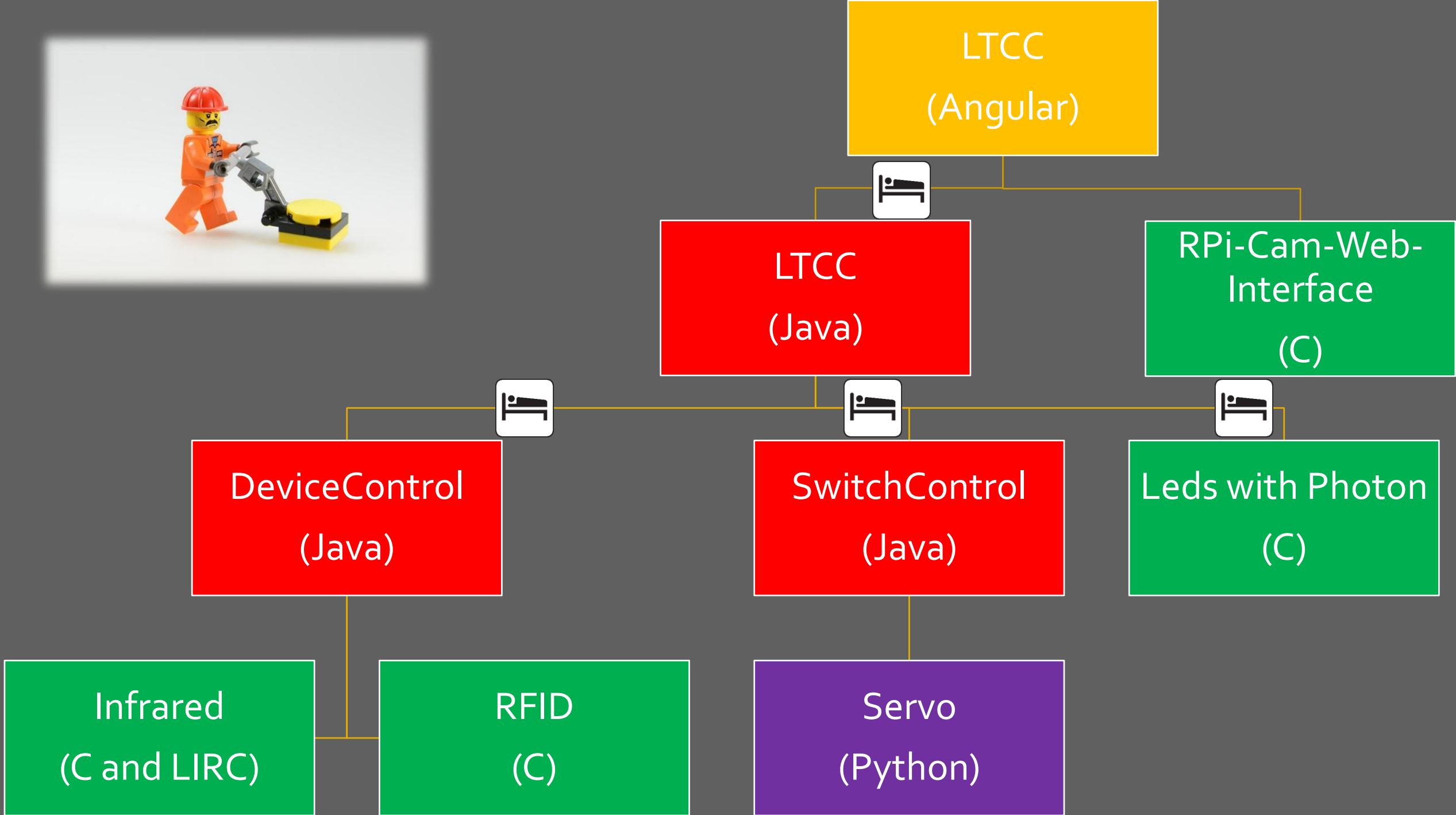


COMPARISON

| | Idle (mA) | Memory (MB) | CPU (Mhz) | Size (mm) |
|-----------------|-----------|-------------|-----------|-----------|
| RPi A+ | 180-240 | 256 | 700 | 65 * 56 |
| RPi Zero | 30 | 512 | 1000 | 65 * 30 |
| RPi B+ | 230-240 | 512 | 700 | 85 * 56 |
| RPi 2 B | 420 | 1024 | 4*900 | 85 * 56 |
| Odroid C1 | 325 | 1024 | 4*1500 | 85 * 56 |
| Particle Photon | 80-100 | 128KB | 120 | 38 * 21 |



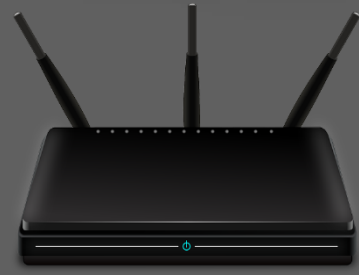
Architecture



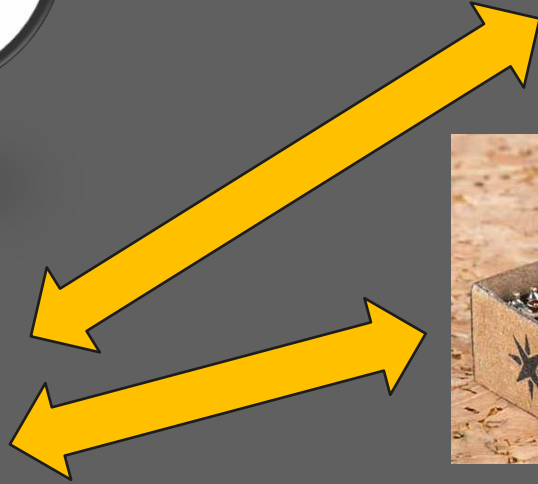
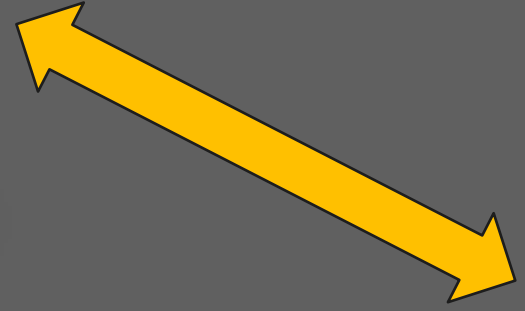
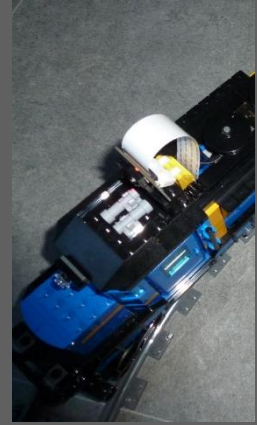
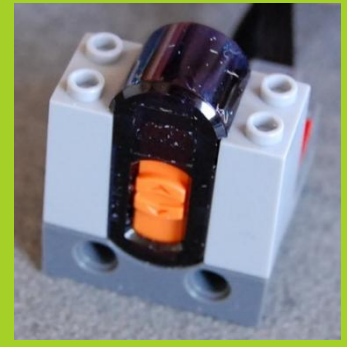
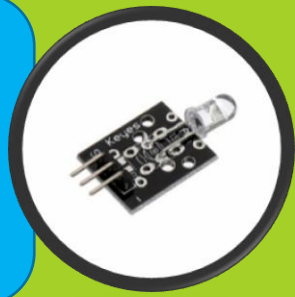
SwitchControl (Pi)

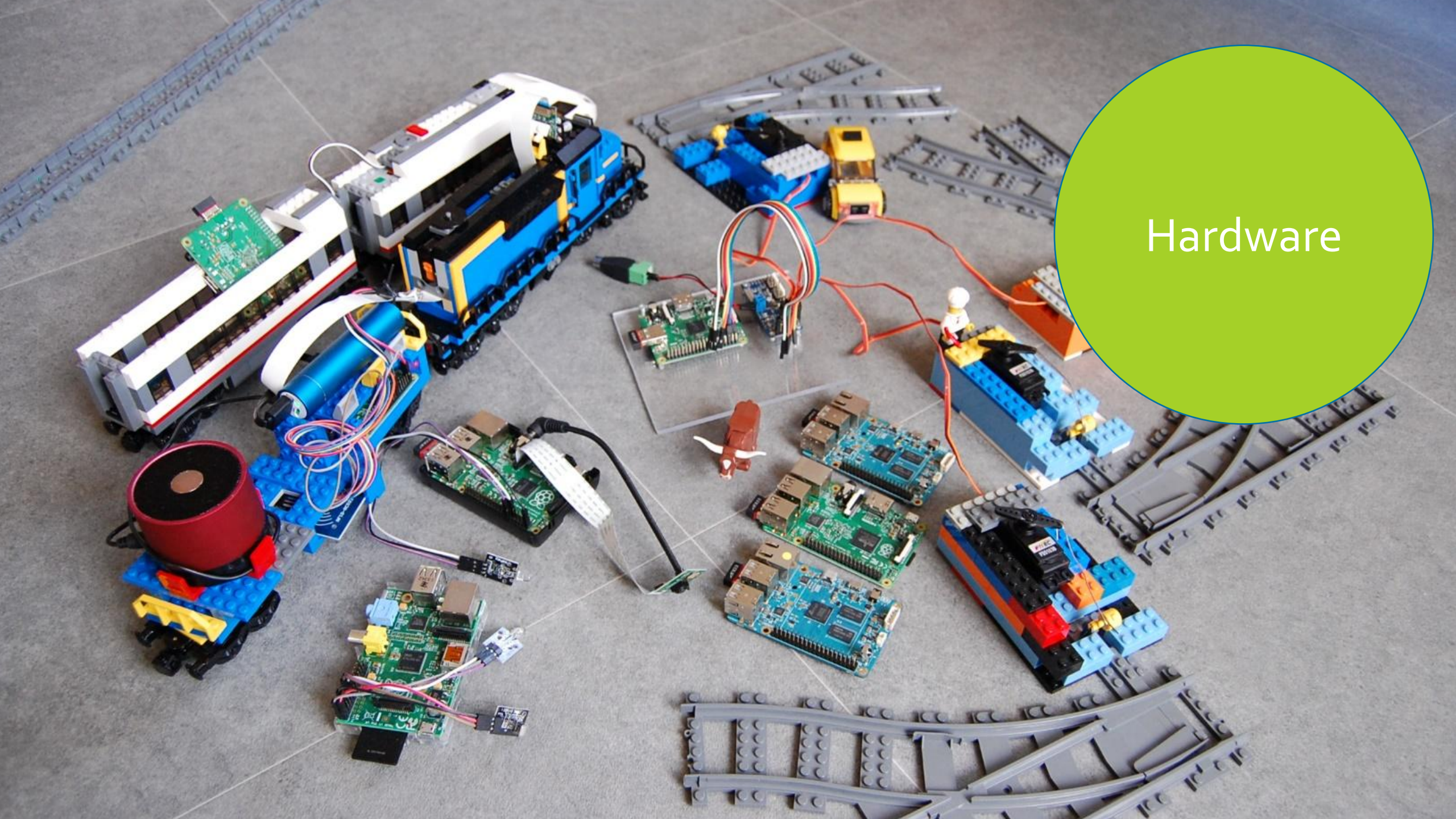
LTCC (Laptop)

Camera (Pi)



Device Control (Pi)





Hardware



Original controls

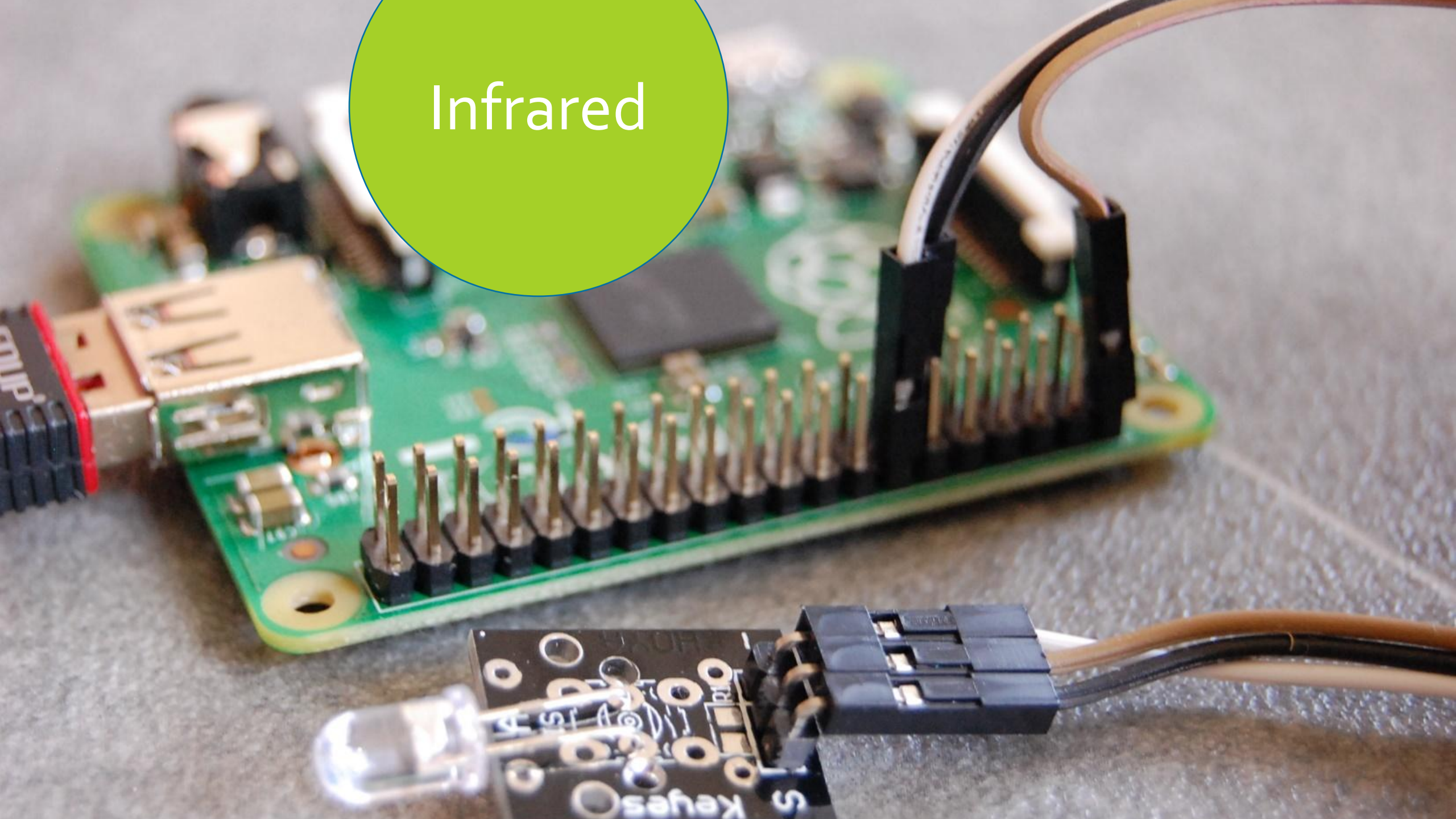


Out



Channels

Infrared



CALLING THE APPLICATION

- <http://ipaddress/cgi-bin/test/?ch=0&out=1&cmd=1&spd=3>
- ch: channel (there are 8)
- out: output
- cmd: command
 - 0 Break
 - 1 Forward
 - 2 Backward
- spd: speed (not necessary with command 'Break')



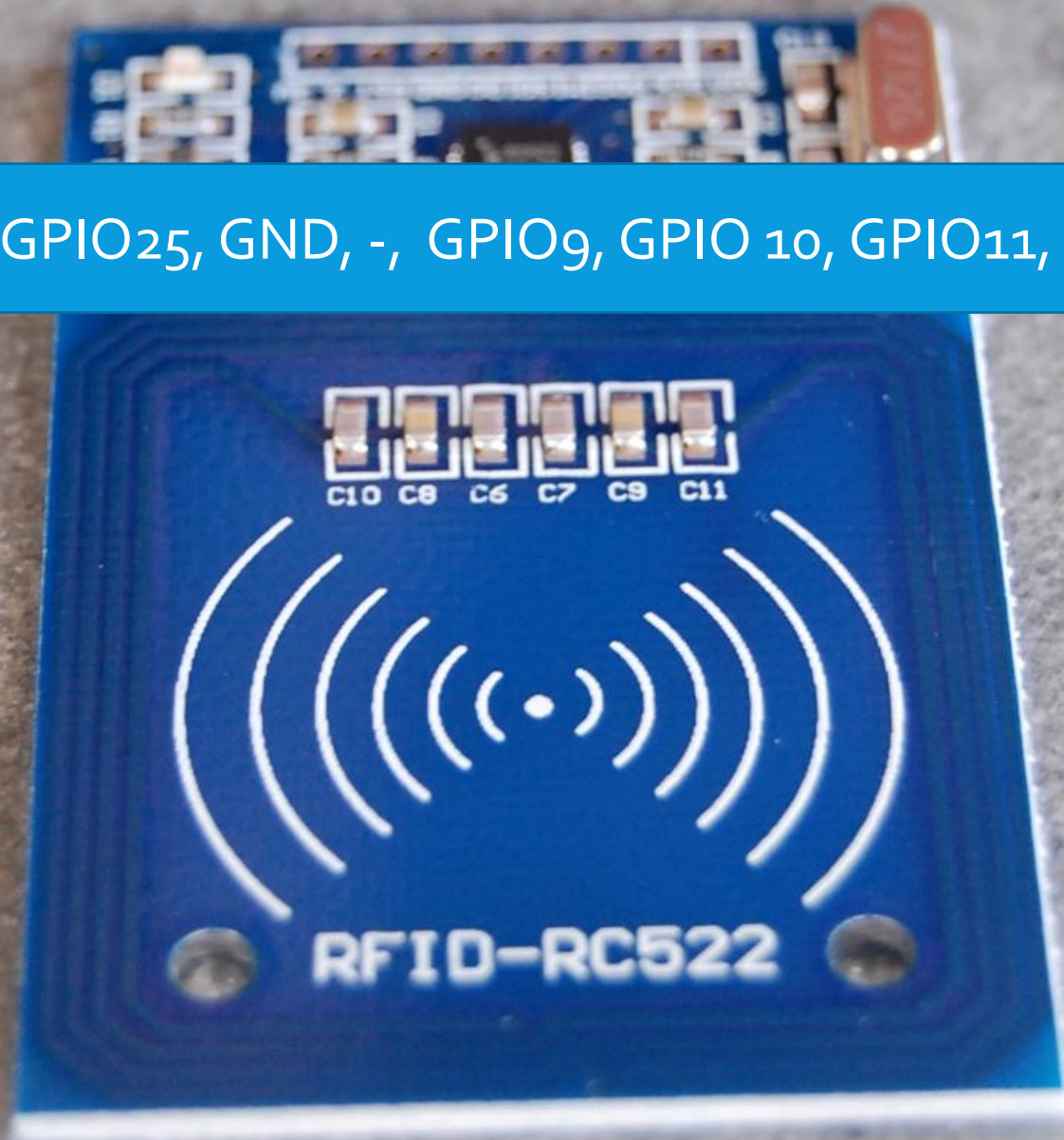

```
@Path("train")
public class TrainService {
    @GET
    @Path("{channelParam}/forward/{speedParam}")
    public void forward(@PathParam("channelParam") String channel,
        @PathParam("speedParam") String speed) {
        String command = "1";
        callURL(channel, command, speed);
    }

    private void callURL(String channel, String command, String speed) {
        StringBuilder result = new StringBuilder();
        result.append("http://127.0.0.1/cgi-bin/test/?ch=");
        result.append(channel);
        result.append("&out=1&cmd=");
        result.append(command);
        if (speed != null) {
            result.append("&spd=");
            result.append(speed);
        }
        URL url = new URL(result.toString());
        InputStream is = url.openStream();
    }
}
```

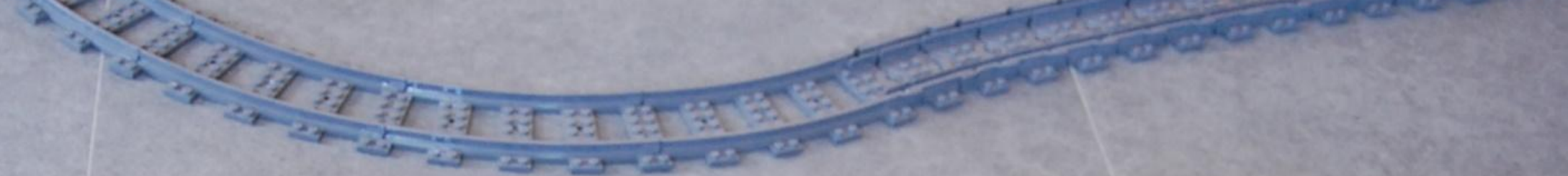
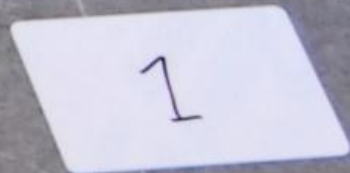
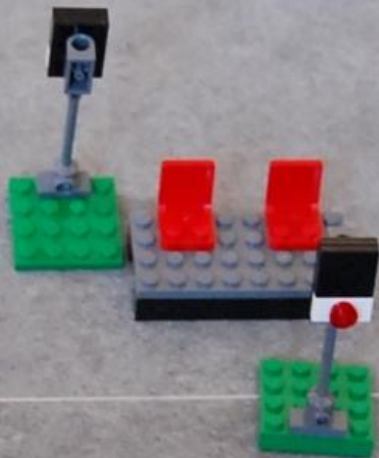
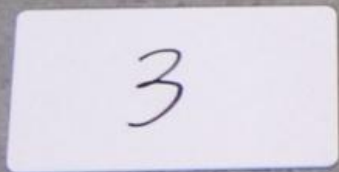


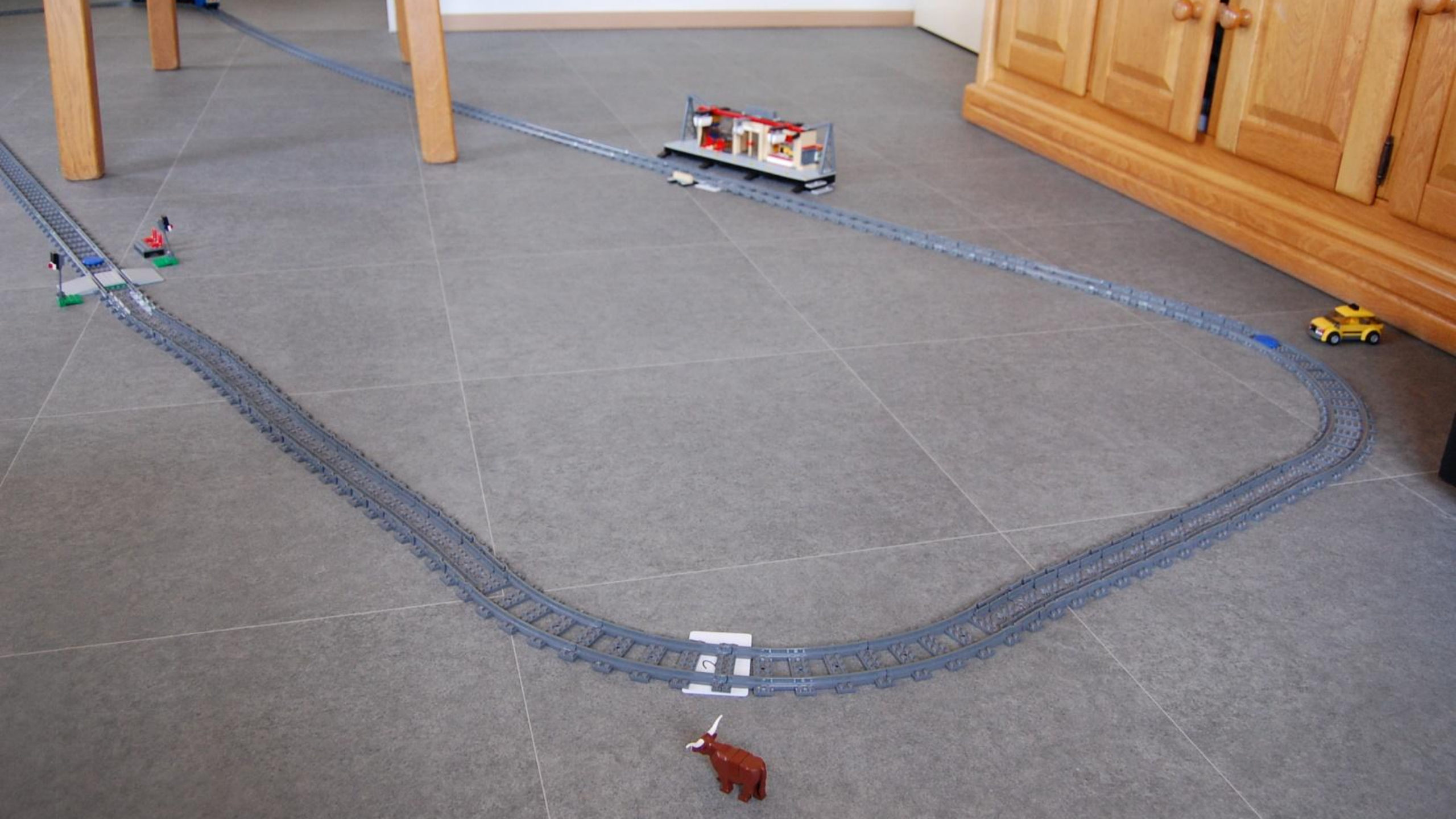
Sound

3.3 V, GPIO25, GND, -, GPIO9, GPIO 10, GPIO11, GPIO 8



RFID



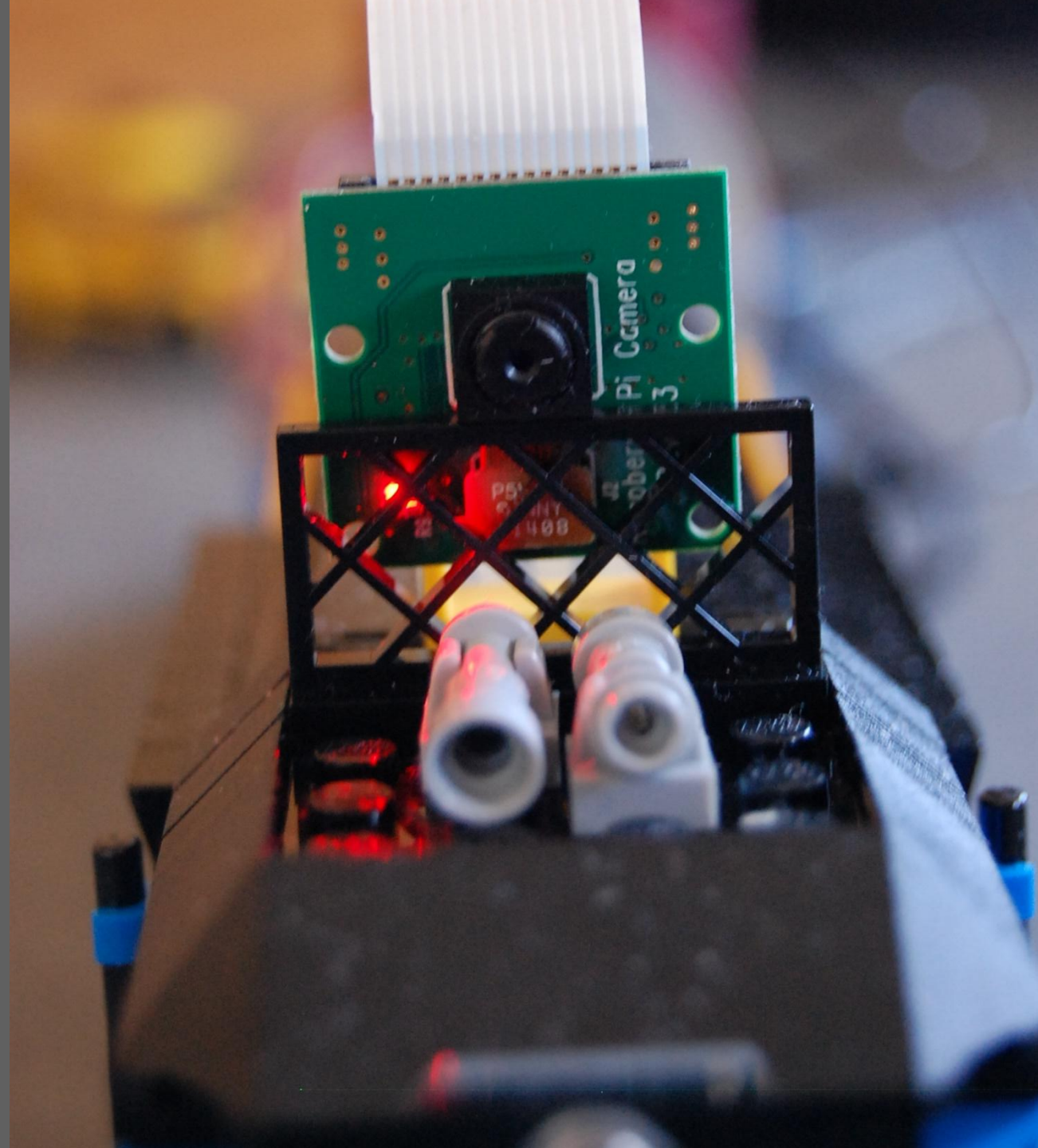


CONFIGURE RFID READER

- Execute action after reading specific RFID
 - [a419d15f] curl http://localhost:8080/.../a419d15f
 - [f2d98c45] curl http://localhost:8080/.../f2d98c45
- Use /etc/rc.local to start the RFID reader on boot

A photograph of a LEGO Technic race track set up on a grey carpeted floor. The track is made of black Technic beams and has several small LEGO cars with colorful minifigures on it. In the background, there is a window with a potted plant on the sill, a wooden table with legs, and a white flag on a pole. A large green circle with a thin blue border is overlaid on the image, containing the word "Camera" in white text.

Camera





record video start

record image

timelapse start

motion detection start

stop camera

Download Videos and Images

Settings

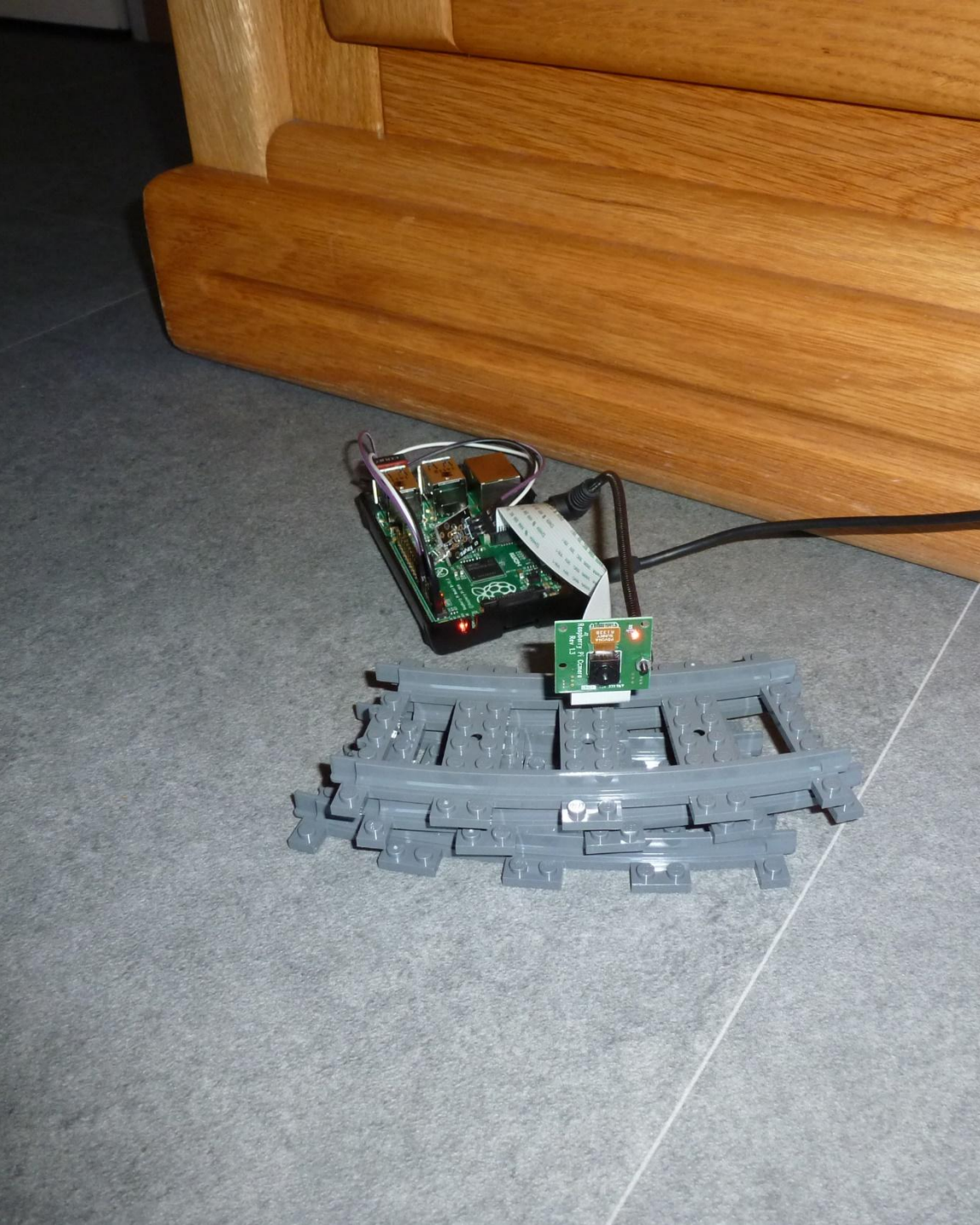
System

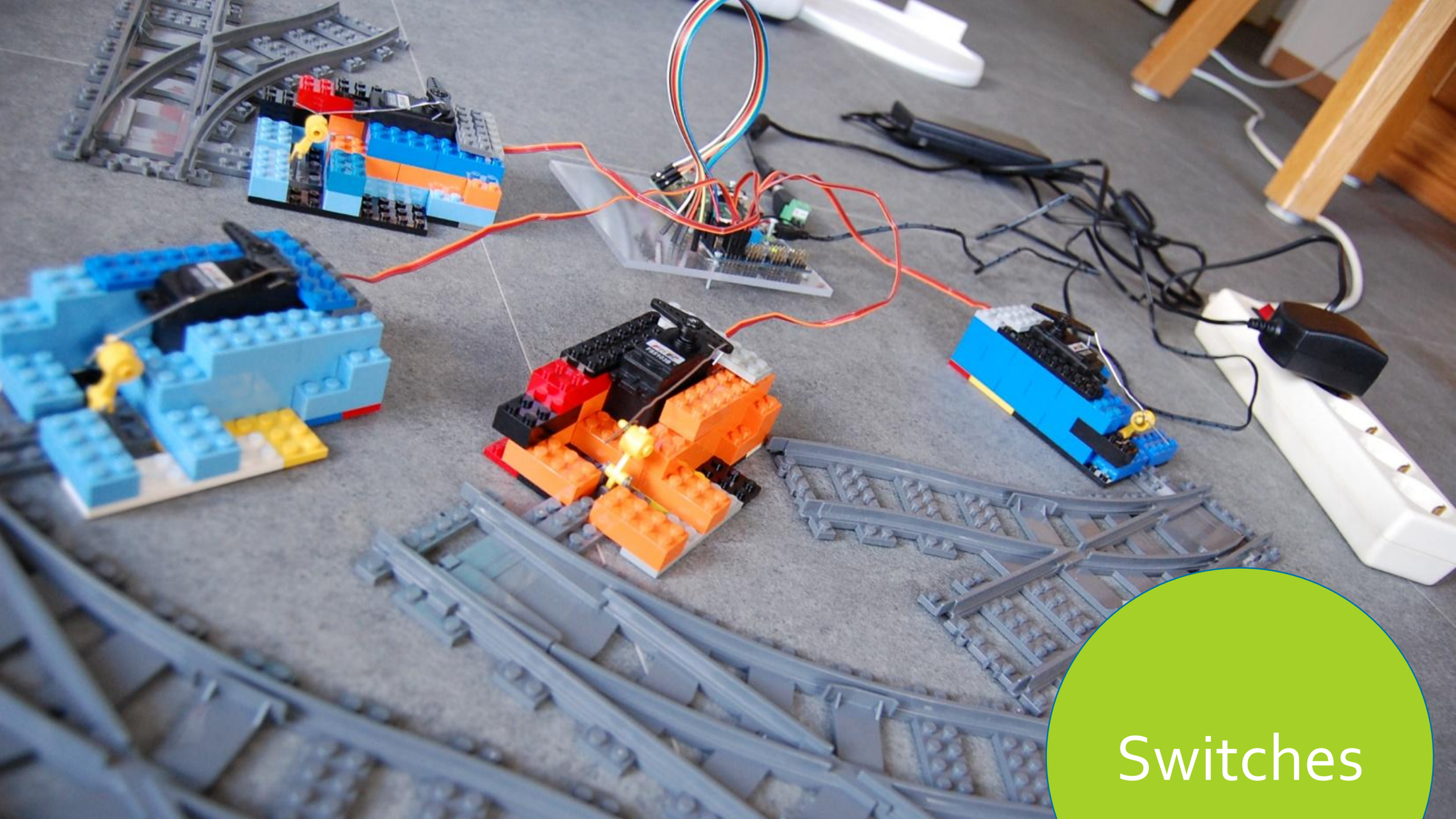
RPI CAM WEB INTERFACE

```
<!DOCTYPE html>
<html>
  <head>
    <title>RPi Cam Preview</title>
    <script src="script_min.js"></script>
  </head>
  <body onload="setTimeout('init();', 100);">
    <center>
      <div><img id="mjpeg_dest" /></div>
    </center>
  </body>
</html>
```




Overview
camera





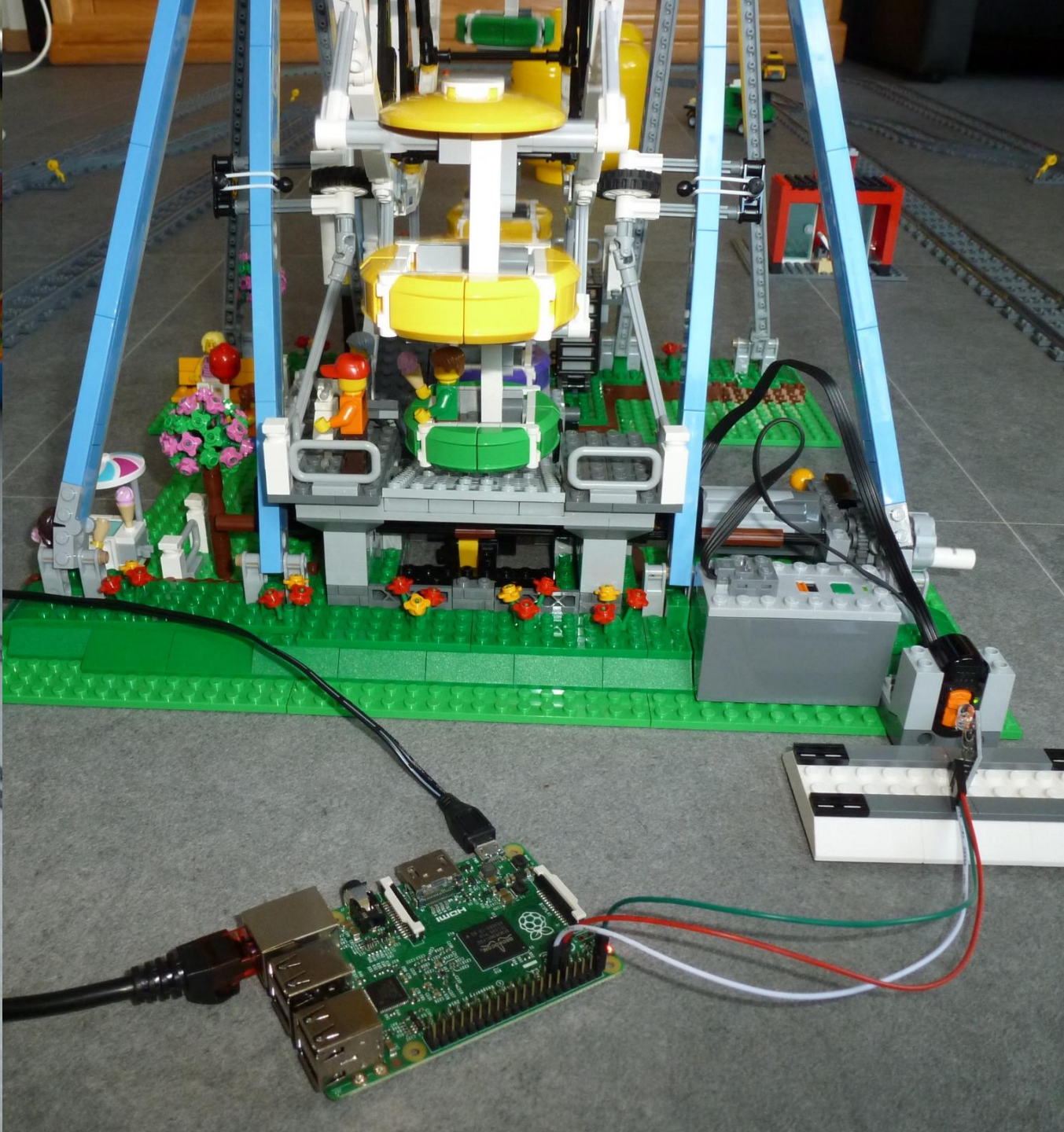
Switches

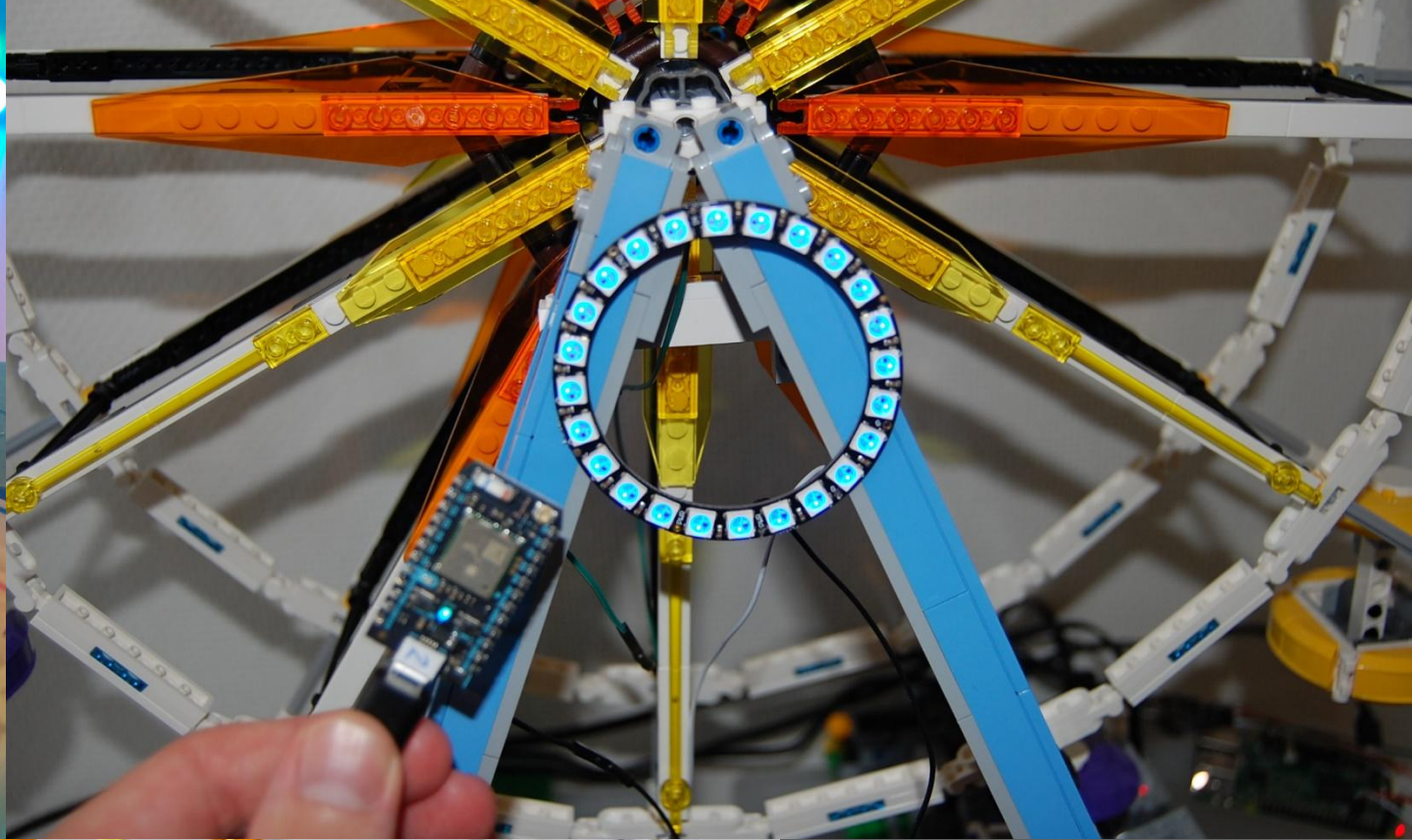
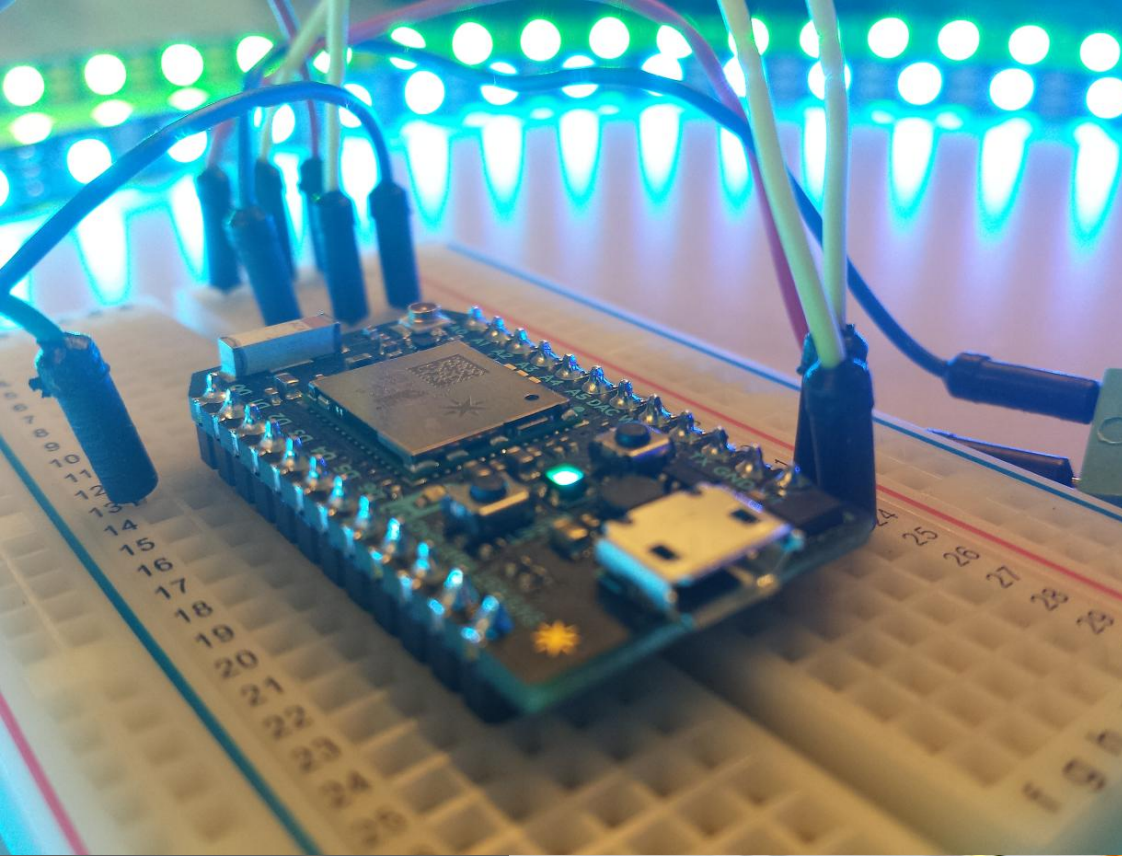
INGREDIENTS

- Raspberry Pi A+
- Adafruit Servo Driver PCA9685
- 60W adapter Volt
- FeeTech FS5103B servo's
- Some cables
- Paperclips




```
private void sendCommandToSwitch(String switchid,  
    String direction) {  
    String[] cmd = {  
        "python",  
        ".../Servo_Example.py", switchid, direction  
    };  
    Runtime.getRuntime().exec(cmd);  
}
```






Particle Devices


Photon

1 >

 4 >

cranky_banjo >

cranky_hoosier >

hunter_cranky  >

zombie_penguin >

jim.ino

```
1 #include "application.h"
2 #include "neopixel/neopixel.h"
3
4 SYSTEM_MODE(AUTOMATIC);
5
6 // IMPORTANT: Set pixel COUNT, PIN and TYPE
7 #define PIXEL_PIN D0
8 #define PIXEL_COUNT 24
9 #define PIXEL_TYPE WS2812B
10
11 Adafruit_NeoPixel strip = Adafruit_NeoPixel(PIXEL
12
13 uint16_t brightness = 100; // Niet gebruikt?
14 const uint32_t red = strip.Color(255,0,0);
15 const uint32_t green = strip.Color(0,255,0);
16 const uint32_t blue = strip.Color(0,0,255);
17
18 int direction = -1; //-1, 0 or 1
19 int offset = 0;
20 int speed = 1;
21
22 bool displayRainbow = false;
23 int rainbowDelay = 20;
24
25 /**
26  * Roep setSpeed aan met een waarde tussen -PIXE
27  * Bijvoorbeeld:
28  * curl https://api.particle.io/v1/devices/<devi
29  *
```


LTCC APPLICATION

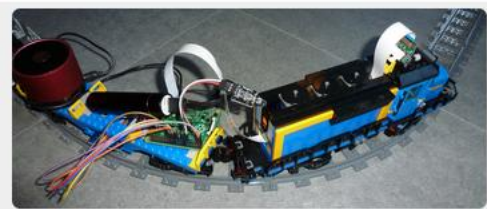
LTCC

Control trains

Auto Pilot

Overview cam

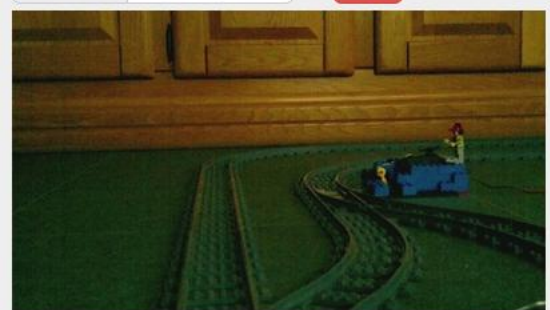
Cargo train cam



Speed 0



Speed 0



AUTOPILOT APPLICATION

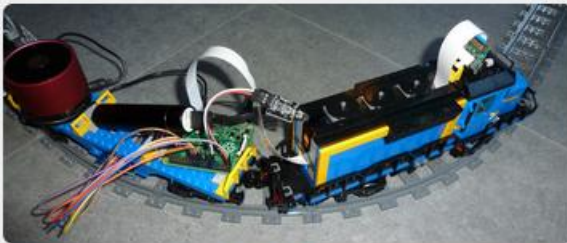
LTCC

Control trains

Auto Pilot

Overview cam

Cargo train cam



| Type | Command | Argument |
|-------|----------------------------|----------|
| speed | 3 | 5 |
| speed | 0 | 3 |
| sound | train-crossing-bell-01 | |
| speed | -3 | 15 |
| speed | 0 | 5 |
| sound | train-pass-by-03 | |
| speed | 3 | 12 |
| speed | 0 | 3 |
| sound | steam-locomotive-depart-01 | |

Short example Long example No sound example



| Type | Command | Argument |
|-------|---------|----------|
| speed | 3 | 5 |
| speed | 0 | 3 |
| speed | -3 | 15 |
| speed | 0 | 5 |
| speed | 3 | 12 |
| speed | 0 | 3 |

Short example Long example No sound example



SOFTWARE

- Twitter Bootstrap
- Angular Seed
- Angular
- Bower
- NPM
- Java
- Jersey
- Maven
- Libraries for RFID, infrared, servo's and camera

Challenges







ALKALINE
Rispettare la polarità (+/-). Non ricaricare.
Respecter les polarités + et -. Ne pas recharger.
Auf richtige Polarität achten. Nicht wiederaufladbar.
Made in Belgium

| | |
|----------|-------|
| AA | 1.5 V |
| MN1500 | LR6 |
| MAR 2019 | |

Best Before
MAR 2024
1.5 V
LR6

Best Before
MAR 2024

ACELL

ping is for







LINKSYS®

Wireless-G
Broadband Router
With 4-Port Switch

Model WRT54GL

Power Ethernet
WAN 1 2 3 4 Internet



SATEL





1806 km

KUTAISI
GEORGIA

8900 km

OKAZAKI

КОШИЦЕ
СЛОВАКИЯ

1096 km

1921 km

DAEGU
KOREA

БЪРНО
ЧЕХИЯ

1000 km

7800 km

GYUMRI
ARMENIA

ПОЗНАН
ПОЛША

2435 km

403 km

LUOYANG
CHINA

САНКТ-ПЕТЕРБУРГ
РУСИЯ

9 km

TURK

ШУВО
МАКЕДОНИЈА

324 km





Jiří Sovák

Politika ekonomie

VAČ CASU

LEONARD

Ján Čajka Vole kráľovny

CVAL RYTÍŘSKÝCH KONÍ

VICHRIČE

SMEJCOVA

KEBY SOM MAL DIEVČA

Ian Feko

DVE LÁSKY NA ZACÁTEK

OTTO MEINIC

PAINEN - MÁ PANENKA

D. HAMMETT VRAŽEDNÉ POVIČKY

KAŇA - VÁLKOU NARUŠENÍ

ERICH FROM

SLEČNA ZO SCUDERI

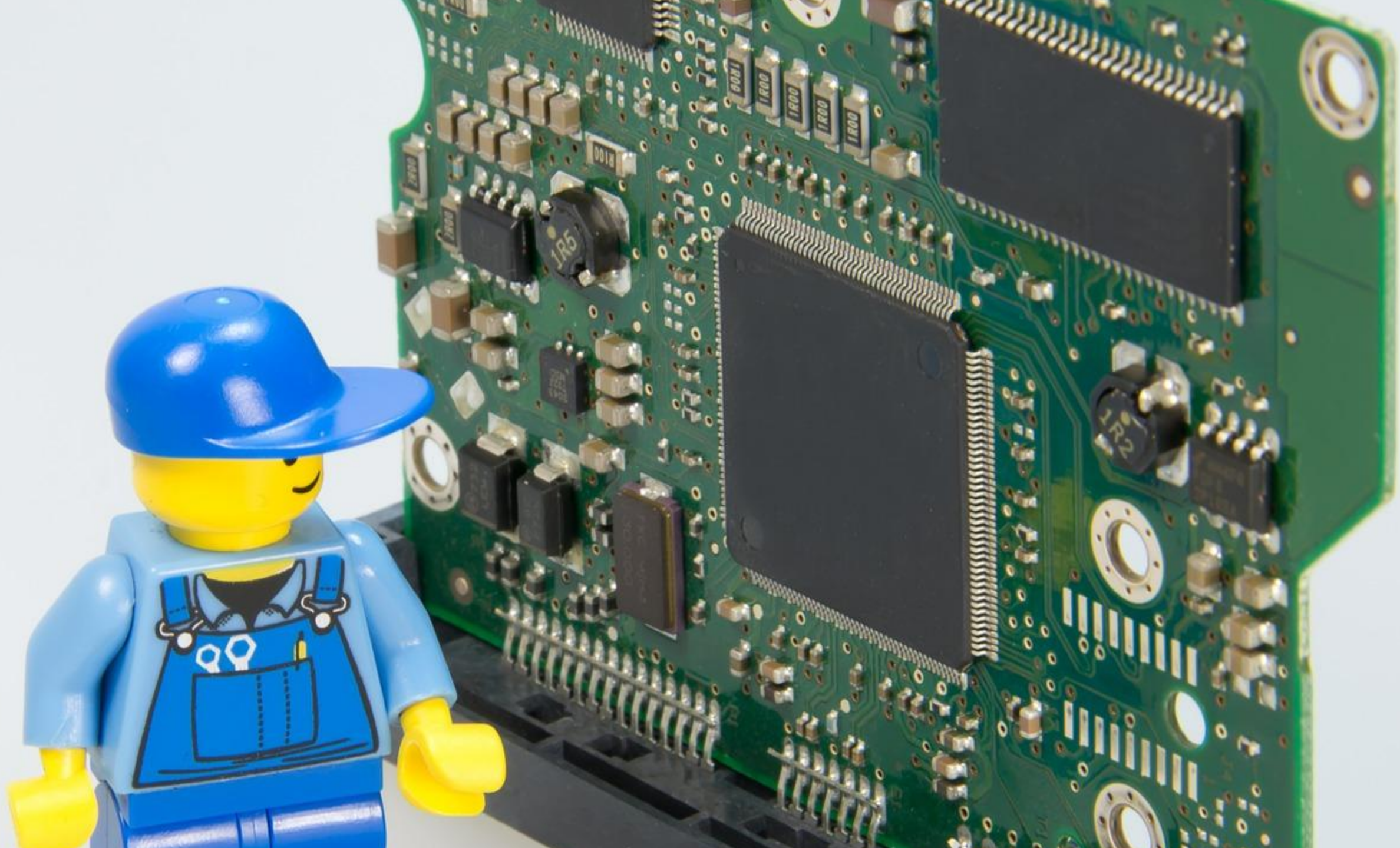




PERSUADE YOUR MANAGER TO GET SOME TIME FOR A FUN PROJECT

- Fun
- HR and recruitment
- Discover
- Innovate





SCALA AND AKKA





LTCC
(Angular)



LTCC
(Scala/Akka)

RPi-Cam-Web-Interface
(C)



DeviceControl
(Scala/Akka)



SwitchControl
(Scala/Akka)

Leds with Photon
(C)

Infrared
(C and LIRC)

RFID
(C)

Servo
(Python)


```
class Coordinator extends Actor {  
  def receive = {  
    case mymessage =>  
      println(mymessage)  
  }  
}
```

```
implicit val system = ActorSystem("ExampleActorSystem")  
  
val coordinatorActorRef = system.actorOf(Props[Coordinator])  
coordinatorActorRef ! "Hello jfokus"
```

```
val coordinatorActorRef =  
system.actorOf(Props[Coordinator])  
coordinatorActorRef ! "Hello jfokus"
```



```
val coordinatorActorRef =  
    context.actorSelection("akka.tcp://  
        ExampleActorSystem@127.0.0.1:9005  
        /user/coordinatorActor")  
coordinatorActorRef ! "Hello jfokus"
```



```
akka {  
  actor {  
    provider =  
      "akka.remote.RemoteActorRefProvider"  
  }  
  remote {  
    enabled-transport =  
      ["akka.remote.netty.tcp"]  
    netty.tcp {  
      hostname = "127.0.0.1"  
      port = 9002  
    }  
  }  
}
```

LEGO

BACK TO THE FUTURE™

Ages/edades

10+

21103

401
pcs/pzs

Building Toy
Jouet de Construction
Juguete para Construir





<https://github.com/wmeints/ReactivePI>



COLLISION DETECTION



- Ultrasonic module: HC-SR04
- <http://www.modmypi.com/blog/hc-sro4-ultrasonic-range-sensor-on-the-raspberry-pi>



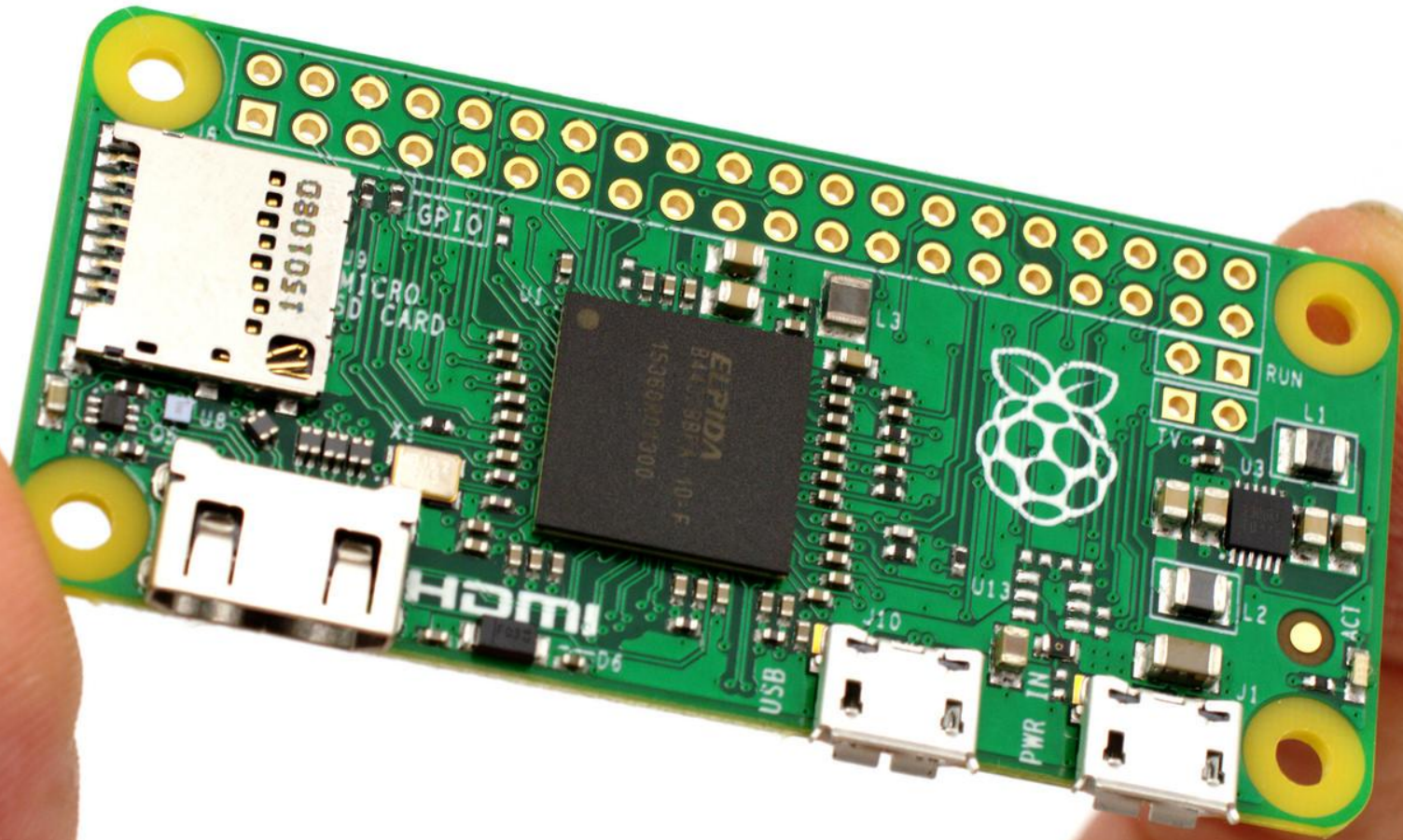
WIRELESS PARKING CHARGE



WIRELESS PARKING CHARGE



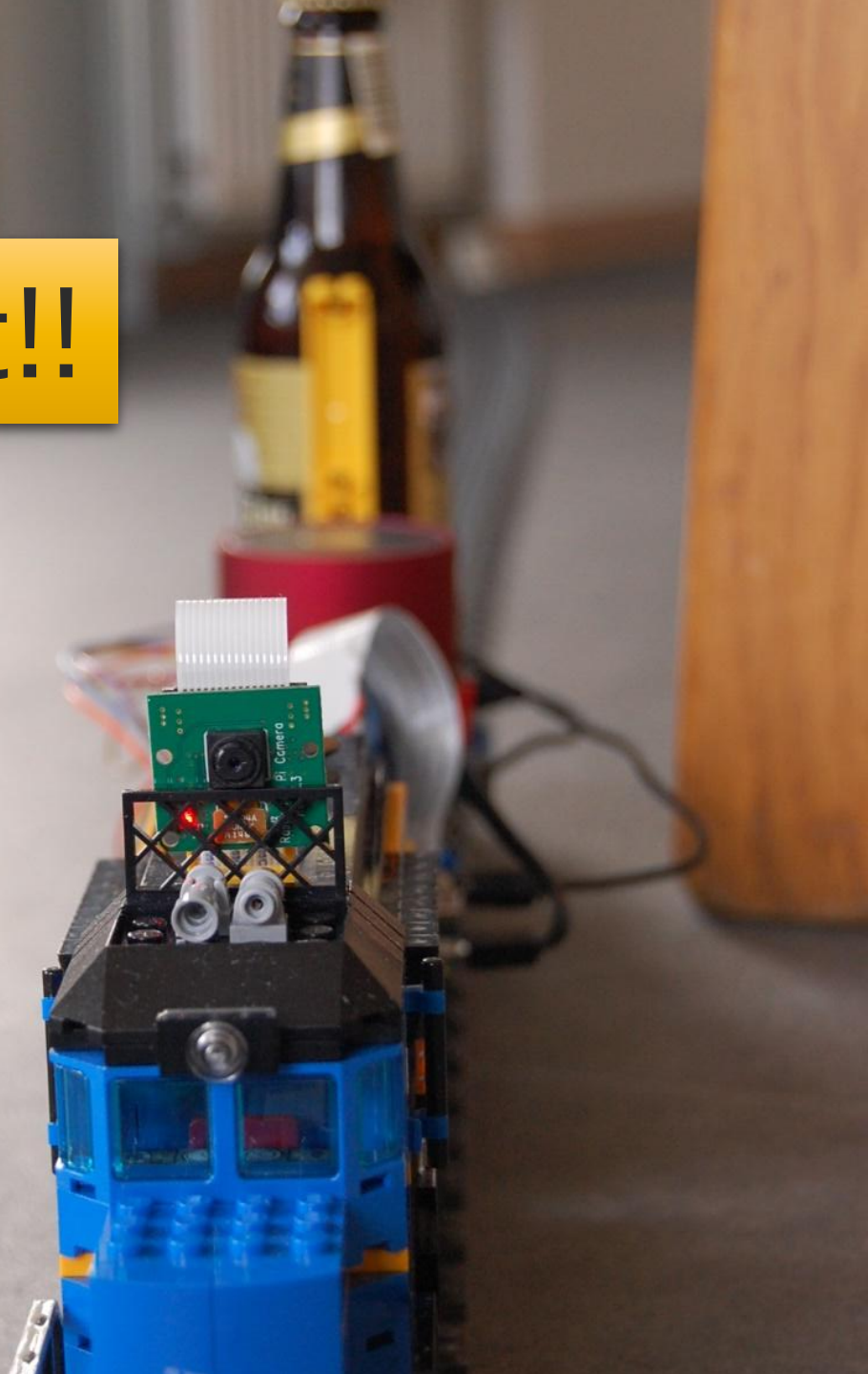
非接触



CONCLUSION



The best part!!



QUESTIONS?



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