GDAŃSK UNIVERSITY OF TECHNOLOGY

Karunya INSTITUTE OF TECHNOLOGY AND SCIENCES
Declared as Deemed-to-be University under sec. 3 of UGC Act, 1956
Karunya Nagar, Coimbatore 641 114, Tamil Nadu, India.

„Robotics in India”
Intelligent Robot - Remote Car project

by Bartłomiej Borzyszkowski (Poland)

Gdansk University of Technology (ETI)
Karunya Institute of Technology and Sciences (IE)

About the author

Bartłomiej Borzyszkowski

- Control Engineering and Robotics (BSc) student (ETI) at Gdansk University of Technology, Poland.
- Scientific intern with the IAESTE program at Karunya Institute of Technology and Sciences, Coimbatore - India.
- Gradient Science Club - artificial intelligence developer.
- IAESTE Poland IT Coordinator and Job Raising member.

GDAŃSK UNIVERSITY OF TECHNOLOGY

"Robotics in India"

by Bartłomiej Borzyszkowski

GDAŃSK UNIVERSITY OF TECHNOLOGY

Karunya INSTITUTE OF TECHNOLOGY AND SCIENCES

„Robotics in India" – Intelligent Robot project

by Bartłomiej Borzyszkowski

Gdańsk and Technology

GDAŃSK UNIVERSITY OF TECHNOLOGY

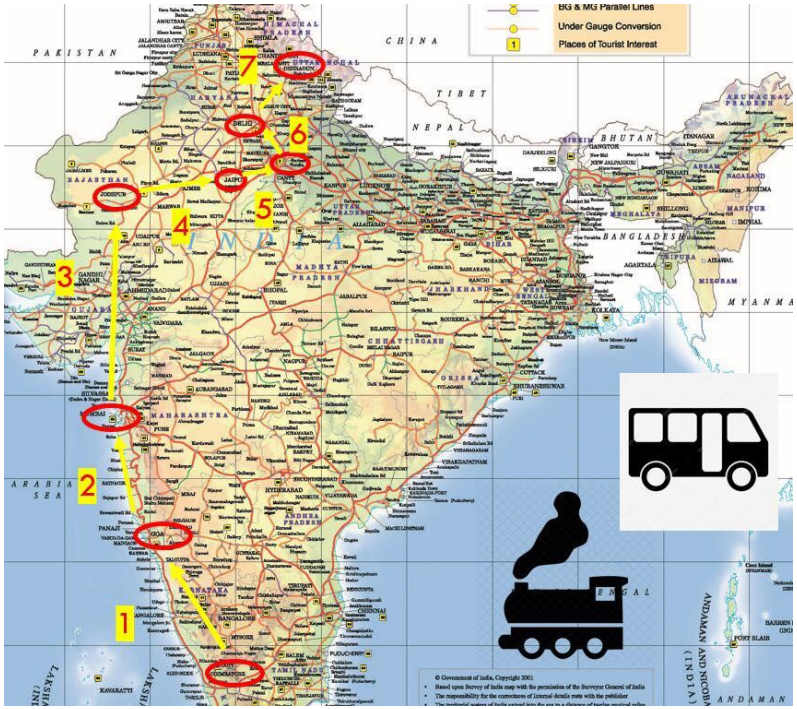
Karunya INSTITUTE OF TECHNOLOGY AND SCIENCES

„Robotics in India" – Intelligent Robot project

by Bartłomiej Borzyszkowski

Project introduction

- 8 week internship at the Karunya Instrumentation Department under the supervision of Dr. K. Rajasekaran with an assistance of Mr. J. Chinnadurai.
- Creating and developing of the intelligent robot, remote/self-driving car.
- Cooperation in the international engineering team.



Besides the work:

- Over 3 week travel adventure including: Goa, Mumbai, Jodhpur, Jaipur, Delhi, Agra, Haridwar, Rishikesh, Ganges, Himalayas.
- Exploration of India, discovery of the rich culture, unique cuisine, wild nature and diverse environment of the country.

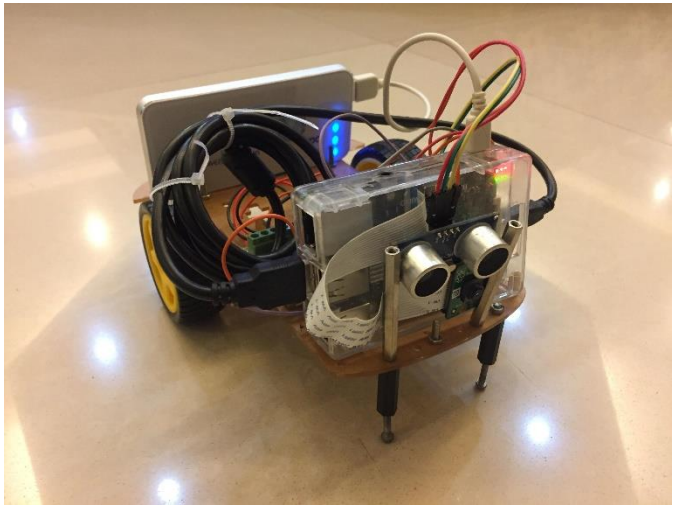
Project introduction

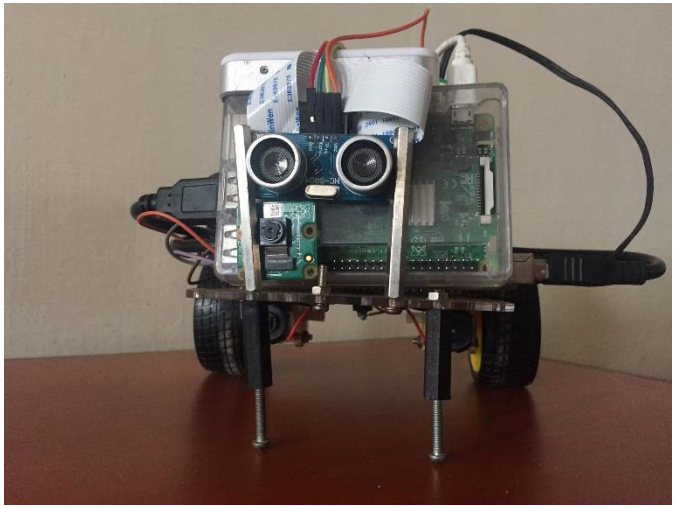
GitHub repository:

- github.com/Borzyszkowski/Robotics-in-India-Intelligent-Robot

Crowdfunding campaigns and the full internship description:

- zrzutka.pl/robotics **(Polish)**
- youcaring.com/robotics **(English)**





Scientific internship at the Karunya Institute of Technology and Sciences in Coimbatore, India. Development of an intelligent, remote/self-driving car based on Raspberry Pi, ultrasonic sensors, camera and Arduino (Python + OpenCV with neural networks and digital image processing). Vehicle capable of recognizing traffic lights, road signs and obs...

Edit

Add topics

84 commits | 1 branch | 0 releases | 3 contributors | BSD-2-Clause

Branch: master | New pull request | Create new file | Upload files | Find file | Clone or download

This branch is 50 commits ahead, 28 commits behind hamuchiwa:master. Pull request | Compare

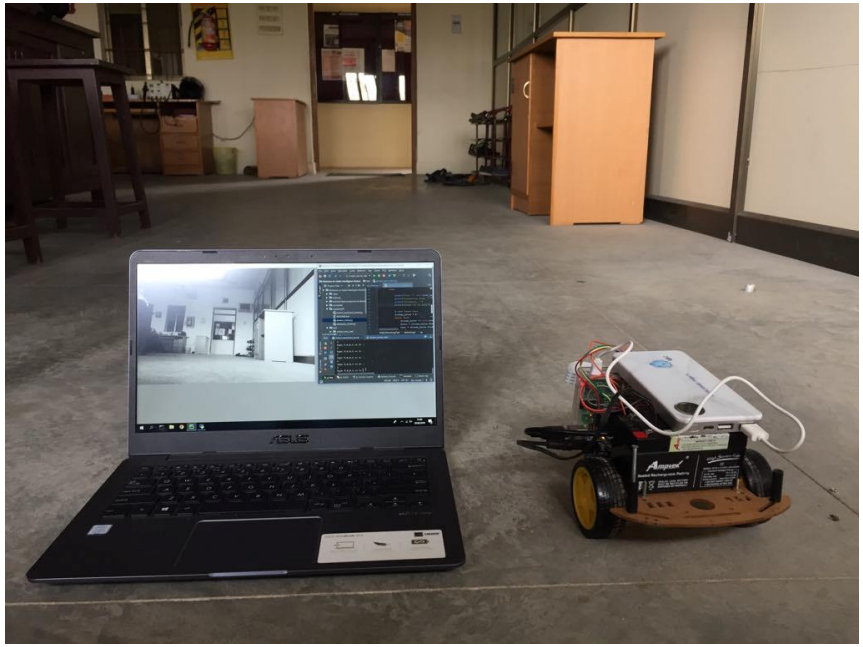
Borzyszkowski scheme — Latest commit 5d89e7c an hour ago

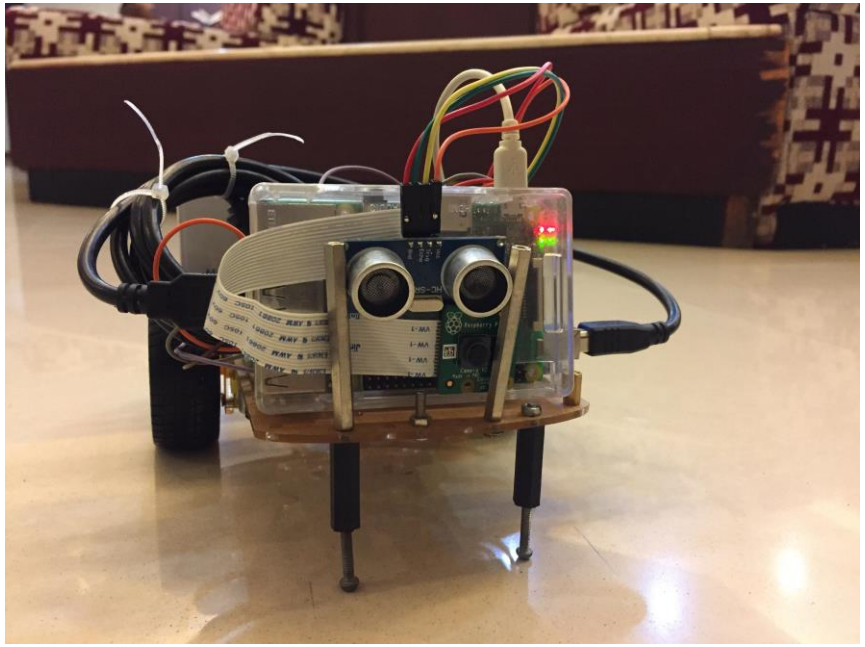
.idea	scheme	an hour ago
Multimedia and Sources	scheme	an hour ago
Traffic_signal	Traffic_Signal	2 years ago
arduino tests programs by Bartek Borzyszkowski	Ultrasonic change	10 days ago
arduino	Create README.md	3 years ago
computer	keyboard server/client	12 days ago
raspberryPi	keyboard client	11 days ago
test	readme	a day ago
venv	init	19 days ago
.gitattributes	init	19 days ago
Agenda for the workshop by Borzyszkowski Bartlomiej.jpg	multimedia	a day ago
LICENSE.md	Create LICENSE.md	3 years ago
README.md	scheme	an hour ago
Scheme.png	scheme	an hour ago
environment.yml	init	19 days ago
robot1.jpg	robotpic	a day ago
robot2.jpg	robotpic	a day ago

„Robotics in India" – Intelligent Robot project

by Bartłomiej Borzyszkowski

Robot overview

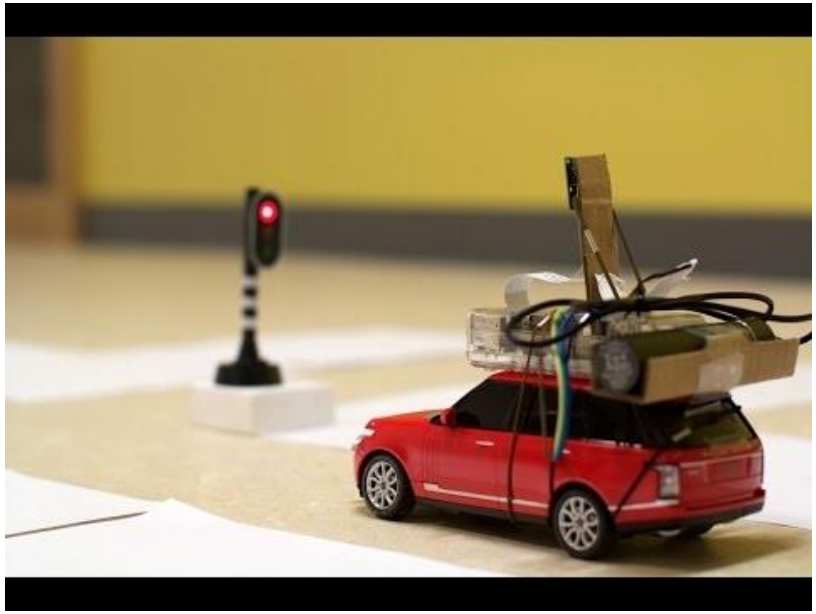


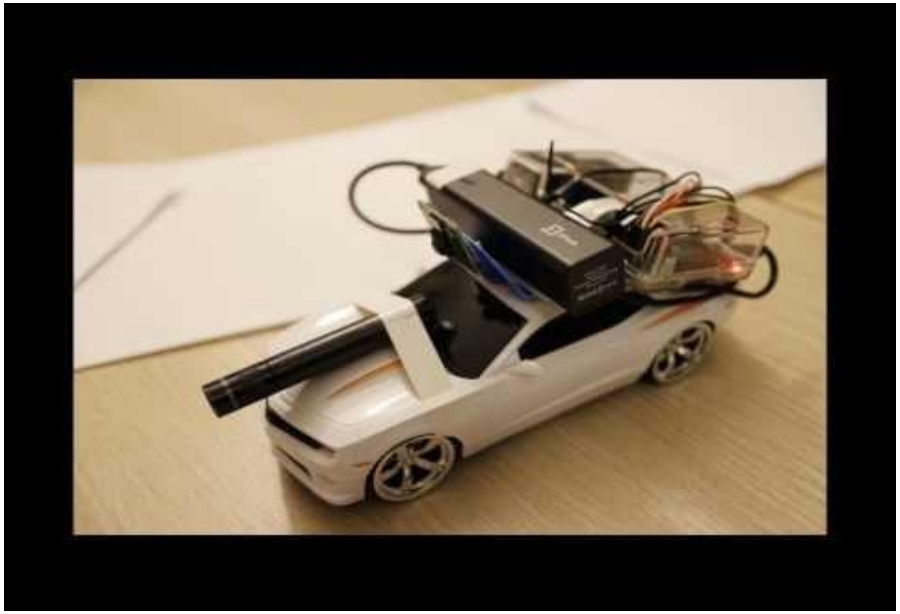


Inspiration

Zheng Wang Auto RC Car:

- github.com/hamuchiwa/AutoRCCar
- zhengludwig.wordpress.com/projects/self-driving-rc-car/



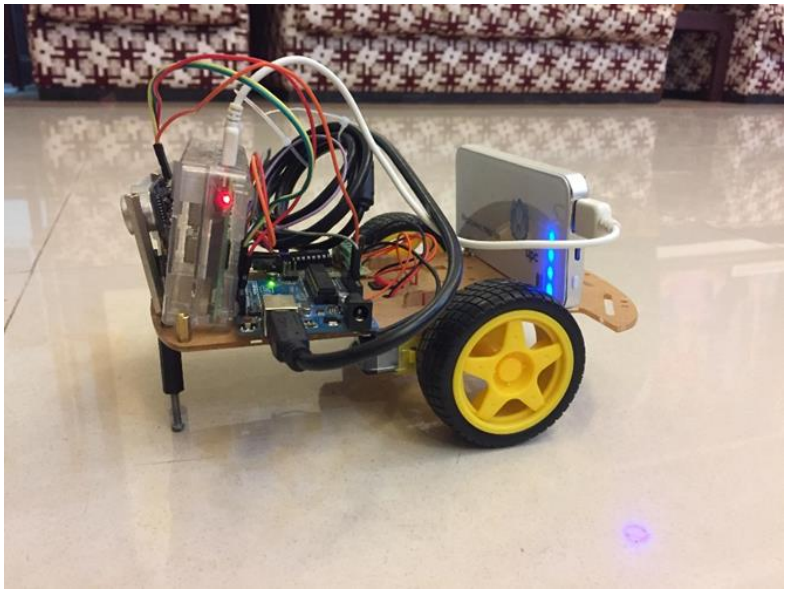


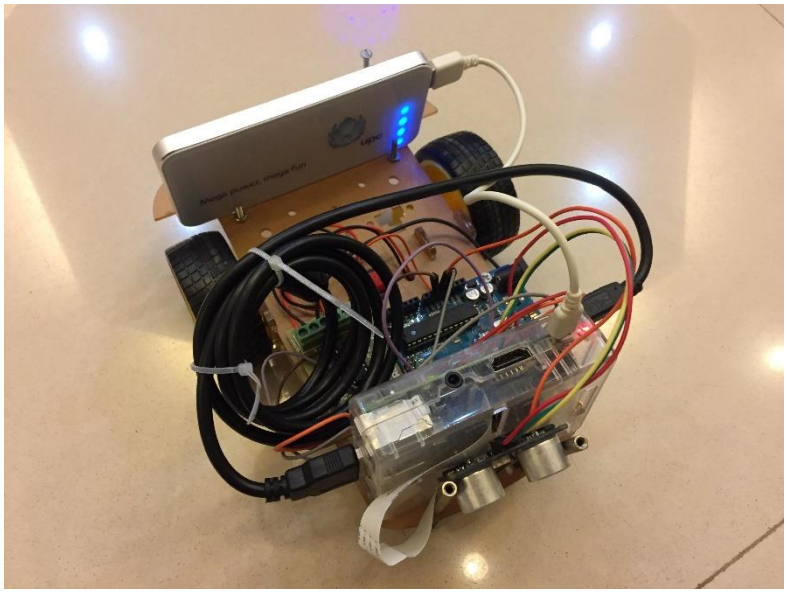
„Robotics in India" – Intelligent Robot project

by Bartłomiej Borzyszkowski

Functionality overview

- Remote control using laptop keyboard
- Camera display on the laptop
- Distance measurement thanks to ultrasonic sensor
- Steering (Forward, Backward, Right, Left, Stop)

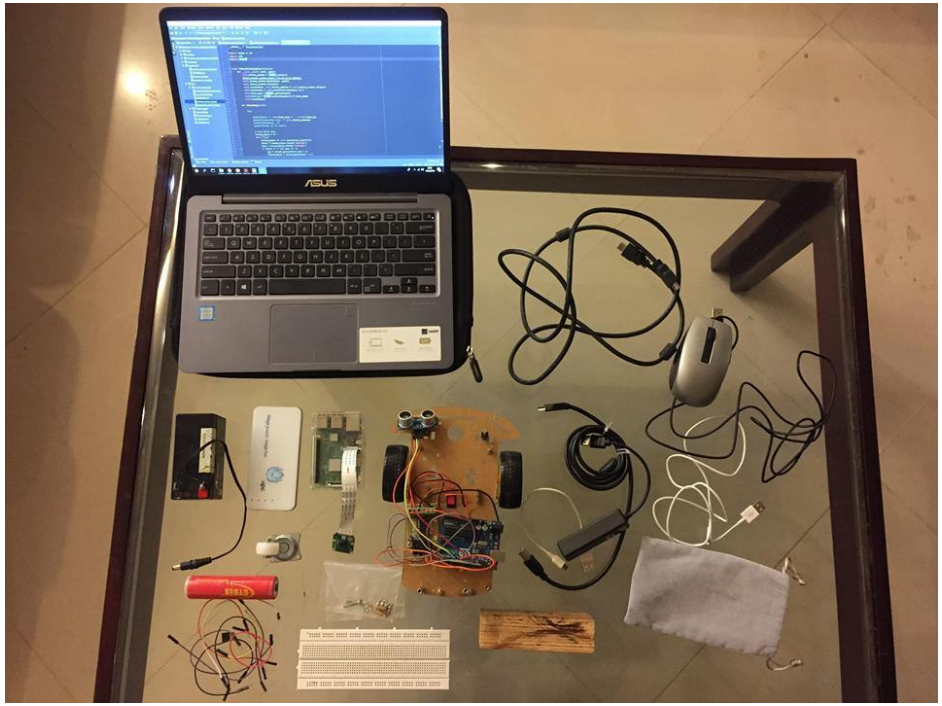




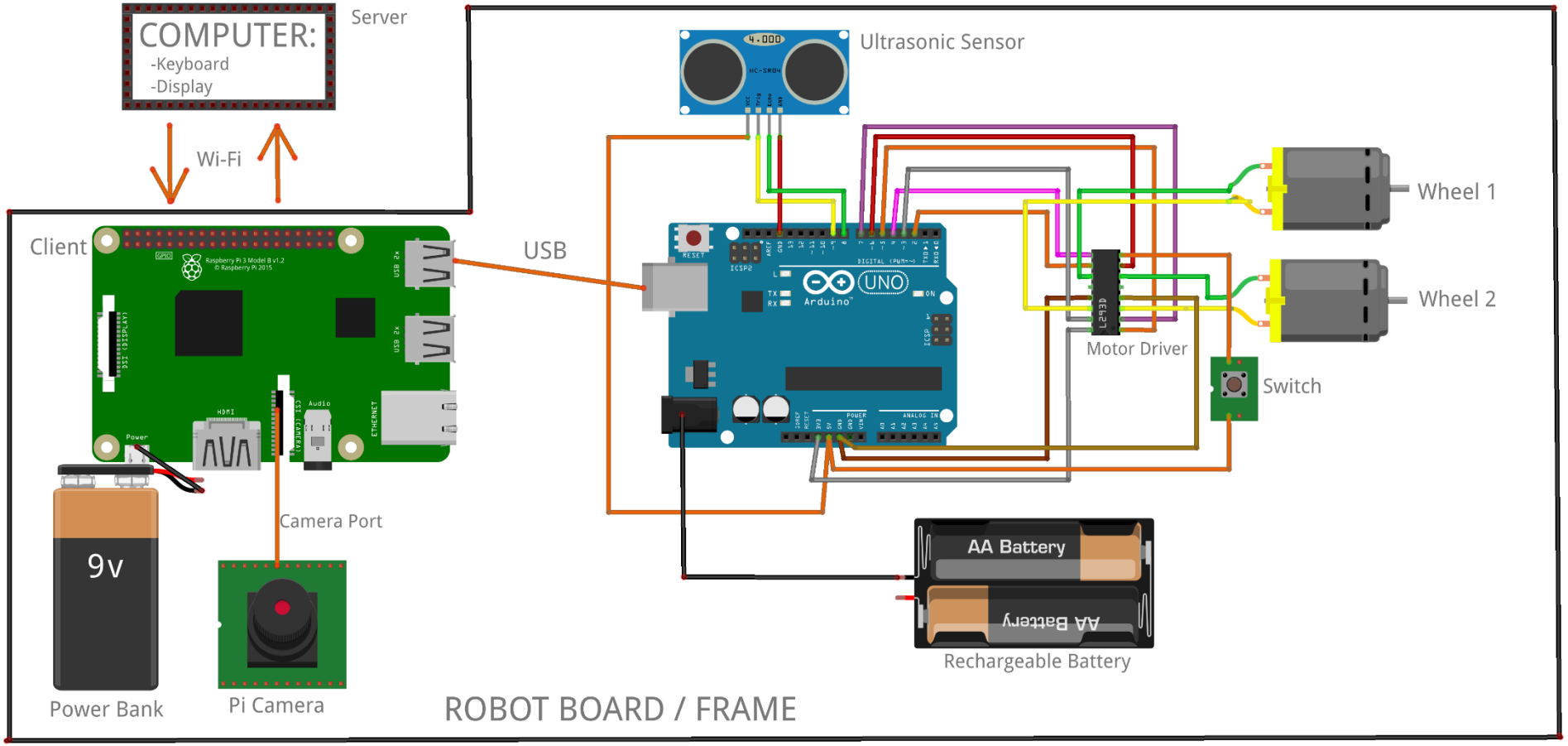
Construction details - components

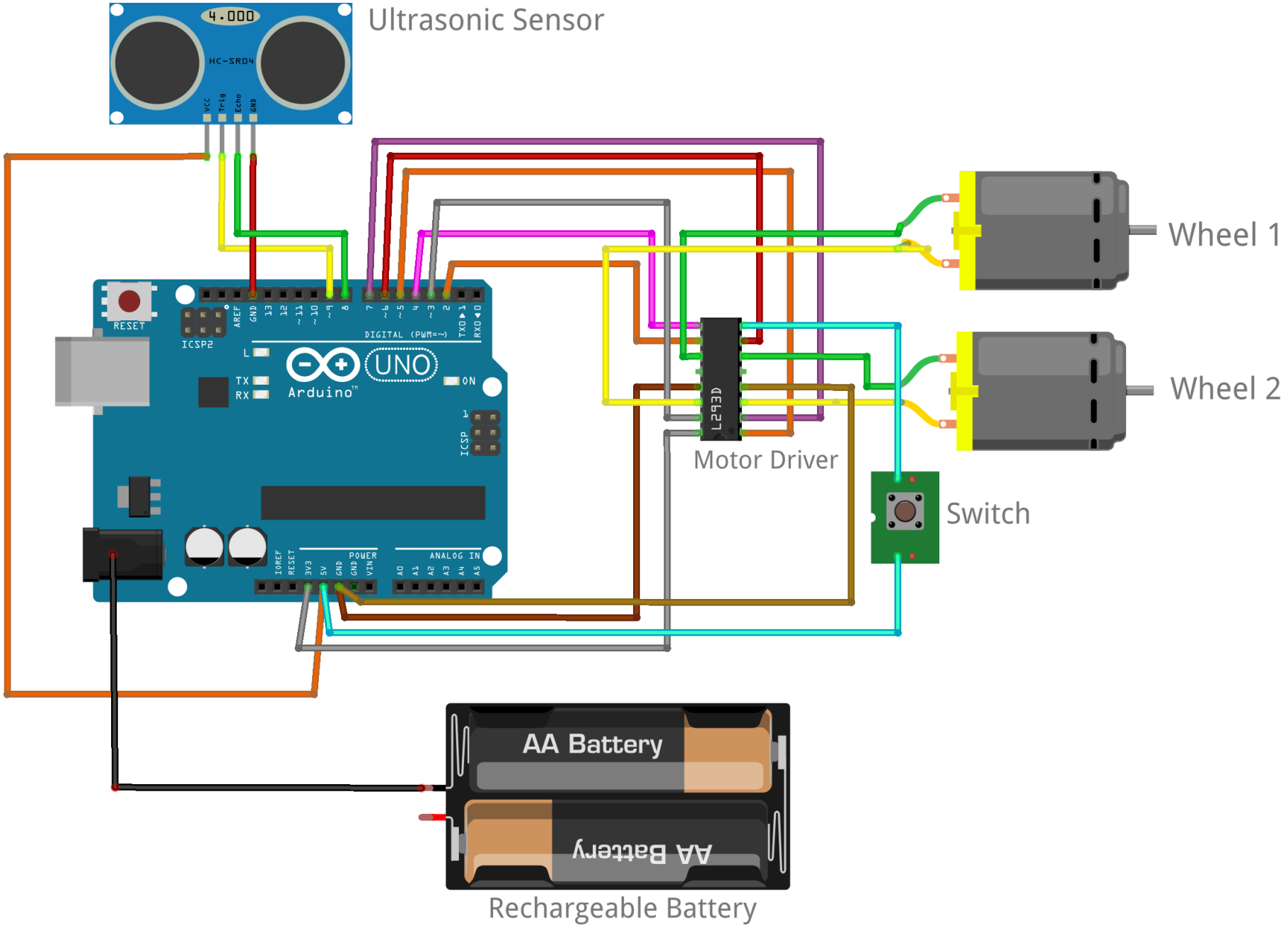
Project elements:

- Raspberry Pi 3 Model B
- Camera desired for the Raspberry Pi
- Arduino UNO
- Laptop/PC
- Ultrasonic sensor HC-SR04
- Motor driver L293
- 2 separate motors and 2 wheels
- Power supply (Power Bank)
- Robot board – car frame
- Cords/wires and a switch button
- Soldering equipement
- Wi-Fi network
- External display
- Programming environment and software



Construction details - architecture

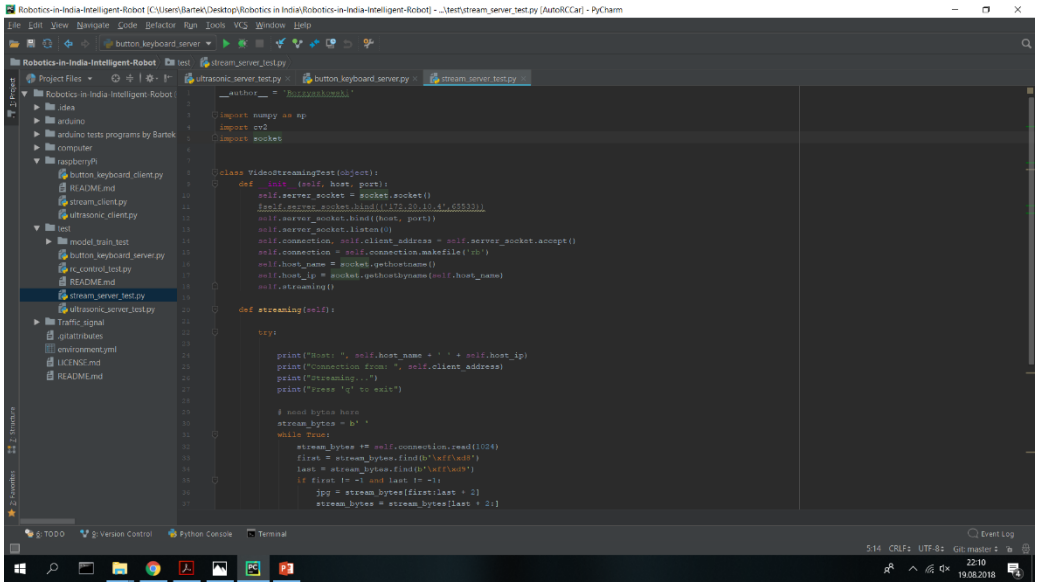


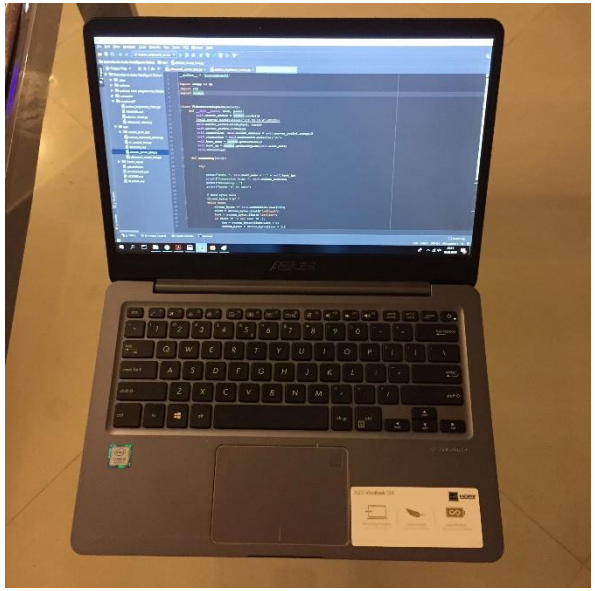

Ultrasonic Sensor
4.000
HC-SR04
VCC
Trig
Echo
GND
Wheel 1
Wheel 2
Motor Driver
L293D
Switch
RESET
ICSP2
UNO
Arduino
DIGITAL (PWM=~)
POWER
ANALOG IN
AA Battery
AA Battery
Rechargeable Battery

Construction details - Computer

Computer – laptop/PC:

- Working as a server for the Raspberry Pi (client) via Wi-Fi
- Collecting information about steering from the keyboard and forwarding it to the Raspberry Pi
- Receiving video from the Raspberry Pi and showing the display

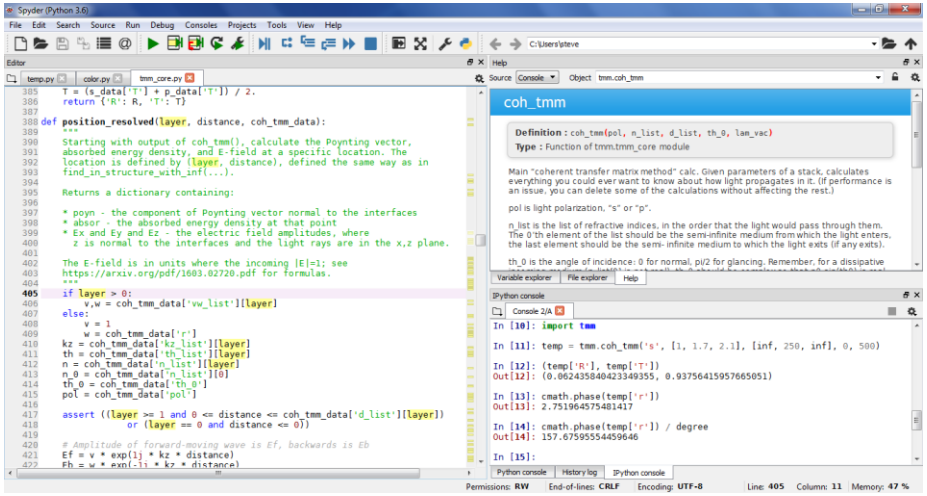


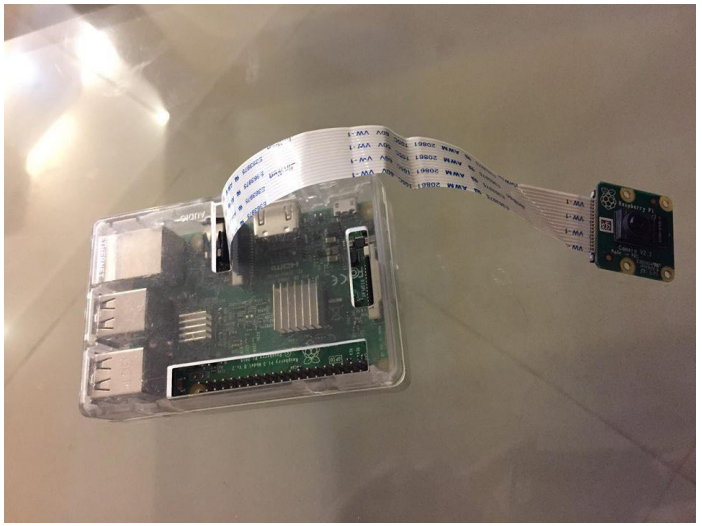


Construction details - Raspberry Pi

Raspberry Pi:

- Working as a client for the computer (server) via Wi-Fi
- Connected to the Arduino via USB
- Connected with the Pi camera
- Collecting information about steering from the computer (keyboard) and forwarding it to the Arduino
- Collecting data from the camera and sending it to the computer

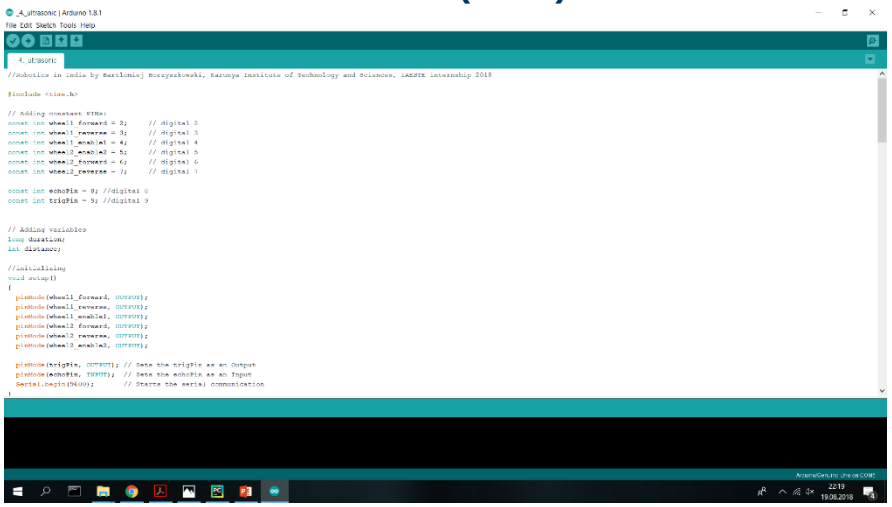


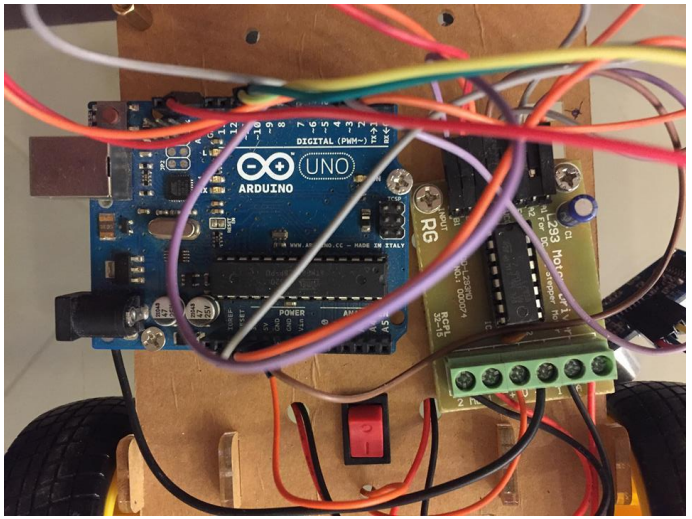


Construction details - Arduino

Arduino:

- Connected to the Raspberry Pi via USB
- Connected to the Motor Driver
- Connected to the ultrasonic sensor
- Receiving data for steering from the Raspberry Pi and forwarding information to the Motor Driver
- Receiving distance from the ultrasonic sensor and stopping the car in case of obstracle detection (front)





GDAŃSK UNIVERSITY OF TECHNOLOGY

Karunya INSTITUTE OF TECHNOLOGY AND SCIENCES

„Robotics in India” – Intelligent Robot project

by Bartłomiej Borzyszkowski

Software details

In the current project version to achieve the required result five programs should run in the same time.

Computer:

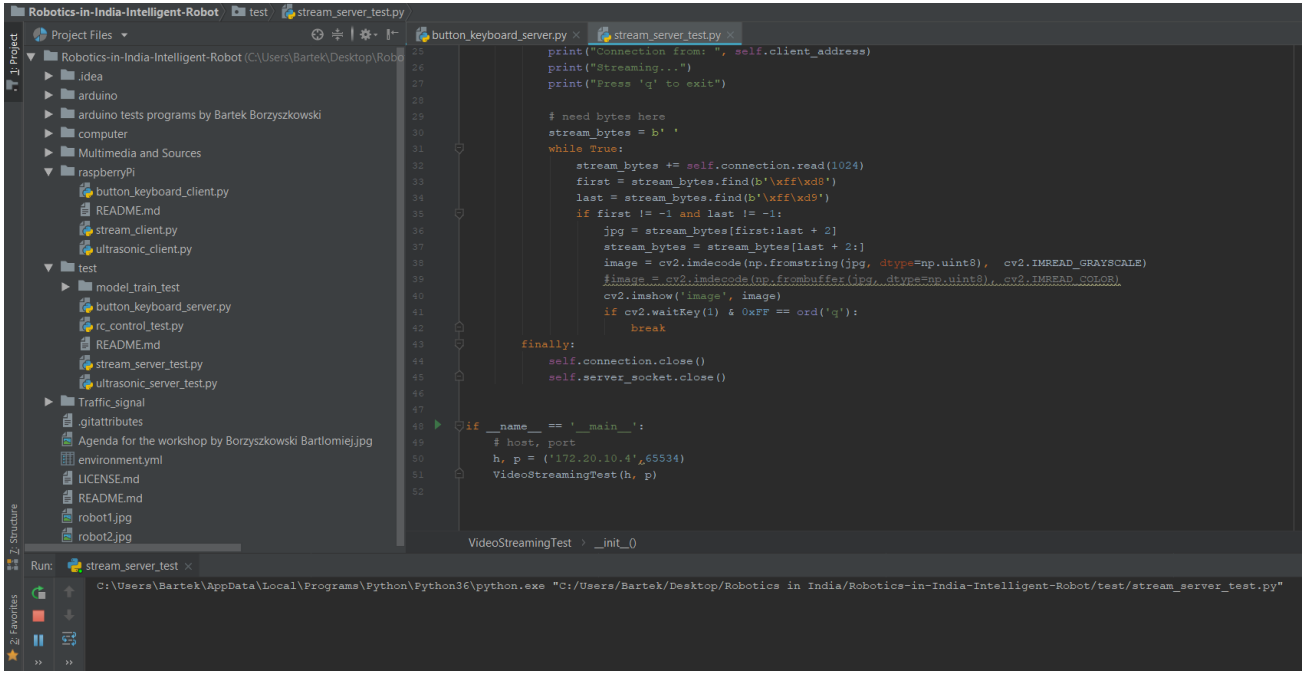
- 1.„button_keyboard_server.py”
- 2.„stream_server_test.py”

Raspberry Pi:

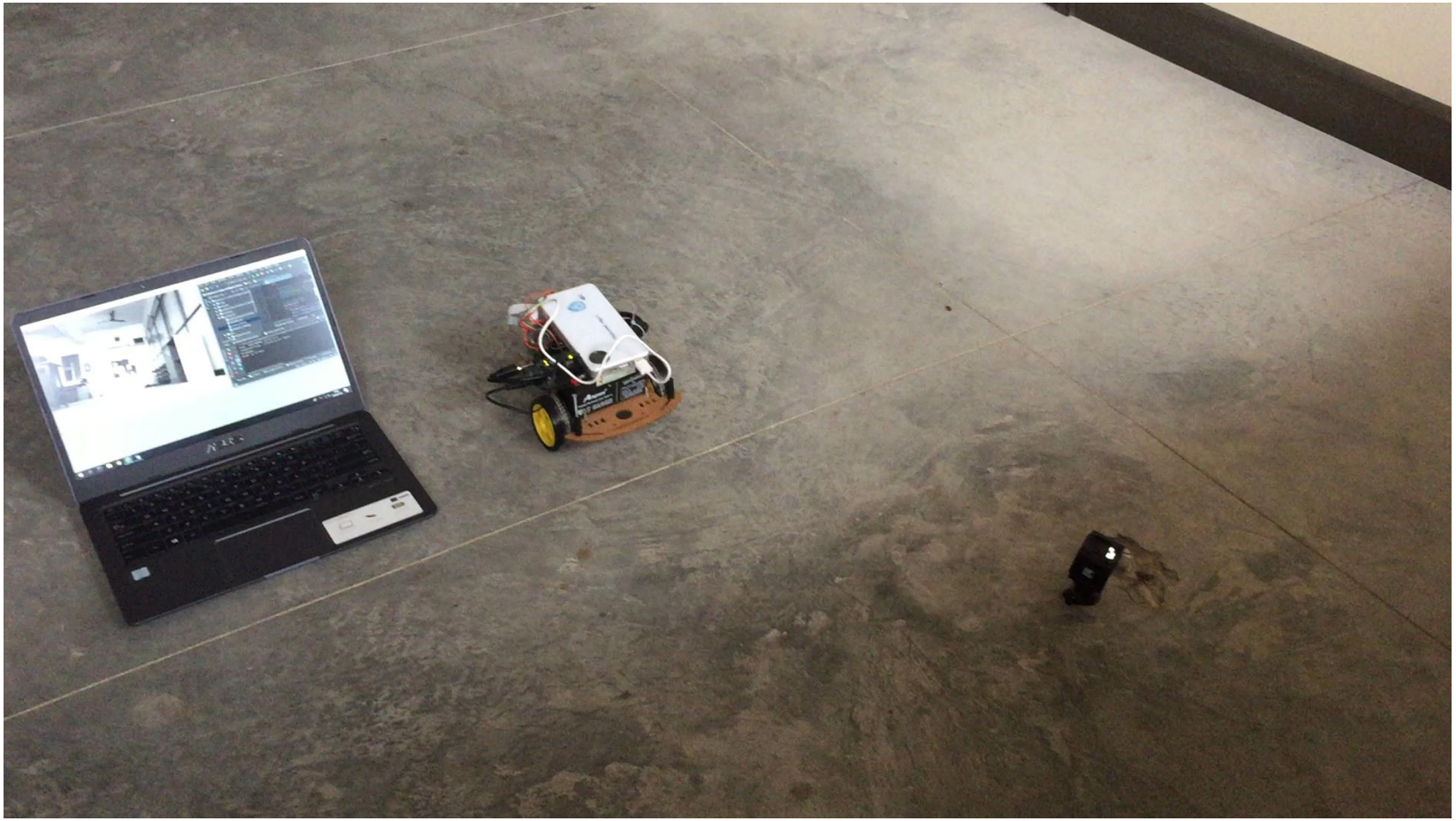
- 3.„button_keyboard_client.py”
- 4.„stream_client.py”

Arduino:

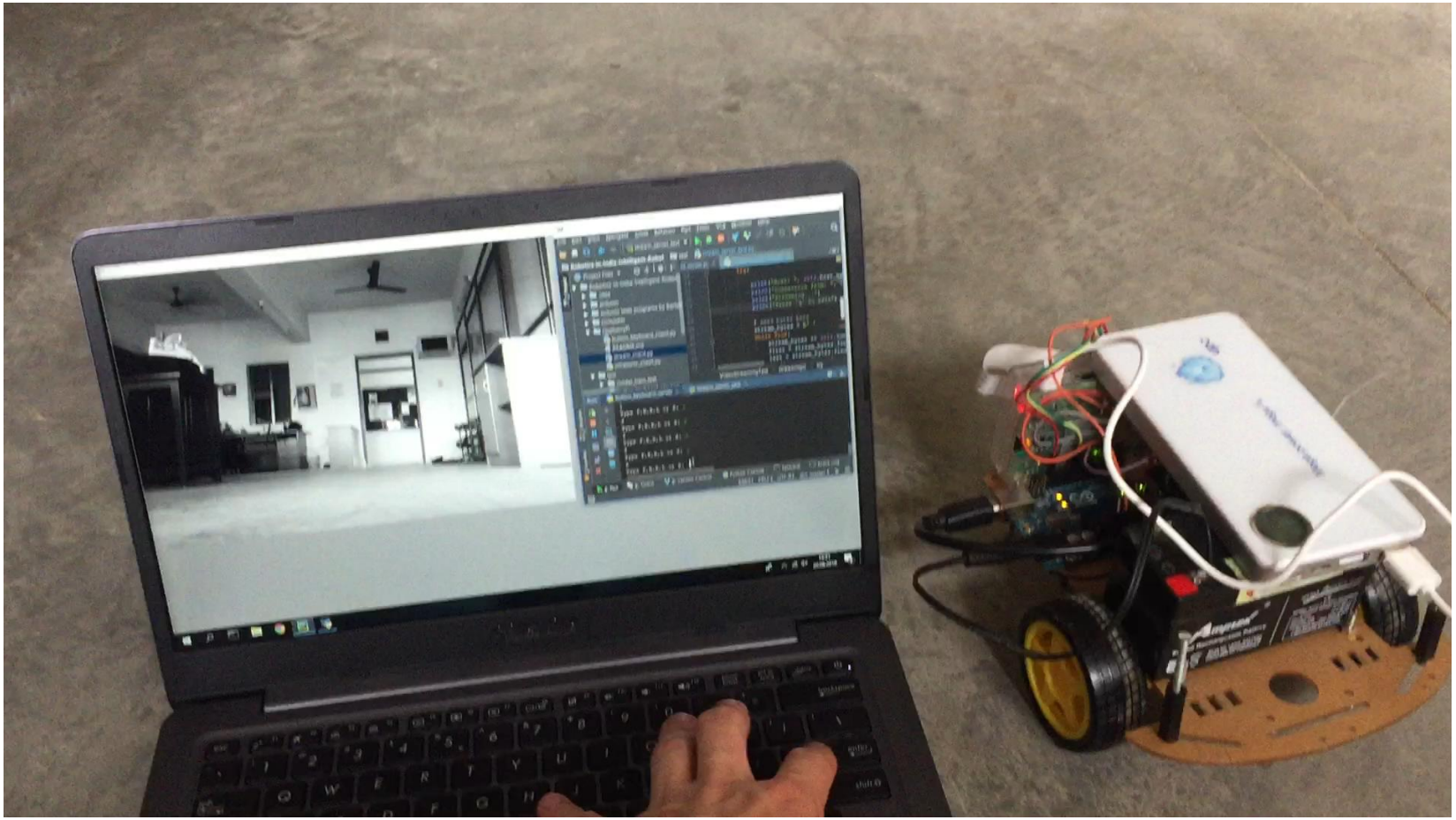
- 5.„_7._steering.ino”



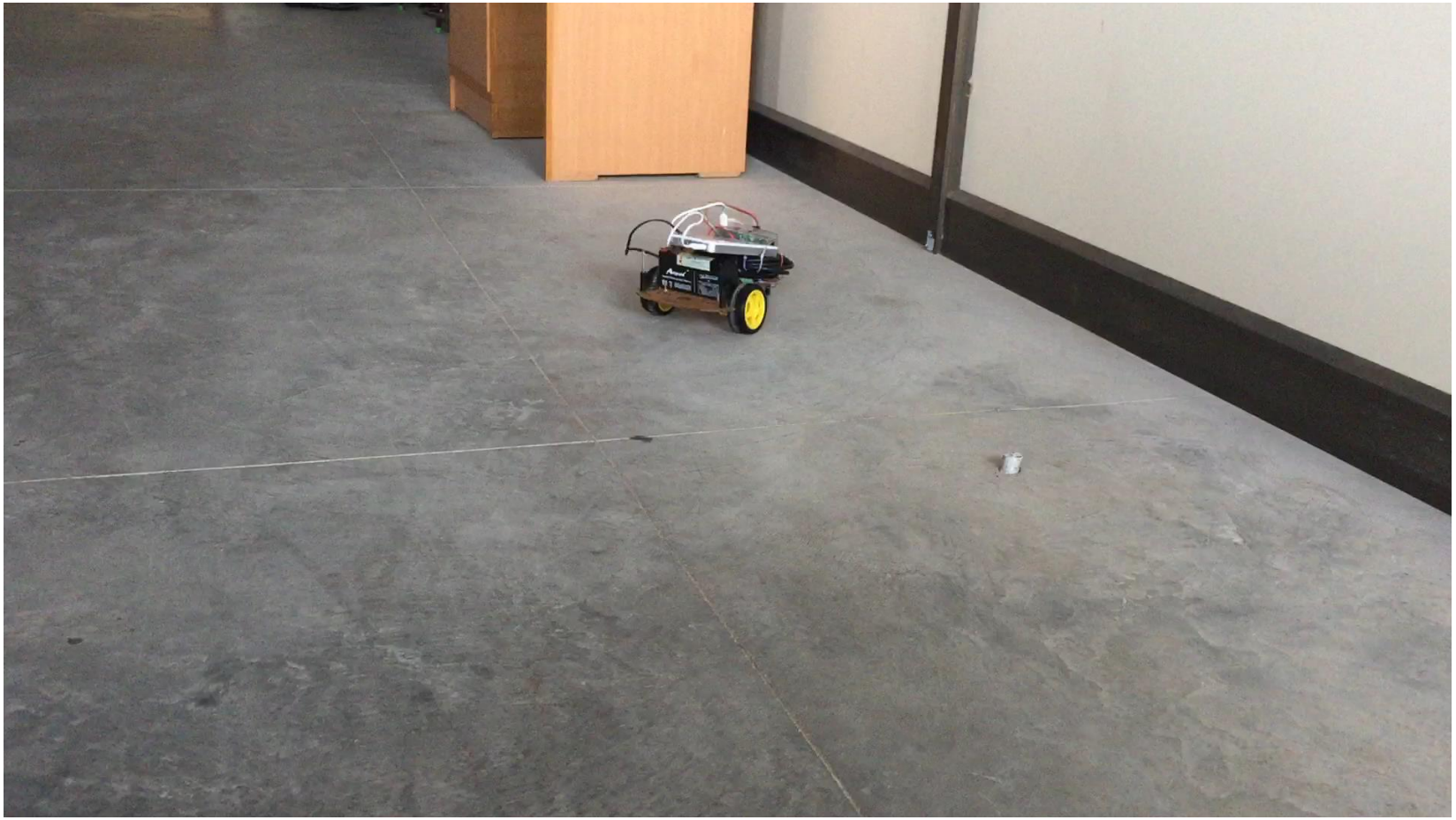
Actual effect



Actual effect



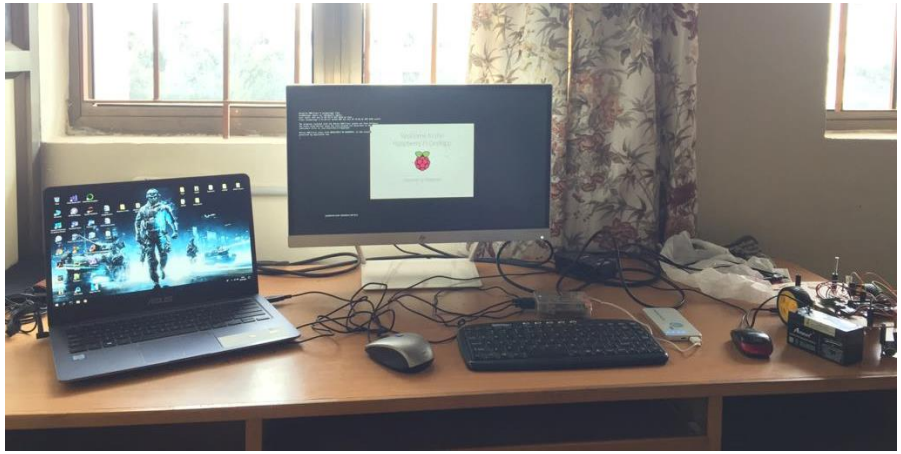
Actual effect

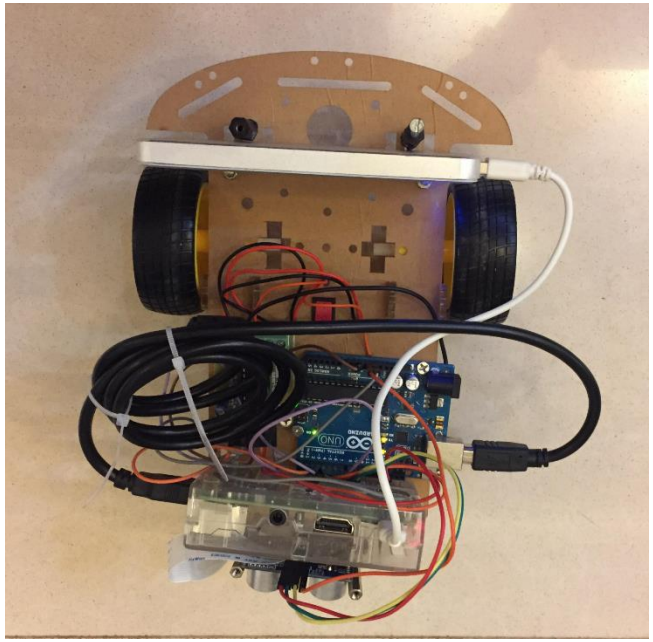


Difficulties

- Real time data transfer (a significant number of operations at the same time)
- Camera video streaming delay (scaling down the resolution is required)
- Multi-level architecture (long way for the information to cover)
- Complex software (big numer of programs)

Despite difficulties the robot works!



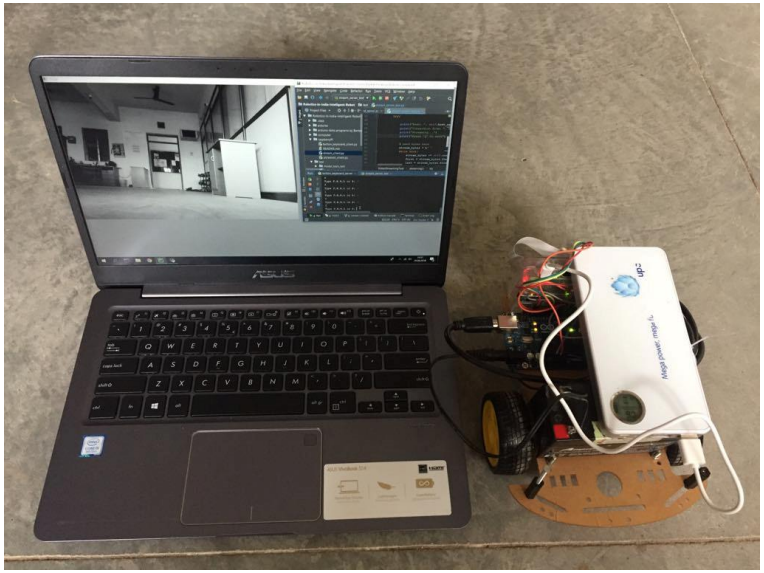


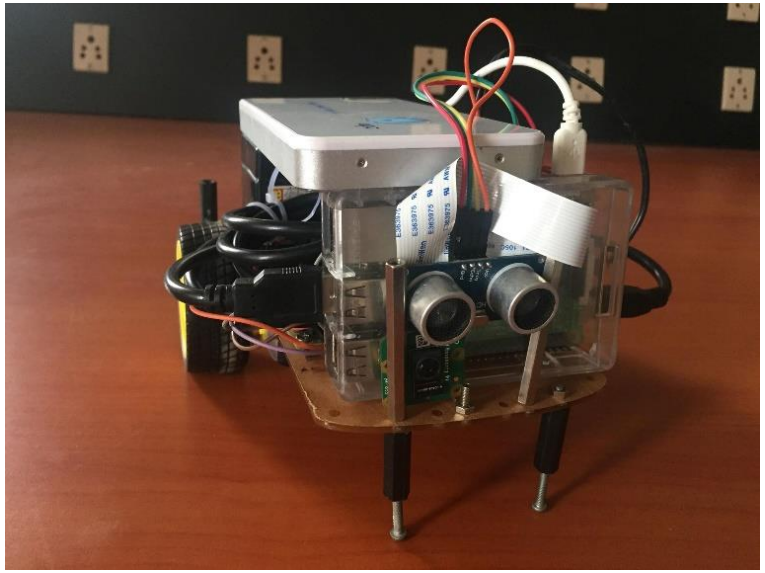
Further Develop

- Total autonomous
- Artificial intelligence, neural networks and image processing
- Road lines, signs and traffic lights recognition
- More advance steering
- Both kinds of control (self-drive and remote control) with balanced priorities

Project sum up

To conclude, the aims of this internship were achieved successfully and are posted above as a result and source for future extensions and uses. The design of the robot model allows to observe the processes necessary to construct an intelligent car, learn and draw the presented conclusions that will help in solving future potential problems.





Useful materials

Similar projects:

- by Zheng Wang
  1. *zhengludwig.wordpress.com/projects/self-driving-rc-car/*
  2. *github.com/hamuchiwa/AutoRCCar*
- by Ryan Zotti
  3. *github.com/RyanZotti/Self-Driving-Car*
- by Yazeed Alrubyli
  4. *becominghuman.ai/building-self-driving-rc-car-series-5-serverless-control-using-computer-vision-fdf0d0136888*
  5. *github.com/yazeedalrubyli/SDRC*
- by Multunus
  6. *github.com/multunus/autonomous-rc-car*

Useful materials

Guides and specifications:

L293 Motor Driver:

- *ti.com/lit/ds/symlink/l293.pdf*

HC-SR04 Sensor:

- *components101.com/ultrasonic-sensor-working-pinout-datasheet*
- *tutorials-raspberrypi.com/raspberry-pi-ultrasonic-sensor-hc-sr04/*
- *howtomechatronics.com/tutorials/arduino/ultrasonic-sensor-hc-sr04/*

Pi Camera:

- *projects.raspberrypi.org/en/projects/getting-started-with-picamera*
- *opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_calib3d/py_calibration/py_calibration.html*

GDAŃSK UNIVERSITY
OF TECHNOLOGY

HISTORY IS WISDOM
FUTURE IS CHALLENGE