Telecommunication Application Project

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Introduction

The purpose of this project was to use machine learning in a practical IoT application. Our IoT application was a proof-of-concept of a rat trap with machine learning algorithms. Project was done with Scrum framework.

Objectives

The main objectives of this project were to develop a rat trap that recognizes a rat with a camera and a web interface to control the trap. (See Figure 1 below)

First the trap would detect an object with an ultrasonic sensor. After that it would start the machine learning algorithms to recognize a rat from the picture. If there was a rat in the trap it would then send the image to our server that hosts a database and web page. User could then see from the web page if there was a rat in the trap and the image of the rat. There was also a possibility to reset the trap from the web page.

Methods

Our team used Teams for communication and Trello for Scrum. We had an Ubuntu Linux server where we ran MySQL database. In the server we used Python based Flask for our web development. We also had a Raspberry Pi 3B+ in which we used HC-SR04 ultrasonic sensor and Raspberry Pi Camera Module V2. (See Figure 2 on the right) Connection between Raspberry Pi and the Internet was done with Wi-Fi. The Python application in Raspberry Pi was designed to be modular for easy maintenance. Our machine learning algorithm was done in Python with TensorFlow Lite runtime package. GitHub was used for version control.

Results

The proof-of-concept was successful. The algorithm that we created recognized our rat analogue. Application in the Raspberry Pi worked correctly, and the server and the web page fulfilled our needs.

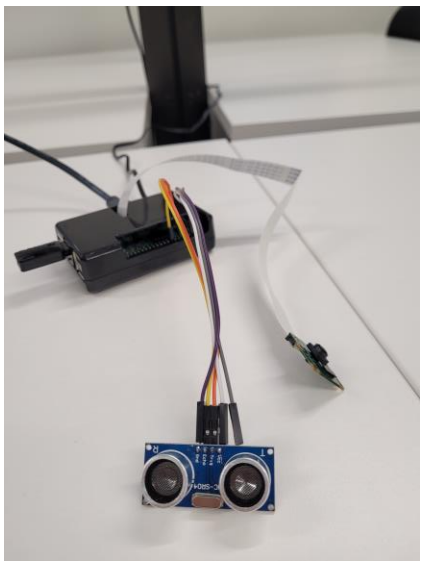

FIGURE 2. Raspberry Pi 3B+, HC-SR04 and Raspberry Pi Camera Module V2

Conclusions

Although the proof-of-concept was successful, for a real product most of the hardware would need to be changed. We would need a more power efficient microcontroller and components. Also, there would be a need for a new communication method for the trap. That could be an LTE modem. The database and the web page hosting would also need to be changed for outsourced cloud service.

FIGURE 1. Front page of the web interface

References

1.HC-SR04 datasheet:
https://tinyurl.com/bdcr49b7
2. Raspberry Pi Camera Module V2:
https://tinyurl.com/yhj34crn
3. TensorFlow Lite documentation:
https://tinyurl.com/zvumdys6

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