Self-driving-tank - version 1.1

Michał Nizioł, Michał Zelek



Project objectives

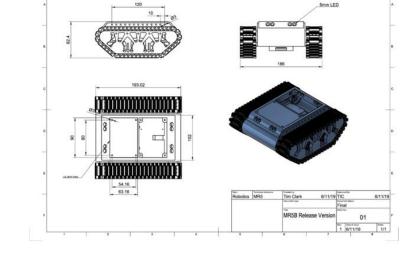


- Goal of a project is to create robot which moves on tracked chassis & is remotely controlled by website app (rest-api)
- Gathers acceleration data from accelerometer and calculates current net acc, velocity and position, which is displayed in real time on website
- Checks distances data from ultrasound and laser sensor which impacts the tank movement and behaviour
- Authorises user by RFID card and allows to use tank only with proper access

List of used elements

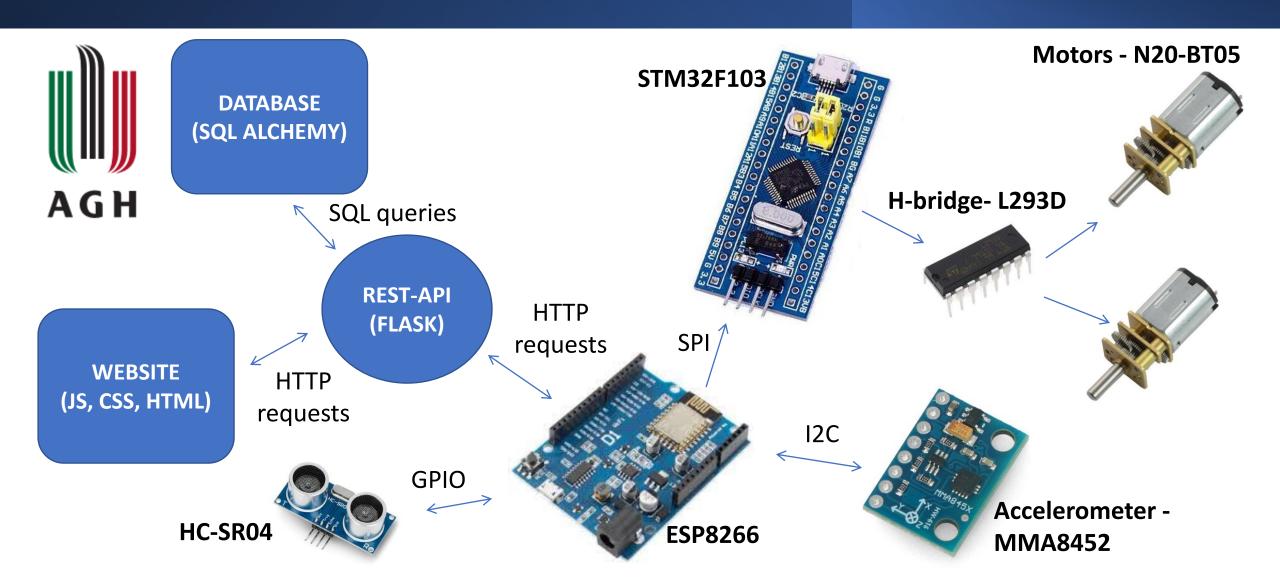


- STM32F103C8T6 ARM Cortex M3
- Accelerometer MMA8452
- ESP8266 with WiFi module
- Voltage stabilizer LM317
- H-bridge L293D
- 2x motors DC 12V N20-BT05 micro 50:1 625RPM
- Tracked chassis created in 3D printing
- Ultrasound sensor HC-SR04
- Laser sensor TOF VL53L0X
- RFID MF RC522 module
- ESP32





Block diagram



Software – project structure



- api -> contains Flask application (Python), which handles requests, collects data in database, allows user to control tank via website
- **esp** -> contains code for ESP-8266 (C++), which reads data from accelerometer and ultrasound sensor, makes POST & GET requests to api, and communicates with STM32
- **stm** -> contains code for STM32F103 (C) responsible for motors controls via H-bridge
- rfid_rc522 & servo_tof -> contains code for ESP32 (C++) which controls servo, gaters data from laser sensor and handles RFID MF RC522 module



Software – api structure



- To setup api run venvSetup.bat which will install all nedded dependencies from Pipfile
- Service can be deployed by run.bat or server.py
- Dir database contains SQL alchemy object, models & schemas for data tables and database file (.db)
- Dir app contains Flask application with defined endpoints (acc, velocity, positions, controls and GUI views), templates files & APScheduler



View - /controls/

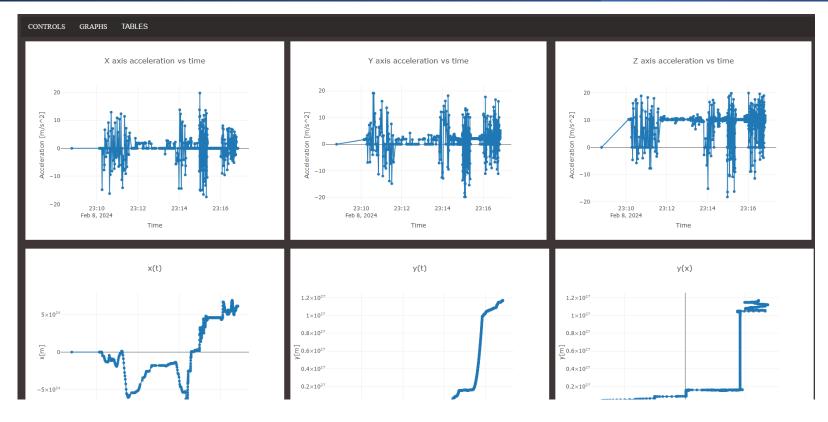




Tank can be steer by controls (buttons). In real time are updated graphs: net acc of time, net velocity of time, position y of x.

View - /graphs/





In view graph are displayed graphs of all gathered data. (acc of time for all axis, postion of time for x i y and x of y.

View - /<data_name>_table/



Acceleration Search by phrase	CONTROLS GRAPHS TABLES					
Do DATE X.AXIS Y.AXIS Z.AXIS 1 2024-02-08 23-08-47-559907 0 0 0 2 2024-02-08 23-10-07/07/250 0 1.75 1034 3 2024-02-08 23-10-0008 851770 0 1.74 10.27 4 2024-02-08 23-10-10008 622 0 1.67 10.15 5 2024-02-08 23-10-1145123 0 1.78 10.25 6 2024-02-08 23-10-1282342 0 1.81 10.31 7 2024-02-08 23-10-14559710 0 1.83 10.3 8 2024-02-08 23-10-14559752 0 1.94 10.57 9 2024-02-08 23-10-14559752 1-148 2.27 3.71 10 2024-02-08 23-10-1559533 0 0 0 11 2024-02-08 23-10-1559593 1-9 6.84 4.6 12 2024-02-08 23-10-19-559562 1-9 6.84 4.6 13 2024-02-08 23-10-19-559562 7.75 0 14.23 15	Acceleration					
1 2024-02-08 23-08-47,559907 0 0 0 2 2024-02-08 23-10-07,707250 0 1.75 10.34 3 2024-02-08 23-10-08.851770 0 1.74 10.27 4 2024-02-08 23-10-10.003622 0 1.67 10.15 5 2024-02-08 23-10-11.145123 0 1.78 10.25 6 2024-02-08 23-10-12.282342 0 1.81 10.31 7 2024-02-08 23-10-13.421340 0 1.83 10.3 8 2024-02-08 23-10-14.559710 0 1.94 10.57 9 2024-02-08 23-10-15.705523 -14.8 2.27 3.71 10 2024-02-08 23-10-15.705523 -14.8 2.27 3.71 11 2024-02-08 23-10-16.85360 0 0 0 11 2024-02-08 23-10-16.85360 0 3.28 10.26 12 2024-02-08 23-10-16.85360 -1.91 -6.84 -4.6 13 2024-02-08 23-10-15.705902 -1.91 -6.84 -4.6 14 2024-02-08 23-10-20.313257 0 14.23	Search by phrase					
2 2024-02-08 23-10-07.707250 0 1.75 10.34 3 2024-02-08 23-10-08 851770 0 1.74 10.27 4 2024-02-08 23-10-10 003622 0 1.67 10.15 5 2024-02-08 23-10-11.143123 0 1.78 10.25 6 2024-02-08 23-10-12.282342 0 1.81 10.31 7 2024-02-08 23-10-13 421340 0 1.83 10.3 8 2024-02-08 23-10-14.559710 0 1.94 10.57 9 2024-02-08 23-10-15.705523 -14.8 2.27 3.71 10 2024-02-08 23-10-16.853560 0 0 0 11 2024-02-08 23-10-19.166422 -1.91 -6.84 -4.6 13 2024-02-08 23-10-20.313257 0 1.76 16.19 14 2024-02-08 23-10-21.457052 -7.75 0 14.23 15 2024-02-08 23-10-23.737037 -5.91 3.97 10.96 16 2024-02-08 23-10-23.737037 663 7.19 0	ID	DATE	X_AXIS	Y_AXIS	Z_AXIS	
3 2024-02-08 23:10-08 851770 0 1.74 10.27 4 2024-02-08 23:10-10.003622 0 1.67 10.15 5 2024-02-08 23:10-11.143123 0 1.78 10.25 6 2024-02-08 23:10-12.282342 0 1.81 10.31 7 2024-02-08 23:10-13.421340 0 1.83 10.3 8 2024-02-08 23:10-14.559710 0 1.94 10.57 9 2024-02-08 23:10-15.705523 -14.8 2.27 3.71 10 2024-02-08 23:10-16.855360 0 0 0 11 2024-02-08 23:10-19.166422 -1.91 -6.84 -4.6 13 2024-02-08 23:10-20.313257 0 1.76 16.19 14 2024-02-08 23:10-21.457052 -7.75 0 14.23 15 2024-02-08 23:10-22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10-23.737037 6.63 7.19 0	1	2024-02-08 23:08:47.550907			0	
4 2024-02-08 23:10:10 003622 0 1.67 10.15 5 2024-02-08 23:10:11.143123 0 1.78 10.25 6 2024-02-08 23:10:12.282342 0 1.81 10.31 7 2024-02-08 23:10:13.421340 0 1.83 10.3 8 2024-02-08 23:10:14.559710 0 1.94 10.57 9 2024-02-08 23:10:15.705523 -14.8 2.27 3.71 10 2024-02-08 23:10:16.855360 0 0 0 11 2024-02-08 23:10:17.999032 0 3.28 10.26 12 2024-02-08 23:10:19.16422 -1.91 -6.84 -4.6 13 2024-02-08 23:10:20.313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:22.595672 -591 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	2	2024-02-08 23:10:07.707250		1.75	10.34	
5 2024-02-08 23:10:11.143123 0 1.78 10.25 6 2024-02-08 23:10:12.282342 0 1.81 10.31 7 2024-02-08 23:10:13.421340 0 1.83 10.3 8 2024-02-08 23:10:14.559710 0 1.94 10.57 9 2024-02-08 23:10:15.705523 -14.8 2.27 3.71 10 2024-02-08 23:10:16.855360 0 0 0 11 2024-02-08 23:10:17.999032 0 3.28 10.26 12 2024-02-08 23:10:19.166422 -1.91 -6.84 -4.6 13 2024-02-08 23:10:20.313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:23.737037 6.63 7.19 0	3	2024-02-08 23:10:08.851770		1.74	10.27	
6 2024-02-08 23:10:12 282342 0 1.81 10.31 7 2024-02-08 23:10:13 421340 0 1.83 10.3 8 2024-02-08 23:10:14 559710 0 1.94 10.57 9 2024-02-08 23:10:15 705523 -14.8 2.27 3.71 10 2024-02-08 23:10:16 855360 0 0 0 11 2024-02-08 23:10:17 999032 0 3.28 10.26 12 2024-02-08 23:10:19.166422 -1.91 -6.84 -4.6 13 2024-02-08 23:10:20.313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	4	2024-02-08 23:10:10.003622		1.67	10.15	
7 2024-02-08 23:10:13.421340 0 1.83 10.3 8 2024-02-08 23:10:14.559710 0 1.94 10.57 9 2024-02-08 23:10:15.705523 -14.8 2.27 3.71 10 2024-02-08 23:10:16.855360 0 0 0 11 2024-02-08 23:10:17.999032 0 3.28 10.26 12 2024-02-08 23:10:19.166422 -1.91 -6.84 -4.6 13 2024-02-08 23:10:20.313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	5	2024-02-08 23:10:11.143123		1.78	10.25	
8 2024-02-08 23:10:14.559710 0 1.94 10.57 9 2024-02-08 23:10:15.705523 -14.8 2.27 3.71 10 2024-02-08 23:10:16.855360 0 0 0 11 2024-02-08 23:10:17.999032 0 3.28 10.26 12 2024-02-08 23:10:19.166422 -1.91 -6.84 -4.6 13 2024-02-08 23:10:20.313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:23.737037 5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	6	2024-02-08 23:10:12.282342		1.81	10.31	
9 2024-02-08 23:10:15 705523 -14.8 2.27 3.71 10 2024-02-08 23:10:16 855360 0 0 0 11 2024-02-08 23:10:17 999032 0 3.28 10.26 12 2024-02-08 23:10:19.166422 -1.91 -6.84 -4.6 13 2024-02-08 23:10:20.313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	7	2024-02-08 23:10:13.421340		1.83	10.3	
10 2024-02-08 23:10:16 855360 0 0 0 11 2024-02-08 23:10:17 999032 0 3.28 10.26 12 2024-02-08 23:10:19.166422 -1.91 -6.84 -4.6 13 2024-02-08 23:10:20.313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	8	2024-02-08 23:10:14.559710		1.94	10.57	
11 2024-02-08 23:10:17 999032 0 3.28 10.26 12 2024-02-08 23:10:19 166422 -1.91 -6.84 -4.6 13 2024-02-08 23:10:20 313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	9	2024-02-08 23:10:15.705523	-14.8	2.27	3.71	
12 2024-02-08 23:10:19.166422 -1.91 -6.84 -4.6 13 2024-02-08 23:10:20.313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	10	2024-02-08 23:10:16.855360			0	
13 2024-02-08 23:10:20.313257 0 1.76 16.19 14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	11	2024-02-08 23:10:17.999032		3.28	10.26	
14 2024-02-08 23:10:21.457052 -7.75 0 14.23 15 2024-02-08 23:10:22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	12	2024-02-08 23:10:19.166422	-1.91	-6.84	-4.6	
15 2024-02-08 23:10:22.595672 -5.91 3.97 10.96 16 2024-02-08 23:10:23.737037 6.63 7.19 0	13	2024-02-08 23:10:20.313257		1.76	16.19	
16 2024-02-08 23:10:23:737037 6.63 7.19 0	14	2024-02-08 23:10:21.457052	-7.75		14.23	
	15	2024-02-08 23:10:22.595672	-5.91	3.97	10.96	
17 2024-02-08 23:10:24.883315 3.28 2.14 7.45	16	2024-02-08 23:10:23.737037	6.63	7.19	0	
	17	2024-02-08 23:10:24.883315	3.28	2.14	7.45	
18 2024-02-08 23:10:26.025868 0 -6.71 5.5	18	2024-02-08 23:10:26.025868		-6.71	5.5	

In this view can be seen all gathered data in database in useful table format (with sorting option, search filter etc.)