A small, incomplete collection of projects I have undertaken over the years

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Contents

0.1 Research Projects with Emphasis on Robotics

0.1.1 RELIEF: Intelligent Repeaters and Robots for Fast, Reliable, Low-Cost RFID Inventorying & Localization

Context: Project co-financed by EU and Greek National Funds, under the call RESEARCH - CREATE -INNOVATE (project code: T1EDK-03032)

Aristotle University of Thessaloniki, Greece

Duration: 09/2018–09/2021

In a nutshell

`[Website] [fb] [Videos] [Publications]`

Figure 1: Left: RELIEF's heavyweight autonomous ground vehicle at the Beyond Expo 2021 and a collection of RFID-tagged typical supermarket products. Right: the robot's reconstructed map of the products in physical space

Inventorying and localisation of products in large warehouses is constrained by the accuracy, precision, and stamina of focus of human-led efforts. If RFID tags substitute bar codes (optical, remember!), both needs may be fulfilled with greater accuracy and in less time. If, additionally, robots replace humans, their time may be liberated for other, more engaging/demanding activities, and errors may be erased.

The aim of project RELIEF was to provide real-time Simultaneous Robot Localisation and Mapping of RFID tags in 3D space, with centimeter accuracy. The means of achieving these goals were three Autonomous Unmanned Robotic Vehicles:

- Two Autonomous Unmanned Ground Vehicles: one modified Yujin Turtlebot 2 (figure 2) and one modified Robotnik RB1 (figure 3)
- One Autonomous Unmanned Aerial Vehicle: a modified Italdron Evo 4HSE (figure 4)

Press coverage (Greek only):

- Έξυπνα ρομπότ - Καλημέρα Θεσσαλονίκη
- Η Beyond 4.0 πηγαίνει με Drone και την Πληροφορία πιο πέρα από την κληρονομιά της Infosystem
- Εικόνες από το εγγύς μέλλον: Φάρμακα από drones, πάρκινγκ με ένα κλικ, ρομπότ στα σούπερ μάρκετ
- Το έξυπνο ρομπότ που βρίσκει αντικείμενα
- Ο ΑΝΤΩΝΗΣ ΔΗΜΗΤΡΙΟΥ ΣΤΟΝ FM100
- Το ρομπότ FRIDA κάνει βόλτα στο Περίπτερο 14 της 84ης ΔΕΘ!
- Τα ρομπότ του ΑΠΘ στην 84η ΔΕΘ

Key project aspects are succinctly portrayed through the following videos:

- Autonomous Inventorying and Accurate Real-Time 3D Localization—Library demo
- Robots for 24/7 Inventorying and Localization
- Precise Agriculture with Relief Drone and Sustainable Technology
- Experimenting inventorying from above
- Indoor RFID Drone Inventorying

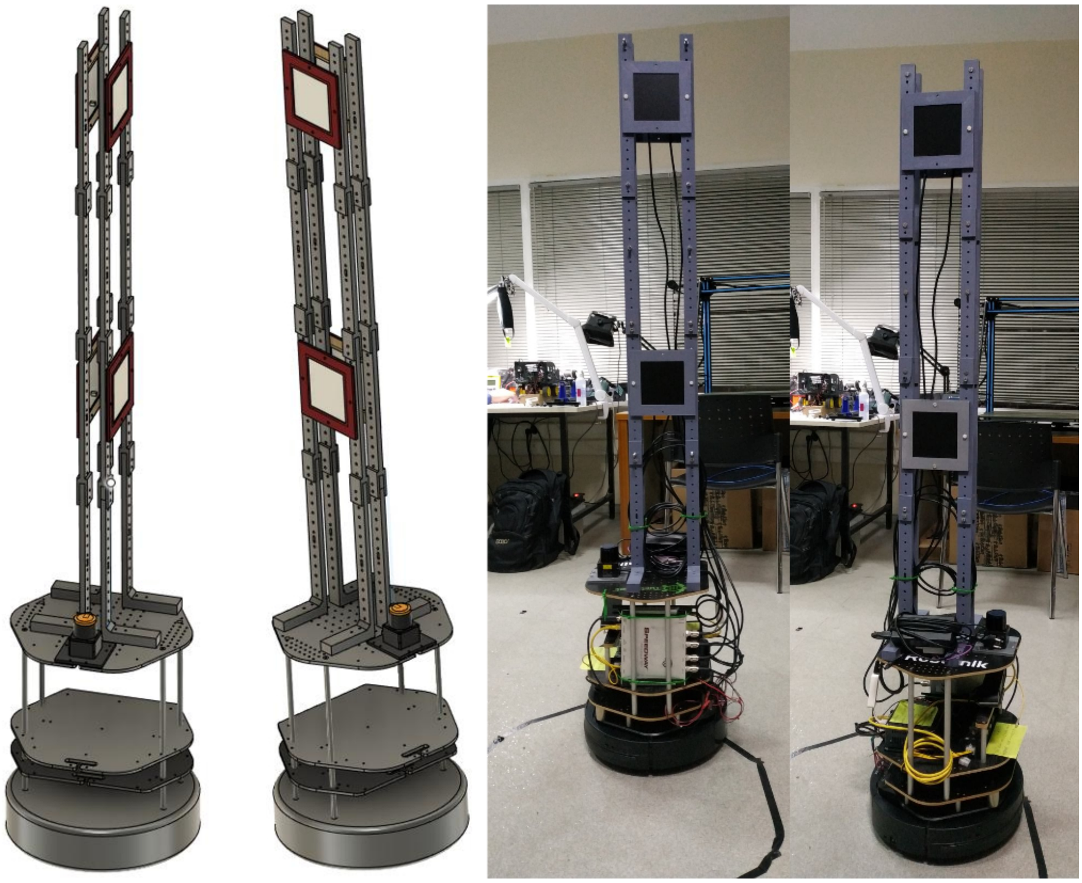

Figure 2: Views of the design and real (WIP) modified Yujin Turtlebot 2 robot used as a lightweight autonomous ground vehicle for inventorying and 3D localisation of RFID tags. Source: project deliverable #9

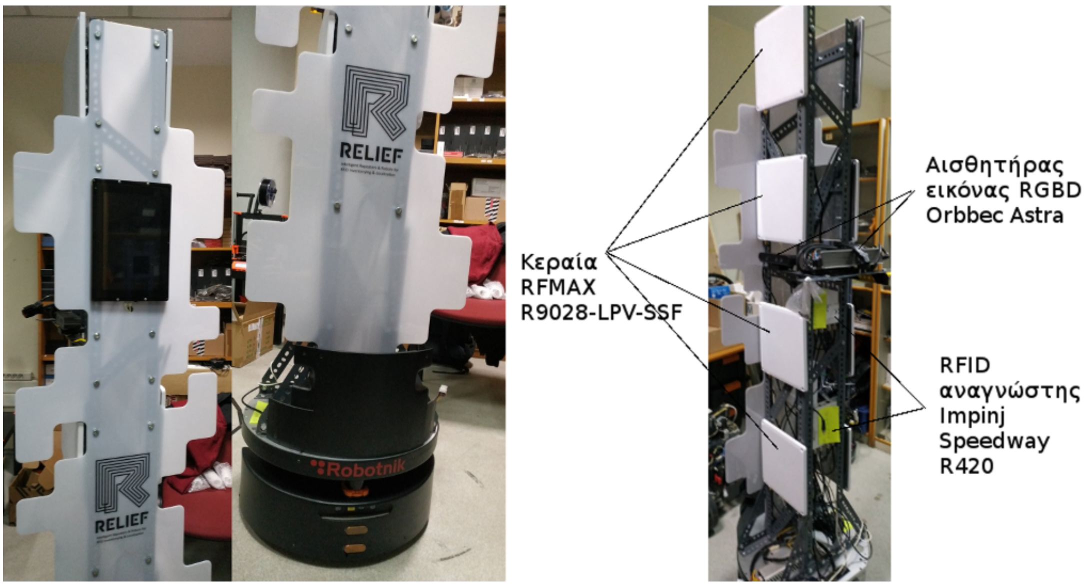

Figure 3: Views of the modified Robotnik RB1 robot used as a heavyweight autonomous ground vehicle for inventorying and 3D localisation of RFID tags. Source: project deliverable #9

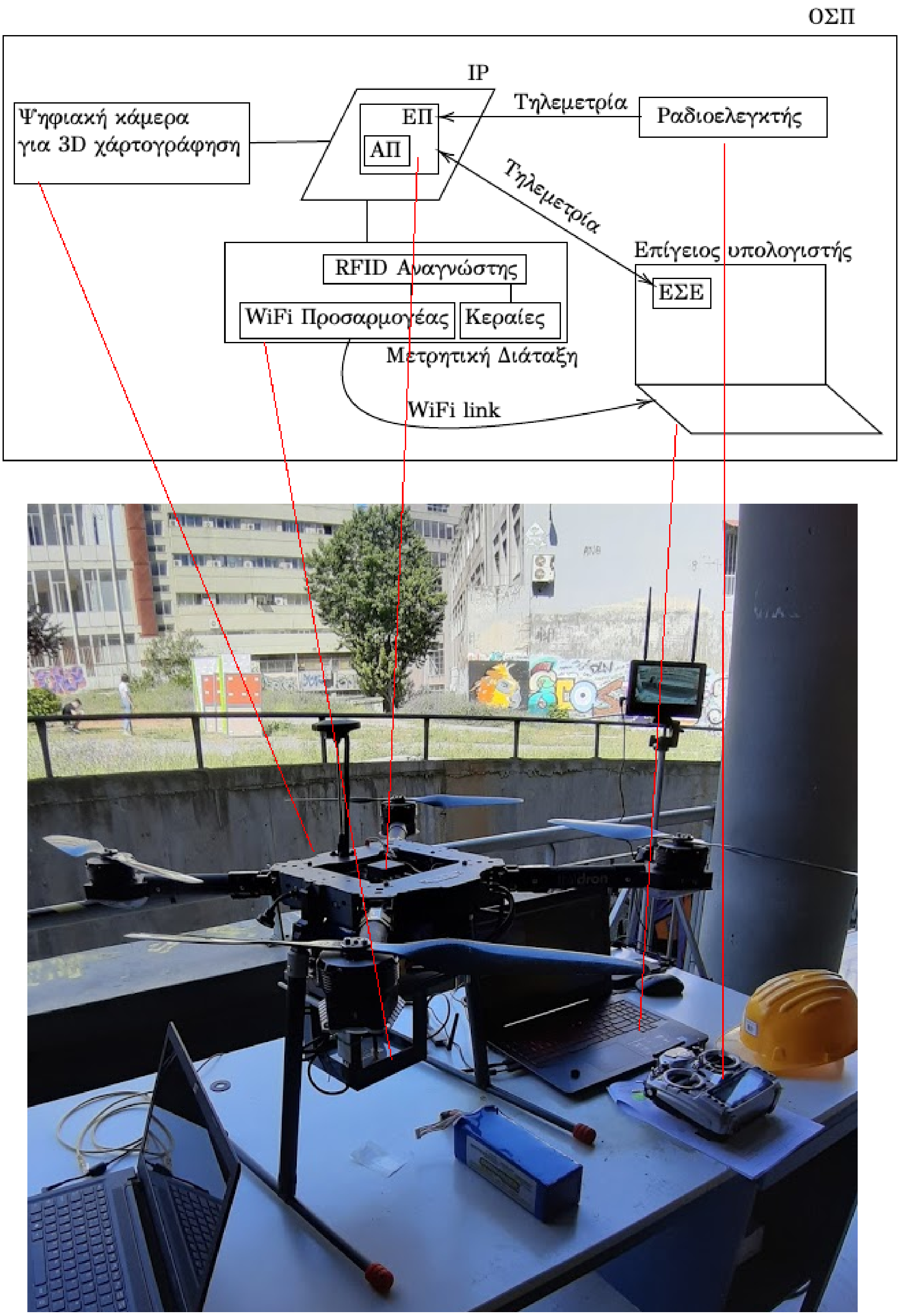

Figure 4: The modified Italdron Evo 4HSE used as an autonomous aerial vehicle for inventorying and 3D localisation of RFID tags and the architecture of entire flight-and-control system. Source: project deliverable # 12

Images 5 and 6 depict (a) a 2D map and (b) a 3D octomap of the Laboratory of Computer Systems Architecture of the Aristotle University of Thessaloniki's (AUTh) Department of Electrical and Computer Engineering, while (c) shows a loose mesh map of the eastern-most corner of the AUTh campus (40°37'37.7"N 22°57'38.8"E).

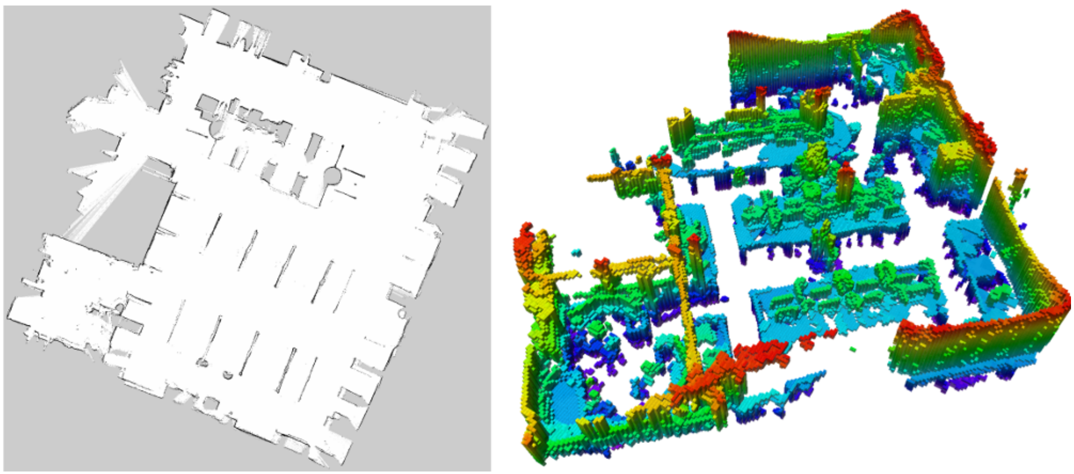

Figure 5: The 2D and 3D map of AUTh's CSAL built by the heavyweight autonomous ground robot

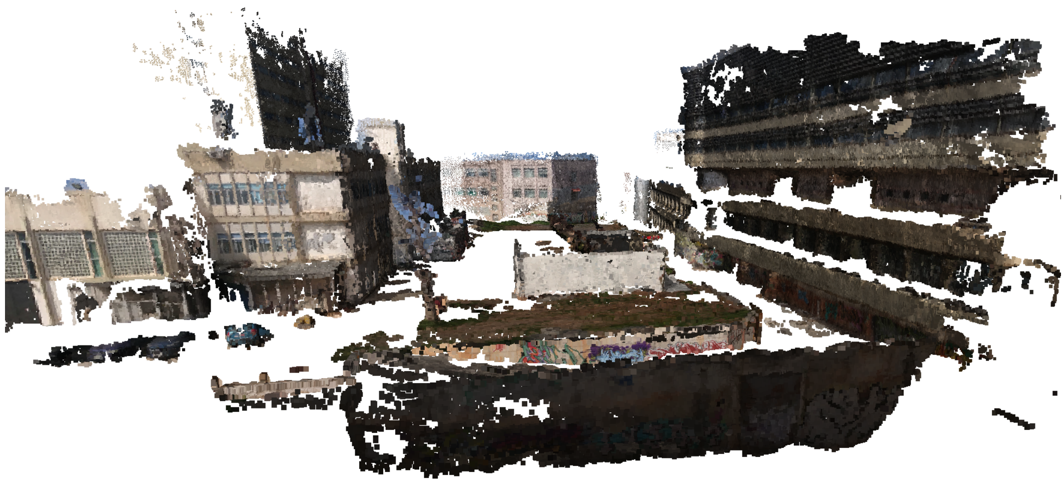

Figure 6: A mesh map of the outdoor space surrounding AUTh's CSAL, built by the autonomous aerial robot

Images 1 and 7 show the end result of autonomous real-time mapping of 3D space for RFID tags by the project's heavyweight autonomous robot. The demos took place live at the Beyond Expo in 2021.

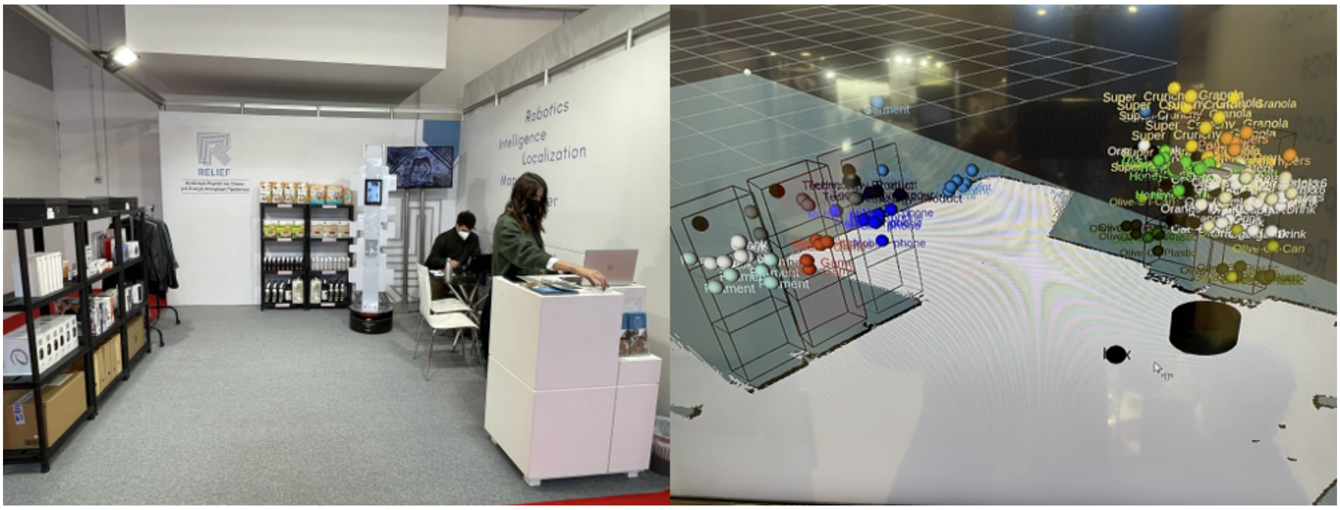

Figure 7: The total view of the project's booth wrt image 1

You may find an extensive briefing of all of the project's objectives, applications, advantages and more at its website: `http://relief.web.auth.gr/`.

- Notions/resources/tools used: `ROS`, Linux, Hokuyo LIDAR, 2D/3D SLAM, Depth ASTRA Cameras, `amcl`, `git`, `RTAB-Map`, Impinj R420 RFID Reader, Rasa, ReSpeaker Mic Array

- Publications resulted from this work: [Myl+21; Fil+22; Fil+23; Tzi+23; FSD22]

0.1.2 CultureID: Internet of Things, Robotics, Big Data, AI in Culture

Context: Project co-financed by EU and Greek National Funds, under the call RESEARCH - CREATE -INNOVATE (project code: T2EDK-02000)

Aristotle University of Thessaloniki, Greece

Duration: 09/2020–09/2023

In a nutshell

[Website] [fb] [Videos] [Publications] [Public code]

Figure 8: CultureID's robot acting as a game master with pupils from the 4th public elementary school of Thessaloniki

Among other things the project developed a social robot—Indy!—with the explicit intent of bridging cultural facts, artefacts, works of art, and general knowledge—over to the audience of a museum: in particular that of the Archaeological Museum of Thessaloniki (AMTh), Greece. Specifically, I, in partnership with the project's partners and our team's members, thought, designed, implemented, deployed, and refined the systems concerning the two activities that the robot was tasked to hold in the museum: (a) playing games while acting as the game master with students whose school pays visit to the museum, and (b) acting as a tour guide for specific displayed artefacts.

0.1.2.1 Playing games with pupils

The actual contents of the games, regardless of the nature of the game master were expertly crafted by Dr (of Education) Sofia Pliasa. The games focused around AMTh's exhibitions and themes of artefacts, e.g. armament, daily habits, grooming (καλλωπισμός), hunting, and others. Indy, with a clear mind of the pupils' abilities (ages ranged from 8 to 14), organised them into groups, asked them questions with regard to themes and artefacts around them, gave them hints and instructions–all while handling groups in a round-robin fashion.

The interaction between the robot and the pupils was performed via a screen, placed at an appropriate-for-the-children height on the robot, speakers, and a panoramic microphone array. RFID technology was used in order to engage the pupils and arouse their sense of playing and therefore alleviating their boredom, prevalent in the era before Indy. These are all summarised in the two images that follow.

—Of course, one would ask: "Alexandros, what is the use of a robot for playing this type of game you are describing when an static computer could perform the same task?" The first difference is that the robot cheered on groups of pupils by executing dance maneuvers while singing appropriately-chosen songs. The second was that the game was not concentrated in one region of the museum, but it was designed to be highly extensible, meaning that it could be (and actually was) possible to navigate between regions around which games were played.

Figure 9: A typical game screen displayed at the robot's mounted monitor. The question asks of the pupils to use a handheld RFID scanner and point it to the direction of the right artefacts in order to provide the correct answer

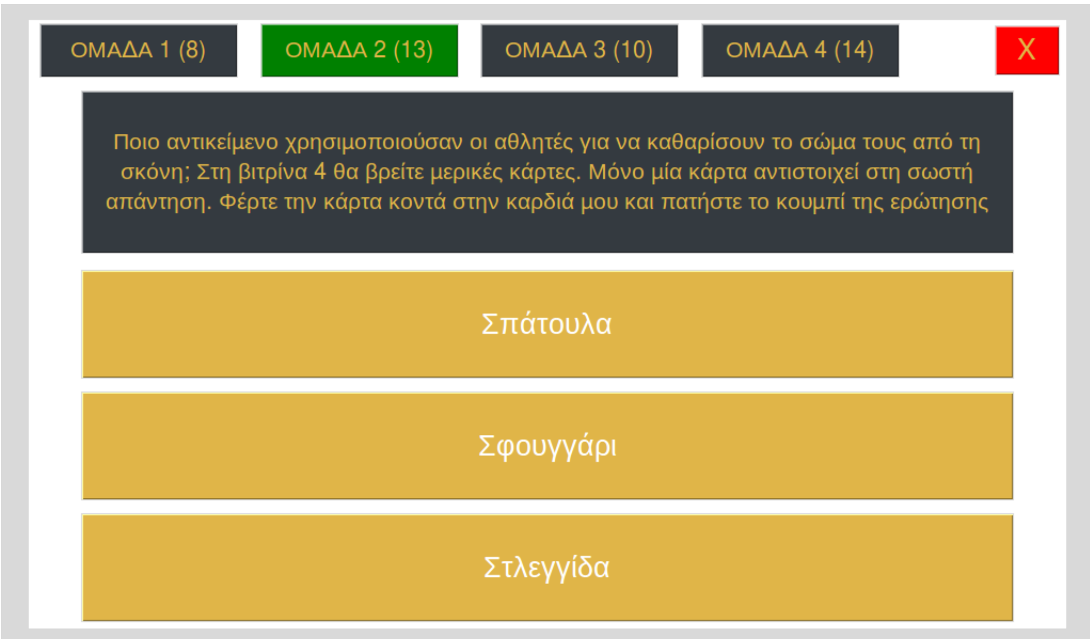

Figure 10: A typical game screen displayed at the robot's mounted monitor. The question asks of the pupils to walk around the museum, locate RFID tags imprinted with the correct answer, bring it to the robot, and scan it using its mounted RFID reader

Figure 11: A screen cheering on a team when they provided the correct answer

Images 12-14 show comments left by students of the 28th public elementary school of Thessaloniki regarding their experience playing games with the project's social robot.

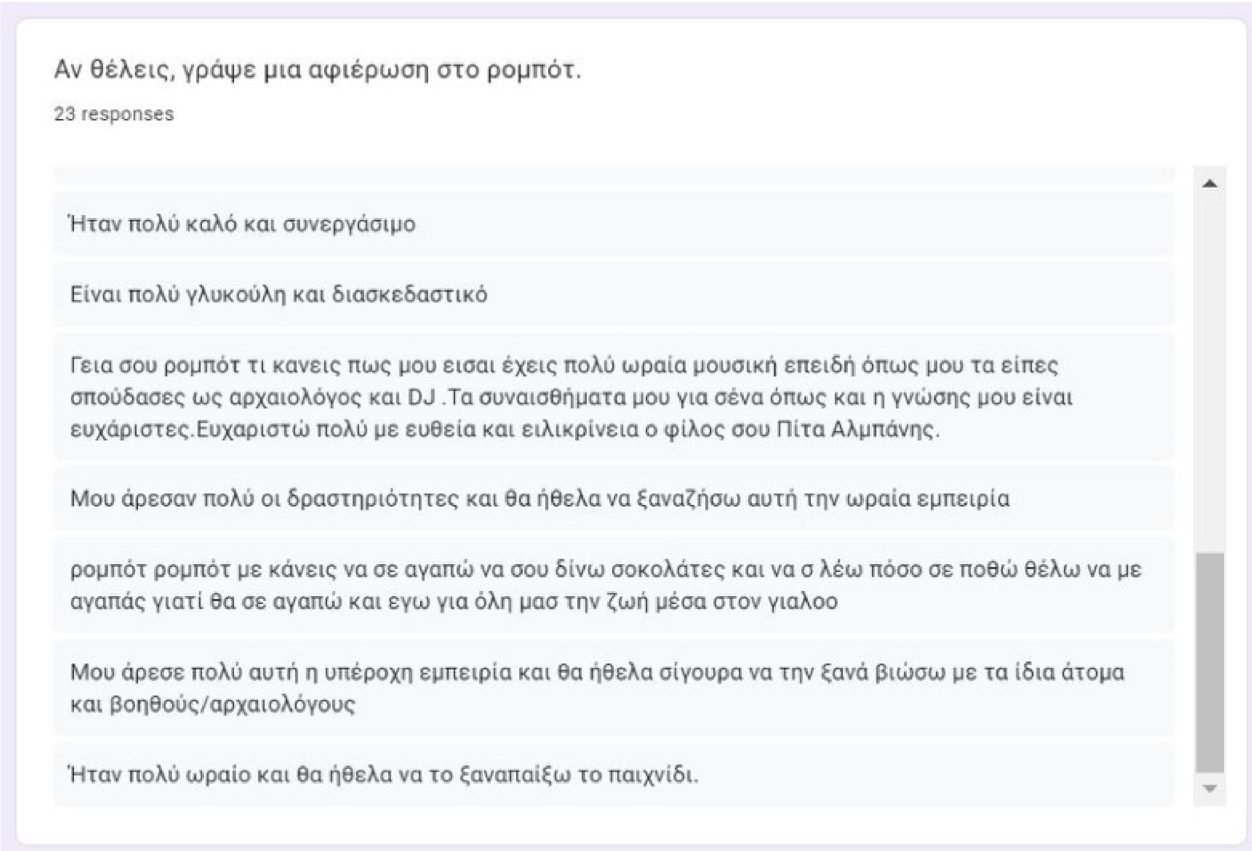

Figure 12: Pupils' feedback on their experience playing games with the robot (1/3)

Αν θέλεις, γράψε μια αφιέρωση στο ρομπότ.

23 responses

κύριε ρομπότ είμαι ο president και μου αρεσε το παιχνιδι σου παρά πολυ!!!

Κύριε ρομπότ ειστε τελειο

Ιντυ, Σαγαπώ.
Μπάμπης

Γεια θου ρομποτακιο

Γεια σου φίλε μου ΜΠΙΜΠ ΜΠΙΜΠ

Ήσουν πολύ γλυκό και έξυπνο

Δεν έπρεπε να κόψεις το τραγούδι το ισπανικό

Figure 13: Pupils' feedback on their experience playing games with the robot (2/3)

Αν θέλεις, γράψε μια αφιέρωση στο ρομπότ.

23 responses

ΕΙΣΑΙ ΜΑΓΚΑΣ

Είσαι Κουλ

Μου αρέσουν τα γουρούνια

Να είναι καλά

Το ρομπότ ήταν πολύ όμορφο!

Να κάνει καλύτερο μακιγιάζ για να έχει καλύτερη βαθμολογία

Το ρομπότ ήταν πολύ όμορφο αλλά άσχετο εγώ περίμενα να δω τον Elon Musk και επίσης να είχε το ρομπότ πόδια.

Figure 14: Pupils' feedback on their experience playing games with the robot (3/3)

0.1.2.2 Tour guide

The second functionality of Indy was acting as a tour guide. The role of the robot was to sit besides three important artefacts and interact with visitors when they asked her for further details. In a nutshell, three main datasets were developed, one pertaining exactly to each artefact, with the expert help of the Museum's archaeologists. Then rasa was built around these scenarios. The text-to-speech and speech-to-text was handled by Google. Sound was captured via a panoramic microphone array, which was specifically chosen with conversation in mind.

Key project aspects are succinctly portrayed through the following videos:

- CultureID in 80 seconds
- Games with the Robot in the Museum
- Talking with the robot of the Archaeological Museum of Thessaloniki
- Recording of the project's final scientific symposium

Figure 15: From front to back and left to right: the Deputy Head of the Region of Thessaloniki, the Deputy Minister for Macedonia and Thrace, the President of the Hellenic Republic, Dr Aggeliki Moneda, Dr Antonios Dimitriou, and Dr Stavroula Siachalos. The latter three belong to CultureID's organisational and administration team. Dr Dimitriou was the project's coordinator. The event was the celebration of the Archaeological Museum's sixtieth birthday, in which CultureID was invited to contribute with its objective and results. Source: `https://shorturl.at/tzMT2`

Figure 16: From left to right: CultureID's coordinator, Indy, the Deputy Head of the Region of Thessaloniki, Dr Stavroula Siachalos, Dr Aggeliki Moneda, the Deputy Head of Digital Governance for the Region of Central Macedonia, and Ms. Mariana Politou, at the celebration of the Archaeological Museum of Thessaloniki's sixtieth birthday

You may find an extensive briefing of all of the project's objectives, applications, advantages and more at its website: `http://cultureid.web.auth.gr/`.

- Notions/resources/tools used: `ROS`, Linux, Hokuyo LIDAR, RPLIDAR, 2D/3D SLAM, Depth ASTRA Cameras, `amcl`, `git`, Impinj R420 RFID Reader
- Publications resulted from this work: [Tzi+19; Meg+19; Fil+20b; Tzi+20b; Tzi+20a; Fil+20a; Dim+21; Myl+21]

0.2 Control Projects

0.2.1 Robust Decentralized Control of Cooperative Multi-robot Systems

Context: M.Sc. Degree Project

KTH Royal Institute of Technology, Stockholm, Sweden; 2017

In a nutshell

[Presentation] [Report] [Code]

Problem I. In a given 3D physical workspace there are a number of agents whose motion is described by non-linear continuous-time dynamics, and a number of obstacles. All agents are constrained in (a) moving within the workspace boundaries and (b) avoiding collisions with each other and with the obstacles in the workspace. Additionally, some agents are constrained in keeping certain distance bounds from other agents. Given this setting and these constraints, the goal is for the whole multi-agent system to navigate itself from some initial configuration to a goal configuration and to stay there (be stable there), regardless of disturbances affecting the agents.

One solution to this problem is the design of a robust model predictive control regime for the entire team of cooperating robot systems. In this case there are two schools of thought: control laws are handed down by an all-knowing supreme authority, or calculated by each agent individually, with the incomplete knowledge that each possesses. The decentralised approach is more grounded in reality than the first approach, assumes an additional degree of independence between agents, and makes no further requirements of the overall system. While the problem involves agents whose dynamics are independent of one-another, the decentralised solution given here couples their constraints as the means of capturing the cooperative behaviour required. Figure 17 shows a three-agent system controlled by such a control regime, passing through a narrow gap between two objects before reaching its intended configuration, without additionally violating its prescribed constraints.

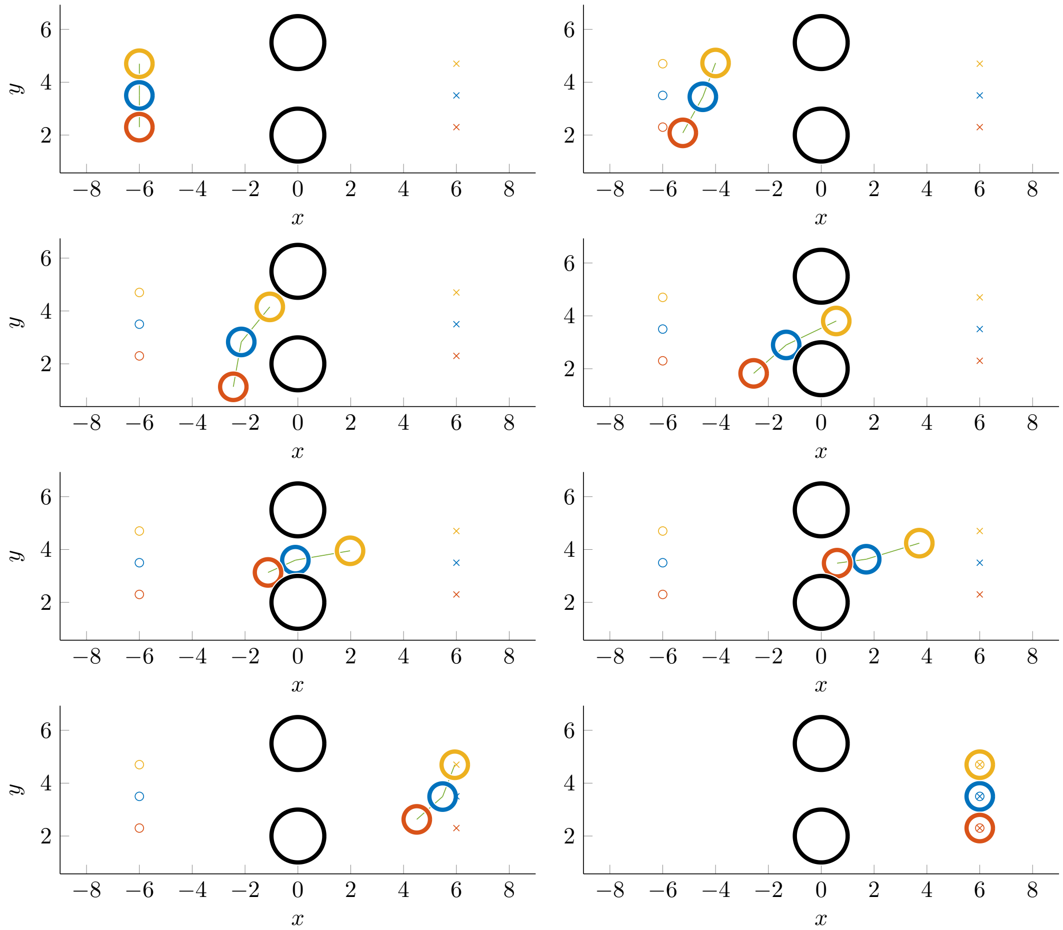

Figure 17: Trajectories of three agents in the $x - y$ plane. A faint green line connects agents who are to stay within certain distance bounds from one-another. Obstacles are marked with black. Mark $\circ$ denotes equilibrium configurations. Mark $\times$ marks desired configurations

Analytical proofs are given to show that under the proposed control regime: (a) Subject to initial feasibility, the optimization solved at each step by each agent will always be feasible, irrespective of whether or not disturbances affect the agents. (b) Each (sub)system can be stabilized to a desired configuration, either asymptotically—when uncertainty is absent—or within a neighbourhood of it when uncertainty is present, thus attenuating the affecting disturbance. In this context disturbances are assumed to be additive and bounded.

- Notions/resources/tools used: Predictive Control, ISS stability, `MATLAB`, `git`, MoCap
- Publications resulted from this work: [FND18; FND20]

0.2.2 Tracking the circumference of a circle with a RC car

Context: EL2425 Automatic Control Project Course

KTH Royal Institute of Technology, Stockholm, Sweden; 2017

In a nutshell

`[Wiki/Resources] [Video 1 | Video 2] [Code]`

Problem II. Assume a remotely controlled vehicle of Ackermann steering whose pose (x, y, θ) is measureable in 2D space, equipped with a computing unit. Given a circular path of appropriate radiue, the goal is for the vehicle to navigate the path as closely as possible.

The solution was sought after using Model Predictive Control, with variable reference poses within the horizon of the optimization problem. Figure 18 shows the trajectory of the vehicle from a top view during the transient phase; figure 20 depicts it during the steady-state phase. Accordingly, figures 19 and 21 show the respective errors in each phase as a function of time. These refer to actual experiments, not simulations. Notably, the steady-state error does not exceed 3.5cm, that is, the center of gravity of the vehicle does not diverge more than 3.5cm from the reference circular trajectory.

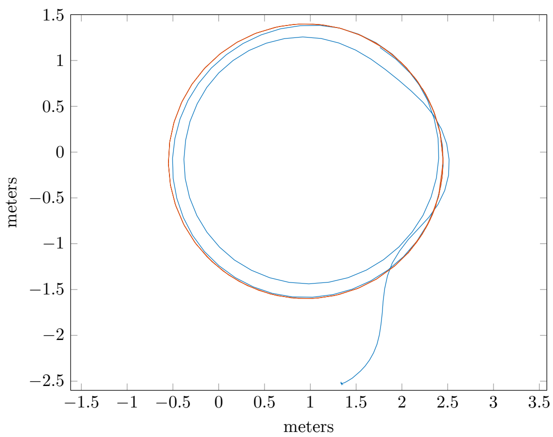

Figure 18: Reference trajectory (red) and trajectory of the vehicle (blue), in the transient phase

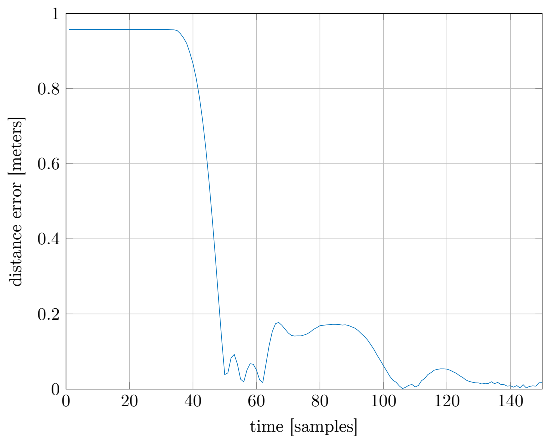

Figure 19: The discrepancy in distance between the trajectory of the vehicle and the reference trajectory in the transient phase, in meters

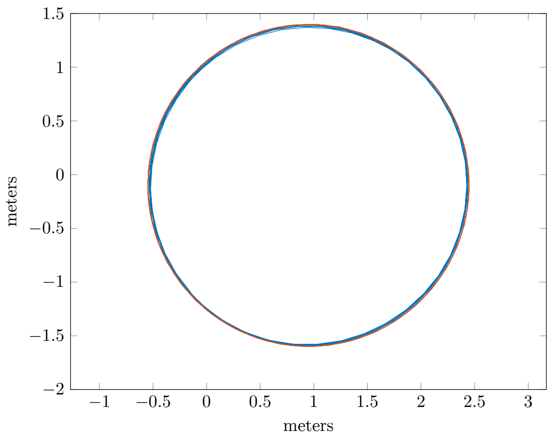

Figure 20: Reference trajectory (red) and trajectory of the vehicle (blue), in steady state

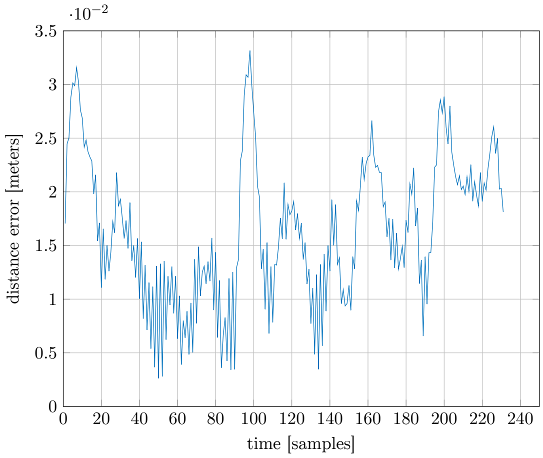

Figure 21: The discrepancy in distance between the trajectory of the vehicle and the reference trajectory in steady state, in meters

- Notions/resources/tools used: Predictive Control, `ROS`, Linux, `Python`, `git`, `MATLAB`, MoCap

0.2.3 Tracking the centerline of a lane with a RC car

Context: EL2425 Automatic Control Project Course KTH Royal Institute of Technology, Stockholm, Sweden; 2017

In a nutshell

[Wiki/Resources] [Video 1 | Video 2] [Code]

Problem III. Assume a remotely controlled vehicle chassis of Ackermann steering, equipped with a laser rangefinder and a computing unit. Given a straight path (something that simulates a road lane, e.g. a corridor), the goal is for the vehicle to navigate the path while always staying in the middle of it.

The solution to the problem involves solving two distinct and independent sub-problems, centered around the (a) translational error, and (b) the rotational error, with respect to the middle line of the path. Furthermore, the problem can be approached by two ways: through the design of a PID controller, which is easier to setup, faster in execution, but potentially difficult to tune, and through that of a MPC controller, which requires more work, is slower in execution, but is more robust than the PID controller. Figure 22 shows the evolution of the one-dimensional angular error of the vehicle under control by the PID controller.

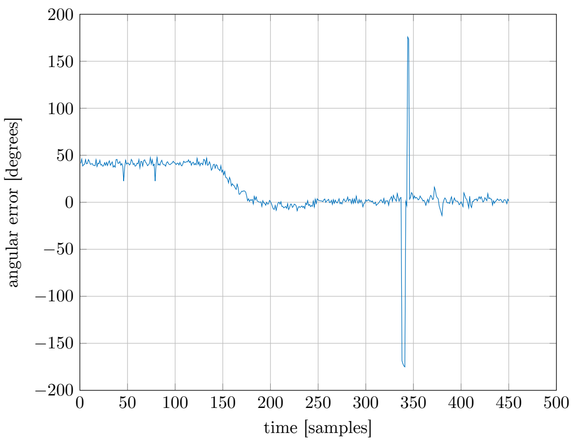

Figure 22: The angular error of the vehicle controlled via PID control in degrees

- Notions/resources/tools used: {PID, Predictive} Control, `ROS`, Linux, `Python`, `git`, `MATLAB`, MoCap

0.2.4 Balancing a segway

Context: EL2222 Systems and Control in Practice KTH Royal Institute of Technology, Stockholm, Sweden; 2015–2016

Problem IV. Assume a two-wheeled motor-led contraption equipped with a computing unit and an IMU. The goal is to balance the system in an upright position using information from the gyro and the accelerometer.

A basic solution consists of first integrating and fusing the angular velocity and linear acceleration measurements to a Kalman filter that estimates the system's angular error with respect to the vertical. The second step employs a (in this case PID) controller that acts in a way that keeps this error at zero. Figures 23 and 24 show the real and idealized "shellfie" segway.

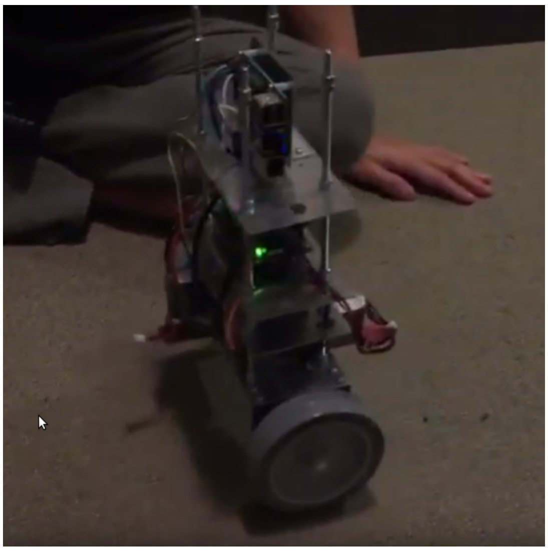

Figure 23: The custom-built "shellfie" segway. Image courtesy of Jatesada Borsub

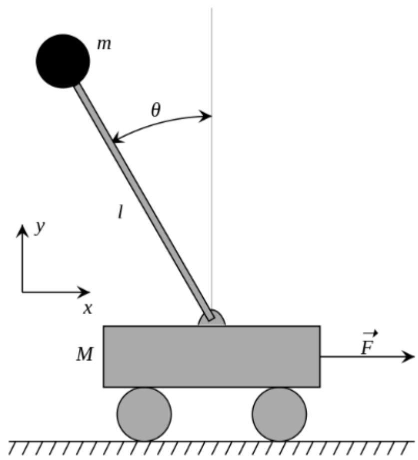

Figure 24: The shellfie is in principle an inverted pendulum

- Notions/resources/tools used: PID Control, Raspberry Pi, IMU, `ROS`, Linux, `Python`

0.3 Estimation Projects

0.3.1 How one detects vehicles violating the speed limit when all one has is a stationary camera

Context: EL2320 Applied Estimation Project

KTH Royal Institute of Technology, Stockholm, Sweden; 2016

`[Kalman filter   implementation and documentation]`

`[Particle filter implementation and documentation]`

Problem V. Assume a stationary camera overseeing a stretch of road on which vehicles travel freely. We would like to identify vehicles travelling at a speed larger than a given threshold.

One solution is comprised of two segments: (a) At first, a differentiation between what is considered background (the unvaried and vehicle-less road scene) and what is considered foreground (the objects "travelling" on top of the background) is in order. Since the data is in video form, we need to track the colour of each pixel through time, and therefore perform segmentation via Gaussian Mixture Models. (b) After vehicles have been detected, a separate Kalman filter (alternatively, a Particle filter) estimates the vector of the velocity of each detected vehicle. Given that the camera is stationary, information (or even guesstimates) about its placement with respect to the road it oversees can establish a correspondence between a vehicle's real (road) velocity and represented (image) velocity, so that vehicles above the speed limit are identified. Image 25 shows a frame drawn from a video sequence where the position and velocity of two vehicles are being tracked.

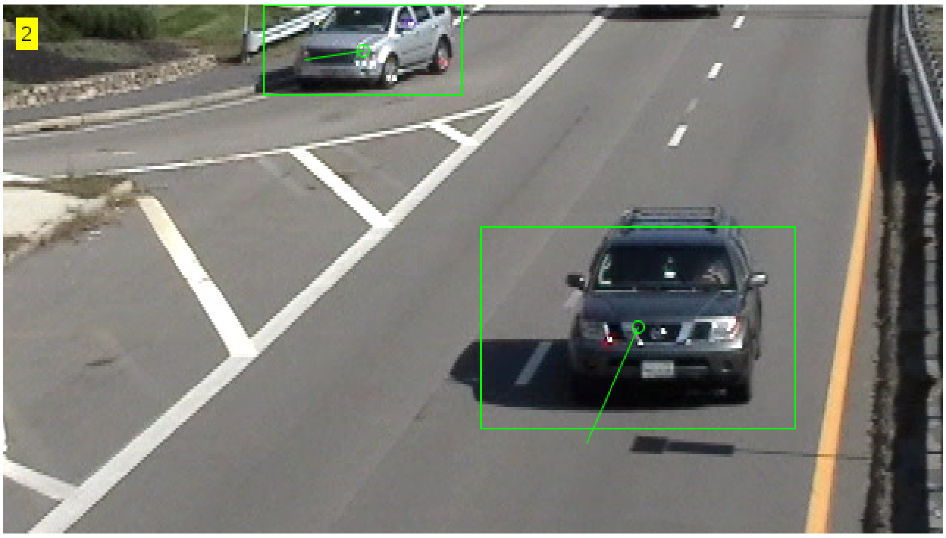

Figure 25: Two vehicles are successfully detected, with their velocity vector being estimated through time, using one Kalman filter per vehicle

- Notions/resources/tools used: video segmentation, Gaussian Mixture Models, Kalman filter, Particle filter, `MATLAB`

0.4 Computer Vision Projects

0.4.1 Hole detection via RGB-D camera within the RoboCup Rescue competition

Context: Voluntary work at PANDORA Robotics group

Aristotle University of Thessaloniki, Thessaloniki, Greece; 2014

In a nutshell

`[Website] [ROS Hydro packages] [My hole-detector ROS pkg]`

"The RoboCupRescue Robot League is an international league of teams with one objective: Develop and demonstrate advanced robotic capabilities for emergency responders using annual competitions to evaluate, and teaching camps to disseminate, best-in-class robotic solutions."[1]. Within the context of the RoboCup Rescue competition, robotic rescuers have to be able to locate simulated victims in closed spaces, simulating what is to happen during emergency situations. A rescuer has to first detect the "holes" in walls behind which these victims are assumed to be located. The unmanned ground vehicle PANDORA competes in the autonomous class and uses a RGB and a Depth camera for such purposes. Each of the images of the two cameras undergo independent analyses so as to make locating the precise outline of holes more probable. Figure 27 shows an example outcome of such analyses after cross-referencing RGB-derived holes to Depth-derived holes and vice versa, and after further processing. In terms of development and testing time, the resulting ROS package took around seven months to build; in terms of size it is comprised of around 8K lines of code and 4K lines of comments.

[1] `http://wiki.robocup.org/Robot_League`

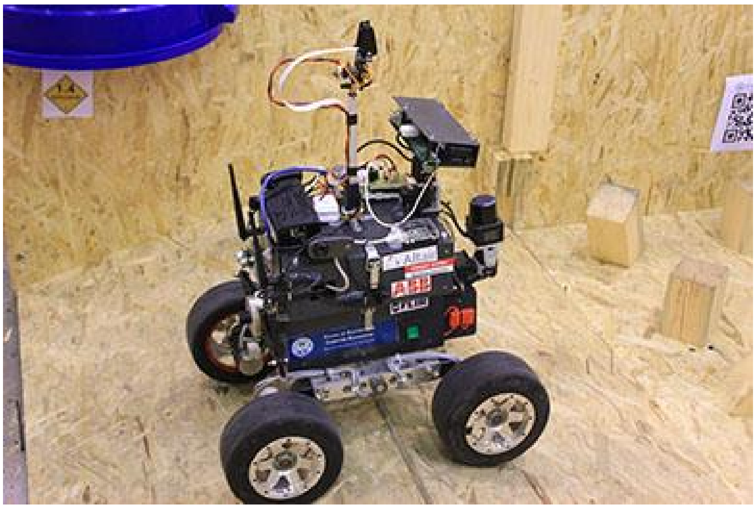

Figure 26: The PANDORA robot of 2014

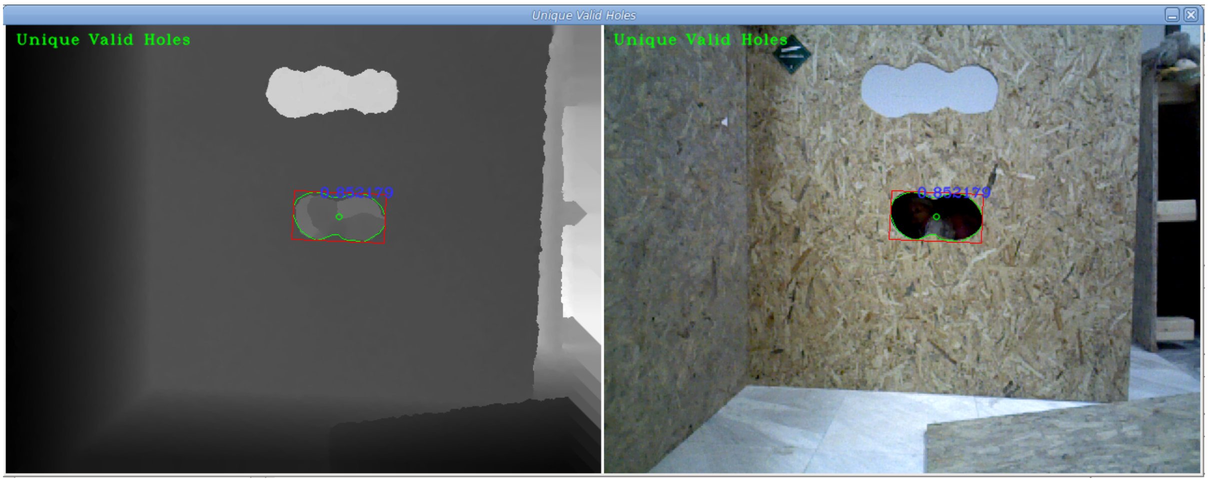

Figure 27: Although the wall has two holes, only the one closer to the ground is valid: the one above it is a through hole and therefore cannot contain possible victims

- Resources/tools used: `OpenCV`, `C++`, `ROS` hydro, `git`

0.5 Machine Learning Projects

0.5.1 Multi-label classification using Learning Classifier Systems

Context: Diploma Thesis Aristotle University of Thessaloniki, Thessaloniki, Greece; 2013

`[Code]`

Problem VI. Assume a set of annotated data of multiple labels (not multiple classes: each instance is simultaneously classified to more than one labels). Given this set, we would like to build a classifier which, trained with this set, can classify unseen data to multiple labels with the highest accuracy possible.

The solution was sought after through extending the framework of Learning Classifier Systems to the multi-label dimension. LCS's are systems that represent data instances with rules of the form "antecedents ⇒ consequents". Within this frame, rules are treated as a population evolving through time according to the principles of evolution mapped out by Charles Darwin. Rules undergo (a) crossover with other rules depending on a measure of their fitness (their "quality"), and (b) mutations indiscriminately during crossover, through time, iteratively.

The resulting classifier, called GMl-ASLCS, was compared against the state-of-the-art classifiers on a number of datasets and its performance was found to be (a) overall the highest in terms of accuracy, and (b) not statistically significantly divergent than those it was compared against. Table 1 shows the accuracy of the designed LCS called GMl-ASLCS and that of its rivals on 6 standard multi-label datasets.

Algorithms / Datasets	music	yeast	genbase	scene	medical	enron	Rank
GMl-ASLCS	$\mathbf{60.47}^1$	$\mathbf{51.67}^1$	$\mathbf{98.63}^1$	63.15^2	51.58^3	40.35^2	$\mathbf{1.67}^1$
GMl-ASLCS $_0$	50.05^4	45.51^4	87.90^5	42.39^5	40.14^5	39.40^3	4.33^5
BR-J48	46.23^5	43.95^5	$98.62^{2.5}$	51.34^4	$\mathbf{74.26}^1$	36.71^4	3.58^4
RA*k*EL-J48	50.91^3	48.74^3	$98.62^{2.5}$	57.76^3	72.84^2	$\mathbf{41.04}^1$	2.42^2
Ml*k*NN	53.26^2	51.62^2	94.11^4	$\mathbf{66.14}^1$	41.77^4	31.84^5	3.00^3

Table 1: Comparison between GMl-ASLCS and rival multi-label classifier algorigthms. The exponents refer to the rank of each algorithm on each specific dataset. Column "Rank" summarises the overall rank of each classifier

- Notions/resources/tools used: Genetic algorithms, `Java`, `git`

0.6 Other

0.6.1 Play Simon with a Raspberry Pi

Context: Systems and Control in Practice EL2222 Project KTH Royal Institute of Technology, Stockholm, Sweden; 2017

[Code]

The game "Simon" is used as a measure of the ability to retain memories, and in particular, memories of events and their sequence. The simplicity of the game can be captured by the equal simplicity with which the game as an artefact can be set up using a Raspberry pi, a small breadboard, four or more leds and some cables.

Bibliography

[FND18] Alexandros Filotheou, Alexandros Nikou, and Dimos V. Dimarogonas. “Decentralized Control of Uncertain Multi-Agent Systems with Connectivity Maintenance and Collision Avoidance”. In: *2018 European Control Conference (ECC)*. IEEE, June 2018, pp. 8–13. ISBN: 978-3-9524-2698-2. DOI: `10.23919/ECC.2018.8550343`. URL: `https://ieeexplore.ieee.org/document/8550343/`.

[Meg+19] Spyros Megalou, Anastasios Tzitzis, Stavroula Siachalou, Traianos Yioultsis, John Sahalos, Emmanouil Tsardoulias, Alexandros Filotheou, Andreas Symeonidis, Loukas Petrou, Aggelos Bletsas, and Antonis G. Dimitriou. “Fingerprinting Localization of RFID tags with Real-Time Performance-Assessment, using a Moving Robot”. In: *2019 13th European Conference on Antennas and Propagation (EuCAP)*. 2019, pp. 1–5.

[Tzi+19] Anastasios Tzitzis, Spyros Megalou, Stavroula Siachalou, Traianos Yioultsis, Athanasios Kehagias, Emmanouil Tsardoulias, Alexandros Filotheou, Andreas Symeonidis, Loukas Petrou, and Antonis G. Dimitriou. “Phase ReLock - Localization of RFID Tags by a Moving Robot”. In: *2019 13th European Conference on Antennas and Propagation (EuCAP)*. 2019, pp. 1–5.

[FND20] Alexandros Filotheou, Alexandros Nikou, and Dimos V. Dimarogonas. “Robust decentralised navigation of multi-agent systems with collision avoidance and connectivity maintenance using model predictive controllers”. In: *International Journal of Control* 93.6 (June 2020), pp. 1470–1484. ISSN: 0020-7179. DOI: `10.1080/00207179.2018.1514129`. URL: `https://www.tandfonline.com/doi/full/10.1080/00207179.2018.1514129`.

[Fil+20a] Alexandros Filotheou, Emmanouil Tsardoulias, Antonis Dimitriou, Andreas Symeonidis, and Loukas Petrou. "Pose Selection and Feedback Methods in Tandem Combinations of Particle Filters with Scan-Matching for 2D Mobile Robot Localisation". In: *Journal of Intelligent and Robotic Systems: Theory and Applications* 100.3-4 (2020). ISSN: 15730409. DOI: 10.1007/s10846-020-01253-6.

[Fil+20b] Alexandros Filotheou, Emmanouil Tsardoulias, Antonis Dimitriou, Andreas Symeonidis, and Loukas Petrou. "Quantitative and Qualitative Evaluation of ROS-Enabled Local and Global Planners in 2D Static Environments". In: *Journal of Intelligent & Robotic Systems* 98.3-4 (June 2020), pp. 567–601. ISSN: 0921-0296. DOI: 10.1007/s10846-019-01086-y. URL: http://link.springer.com/10.1007/s10846-019-01086-y.

[Tzi+20a] Anastasios Tzitzis, Alexandros Filotheou, Stavroula Siachalou, Emmanouil Tsardoulias, Spyros Megalou, Aggelos Bletsas, Konstantinos Panayiotou, Andreas Symeonidis, Traianos Yioultsis, and Antonis G. Dimitriou. "Real-time 3D localization of RFID-tagged products by ground robots and drones with commercial off-the-shelf RFID equipment: Challenges and Solutions". In: *2020 IEEE International Conference on RFID (RFID)*. 2020, pp. 1–8. DOI: 10.1109/RFID49298.2020.9244904.

[Tzi+20b] Anastasios Tzitzis, Spyros Megalou, Stavroula Siachalou, Tsardoulias G. Emmanouil, Alexandros Filotheou, Traianos V. Yioultsis, and Antonis G. Dimitriou. "Trajectory Planning of a Moving Robot Empowers 3D Localization of RFID Tags With a Single Antenna". In: *IEEE Journal of Radio Frequency Identification* 4.4 (2020), pp. 283–299. DOI: 10.1109/JRFID.2020.3000332.

[Dim+21] Antonis Dimitriou, Anastasios Tzitzis, Alexandros Filotheou, Spyros Megalou, Stavroula Siachalou, Aristidis R. Chatzistefanou, Andreana Malama, Emmanouil Tsardoulias, Konstantinos Panayiotou, Evaggelos Giannelos, Thodoris Vasiliadis, Ioannis Mouroutsos, Ioannis Karanikas, Loukas Petrou, Andreas Symeonidis, John Sahalos, Traianos Yioultsis, and Aggelos Bletsas. "Autonomous Robots, Drones and Repeaters for Fast, Reliable, Low-Cost RFID Inventorying & Localization". In: *2021 6th International Conference on Smart and Sustainable Technologies (SpliTech)*. 2021, pp. 01–06. DOI: `10.23919/SpliTech52315.2021.9566425`.

[Myl+21] George Mylonopoulos, Aristidis Raptopoulos Chatzistefanou, Alexandros Filotheou, Anastasios Tzitzis, Stavroula Siachalou, and Antonis G. Dimitriou. "Localization, Tracking and Following a Moving Target by an RFID Equipped Robot". In: *2021 IEEE International Conference on RFID Technology and Applications (RFID-TA)*. 2021, pp. 32–35. DOI: `10.1109/RFID-TA53372.2021.9617436`.

[FSD22] Alexandros Filotheou, Georgios D. Sergiadis, and Antonis G. Dimitriou. "FSM: Correspondenceless scan-matching of panoramic 2D range scans". In: *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2022, pp. 6968–6975. DOI: `10.1109/IROS47612.2022.9981228`.

[Fil+22] Alexandros Filotheou, Anastasios Tzitzis, Emmanouil Tsardoulias, Antonis Dimitriou, Andreas Symeonidis, George Sergiadis, and Loukas Petrou. "Passive Global Localisation of Mobile Robot via 2D Fourier-Mellin Invariant Matching". In: *Journal of Intelligent & Robotic Systems* 104.2 (Feb. 2022), p. 26. ISSN: 0921-0296. DOI: `10.1007/s10846-021-01535-7`. URL: `https://link.springer.com/10.1007/s10846-021-01535-7`.

[Fil+23] Alexandros Filotheou, Andreas L. Symeonidis, Georgios D. Sergiadis, and Antonis G. Dimitriou. "Correspondenceless scan-to-map-scan matching of 2D panoramic range scans". In: *Array* 18 (2023), p. 100288. ISSN: 2590-0056. DOI: `https://doi.org/10.1016/j.array.2023.100288`. URL: `https://www.sciencedirect.com/science/article/pii/S2590005623000139`.

[Tzi+23] Anastasios Tzitzis, Alexandros Filotheou, Aristidis Raptopoulos Chatzistefanou, Traianos V. Yioultsis, and Antonis G. Dimitriou. "Real-Time Global Localization of a Mobile Robot by Exploiting RFID Technology". In: *IEEE Journal of Radio Frequency Identification* 7 (2023), pp. 486–506. DOI: `10.1109/JRFID.2023.3288982`.