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Abstract

The aim of this deliverable consists in presenting the scientific dissemination within INCARE project. During the course of the project, the consortium partners have published 11 journal articles and have participated with articles, presentations or posters to 22 conferences. In addition, a contribution in Hungarian language was made by SOFTIC.

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ABBREVIATIONS

AAL	Active Assisted Living
INCARE	Integrated Solution for Innovative Elderly Care
TASKER	Task schedulER framework
WUT	Warsaw University of Technology
CITST	IT Center for Science and Technology
UPB	University POLITEHNICA of Bucharest
IZRIIS	Institute for research, intergenerational relations, gerontology and ICT
BZN	Bay Zoltán Nonprofit Ltd. for Applied Research
EXYS	ECLEXYS Sagl

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1 Introduction

The scientific dissemination within ICANRE project are grouped in the following sections as journal papers, conference papers and presentations, and other types of dissemination.

2 Journal Papers

2.1 An intent-based approach for creating assistive robots' control systems

Reference: T. Winiarski, W. Dudek, M. Stefańczyk, Ł. Zieliński, D. Giełdowski, D. Seredyński; An intent-based approach for creating assistive robots' control systems arXiv preprint arXiv:2005.12106, 2020

Impact on the project: The current research standards in robotics demand general approaches to robots' controllers development. In the assistive robotics domain, the human-machine interaction plays a substantial role. Especially, the humans generate intents that affect robot control system. In the article an approach is presented for creating control systems for assistive robots, which reacts to users' intents delivered by voice commands, buttons, or an operator console. The whole approach was applied to the real system consisting of customised TIAGo robot and additional hardware components. The exemplary experiments performed on the platform illustrate the motivation for diversification of human-machine interfaces in assistive robots.

Short description: Presentation of the system consisting of the robot and the intelligent house components.

2.2 HuBeRo-a Framework to Simulate Human Behaviour in Robot Research

Reference: J. Karwowski, W. Dudek, M. Węgierek, and T. Winiarski HuBeRo-a Framework to Simulate Human Behaviour in Robot Research Journal of Automation, Mobile Robotics and Intelligent Systems, vol. 15, no. 1, pp. 31–38, 2021

Impact on the project: Presentation of the simulation system to verify robots' behavior in the presence of people.

Short description: Social robots' software is commonly tested in a simulation due to the safety and convenience reasons as well as an environment configuration repeatability assurance. An interaction between a robot and a human requires taking a person presence and his movement abilities into consideration. The purpose of the article is to present the HuBeRo framework, which can be used to simulate human motion behavior. The framework allows independent control of each individual's activity, which distinguishes the presented approach from state-of-the-art, opensource solutions from the robotics domain. The article presents the framework assumptions, architecture, and an exemplary application with respect to presented scenarios.

2.3 Scheduling of a robot's tasks with the TaskER framework

Reference: W. Dudek, T. Winiarski; Scheduling of a robot's tasks with the TaskER framework, in IEEE Access, 2020, vol 8, pages 161449-161471, doi: 10.1109/ACCESS.2020.3020265.

Impact on the project: Presentation of the system to handle multitasking needed in e.g. simultaneous hazard detection and human assisting.

Short description: Robots, in contrast to typical computational systems, affect the physical environment directly. Therefore, other assumptions must be considered for task management procedures in these system types. Robots coexist with humans in the environment and act upon potentially dangerous objects (e.g., a cooker), so extra safety procedures in robots' task harmonization need to be ensured. Additionally, an algorithm that schedules tasks for a robot and optimizes the robot's operation needs to consider motion time of the robot, dynamics of physical processes and the robot's user preferences. In this article we investigate the problem of robots' tasks harmonization. We state requirements for a system with the ability to switch between various independent tasks safely. The tasks are uploaded to a store, launched on a robot at the user's request (similarly to smartphone applications) and scheduled following a configurable algorithm. Furthermore, we design a model of systems satisfying the requirements. The systems are structured with agents of different classes. The tasks of the system can be safely interrupted, postponed, resumed and potential danger (like leaving a cooker on for a long time) can be minimized with the proposed harmonization procedure and dedicated states of the Finite State Machines describing the operation of the agents. Finally, we present the TaskER framework implementing the model and we verify the model through the execution of an exemplary system in scenarios showing benefits of the model adaption.

2.4 Spring based on flat permanent magnets: design, analysis and use in variable stiffness actuator

Reference: B. Kozakiewicz, T. Winiarski "Spring based on flat permanent magnets: design, analysis and use in variable stiffness actuator" in Facta Universitatis, Series: Mechanical Engineering, 2021, doi: 10.22190/FUME210412055K

Impact on the project: Presentation of the approach to construct joins that answers the need of increased safety in physical human-machine interaction.

Short description: Modern robot applications benefit from including variable stiffness actuators (VSA) in the kinematic chain. In this paper, we focus on VSA utilizing a magnetic spring made of two coaxial rings divided into alternately magnetized sections. The torque generated between the rings is opposite to the angular deflection from equilibrium and its value increases as the deflection grows – within a specific range of angles that we call a stable range. Beyond the stable range, the spring exhibits negative stiffness what causes problems with prediction and control. In order to avoid it, it is convenient to operate within a narrower range of angles that we call a safe range. The magnetic springs proposed so far utilize few pairs of arc magnets, and their safe ranges are significantly smaller than the stable ones. In order to broaden the safe range, we propose a different design of the magnetic spring, which

is composed of flat magnets, as well as a new arrangement of VSA (called ATTRACTOR) utilizing the proposed spring. Correctness and usability of the concept are verified in FEM analyses and experiments performed on constructed VSA, which led to formulating models of the magnetic spring. The results show that choosing flat magnets over arc ones enables shaping spring characteristics in a way that broadens the safe range. An additional benefit is lowered cost, and the main disadvantage is a reduced maximal torque that the spring is capable of transmitting. The whole VSA can be perceived as promising construction for further development, miniaturization and possible application in modern robotic mechanisms.

2.5 Fusion Mechanisms for Human Activity Recognition Using Automated Machine Learning.

Reference: A. Popescu, I. Mocanu and B. Cramariuc, "Fusion Mechanisms for Human Activity Recognition Using Automated Machine Learning," in IEEE Access, vol. 8, pp. 143996-144014, 2020, doi: 10.1109/ACCESS.2020.3013406.

Impact on the project: recognition of daily human activity

Short description: Human activity recognition has been a branch of interest in the field of computer vision for decades, due to its numerous applications in different domains, such as medicine, surveillance, entertainment or human-computer interaction. We propose an intuitive, effective, quickly trainable and customizable system for recognizing human activities designed with an automated machine learning method based on Neural Architecture Search. Information from all channels of a 3D video (RGB and depth data, skeleton and context objects) is merged by independently passing these data streams through 2D convolutional neural networks. The outputs of all networks are combined in a summarizing array of class scores using fusion mechanisms that are not computationally intensive but reflect the meaningful information from a video. The proposed system is tested using three public datasets and a new dataset—PRECIS HAR—that was created in our laboratory. In all our experiments, the system is proven to be highly accurate: 98.43% on MSRDailyActivity3D, 91.41% on UTD-MHAD, 90.95% on NTU RGB+D, and 94.38% on our dataset.

2.6 Active fall prevention: robotic vision in AAL

Reference: D. Gruszczyński, M. Stefańczyk; Active fall prevention: robotic vision in AAL. arXiv preprint arXiv:2103.09298, 2021

Impact on the project: hazard detection - dangerous object detection that lays on the floor

Short description: Effective methods of preventing falls significantly improve the quality of life of the Elderly. Nowadays, people focus mainly on the proper provision of the apartment with handrails and fall detection systems once they have occurred. The article presents a system of active detection and classification of the risk of falls in the home space using a service robot equipped with a vision sensor. Hazard classification allows for effective performance of tasks assigned to the robot while maintaining a high level of user safety.

2.7 The utilization of spherical camera in simulation for service robotics

Reference: K. Chachuła, M. Stefańczyk; The utilization of spherical camera in simulation for service robotics. arXiv preprint arXiv:2103.09297, 2021

Impact on the project: spherical camera usage in system simulation

Short description: Safety is one of the most critical factors in robotics, especially when robots have to collaborate with people in a shared environment. Testing the physical systems, however, must focus on much more than just software. One of the common steps in robotic system development is the utilization of simulators, which are very good for tasks like navigation or manipulation. Testing vision systems is more challenging, as the simulated data often is far from the real camera readings. In this paper, we show the advantages of using the spherical camera for recording the sequences of test images and a way to integrate those with existing robotic simulator. The presented system also has the possibility to be extended with rendered objects to further improve its usability.

2.8 Static LiDAR Assisted UWB Anchor Nodes Localization

Reference: M. Kołakowski, V.Djaja-Josko, J. Kołakowski Static LiDAR Assisted UWB Anchor Nodes Localization, IEEE Sensors Journal, IEEE, 21 December 2020, DOI: 10.1109/JSEN.2020.3046306

Impact on the project: The paper presents an indoor mapping and UWB (ultra-wideband) anchor localization method. The method, unlike most of the solutions described it the literature uses a static LiDAR (Light Detection and Ranging) mounted on a tripod rather than a robotic platform. It can be used at an any place, where employing a robot would be difficult (e.g., private homes), but since it requires manual LiDAR placement it would be most efficient in spaces of moderate areas. The proposed concept consists in mapping the environment of system installation while performing ranging measurements with deployed UWB anchor nodes. The SLAM (Simultaneous Location and Mapping) algorithm used for map integration and device localization relies only on LiDAR results. The matching is performed in two steps by finding an initial match based on corresponding landmarks extracted from the scans (intersections of the detected wall lines) and refining the results using an Iterative Closest Point algorithm. The anchors are localized based on the ranging results and SLAM-derived device locations using a Least-Squares based optimizer. The experiments have shown that the algorithm allows to construct a comprehensive map of the environment and localize the anchors with a root mean square error of 0.34 m, which is at similar level to analogous methods described in other works.

Short description: localization system improvement

2.9 Image Segmentation Using Encoder-Decoder with Deformable Convolutions

Reference: Gurita A, Mocanu I., Image Segmentation Using Encoder-Decoder with Deformable Convolutions. Sensors. 2021; 21(5):1570. https://doi.org/10.3390/s21051570

Impact on the project: image segmentation used for object detection and recognition for the manipulatory part

Short description: Image segmentation is an essential step in image analysis that brings meaning to the pixels in the image. Nevertheless, it is also a difficult task due to the lack of a general suited approach to this problem and the use of real-life pictures that can suffer from noise or object obstruction. This paper proposes an architecture for semantic segmentation using a convolutional neural network based on the Xception model, which was previously used for classification. Different experiments were made in order to find the best performances of the model (e.g., different resolution and depth of the network and data augmentation techniques were applied). Additionally, the network was improved by adding a deformable convolution module. The proposed architecture obtained a 76.8 mean IoU on the Pascal VOC 2012 dataset and 58.1 on the Cityscapes dataset. It outperforms SegNet and U-Net networks, both networks having considerably more parameters and also a higher inference time.

2.10 Combining Supervised and Unsupervised Learning Algorithms for Human Activity Recognition.

Reference: Budisteanu E-A, Mocanu IG. Combining Supervised and Unsupervised Learning Algorithms for Human Activity Recognition. Sensors. 2021; 21(18):6309. https://doi.org/10.3390/s21186309 (Q1 journal, impact factor 3.576).

Impact on the project: image segmentation used for object detection and recognition for the manipulatory part

Short description: Human activity recognition is an extensively researched topic in the last decade. Recent methods employ supervised and unsupervised deep learning techniques in which spatial and temporal dependency is modeled. This paper proposes a novel approach for human activity recognition using skeleton data. The method combines supervised and unsupervised learning algorithms in order to provide qualitative results and performance in real time. The proposed method involves a two-stage framework: the first stage applies an unsupervised clustering technique to group up activities based on their similarity, while the second stage classifies data assigned to each group using graph convolutional networks. Different clustering techniques and data augmentation strategies are explored for improving the training process. The results were compared against the state of the art methods and the proposed model achieved 90.22% Top-1 accuracy performance for NTU-RGB+D dataset (the performance was increased by approximately 9% compared with the baseline graph convolutional method). Moreover, inference time and total number of parameters stay within the same magnitude order. Extending the initial set of activities with additional classes is fast and robust, since there is no required retraining of the entire architecture but only to retrain the cluster to which the activity is assigned.

2.11 Automated Calibration of RSS Fingerprinting Based Systems Using a Mobile Robot and Machine Learning.

Reference: M. Kołakowski, "Automated Calibration of RSS Fingerprinting Based Systems Using a Mobile Robot and Machine Learning", Sensors, vol. 21, 6270, Sep. 2021 https://doi.org/10.3390/s21186270

Impact on the project: localization system performance improvement

Short description: The paper presents an indoor BLE positioning system calibration method utilizing the mobile platform. The method allows for radio map calibration using Machine Learning solutions. The paper presents the results obtained using the following algorithms: interpolation via propagation model fitting, Gaussian Process Regression, Artificial Neural Network Regression, Random Forest Regression.

3   Conference papers and presentations

3.1   An AAL scenario involving automatic data collection and robotic manipulation

Reference: D I Nastac, O Arsene, M Dragoi, I D Stanciu, I Mocanu, An AAL scenario involving automatic data collection and robotic manipulation, In Proc. 3rd IET International Conference on Technologies for Active and Assisted Living (TechAAL 2019), 25 March, 2019, London, UK.

Event size: < 100

Impact on the project: Describing an AAL scenario for robot interaction

Short description: In this paper, we describe an Ambient Assisted Living (AAL) scenario which includes a robotic platform employed in automatic data collection and assistance. As part of this scenario we propose new algorithms and solutions for indoor localization and manipulation. The former involves automatic data collection of WLAN RSS fingerprints by the robotic platform. The latter involves object manipulation with focus on grasping algorithms. Our new hybrid approach, where the localization problem is split into two stages, which are modelled as a classification and regression problem, proves to deliver the best positioning accuracy even when compared with deterministic approaches. At the same time, we also obtained improved results in the object grasping approach. The improvement is most pronounced for previously unseen data showing that our method is able to better generalize new environments.

3.2   Towards facilitating learning and improving education with TIAGO robot

Reference: M. Dragoi, I. Mocanu, O. Cramariuc, B. Cramariuc, Towards facilitating learning and improving education with TIAGO robot, In Proc. 13th annual International Technology, Education and Development Conference, (INTED2019), 11-13 March, 2019, Valencia, Spain.

Event size: ~200

Impact on the project: interaction with a robotic platform

Short description: Recent developments in robotics and machine learning make robot assisted environments no longer seem like a far dream. We are currently witnessing their slow but seamless integration in everyday lives both at home and at school. Robots have a great potential in being employed as an educational technology. They can be used to facilitate learning and improve educational performance of students in various fields such as physics and mathematics. Independent on their roles in the learning process (passive as teaching aid, co-learner, co-tutors, etc) the main concern is to guarantee their safety around humans. For this, the actions of the robot must be socially acceptable and the results of the actions should be as close as possible to the desired outcome. Several key areas of interest in this respect are movements, environment recognition and kinematics planning for the interaction with the environment. The presented work focuses on robotic manipulation, mainly the automatic identification and evaluation of grasping positions for a set of common objects. The main protagonist in our scenarios is the TIAGo robot produced by the Spanish robot maker PAL Robotics who is having both a passive role as teaching aid and an active one as co-tutors.

3.3 Serious games with virtual reality as a learning platform for cognitive training..

Reference: I. Mocanu, O. Cramariuc, B. Cramariuc, Serious games with virtual reality as a learning platform for cognitive training, In Proc. 13th annual International Technology, Education and Development Conference, (INTED2019), 11-13 March, 2019, Valencia, Spain.

Event size: ~200

Impact on the project: developing cognitive games

Short description: This paper proposes a set of serious games as a learning platform for cognitive training with the help of virtual reality. We plan to see how efficient is a serious game with virtual reality as a learning platform in this direction. The games have simple functioning mechanics. For example, one type of game is the following: it introduces the user into a natural scene using virtual reality. In the scene there are different objects with different sizes, colors and orientations and the objects will move through the scene. The user must collect objects in order to create a story with them or to create a picture composed of the collected objects (similar with a puzzle). To make the game more attractive for each user, the designing of the game is adapted based on both the user profile and the user performance.

3.4 An Intelligent Personalized Fashion Recommendation System

Reference: C. Stan, I. Mocanu - An Intelligent Personalized Fashion Recommendation System, 22nd International Conference on Control Systems and Computer Science, CSCS 2019, Bucharest, Romania, May 28-30, 2019, pp. 210-215, DOI 10.1109/CSCS.2019.00042 (ISI Proceedings).

Event size: ~200

Impact on the project: extract recommendations that are used for personalizing levels for cognitives games developed in the INCARE project

Short description: Creating an outfit is a problem that is based on the preferences of each person and it can be difficult even for the best experts. This paper presents an automated system that can recommend a full outfit based on a cloth item considering also user's preference. Two convolutional neural networks based on the AlexNet model are used to identify cloth items and attributes associated with each item. After that, two types of scores are used in order to evaluate the user's preference for combination of different items, that are continuously updated in order to obtain recommendations that are more suitable for each user.

3.5 Using Convolutional Neural Network for Image Enhancement on Mobile Devices

Reference: M. Despotovici, I. Mocanu, L. Rusu - Using Convolutional Neural Network for Image Enhancement on Mobile Devices, ICCP 2019, in curs de publicare (ISI Proceedings).

Event size: ~200

Impact on the project: automatically improving the quality of input images / frames from video that will be used for object detection or supervising people using a robotic platform.

Short description: This paper presents an application used to automatically enhance an image captured by a camera of a mobile device. The proposed solution consists of applying 4 image enhancement algorithms: gamma correction, saturation correction, white and black level correction. In order to parameterize the algorithms, we proposed a solution based on a convolutional neural network. The network was ported on a mobile device, keeping in mind to minimize computation resources and battery consumption. The mobile platform used is a smart phone, which has an accelerator, useful for massive processing of data caused by the neural network and a graphical processor, used to apply the 4 algorithms.

3.6 Task harmonization for a single-task robot controller

Reference: Wojciech Dudek, Maciej Węgierek, Jarosław Karwowski, Wojciech Szynkiewicz, Tomasz Winiarski - Task harmonization for a single-task robot controller, in 12th International Workshop on Robot Motion and Control (RoMoCo), 2019, 8-10 July Poznań, Poland, pp. 86–91

Event size: < 100

Impact on the project: Task harmonisation in the system - initial study

Short description: The technical capabilities of robots and their increasing versatility cause that a single robot is able to perform more and more different complex tasks. What is more, when performing a task, it may be asked to do another one. Switching between different tasks is a known problem in engineering, however, robots, compared to programs operating in a virtual space, are a specific kind of devices as they operate in the face of the laws of physics. In this work, we introduce a method for harmonizing service robot tasks being managed by finite state machines. The method allows handling safe suspend and resume of a complex

task. Additionally, we consider a case when the robot cannot switch the current task to another at any time. The method was implemented and verified by conducting multiple interruptions of one task by another one. The tasks during the verification were being performed in simulation by a TIAGo robot.

3.7   FABRIC: Framework for Agent-Based Robot Control Systems

Reference: Dawid Seredyński, Tomasz Winiarski, Cezary Zieliński - FABRIC: Framework for Agent-Based Robot Control Systems, in 12th International Workshop on Robot Motion and Control (RoMoCo), 2019, 8-10 July Poznań, Poland, pp. 215–222

Event size: < 100

Impact on the project: framework to create part of the system comprising robotic controlers

Short description: The paper presents FABRIC, a framework and a toolchain that facilitates semi-automatic generation of agent-based control systems for robots. Decomposition of a formal specification into a hierarchical structure of patterns and their parameters is employed. It implies a division of the specification into a number of items, produced using a DSL and source code expressed in a universal programming language. Different items are produced by different categories of system builders. The method of generating a working, agent-based system out of its specification is verified on a service robot that executes complex tasks, e.g., door opening.

3.8   Intuitive and Intelligent Solutions for Elderly Care..

Reference: Neja Samar Brenčič, Marius Dragoi, Irina Mocanu, Tomasz Winiarski; Intuitive and Intelligent Solutions for Elderly Care, in Digital Health in Focus of Predictive, Preventive and Personalised Medicine,L. Chaari, Ed. Cham: Springer International Publishing, 2020, pp. 101–108, https://link.springer.com/chapter/10.1007/978-3-030-49815-3_12

Event size: ~100

Impact on the project: Presentation of the outcome of the user-centered design.

Short description: In this article we present our contributions from projects addressing Active and Assisted Living (AAL), a field which can have a considerable impact on elderly care by allowing not only preventive and predictive actions (e.g. monitoring and assessment of health parameters, sleep and mobility patterns) but also personalized care through intelligent solutions which relay on robotic platforms. The latter can also provide active support and intervention in critical situations such as fall detection and hazard identification. We are focusing on the outcome of the user-centered design involved in the projects and on some of the novel technologies which confer novelty and intelligence to our development. The main results from a multinational survey and conjoint analysis are also presented. The authors gratefully acknowledge the contribution of the IONIS consortium partners

3.9   AI in Cancer prevention and treatment.

Reference: Neja Samar Brenčič, "AI in Cancer prevention and treatment", "World Cancer Day Conference and media presentation, 03.02.2020

Event size: ~100

Impact on the project: Presentation of the EU programs that contribute to the cancer prevention in the field of digital / eHealth.

Short description: http://izriis.org/2020/02/04/javna-predstavitev-prizadevanj-za-zmanjsevanje-rakavih-obolenj-v-rs-ob-svetovnem-dnevu-boja-proti-raku/. The article and oral presentation included the presentation of INCARE and AAL projects as solutions that support elderly with cronic diseases.

3.10 A Two Step Approach for Joint Detection

Reference: Irina Maria Sandu, Irina Mocanu, Lucia Rusu- A Two Step Approach for Joint Detection, ICCP 2020

Event size: ~50

Impact on the project: detection of the human skeleton that will be usedd for human activity recognition

Short description: Human joints can be used in areas such as activity recognition, animation, augmented reality and robotics. Thus, there is a need to correctly detect these points. This paper proposes a two step method for joint detection. First an initial prediction is performed using the HRNet network. In the second step an improvement is applied on the initial predictions for each joint using a convolutional neural network. Tests were performed using the Unite the People dataset. The new model is able to improve the results of the base model by 1.81%.

3.11 A Platform to Promote a more Active Lifestyle Between Students.

Reference: Imad Alex Awada, Irina Mocanu - A Platform to Promote a more Active Lifestyle Between Students, 16th eLearning and Software for Education Conference (eLSE 2020)

Event size: ~50

Impact on the project: physical games

Short description: The platform suggests for each user to perform specific physical activities/exercises based on the physical activities that the user had during the day, the duration of the sleep and his/her profile (preferences, performance history) as well as some health parameters (heart rate, blood pressure, weight). All these tasks are realized through a game with an avatar that is controlled by the user by physical exercises (e.g., the avatar is placed in an environment and he/she must collect different objects by jumping, running). The exercises performed by the user are acquired using an RGB camera. Images are processed and

the skeleton of the user is obtained using the OpenPose library. To increase motivation, the platform gives different rewards (e.g., more points) for executing physical tasks and suggests some collective physical activities based on the profile of each user. The platform is multilingual, it supports Romanian and English language, with the possibility to extend it to other languages. The platform integrates a multimodal interface that enables the users to interact through voice and touch-based commands as well as touch-free gestures.

3.12 An e-Learning Platform That Supports Personalized Learning and Multimodal Interactions.

Reference: Imad Alex Awada, Irina Mocanu, Oana Cramariuc - An e-Learning Platform That Supports Personalized Learning And Multimodal Interactions, 14th annual International Technology, Education and Development Conference INTED 2020, 04 Mar 2020, Valencia, Spain

Event size: ~200

Impact on the project: human-robot interraction

Short description: The platform allows tutors to track the evolution of their students and to organize competitive quizzes for a selected group of students. The tutor can create manually a group that contain multiple students or to use groups are generated automatically by the platform based on the knowledge level of each student in a determined topic. In addition, the platform allows the parents to track the evolution of their children, the history of their activities as well as their interactions with the tutors. Each user has a profile in which the users store their personal information, their preferences and their relation with other users, as well as other useful information. The platform tracks each user's performance and emotional status during the use of the platform (e.g. quizzes, engaging with the learning materials...) and update the profile of the user according to the collected information. The platform integrates an avatar and a multimodal interface which makes the interaction easier and more attractive for the students. In additional to the traditional inputs the interface of the platform supports touch and voice inputs and generates visual and phonetic outputs. The platform is multilingual, it has several customizable and adaptive features such as adapting the quizzes level according to the knowledge level of each user (beginner, intermediate and advanced) in the topic and according to his/her previous performances, and adapting the avatar and the educational resources according to the user's preferences and/or emotional status.

3.13 IT Security issues and trends, deep web and the activities in the CTI panorama

Reference: Angelo Consoli - "IT Security issues and trends, deep web and the activities in the CTI panorama", Single speaker conference organized by the cultural association "VareseVive", Varese, Italy, October 2018.

Event size: ~50

Impact on the project: security for communication module in the INCARE platform

Short description: The talk that was given is about the IT Security issues for communication systems, including the e-health ones to which the INCARE platform belongs.

3.14 A Method for TDOA Errors Mitigation in UWB Positioning System

Reference: J. Kołakowski, A Method for TDOA Errors Mitigation in UWB Positioning System, 23rd International Microwave and Radar Conference (MIKON), 5-8 Oct. 2020, Warsaw, Poland, DOI: 10.23919/MIKON48703.2020.9253740

Event size: ~100

Impact on the project: localization system performance improvement

Short description: Contemporary UWB positioning systems are able to provide excellent localization accuracy. However, if the system is deployed in a multipath environment, where the propagation conditions are usually harsh, the positioning errors are significantly higher. The paper contains a description of a novel method for time difference of arrival measurement errors mitigation. The applied corrections depend on the current tag location and their values are determined with fingerprinting technique. The proposed method's efficiency was evaluated based on measurements performed with an UWB positioning system.

3.15 Comparison of Extended and Unscented Kalman Filters Performance in a Hybrid BLE-UWB Localization System

Reference: M. Kołakowski, Comparison of Extended and Unscented Kalman Filters Performance in a Hybrid BLE-UWB Localization System, 23rd International Microwave and Radar Conference (MIKON), 5-8 Oct. 2020, Warsaw, Poland, DOI: 10.23919/MIKON48703.2020.9253854

Event size: ~100

Impact on the project: localization system performance improvement

Short description: The paper presents a comparison of performance of two Kalman Filters: extended Kalman filter (EKF) and unscented Kalman filter (UKF) in a hybrid Bluetooth-Low-Energy-ultra-wideband (BLE-UWB) based localization system. In the system, the user is localized primarily based on Received Signal Strength (RSS) measurements of BLE signals. The UWB part of the system is periodically used to improve localization accuracy by supplying the algorithm with measured UWB packets time difference of arrival (TDOA). The proposed scheme was experimentally validated using two algorithms: the EKF and the UKF. The localization accuracy of both algorithms is compared.

3.16 Cognitive games for improving learning skills

Reference: A. Mocanu, I. Mocanu, O. Cramariuc (2021) Cognitive games for improving learning skills, INTED2021 Proceedings, pp. 7537-7544.

Event size: ~50

Impact on the project: cognitive games

Short description: Presentation of the 6 cognitive games developed in the INCARE project: 1) Match game - find identical cards, 2) Collect & Create - collect different objects for making a pie / a puzzle, 3) Collect Objects - collect one type of object and avoid the others, 4) Get the Differences - find the differences between two scenes, 5) Organize Numbers - organize 15 numbers in ascending order, 6) Object Maze - moving through a maze avoiding some objects and collecting as much as possible other types of objects; the difficulty of the next level depends on the score obtained in the current level. At the end of each session, the score obtained by the player is saved in a MySQL database stored on the Cloud. The information saved are the following: ID of the user, name of the game (for example: make a pie, puzzle, etc), obtained score, date and time when the game is over.

3.17 An e-learning platform adapted to the online learning system
Reference: A.I. Awada, I. Mocanu (2021) An e-learning platform adapted to the online learning system, INTED2021 Proceedings, pp. 7473-7479.

Event size: ~50

Impact on the o project: cognitive & physical games & multimodal interface

Short description: The paper presents an e-Learning platform that enables school students to continue their learning process at home and enhances this process by providing different learning resources, stimulating human interactions between the students from a side and between them and their teachers from another side. In addition, the platform stimulates the physical activity of the students, tracks their evolution during the physical exercises and provide feedbacks about the evolution of each student. The platform is multilingual. It integrates a multimodal interface that has many adaptive and customizable features. Moreover, the levels and the duration of the games and quizzes (excluding the ones initiated by the teachers) are adapted according to the information that are extracted from the profile of each student.

3.18 A platform that aims to help people to learn how to interact with robotic platforms.
Reference: A.C. Popescu, A. I. Awada, I. Mocanu, O. Cramariuc, N. Samar Brencic (2021) A platform that aims to help people to learn how to interact with robotic platforms, EDULEARN21 Proceedings, pp. 6342-6351.

Event size: ~50

Impact on the project: interaction between people and robots

Short description: In the context of rapid development of robotic technologies and fast growth of the ageing population, assistive robots have become an important factor to consider for offering support to elderly people. Thus, not surprisingly, human–robot

interaction plays a crucial role in the booming market for intelligent personal-service. This paper presents two types of human-robot interaction: using gesture and voice commands. These interactions were tested on two robots with different capabilities: Turtlebot and TIAGo.

3.19 Gesture-Based Human-Robot Interaction.

Reference: I. Mocanu, A. Tudor and O. Cramariuc, Gesture-Based Human-Robot Interaction, 2021 23rd International Conference on Control Systems and Computer Science (CSCS), 2021, pp. 151-156, doi: 10.1109/CSCS52396.2021.00032 (ISI Proceedings).

Event size: ~50

Impact on the project: interaction between people and robots

Short description: The paper proposes a method for human robot interaction through gestures. Even if there are different methods that perform gesture recognition, many of them are tested in ideal conditions. This paper proposes a convolutional neural network that is used for gesture recognition applied for human-robot interaction in different environmental conditions: such as: blurring, low or high illumination, low quality image or losing part of frames. We started from a pre-trained ResNeXt 101 model and we increased the accuracy by adding a preprocessing stage for improving the quality of image, applying data augmentation, using different optimisers and learning rate scheduler. The proposed model obtained an improvement of 0.9% compared to the baseline model. Online evaluation of gesture recognition was performed using the Turtlebot robot.

3.20 Testing Federated Learning on Health and Wellbeing Data

Reference: Irina Mocanu, Razvan Smadu, Marius Dragoi, Andrei Mocanu, Oana Cramariuc, Testing Federated Learning on Health and Wellbeing Data, EHB 2021, 18-9 November 2021, Iasi, Romania, in process (ISI Proceedings).

Event size: ~100

Impact on the project: extracting correlations between medical parameters

Short description: Based on current research personalized medicine could transform the healthcare domain. Thus, medical data from users must be collected and used for training models. In order to preserve the privacy of data, federated learning represents a good candidate. This paper proposes an extension of the federated learning model that is evaluated for learning over aa distributed dataset. The proposed architecture is a client-server, where the clients are clustered by the server, according to their data similarity (without exposing data to the server). The server stores the clusters models and manages the clients. Different tests were performed on three datasets: CIFAR-10, MNIST and a non-standard one - a sleep dataset. Results show that an increase of the convergence rate was obtained (in case of the MNIST dataset was 50 times faster). Also, the method has the ability to learn patterns from the data, by keeping data locally.

3.21 Adaptive Anchor Pairs Selection in a TDOA-based System Through Robot Localization Error Minimization

Reference: Marcin Kołakowski, "Adaptive Anchor Pairs Selection in a TDOA-based System Through Robot Localization Error Minimization", Signal Processing Symposium 2021 (SPSympo-2021), 21–23 September 2021, Lodz, Poland

Event size: ~120

Impact on the project: localization system improvement

Short description: The paper presents an adaptive indoor localization method intended for use in UWB positioning system. The methods consists in calibration performed using a mobile robot, during which the most favorable anchor sets are determined for various areas of the apartment, where the system is installed. During the normal work, the algorithm uses, the calibration results to localize the user with higher accuracy.

3.22 Testing the AAL InCare Integrated Smart System (blood pressure measurement, blood oxygen level, balance measurement)

Reference: Dénes Perényi, János Csébfalvi; 05/05/2021; Testing the AAL InCare Integrated Smart System (blood pressure measurement, blood oxygen level, balance measurement) in the Újbuda Social Service - first experiences; Zoom Conference

Event size: ~50

Impact on the project: development of health monitoring services; increase user acceptance and awareness

Short description: HoCare2.0 Conference; Presentation of the results and experiences of the pilot operation of the INCARE system in Hungary.

4   Other types of dissemination

4.1   Időskori gondoskodás és gamifikáció
Type: blog post

Reference: https://egyuttacsapat.hu/idoskori-gondoskodas-es-gamifikacio/

Event size:

Impact on the project: article about the compatibility of gamification and elderly care

Short description: by Eszter Léna Mátis, The article is published on egyuttacsapat.hu - Hungarian gamification blog edited by SOFTIC. It is a short report of INCARE Warsaw meeting and the gamification framework that SOFTIC provides for INCARE. The article is in Hungarian

5   Conclusions

During the course of the project, the consortium partners have published 11 journal articles and have participated with articles, presentations or posters to 22 conferences. In addition, a contribution in Hungarian language was made by SOFTIC.