

Impact-Aware Manipulation by Dexterous Robot Control and Learning in Dynamic Semi-Structured Logistic Environments



Website and Software Repository

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www.i.am-project.com



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Control sheet

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EXECUTIVE SUMMARY

The I.AM. project website has been created and published online. The website has a private area to allow the consortium partners to share and store private information and thus facilitate intra consortium communication. The I.AM. project website includes also direct links to the LinkedIn and Twitter pages, created to foster communication and dissemination of the project goals and results to the general public, scientific and robotics communities, and shareholders in the logistics sector. Additionally, a YouTube channel has been set up. The channel will be used for uploading videos related to the I.AM. project, such as relevant experimental results, interviews, and shootings taken at public events such as public and technical fairs. A software repository based on GitLab for the entire project has been created to facilitate software development and integration among the project partners.



1. INTRODUCTION

1.1. Project background

Europe is leading the market of torque-controlled robots. These robots can withstand physical interaction with the environment, including impacts, while providing accurate sensing and actuation capabilities. I.AM. leverages this technology and strengthens European leadership by endowing robots to exploit intentional impacts for manipulation. I.AM. focuses on impact aware manipulation in logistics, a new area of application for robotics which will grow exponentially in the coming years, due to socio-economical drivers such as booming of e-commerce and scarcity of labour.

I.AM. relies on four scientific and technological research lines that will lead to breakthroughs in modeling, sensing, learning and control of fast impacts:

1. I.Model offers experimentally validated accurate impact models, embedded in a highly realistic simulator to predict post-impact robot states based on pre-impact conditions;
2. I.Learn provides advances in planning and learning for generating desired control parameters based on models of uncertainties inherent to impacts;
3. I.Sense develops an impact-aware sensing technology to robustly assess velocity, force, and robot contact state in close proximity of impact times, allowing to distinguish between expected and unexpected events;
4. I.Control generates a framework that, in conjunction with the realistic models, advanced planning, and sensing components, allows for robust execution of dynamic manipulation tasks.

This integrated paradigm, I.AM., brings robots to an unprecedented level of manipulation abilities. By incorporating this new technology in existing robots, I.AM. enables shorter cycle time (10%) for applications requiring dynamic manipulation in logistics. I.AM. will speed up the take-up and deployment in this domain by validating its progress in three realistic scenarios: a bin-to-belt application demonstrating object tossing, a bin-to-bin application object fast boxing, and a case depalletizing scenario demonstrating object grabbing.

For the project both a website has been set-up that serves the following purposes:

- Communication with the general public, the scientific and robotics communities, and the industry (in particular, logistics domain)
- Private communication and storage among project partners

A software repository has been set-up to serve the following purpose:

- share and develop I.AM. project's related software among partners



1.2. Purpose of the deliverable

This deliverable is labelled as 'Websites, patents filling, etc.'. Therefore, the contents of this report only briefly describe the current implementation of the I.AM. website and the software repository that has been set up in the first 3 months of the project. The reader is guided to these sources for further details.

1.3. Intended audience

The dissemination level of D6.1 is 'public' (PU) – meant for members of the Consortium (including Commission Services) and the general public. This document is intended to serve as an internal guide to the website and software repositories set up at the beginning of the I.AM. project.



2. I.AM. PROJECT'S LOGO

The logo of the I.AM. project is shown in Figure 1. It represents the key elements of the project: logistics (idealized via a box, in yellow, green, and light blue colors), robot manipulation (two end-effectors, in black), and dynamics/impacts (red and gray stripes). The logo has been realized by a professional studio (Visueeltjes, <http://www.visueeltjes.nl/>), who already created the illustrations for the I.AM. proposal and was thus already well informed about the project goals.



Figure 1: The I.AM. project logo, illustrating a pair of robot end-effectors interacting dynamically with a box, illustrating dynamic robot manipulation for logistic applications



3. PUBLIC WEBSITE

A Joomla! [1] based website was set up and published on February 2020 at the web address <http://www.i-am-project.eu>. The website contains a public section and a private section (password protected) for confidential information exchanged among the consortium (see Figure 2).

The screenshot shows the top portion of the I.AM. website homepage. At the top, there is a navigation bar with links for HOME, PARTNERS, EVENTS, and a search bar. Below the navigation bar is a large 3D rendering of a robotic assembly line. The line consists of various industrial robots (including a blue articulated arm and an orange articulated arm) working on a conveyor belt that moves through different stations. There are also pallets, boxes, and a blue mobile cart with a display screen. Below this image, the word "Concept" is written. To the left of the main content area, there is a small diagram of a robotic arm interacting with a cube, with the text "I.A.M." underneath it. To the right, there is a "Tweets by @I_AM_H2020" section displaying a single tweet from the project's Twitter account. The tweet discusses the European Robotics Forum (ERF) in Malaga, featuring the project's coordinator, Alessandro Saccoccia, discussing impact-aware robot manipulation and its practical implications for logistics. It includes a link to view the tweet on Twitter.

Figure 2: Upper portion of the homepage of the I.AM. website, also showing the project's Twitter feed

Currently, the public webpage features (i) a main page including a general introduction to the project and list of partners, (ii) a partners' page that provides an overview of each partner and its role in the consortium including involved researchers, engineers, and supporting staff, and (iii) finally an event page where details about the agendas of past and planned events is provided.

3.1. Public website – private section

The website contains a private section where confidential material can be stored. Access to the private section is granted after logging in by clicking on the login button display on the footer of each webpage of the I.AM. website, as illustrated in the following Figure 3.



Contact us

[Twitter](#) [LinkedIn](#)

email info@i-am-project.eu

phone [+31 40 247 5423](tel:+31402475423)



[LOGIN](#)

I.AM. has received funding from the European Union's Horizon 2020 Research and Innovation Programme (call: H2020-ICT-09-2019-2020, RIA) under Grant Agreement No. 871899



Figure 3: Access to the private section through the LOGIN button placed on the footer of each website page

Registration can be obtained as follow

1. A request to create an account is send by a new user for the website it sent directly to info@i-am-project.eu
2. The e-mail is automatically redirected to the website administrator that, once identified the requester, creates a new user account
3. The newly authorized user receives an email from the I.AM. Joomla! website asking to setting up a new password

This process ensures that we do not give access to the private section to unauthorized users. The private section itself contains private information regarding the project (e.g. slides of previous meetings or practical information about an upcoming meeting) as well as useful material (e.g., the I.AM. project logo in different sizes and formats).

The private section appears on the website as a new menu item ("private section") once logged in and allow to browse a tree-structured repository folder that currently contains the slides of the consortium meeting and, for ease of access and documentation, published deliverables.

The screenshot shows the I.AM. website's private section. At the top, there is a navigation bar with links for HOME, PARTNERS, EVENTS, PRIVATE SECTION, and a search bar. On the right side of the header are social media icons for Twitter and LinkedIn, and a European Union flag. Below the header, there are three buttons: '+ ADD DOCUMENT', '+ ADD CATEGORY', and 'UPLOAD'. The main content area is titled 'Private Section' and contains two folder sections: 'Deliverables' and 'Slides'. The 'Deliverables' folder is described as containing submitted I.AM. project deliverables. The 'Slides' folder is described as containing slides shared by consortium partners. At the bottom of the page, there is a logo for I.AM., a statement about funding from the European Union's Horizon 2020 Research and Innovation Programme, and a 'LOGIN' button.

I.A.M. has received funding from the European Union's Horizon 2020 Research and Innovation Programme (call: H2020-ICT-09-2019-2020, RIA) under Grant Agreement No. 871899

Figure 4: The I.AM. website's private section where partners can confidentially share documents



3.2. Additional communication channels

In addition to the website, other communication channels have been setup to give a social presence to the project. In particular, the project currently has a

- LinkedIn page (<https://www.linkedin.com/company/i-am-h2020>)

The screenshot shows the LinkedIn profile page for the 'I.AM. H2020 Project'. The header features the LinkedIn logo and a search bar. The main banner image depicts a robotic arm interacting with a conveyor belt system in a factory setting. Below the banner, the project's name 'I.AM. H2020 Project' is displayed along with its description: 'Logistics & Supply Chain - 12 followers'. A note indicates it is an 'H2020 project (Jan 2020 - Dec 2024). Coordinated by Alessandro Saccon, TU/e. Developing impact-aware robot manipulation.' Two buttons are visible: '+ Follow' and 'Visit website'.

Left sidebar:

- Home
- About
- Jobs
- People
- Ads

Top navigation:

- All
- Images
- Documents
- Videos

Sort by: Top

Project Overview:

I.AM. H2020 Project
12 followers
1w + ①

During the last European Robotics Forum (ERF) in Malaga, Spain, the I.AM. project's coordinator Alessandro Saccon provided the essence of impact-aware robot manipulation and discussed its practical implications ...see more

Image: Two men in suits are interviewed at a conference booth. One man holds a microphone with the 'I.AM.' logo.

Right sidebar:

Your dream job is closer than you think
See jobs

LinkedIn

Figure 5: Impression of the LinkedIn page of the I.AM. project



- Twitter page (https://twitter.com/I_AM_H2020)

The screenshot shows the Twitter profile for the I.AM. H2020 EU Project. The profile picture is a 3D rendering of a robotic assembly line. The bio reads: "I.AM. H2020 project (Jan 2020 - Dec 2024). Developing impact-aware manipulation technology for the logistic industry". The tweet from the coordinator (@I_AM_H2020) states: "During the European Robotics Forum (ERF) in Malaga, the I.AM. project's coordinator Alessandro Saccon provided the essence of impact-aware robot manipulation and discussed its practical implications for logistics". The tweet has 3 likes and was posted on March 17, 2020.

Figure 6: An impression of the I.AM. Twitter page

- YouTube channel (<https://www.youtube.com/channel/UC8ULOhHLQuiH3kNQUKupllw/about>)

The screenshot shows the YouTube channel page for the H2020 I.AM. project. The channel has no subscribers. The description provides details about the project: "I.AM. (acronym for 'Impact-Aware Manipulation by Dexterous Robot Control and Learning in Dynamic Semi-Structured Logistic Environments') is a research project coordinated by the Eindhoven University of Technology (TU/e). The project aims at improve the ability of robots of performing dynamic contact tasks in logistics environments by endowing robots with the abilities of reasoning instead of following fixed rules. The project started in Jan 2020 and will run for four years, co-funded by the European Commission with about € 4.4 million under the program Horizon 2020. It involves research institutes and international companies in the Netherlands, Switzerland, Germany, France, and Sweden. The consortium of I.AM. project consists of: TU/e – Eindhoven University of Technology (as coordinator), EPFL – École Polytechnique Fédérale de Lausanne, TUM – Technische Universität München, CNRS – Centre National de la Recherche Scientifique, Algoryx Simulation, Franke Ernka, Smart Robotics, Vanderlande Industries." The channel was joined on February 26, 2020. There are links to the I.AM. website and Twitter.

Figure 7: Impression of the I.AM. project YouTube channel

The LinkedIn and Twitter accounts have been currently employed to share images of the kick-off meeting and the presentation of the I.AM. project during the European Robotic Forum (ERF) in Malaga, Spain. The YouTube channel will be used to share videos of the project results as well as the other communication activities (public interviews, promotional videos about the project, etc.).



4. SOFTWARE REPOSITORY

The I.AM. project's partners will work together on developing software to enable impact-aware robot manipulation which will be made open source at the end of the project. In order to facilitate the development, integration, debugging, and sharing of this software, a private GitLab repository [1], hosted on TU/e servers, has been set up (see Figure 8).

The screenshot shows the GitLab interface for the 'I-AM software repository'. The sidebar on the left lists various project management sections: Project overview, Details, Activity, Releases, Repository, Issues (0), Merge Requests (0), CI / CD, Operations, Analytics, and Wiki. The main content area displays the repository details for 'i-am-software-repository' (Project ID: 1890). It shows 7 Commits, 1 Branch, 0 Tags, and 276 KB Files. The repository is described as the 'H2020 I.AM. project main repository'. Below this, there is a commit history entry for 'Update README.md' by 'Saccon, A.' (authored 1 hour ago) with commit hash 'c5a8fed9'. There are also buttons for README, Auto DevOps enabled, Add LICENSE, Add CHANGELOG, Add CONTRIBUTING, and Add Kubernetes cluster. At the bottom, a table shows the last commit for 'tosssbot' (Add new directory) which occurred 1 hour ago.

Name	Last commit	Last update
tosssbot	Add new directory	1 hour ago

Figure 8: Overview of I.AM. project's private software repository on TU/e GitLab server



At the time of writing, the TU/e GitLab git server is already used by partners Smart Robotics, Vandelande, and TU/e, with the support of Algoryx, for setting up the software infrastructure required for the data collection and dynamic simulation for the first scenario (TOSS) of the I.AM. project. Such a repository will be incorporated in the main repository within the first year of the project. An impression of the TOSS scenario GitLab repository is shown in Figure 9.

The screenshot shows the 'Details' page of the 'tossbot' project on TU/e GitLab. The sidebar on the left lists various project management sections: Project overview, Details, Activity, Releases, Repository, Issues (0), Merge Requests (0), CI / CD, Operations, Analytics, Wiki, Snippets, and Settings. The main content area displays the project's summary: 'tossbot' (Project ID: 1508), 14 Commits, 2 Branches, 0 Tags, 43.6 MB Files, and Software components related to robot-tossing research activities. A commit history table is shown:

Name	Last commit	Last update
AGX	Included AGX files for backup	1 week ago
UR10	Proper AGX comm, improved visualization and camdata storag...	1 week ago
database	Proper AGX comm, improved visualization and camdata storag...	1 week ago
eval_tool	Proper AGX comm, improved visualization and camdata storag...	1 week ago
.gitignore	Import functions for both data and basic visualization single gr...	2 months ago

Figure 9 Overview of the subproject Tossbot hosted on TU/e GitLab, related to the TOSS scenario of the I.AM. project



5. CONCLUSION

The main infrastructure for online communication of the project goals, news, and results has been created and put in place. This includes a main project webpage, a LinkedIn page, a Twitter account, and a YouTube channel. The website and related social media feeds will be updated and improved as soon as new results and publications will become available. In particular, a new menu item ("results") will be created to provide the list of all publications with link to the publisher URLs and a gallery of videos and images related to the project's progress. Finally, for dealing with data management issues, a data management form will be made available on the main website in M6 (June 2020) when deliverable D6.3 "Data Management Plan" will be released.



REFERENCES

- [1] "GitLab," [Online]. Available: <https://about.gitlab.com/>.
- [2] "Joomla!," [Online]. Available: <http://www.joomla.org>.
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