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BACHELOR THESIS / MASTER'S THESIS

Usage of Natural Language Processing to facilitate robot programming in ROS

Problem description:

Programming robots is a hard task which usually requires several years of expertise. However, in order to facilitate this task and enable also European Small Medium Enterprise to benefit from robots [1] a new approach is necessary. A current approach to solve this task can be based on the Business Process Model Notation (BPMN), which is a modeling language understood by business and IT stakeholders [2]. Therefore, a special version of a BPMN based programming framework has been created using Natural Language Processing (NLP). However, to evaluate its effectiveness against other programming languages in this thesis you will improve the actual BPMN [4] based programming and you will compare with other programming languages by creating a user study. In this user study you will investigate how the BPMN based programming compares to the others. Therefore, in this work you will learn how to use an existing BPMN based programming to generate robot executable code compliant with a target robot language (i.e., Robot Operating System (ROS)). Then, you will implement other programming strategies (i.e., Blockly). Finally, you will structure the user test and analyze data from the experiments. More precisely, your tasks will be as follows:

Tasks:

- Learn the existing BPMN notation
- Understand what other programming languages are present in industrial robotics
- Implement the different languages in a common simulator
- Design the user experiment with the different programming languages and run the experiment
- Evaluate the results and define if the BPMN based approach is more usable than other languages

Bibliography:

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- [2] Schonberger, Dominik; Lindorfer, Rene; Froschauer, Roman (2018): Modeling Workflows for Industrial Robots Considering Human-Robot-Collaboration. In : 2018 IEEE 16th International Conference on Industrial Informatics (INDIN). 2018 IEEE 16th International Conference on Industrial Informatics (INDIN). Porto, 18.07.2018 - 20.07.2018: IEEE, pp. 400-405.
- [3] Brown, Tom B., Benjamin Mann, Nick Ryder, Melanie Subbiah, Jared Kaplan, Prafulla Dhariwal, Arvind Neelakantan et al. "Language models are few-shot learners." arXiv preprint arXiv:2005.14165 (2020).
- [4] Pantano M., Bernacka K. and Yan C. "Usage of Natural Language Processing to facilitate robot programming in ROS". <https://github.com/matteopantano/NLP4BPMN2ROS>

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