

I. IDENTIFICATION DATA

Thesis title:	Probabilistic Gesture Control for a Robotic Arm
Author's name:	Petr Vanc
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of measurement
Thesis reviewer:	Jan Behrens
Reviewer's department:	CIIRC, CTU in Prague

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	extraordinarily challenging
<i>How demanding was the assigned project?</i>	
The assignment was challenging as the tasks were spanning a wide area of topics: from robot control using the Robot Operating System (ROS) via probabilistic representations of robot and hand trajectories to processing data from the Leap Motion hand tracking system. Furthermore, a system of existing and new components had to be built and evaluated.	

Fulfilment of assignment	fulfilled
<i>How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.</i>	
The thesis fulfills most of the given tasks completely. It falls a bit short on the theoretical explanations about the probabilistic gesture representation and the teaching of new gestures. On the other hand, the created graphical user interface (GUI), the implemented practical use-cases, and the conducted user-studies exceed the expectations.	

Activity and independence when creating final thesis	A - excellent.
<i>Assess whether the student had a positive approach, whether the time limits were met, whether the conception was regularly consulted and whether the student was well prepared for the consultations. Assess the student's ability to work independently.</i>	
The student was fast to implement all parts required to fulfill the thesis assignment and also evaluate the achieved quality. Many students would have struggled on this part. Then he prepared datasets to develop the core methodical contributions in an isolated environment, before integrating it into his system, which is following modern best practices in software development. When Mr Vanc was unsure about the best way to proceed, he presented the problem and his approach ideas clearly and was often able to demonstrate the effect of suggestions on the fly.	

Technical level	A - excellent.
<i>Is the thesis technically sound? How well did the student employ expertise in his/her field of study? Does the student explain clearly what he/she has done?</i>	
The thesis is building on top of the state-of-the-art methods in probabilistic modeling of movements and gesture recognition. Furthermore, these methods are extended and combined to a fully novel system, which is supported by a graphical user interface. All the parts of the system were implemented on a high quality level. Mr Vanc evaluated several methods for static and dynamic gesture recognition, and presented all the results in the thesis, showing that the proposed solution enables high accuracy in gestures recognition. The text is complemented with several figures, tables, code snippets, and graphs. Some descriptions of the proposed solutions and interpretations might be extended to provide more clarity.	

Formal level and language level, scope of thesis**C - good.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The thesis is written in Latex with mostly good formatting and notations mainly properly used. The organization of the thesis is reasonable. The thesis is quite long - 78 pages (88 including appendixes). The text is mostly understandable. The handed thesis is written in English, which is on reasonable level. It should be noted that English was not a primary selection of the student, but was necessary as the supervisor does not speak Czech. This is sometimes visible on the quality of the explanations of the system as well as on interpretations, which might be sometimes a bit harder to understand. What might be partly criticized is, that the student did not allocate sufficient time for writing and especially revising the text.

Selection of sources, citation correctness**B - very good.**

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

Citing other works was appropriate, formatting of the citations is good (apart of some of the online citations - [1], [28], and [40]). The basic selection of works was suggested, but additional online sources and also scientific articles were added by the student.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

Please insert your comments here.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading.

Petr Vanc was working independently and showed high motivation while working on this challenging thesis assignment. It was pleasant to advice Mr Vanc as he was well prepared for our meetings. The achieved technical solution seems promising and we will try to turn it into a scientific publication. Mr Vanc received ample advice on the thesis writing, but because he ran out of time, he could not tune the text to a very high standard. Nevertheless, the text mostly explains accurately what was done. What I evaluate the most is the fact, that the student was able to implement, combine and extend current state-of-the-art methods to create a working system for gesture based control of a robotic manipulator. The usability of the system was evaluated in a user study which clearly shows that the developed system might be easily used in daily situations by untrained users.

The classification grade that I award for the thesis is B - very good.

Date: **9.6.2021**

Signature: