I. IDENTIFICATION DATA

Thesis name:	**Vision-guided handling operations for assistive robots in un-structured environments**
Author's name:	**Zuzana Kožnarová**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Cybernetics
Thesis supervisor:	Prof. Dr.-Ing. Hartmut Bruhm
Supervisor's department:	Dept. of Engineering, Technische Hochschule Aschaffenburg (Germany)

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**extraordinarily challenging**

Evaluation of thesis difficulty of assignment.

Multitude of competencies and methods required: Analysis of user scenarios, user interface design, reliable recognition of object classes, robot arm control with ROS, grasp and path planning, inverse kinematics, working in a multi-language environment (German, English).

Satisfaction of assignment	**fulfilled**

Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.

Goals achieved:
- Analysis of typical application scenarios of assistance robots in hospitals and care facilities.
- Selection and system integration of Kinect vision sensor (mechanical, electrical, software).
- Concept for integration of robot arm and vision sensor with mobile platform.
- Matching of Kinect FOV with work envelope of robot arm.
- Calibration procedure for vision system and robot arm: Concept, design and making of calibration reference object, implementation and testing of the procedure
- Selection of suitable algorithms for detection and localization of specific and generic objects in the camera image.
- Movement planning for gripping and depositing detected objects.
- Mathematical formulation, implementation and testing of inverse kinematics for the robot arm.
- Implementation of the whole project under ROS.
- Demonstration and testing of system capabilities, discussion of limitations.

No shortcomings that are worth mentioning.

Activity and independence when creating final thesis	**A - excellent.**

Assess that student had positive approach, time limits were met, conception was regularly consulted and was well prepared for consultations. Assess student's ability to work independently.

The student worked independently and perfectly according to the project plan. She was always well prepared for the regular consultations with the supervisor. Feedback was accepted in a very constructive manner, and on the other hand she made many valuable suggestions regarding the project work.

Technical level	**B - very good.**

Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.

The student has shown very good competencies in the fields of robot arm control, visual object recognition, software architecture, system engineering, calibration and testing. System concept development was supported by an extensive evaluation of relevant literature sources. The same holds for the analysis of the application scenario.

Formal and language level, scope of thesis — A - excellent.
Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.
The formal quality of the thesis is excellent. Formulations are fluent and the course of arguments can easily be followed by the reader. Figures have been used in a carefully considered manner.

Selection of sources, citation correctness — A - excellent.
Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.
The citations are formally correct according to the aforementioned criteria. The student performed literature research for all relevant aspects (application scenario, user interface design, vision and object recognition, arm control). The literature research work provided a sound basis for the subsequent system design and implementation. Related work of other researchers is adequately discussed.

Additional commentary and evaluation
Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.
The goals of thesis have been fully achieved and in many respects over-fulfilled. Theoretical studies and implementation and testing activities were well-balanced. Results are convincing and have been demonstrated in live experiments as well as in documentation videos.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION
Summarize thesis aspects that swayed your final evaluation.

I evaluate handed thesis with classification grade **A - excellent.**

Date: **2.6.2019**   Signature: