UiT
THE ARCTIC
UNIVERSITY
OF NORWAY

Faculty of Engineering Science and Technology

Department of Computer Science and Computational Engineering

Design of a Descending Commuter

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Daniel Myrberg

Master thesis in Engineering Design xxxxxxxxx (date)

UNIVERSITY OF TROMSØ

Background

Hiking in the mountains is a popular activity, in particularly hiking to peaks and mountaintops and other elevated sites.
In Norway there is even an organized activity called “Ti på Topp” or “Ten Peaks”. Roughly said, there are about 15 unique destinations/ peaks. Any person can participate. One can go each route as many times as one wishes. There is an app for a mobile phone where one can read about each destination, there is a map in there and the app will use the GPS unit built in the phone to show the location of the hiker in real time. One uses the app in order to “check in” each destination upon arrival to the peak/ destination.

While hiking up to the summit/ peak is seen as an exciting part of the activity, many are not as excited upon going down from the mountaintop. In particularly if the descent is on a well prepared gravel road or a smooth and not too steep single track. At such cases, many wish they could simply “roll” down from the mountain. There can be several reasons that motivates this state of mind:

1. Saving the knees
2. Saving time
3. Having a, more exciting descend. Traveling down on a well prepared trail can be simply “boring”
4. More and more people use Randonee or Telemark skies during the winter, which means that one need to work hard on the ascent then simply ski down on the descent.

Problem description

The purpose of this task is to design a type of a lightweight, foldable and carry-able commuter. The main idea behind this commuter is that people who like to hike can use whichever path/ trail they wish on the way to up the summit carrying the commuter on the back. When the hiker wishes to descend back to the car the hiker should be able to unfold the commuter and descend down in a safely manner. The commuter can be also used in the city in situations where one need a light and mobile commuter, which can fold easily and taken inn a bus/ train/ taxi or into a shopping center.
In the figures bellow one can see an example of a popular hiking area in Narvik where many tend to hike to the upper ski lift by either using the red path (a steep single track/ path called “Ytre”) or the more moderate gravel road (blue).
Many have expressed their thought regarding the possibility of hiking up on foot and cruising down on wheels.

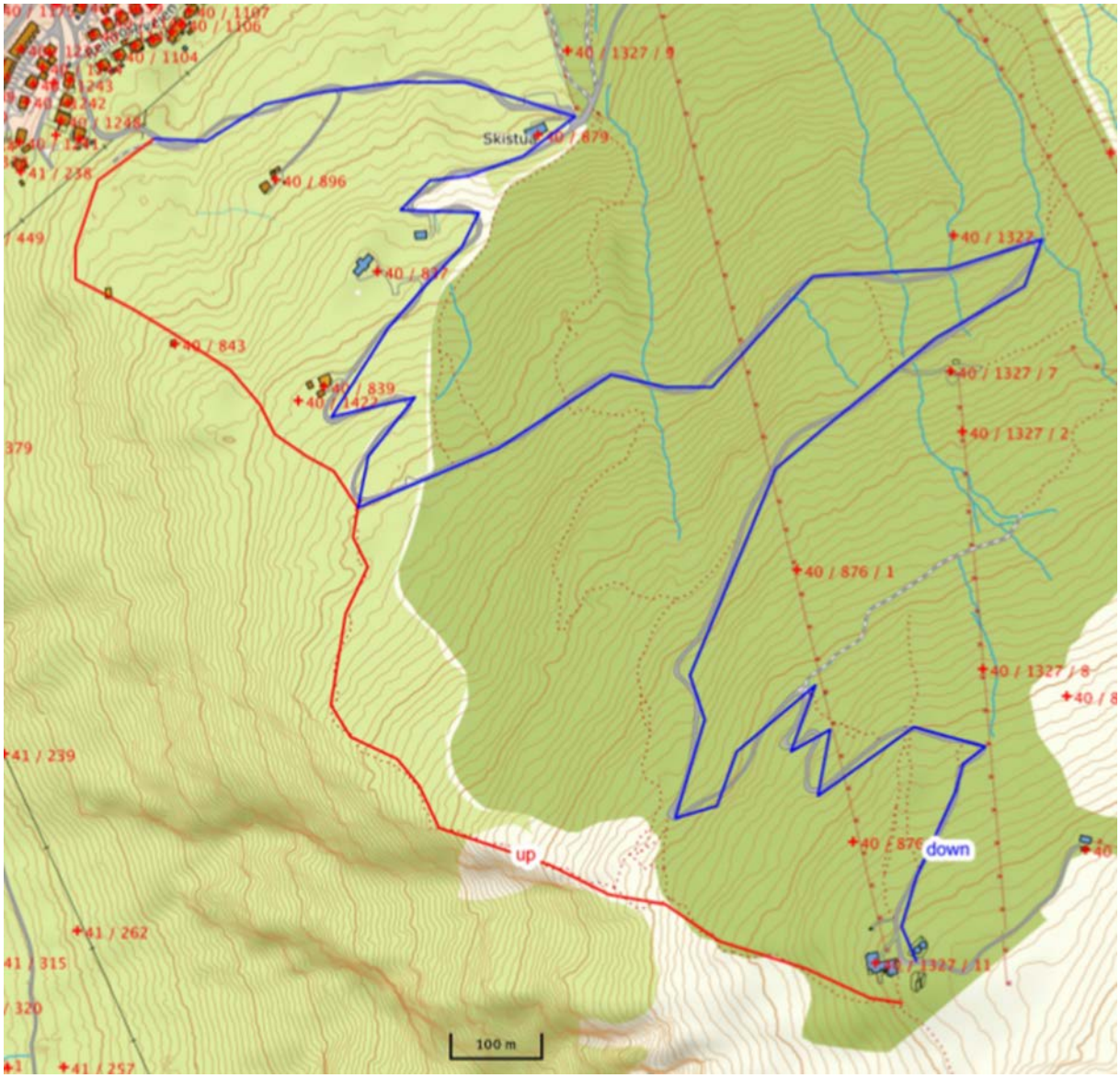

Figure 1 *single track (red) and a gravel road (blue) [Norgeskart]*

Figure 2 *An overview over the terrain between Narvik city and the upper ski lift*

The goal of this task is to develop a commuter that can be carried on the back while ascending on foot to a destination located on a mountain. The kick bike is used to decent down on a gravel road or hard packed path.
Key points:

1. The descending commuter should then be sufficiently light and compact (in folded form) in order to be carried on the back of a person while ascending on narrow and steep trail.
2. The descending commuter should be sufficiently stiff and strong in order to withstand descending on a gravel road.
3. The descending commuter should be safe and should be easy to stop/ slow down.
4. The descending commuter should offer good control and stability.
5. The commuter should offer an attractive solution for urban commuting and should be easy to take on a bus, train or in a car.

The work shall include:

1. A literature study both in terms of finding state-of –the art for these types of products, relevant existing products on the market and potential competitors, as well as literature that is necessary in order to solve the problem (regulations, standards for materials, etc.).
2. Establish design requirements and some case studies including specifications (i.e. loading and boundary conditions, physical conditions, requirements for stiffness, strength, weight, materials, temperatures, ergonomics etc).
3. A systematic design- and material selection process of the system ending up with a final proposal to the technical solution for the product/system.
4. Analysis of the product/system shall be made in order to determine which aspects/ parts of the system/ product should undergo numerical and analytical calculations.

5. **Modelling of the system** in a 3D parametric CAD system and simulation/visualization of for instance movements. A set of 2D drawings should be generated. These drawings should include assembled drawings of the system in open and closed position and complete part production drawings with tolerances.
6. **Numerical analysis** of the product/system by using an appropriate numerical calculation tool (such as Ansys). The result should be compared with the analytical calculations of the product/system.
7. **Suggestions** for future work and description of remaining work.

The solution of the task should be based on typical engineering design methods and areas of study for the Master Program Engineering Design at UiT – campus Narvik.

General information

This master thesis should include:

- Preliminary work/literature study related to actual topic
  - A state-of-the-art investigation
  - An analysis of requirement specifications, definitions, design requirements, given standards or norms, guidelines and practical experience etc.
  - Description concerning limitations and size of the task/project
  - Estimated time schedule for the project/ thesis
- Selection & investigation of actual materials
- Development (creating a model or model concept)
- Experimental work (planned in the preliminary work/literature study part)
- Suggestion for future work/development

Limitations of the task/project

There may be information in the report that may not be open, and if so, the report should be restricted. This will be considered before the candidate submits the thesis.

Preliminary work/literature study

After the task description has been distributed to the candidate a preliminary study should be completed within 4 weeks. It should include bullet pints 1 and 2 in “The work shall include”, and a plan of the progress. The preliminary study may be submitted as a separate report or “natural” incorporated in the main thesis report. A plan of progress and a deviation report (gap report) can be added as an appendix to the thesis.

In any case the preliminary study report/part must be accepted by the supervisor before the student can continue with the rest of the master thesis. In the evaluation of this thesis emphasis will be placed on the thorough documentation of the work performed.

Reporting requirements

The thesis should be submitted as a research report and must include the following parts; Abstract, Introduction, Material & Methods, Results & Discussion, Conclusions, Acknowledgements, Bibliography, References and Appendices. Choices should be well documented with evidence, references, or logical arguments.

The candidate should in this thesis strive to make the report survey-able, testable, accessible, well written, and documented.

Materials which are developed during the project (thesis) such as software/codes or physical equipment are considered to be a part of this paper (thesis). Documentation for correct use of such information should be added, as far as possible, to this paper (thesis).

The text for this task should be added as an appendix to the report (thesis).

The report (Abstract, Introduction, Material & Methods, Results & Discussion, Conclusions, Acknowledgements, Bibliography, References) should not exceed 50 pages. Any additional material should be included in the appendix.

General project requirements

If the tasks or the problems are performed in close cooperation with an external company, the candidate should following the guidelines or other directives given by the management of the company.

The candidate does not have the authority to enter or access external companies' information system, production equipment or likewise. If such should be necessary for solving the task in a satisfactory way a detailed permission should be given by the management in the company before any action are made.

Any travel cost, printing and phone cost must be covered by the candidate themselves, if and only if, this is not covered by an agreement between the candidate and the management in the enterprises.

If the candidate enters some unexpected problems or challenges during the work with the tasks and these will cause changes to the work plan, it should be addressed to the supervisor at the UiT Campus Narvik or the person which is responsible, without any delay in time.

Submission requirements

This thesis should result in a final report with an electronic copy of the report included appendices and necessary software codes, simulations and calculations. The final report with its appendices will be the basis for the evaluation and grading of the thesis. The report with all materials should be delivered in an electronic format. The report should be in PDF format while the rest of the material should be bundled in ZIP file. A standard front page, which can be found on the UiT Campus Narvik internet site, should be used. Otherwise, refer to the "General guidelines for thesis" and the subject description for master thesis.

The final report with its appendices should be submitted no later than the decided final date. The final report should be delivered/ submitted/ uploaded to WISEflow.

Date of distributing the task: xx.x.2018

Date for submission (deadline): xx.x.2018

Contact information

Supervisor at the UiT Campus Narvik:

Førsteamanuensis Guy Beeri Mauseth e-mail: guy.b.mauseth@uit.no

Candidate contact information:

Daniel Myrberg e-mail: dmy003@post.uit.no