Project plan

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Bachelor of Science in Engineering
2018

DTU Electrical Engineering
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Project plan, Continous orientation measurements of mobile antenna

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Project period:	2. Februar- 24. May
ECTS:	20
Education:	B.Sc.Eng.
Field:	Electrical Engineering
Class:	Public
Edition:	1. edition
Remarks:	This report is submitted as partial fulfillment of the requirements for graduation in the above education at the Technical University of Denmark.

Contents

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CHAPTER 1
Outlining the objectives

Magnetic fields are present everywhere and with more products around us being digitalized there are an increasing amount of magnetic fields present in our everyday life. For several centuries the magnetic field has been used for navigation. The increased amount of magnetic fields can make it harder to navigate and orientate using the magnetic field from the earth. An solution to this problem is to measure the magnetic field in the current setting and remove the disturbing fields with calibration. This project will examine the possibilities to remove disturbing magnetic fields for a mobile directional antenna by utilizing calibration. It is important to orient a directional antenna correctly otherwise it will not be capable of receiving the desired signal. Firstly, the stationary calibration will be improved, this is a calibration where the configuration is not moving. Following the possibilities for a dynamic calibration of the configuration will be explored. To do a dynamic calibration it will likely be necessary to add a gyroscope to the current configuration, where dynamic calibration is where the configuration is moving while calibrating.

1.1 Learning outcomes

The following learning outcomes should be accomplished by the project:

- can work independently and is able to structure a major project, including meeting deadlines and organizing and planning the project work
- can summarize and interpret technical information and is fully familiar with technical problem solving through project work
- is able to work with all project phases, including the preparation of proposals, solutions, and documentation
- is able to independently acquire new knowledge and adopt a critical approach to the acquired knowledge and carry out relevant and critical information searches, and on this basis find the right methods to shed light on the problem in question
- is able to communicate technical information, theory, and results in written, visual/graphic, and oral form.

This very document would be a good example of how the student is able to structure a major project. Since this is a plan for the project, which detail the work that should be done, it illustrates the ability to organize and plan the project work. The "Tasks" section of this project plan also slightly demonstrates the ability to summarize and interpret technical information. The actual project work will prove the student is fully familiar with technical problem solving through project work and is able to independently acquire new knowledge and adopt a critical approach to the acquired knowledge and carry out relevant and critical information searches, and on this basis find the right methods to shed light on the problem in question. The report written by the student will demonstrate the ability to communicate technical information, theory, and results in written and visual/graphic form. The defence of the project/report will demonstrate the ability to communicate technical information, theory, and results in oral form.

CHAPTER 2

List of tasks

The following tasks is to be completed in the project:

1. Improve hard iron calibration
2. Implement accelerometer driver
3. Tilt compensation
4. Soft iron calibration
5. Add gyroscope
6. Dynamic calibration
7. Final test
8. Write report

2.1 Improve hard iron calibration

It should be investigated if the current hard iron calibration is satisfactory, since it is rather simple in its current state. It currently take the average of the highest and lowest value measured for each component (x,y,z) and uses those three value as the hard iron offset. It might be better to use the mean for all points, center of gravity, center of mass, etc.

2.2 Implement accelerometer driver

To be able to determine the stationary pitch and roll angle of the device, the accelerometer will be used. This means a driver should be written to be able to utilize the accelerometer. The driver will be written in ”C” and then bind to Lua. By binding the driver to Lua, the functions from the driver will importable in Lua.

2.3 Tilt compensation

The tilt compensation makes the device capable of measuring the magnetic field parallel to the surface of the earth with a pitch or roll angle. The tilt compensation will be done using the pitch and roll angle calculated from the accelerometer and the 3 components of measured magnetic field.

2.4 Soft iron calibration

The soft iron calibration will make add soft iron distortion consideration to the calibration process. Soft iron distortions are caused by ferromagnetic material distorting the magnetic field depending on the direction of the magnetic field. The soft iron calibration is done by considering the measured magnetic field as a ellipse instead of a perfect circle. And by finding the major and minor axes of the ellipse it is then possible

2.5 Add gyroscope

By adding a gyroscope to the device it will be possible to measure the rotation of the device. This will be necessary to implement a dynamic calibration of the device.

2.6 Dynamic calibration

The dynamic calibration is meant as a calibration where the device is rotating and moving while calibrating. So by utilizing both the accelerometer and the gyroscope it might be possible to do a dynamic calibration.

2.7 Final test

This is where the final testing of the final device will be done. This will involve the device being mounted to some kind of moveable configuration and the calibration results will be tested

2.8 Write report

This is where the report for the project will be written.

CHAPTER 3

Gantt chart

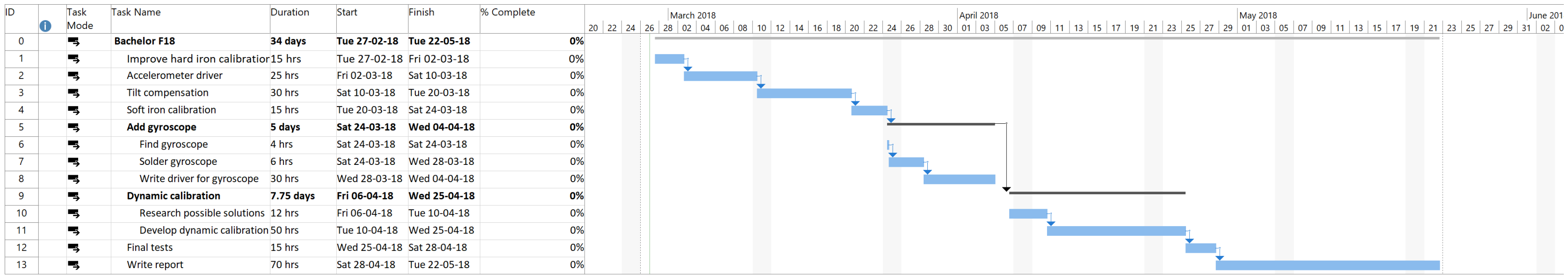

Figure 3.1: Gantt chart for the project with estimated hours per task.

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