Photo Voltaic Cells

PRO4 Project

AU-Herning

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Summary SHORT

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Chapter 1

Executive Summary (Jacob)

This is a report on the process of analyzing and implementing a Solar Panel system, in close dialogue with the costumer, to get his exact needs for the system-to-be. The customer wants this product as a showcase for high-school visitors, so they can see how to produce green energy. This report will discuss power line communication, LPC2478 programming and many other exciting topics, in the process of producing this solar panel system, which is only a small part of a bigger, more complex system. Other Teams creates different system parts (modules), which at the end have to work together and interact with each other.

Chapter 2

Preface (Jacob)

This report is aimed at lectors and sensors at the Electronic Design Engineering study program at AU- Herning, to share the process of creating the Solar Panel system. The report was prepared at 3rd and 4th semester of the EDE study, from 08-11 to 05-12. Thank you to classmates and cooperative teams at E10 class for sharing knowledge and experiences when problems occurred, and also for being structured and conscientious when developing the common parts of the project. The lectors at the AU Herning has been helpful and willing to help and sharing their knowledge, it is their job to do so, but a big thanks to them for doing a great job teaching has to be given!

Chapter 3

Version History

0.1
All steps in the launch phase were followed in order to gain knowledge regarding the system that is going to be built.

- Launch Phase

  The first approach of the report is made.

0.2

Meeting with the teachers was made, where the discussed topics were: changes and modifications.

- History added.
- Summary added
- Preface added
- Introduction added
- Blocks/events updated throughout the entire report.

0.3

Even more discussion with the teachers gave more additions to the report.

- Words like we and our were translated into science language. (3rd person passive)
- Block Event table, blocks/events switched
- State Machine Diagram Updated

- Common Requirement document made.
- Requirements updated.
- Design Criteria, safety added.
- Technical platform updated. Emergency added!
- Product Acceptance added

0.4

And a final walkthrough of the Launch Phase report.

- Grammar and Language revised
- User needs/requirements updated and corrected
- Updated Blocks/events
- Block Diagram Added
- State machine diagrams added (for all blocks)
- Update the system interface analysis
- Updated function analysis
- Improved requirement analysis

0.5 (15/12 2011)

Collect pre project, launch phase and realization phase in a single document, updating the intro to the report, to fit all phases.

- Phases collected in a single document.
- Structure and order fixed.
- Introduction updated.
- Executive Summary Updated.
- Preface Updated.
- Problem Statement Updated
- Introduction to the different phases added.

Chapter 4

Introduction

- was the project initiated?
- ideas, interests and thoughts are behind your choice of subject?
- others worked on the problem and what did they do?
- introduction may include artifacts from the PreProject, e.g. Rich Picture. It may fill two pages and cover the problem widely
- may be a good idea to write this part at the end of a project period
- Remember to include a list of abbreviations, e.g. in a table under Introduction or alternatively under Appendices
- describe how references can be found in the report (i.e. in square brackets).

Contents

Chapter 5

Problem Statement

The task is to make a solar panel convert the energy from the sun into a desired current / voltage value. That value is to be chosen and agreed by all teams working on the system. Different teams have to make different parts (modules) to the system, which makes green energy and stores it until its needed by the user. Some teams produce wind power, others solar power and some groups have to make the storing devices. One group has to make an energy hub, which will transfer the power from the gathering devices unto the storing devices. The Solar Panel system, which is covered in this report, will convert the energy from the sun to electricity, and then transfer it to the hub. The system will gain a feature, which will track the suns position and turn the solar panel into that position, in order to gain maximum effect from the sun, thus giving us the maximal power output to the hub. There are a lot of different kinds of sun tracking systems which will provide information to help decide which system will work best for the project. The hub will communicate and request to start/stop production of power, when it need or does not need more power from our device. The problem is that the customer needs a green energy source, which will supply the customer with energy, so he saves money over time. The cost of the system should be covered by the electricity saved by the system, after a shorter period of time. The second problem is, that the user needs a showcase of a green energy system, which he can show to the visitors (high-school students), who is interested in green energy. Problems:

- There is a need of a green energy source.
- There is a need of a showcase system, to show for visitors.

There were different green energy sources to choose from, and we chose to construct a system, collecting energy from the sun. Our goals are then to:

- Primary Goals:

Collect solar energy

energy to desired voltage/current, needed for the storage devices to work probably.

Transfer collected energy to energy hub.

Start/stop production when requested.

- Secondary Goals:

  Track the suns position and adjust position of solar panel according to the measurements.

Both the storage devices of the system and the energy hub are affected by this problem, because they need the produced energy. If this part of the system does not succeed, the modules mentioned before may not have the necessary power to work probably, so it is important to make this module work, and to make this module able to communicate and cooperate with the other modules of the system-to-be.

5.1 Teacher given requirements

Different requirements are given, to involve the different subjects in the project.

- system must be controlled by the LPC2478 board.
- user interface must contain a HTML webpage.
- from different courses must be applied to the project in suitable places (AAM, EEMB1, EEMB2, and EDSP1).

Chapter 6

Material and Methods (Theory)

During this project we will use the EUDP guideline found at www.eudp.net, to give a structured method of working. During this process the problem will be analyzed and discussed through several times, before the product will be realized. This is done to understand what have to realize and how this can be done. If the problem is analyzed and a good solution is found, then the solution will be analyzed and validated if it is possible or not. A document called Writing reports with EUDP created by lectures at AU- Herning will be followed, this will provide a good structure to the report, and together with the good working process structure from the EUDP method will give an overall good structure of the project and its documentation. As mentioned before, the system has to be part of a bigger system. This part has to function and communicate with other parts, made by other teams. Communication with the other teams will be kept in order to make a common interface and to find out, how the interaction between each others parts will be. A webpage will be made where the user can find information about all the parts made by the different teams. A team representative from each team is chosen, whom plan and attend to meetings where all the representatives discuss the common details. Meetings will be made in order to have meetings with the teachers, to ensure that the process is going correct and smoothly. They also have to know what we are doing, so we are where we have to be to the exams. They will also advise us to make different parts and instruct us in how we could make the different parts. We can ask them if we are stuck or if we are in doubt about something. They are our guidelines. The customers / users of the system also have to decide how they will use the system and how the interface should be. We have to satisfy their needs and make them happy. We also plan meetings with them, and we show them prototypes of our product, to ensure we are developing what they

need and asked for. A lot of meetings and cooperating with the costumer has to be planned, in order to make sure the project is on right track. It is hard to remember what is being said to all the meetings we plan, so we write summaries after every meeting; to document the words and the decisions. The class has a wiki page, where the team meetings will be uploaded, so they are available to all teams. They can be found here: LINK TO COMMON REQUIREMENTS

Chapter 7

Discussion

Below a discussion regarding two sun-tracking methods will take place. Pros and Cons for each method in a shorter summary and then a full discussion regarding the choice of the sun tracking method:

Sun Tracking Method: Sun Sensor

Pros	Cons
• More precise • Can adjust itself to the various actions that might occur to the position of the sun versus the position of the earth • The Sensor can be used as a call to start up the solar panel instead of a fixed time for the panel to start up • Considers variables • Measure sun intensity	• More expensive • More complex to code • Hard to avoid disturbances • Sensor blockade • Breakable • Limited lifetime • High Maintenance

7.0.1 Sun Tracking Method: Look-up Data table

Pros	Cons
• Easy to implement. • Low cost. • No disturbances from environment. • Easy to update. • Low maintenance.	• Limited lifetime • Not entirely precise

The sun sensor will be able to keep a precise tracking system for a solar panel because it can adjust to the sun at most times, where the only exceptions are when something is blocking the sensor etc. a cloud, a car or a person. While a look-up data table will have fixed values for the position that it has to be in thus keeping a better tracking system when the sun is hidden behind a cloud, while if for example on a day with the sun never hidden by a cloud and with no one to interact and causing trouble for the sun tracker, then the sun sensor will keep a more precise tracking while the data table might have tiny flaws in the position of where the solar panel have to be. Financial-wise the sun sensor will be the more expensive choice, because of the start price of the sensor and because the sensor is physical hardcore that might break if contact between another hard object is achieved, while the data look-up table is entirely software and can only be harmed if the software gets infected by a virus which is considered to have a much lower chance of happening compared to a physical blow to the equipment. Speaking in terms of maintenance, the sensor will need to be cleaned in order to have a clear vision of the sun, and the sensor will need help if something is blocking the sensor, while the data look-up tables worst case of maintenance is when a new data table will be required, the software will then automatically download a new look up table and continue to track the sun as good as the software is programmed, this will be completed automatically through the web server. To sum it up, the sensor will be better overall as a tracking method but the budget for the smaller improvement in sun tracker is not worth the higher difference in budget.