

Prepared (also subject responsible if other)		No.		
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Approved	Checked	Date	Rev	Reference
		03/14/12	A	

## Heat Pump System Monitor

### Requirement Specification

## Indice generale

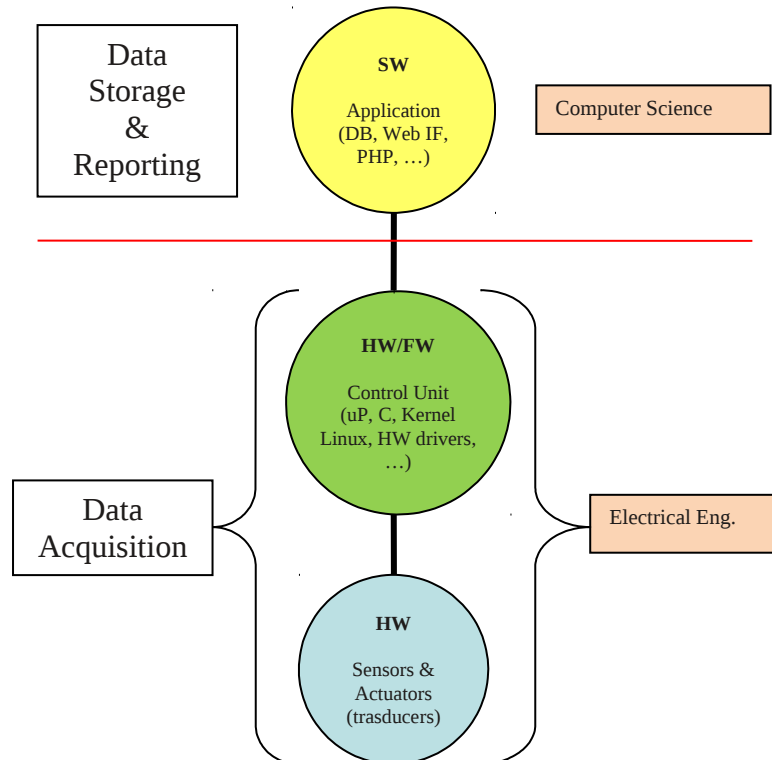
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## 1.1 Competencies

A number of different competencies are needed to develop a prototype of HPSM. As depicted below, both Electrical Engineering and Computer Science are needed to develop respectively the Hardware and Firmware parts for building the acquisition device and Software part for building the data storage and data reporting module of HPSM.

We should not consider the competencies related to thermal and mechanics subjects, instead, they are taken as input for this project.



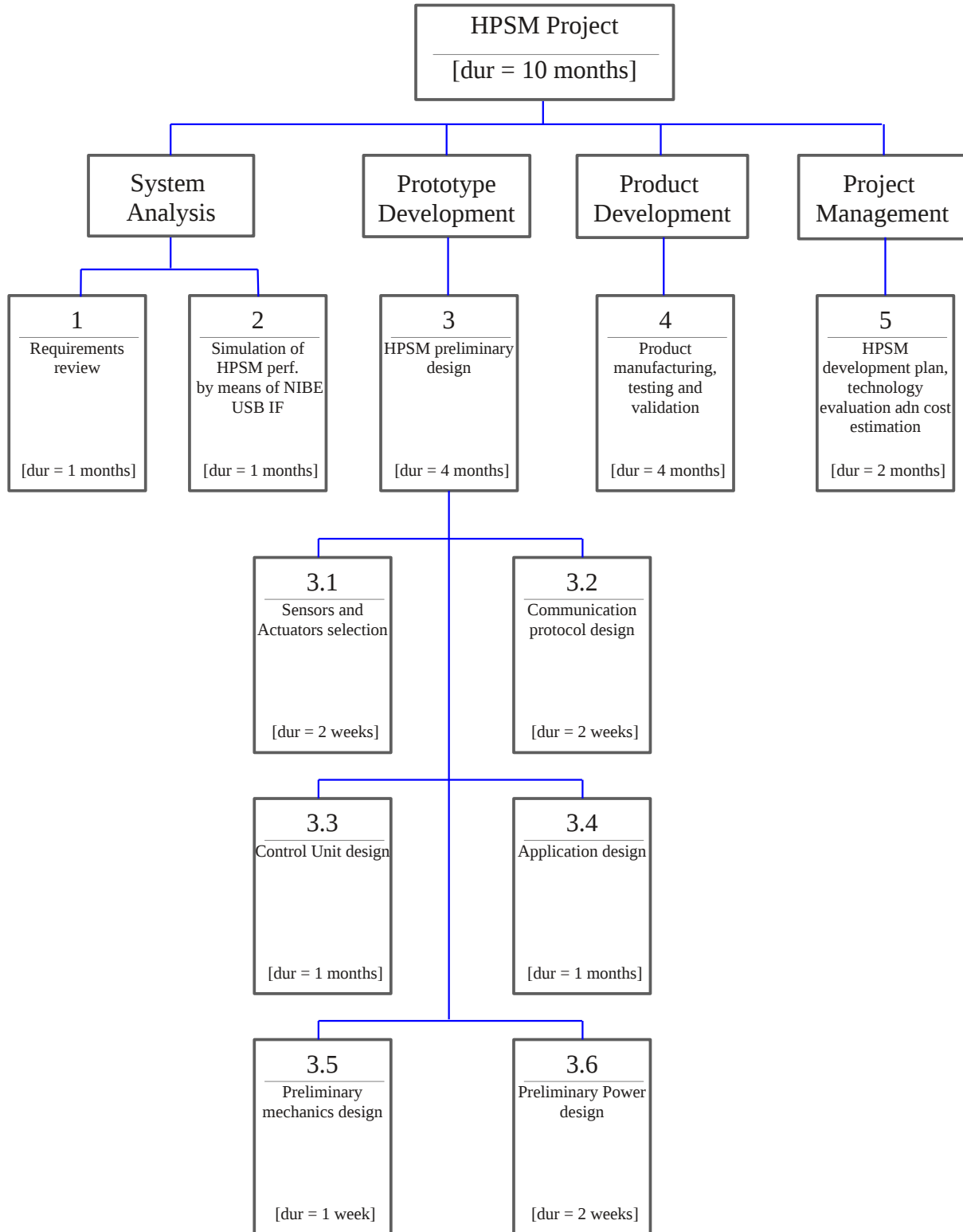
This document is used both for describing what HPSM should be and should do and to describe what kind of competencies the developing phase of this project would need to be completed.

From Company point of view a person with the HW and FW competencies described in the green box would be preferred, as in this way the person could hopefully be reallocated in other projects where the Company currently works, once the HPSM develop is completed.

On the other hand this document shall also be a place to gather all available information which can be useful for developing the data acquisition device and the data reporting interface.

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## 1.2 Work Breakdown Structure





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## 2 HPSM description

HPSM should be built up with different kind of sensors for measuring temperature, flow, voltage and current, with transducers to convert these measures into electrical analog signals, with analogue-to-digital converters to get digital signals.

A digital platform device will collect the digital signals, process them and transmit the relevant information to a remote server in a convenient location for further processing, by means of different kind of communication protocols and links, such as ADSL or GPRS, Ethernet or Wi-Fi.

Here is a list of functionalities that the monitor should provide.

*Mandatory:*

- Acquisition of data from sensors/trasducers
- Periodic transfer of latest data files to remote server
- Remote console access to device for maintenance
- GPRS/UMTS data connection
- ADSL over Ethernet data conenction
- ADSL over Wi-Fi data connection
- Fault recovery after power failure, connection loss, ...
- Open Source Platform
- Low cost
- ...

*Optional (nice to have)*

- Local web interface for data presentation
- Local web interface for device configuration
- Device resource monitoring and alarm notification
- GPRS/UMTS traffic data counter
- SMS Alert when missing data connection
- ...

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**2.1 Data measuring mechanism**

Tbd

**2.2 Data storage mechanism**

Tbd

**2.3 Data transmission mechanism**

Tbd

**3 Sensors, transducers and converters**

Tbd

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## 4 Data acquisition device

### 4.1 Alternative 1: Open Source Linux Platform

This device is currently based on the [FOX Board G20 Single Board Computer](#).

This board was chosen from a number of possible solutions mainly for the following reasons:

- small and reliable embedded device
- presence of a USB device port to connect to heat pump controller USB host port
- relatively low cost
- easy to get it "up and running" (comes with Debian "Squeeze" Linux preinstalled)
- a lot of board specific documentation and tutorials available from the manufacturer
- vast amount of open source software available from the Linux community

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## 5 Data processing/presentation

Once the data is stored on the central server we need to collect it in a central database and provide it in a user friendly way via a web interface.

A server application has to be developed in order to:

- Extract data from the file stored in the server file system
- Save data in the database with the proper format in order to make data manipulation as easiest as possible
- Configure the database (records, keys, ...)
- Provides a graphical web interface in order to let users access the data in user friendly way (synoptic schemes with values which change in "real-time" way, curves displaying data along the time, ...).
- Provides multi-users access
- Provides different levels of rights for different users (specifically there will be one administrator or super-user which shall be able to access data of all users and a number of different user at the same level which shall be able to access only data they own
- Process data stored in the database and display them on the graphical web. In example power consumption needs to be calculated before being printed. At today we foresee five kind of physical measure to be displayed, which are, temperatures in °C, flows in litres/h, binary status (i.e. to check if compressor is ON or OFF), time in hour and minute-degree. Therefore five kinds of graph will need to be displayed in column in order to be able to compare them.
- Provides parameters the user can choose in order to change the way data is displayed