Software Maintainability Plan

ECE 492 – Spring 2014

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Prepared by: Naing Htet

Abstract

The software written for this project must be used by others over the 5-year life of the system. This deliverable documents how software maintainability will be achieved.

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Introduction

System Design

The PacMan Program is designed to control the smart charging algorithms used to charge the pack as well as data manipulation including logging, relaying, displaying data for the user. The program is written in C and runs on Debian Linux Kernel. The hardware being used is a TS-8160-4200. This board comes with 64MB RAM and a 256MB XNAND Drive. For more details on System Design, please refer to System Design Document.

Scope

For LFEV 2014, the scope of the project is to develop a program that will manage the PacMan. Its responsibilities are: -

1) Communicate with AMS to poll data
2) Relay data to Central SCADA
3) Manages charging the battery pack with cell balancing algorithm
4) Ensures the safety of the battery pack

The PacMan is responsible for only one battery pack and a number of cells contained in the pack. Due to the time constraint, the design and maintainability of the Central SCADA will not be within scope. The integration and testing with four battery packs will not be within scope as well.

Reference Materials

System Design Document
http://sites.lafayette.edu/ece492-sp14/files/2014/03/PacManProgramDesign.pdf
Product Wiki Page
http://wiki.embeddedarm.com/wiki/TS-8160-4200
Maintenance Manual
https://sites.lafayette.edu/ece492-sp14/deliverables/maintenance-manual/
Technologic Systems – Tech Support
http://www.embeddedarm.com/support/index.php

Maintainability Plan

Hardware Maintainability

The software runs on a single boarded-computer, TS8160-4200. **This computer is guaranteed by the company to last more than 5 years** and the company offers full tech support. In case of damage to the computer, the user should be able to contact the company, Technologic Systems for tech support.

If the tech support fails to help, a **backup computer is available already installed with the operating system, kernel and the software**. If the backup computer is also broken, the user may buy another board from the same manufacturer, as the product is guaranteed not to be discontinued within 8 years of its release.

Software Maintainability

The computer uses an SD card to store the operating system, kernel and the software. If a new computer is used or the SD card has failed, **3 backup SD cards are available with the image of the software and the kernel preinstalled**. The user can easily swap the SD cards. Please refer to the Developer Level section if all the backup SD cards have been broken.
NOTE: Please disconnect the PM board from all its connections and follow safety procedures when replacing the board or the SD card.

Backup and Restoration

Here is how to install the image onto a new SD card. Before beginning, please make sure that the SD card is a **microSD card.**

First download the image from LFEV 2014 website. The image will be named "pacman14backup.dd". Please take care to specify the paths of the backup file and SD card correctly. If everything went correctly, the SD card will be loaded with the kernel and software and the user just needs to replace the SD card. Complete instructions are available on the product wiki page wiki.embeddedarm.com/wiki/TS-8160-4200 and the maintenance manual.

In case, the software contains a bug, the developer can access the source code of the software. The source code and the program will be available on the image. It will be located in the directory "/root/PM14". The repository is also available on https://github.com/NaingHtet/PM14. A copy of the repository will also be available on LFEV 2014 website.

Accessing the terminal

An Ethernet port is available for the user to connect to the computer while the program is still running. The Ethernet port is outside the pack. The user needs to connect the computer to a network via any preferred method. From a workstation, ssh into the PacMan. The username is "root" and the password is "12345". The default static IP address for the PacMan is 192.168.1.5x where x is the pack number. However, there could be IP address conflicts depending on the network the PacMan is connected to. Therefore, another method is also provided to access the terminal.

The PacMan has a serial port "ttys0" or COM1 that is directly connected to the console. However, the port is not available outside the pack and the user must open up the pack and use a null modem cable to connect to it. Please also ensure that the console enable jumper is on. Please refer to product wiki page for more information. Once the cable is connected, the user may use SCREEN or PUTTY or another other client capable of serial communication. The PacMan should ask for login and the user name is "root" and the password is "12345".

Once accessed to the terminal, the user may change IP address or change configuration parameters or check log files. Detailed instructions on how to change IP address and configuration parameters are available in Maintenance Manual.

System Configuration

The config file that determines how the program will function on the board will be installed on the SD cards. If you want to change the configuration, you can use the SD card reader and change the config file easily using any text editor. System will auto detect hardware changes and see if it fits the requirements set by the config file on the SD card. The consequence of misconfiguration is that the software will detect it and will raise an error for user to correct.

To change any configuration, the user will need to access the terminal with the Ethernet as described above. Then, using VIM or any other text editor, change the configuration file. Please note that this method can be used to access the log files or to access the terminal for other purposes.

NOTE: It is recommended to stop the program before changing configuration file as the program needs to be restarted anyway for the changes to take effect. This can be achieved by typing "service pm14 stop" in the terminal. To start the program again, "service pm14 start".

Tool Chain

The board manufacturer has provided a tool chain to be used on the board. This board was released in July 2013 and the software has been maintained to date. The tool suite is designed for stable functionality and supports our needs. The following is a quote from the manufacturer's website describing evidence for these claims. "Technologic Systems provides complete documentation for our mature products, including manuals, schematics, mechanical drawings, etc. The most recent documentation files are always made available through our website. If you don't find the documentation you are looking for, contact support for more information. Also, please make sure to visit our Embedded Systems Support webpage, our official WIKI and join our official Developers Forum."

In case, future teams need to use the tool chain to develop the software, the tool chain and instructions on how to use it are available on http://wiki.embeddedarm.com/wiki/TS-8160-4200.

An archive of the tool chain and the wiki page will also be available on our website for future teams to access.

Please be aware that the tool chain is not essential to develop the software compatible with the board. The tool chain only provides a cross compiler and the cross compiler allows developers to compile the program on other computers. The developers may still compile the programs on the computer itself even though it might take longer. Please refer to the Maintenace manual and the product wiki page for instructions on how to compile. To access the computer terminal, refer to the Accessing the terminal section above. The compiler, header files and kernel are available on backup SD cards and backup images as discussed above.

Third Party Software

Third Party Software is necessary to cut down the development time and provide a maintainable solution. Two libraries will be used. They are: -

1) libconfig – C Configuration File Library
   http://www.hyperrealm.com/libconfig/

2) CUnit – A Unit testing framework for C
   http://cunit.sourceforge.net/

3) Syslog – Logging
   http://www.gnu.org/software/libc/manual/html_node/Syslog.html

Please be aware that syslog is not a third party software. It is a standard logging solution for unix systems. Nevertheless, syslog is mentioned to bring attention to the fact that we would not be using a third party software or developing our own library for logging.

The libraries will be backed up on all the images and also on the website. They should also be available on their source websites. Please note that the latest versions of this software may not be backward compatible with later versions. Therefore, it is advised that future teams use the same versions as LFEV 2014. If newer versions must be used, the developers should take care to make the program compatible with the third party softwares.