Project: Power Cloud

Client: Hanrich Potgieter, Bühler

Team: Quadcore Productions

Author(s):	*Student number(s):*
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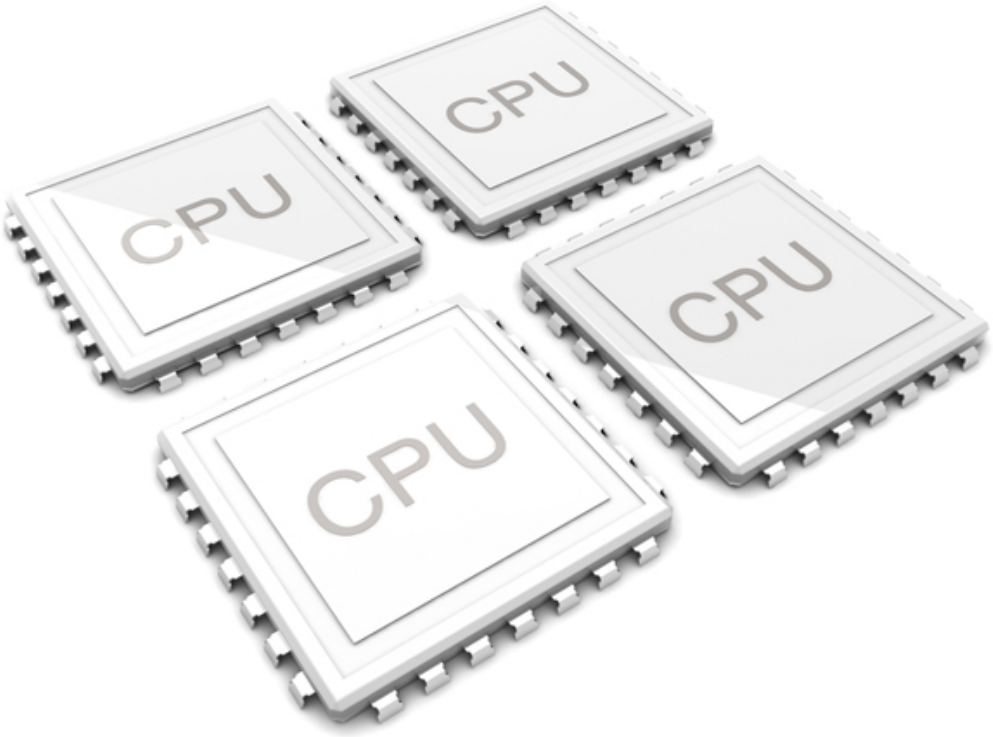

University of Pretoria, Department of Computer Science

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1 The Team

1.1 Mpho Baloyi

1.1.1 Interests

- Keeping abreast with new technologies
- Learning and using new technologies to solve problems
- Reading up and doing research on new and old concepts in computer science
- Solving riddles and puzzles
- Helping people through ICT

1.1.2 Technical Skills

- Solid programming skills in java,c++ and python
- Fair amount of knowledge in assembly programming
- Web development with HTML,JAVASCRIPT,JQUERY,CSS,PHP,AJAX,ANGULARJS
- Interaction Design
- Database design with MySQL
- Understanding of process development
- Unit testing,mocking and dependency Injection

1.1.3 Non-Technical Strengths

- Excellent Communication skills
- Patient
- Creative approach to problem solving
- Pay attention to detail
- Excellent planning skills
- Ability to grasp concepts quickly

- Willingness to learn new things
- Ability to interpret and follow technical plans
- Ability to collaborate and work efficiently with other people
- Ability to work under pressure

1.1.4 Relevant Past Experiences

1.1.5 Reasons for wanting to do the project

My interest and deep passion for Internet of Things,helping people and more importantly providing people with means to take care of the environment through careful power consumption are the main reasons why I want to do this project. I also want to do this project because it is an opportunity to learn and see how software and hardware work together which has always been one of my many interests.The project presents an opportunity to learn new things,acquire new skills and refine my skills and I believe this is the head-start I need for my career in Computer Science.

1.2 Hlengekile Jita

1.2.1 Interests

1.2.2 Technical Skills

- Microsoft Office – Word, Excel, Access, PowerPoint
- Programming – Java, C++, Python, Android
- Database Design - MySQL
- Web Development – XHTML, HTML5, CSS, JavaScript, PHP

1.2.3 Non-Technical Strengths

- Good leader
- Excellent communication skills both verbal and written
- Works well under pressure
- Great at teamwork
- Sociable character that gets along with people

- Organized individual with meticulous planning skills
- Determined

1.2.4 Relevant Past Experiences

1.2.5 Reasons for wanting to do the project

1.3 Moses Mayimela

1.3.1 Interests

1.3.2 Technical Skills

1.3.3 Non-Technical Strengths

1.3.4 Relevant Past Experiences

1.3.5 Reasons for wanting to do the project

1.4 Themba Mbhele

1.4.1 Interests

1.4.2 Technical Skills

1.4.3 Non-Technical Strengths

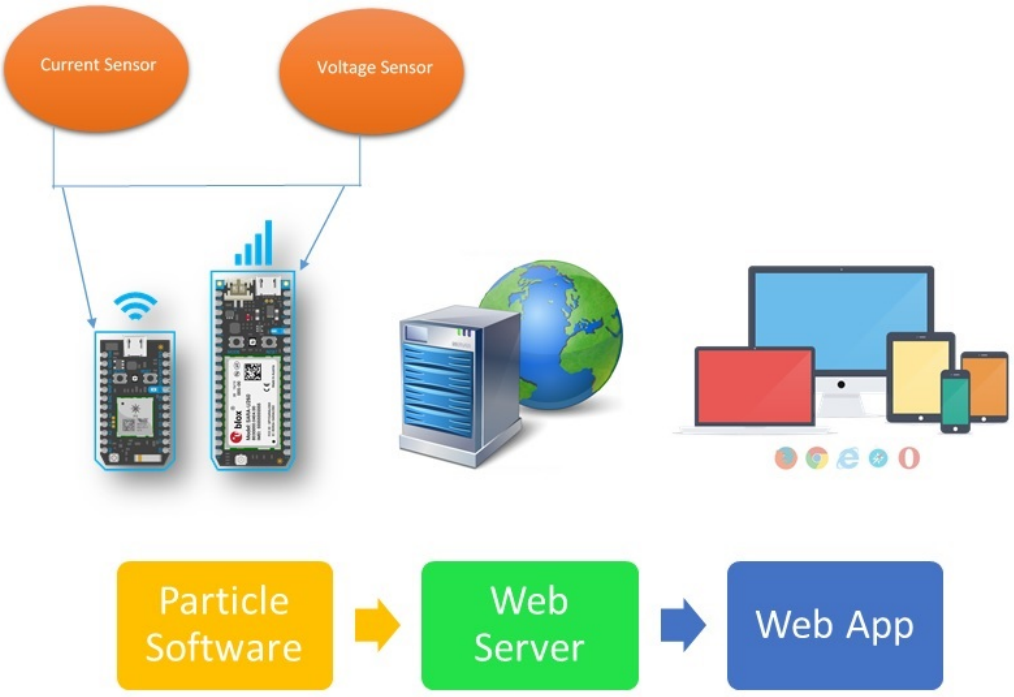
1.4.4 Relevant Past Experiences

1.4.5 Reasons for wanting to do the project

2 Project Execution

2.1 Development Methodology

For this project, there are three main development aspects, first programming the particle that logs data to the server, then the server which processes the data by performing mathematical analysis and finally the user interface provided by the web app where the processed data is displayed and the client is able to view the information.



On the first level, that is programming the particle, we would need to read data specific to power consumption and log this data to the server. This data includes data such as voltage and current. This information could be gathered using CT sensors connected to the electronic device. Once this data is logged to the server then it can be stored in a database so that at a later stage when a client makes a request using HTTPS the data can be retrieved and the necessary calculations can be performed and the server is able to respond appropriately.

Based on the above, we have decided to adopt an Agile Development Methodology and more specifically, Extreme Programming. Using this methodology we are able to incrementally build the software system using sprints where specific functionality is completed. We would like to continuously deliver high quality software. This would mean work very closely with the client, Bühler, and more specifically the project owner, Mr. Hanrich Potgieter. As we work together we will be able to identify numerous use cases that will become the focus of the sprints, the development team will complete.

Extreme Programming practices focus on having a continuous process, a shared understanding and giving feedback. These principles are important to our project because as previously mentioned, we would like our client to be satisfied hence we need to make sure that we have a proper understanding

of their needs and provide them with working progress at regular intervals for their feedback. The practices that are key are:

- Planning
- Test-Driven Development
- Continuous Integration
- Small Releases

The system will thus have to demonstrate working functionality at the end of each sprint and incrementally grow to its best form as it gains aspects of functionality. We will follow a development process of planning, design, implementation and testing at every sprint. In this way, because as the project progresses, development processes are completed as a whole, we only have to revisit completed aspects of the system if we have ways to modify and improve on it and not to make corrections because of faults.

In addition to this development process, other aspects of Extreme Programming that will add great value to the development of this power monitoring solution is:

- Pair programming, in this way code is continuously reviewed by the team.
- Simple Design, in this way every member of the team is able to learn as we go and develop a rounded understanding of the system enabling the production of better software.
- Sustainable pace, in this way we are able to produce our best work at all times, instead of trying to rapidly produce software that fails.

Our starting point will be the collection of data using the particle, and as we work with our client and identify units of functionality we begin the work on the server and interface which will be done simultaneously so that each unit can be put to user testing as the project progresses.

2.2 Communication With Client

To keep the clients informed we are going to use the following means of communication

2.2.1 email

- To inform the client of our progress
- To address any issues or concerns that they client may have
- To acquire information from the client
- To require any resources that the client has to offer for their project,..

2.2.2 Phone calls

This will only be used to address very urgent matters if they arise during the course of the project development however this will only be done with permission from the client and during business hours.

2.2.3 Regular Meetings

These will take place depending on the clients availability and willingness. We may discuss the progress of the project,to address any concerns,etc.

2.2.4 GIT

Access to our git repository will be provided to the client,so the client can be able to monitor our progress and have access to the project material.

We are also open to any means of communication that the client may prefer or suggest.

2.3 Technical Challenges

2.3.1 Collecting the readings

The sensors or hardware that will be used to collect the physical readings have not been outlined and thus the challenge is how these values will be captured from the operating machinery.

The solution:
Since the boards (photon and electron) have GPIOs, these can be used to interface with the various sensors that will capture the readings such as voltage and current. To measure current, a Current transformer, for example can be used to capture the operating current of a machine.

To measure voltage, a step down transformer can be used to step down the voltage of the line connected in parallel to the operating machine. once

the voltage has been stepped down to a level that the boards can tolerate i.e the max voltage would be 3.3V logic since the boards can operate at 3.3V VCC, then the signal can be fed to the analog pins of either the photon or the electron board.

These values, voltage and current are essential for the computation of other values such as power, e.g P=VI.

2.3.2 Connecting the photon to a local router

The electron has a direct connection to the internet through the SARA-U260 module. The photon board, however needs a mobile device to get internet connection and thus thus the challenge will be to eliminate the need for a cellphone for the internet connection.

The solution:
The approach to follow is to use a device that can connect more than one device to the internet e.g a wifi router. The router can provide all the photon boards with a connection to the internet.

2.4 Technologies

This section will list the technologies that will be used to implement the system.
To implement the back-end of the system, the following technologies will be used:

- NodeJS will be used to implement the server.
- MongoDB will be used to store the data that will be collected.
- C++ will be used to program the hardware

To implement the front-end of the system, the following technologies will be used:

- AngularJS will be used for the web front-end.