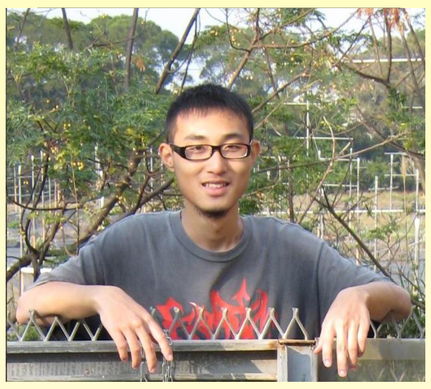
101年大學部國際交流甄選專題成果展



Simulation and Analysis of a Fuel Cell System

23

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Abstract

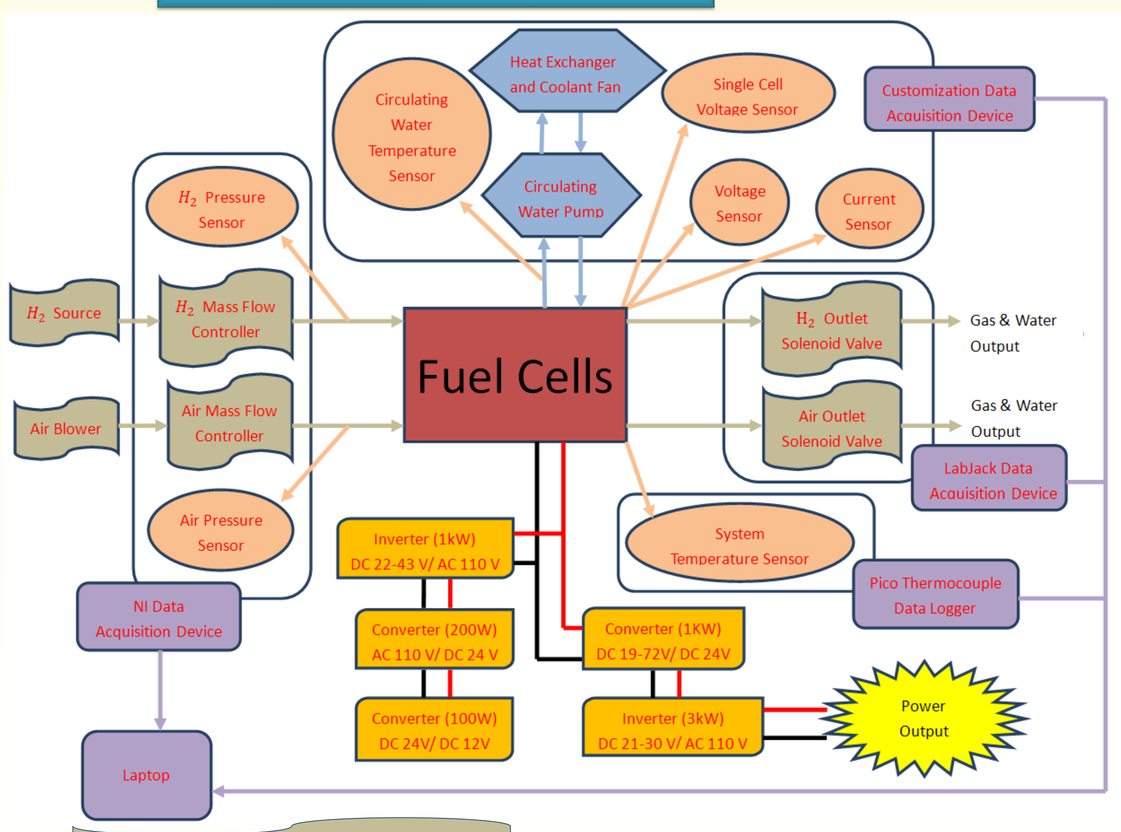
In recent years, due to the innovative breakthrough of the fuel cell technology, coupled with the pressures of environmental issues, and lack of fossil fuel; so we hope that the fuel cell technology developed in our laboratory can be put into use in daily life.

The products we chose is “backup power generator,” so we need a completely isolation system to control and to achieve the purpose of easy operation, stable performance and security, then we can gradually replace the conventional diesel engine generator by the fuel cell in the near future.

Purpose

The topic of the research is how to use our lab-made “PEM fuel cell,” as the core, to build a fully independent fuel cell system that is able to supply the power to external load.

Hardware structure



1. Fuel supply module

To supply and control the fuel required of the fuel cell, and reduce fuel waste, also increase the security of the system.

2. Temperature control module

This part is to maintain the temperature to keep stable performance and the life of the fuel cell.

3. Measurement module

We use many different kinds of sensors to monitor the fuel cell performance in real time.

4. Signal Integration module

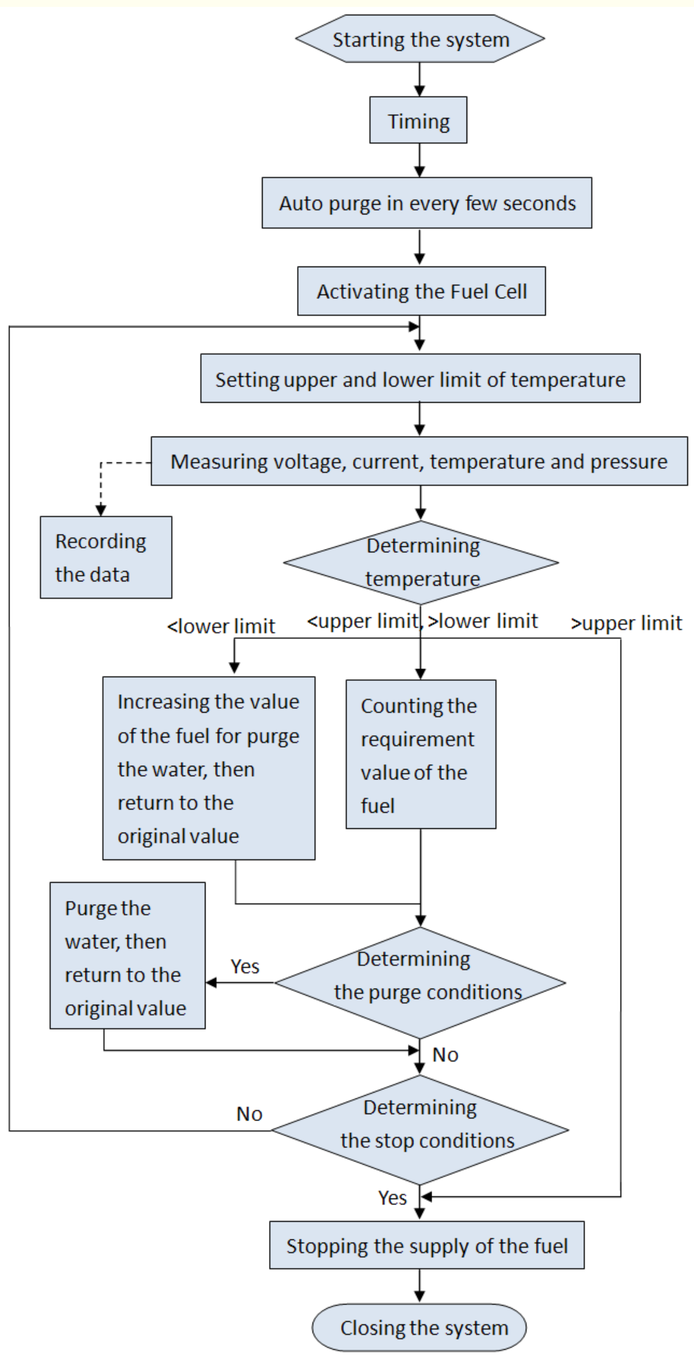
All hardware of the system connected to individual control panels, and finally use the computer to control the system operation.

5. Power conditioning module

The purpose is to stabilize the power output of the fuel cell, and it can supply the power not only for internal consumptions, but also for external load.

Program procedure

We use Labview to control the system, and reference to the conditions of our fuel cell performance to create the best operating procedures.



1. Calculate the system time

Timing functions is written to the program to calculate the total time of the system started.

2. Fuel cell activation

We write fixed steps of fuel cell activation process, make sure that it can reach the stable state within a few minutes.

3. Read and send signals

The main function is read the signals of all sensors, then sent to other devices for determining or display.

4. Determine status

This section is the main core of the program; because temperature is one of the key factors that affect the performance, so we need different operating conditions for different temperatures of the fuel cell to minimize damage to the fuel cell.

5. Automatic purge

When too much water is generated by the fuel cell reaction, it will reduce the performance, so we set four states of different purge conditions.

6. Emergency shutdown

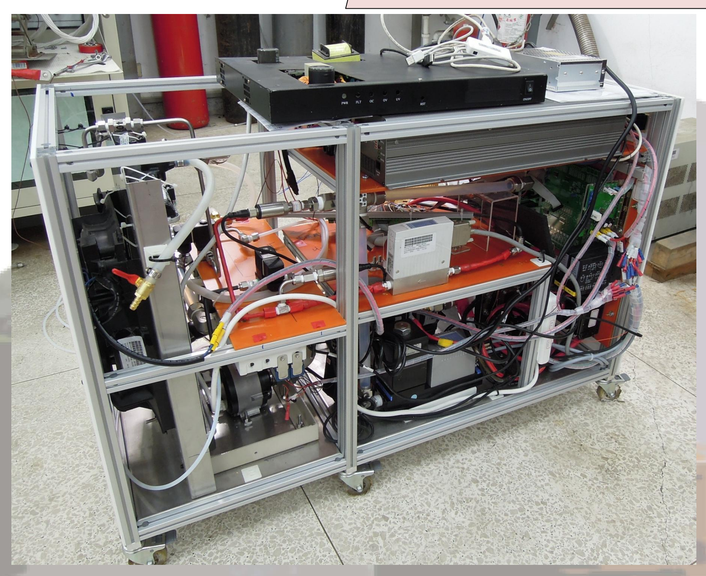
When the performance is too low or exceed the operating limits of the fuel cell or other abnormal states, the system automatically shuts down quickly to protect the fuel cell, and to ensure the safety of the system.

7. Data recording

We can record the data of the fuel cell system for reference and research purposes.

Result

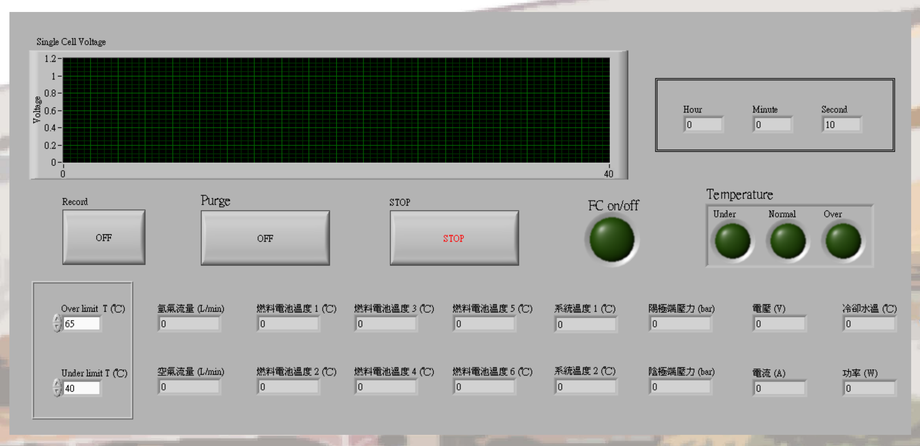
1. System equipment



We want to install the system in the minimum volume, reducing the space it occupied; the final size of the system is (100cm x 40cm x 60cm).

After measurement, the total internal power consumption is approximately 355 (W) in actual operating.

2. Monitor and control interface



in addition to display the data that we monitored and the status lights of fuel cell, there are manual controls as assistance.

The fuel cell activation takes about 1 minute.

The system can safely shutdown within 25 seconds.