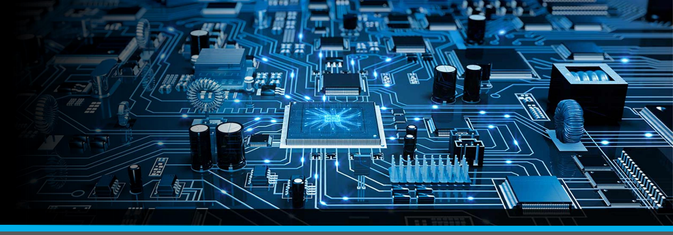
Implementation of Digital Control in High Voltage Power Supplies



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KTP Partnership between the HiTek Power Ltd and the University of Brighton

Background

The use of digital devices to push technology to the limit has long been under way, but recently this trend has been increasing. Fueled by faster speeds as well as a shrinking of both cost and size, more and more products are making use of the benefits of going digital. From our cars to our homes every new product is incorporating novel digital features. This evolution has been driven by the topic of digital control which replaces traditional methods of physical control with a programmable piece of software.

Aim of Project

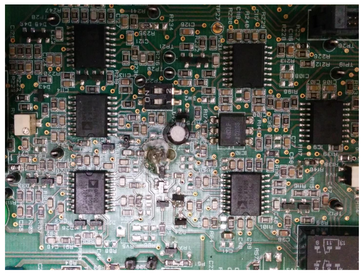
The aim of this project is the research of digital control to improve both the performance and development of High Voltage power supplies. To achieve this goal the project's objectives are :

- Development of software for performing signal processing functions.
- Implementation of software in an embedded system.
- Integration of embedded controller into High Voltage Power supply.
- Development of software suite to facilitate design process.

The Company

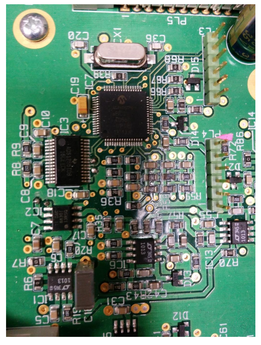
HiTek Power specializes in high voltage power supply design. These types of power supplies operate in ranges of 1 kV to 100 kV and are used in a wide array of fields from semiconductor manufacturing to medical imaging. As such the company faces a number of unique challenges in their design process not normally encountered in everyday power supplies. It is these challenges coupled with customers driving new technologies that requires HiTek to constantly push the boundaries in their designs.

Benefits of Digital Control



Digitisation

Digitisation of an analogue circuit divides the implementation into two components. Hardware and Software.



Analogue Circuit:

- Large Number of Components.
- Circuit design changes based on requirements.
- Long routing times during design.
- More components increase probability for failure during production.
- Fixed controller response.
- As circuit complexity increases so does component count.
- Increased susceptibility to aging and temperature.

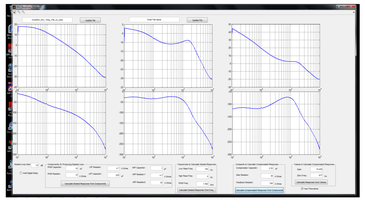
Hardware:

- Reduced component count (70% less).
- Smaller area requirement (50% reduction).
- Standardised circuit design, independent of product requirements.
- Reduction in long term production costs.
- Greater insensitivity to environmental factors.

```
public class TcpClientSample
{
  public static void Main()
  {
    byte[] data = new byte[1024]; string input, stringData;
    TcpClient server;
    try{
        server = new TcpClient(" . . . . ", port);
    }catch (SocketException){
      Console.WriteLine("Unable to connect to server");
      return;
    }
    NetworkStream ns = server.GetStream();
    int recv = ns.Read(data, 0, data.Length);
    stringData     = Encoding.
      ASCII.GetString(data, 0, recv);
    Console.WriteLine(stringData);
    while(true){
      input = Console.ReadLine();
      if (input ==
```

Software:

- Design can be as complicated as possible with little to no detriment.
- Controller response can be changed on the fly.
- Able to protect Intellectual Property as any techniques are performed in software and cannot be reverse engineered.
- Able to actively monitor the health status of products allowing for faster repair times.
- Graphical User Interface allows for faster design times.
- System response can be updated via a quick firmware updated of processor.



Benefits of KTP

The KTP project itself is a great experience for anyone. It provides a number of benefits for all the parties be it the company, University and the Associate. The benefits stemming from this KTP Project have been:

- Ability for company to perform dedicated research.
- Sharing of expertise between associate and company allows for a dissemination of knowledge between the two.
- Closer ties between HiTek and University of Brighton help generate ideas for final year projects.
- Dedicated research allows for in-depth analysis improving the companies' understanding.
- Development fund encourages associate career growth.

Overall I encourage any graduate to consider undertaking a KTP project and any recent KTP Associates to think about making the most of their budget to develop themselves and their future.

KTP Associate Development Areas

Industry		Academia		Personal	
Work Experience	Industrial Knowledge	Research Techniques	Technical Expertise	Career Development	Project Management Skills

Knowledge Transfer Partnerships

HiTek Power

University of Brighton