WaveGen

Portable Waveform Generator

ELECOMP Capstone Design Project 2017-2018

Sponsoring Company:

AstroNova, Inc.
600 East Greenwich Ave, West Warwick, RI, 02893
Tel.: (401) 828-4000
www.astronovainc.com

Background:

AstroNova (formerly Astro-Med, Inc.) is a global leader in developing and applying data visualization technologies in products serving industrial, packaging, aerospace, and defense markets. The company delivers total solutions that acquire, process, analyze, store, print, and present data in a variety of useable forms. These solutions are adapted specifically to customer requirements to enhance the quality, productivity, and profitability of their businesses.

Technical Director:

David Kortick **(URI Class of 1990)**
Product Development Manager
Email: dkortick@astronovainc.com
LinkedIn: https://www.linkedin.com/in/david-kortick-6a32597/

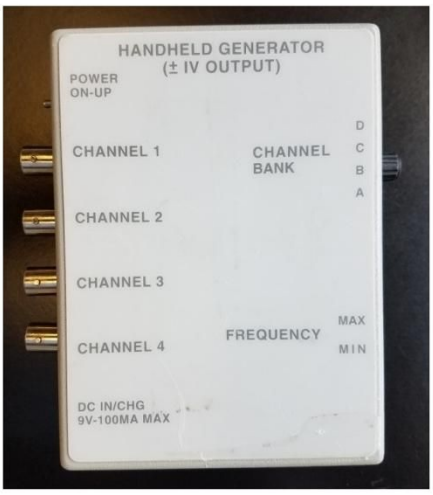
Technical Director:

Chris Tate **(URI Class of 1989)**
Senior Electrical Design Engineer
Email: ctate@astronovainc.com

Project Motivation:

AstroNova requires a replacement for a standalone handheld waveform generator that is an essential tool for demonstrating our data acquisition systems. The currently used design is quite old and is no longer feasible to manufacture. A market search for a similar device has shown that there does not seem to be anything that meets our requirements for a replacement. The purpose of the proposed project is to design a replacement.

For reference, photos of the current version are shown here:



Anticipated Best Outcome:

The group will develop a new portable waveform generator that can be used as a direct replacement for the older model, with new capabilities that will make this new model even more useful.

Project Details:

The required specifications are as follows:

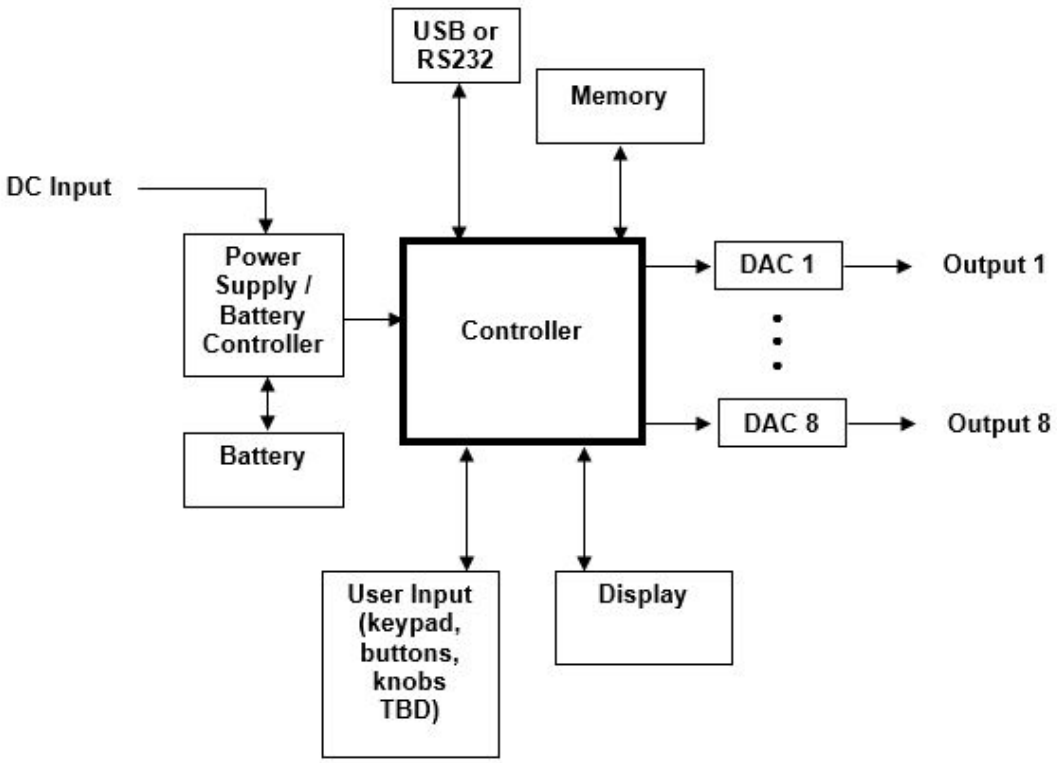
- 8 channels of waveform output
- +/- 10V
- 12-bit D/A with 2.5MS update rate
- Pre-configured waveform “bank” selections

- Programmable/downloadable waveform patterns
- Frequency variation
- USB connection to a PC for programming / setup
- DC and battery operation (at least 8 hour battery life)
- LCD display user interface (text or graphics TBD)
- Simple user interface
- PC app for programming / setup
- Manufacturing cost of less than $500

Some of the desired specifications are:

- Amplitude variation
- Wireless connection for programming / setup
- Wireless app for programming / setup

Block Diagram:



Design Considerations:

One of the design considerations that the group will be expected to make is the main controller architecture. One method is to use a Xilinx FPGA as a state machine with a Microblaze processor core internally. Another method may be to use a Raspberry Pi, Arduino, Beaglebone or similar device, but that does add the need for OS support. The choice of this architecture will determine the possible subset of desired features (i.e. wireless).

The display is another area where the group can select a simple text-based LCD or a bitmapped graphics LCD that would require more software support and design. There are pros and cons associated with both selections and cost may be a driver here.

The battery selection will also be an important part of this design. AstroNova has a 4-cell Li-Ion battery pack already employed in other designs, but this will add size and cost that will need to be evaluated. The expected power draw will need to be calculated and it may turn out that a single-cell Li-Ion battery or even commercially available rechargeable NiMH batteries are appropriate.

The user interface is another area of design concern. The main goal is overall simplicity for the user. Dedicated keys, soft-keys, encoder-based "knobs" are all options for this interface.

Composition of Team:

Two electrical engineers and one computer engineer.

Skills Required:

The following areas are identified for tasks and deliverables and will be need to be detailed further in conjunction with AstroNova:

- System engineering
    - Review requirements including electrical, software, mechanical, human factors, safety, regulatory and manufacturability.
    - System schematic
    - Integration testing
    - System verification
    - Documentation

- Hardware tasks
    - Determine architecture and update/detail the block diagram
    - Design a PCB with circuits as outlined in the block diagram
    - Documentation (includes schematic, bill of materials, theory of operation
    - Devise test cases for hardware verification.
    - Perform board verification

- Software tasks
    - Develop OS image (if needed)
    - Develop software for controller selected on the PCB (includes operation and user interface)
    - Develop default waveform bank patterns
    - Develop application for PC for configuration of the generator (via USB or RS232)
    - Software verification
    - Documentation (includes theory of operation and command protocol)

Anticipated Best Outcome's Impact on Company's Business:

The replacement waveform generator will be an important instrument for our sales, technical support and marketing professionals. The flexibility provided by this new design will give them new capabilities that were desired but missing in the current design. This will lead to a more effective demonstration of the myriad features of AstroNova's powerful data acquisition systems and will result in a direct increase in sales.

Broader Implications of the Best Outcome on the Company's Industry:

Our research has shown that there is no other device such as this waveform generator with the proposed feature set and functionality. There is a real possibility that this could be sold as a standalone product or accessory for testing, troubleshooting and technical support of other instrumentation. It could also be used as an educational tool which could introduce the AstroNova brand to new generations of engineers and technicians that will potentially be employed by the industries that we serve.