# Nicholas **Butts**

Chief Engineer Projects, Director Technology Development/Proof-of-Concepts · Embedded System Expert

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## Summary

Current Chief Engineer Projects, Directory of Technology Development/Proof of Concepts at Appareo Systems. 21 years of experience designing, building, and fielding rugged embedded systems. I am a passionate, enthusiastic, and results driven engineer. I enjoy all aspects of embedded systems, from system engineering and architecture to embedded software design, from code and testing to electronics design and PCB layout. I've worked with bare-metal deeply embedded control systems to high end Linux based AI camera systems. I enjoy solving complex problems with an innovative and focused team. I push myself to continuously learn new technologies and tools.

## Skills

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| **Languages** | C, C++, Python, C#, Bash, Matlab, Perl |
| **OS** | Yocto Linux, Ubuntu Linux, Windows, Windows CE, Nucleous, FreeRTOS, Bare Metal |
| **Frameworks** | OpenCV, Tensorflow, Keras, Matplotlib, Pandas, Numpy, SciPy, Protobuf, Google Test, Google Mock, GStreamer |
| **Networks** | TCP/IP, ZMQ, CAN, J1939, ISO-11783, MQTT, Custom protocols |
| **Technology Focus** | Embedded Systems, Microcontrollers, Computer Vision, Machine Learning, FPGAs, RF radios, SDR |
| **General** | Team builder, Innovator, Hard Worker, Farm kid |

## Work Experience

### Appareo Systems — *Fargo, ND*

Chief Engineer Projects, Director Technology Development/Proof-of-Concepts — *Jun. 2020 - Present*

- Leading group that investigates new technology, creates proof-of-concept demonstrators, and de-risks complex technologies.
- Technical lead, project manager, and lead embedded software engineer on an AI, CATM1 enabled rugged aviation camera that used the NVidia Jetson platform, 4K imaging, and Deep Neural Networks (DNN) for cockpit gauge recognition utilizing Yocto Linux, C/C++, Python, Tensorflow, GStreamer, ZMQ, and Protobufs.

### Appareo Systems — *Fargo, ND*

Staff Research Engineer — *Jun. 2017 - Jun 2020*

- Project lead on a complex multi-radio communications Gateway for Northrop Grumman that utilized Iridium, OpenThread, Trellisware, and ultrawideband radio technologies developed in Yocto Linux and C/C++.
- Technical lead on a real-time embedded sensing module for liquid flow pressure and volume monitoring for agricultural sprayers.
- Architectured a complex real-time embedded control module to control certain aspects of agricultural sprayers.
- Studied advanced acoustic designs for individual seed counting in air seeder applications. Created proof-of-concept hardware platforms for data acquisition and advanced signal processing algorithms to count seeds and separate singles from double impacts.
- Researched, designed, built, and tested a 2.4 GHz Frequency Modulated Continuous Wave radar for under crop canopy obstacle detection utilizing C/C++ and Python.
- Technical lead of an Emergency Use Authorization COVID 19 mechanical resuscitator that was designed, fabricated, and tested in three weeks.
- Research on various acoustic electro/mechanical conduction means for seed counting.
- Designed, built, and tested an innovative low light 360 degree underwater camera for fisherman utilizing C/C++, Python, POE, ray traced optical simulation.

### Appareo Systems — *Fargo, ND*

Embedded Software Architect — *Jan. 2016 - Jun. 2017*

- Lead team of embedded software engineers, created processes and procedures for company wide New Product Realization Process, guided software architecture on new products, mentored embedded software engineers.
- Technical lead on embedded acoustic mass flow detection device mounted inside combine processor/cleaning shoe utilizing C/C++, and ISO 11783.
- Technical lead on embedded grain quality sensor that is mounted on the clean grain elevator. This device utilized acoustic sensing to synchronize high output LED flash and a high speed image sensor capture of grain passing through the clean grain elevator. Then it applied computer vision techniques to detect material other than grain and broken grain utilizing C/C++, Python, CAN, Ethernet, and ISO 11783.
- Researched on autonomous combine operation using advanced acoustic, electro-optical, LIDAR, 24/77 GHz radars sensors and fuzzy logic control systems.

### Appareo Systems — *Fargo, ND*

Senior Embedded Software Engineer — *May. 2010 - Jan. 2016*

- Embedded software engineer on Stratus 1 and 2 portable ADS-B receiver. Wrote C/C++ code to interface with FPGA software defined radio, packet decode, power sequencing, firmware upgrading, and data recording.
- Embedded software engineer on several cockpit crash recorders for light helicopters and fixed wing aircraft, implemented and optimized image pipeline and robust, fail-safe data recording and recovery utilizing C/C++

**John Deere Electronic Solutions** *Fargo, ND*

Senior Software Engineer *May 2000 - May. 2010*

- Software lead on various rugged embedded systems: high end Windows CE displays, bare-metal embedded displays, transmission shift controllers, hydraulic controllers, center pivot control electronics.
- Researched new technologies and processors.
- Member of the Software Engineering Process Group and the Software Reuse library.
- Researched utilizing FPGA as a replacement for obsolete processors.

## Patents

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|---|---|
| **US8213321B2** | Controller area network condition monitoring and bus health on in-vehicle communications networks |
| **US9047717B2** | Fleet operations quality management system and automatic multi-generational data caching and recovery |
| **US9172481B2** | Automatic multi-generational data caching and recovery |
| **US9202318B2** | Ground fleet operations quality management system |
| **US20160000008A1** | Harvesting machine capable of automatic adjustment |
| **EP3192011A1** | Non-image-based grain quality sensor |
| **US9756785B2** | Grain quality sensor |
| **EP3530115A1** | Innovative spraying system |
| **US20160077075A1** | Crop mass determination based on feed roller displacement |
| **US20170235471A1** | Harvesting machine capable of automatic adjustment |
| **US20200027457A1** | Wireless communications system and method |
| **US20190049576A1** | Ads-b transponder system and method |

## Presentation

**VDI Smart Farming Conference** *Düsseldorf, Germany*

Presenting Intelligent Grain Quality Sensor *May. 2018*

**LAND.TECHNIK 2020** *Hannover, Germany*

Presenting Mass Flow Combine Sensors *Nov 2017*

## Education

**NDSU(North Dakota State University)** *Fargo, ND*

M.S. in Electrical Engineering *Aug. 2001 - May. 2007*

- Controller Area Network Condition Monitoring and Bus Health on In-Vehicle Communications Networks

**NDSU(North Dakota State University)** *Fargo, ND*

B.S. in Electrical Engineering *Aug. 1995 - May. 2020*

## Extracurricular Activity

**IEEE (Institute of Electrical and Electronics Engineers)**

Member

**CAP (Civil Air Patrol)** *Fargo, ND*

Former Squadron Commander *Aug. 2012 - Apr. 2020*

- Lead group of volenteers, mentoring members on new skills, and education on aerospace.

**Boy Scouts of America** *Fargo, ND*

Eagle Scout

**Appareo Systems** *Fargo, ND*

Core Award

- 2020 Pushing the boundaries of what is possible
- 2016 Pushing the boundaries of what is possible
- 2012 Pushing the boundaries of what is possible