JUDE: Thank you. As I just mentioned, we recently realized that the problems we have in off-grid Cameroon are the same in other African countries where people remain without access to electricity. Also, we are in Cameroon and know the contest (context?) in Cameroon better then Kenya. But in order to provide the same level of service in Kenya or Tanzania, we have created technical relationships with electricity entrepreneurs in those countries. REIc's approach, therefore, is to train other electricity entrepreneurs to provide the level of quality and reliability in their respective countries that REIc provides in Cameroon. ISV is supporting many energy entrepreneurs who want to venture into electricity businesses across the continent and REIc, being an ISV-supported enterprise, wants to share the know-how and create footprints across Africa. To create sustainability, REIc's training goes with life-time business support in a franchise-type relationship with the trained entrepreneur.

JOHN: REIc has received a grant from USTDA to determine the feasibility of expanding REIc to roughly 130 villages and ultimately to roughly 760 villages within Cameroon. Can you discuss the significance of the grant, who is involved and what is the planned outcome of the grant?

JUDE: Thank you. This grant is our launching pad! We have extensive experience, we have piloted several minigrids, we have built and are expanding our team, we are building partnerships with OEMs and we have built trust in villages and with the government. With all these it is time to scale. This grant is the first step towards scaling our minigrid program to several villages. The grant is to support feasibility studies in 134 villages in Cameroon. In addition to the USTDA grant, we secured $200K from ISV to implement a minigrid whose operational data will be used to feed the studies.

The study is being conducted by three US firms including the National Renewable Energy Laboratory (NREL), Morua Power and SimpliPower, as well as a local survey firm, GROUCONSER. The deliverable product of the grant is a detailed report on the feasibility of electrifying 134 qualified villages in Cameroon using the REIc business model and the SunBlazer technology. With the report, REIc will have the necessary details (credentials?) to attract the needed financing for the implementation of the minigrids.

JOHN: You have been a long-standing entrepreneur with IEEE Smart Village. How has IEEE Smart Village impacted REIc?

JUDE: A lot! The first time I got introduced to IEEE smart village was in 2012 by the Torch Bearers Foundation. Since then, it has been a very beneficial relationship. We have gotten invaluable pro-bono support in various domains of business and technology and we have been exposed and introduced to great partners. One great support is the seed financing from ISV which we have gotten. This made the difference. It allowed us to test our business in dimensions that we would never have been possible without it. Thank you IEEE Smart Village!

JOHN: We have set up this interview knowing that the time difference between Evergreen, Colorado and Yaounde, Cameroon is eight hours. An 8 AM meeting in Colorado equates to a 4 PM meeting in Cameroon. As a result, you are required to attend IEEE Smart Village meetings that can be later afternoon or into the evening hours. What has been the impact of the time difference between Cameroon and the US in attending meetings and conducting business?

JUDE: Well, this is an interesting question. Most of the time while my other team members are going home, I have to stay back to attend these meetings, or sometimes in the car while leaving the office. Also, at 4 pm, as you know, one is looking forward to retiring for the day but for me, since I have several of these kinds of meetings with external supporters and partners, I tend to work until 8 pm. Zoom actually makes it better in that I can be taking dinner while listening in, I can be driving while attending the meeting and so forth. So, it is not a big challenge.

JOHN: We have covered a lot of ground during this interview. Could you please provide some closing remarks including topics we may not have covered?

JUDE: Thank you for taking the time to carry out this interview. I would love to do more of them. I believe there are many youths like me who may read this interview and be inspired or motivated to follow their passion and do impactful things in their communities.

CONCLUSION

I hope that you enjoyed this discussion between Jude Numfor and me. IEEE Smart Village is very proud of the accomplishments made by Jude and are encouraged by his passion to provide electricity to off-grid communities.

As you noticed, Jude is making a difference in Cameroon and expects to impact close to 10% of the off-grid villages. However, for Jude, tis is just the beginning in addressing a much larger population in need.

Patrick Ryan

Jude is helping support Patrick Ryan's vision in a strong IEEE Smart Village Program where he was instrumental in getting projects like Jude's funded. Please feel free to help support IEEE Smart Village through a fund developed in the Memory of Patrick Ryan, past executive director of PES and mentor of IEEE Smart Village. Please check out the website and consider a donation.

https://www.ieeefoundation.org/PatrickRyan

Article

Combining Deep Learning and FPGAs for Real-Time Neutron/Gamma Discrimination

In the context of research on magnetic confinement fusion, and indeed in the field of nuclear safeguards, the problem of neutron/gamma classification has been extensively researched [1]. The fusion yield, which is an essential quantity in tokamaks, is measured through neutrons generated by nuclear reactions. However, in fusion environments, both gammas and neutrons are present in the reactor. Thus, liquid scintillators with the capability of discriminating between gammas and neutrons are usually employed.

Miguel Astrain
2020 Real Time Student Paper Award Recipient

The I2A2 research group at Universidad Politécnica de Madrid (UPM), develops tools to help integrate complex algorithms in FPGAs [3]. For complex systems, the FPGA is often employed for front-end electronics. This is the case of diagnostic systems used in fusion devices. Many approaches apply new machine learning techniques to these complex problems [2]. However, all the previous examples of these studies did not implement complete systems running on FPGAs. In this work, a collaboration was stablished with the purpose of creating a complete working prototype that would also use real tokamak data to train the Neural Networks (NN). The results presented here were obtained using a database generated from the KM13 Compact Neutron Spectrometer (vertical view) in JET [4].

To simplify the development of these complex neural network systems on the FPGA the OpenCL language was used. OpenCL is a heterogeneous programming language that enables implementing algorithms on the FPGA with extensively used high-level programming languages like C or C++. The OpenCL model contemplates a host system coordinating the computation made by kernels that are implemented in the device, in this case the FPGA. As can be seen in Figure 1, the neural network is implemented as kernels, using OpenCL and connected to other data-acquisition kernels to complete the system [3]. In Big Science facilities such as tokamaks, the thousands of instruments that control operation are coordinated using a control system. Many facilities in the world use the EPICS control system, but the integration of each system still needs to be done ad hoc. To mitigate this, ITER is using standardization tools such as Nominal Device Support v3 (NDS). The OpenCL host-device model, is integrated into a standard driver using NDS; the model and its connection with EPICS can be seen in Figure 2.

The implementation of the NN in hardware has been done using IntelFPGA OpenCL SDK. The host computer (running Red Hat Enterprise Linux 7 with ITER CODAC Core System) and the target device is an Advanced Mezzanine Card (AMC) data acquisition device with an ARRIA10 FPGA hosted by a MTCA.4 chassis. The prototype achieved around 80 kEvents/s of throughput using half of the FPGA resources with a latency estimate of 50 µs, while the typical scintillator detector used for these applications goes up to 25 kEvents/s. With these results, our study concludes that it is possible to implement Neural Network systems using OpenCL applied to complex neutronics. Additionally, the proposed new architecture is capable of real-time classification of neutron/gamma waveforms, with accuracies better than 1%.

Miguel Astrain is a student at the Universidad Politecnica de Madrid and can be reached by E-mail at miguel.astrain@i2a2.upm.es

Figure 1. Simplified scheme of the neural network architecture, implemented as kernels in the FPGA and the connection with the data-acquisition system [3].

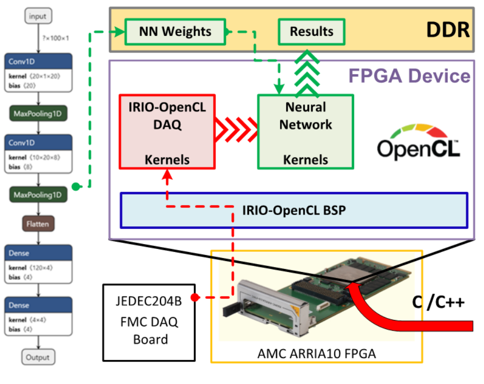
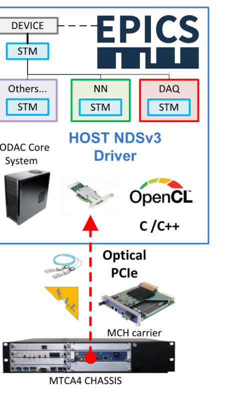


Figure 2. Simplified scheme of the system host connection, and the integration with the control system using NDS [3].



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