InnovateFPGA

Issue 6: March 2022

FLEXbits

The Monthly Newsletter of the InnovateFPGA Design Contest

We invite you join the InnovateFPGA community to see the amazing projects developed based on Intel's Edge-centric FPGAs.

Join the community today!

Team projects will focus on the sustainability theme and deliver benefits to environmental issues such as water conservation, optimizing energy usage, limiting waste, and making intelligent use of the planet's resources.

If this seems interesting to you, go to www.InnovateFPGA.com now to sign up as a community member and engage with the contest teams!

In this issue

At the Edge with Smart Agriculture

By Christina Unarut, Mouser Electronics

I do not think it's a stretch to say that the IoT is prevalent in almost all aspects of our lives. Devices at the edge that measure, monitor, and provide immediate feedback on a wide range of parameters can give us important and relevant information. The ability to communicate that information to the cloud for further analysis can be critical for many applications.

Mouser and Intel have partnered to provide a two-part project article that will demonstrate how to create an edge-based solution running on an embedded Linux to monitor information from different sensors and connect to and relay that information to Microsoft Azure servers.

In this project, several components will be used together from Terasic, Analog Devices, and DFRobot.

The Terasic Technologies FPGA Cloud Connectivity Kit is based on the Terasic DE10-Nano Kit and adds Wi-Fi® and BLUETOOTH® wireless communication. Ambient light, temperature, and humidity sensors are included, along with an accelerometer and gyroscope. The FPGA Cloud Connectivity Kit will permit users to put a flexible and reconfigurable FPGA in a clever IoT edge design.

We paired this FPGA Cloud Connectivity Kit with three other products to create a soil monitoring system. The primary two sensors are from DFRobot's gravity series. A waterproof capacitive soil moisture sensor and a spear tip pH sensor/meter Kit. There are several sensors from this series that could work for a variety of different applications.

Gravity has a variety of professional and commonly used modules, with a wealth of imagination. These modules include pH water quality sensors for professional rivers, industrial wastewater testing professional applications, and infrared human body sensors, flame, ultrasonic and other applications for all kinds of basic applications. Heart rate, UV, motion sensors and other sensors can help open the possibility of wearable items.

Digital technology could play a key role in scaling up local solutions led by civil society and local communities to address the climate crisis and biodiversity loss in developing countries. This collaboration between the GEF Small Grants Programme (SGP), Intel and Microsoft is an excellent opportunity to design and apply innovative and scalable digital solutions to real world problems, and help local communities to improve and expand their initiatives, ranging from climate smart agriculture to wildlife management.

– Yoko Watanabe, Global Manager, GEF Small Grants Programme

Watch this ADI video to see how a large variety of ADI daughtercards can be plugged into the FPGA Cloud Connectivity Kit.

https://www.youtube.com/watch?v=ft-SWOKmxNs

For the evaluation of these sensors are we using Analog Devices Inc. EVAL-CN0398-ARDZ Evaluation Board. It features the Arduino Shield form factor for rapid prototyping of the CN0398 Smart Agriculture pH and Soil Moisture Measurement system. Water is a huge expense for farmers and greenhouses. If plants already have sufficient moisture levels, why should farmers and greenhouse owners continue to water the plants? The CN0398 Smart Agriculture pH and Soil Moisture Measurement system makes two critical measurements when it comes to the health of plants. This system takes measurements in the soil to determine when to water and which nutrients need to be added to balance the pH for optimal plant growth.

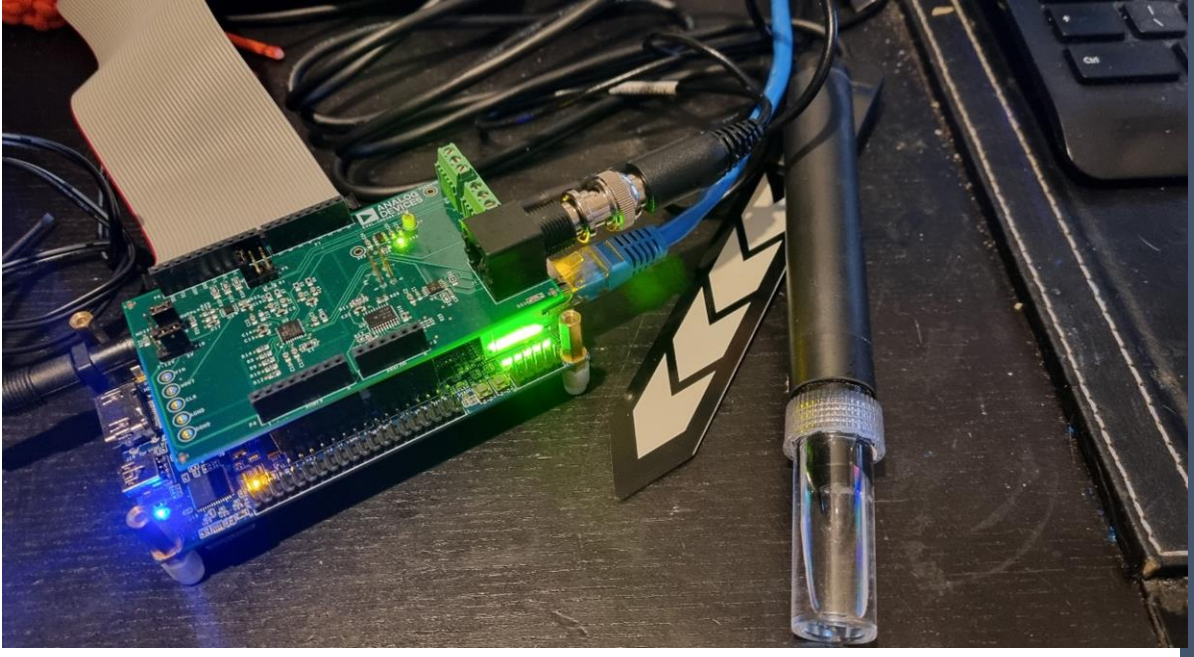
To connect to the Microsoft Azure servers, we will be running an embedded Linux solution on the Hard Processor System (HPS). At the same time, the connectivity to the necessary pins on the Arduino shield will be made via the FPGA Fabric.

The embedded Linux solution running on the HPS must be Ubuntu 18.04 to support the connection to Microsoft Azure services. The SD Card image for Ubuntu 18.04 can be found here. Download the file and write it to an SD Card using BaleaaEtcher or.

We can now start creating the overlay and device tree for the FPGA Fabric interfacing and the necessary drivers from the Linux kernel. This includes using the Industrial Input Output drivers, which support working with the AD7124 ADC.

Please see part one of the project for more information on how to create the overlay and the device tree overlay.

Now we have an overlay that is communicating with the sensor, and we can start the development of the cloud application, which will make use of the sensor in this overlay.



In the second part of this project, we will connect DE10-Nano to the Microsoft Azure Cloud and communicate measurements to the cloud. There are several detailed steps in the second part of the project, such as configuring the DE10-Nano, deploying the Azure Services, and running the application.

This project has shown that we can create a new overlay for the intel cloud connectivity kit and connect it to the Azure cloud. This would enable several remote edge-based soil quality measurement systems to be deploy and remotely monitored using Azures capabilities.

Additional resources for the FPGA Cloud Connectivity Kit including, Technical Resources, Downloads, and Technical support can be found at the InnovateFPGA support site Support - InnovateFPGA. Additionally, a GitHub repository which includes “Getting Started” documentation for Microsoft Azure, can be found at GitHub - terasic/InnovateFPGA2021. Both of these will provide a number of additional support resources to help launch your project.

Both parts of the project can be found in the links below

https://resources.mouser.com/input-stream/terasic-fpga-cloud-connectivity-kit-part-one

https://resources.mouser.com/iot/terasic-fpga-cloud-connectivity-kit-part-two

terasIC
www.terasic.com

Terasic is dedicated in providing engineers of the future the opportunities to share their visions and innovations and demonstrate their FPGA development skills on an international stage.

Continued from the success we had with previous InnovateAsia design contests, where we see many innovative inventions, there should be no doubt that we will see more brilliant works from 2021 InnovateFPGA Design Contest.

- Sean Peng, CEO of Terasic.

Professional Support

Contest organizer Terasic will answer questions and provide technical support for contestants / developers. Stay tuned for more 'how to' details in upcoming newsletters. Go to URL to submit questions:

https://www.innovatefpga.com/portal/support.html

Key Dates

Develop Designs Oct. 16, 2021 – April. 3, 2022

Selected teams will develop the projects using provided resources and upload completed **design paper** and **project video** before the deadline, April 3. Teams who advance to the regional finals will be announced on April 11 on InnovateFPGA website.

Terasic, Intel, Microsoft, Analog Devices have developed a complete set of technical resources, getting started documents & videos for the contest platforms. Contestants can utlize the resource available on InnovateFPGA Support Page during the development.

FPGA Cloud Connectivity Kit:

- Terasic Getting Started Resources for FPGA Cloud Connectivity Kit
- Intel Developer Zone Resources for DE10-Nano
- Intel Developer Zone Getting Started Articles for FPGA Cloud Connectivity Kit

Microsoft Azure IoT:

- Watch a video from Microsoft showing how to get started with Azure IoT
- GitHub Resources for Azure IoT and the FPGA Cloud Connectivity Kit

Analog Devices Plug-in Boards:

- EngineerZone support for questions related to ADI Plug-in Boards
- Overview and Reference Materials of ADI Boards for InnovateFPGA Contest

Regional Finals April. 22, 2022

The Judging Committee will select 1 winner and 2 runners-up in each region based on teams' design papers, video presentations, and the online live Q&A sessions held on April 22. For details of the online regional finals, please refer to: Regional Final Announcement

Grand Final June. 23, 2022

The top 3 teams from each of the Regional Finals will be invited to present and demonstrate their projects to the judging committee, consisting of industry experts in San Jose, CA.