Mini AFG: Hardware for Generating Arbitrary Analog Waveforms using GNU Radio

To generate RF signals in your Communications Lab (EE340) experiments, you used the IQ modulator board. For the board, you also had to generate baseband analog signals using the Arbitrary Waveform Generator (AFG), which is a costly equipment. Besides being costly, it can't be interfaced with your PC/GNU-Radio software directly.

In this project, you have to make a mini-AFG for next year's EE340 students. This board will have the following advantages:

1. We will be able to eliminate the costly AFG completely. The new kit will be low cost and will be affordable for the engineering colleges across the country.
2. It will be easier to use the IQ modulator board with the GNU-Radio setup. There will be no need to first synthesize the signals, transfer them to the USB stick and then to the AFG (as done currently).

Effectively, the combo of the mini-AFG and the IQ-modulator board will make the Made-in-IITB **"RTL-SDR Transmit Dongle"** (recall that the low cost $10 RTL-SDR Receive Dongle is available, but a similar low-cost hardware is not available for the transmitter). Expensive alternatives (USRPs) cost around USD 1500, and therefore can't be used on a mass-scale.

Students from last year's batch and the WEL RAs have made signal source blocks in GNU Radio to generate different waveforms (e.g. sine wave). They have already been able to transfer digital samples from the computer (on which GNU-Radio is running) to a microcontroller (Tiva Board: TM4C1294NCPDT with TI-RTOS) over an ethernet connection. Your task is to give the digital samples to DACs at a specific rate to generate analog waveforms. The requirement of a uniform sampling period is very stringent here – it will also limit the maximum sampling rate you can achieve. Different aspects in the project can be explored.

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