ArTooth: Bluetooth transmission and data visualization for arduino analog signal

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Analog signals can be discretized and visualized with an oscilloscope or an arduino with computer connection and arduino editor. However, that setup is not mobile, and data can not easily be saved. A solution to this problem is by connecting the arduino to a bluetooth module (e.g. HC-06) and programming it to communicate with a dedicated smartphone (eg. android) app (e.g. via MIT app inventor) for receiving, visualizing and storing data. For this purpose, arduino code and a matching app was developed.

Circuit

The transmission circuit needs:

- An arduino
- A power supply with suitable voltage to the arduino.
- A power supply with suitable voltage to the Bluetooth module.
- A bluetooth module connected to the digital arduino channels
- A connection at an analog channel (A0 in code) with the analog signal
    - Please note: the analog channel can only read signals in the range 0-5 V relative to arduino ground. This voltage range is mapped to 10 bits : 0 - 1023, which is what is transmitted to the app.

Arduino

This code performs analogRead(pin: A0) and creates a message in suitable form for transmission. The arduino communicates via digital channels to the bluetooth module, with online transmission of these data messages to a running app with bluetooth connection. Depending on version, the analog sampling varies which yields different temporal resolutions. TransmitTextDataViaBt version 3 quickly reads and transmits 1000 data points (no delay except a for-loop) and then waits (3*1000 ms) before repeating in loop(). This delay() is necessary for the app to process and visualize the data. On the other hand, TransmitTextDataViaBt version 2 does analogRead() once, sends this single value, and waits 1200 microseconds for allowing the app to “catch up“ (might vary depending on smartphone) so the temporal resolution is lowered, but the data points are more equally distanced in time.

MIT App Inventor

User interface

The app has three main interactive parts

- Home, here you can
    - Establish a connection with a known, transmitting bluetooth unit
    - Navigate to Settings and Home
- Settings, here you can
    - Change visualization parameters such as
        - Timespan (how many data points are visualized, horizontal window)
        - Lower and upper bound (vertical scale and shift of data to the window)
    - If there are several sensors, you can switch between which you are visualizing.
    - Navigate to Plot and Home
- Plot, here you can
    - Look at an online data plot
    - Navigate to Settings and Home

While receiving data, the app also writes the data to a .csv file in downloads called arduinoData with the month and day : MMM_d.