CIWS-WM-Node

Off-The-Shelf Build Instructions

Hardware ver. 1.0.0

Overview

This document covers the construction of a CIWS-WM-Node using mainly off-the-shelf parts. If desired, design files for a printed circuit board solution are included in the repository, and may be used instead. The CIWS-WM-Node built using off-the-shelf parts consists of two main units:

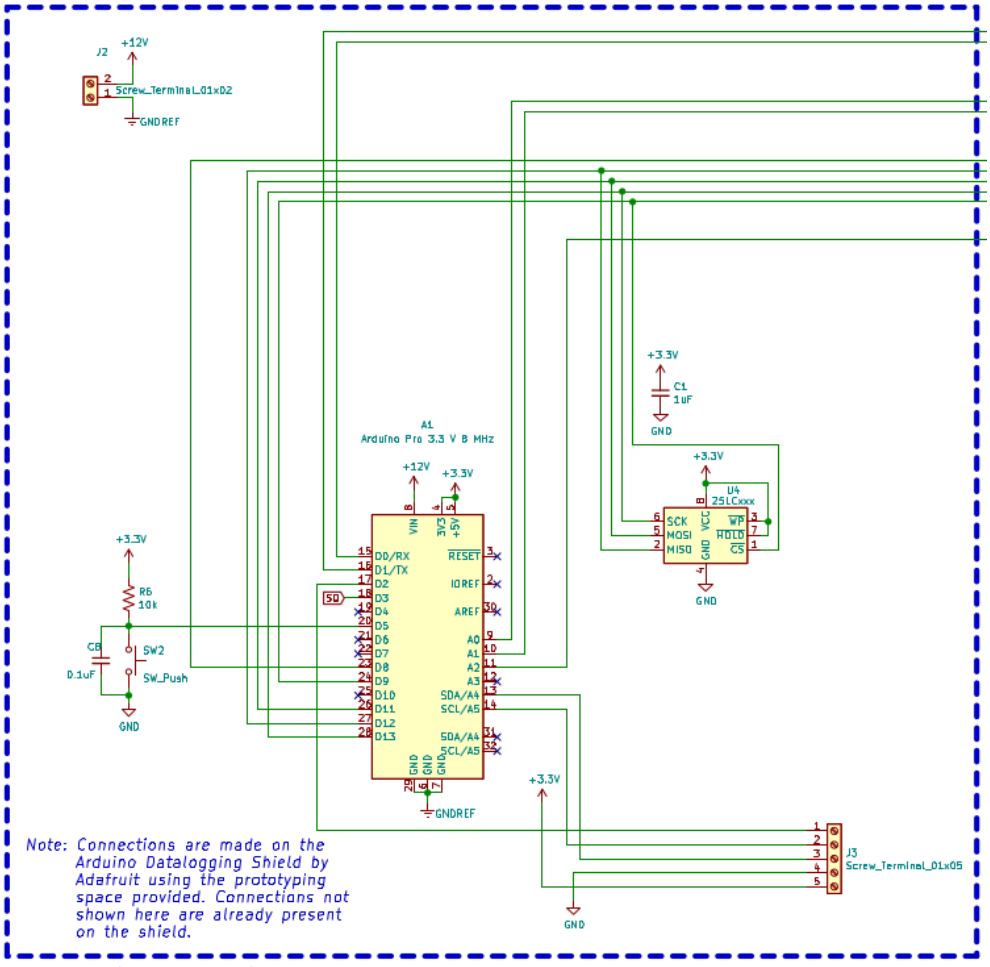
- Data aquisition device
- Computational node

Data Aquisition Device

The data aquisition device is similar to the CIWS-MWM-Logger device. It is built using an Arduino Pro (Sparkfun part #DEV-10914) development board and a Datalogging Shield (Adafruit part #1141). The following must be soldered on the Datalogging Shield's prototyping area, along with their associated connections to the microcontroller pins:

- EEPROM chip
- 5 position terminal block connector for Magnetometer
- 2 position terminal block connector for 12 V battery power
- Button circuit

The following diagram shows the connections required, including wires to the computational node:



Arduino Pro (3.3 V at 8 MHz) with Datalogging Shield

Along with these connections, the following must also be made:

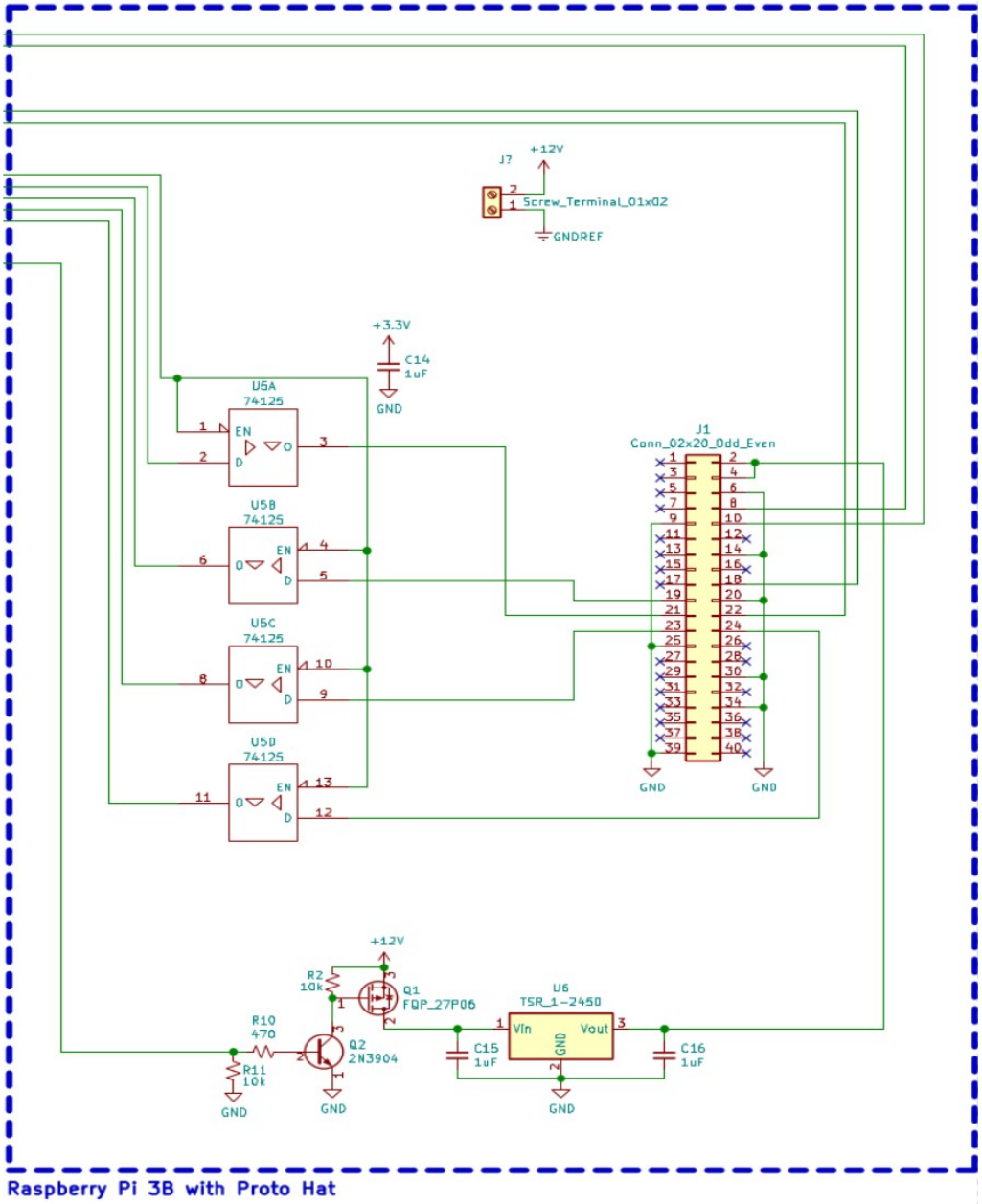
- Solder the 3V, 5V, and Vio (or IOr) pads together (on the top side of the board, near the RTC chip)
- Bridge the I^2C pads on the underside of the board, near the analog pin bank.

Computational Node

The computational node is constructed using a Raspberry Pi 3B and a Perma-Proto HAT (Adafruit part #2310). The following must be soldered onto the Perma-Proto HAT, along with their associated connections to the Raspberry Pi's GPIO pins:

- Bus buffer chip (74HC125)
- Power control circuit
- 5 V regulator
- 2 position terminal block connector for 12 V battery power

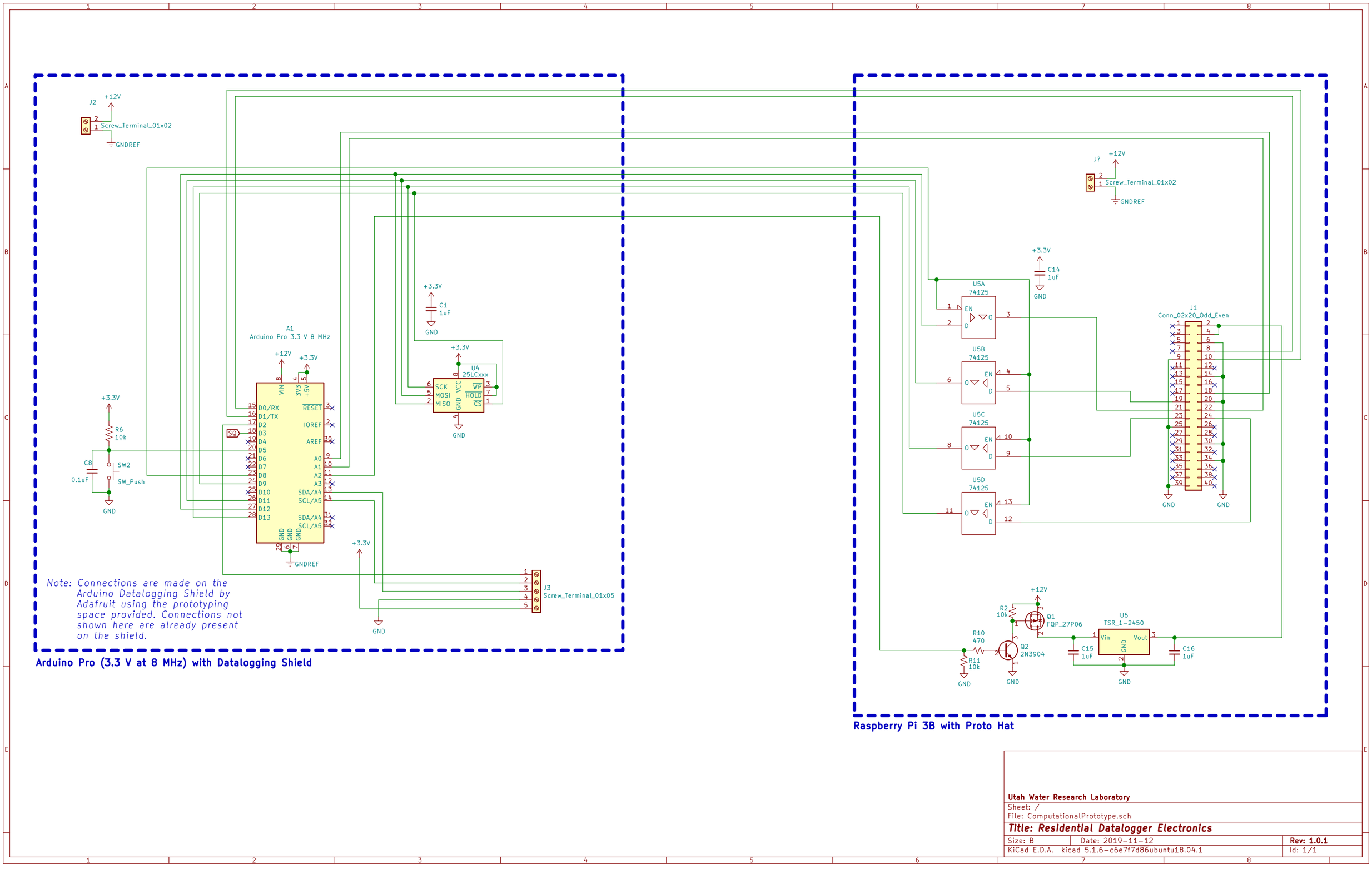
The following diagram shows the required connections, including wires to the data aquisition device:



Notice that the symbols used for the bus buffer chip (74HC125) do not include power connections; however, this chip must be connected to 3.3 V and GND in order to function.

Unlike the updated design files, our off-the-shelf prototypes do not have an ADC connected for reading the battery voltage. If the ability to read battery voltage is desired, the ADC can be added. The ADC used, MCP3425, only comes in a surface-mount package. For ease of assembly, use a breakout board / development kit for the MCP3425. Connect the ADC board to the Raspberry Pi's I^2C bus, and pull the lines up to 3.3 V using resistors. Step down the battery voltage with a voltage divider before the ADC input in order to keep the voltage reading within the ADC's range, and remember the conversion ratio for your software application.

At the end of this document is included the full electrical schematic of the two devices from off-the-shelf parts.


J2
+12V
Screw_Terminal_01x02
GNDREF
A1
Arduino Pro 3.3 V 8 MHz
+12V
+3.3V
VIN
3V3
+5V
D0/RX
D1/TX
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
RESET
IOREF
AREF
A0
A1
A2
A3
SDA/A4
SCL/A5
GND
GNDREF
+3.3V
R6
10k
C8
0.1uF
SW2
SW_Push
GND
SQ
+3.3V
C1
1uF
GND
+3.3V
U4
25LCxxx
SCK
MOSI
MISO
VCC
GND
WP
HOLD
CS
GND
+3.3V
J3
Screw_Terminal_01x05
GND
Note: Connections are made on the Arduino Datalogging Shield by Adafruit using the prototyping space provided. Connections not shown here are already present on the shield.
Arduino Pro (3.3 V at 8 MHz) with Datalogging Shield
J?
+12V
Screw_Terminal_01x02
GNDREF
+3.3V
C14
1uF
GND
U5A
74125
U5B
74125
U5C
74125
U5D
74125
EN
D
J1
Conn_02x20_Odd_Even
GND
GND
+12V
R2
10k
Q1
FQP_27P06
R10
470
Q2
2N3904
R11
10k
GND
U6
TSR_1-2450
Vin
Vout
GND
C15
1uF
C16
1uF
GND
Raspberry Pi 3B with Proto Hat
Utah Water Research Laboratory
Sheet: /
File: ComputationalPrototype.sch
Title: Residential Datalogger Electronics
Size: B
Date: 2019-11-12
Rev: 1.0.1
KiCad E.D.A. kicad 5.1.6-c6e7f7d86ubuntu18.04.1
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