

Open-Robot Vision & Memory Shield

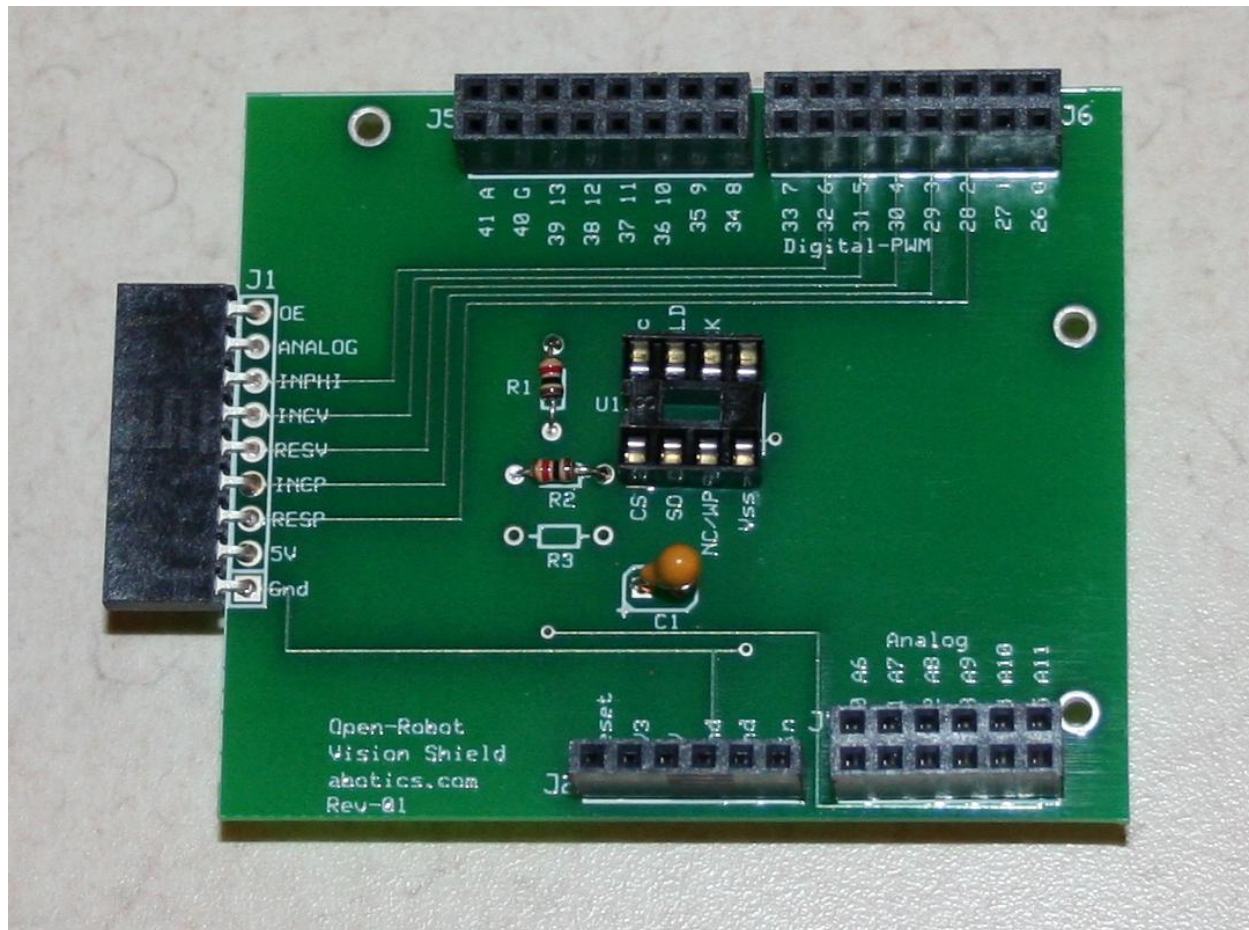


FIG 1. Open-Robot Vision & Memory Shield.

The 32-Bit Open-Robot leverages the new open-source, chipKit UNO32™ Arduino™ compatible prototyping platform and opens up a whole new world of programming possibilities ¹. The Vision Shield is a specially designed stackable circuit board that provides access to high-speed SRAM memory and a unique vision sensor, Stonyman, by Centeye Inc ². Figure 1 shows an assembled and soldered Vision Shield. Be sure to visit Centeye's web site and download their Stonyman documentation.

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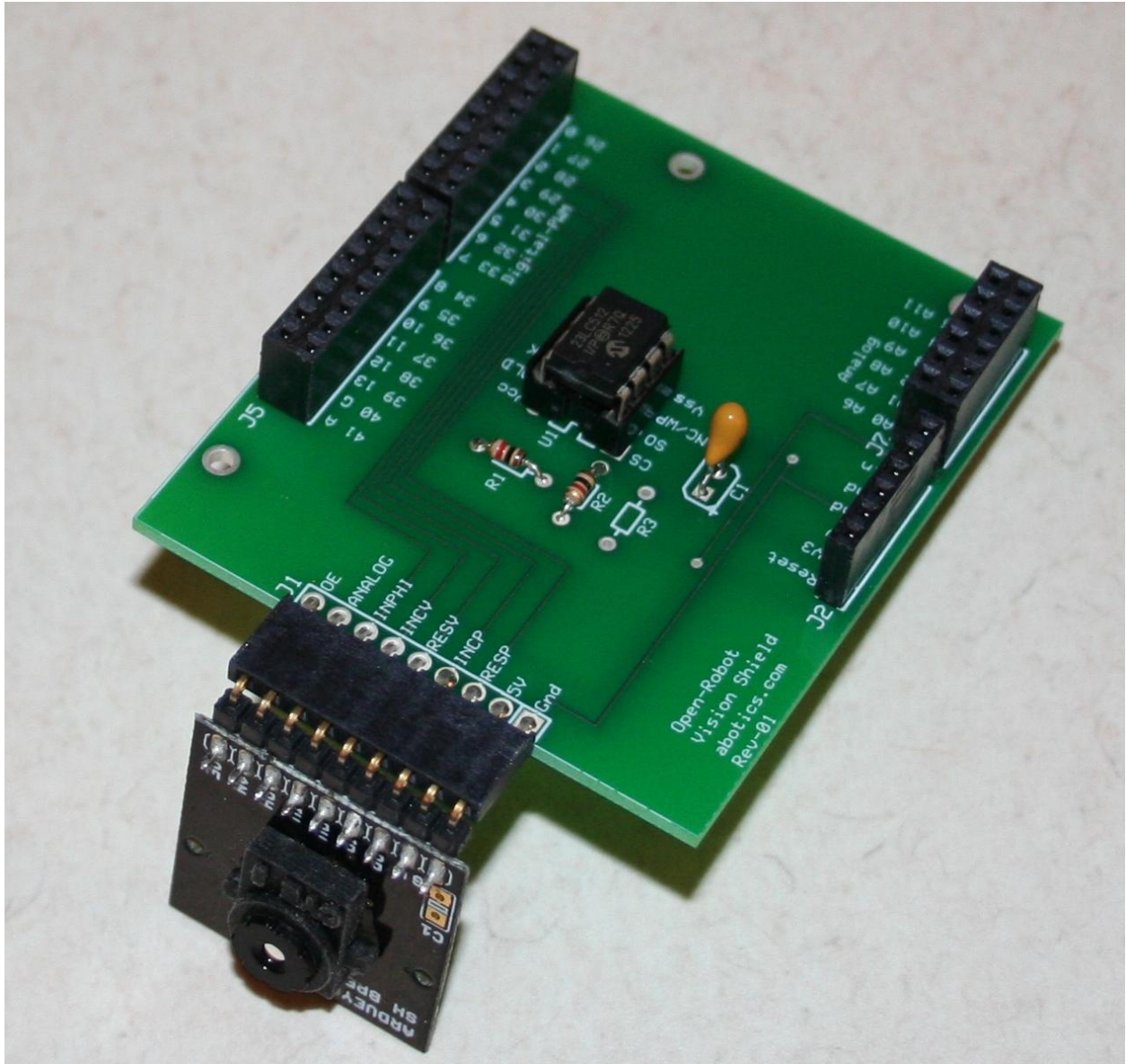


FIG 2. Open-Robot Vision & Memory Shield shown with SRAM and Stonyman sensor.

In figure 2 above it can be seen that a Stonyman vision sensor and Microchip® SRAM memory chip have been installed ³. Be sure to properly line up the pins on both the Stonyman sensor and SRAM chip to ensure that you do not cause damage when power is applied.

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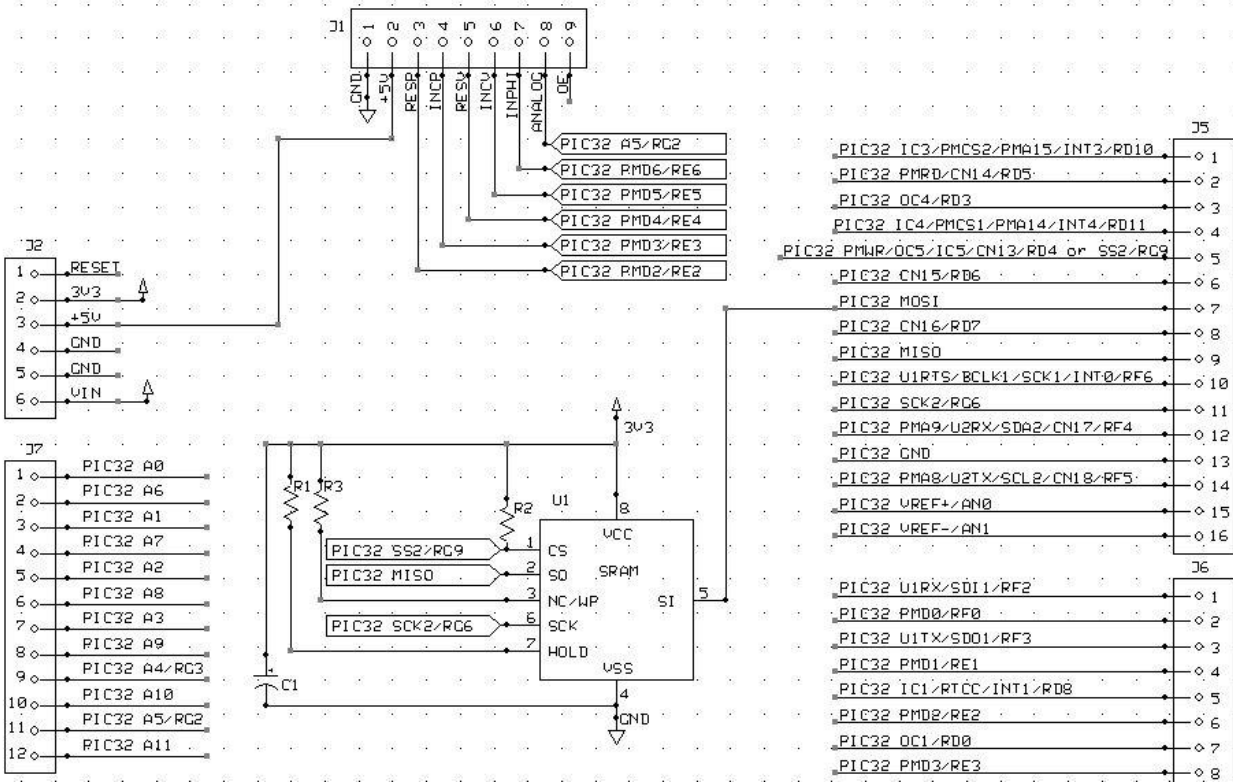


FIG 3. Open-Robot Vision & Memory Shield PCB Schematic.

From the PCB schematic shown above in figure 3 it can be seen that the following connections are made to the PIC32™ chip on the UNO32™ board. You will need to understand these connections if you are going to modify the software libraries or write and develop your own.

- Stonyman ANALOG → PIC32 A5
- Stonyman INPHI → PIC32 RE6
- Stonyman INCV → PIC32 RE5
- Stonyman RESV → PIC32 RE4
- Stonyman INCP → PIC32 RE3
- Stonyman RESP → PIC32 RE2
- SRAM CHIP SELECT (CS) → PIC32 SS2
- SRAM SERIAL OUT (SO) → PIC32 MISO
- SRAM SERIAL CLOCK (SCK) → PIC32 SCK2
- SRAM SERIAL IN (SI) → PIC32 MOSI

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Be sure to download the latest version of the Open-Robot MPIDE libraries to ensure that you have the updates Stonyman vision library ⁴. After unzipping the OpenRobotLibMPIDE file you will find that there is a vision example, **OpenRobotVision_Example_01052013**, contained within the OpenRobot Examples folder as shown in figure 4 below.

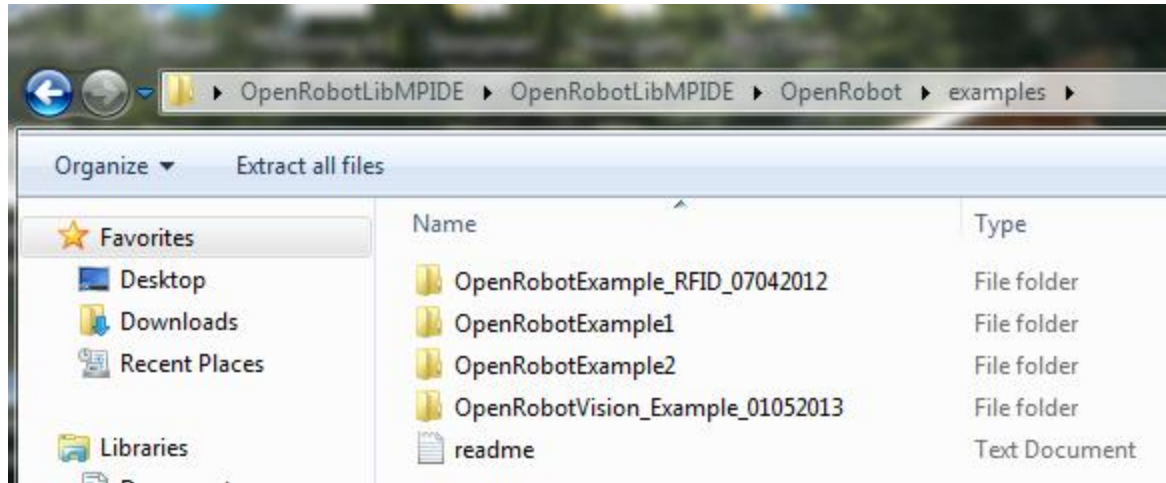


FIG 4. Open-Robot Vision Example.

You will need to open the vision example with the MPIDE, compile and upload to your OpenRobot before you can acquire and view images using the free **32 Bit OpenRobot Vision GUI** ⁵. Download and install the **32 Bit OpenRobot Vision GUI** using the link provided below in the References section. After installing the Graphical User Interface (GUI) you should be able to run and observe the interface presented in figure 5 below.

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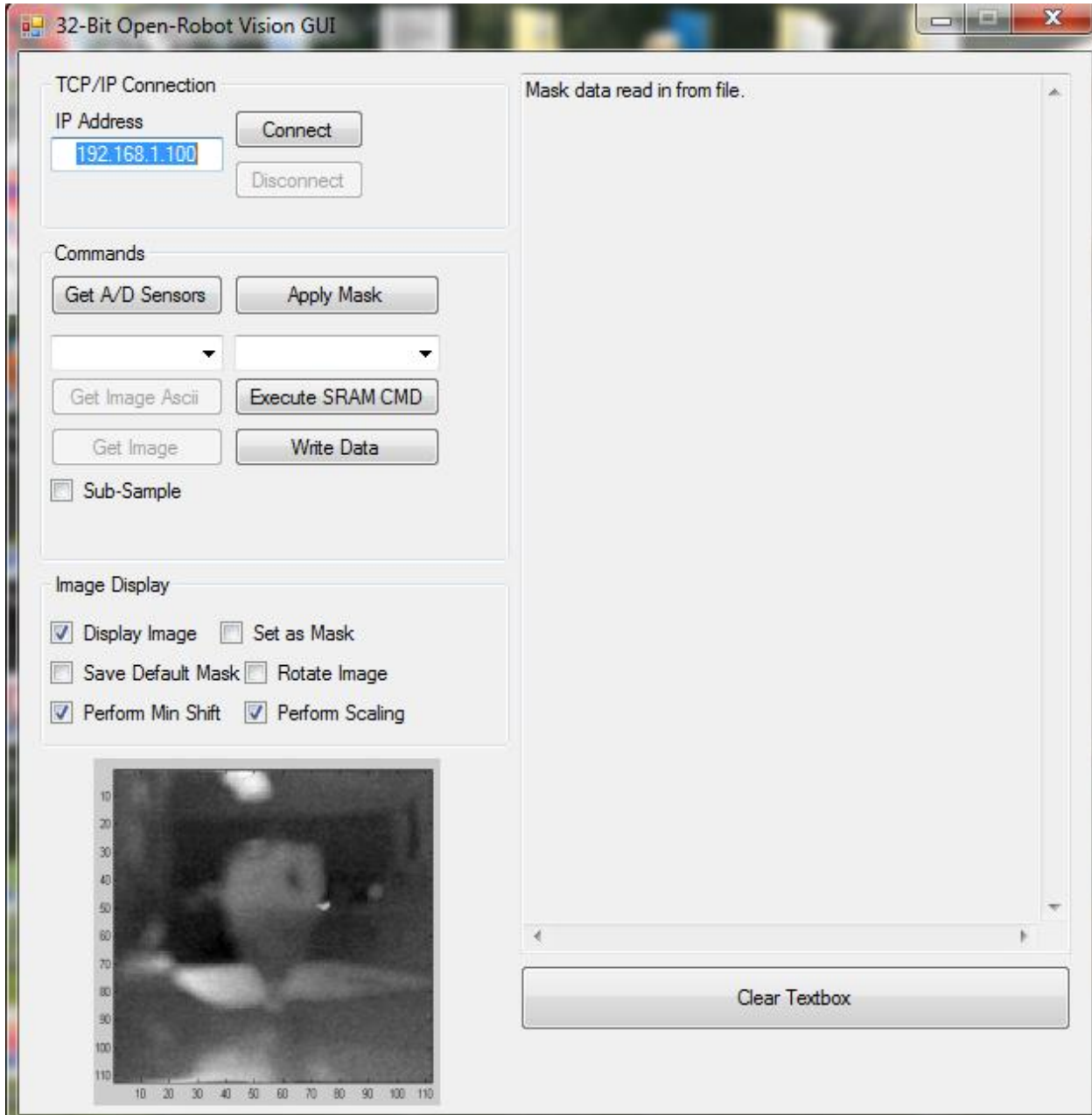


FIG 5. 32-Bit Open-Robot Vision GUI.

You need to enter the correct IP Address for your specific Open-Robot's RN-XV WiFi module. Next click the **Connect** button in order to connect to your robot. Test the connect by clicking the **Get A/D Sensors** button.

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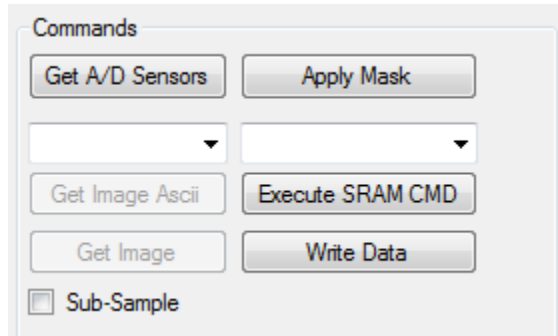


FIG 6. Robot Commands.

You can access all the Vision commands from within the **Commands** group-box shown above in figure 6. The drop-down list that is above the **Get Image Ascii** button provides access to 6 vision commands: **I, KA, KB, KF, KI & KR**.

1. Command **"I"** retrieves image data, and transmits image data out UART2 using Ascii readable characters.
2. Command **"KA"** retrieves image data, copies the image to SRAM, applies the Fixed Pixel Noise (FPN) map and then sends byte-sized image data out UART2. A total of **12,544 bytes** are transmitted for a full image and **6,272 bytes** if sub-sampled.
3. Command **"KB"** retrieves image data, copies the image to SRAM and then sends byte-sized image data out UART2.
4. Command **"KF"** retrieves FPN data from SRAM and then sends byte-sized FPN data out UART2.
5. Command **"KI"** retrieves final image data from SRAM and then sends byte-sized image data out UART2. Final image data means that the FPN has been applied to a raw image and copied to this location in SRAM.
6. Command **"KR"** retrieves raw image data from SRAM and then sends byte-sized raw image data out UART2.

The drop-down list that is above the **Execute SRAM CMD** button provides access to 3 SRAM commands: **JF, JR & L**.

1. Command **JF** acquires an image from the Stonyman sensor and writes it to a location in SRAM that is for the Fixed Pixel Noise (FPN). Recall that you must first cover the Stonyman sensor with a piece of white paper prior to using the **JF** command.

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2. Command **JR** acquires an image from the Stonyman sensor and writes it to a location in SRAM that is set aside for raw images.
3. The **L** command applies the FPN data from SRAM to the raw image and writes the resulting Final Image to a special location in SRAM memory.

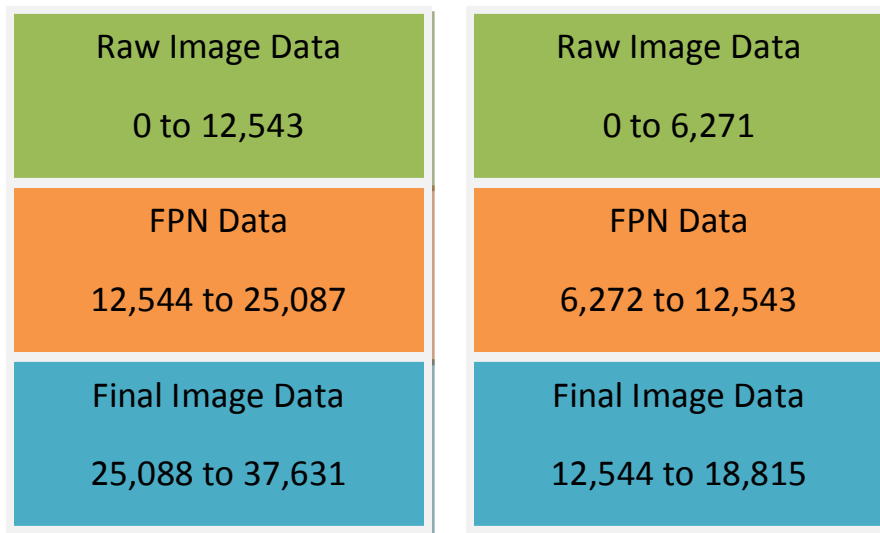


FIG 7. SRAM Memory Layout for full image (left) and sub-sampled image (right).

Figure 7 shows the layout of the attached SRAM memory. The raw image is saved in the first 12,544 byte locations within the attached SRAM Memory chip. FPN data is saved in the second 12,544 byte locations. The Final image is saved in the last 12,544 byte locations. When an image is sub-sampled, then only 6,272 bytes are required for an image and the memory locations are adjusted accordingly.

If you purchased an unassembled Vision & Memory Kit, then you must solder various components to the supplied Printed Circuit Board (PCB) as shown below in Figure 8. I recommend using a No-Clean Solder such as Kester (P/N 24-7068-7601), which can be purchased from Mouser Electronics (P/N 533-24-7068-7601) ⁶.

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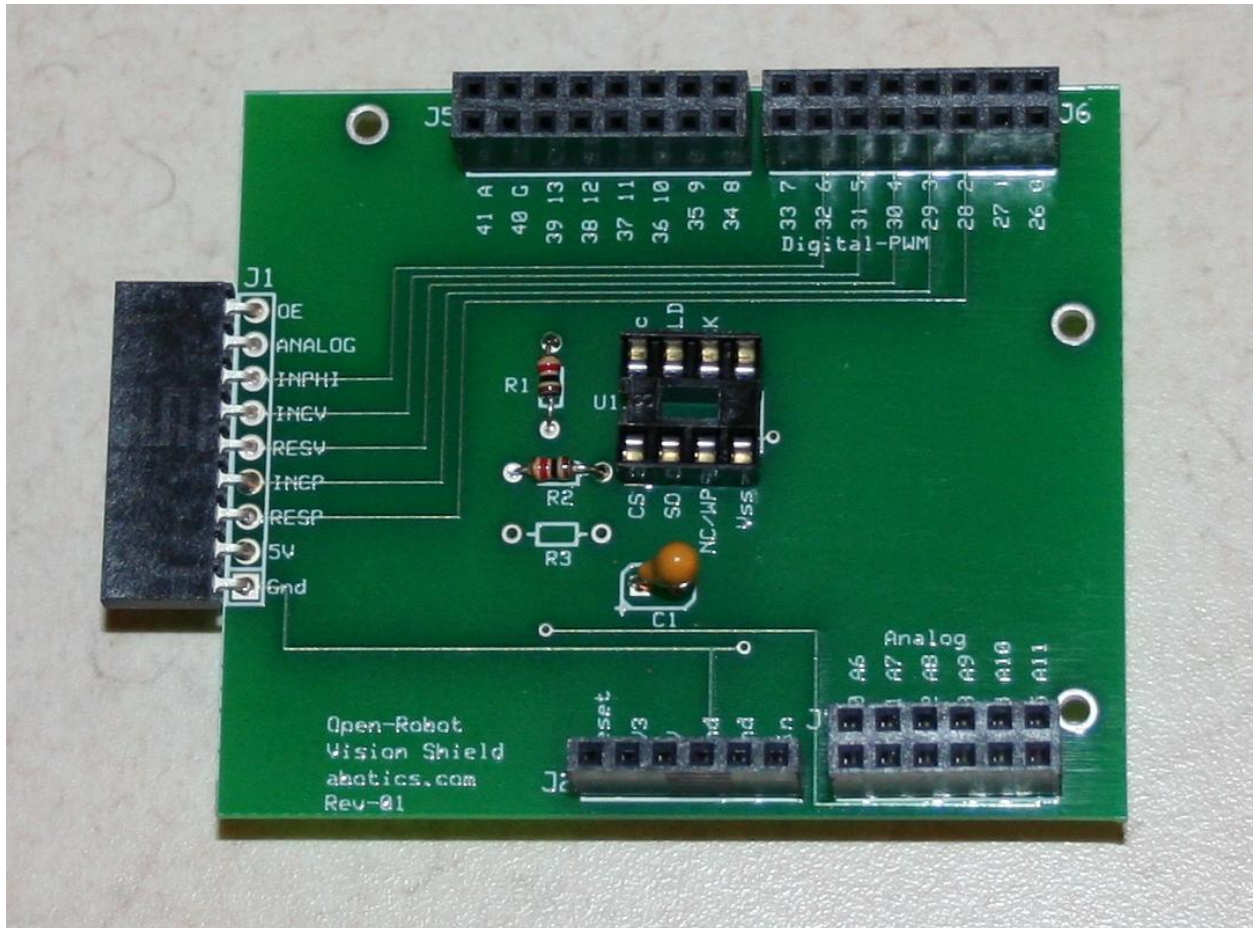


FIG 8. Solder Vision & Memory PCB.

- J5 & J6 are 2x8 Stackable Headers by Samtec⁷. [P/N SSQ-108-03-T-D](#)
- J7 is a 2x6 Stackable Header by Samtec. [P/N SSQ-106-03-T-D](#)
- J2 is a 1x6 Stackable Header by Samtec. [P/N SSQ-106-03-T-S](#)
- C1 is a 0.1 μ F Tantalum Capacitor. Be sure to properly orient for polarity.
- R1 & R2 are 1kOhm Resistors.
- J1 is a Right Angle 1x9 Header by Samtec. [P/N SSQ-109-02-T-S-RA](#)
- U1 is a 2x4 Pin Low Profile IC Socket.

After soldering you must insert the SRAM Memory chip into the 2x4 Pin IC Socket and the Stonyman Vision sensor into the 1x9 right angle header as shown below in Figure 9. The small notch on the SRAM chip must be oriented and aligned with the silkscreen notch.

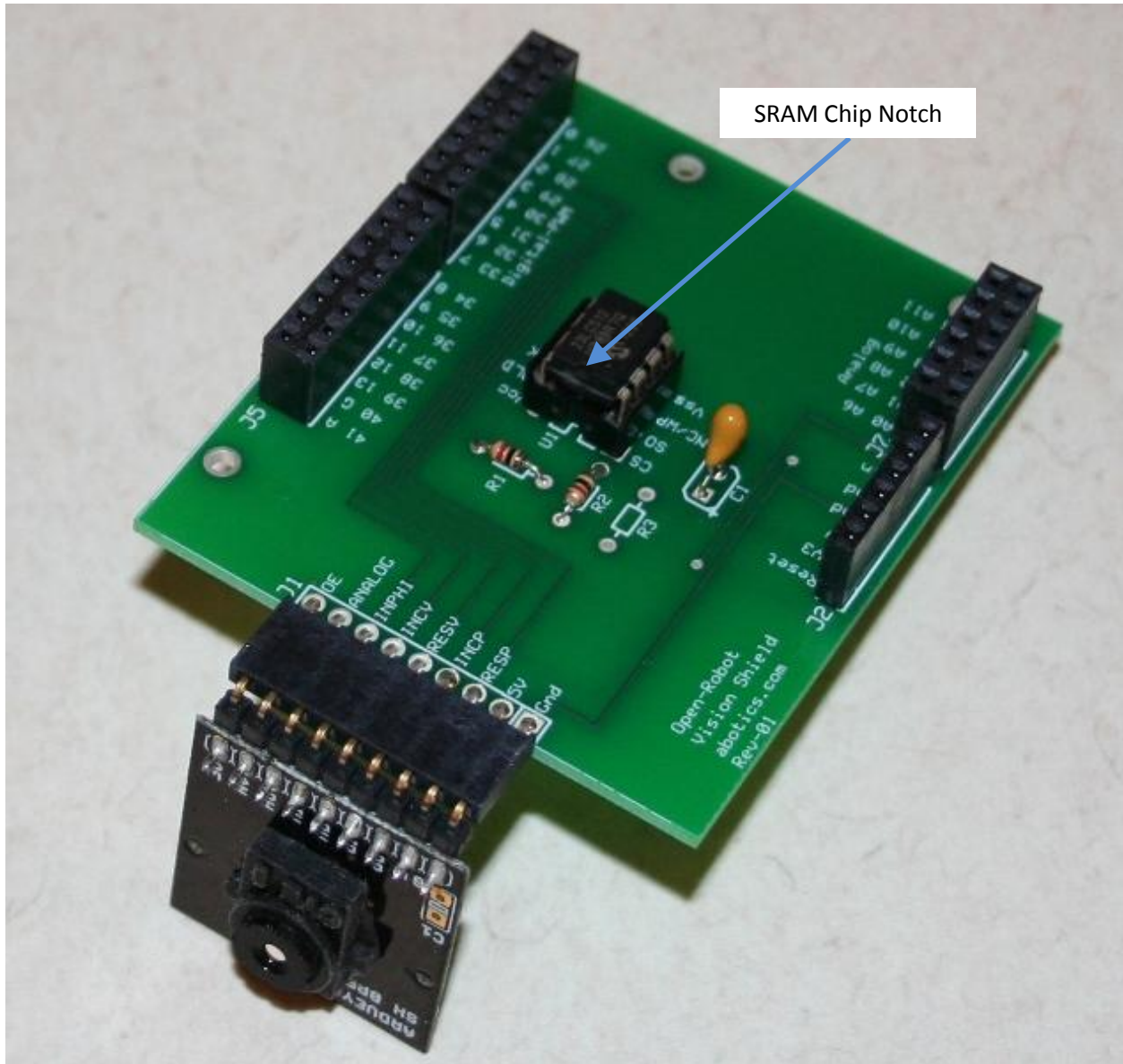


FIG 9. Attach SRAM Memory Chip and Stonyman Vision Sensor.

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REFERENCES

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2. <http://centeye.com/>
3. <http://www.microchip.com/>
4. <http://www.abotics.com/docs/OpenRobotLibMPIDE.zip>
5. <http://www.abotics.com/docs/32BitOpenRobotVisionGUI.zip>
6. <http://www.mouser.com/>
7. <http://www.samtec.com/>