How to use MATLAB with Raspberry Pi to Collect and Analyze Data from Sensors and Imaging Devices

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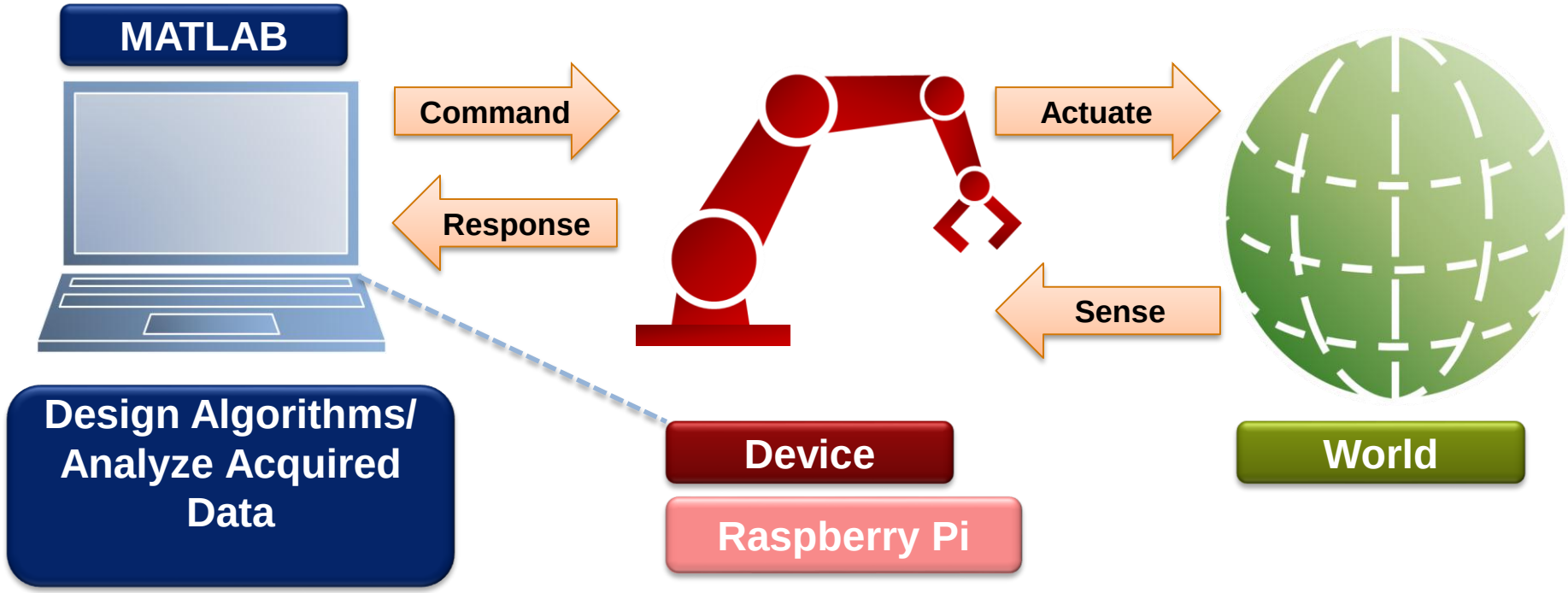
Agenda

- Introduction to MATLAB
- Installation of Support Package
  - Setting up MATLAB to talk to your Raspberry Pi
- Camera Board demo
  - Setting up Camera Board and detecting faces
- I2C and SPI sensor demos
  - Sparkfun TMP102 Temperature sensor
    - Setting up sensor and plotting temperature data
  - Sparkfun LIS331 Triple axis accelerometer
    - Setting up sensor and taking measurements
    - Using data to visualize orientation
- Conclusion and Additional Resources

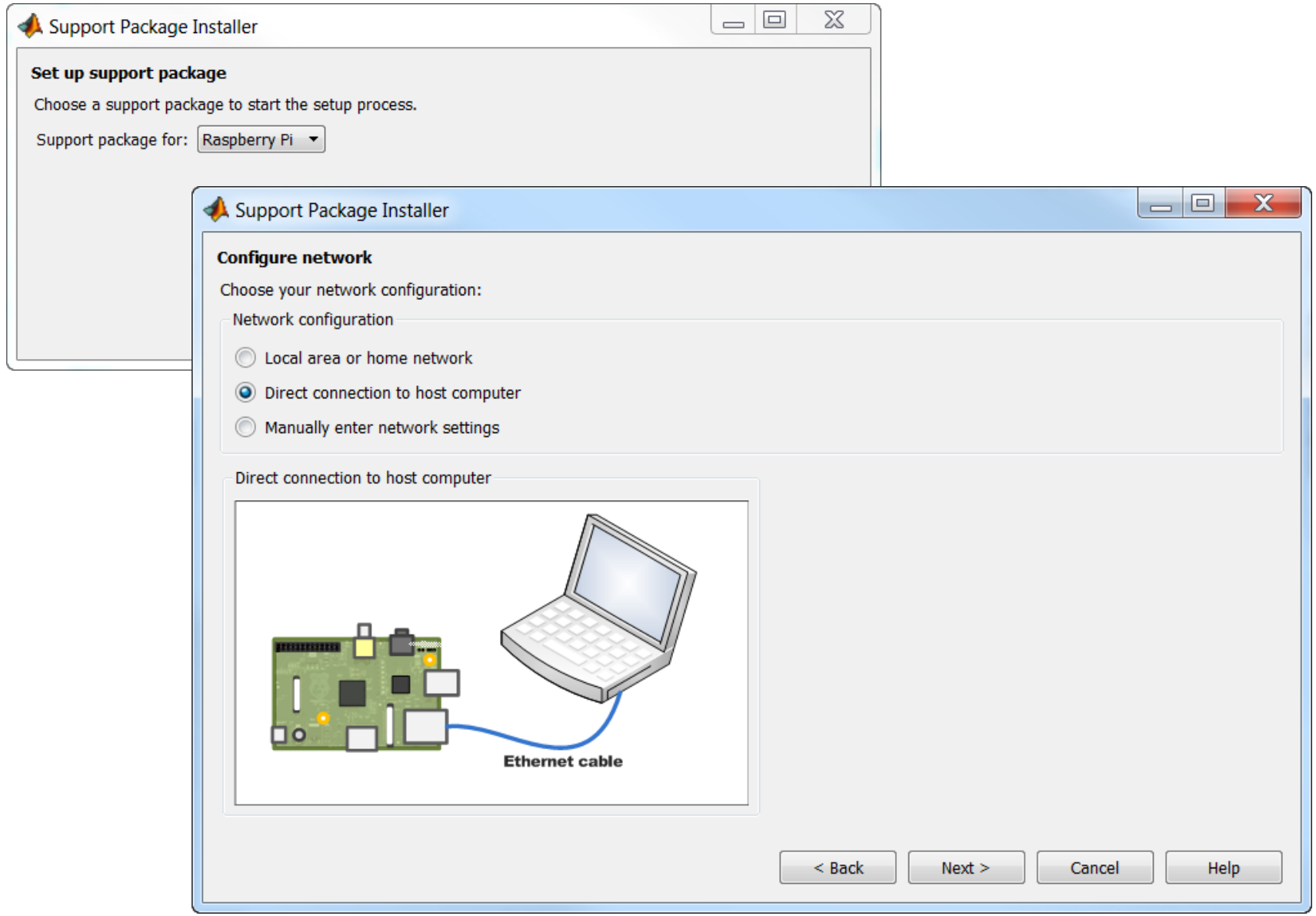
Introduction to MATLAB

Using MATLAB with Raspberry Pi

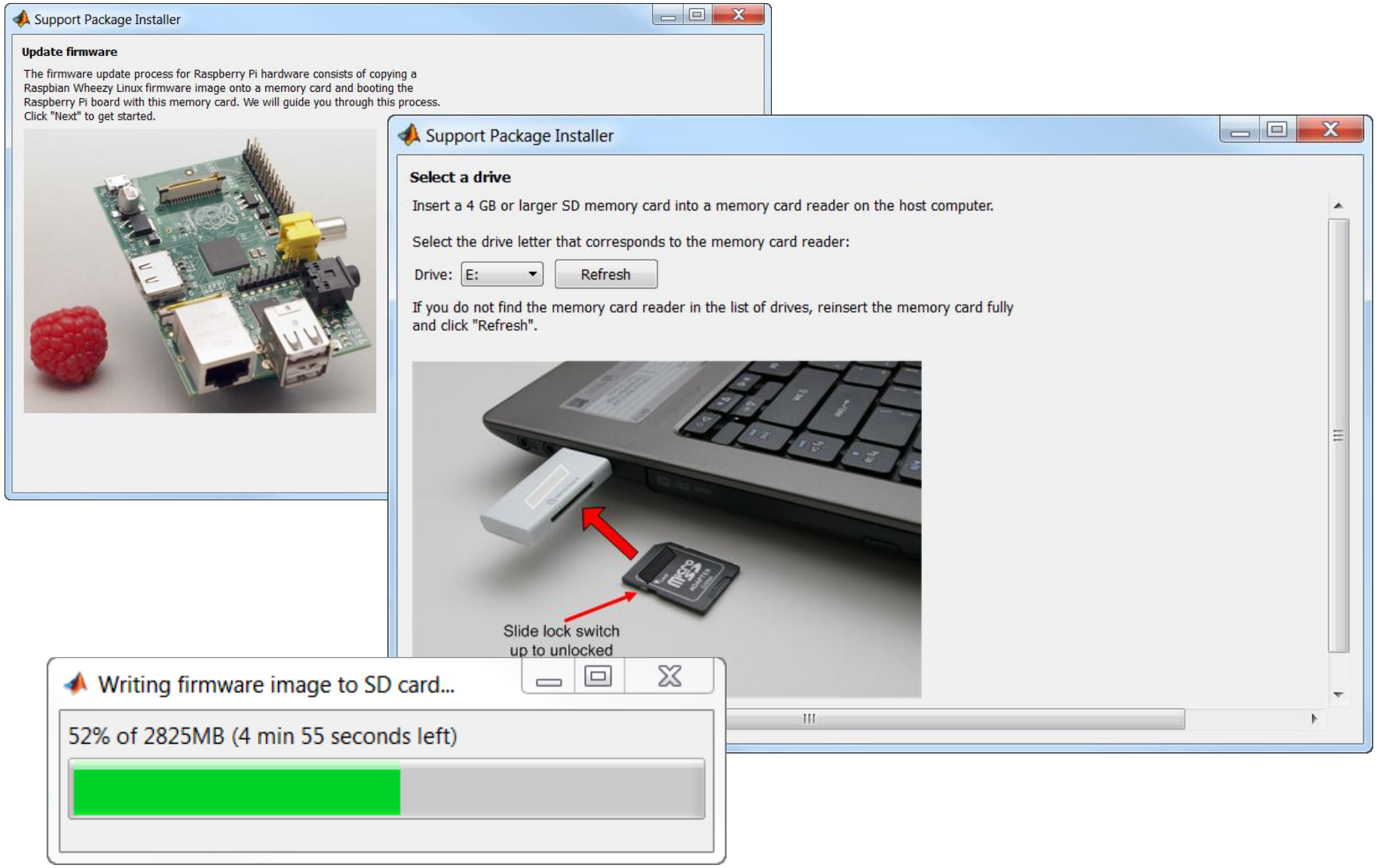


Installing Raspberry Pi Support for MATLAB

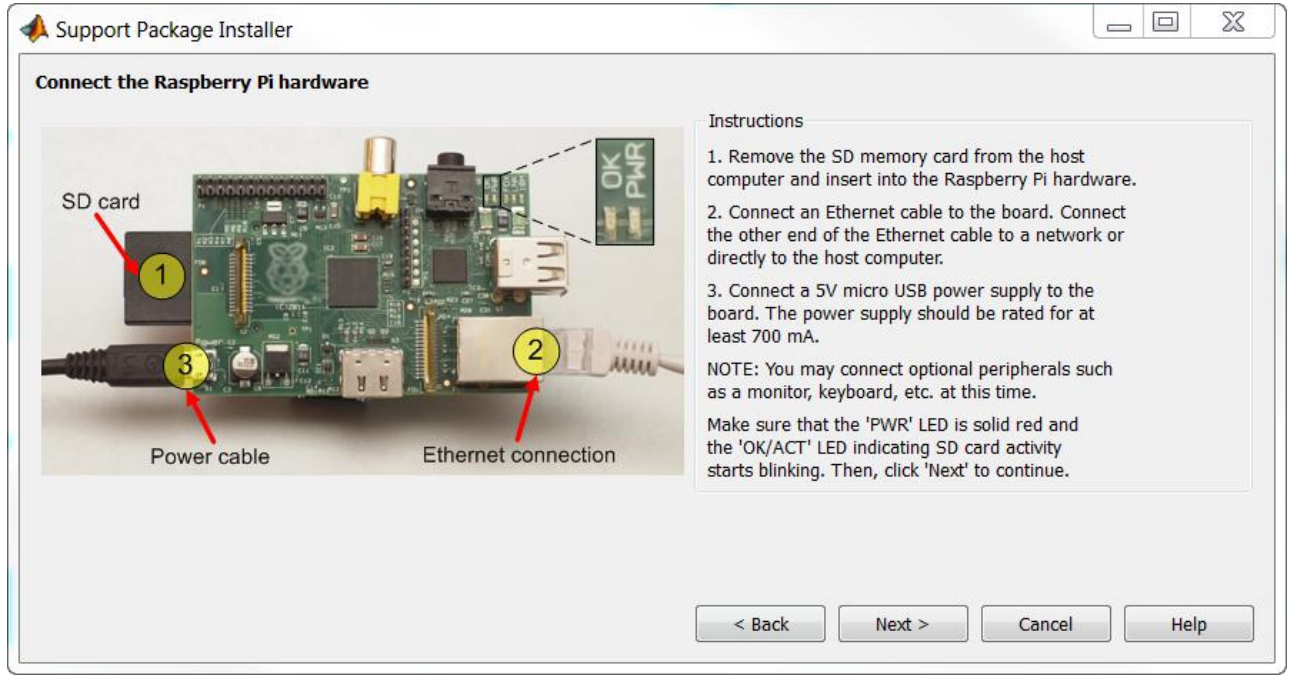
Setting up Support Package

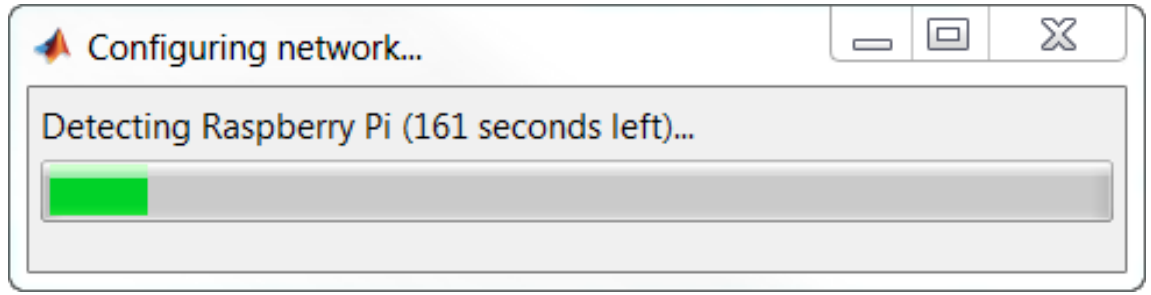


Uploading firmware

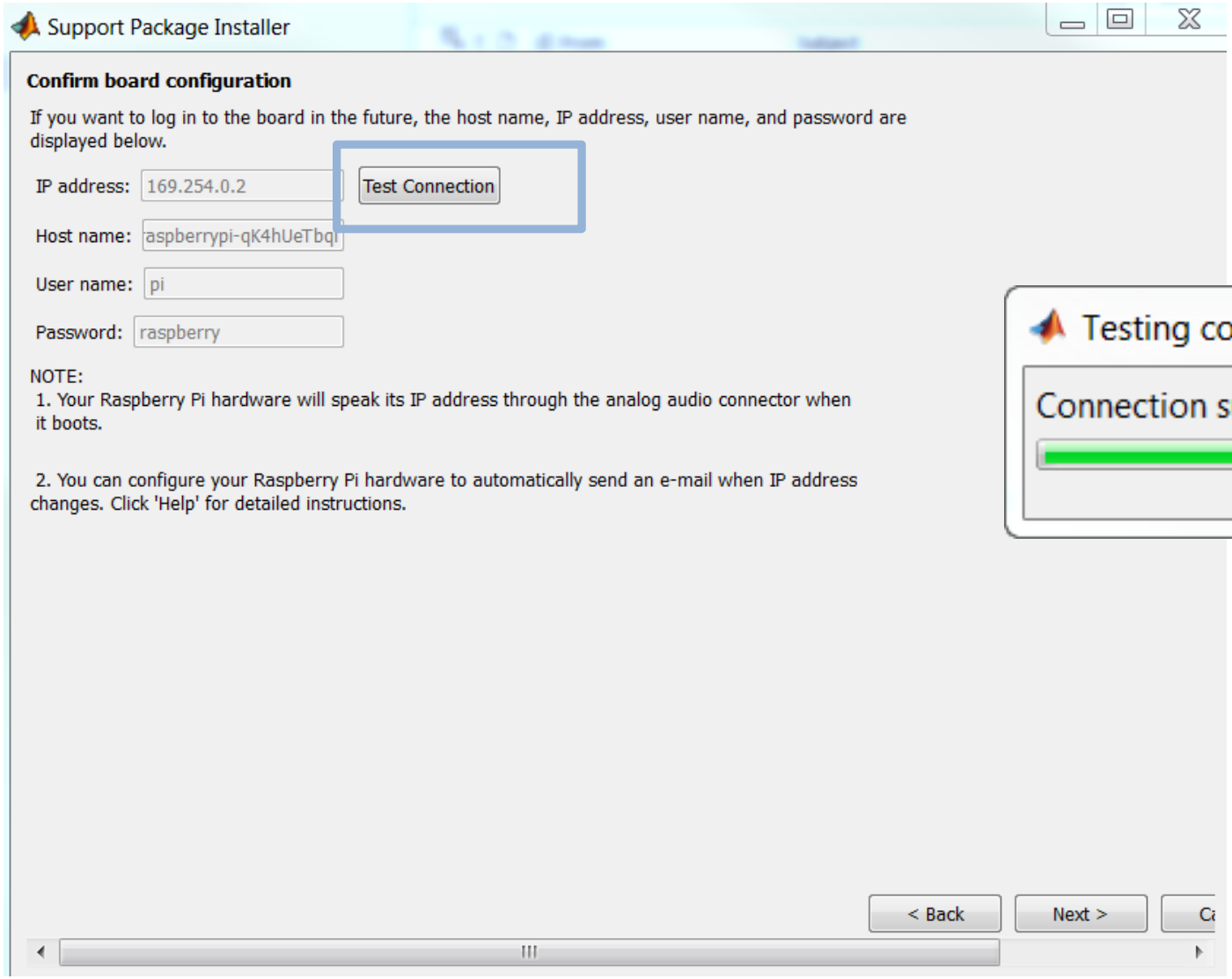


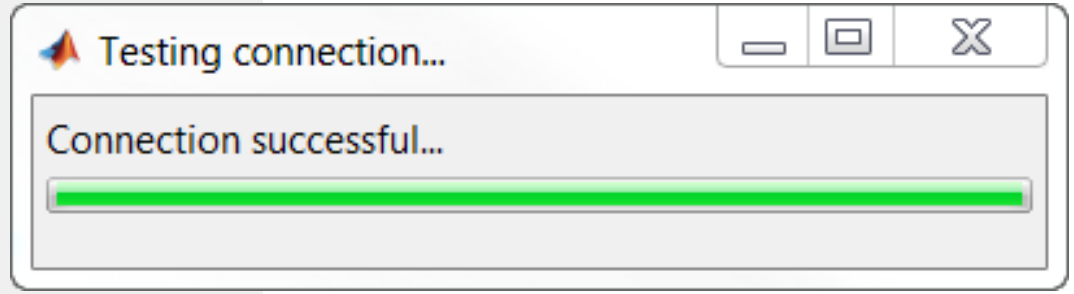
Detecting Raspberry Pi



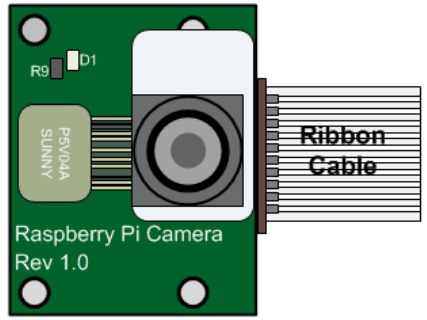


Completing Installation

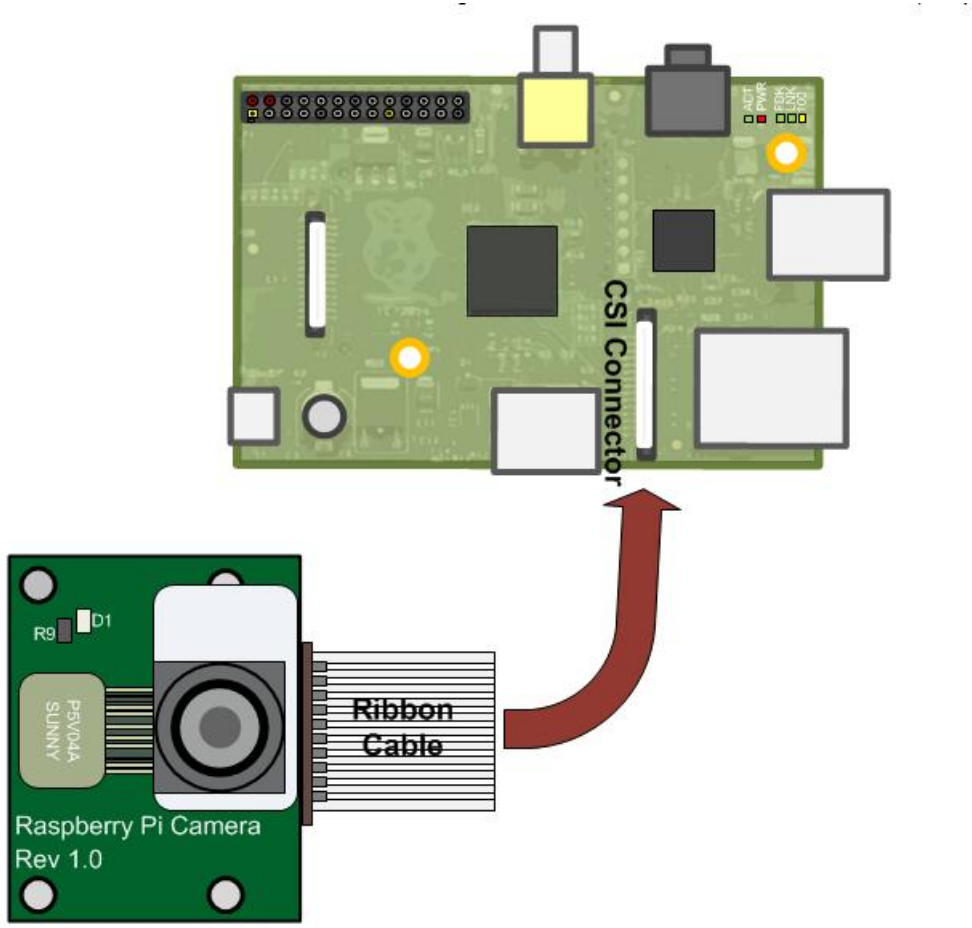




Demo: Capturing an image with the Camera Board and Detecting Faces



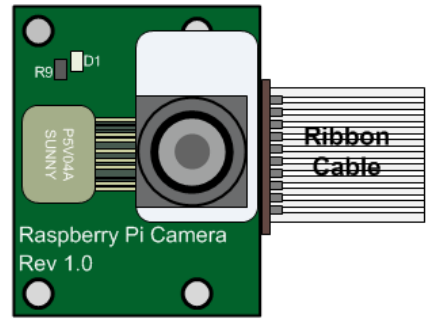
Connecting the Camera Board



Summary: Using Camera Board from MATLAB

- Create raspi object
- Create Camera Board object
- View/Change Camera Board Settings
- Use snapshot to take acquire image
- Create loop to acquire video
- Perform face detection on the acquired video

```
mypi= raspi;
cam = cameraboard(mypi,'Resolution','1280x720');
cam.Brightness=70;
image=snapshot(cam);
imagesc(image) % view image
```

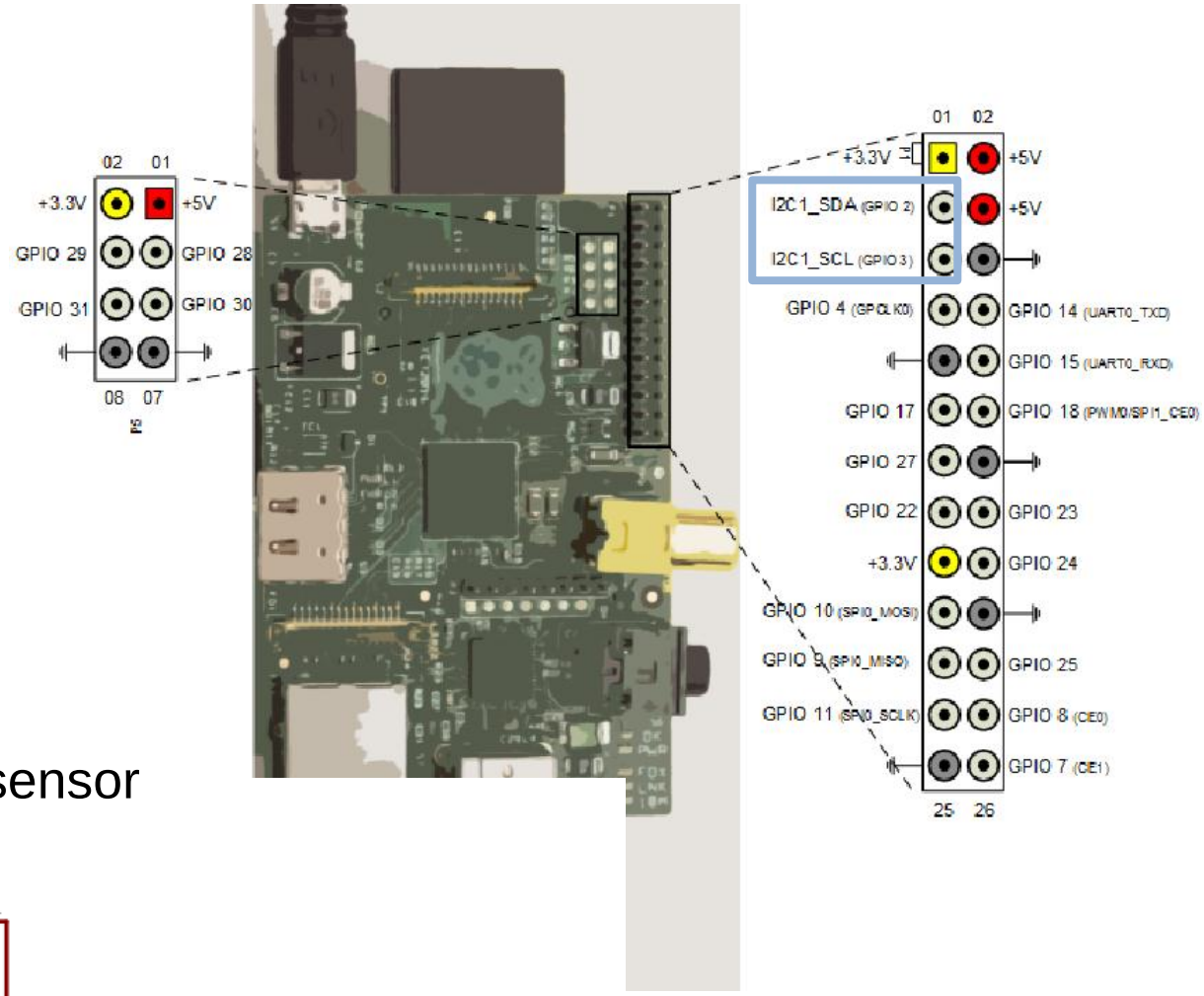


Demo: Measuring temperature with an I2C temperature sensor

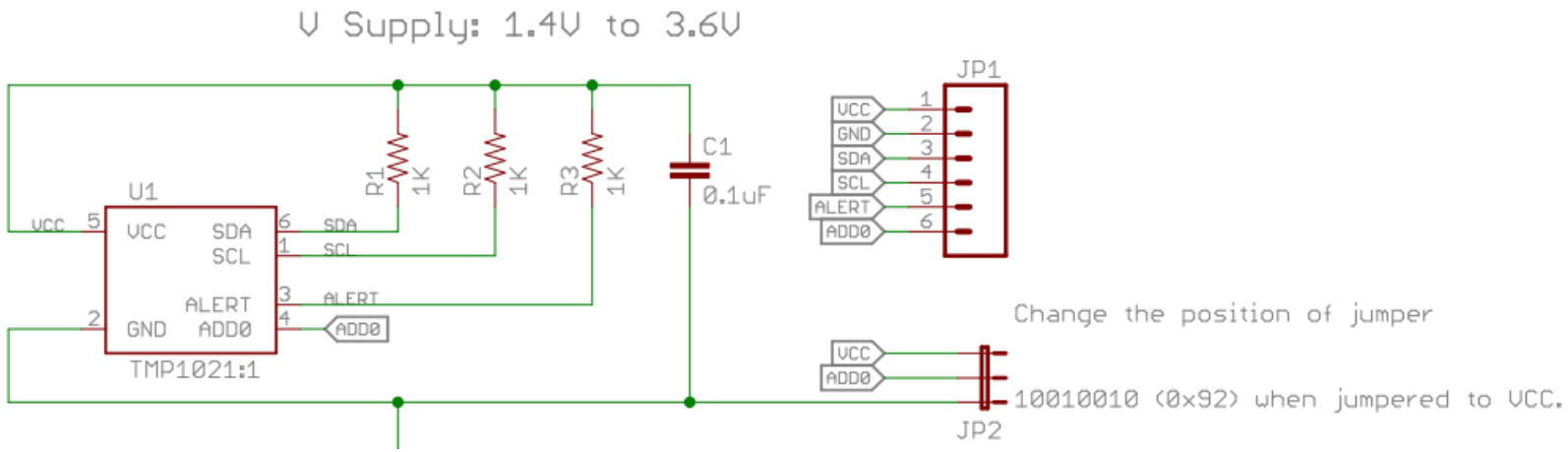
Connecting an I2C sensor

We need to connect:

- SDA to GPIO 2 (I2C1_SDA)
- SCL to GPIO 3 (I2C1_SCL)
- VCC to **3.3V**
- GND to GND
- ADD0 to GND

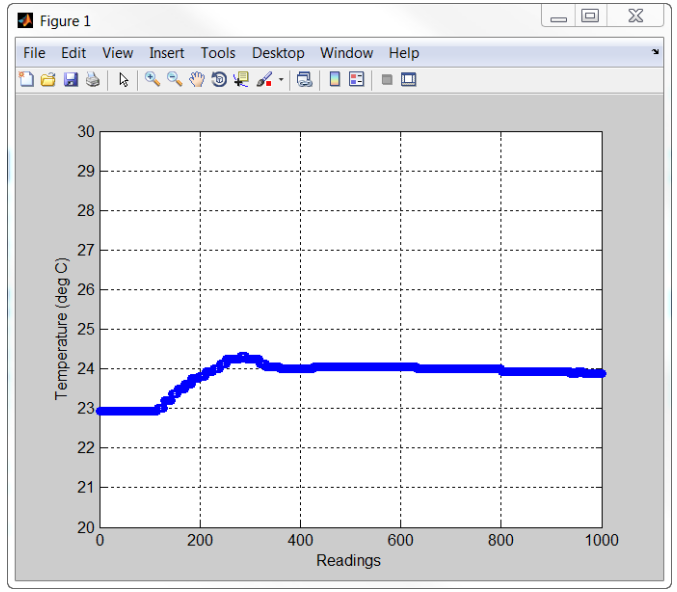


Sensor pinout for TMP102 temperature sensor



Summary: Reading from TMP102 I2C sensor

- Create raspi object
- Scan I2C bus for address of sensor (0x48)
- Create i2cdevice object
- Read temperature register
- Decode temperature using formula in datasheet




```
mypi = raspi;
Active_Addresses = scanI2CBus(mypi,'i2c-1'); % look for sensors on I2C bus
tempsensor = i2cdev(mypi,'i2c-1','0x48'); % create temp sensor object
temp = double(bitshift(swapbytes(tempsensor.readRegister(0, 'int16')), -4))...
*.0625;  % convert values to degrees C
```

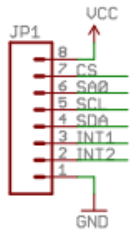
Demo: Orientation Sensing with an SPI accelerometer

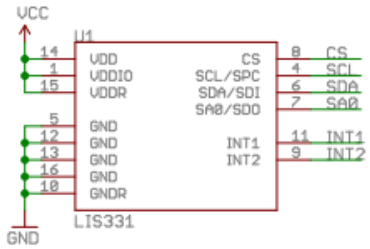
Connecting an SPI sensor

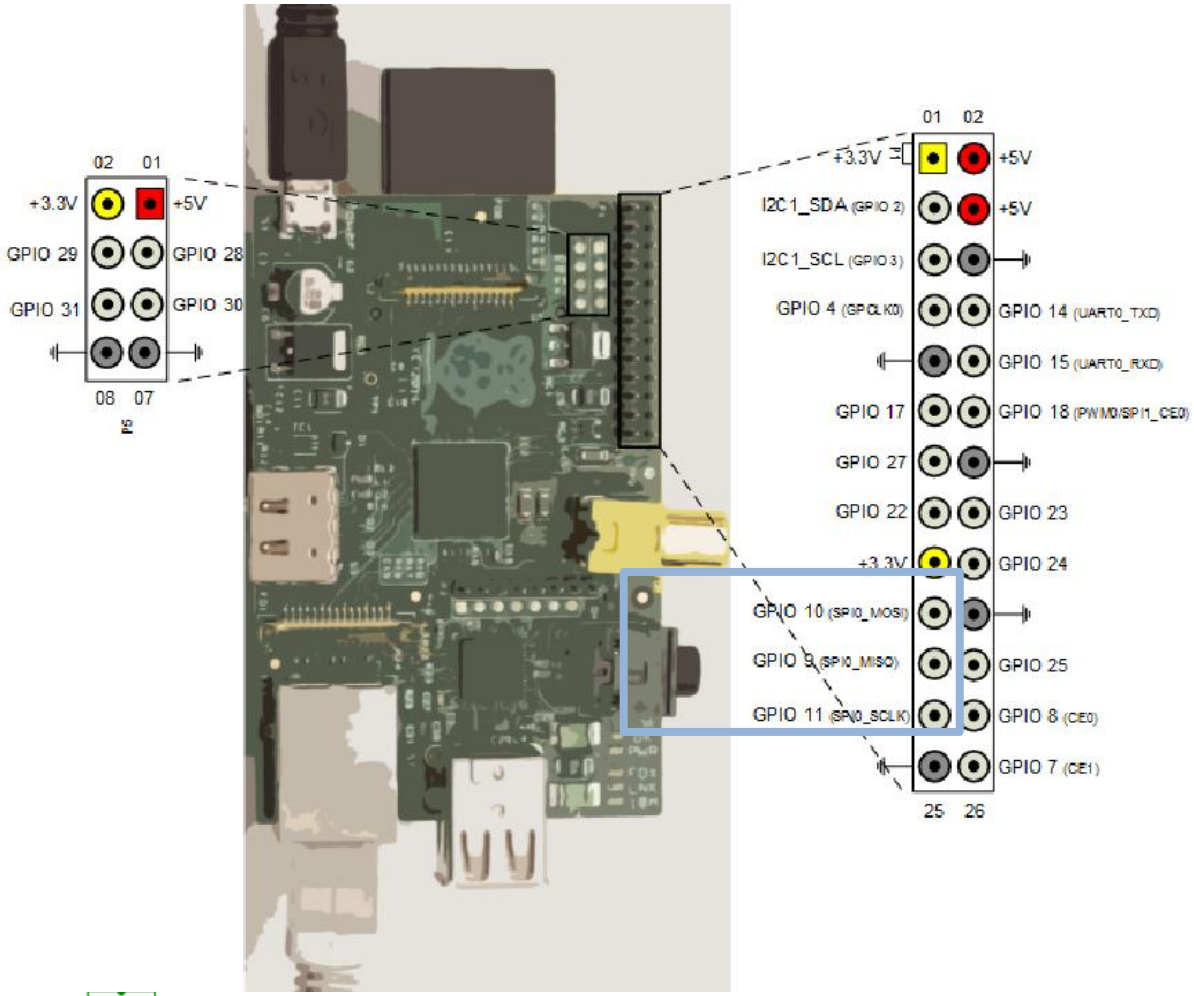
We need to connect:

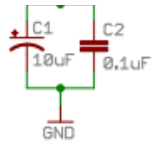
- SDA to GPIO 10 (SPIO_MOSI)
- SAO to GPIO 9 (SPIO_MISO)
- SCL to GPIO 11 (SPIO_CLK)
- CS to GPIO 8 (CEO)
- VCC to **3.3V**
- GND to GND

Sensor pinout for LIS331 accelerometer





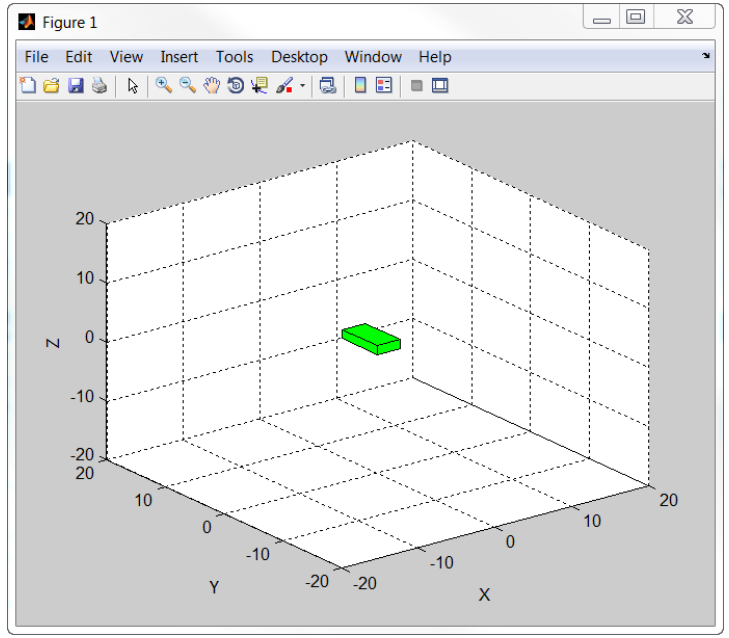




Summary : Reading from LIS331 3- axis accelerometer

- Create raspi object
- Enable SPI
- Create Acceleration Sensor object
  - Object decodes
  - Object maps registers
- Take readings
- Do something interesting
  - Simple Orientation Sensor

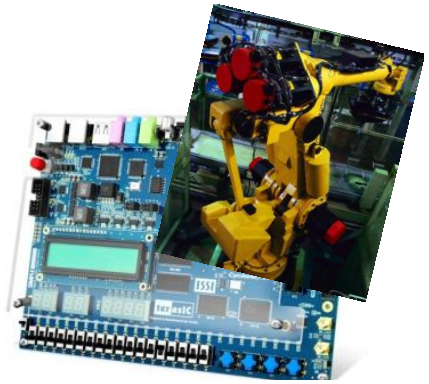
```
mypi = raspi;
enableSPI(mypi);
ac = lis331(mypi, 'CE0'); % create sensor object
[x,y,z]=ac.readAcceleration;
```



Wrap-Up

- How to install Raspberry Pi MATLAB Support
- How to acquire images using Camera Board
- How to use I2C and SPI sensors from MATLAB with your Raspberry Pi
- Application examples
  - Face Detection
  - Plotting temperature
  - Orientation sensing

How to buy MATLAB and Simulink



Standard

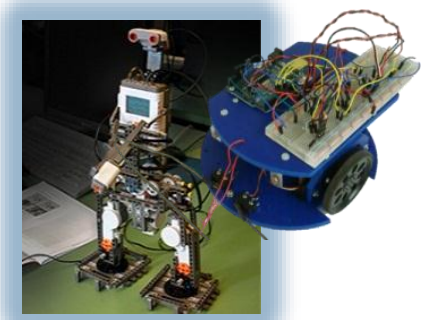
For use at a commercial, government, or other organization by a single user.

Education

For use in teaching and academic research at a degree-granting institution.

Student

For use in conjunction with courses offered at a degree-granting institution.



Home

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https://www.mathworks.com/store/index.do

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