Raspberry Pi 2/B+ w/ Thingworx C SDK

Getting Started

Congratulations! If you are reading this then you have already taken the first step into a brave new world. The goal of this kit is to provide a starting point to learn about the Internet of Things and give some sample code to illustrate how it could be used. The rest of this document will walk you through:

1. Getting the files on to your Raspberry Pi
2. Starting the “agent” to send data
3. Interacting with the GPIO pins
4. Further extending the sample code.

So let’s get started!

# Section 0 – Prerequisites

To ensure the best experience possible we recommend a common starting point for your setup.

* Raspberry Pi Ver1 Model B+ OR Raspberry Pi2 A or B
* An SD card with Raspbian installed (other distros may work, but have not been tested)
* Optional: GPIO Breakout board ( Pi Cobbler, Pi Crust or Pi Wedge)
* Jumper wires and a breadboard
* For Windows: WinSCP and PuTTY
* For Mac: Terminal (already installed in Applications/Utilities)

Note: If you do not have an operating system installed on your Pi we recommend downloading and installing NOOBS/Raspbian: <https://www.raspberrypi.org/help/noobs-setup/>

# Section 1 – Where am I?

If you haven’t already done so, plug in your Raspberry Pi to power and the network. It may also be helpful to have a display, keyboard and mouse on hand for this step. Once the Pi powers up it will get an IP address from the network that we will use to communicate with it in the next few steps. There are two ways to get that mystery IP address, go directly to the router and see what addresses it’s leased out OR log into the pi with a keyboard and mouse. Since router interfaces can vary wildly we are going to trust you to know how to look up the DHCP Leases table. If you are using the Display/Keyboard method:

1. Log into the pi if requested, username: pi password: raspberry
2. Start the Terminal app.
3. Type ‘ifconfig’ (no quotes)
4. Look for the IP address in the output, it will be listed in the eth0 section as ‘inet addr:’

# Section 2 – Copying the files to your Raspberry Pi

A number of different methods can be used to transfer your files on to the Pi and you are free to use whichever you are most comfortable with. For those that are not comfortable please follow these directions:

Windows:

1. If you haven’t already Download WinSCP and install
2. Start WinSCP and connect to your RaspberryPi
3. (for Raspbian) Username: pi Password: raspberry
4. In your home folder create a directory for the app named TWC\_Agent
5. Copy all files from the ‘install’ directory in this archive to your newly created TWC\_Agent folder

Mac: Use the SCP command

1. Open up Applications/Utilities/Terminal
2. Type:

ssh pi@< IP\_ADDRESS >

1. In your home directory make a new folder called “TWC\_Agent” by typing “mkdir TWC\_Agent”
2. Close the SSH session by typing “logout”
3. Type:

scp <file\_name> pi@< IP\_ADDRESS >

1. Your computer will start transferring the files, Copy all files from the ‘install’ directory in this archive to your newly created TWC\_Agent folder

# Section 3 – Starting the TWC agent

Now we want to get things actually running and start data getting streamed up to the platform. For this step we will need an SSH terminal and the IP address of the pi found in Section 1.

1. Start an SSH Connection to your Pi
   1. Windows: Start Putty and in the connection window use the following string: pi@<IPADDRESS>, where <IP\_ADDRESS> is the one found in Section 1
   2. Mac: Open Applications/Utilities/Terminal, Type: ssh pi@<IP\_ADDRESS> where <IP\_ADDRESS> is the one found in section 1
2. Use the password raspberry
3. You will see a command line appear once you are logged in.
4. Go into the directory where you put the files: cd TWC\_Agent
5. For the first run we need to set permissions on the executable: chmod 755 twc\_agent
6. Now we can run it as a super user: sudo ./twc\_agent
7. You will see all kinds of output on the screen as it sends data up to the Thingworx platform. Now is a good time to view the content on the platform.

# Section 4 – Interacting with GPIO pins

This demo agent has been written such that you can now access the basic GPIO pins on your raspberry Pi from the Thingworx Platform. You can set the pin as an input or output as well as setting and reading values from those pins. This agent does not do any more advanced communication such as I2C or SPI etc. You can wire in an LED or light sensor to test this functionality.

INSERT Basic LED diagram, Light sensor diagram Here.

# Section 5 – Extensibility

As mentioned before this agent has been designed to serve as a starting point for your next IoT project. What good would it be if you couldn’t change anything? The agent includes all of the source code along with the binary so that you can create your own agent to do whatever is needed. A make file has also been included that will handle the heavy lifting of compiling the source code and producing a binary. To invoke the make file and compile your app all you need to do is:

make app

The bulk of the code you want to alter will be located in src/twc\_c\_agent.c. This is where we do all the property registration, data collection and service definitions. More device specific code can be found in src/pinspectre\_rPi2.c. The other C and H files are used for utility such as parsing JSON files and handling settings files.

## Go Mode

The agent ships with a “Go!” widget mode that provides specific data items that drive a business template on the TW instance. For the Raspberry Pi we have selected an Oil Pump. When the agent comes out of the box it supplies randomized data to drive this widget. You can switch the agent around to read actual pins instead of sending random data. To disable the sim mode all you need to do is open up agent.properties, located at the top level of your agent and alter the value for the SimMode setting to “false” (no quotes) and restart the agent. The device will now start reading from select GPIO pins to get the values according to the table below.

|  |  |  |
| --- | --- | --- |
| Data Item | Default Pin | Ideal Input device |
| Temperature | GPIO 17 | Temperature Sensor |
| Pressure | GPIO 18 | Force Sensor |
| In Use | GPIO 21 | Button/Switch |
| Power Consumption | GPIO 22 | Potentiometer |

It is important to note that the Raspberry Pi only does Digital inputs and it doesn’t support Analog inputs out of the box. An add-on board must be purchased to support analog sensors. You will also need to add the appropriate code to support your new add-on board. In the Pi’s base configuration, the data supplied will only have the value of 1 or 0.