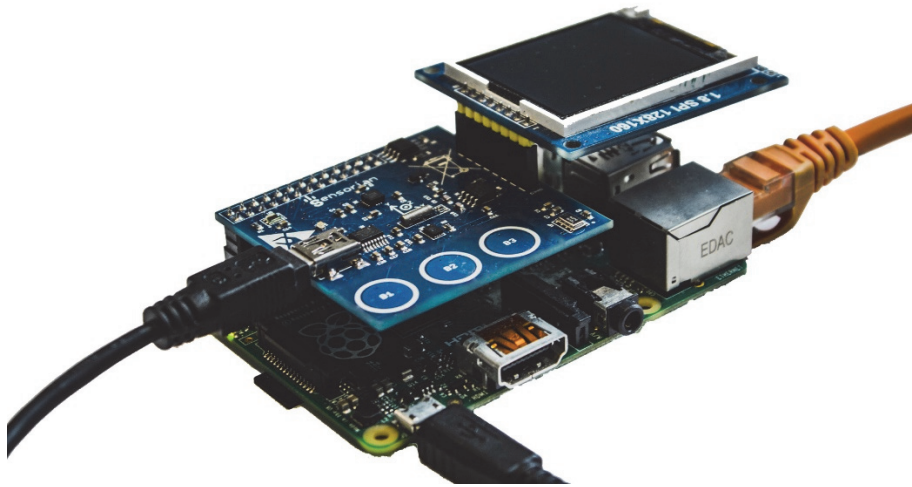


Sensorian

Getting Started Guide



2015 Sensorian. All rights reserved.

All trademarks or registered trademarks referenced herein are the properties of their respective owners.

The latest Getting Started Guide is available online at: www.sensorian.io

Copyrights

© Sensorian, 2015. The information contained herein is subject to change without notice. Sensorian assumes no responsibility for the use of any circuitry other than circuitry embodied in a Sensorian product. Nor does it convey or imply any license under patent or other rights. The Sensorian shield is not warranted nor intended to be used for medical, life support, lifesaving, critical control or safety applications, unless pursuant to an express written agreement with Sensorian. Sensorian reserves the right to make changes without further notice to the materials described herein. Sensorian does not assume any liability arising out of the application or use of any product or circuit described herein. Sensorian does not authorize its products for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of Sensorian product in a life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies Sensorian against all charges.

Regulatory Compliance

The Sensorian Kit is intended for use as a development platform for hardware or software in a laboratory environment. The board is an open system design, which does not include a shielded enclosure. Due to this reason, the board may cause interference to other electrical or electronic devices in close proximity. In a domestic environment, this product may cause radio interference. In such cases, the user may be required to take adequate preventive measures. Also, this board should not be used near any medical equipment or RF devices. Attaching additional wiring to this product or modifying the product operation from the factory default may affect its performance and cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures should be taken. The Sensorian Kit as shipped from the factory has been verified to meet with requirements of CE as a Class A product.



Handling Boards

Sensorian boards are sensitive to ESD. Hold the board only by its edges. After removing the board from its box, place it on a grounded, static free surface. Use a conductive foam pad if available. Do not slide board over any surface.

Preface

This document describes how to get started with the Sensorian shield as a development tool to explore the various sensors it comes with. The guide is structured as follows:

Chapter 1. "Introduction" provides a brief overview of the Sensorian kit and its capabilities.

Chapter 2. "Getting started" shows how to install the shield and get started with the software examples.

Chapter 3. "Hardware" give a brief description of all shield modules.

Appendix. "Sensorian Pinout" provides a detailed table with the pin connections of each sensor.

Chapter 1. Introduction

1.1 What's in the kit?

The basic Sensorian Kit comes with the Sensorian Shield and a USB mini B cable. **Other items might be included depending on the kit version** you have purchased, as shown in Figure 1:

- Sensorian Shield
- USB mini B cable
- 1.8 inch graphic TFT Display
- 8GB Micro SD Card with Adapter



Figure 1: Sensorian Kit (complete content)

1.2 Features

- Fully compatible with all versions of Raspberry Pi (ARM V6) and Raspberry Pi V2 (ARM v7)
- **Micro-USB port for serial logging**
- Ambient Light Sensor
- Accelerometer /Magnetometer sensor.
- Barometer / Altimeter/ Temperature sensor.
- Three capacitive touchpads
- Real Time Clock with battery backup and integrated EEPROM memory.
- Non-volatile flash memory.
- On-board LED.
- **TFT display socket**

Chapter 2. Getting started

The Sensorian Shield is a low-cost **add-on sensor board** that augments the capabilities of the Raspberry Pi.

2.1 Shield Installation

The Sensorian Shield is compatible with all Raspberry Pi models. This compatibility decision does not allow it to conform to the HAT specification. The user simply needs to plug in the shield on top of the 26 pin header (or 40 pin header for Model B+). The 1.8 inch TFT screen can then be plugged on the 8 pin female header. These steps complete the installation of the Sensorian shield.

2.2 Software Installation

To quickly get started, download the Sensorian iso image and load it on the SD card that comes with the kit, or on your own SD. The Sensorian drivers are already installed on the /home/ directory together with the sample examples.

Alternatively, you can clone the Sensorian Github repository.

2.3 Developing Applications

The Sensorian Library provides an API-driven approach to coding applications. This abstraction layer eliminates the low-level approach that is required for microprocessor peripheral configuration and sensor driver development. Figure 2 shows the Sensorian Library Block Diagram.

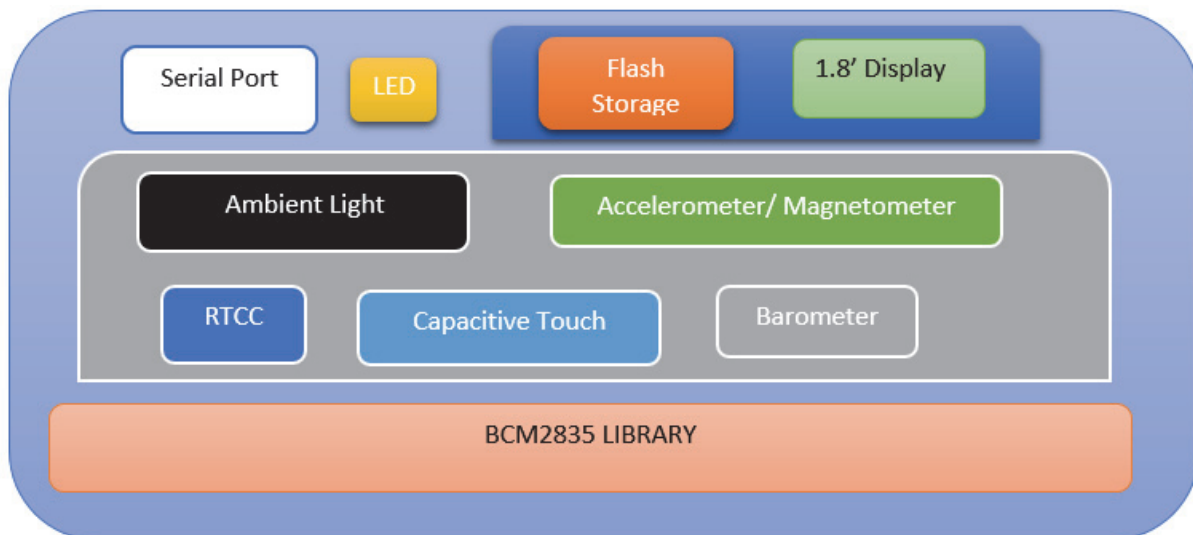


Figure 2: Sensorian Library Block Diagram

You can develop code using high level peripheral abstractions and API calls that are intuitive. This allows you the users to experiment by being more creative and **concentrate** on **their** design objectives.

Together with the provided examples, Sensorian allows reuse of the library functionality by providing clear **API** interfaces. The core library supports most of the peripheral drivers the BCM2835 SOC has to offer.

When coupled with high level frameworks like Flask and Nodes JS the Sensorian API allows the user to leverage the whole power of embedded Linux while at the same time following the physical computing paradigm.

C libraries and Python modules for each sensor are provided. The tight combination of firmware and hardware makes it really easy to explore and invent creative application. In addition, Sensorian provides support for Scratch and Node-RED.

2.4 Code Examples

Please refer to the online API documentation at sensorian.io. Download the code and examples from Sensorian Github repository at <https://github.com/sensorian>

Python Code

Python examples should be run using the following command:

```
sudo python NameOfPythonProgram
```

Python examples can be found in `~/Sensorian/Apps_Python`

C Code

C examples can be found in `~/Sensorian/Apps_C`

To compile one of the example applications, change directory, open a terminal and enter
`make`

To run the application, enter:

```
sudo ./NameOfCompiledCProgram
```

Follow Table A1 in the Appendix to learn the pin mapping for the different sensors.

Scratch

To use Sensorian in Scratch on the Raspberry Pi, open Scratch and **issue** Shift+Click on Share and select “Host Mesh”. Next, open a terminal and run:

```
sudo python ~/Sensorian/Handler_Scratch/run_server.py
```

This will print a help page with a list of arguments. Now, you can start the server with the list of sensors to export to Scratch. For example:

```
sudo python ~/Sensorian/Handler_Scratch/run_server.py --touchpad
```

will export the capacitive touch sensors to Scratch running locally on the Raspberry Pi.

The sample applications can be found under `~/Sensorian/Apps_Scratch`

To use Sensorian in Scratch on a Windows/Mac/Linux computer, open Scratch, **issue** Shift+Click on Share and select “Host Mesh”. Next, open a terminal on the Raspberry Pi and follow the above steps for running the server and append `--connect IPADDRESS` (IPADDRESS is the address of the Windows/Mac/Linux computer where Scratch is running).

Node-RED

To use Sensorian **with** Node-RED open a terminal and run:

```
sudo ~/Sensorian/Handler_NodeRED/run_servers.sh
```

then open another terminal and run:

```
node-red
```

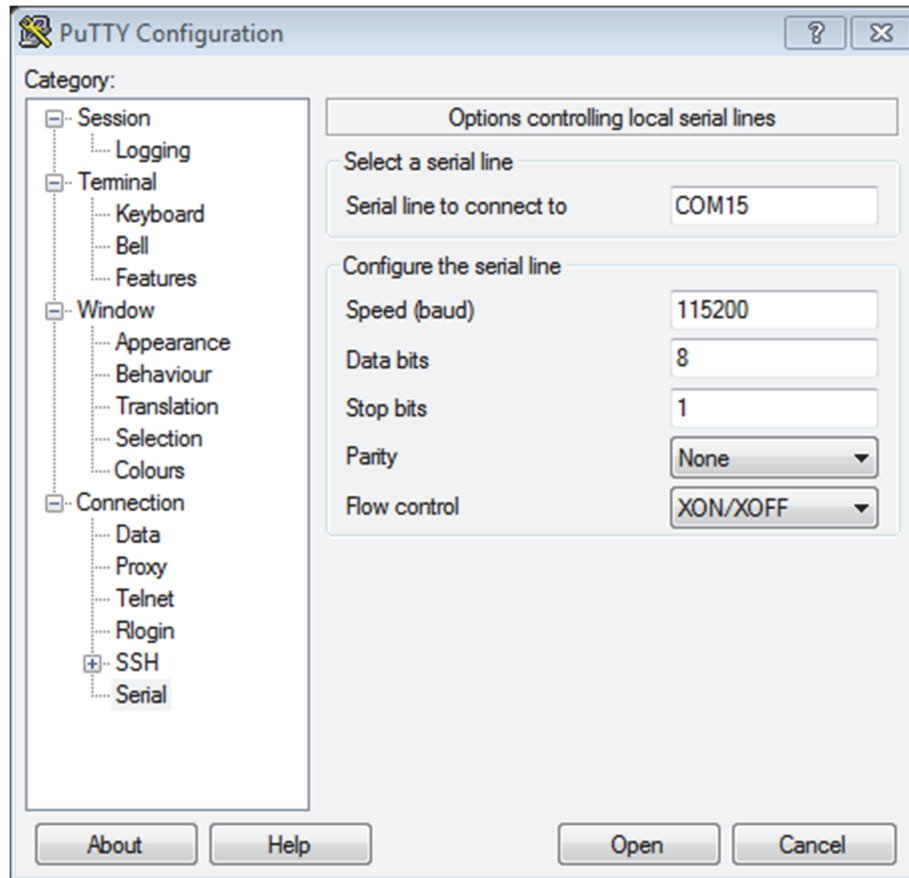
Open the browser and go to `127.0.0.1:1880` to use Node-RED on the Pi or `<IP-Address-of-RPi>:1880` to access Node-RED from a desktop computer.

Sample workflows can be found under `~/Sensorian/Apps_NodeRED`

2.5 Serial Port

To login to the Linux command line over the USB-Serial port connect a USB-A-to-B mini cable between the Sensorian and the desktop computer. On the desktop computer open any serial terminal.

In this example PuTTY (Windows, Linux) is used.



Click the *Serial* radio button. The *Serial line* can be found by running `sudo dmesg` on Linux or by inspecting the *Device Manager* in Windows. Set the Speed to *115200* and click *Open*. Press *Enter* and you will be able to login.

Chapter 3. Hardware

3.1 Sensor details

The Sensorian Shield is designed around the Raspberry Pi single Board Computer. The figure below shows the main modules available on the shield.

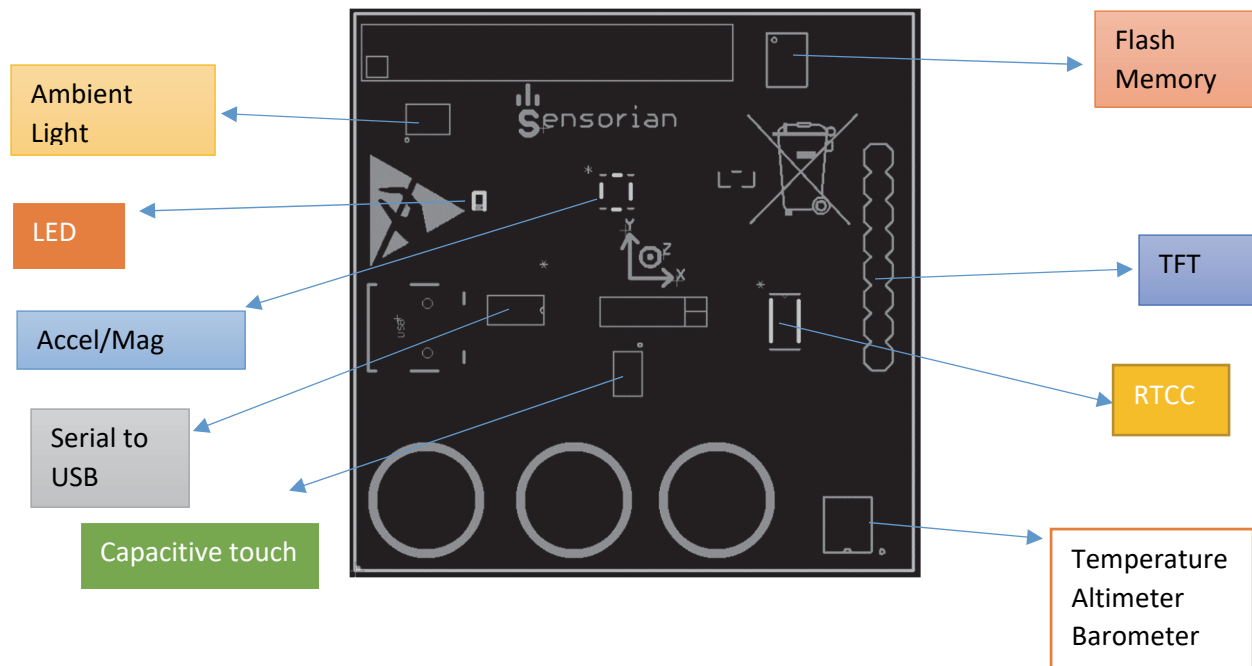


Figure 3: Sensor Modules on the Sensorian Shield

3.2 Functional description

The shield contains the shown sensors, a serial port, capacitive touch inputs, a display and non-volatile flash storage. Each of the sensors can be used individually or together with other sensors.

3.3 Sensor modules

Ambient light sensor: The ambient light sensor can quantify ambient light. The sensor is also equipped with interrupt capabilities to announce to the user when the ambient light falls below a certain level.

Barometer/altimeter sensor: The barometer sensor is capable of measuring pressure, altitude and temperature.

Accelerometer Magnetometer: The accelerometer/magnetometer chip is also equipped with smart embedded functionality which allows it to detect landscape or portrait mode. In addition the sensor can be used to detect simple gestures such as double tap or single tap.

3.4 Graphic LCD display

The 1.8 inch TFT display can be used to display all sensor information. In addition, if used with a frame-buffer it can be used as a display for the computer.

3.5 Serial Flash Module

The serial flash module offers 2Mbit of NOR flash memory for non-volatile data storage.

3.6 Serial Port

The serial port module allows serial communication up to 115200 baud with external microcontrollers or microprocessors. To use the serial port the user needs to provide a USB mini B cable.

3.7 Capacitive Touch

The capacitive touch controller gives the user three capacitive touch buttons with configurable sensitivity.

3.8 Real time Clock

The real time clock allows tracking time in case of power failure. Two separate alarms are provided with independent configuration.

Appendix A

Table A1: Sensorian Shield Pin Assignment Table

Functionality	RPi GPIO
MPL PIN	RPI V2 GPIO P1 07
LUX PIN	RPI V2 GPIO P1 11
ACLM PIN	RPI V2 GPIO P1 12
ALERT PIN	RPI V2 GPIO P1 13
LED PIN	RPI V2 GPIO P1 15
MFP PIN	RPI V2 GPIO P1 18

A2. Document Revision History

Revision	Issue Date	Origin of Change	Description of Change
Rev 1.0	26/01/2015	NA	First release
Rev 1.1	14/06/2015		Structural changes

A3. Document Conventions

Convention	Usage
Courier New	Code
Times New Roman	Text