User Manual

# Introduction

This document describes how to use each component of the framework. Before you start reading this you should preferably have read the conceptual introduction of the framework. You should also have read the user quickstart if you are not familiar with the framework. It describes how to set up and launch every component of the framework.

For an explanation of the code or the software in general, head over to the code documentation or the developer quick start respectively.

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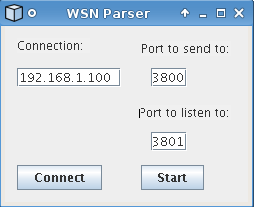
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# TelosB XML Parser

The WSN parser exists out of one window:



Under the textbox “Connection” you enter the IP of the controller.

Under the textbox “Port to send to:” you enter the port you must transmit your data to.

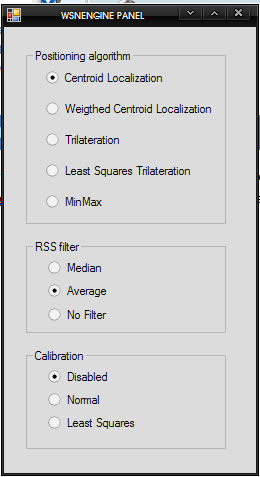
Under the textbox “Port to listen to:” you enter the port you want to listen on for requests transmitted by the controller

The button “Connect” is used to set up the connection, so the socket is created.

The button “Start” is used to start listening and sending packets.

# Controller

The controller consists out of a single form and a console window. On this form the user can select a localization algorithm, RSS filter and method of calibration. Below is a screenshot of the form.



In the upper groupbox you can select the localization algorithm. The user can choose from:

* Centroid Localization
* Weighted Centroid Localization
* Trilateration
* Least Squares Trilateration
* MinMax

In the middle groupbox you can select the RSS filter. The user can choose from:

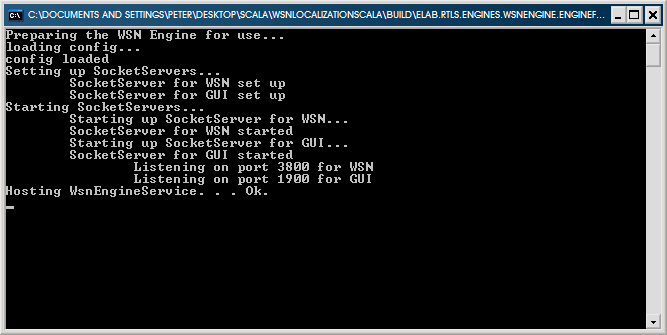
* Averaging filter
* Median filter
* False filter (The data will not be filtered)

In the lower groupbox you can select the calibration method. The user can choose from:

* Disabled
* Normal (Our own implementation of calibration)
* Least Squares Calibration

By choosing the parameters the user will affect the localization performance and behavior

The controller also provides a console window on which important information is printed out. The following data is printed out when the controller starts:



When the controller is running the following data is printed out as well:

* Received and sent messages
* Calculated positions
* Exception messages (hopefully not too much)

The user can not interact with the console. The function of this console is thus to inform the user of what is going on in the network and with the localization algorithms. Do not worry if an exception passed too fast to read it, they are printed to a log file (Exceptions.txt for normal exceptions and DBFaults.txt for ODBC exceptions) as well.

# GUI

This part of the framework consists out of a single WinForm with several tabs:

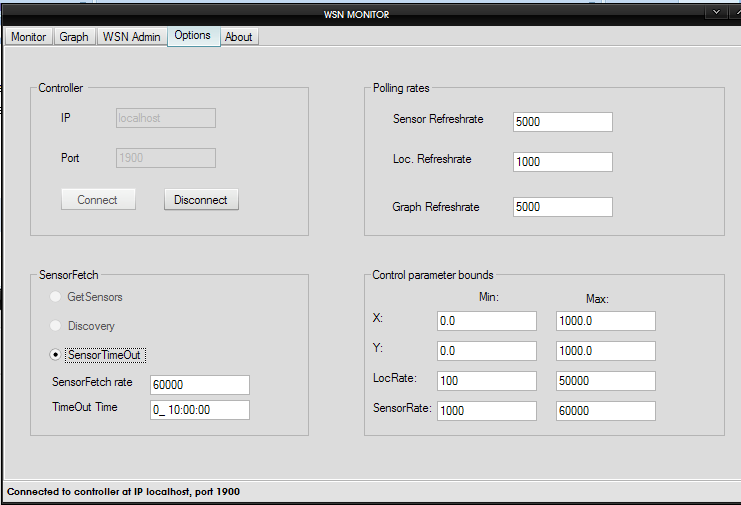
* Monitor tab
* Grap tab
* WSN Admin Tab
* Options Tab
* About Tab

The first four tabs will be explained in the following sections. The about tab merely mentions the team members of the senseless framework and thus has no own section.

## Connecting to the controller

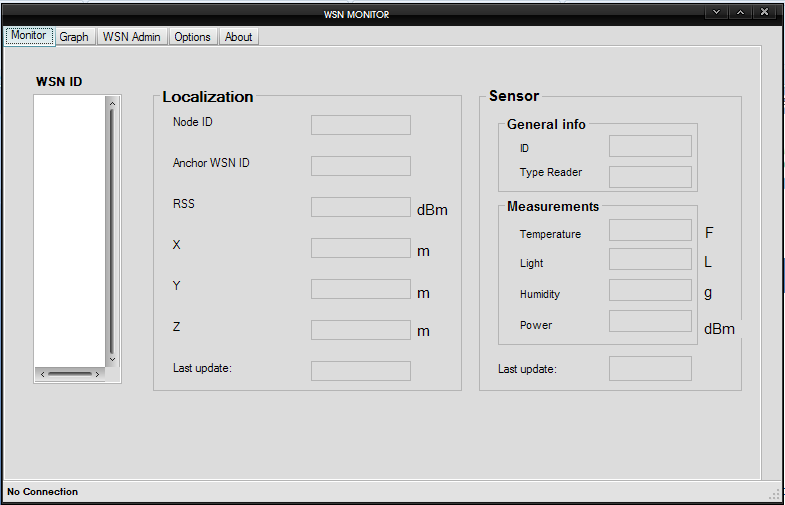
Before you can start using the GUI actively, you should connect to the controller to be able to exchange data over the network.

Click the *Options Tab* and then press the *Connect* button. The status of the bottom of the window should change from “No connection” to “Connected to controller at IP XXX, port XXX. The following screenshot will help clarify this:



## Monitor tab

On this tab you can inspect real-time data coming from the WSN.



On the utter left of the tab you can selected a node by their respective WsnIDs. These IDs are the native IDs of the used WSN technology. In case of a TinyOS WSN this is simply a 16-bit integer.

When you have selected a node you will view the following data:

In the groupbox localization:

* The node ID ( A unique identifier within the framework, independent of the used technology)
* The WSN ID of the connected anchor node
* The RSS reading from the received broadcast message
* X, Y and Z coordinates of the node
* Time of the update

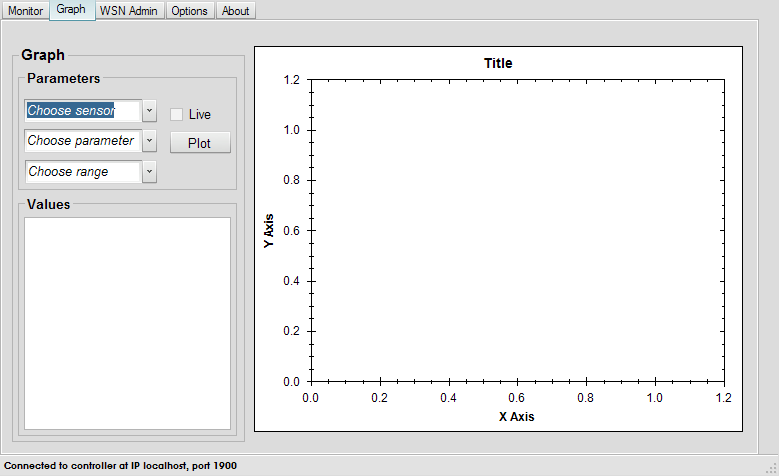
Unique to the groupbox sensor

* Type reader: the used technology (TelosB, SunSpot)
* Sensor readings (Temperature, Light, Humidity and Power)

The purpose of this tab is to quickly inspect the current state of any node in the system. The refresh rate of this data can be set in the options tab.

## Graph

On this tab you can view a certain parameter of a node in more depth.



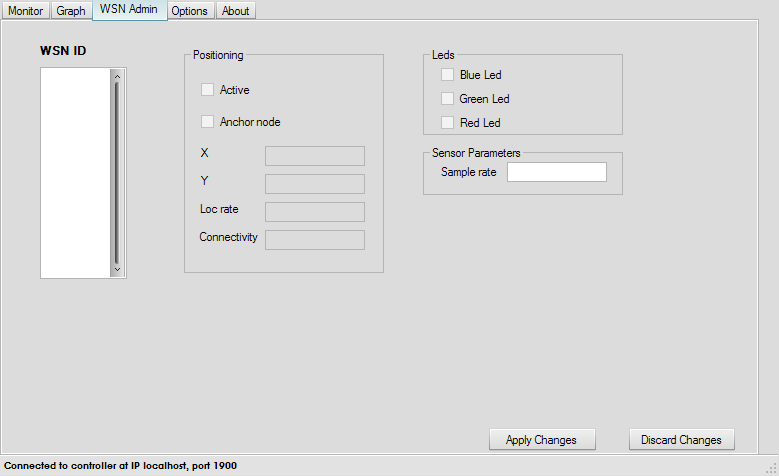
To view a parameter you must set three options on the left of the screen:

* Choose sensor: the node you wish view data from
* Choose parameter: the sensor you wish to track data from. This can be:
  + Temperature
  + Light
  + Humidity
  + Power
  + RSS
* Choose range: the amount of readings which you want to plot (10 – 100)

Then click the plot button to request the data or check the live checkbox to let the GUI keep polling for data. The GUI will then plot the graph on the right side of the screen and display all the data in the values box.

## WSN Admin

This tab allows the user to control several parameters of the WSN. Given the long deployment time of a WSN because of the manual configuration of each node, this tool can dramatically shorten the deployment time.



On the left side of the screen the user can select the node which he wishes to control. The user can then edit a variety of parameters of this node. Some of the parameters can only be edited when certain requirements are met. For example: X & Y can only be set when the node is an anchor node. You cannot set the position of a blind node! Otherwise it would not be a blind node!

* Active: Controls whether the node is participating in the localization
* Anchor Node: Determines if the node is an anchor node or a blind node
* X & Y: The coordinates of the anchor node
* Localization rate: The rate at which anchor nodes broadcast a beacon message to the blind nodes, this message allows the RSS to be determined
* Connectivity: the number of nodes, the actively selected node is connected to. Currently not yet supported.
* Leds: The state of the leds
* Sensor sample rate: The rate at which the onboard sensors are sampled.

After you have set these parameters to your liking, press the apply changes button at the bottom right of the screen. If however, you want to go back to the last known state of the node, press the discard changes button.

When you have changed the anchor node parameters, the GUI will ask you if the parameters are correct. Often the user will the node as an anchor node, but will forget to set the coordinates. This is by no means fully secure, but it will certainly eliminate some human errors.

If at some point you lose the focus of your selected node, do not worry. This is because the GUI has been given new data about the active nodes. This is to make sure you cannot apply changes to a node which is no longer active.

After you have pressed the apply changes button you should get a message box displaying the result of the command. This can be negative or positive. The message box will then display: WSN successfully replied or WSN did not successfully reply.

## Options

On this tab the user can set several options concerning the GUI and connect or disconnect from the controller

### Connect

When not already connected do the following:

1. Enter an IPv4 address or computer name in the field *IP*
2. Enter the port to connect to in the field *Port*
3. Click the connect button

The connect button will now become disabled and the disconnect button will be enabled. The status at the bottom of the screen should change as well.

### Disconnect

When connected to the controller, do the following

1. Press the disconnect button

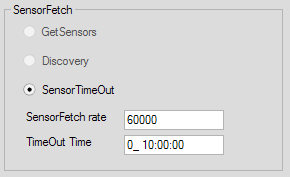
### Sensorfetch

The parameters in the Sensorfetch groupbox determine how the GUI checks or determines if nodes are still active. Active nodes will be displayed in the GUI on every tab, where the user can select them. Three methods are supported:

* GetSensors: this method puts the responsibility of deciding which node is still active in the hands of the controller
* Discovery: this method actively polls the WSN to see which nodes respond. Several attempts are made before this method times out. Nodes that have responded are considered to be active.
* SensorTimeOut: this method does not actively poll the WSN, but rather checks the lasts updates received from a node. If the last update occurred more than a certain amount of time ago, the node is said to be inactive.

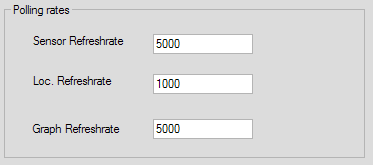
Below the radiobutton the user can set two parameters:

* SensorFetch rate: the rate at which the GUI performs one of the above mentioned methods.
* TimeOut Time: the amount of time within which a node has to have sent its last update. Applicable to the SensorTimeOut method.



### Polling rates

Here the user can set the polling rates of various functions:



The Sensor & Loc Refreshrate determine how fast the data on the monitor tab is updated. The Graph Refreshrate does the same for the Graph tab.

### Control parameter bounds

Here the user can set the bounds of certain parameters for the control tab. Doing so no unfortunate mistakes can happen when controlling the WSN.

