
pvWebMonitor Documentation

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NOTE: We are moving this repository in 2020-Q3! See <https://github.com/prjemian/pvWebMonitor/issues/39>

post EPICS PVs to read-only (static) web page(s)

This package provides a background service that monitors EPICS PVs and writes them into customized HTML files in a WWW server directory. The service can be started and stopped by a `manage.csh` script for automated startup in a cron task or at system startup.

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docs <http://pvWebMonitor.readthedocs.io>

git <https://github.com/prjemian/pvWebMonitor.git>

PyPI <https://pypi.python.org/pypi/pvWebMonitor>

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1.1 Overview

The basic flow of data from EPICS to the WWW site is described in the following diagram:

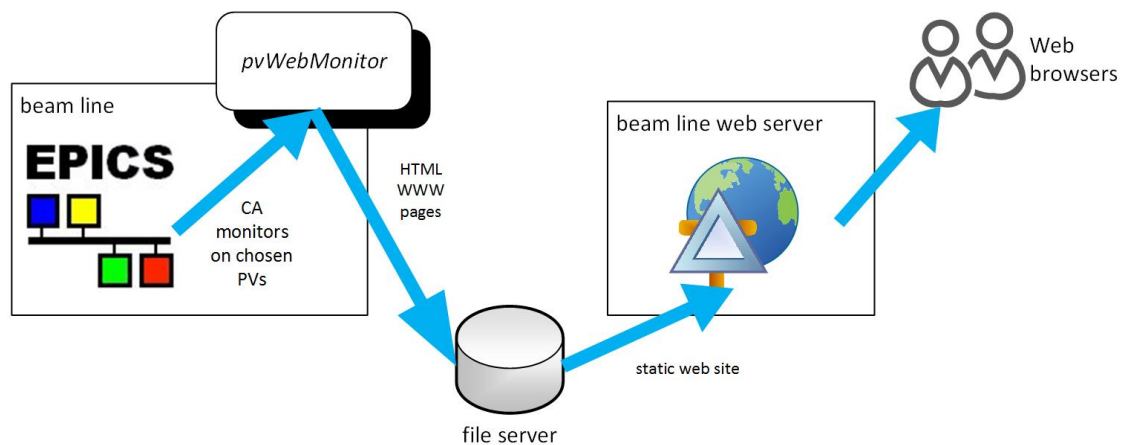


Fig. 1: flow of data from EPICS to WWW site

The **pvWebMonitor** service is run on a computer in the same subnet as the EPICS system to be monitored. All configuration files and other resources are placed in a single project directory. **pvWebMonitor** places an EPICS Channel Access monitor on each PV in the *pvlist.xml* file and stores updates in-memory. Periodically, as specified in *config.xml*, **pvWebMonitor** writes the PV values from memory to an XML file (named *rawdata.xml*) in the project directory. Once that XML file is written, **pvWebMonitor** uses *rawdata.xml*¹ with each of the XSLT files² in the project directory to create a corresponding HTML file in the project directory. The complete list of HTML files is written into

¹ The *rawdata.xml* file contains all the EPICS PV values, as well as some additional metadata useful in building the WWW site.

² Each XSLT files (*.xsl) contains the layout of a single HTML page, with additional markup to display the current EPICS PV values (and metadata). The EPICS PV data is provided in *rawdata.xml*.

an *index.html* file in the project directory. Finally, all content in the project directory (except for the *config.xml* file) is copied to the WWW site directory. (Only new content is copied, files that do not change are not re-copied.)

It is important to note the WWW site is written as a *static web site* so that it provides no opportunity to change values in the EPICS system being monitored.

Also, since some browsers do not have XML parsers and thus cannot render XSLT³, all HTML files are created by **pvWebMonitor**.

1.1.1 Examples

Example (very brief⁴) *rawdata.xml* file:

```
1 <?xml version="1.0"?>
2 <?xml-stylesheet type="text/xsl" href="short.xsl"?>
3 <pvWebMonitor version="1">
4   <written_by>pvWebMonitor/PvWatch</written_by>
5   <datetime>2015-01-15 16:48:36</datetime>
6   <pv id="VDM_Stripe" name="prj:m1.RBV">
7     <name>prj:m1.RBV</name>
8     <id>VDM_Stripe</id>
9     <description>VDM_Stripe motor</description>
10    <timestamp>2015-01-15 15:30:16.837633</timestamp>
11    <counter>2</counter>
12    <units>deg</units>
13    <value>-1.510</value>
14    <raw_value>-1.51</raw_value>
15    <format>%.3f</format>
16  </pv>
17 </pvWebMonitor>
```

Each XSLT file describes the format of an HTML page. The XSLT file uses XSL markup to pick EPICS PV values from the XML file. Here's an example that shows the value of the PV `prj:m1.RBV`. (The *id* `VDM_Stripe` is used here as a symbolic reference.):

```
<xsl:value-of select="//pv[@id='VDM_Stripe']/value"/>
```

Here's how to show when that PV value was last updated:

```
<xsl:value-of select="//pv[@id='VDM_Stripe']/timestamp"/>
```

Here's how to show when the EPICS PV data was last posted to the WWW site:

```
<xsl:value-of select="/pvWebMonitor/datetime"/>
```

The XSLT language has many additional functions available to help as your page designs get more complex. Look at the supplied *livedata.xsl* file for additional examples. There are good tutorial web sites available, such as: <http://www.w3schools.com/xsl>

Here's an example XSLT file using these example lines above (line breaks, `<br />`, were added for clarity):

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <xsl:stylesheet
3   xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
```

(continues on next page)

³ https://www.w3schools.com/xml/xsl_intro.asp

⁴ A more complete example is provided in the *Example* section.

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```

4  version="1.0"
5  description="simple example XSLT to EPICS PV value">
6
7  <xsl:template match="/">
8      <html>
9          <body>
10             EPICS PV: <xsl:value-of select="//pv[@id='VDM_Stripe']/name"/><br />
11
12             PV value: <xsl:value-of select="//pv[@id='VDM_Stripe']/value"/><br />
13
14             PV last updated: <xsl:value-of select="//pv[@id='VDM_Stripe']/
15             ↪timestamp"/><br />
16
17             HTML file written: <xsl:value-of select="/pvWebMonitor/datetime"/>
18          </body>
19      </html>
20  </xsl:template>
21 </xsl:stylesheet>

```

The XSLT transformation using the XML file above looks like:

```

1 <html><body>
2     EPICS PV: prj:m1.RBV<br>
3
4     PV value: -1.510<br>
5
6     PV last updated: 2015-01-15 15:30:16.837633<br>
7
8     HTML file written: 2015-01-15 16:48:36</body></html>

```

Which shows in a browser:

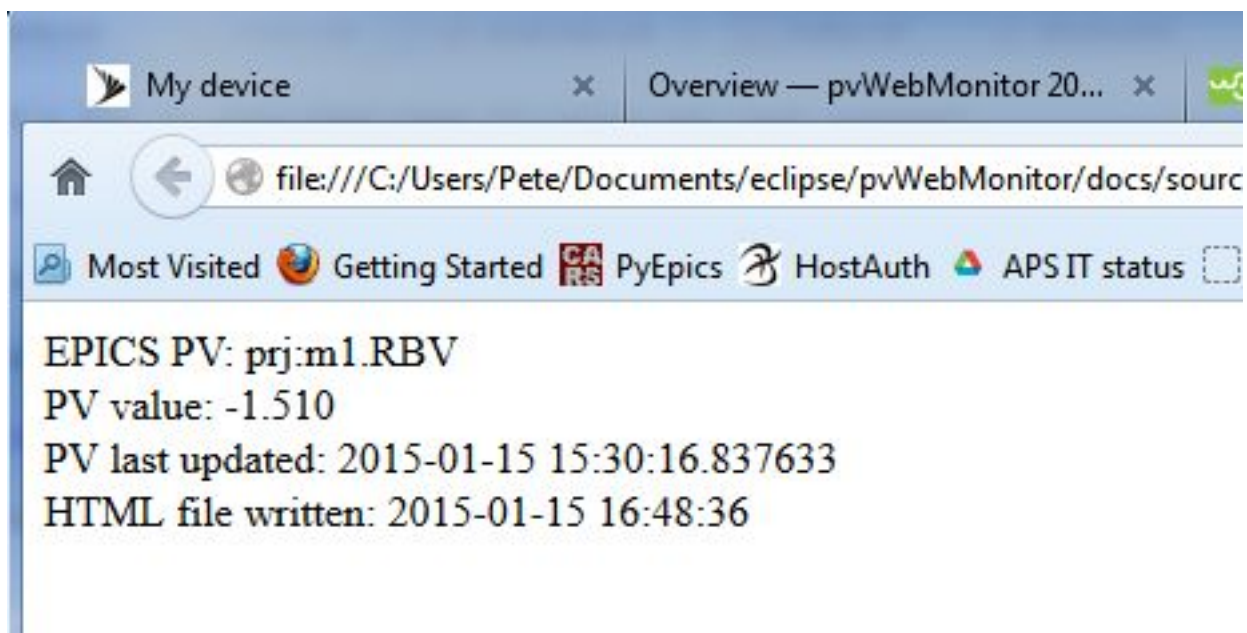


Fig. 2: Example HTML web page from above.

1.2 Configuration

These are the steps needed to get the **pvWebMonitor** service running on your workstation.

1. install the *pvWebMonitor* package into your Python environment
2. setup the project configuration directory
3. identify the web server directory to be used
4. edit config.xml
5. identify the list of EPICS PVs
6. edit pvlist.xml
7. customize the livedata display file: edit livedata.xsl
8. run the config.xml file
9. watch the log_data.txt file in the project directory

These steps are described in the following sections:

1.2.1 Installation

If you need to install the *pvWebMonitor* package, follow these terse instructions:

```
pip install pvWebMonitor
```

Alternatively, you could clone the GitHub project:

```
git clone https://github.com/prjemian/pvWebMonitor.git
```

Once the installation is complete, the *pvWebMonitor* executable should be ready to use.

1.2.2 Setup a new project directory

The *pvWebMonitor* service is configured by files configured by the user in a *project directory*.

To get default versions of the files, run this command:

```
mkdir path/to/project/directory
pvWebMonitor --setup path/to/project/directory
cd path/to/project/directory
```

where *path/to/project/directory* is either a partial, relative, or absolute path to an existing directory to be used. Once this command has run, the files will be copied to the designated directory. If files with these names already exist, *pvWebMonitor* will stop with an error report and not overwrite the existing files.

file	How is it used?
config.xml	defines user settings for the program
pvlist.xml	declares list of EPICS PVs to be monitored
pvlist.xsl	for easy display of pvlist.xml
livedata.xsl	user-customized display
rawdata.xsl	standard display of all monitored EPICS PVs
manage.sh	shell script to manage the background task

Each of these files will be explained in the coming sections.

1.2.3 The *config.xml* file

The *config.xml* file defines constants needed by the program.

Definitions for each item listed in the table under *pvWebMonitor.read_config.read_xml()* are provided, such as this example:

Example *config.xml* file.

```

1  <?xml version="1.0" ?>
2  <pvWebMonitor__config version="1.0.1">
3
4      <!-- PVs to be monitored -->
5      <var name="PVLIST_FILE"           value="pvlist.xml" />
6
7      <!-- absolute directory path to WWW site on local file system -->
8      <var name="LOCAL_WWW_LIVEDATA_DIR" value="." />
9
10     <!-- writing messages to log file -->
11     <var name="LOG_INTERVAL_S"        value="300" type="float" />
12
13     <!-- updates to HTML pages -->
14     <var name="REPORT_INTERVAL_S"      value="10" type="float" />
15
16     <!-- sleeps at end of main loop -->
17     <var name="SLEEP_INTERVAL_S"       value="0.1" type="float" />
18
19     <!-- another logging message interval -->
20     <var name="MAINLOOP_COUNTER_TRIGGER" value="10000" type="int" />
21
22     <!-- files with these name patterns (glob style match)
23         will be copied from project dir to www dir
24         (upper/lower case variants will be searched as well)
25
26         uses Python ``fnmatch.filter()``
27     -->
28     <pattern value="*.html" /> <!-- web pages -->
29     <pattern value="*.gif" /> <!-- images -->
30     <pattern value="*.jpeg" /> <!-- images -->
31     <pattern value="*.jpg" /> <!-- images -->
32     <pattern value="*.png" /> <!-- images -->
33     <pattern value="*.xsl" /> <!-- XML stylesheets -->
34     <pattern value="*.txt" /> <!-- text -->
35     <pattern value="*.pdf" /> <!-- documentation -->
36
37 </pvWebMonitor__config>

```

To use the *pvWebMonitor* service effectively, it is likely you will only need to edit the value for *LOCAL_WWW_LIVEDATA_DIR* which defines the location of the directory used by the web server to serve content.

Preamble

The *config.xml* must be “well-formed XML”.

The first line of the file is *always*:

```
1 <?xml version="1.0" ?>
```

This line declares this to be a file that should be well-formed XML according to the version 1.0 standard.

Root Tag

All well-formed XML files have a single element at the outermost (root) level of the file. In the *config.xml* file, the root element is **pvWebMonitor__config**. Note the closing `</pvWebMonitor__config>` tag at the end of the file.

A version attribute describes this file adheres to the `version="1.0"` definition of *config.xml* files. That definition is described in the XML Schema file *config.xsd* provided in the source code package.

This XML Schema definition is used to validate the *config.xml* when it is read. If there are problems, the first problem discovered will be reported.

1.2.4 The *pvlist.xml* file

The complete list of EPICS Process Variables to be monitored is declared in the *pvlist.xml* file.

Preamble

The *pvlist.xml* must be “well-formed XML”. (Google for this term to become informed what this means.)

The first lines of the file are *always*:

```
1 <?xml version="1.0" ?>
2 <?xml-stylesheet type="text/xsl" href="pvlist.xsl" ?>
```

The first line declares this to be a file that should be well-formed XML according to the version 1.0 standard. The second line provides a convenience definition for visualizing the *pvlist.xml* file in a browser that uses the *pvlist.xsl* file to format the XML content into something that humans can more easily read. To do this, the *pvlist.xsl* file must be in the same directory as the *pvlist.xml* file.

Root tag

All well-formed XML files have a single element at the outermost (root) level of the file. In the *pvlist.xml* file, the root element is **pvwatch**. Note the closing `</pvwatch>` tag at the end of the file.

A version attribute describes this file adheres to the `version="1.0"` definition of *pvlist.xml* files. That definition is described in the XML Schema file *pvlist.xsd* provided in the source code package.

This XML Schema definition is used to validate the *pvlist.xml* when it is read. If there are problems, the first problem discovered will be reported.

Inside the root tag, *EPICS_PV* elements describe the PVs to be monitored. Additionally, *definition* tags are provided to describe the terms used.

Describe a PV to Monitor

Each PV to be monitored is declared in the XML file using a line such as this example:

```

1 <EPICS_PV
2   PV="ioc:xps:c0:m1.RBV"
3   mne="mr"
4   description="motor MR, degrees"
5 />

```

This says to monitor the EPICS process variable named `ioc:xps:c0:m1.RBV` and to associate that value with the mnemonic named `mr`. The description text `motor MR, degrees` can be used in displays for this value. The tag `EPICS_PV` describes this as a PV declaration. It must appear in uppercase letters. A complete list of terms is described in the section below: *ref:pvlist.terms*.

At minimum, it is required to provide the *PV*, *mne*, and *description* attributes.

The order of the attributes is not important, they can be given in any order. Also, the spacing between attributes is not important. The entire *EPICS_PV* element can be specified on one line or broken across several lines.

Keep the description text short. Longer descriptions, including those with line breaks, are less useful in creating display screens.

Note: The mnemonic name *mne* must adhere to the rules for XML NCName (non-colonized name). The practical restrictions of NCName are that it cannot contain several symbol characters like `:`, `@`, `$`, `%`, `&`, `/`, `+`, `,`, `;`, whitespace characters or different parentheses. Furthermore an NCName cannot begin with a number, dot or minus character although they can appear later in an NCName. The regular expression is: `[\i-[:]] [\c-[:]] *`

The closing tag

Note that `>/>` is used to close the *EPICS_PV* element. It is equivalent to use:

```

1 <EPICS_PV
2   PV="ioc:xps:c0:m1.RBV"
3   mne="mr"
4   description="motor MR, degrees"
5 ></EPICS_PV>

```

but this is not advised since no content is allowed for *EPICS_PV* elements, only attributes.

Terms

attribute	definition
mne	one-word mnemonic reference used in python and xslt code (mne should be unique for each EPICS_PV)
PV	EPICS process variable name (must be used in only one EPICS_PV)
description	useful text informative to others
display_format	(optional, default="'%s'") PVs will be formatted for display with this string
ignore	(optional, default="false") this PV is ignored if value is not "false"
as_string	(optional, default="false") whether to return the string representation of the value

These two declarations are equivalent:

```

1 <EPICS_PV PV="ioc:xps:c0:m1.RBV" description="motor MR, degrees" display_format="%.6f
  ↪ " mne="mr" />

```

```
1 <EPICS_PV
2   PV="ioc:xps:c0:m1.RBV"
3   description="motor MR, degrees"
4   display_format="%.6f"
5   mne="mr"
6 />
```

EPICS R3 strings using the *waveform* record (*as_string*)

In EPICS R3 IOCs, it is common to provide support for long strings (40 or more characters) using a waveform¹ record with character data type. For example, the EPICS AreaDetector² has such a PV to store the full path (length up to 256) to an attributes file. Here's an example using the PV with an instance of the ADSimDetector³:

```
$ caget 13SIM1:cam1:NDAAttributesFile.{RTYP,FTVL,VAL}
13SIM1:cam1:NDAAttributesFile.RTYP waveform
13SIM1:cam1:NDAAttributesFile.FTVL CHAR
13SIM1:cam1:NDAAttributesFile.VAL 256 47 116 109 112 47 ...
```

pvWebMonitor uses the *as_string* support from PyEpics⁴ to report both the character list values and the text string values of the string waveform. Here is the configuration in *pvl*ist.xml to watch that PV:

```
<EPICS_PV
  PV="13SIM1:cam1:NDAAttributesFile"
  description="NDAAttributesFile array"
  mne="NDAAttributesFile_array"/>
```

and here is typical content in the *rawdata.xml* file:

```
<pv id="NDAAttributesFile_array" name="13SIM1:cam1:NDAAttributesFile">
  <name>13SIM1:cam1:NDAAttributesFile</name>
  <id>NDAAttributesFile_array</id>
  <description>NDAAttributesFile array</description>
  <timestamp>2017-12-11 11:09:43.157445</timestamp>
  <record_type>waveform</record_type>
  <counter>2</counter>
  <units></units>
  <value>[ 47 116 109 112 47 97 116 116 114 105 98 117 116 101 115 46 120 109_
↪108 0]</value>
  <char_value>/tmp/attributes.xml</char_value>
  <raw_value>[ 47 116 109 112 47 97 116 116 114 105 98 117 116 101 115 46 120_
↪109 108 0]</raw_value>
  <format>%s</format>
</pv>
```

You'll need to access the text as a string using *char_value* rather than just *value*. If you want the value to be the text string, add the *as_string="true"* attribute in the entry in the *pvl*ist.xml file, such as:

```
<EPICS_PV
  PV="13SIM1:cam1:NDAAttributesFile"
  description="NDAAttributesFile array"
  mne="NDAAttributesFile_array"
  as_string="true"/>
```

¹ EPICS R3 *waveform* record: https://wiki-ext.aps.anl.gov/epics/index.php/RRM_3-14_Waveform

² EPICS AreaDetector: <http://cars9.uchicago.edu/software/epics/areaDetector.html>

³ ADSimDetector: <http://cars.uchicago.edu/software/epics/simDetectorDoc.html>

⁴ PyEpics: http://cars9.uchicago.edu/software/python/pyepics3/pv.html?highlight=as_string#pv.get

Then, the `char_value` and the `value` both have the string as a result:

```
<pv id="NDAttributesFile_string" name="13SIM1:cam1:NDAttributesFile">
  <name>13SIM1:cam1:NDAttributesFile</name>
  <id>NDAttributesFile_string</id>
  <description>NDAttributesFile_string</description>
  <timestamp>2017-12-11 11:09:43.185298</timestamp>
  <record_type>waveform</record_type>
  <counter>2</counter>
  <units></units>
  <value>/tmp/attributes.xml</value>
  <char_value>/tmp/attributes.xml</char_value>
  <raw_value>[ 47 116 109 112  47  97 116 116 114 105  98 117 116 101 115  46 120_
↪109 108  0]</raw_value>
  <format>%s</format>
</pv>
```

In both cases, whether or not `as_string` is used, the character list representation is available in the `raw_value` and the text string representation is available in the `char_value`.

Removing declarations

Sometimes, it is necessary to stop watching a certain PV. There are three ways to do this. It can be commented out using XML comments, it can be marked to `_ignore_` it, or the declaration could be deleted. We'll describe the first two cases.

Comment out in XML

To comment out using an XML comment (`<!-- -->`), take this code:

```
1 <EPICS_PV PV="ioc:m1" mne="m1" description="motor 1" />
```

and surround it with XML comment tags, such as:

```
1 <!--
2 <EPICS_PV PV="ioc:m1" mne="m1" description="motor 1" />
3 -->
```

XML comment tags can be used to block out many `EPICS_PV` declarations at once.

Marking with `_ignore_` attribute

To mark a single `EPICS_PV` declaration to be ignored, take this code:

```
1 <EPICS_PV PV="ioc:m1" mne="m1" description="motor 1" />
```

and add the `_ignore_="true"` attribute, such as:

```
1 <EPICS_PV _ignore_="true" PV="ioc:m1" mne="m1" description="motor 1" />
```

The `_ignore_` attribute can be given in any order. The value `true` may be upper or lower case but must be enclosed by double quotes.

Each PV to be ignored using the `_ignore_` attribute must have its own `_ignore_` attribute. You cannot mark a whole block of `EPICS_PV` elements with a single `_ignore_` attribute.

Example *pvlist.xml* file

An example of such a file is shown below.

Example *pvlist.xml* file. You can edit this file with a text editor.

```
1  <?xml version="1.0" ?>
2  <?xml-stylesheet type="text/xsl" href="pvlist.xsl" ?>
3
4  <!-- You can edit this file with a text editor -->
5
6  <pvwatch version="1.0">
7
8      <EPICS_PV PV="ioc:alldone"
9          description="IOC motors moving"
10         mne="ioc_alldone"
11         />
12
13     <EPICS_PV PV="APS:SRcurrentAI"
14         description="APS storage ring current, mA"
15         display_format="%.2f"
16         mne="SR_current"
17         />
18
19     <EPICS_PV PV="ID:Energy"
20         mne="Und_E"
21         description="ID E, keV"
22         display_format="%.4f"
23         />
24     <EPICS_PV PV="dcm:BraggEAO"
25         mne="DCM_E"
26         description="DCM E, keV"
27         display_format="%.4f"
28         />
29
30     <EPICS_PV PV="PSS:STA_A_FES_OPEN_PL.VAL"
31         description="white shutter opened"
32         mne="white_shtr_opened"
33         />
34     <EPICS_PV PV="PSS:STA_B_SBS_OPEN_PL.VAL"
35         description="mono shutter opened"
36         mne="mono_shtr_opened"
37         />
38     <EPICS_PV PV="PSS:D_BEAM_READY"
39         _ignore_="true"
40         description="PSS: D Beam Ready"
41         mne="D_beam_ready"
42         />
43
44 </pvwatch>
```

1.2.5 The *rawdata.xsl* file

The *rawdata.xsl* file is used to format the complete list of monitored EPICS PV values into an HTML file for display from the web server. It should not be necessary to edit this file.

pvWebMonitor: raw PV data from EPICS

written by: pvWebMonitor/PvWatch

date/time stamp: 2015-04-15 17:30:12

EPICS process variables (sorted by id)

name	id	description	value	units	timestamp
xxx:m2.RBV	DCM_theta	DCM_theta motor	0.000000	deg	2015-04-15 17:29:22.250684
xxx:m2.DMOV	DCM_theta_DMOV	DCM_theta motor done moving	1	deg	2015-04-15 17:29:22.307696
xxx:m2.VAL	DCM_theta_VAL	DCM_theta motor target	0.000000	deg	2015-04-15 17:29:22.278284
xxx:m1.RBV	VDM_Stripe	VDM_Stripe motor	0.000	deg	2015-04-15 17:29:22.136824
xxx:m1.DMOV	VDM_Stripe_DMOV	VDM_Stripe motor done moving	1	deg	2015-04-15 17:29:22.198513
xxx:m1.VAL	VDM_Stripe_VAL	VDM_Stripe motor target	0.000	deg	2015-04-15 17:29:22.167071
xxx:ENGINEER	engineer	engineer	None		2015-04-15 17:29:22.084686
xxx:HOSTNAME	hostname	IOC host name	None		2015-04-15 17:29:12.079250
xxx:alldone	motors_alldone	all motors done moving	1		2015-04-15 17:29:22.361568
xxx:moving	motors_moving	number of motors moving	0		2015-04-15 17:29:22.415822
xxx:STARTTOD	starttod	IOC boot time	None		2015-04-15 17:28:52.067041
xxx:TOD	tod	IOC current time	None		2015-04-15 17:28:42.058600
xxx:UPTIME	uptime	time IOC running	None		2015-04-15 17:29:02.074299

data gathered by: pvWebMonitor/PvWatch

report page: rawdata.xml

Fig. 3: Example *rawdata.html*, generated from the *rawdata.xml* file.

1.2.6 The *livedata.xsl* file

The *livedata.xsl* file is used to format select monitored EPICS PV values into an HTML file for display from the web server. It is intended that the user will modify this file for the desired display features.

Note: need to provide instructions and references on editing XSLT for displaying PVs.

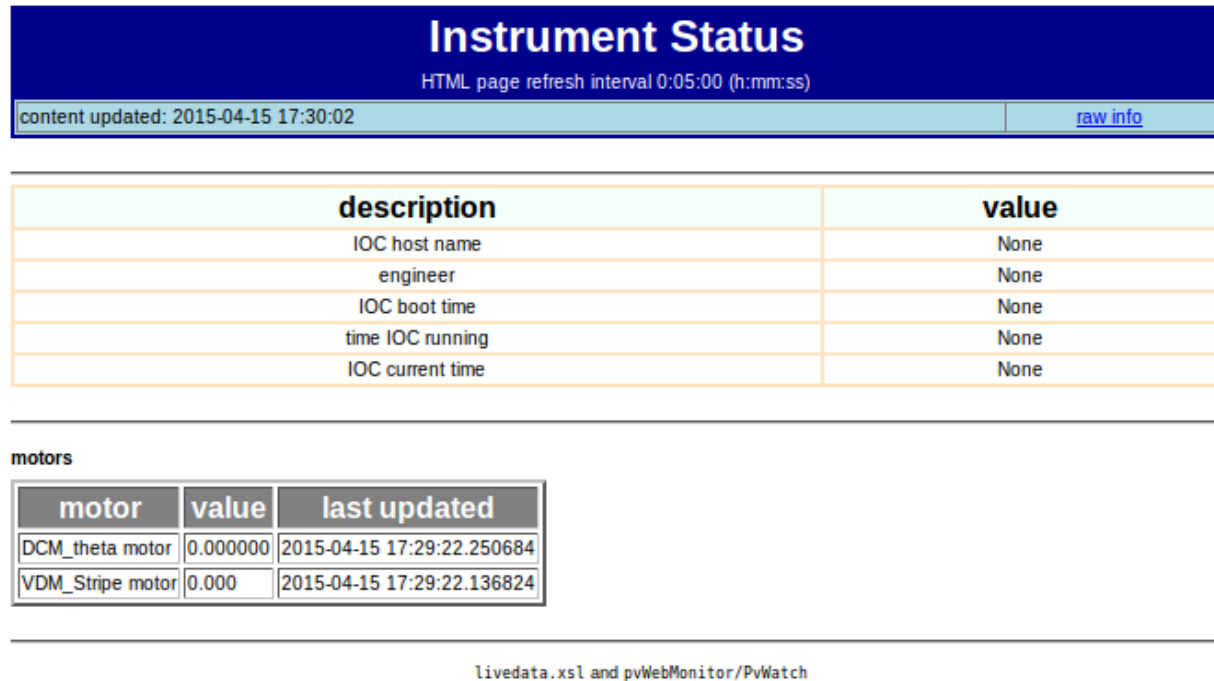


Fig. 4: Example *index.html*, generated from the *livedata.xsl* file.

1.2.7 The *manage.sh* file

explanation ...

Example shell script to manage the pvWebMonitor process either as a startup or a background daemon.

```

1  #!/bin/bash
2  # init file for pvWebMonitor
3  #
4  # chkconfig: - 98 98
5  # description: pvWebMonitor WWW page update script for NAME_YOUR_SYSTEM_HERE
6  #
7  # processname: pvWebMonitor_MAKE_THIS_NAME_UNIQUE
8
9
10 PROJECT_DIR=/tmp/pv
11 # MANAGE=${PROJECT_DIR}/manage.sh

```

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```

12 LOGFILE=${PROJECT_DIR}/log-manage.txt
13 PIDFILE=${PROJECT_DIR}/pid.txt
14 CONFIGFILE=${PROJECT_DIR}/config.xml
15 EXECUTABLE_SCRIPT=/home/oxygen/JEMIAN/Apps/anaconda/bin/pvWebMonitor
16 RETVAL=0
17
18
19 get_pid() {
20     cd ${PROJECT_DIR}
21     PID=$(/bin/cat ${PIDFILE})
22     return "$PID"
23 }
24
25
26 check_pid_running() {
27     get_pid
28     if [ "${PID}" == "" ]; then
29         # no PID in the PIDFILE
30         RETVAL=1
31     else
32         RESPONSE=$(ps -p "${PID}" -o comm=)
33         if [ "${RESPONSE}" == "pvWebMonitor" ]; then
34             # PID matches the pvWebMonitor profile
35             RETVAL=0
36         else
37             # PID is not pvWebMonitor
38             RETVAL=1
39         fi
40     fi
41     return $RETVAL
42 }
43
44
45 start() {
46     cd ${PROJECT_DIR}
47     ${EXECUTABLE_SCRIPT} ${CONFIGFILE} 2>&1 >> ${LOGFILE} &
48     PID=$!
49     /bin/echo ${PID} > ${PIDFILE}
50     /bin/echo "# [${0} $(/bin/date)] started ${PID}: ${EXECUTABLE_SCRIPT}" 2>&
51     <-1 >> ${LOGFILE} &
52     /bin/echo "# [${0} $(/bin/date)] started ${PID}: ${EXECUTABLE_SCRIPT}"
53 }
54
55 stop() {
56     get_pid
57     check_pid_running
58
59     if [ $RETVAL == 1 ]; then
60         /bin/echo "# [${0} $(/bin/date)] not running ${PID}: ${EXECUTABLE_
61     <-SCRIPT}" 2>&1 >> ${LOGFILE} &
62     else
63         kill ${PID}
64         /bin/echo "# [${0} $(/bin/date)] stopped ${PID}: ${EXECUTABLE_SCRIPT}"
65     <-2>&1 >> ${LOGFILE} &
66         /bin/echo "# [${0} $(/bin/date)] stopped ${PID}: ${EXECUTABLE_SCRIPT}"
67     fi

```

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```

66     /bin/cp -f /dev/null ${PIDFILE}
67 }
68
69
70 restart() {
71     stop
72     start
73 }
74
75
76 checkup() {
77     #=====
78     # call periodically (every 5 minutes) to see if pvWebMonitor is running
79     #=====
80     #      field      allowed values
81     #      -----
82     #      minute     0-59
83     #      hour        0-23
84     #      day of month 1-31
85     #      month       1-12 (or names, see below)
86     #      day of week  0-7 (0 or 7 is Sun, or use names)
87     #
88     # */5 * * * * /tmp/pv/manage.sh checkup 2>&1 > /dev/null
89
90
91     get_pid
92     check_pid_running
93     if [ $RETVAL == 0 ]; then
94         echo "# [$0 $(/bin/date)] running fine, so it seems" 2>&1 > /dev/null
95     else
96         echo "# [$0 $(/bin/date)] could not identify running process ${PID},
↳ starting new process" 2>&1 >> ${LOGFILE}
97         start
98     fi
99 }
100
101
102 case "$1" in
103     start)
104         start
105         ;;
106     stop)
107         stop
108         ;;
109     restart)
110         restart
111         ;;
112     checkup)
113         checkup
114         ;;
115     *)
116         echo $"Usage: $0 {start|stop|restart|checkup}"
117         exit 1
118 esac

```

1.3 Example

1.3.1 Livedata Report

file <web_site>/index.html

XSLT livedata.xsl

raw data rawdata.xml (*Example Raw Data for Reports*)

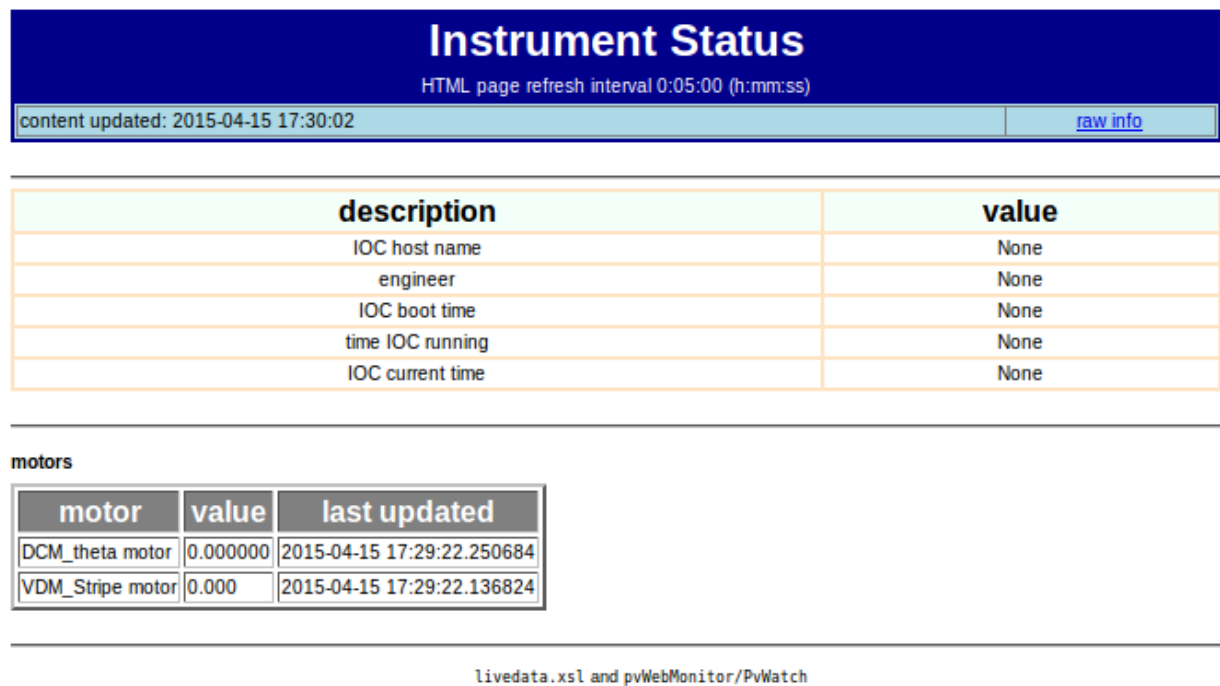


Fig. 5: Example user report of the raw data monitored by an instance of *pvWebMonitor*.

(To view an archive copy of this HTML page in your browser, click here -> [livedata.html](#))

1.3.2 Example Raw Data for Reports

file <web_site>/rawdata.html

XSLT rawdata.xsl

raw data rawdata.xml (*Example Raw Data for Reports*)

```

1 <?xml version="1.0"?>
2 <?xml-stylesheet type="text/xsl" href="pvlist.xsl"?>
3 <pvWebMonitor version="1">
4   <written_by>pvWebMonitor/PvWatch</written_by>
5   <datetime>2015-01-15 16:48:36</datetime>

```

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```

6  <pv id="DCM_theta" name="prj:m2.RBV">
7    <name>prj:m2.RBV</name>
8    <id>DCM_theta</id>
9    <description>DCM_theta motor</description>
10   <timestamp>2015-01-15 15:30:16.891366</timestamp>
11   <counter>2</counter>
12   <units>deg</units>
13   <value>-9.840000</value>
14   <raw_value>-9.84</raw_value>
15   <format>%.6f</format>
16 </pv>
17 <pv id="DCM_theta_dmov" name="prj:m2.DMOV">
18   <name>prj:m2.DMOV</name>
19   <id>DCM_theta_dmov</id>
20   <description>DCM_theta motor done moving</description>
21   <timestamp>2015-01-15 15:30:16.864203</timestamp>
22   <counter>2</counter>
23   <units>deg</units>
24   <value>1</value>
25   <raw_value>1</raw_value>
26   <format>%s</format>
27 </pv>
28 <pv id="VDM_Stripe" name="prj:m1.RBV">
29   <name>prj:m1.RBV</name>
30   <id>VDM_Stripe</id>
31   <description>VDM_Stripe motor</description>
32   <timestamp>2015-01-15 15:30:16.837633</timestamp>
33   <counter>2</counter>
34   <units>deg</units>
35   <value>-1.510</value>
36   <raw_value>-1.51</raw_value>
37   <format>%.3f</format>
38 </pv>
39 <pv id="VDM_Stripe_dmov" name="prj:m1.DMOV">
40   <name>prj:m1.DMOV</name>
41   <id>VDM_Stripe_dmov</id>
42   <description>VDM_Stripe motor done moving</description>
43   <timestamp>2015-01-15 15:30:16.810400</timestamp>
44   <counter>2</counter>
45   <units>deg</units>
46   <value>1</value>
47   <raw_value>1</raw_value>
48   <format>%s</format>
49 </pv>
50 <pv id="ai0" name="ino:cr:ai0">
51   <name>ino:cr:ai0</name>
52   <id>ai0</id>
53   <description>Arduino AI0</description>
54   <timestamp>2015-01-15 16:48:35.481271</timestamp>
55   <counter>1808</counter>
56   <units>V</units>
57   <value>0.0439882697947</value>
58   <raw_value>0.0439882697947</raw_value>
59   <format>%s</format>
60 </pv>
61 <pv id="ai0_mean" name="ino:cr:ai0:mean">
62   <name>ino:cr:ai0:mean</name>

```

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```

63     <id>ai0_mean</id>
64     <description>Arduino mean AI0</description>
65     <timestamp>2015-01-15 16:48:35.987300</timestamp>
66     <counter>7901</counter>
67     <units>V</units>
68     <value>0.0467644183773</value>
69     <raw_value>0.0467644183773</raw_value>
70     <format>%s</format>
71 </pv>
72 <pv id="ai1" name="ino:cr:ai1">
73     <name>ino:cr:ai1</name>
74     <id>ai1</id>
75     <description>Arduino AI1</description>
76     <timestamp>2015-01-15 16:43:42.932475</timestamp>
77     <counter>6</counter>
78     <units>V</units>
79     <value>0.0</value>
80     <raw_value>0.0</raw_value>
81     <format>%s</format>
82 </pv>
83 <pv id="ai1_mean" name="ino:cr:ai1:mean">
84     <name>ino:cr:ai1:mean</name>
85     <id>ai1_mean</id>
86     <description>Arduino mean AI1</description>
87     <timestamp>2015-01-15 15:30:17.053715</timestamp>
88     <counter>2</counter>
89     <units>V</units>
90     <value>0.0</value>
91     <raw_value>0.0</raw_value>
92     <format>%s</format>
93 </pv>
94 <pv id="ai2" name="ino:cr:ai2">
95     <name>ino:cr:ai2</name>
96     <id>ai2</id>
97     <description>Arduino AI2</description>
98     <timestamp>2015-01-15 16:47:54.988769</timestamp>
99     <counter>1319</counter>
100    <units>V</units>
101    <value>2.64418377322</value>
102    <raw_value>2.64418377322</raw_value>
103    <format>%s</format>
104 </pv>
105 <pv id="ai2_mean" name="ino:cr:ai2:mean">
106     <name>ino:cr:ai2:mean</name>
107     <id>ai2_mean</id>
108     <description>Arduino mean AI2</description>
109     <timestamp>2015-01-15 16:48:35.998230</timestamp>
110     <counter>7020</counter>
111     <units>V</units>
112     <value>2.64418377322</value>
113     <raw_value>2.64418377322</raw_value>
114     <format>%s</format>
115 </pv>
116 <pv id="ai3_mean" name="ino:cr:ai3:mean">
117     <name>ino:cr:ai3:mean</name>
118     <id>ai3_mean</id>
119     <description>Arduino mean AI3</description>

```

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```

120   <timestamp>2015-01-15 16:48:33.503247</timestamp>
121   <counter>5977</counter>
122   <units>V</units>
123   <value>2.61974584555</value>
124   <raw_value>2.61974584555</raw_value>
125   <format>%s</format>
126 </pv>
127 <pv id="arduino_rate" name="ino:cr:rate">
128   <name>ino:cr:rate</name>
129   <id>arduino_rate</id>
130   <description>Arduino update rate</description>
131   <timestamp>2015-01-15 16:48:36.004167</timestamp>
132   <counter>6214</counter>
133   <units>1/s</units>
134   <value>2142.0</value>
135   <raw_value>2142.0</raw_value>
136   <format>%s</format>
137 </pv>
138 <pv id="engineer" name="prj:ENGINEER">
139   <name>prj:ENGINEER</name>
140   <id>engineer</id>
141   <description>engineer</description>
142   <timestamp>2015-01-15 15:30:16.782947</timestamp>
143   <counter>2</counter>
144   <units></units>
145   <value>engineer</value>
146   <raw_value>engineer</raw_value>
147   <format>%s</format>
148 </pv>
149 <pv id="hostname" name="prj:HOSTNAME">
150   <name>prj:HOSTNAME</name>
151   <id>hostname</id>
152   <description>IOC host name</description>
153   <timestamp>2015-01-15 15:30:16.755911</timestamp>
154   <counter>2</counter>
155   <units></units>
156   <value>gov.aps.anl.gov</value>
157   <raw_value>gov.aps.anl.gov</raw_value>
158   <format>%s</format>
159 </pv>
160 <pv id="motors_alldone" name="prj:alldone">
161   <name>prj:alldone</name>
162   <id>motors_alldone</id>
163   <description>all motors done moving</description>
164   <timestamp>2015-01-15 15:30:16.919038</timestamp>
165   <counter>2</counter>
166   <units></units>
167   <value>1</value>
168   <raw_value>1</raw_value>
169   <format>%s</format>
170 </pv>
171 <pv id="motors_moving" name="prj:moving">
172   <name>prj:moving</name>
173   <id>motors_moving</id>
174   <description>number of motors moving</description>
175   <timestamp>2015-01-15 15:30:16.945825</timestamp>
176   <counter>2</counter>

```

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```

177     <units></units>
178     <value>0</value>
179     <raw_value>0</raw_value>
180     <format>%s</format>
181 </pv>
182 <pv id="starttod" name="prj:STARTTOD">
183     <name>prj:STARTTOD</name>
184     <id>starttod</id>
185     <description>IOC boot time</description>
186     <timestamp>2015-01-15 15:30:16.701840</timestamp>
187     <counter>2</counter>
188     <units></units>
189     <value>01/12/2015 12:56:08</value>
190     <raw_value>01/12/2015 12:56:08</raw_value>
191     <format>%s</format>
192 </pv>
193 <pv id="tod" name="prj:TOD">
194     <name>prj:TOD</name>
195     <id>tod</id>
196     <description>IOC current time</description>
197     <timestamp>2015-01-15 16:48:35.521618</timestamp>
198     <counter>4701</counter>
199     <units></units>
200     <value>01/15/2015 16:48:35</value>
201     <raw_value>01/15/2015 16:48:35</raw_value>
202     <format>%s</format>
203 </pv>
204 <pv id="uptime" name="prj:UPTIME">
205     <name>prj:UPTIME</name>
206     <id>uptime</id>
207     <description>time IOC running</description>
208     <timestamp>2015-01-15 16:48:35.521851</timestamp>
209     <counter>4701</counter>
210     <units></units>
211     <value>3 days, 03:52:27</value>
212     <raw_value>3 days, 03:52:27</raw_value>
213     <format>%s</format>
214 </pv>
215 </pvWebMonitor>

```

(To view an archive copy of this HTML page in your browser, click here -> [rawdata.html](#))

1.4 Source Code

1.4.1 pvWebMonitor Package: main Module

pvWebMonitor.main

USAGE:

pvWebMonitor: raw PV data from EPICS

written by: pvWebMonitor/PvWatch

date/time stamp: 2015-04-15 17:30:12

EPICS process variables (sorted by id)

name	id	description	value	units	timestamp
xxx:m2.RBV	DCM_theta	DCM_theta motor	0.000000	deg	2015-04-15 17:29:22.250684
xxx:m2.DMOV	DCM_theta_DMOV	DCM_theta motor done moving	1	deg	2015-04-15 17:29:22.307696
xxx:m2.VAL	DCM_theta_VAL	DCM_theta motor target	0.000000	deg	2015-04-15 17:29:22.278284
xxx:m1.RBV	VDM_Stripe	VDM_Stripe motor	0.000	deg	2015-04-15 17:29:22.136824
xxx:m1.DMOV	VDM_Stripe_DMOV	VDM_Stripe motor done moving	1	deg	2015-04-15 17:29:22.198513
xxx:m1.VAL	VDM_Stripe_VAL	VDM_Stripe motor target	0.000	deg	2015-04-15 17:29:22.167071
xxx:ENGINEER	engineer	engineer	None		2015-04-15 17:29:22.084686
xxx:HOSTNAME	hostname	IOC host name	None		2015-04-15 17:29:12.079250
xxx:alldone	motors_alldone	all motors done moving	1		2015-04-15 17:29:22.361568
xxx:moving	motors_moving	number of motors moving	0		2015-04-15 17:29:22.415822
xxx:STARTTOD	starttod	IOC boot time	None		2015-04-15 17:28:52.067041
xxx:TOD	tod	IOC current time	None		2015-04-15 17:28:42.058600
xxx:UPTIME	uptime	time IOC running	None		2015-04-15 17:29:02.074299

data gathered by: pvWebMonitor/PvWatch

report page: rawdata.xml

Fig. 6: Example report of the raw data monitored by an instance of *pvWebMonitor*.

```
jemian@gov:~$ pvWebMonitor
usage: pvWebMonitor [-h] [-l LOG_FILE] [-v] xml_config_file
pvWebMonitor: error: too few arguments
```

HELP:

```
jemian@gov:~$ pvWebMonitor -h
usage: pvWebMonitor [-h] [-l LOG_FILE] [-v] [--setup SETUP] xml_config_file

pvWebMonitor: post EPICS PVs to read-only web page

positional arguments:
  xml_config_file      XML configuration file

optional arguments:
  -h, --help            show this help message and exit
  -l LOG_FILE, --log_file LOG_FILE
                        log file
  -v, --version          show program's version number and exit

getting started (none of the above):
  --setup SETUP          setup a new project directory
```

VERSION:

```
jemian@gov:~$ pvWebMonitor -v
2015.0112.0
```

```
pvWebMonitor.main.main()
    entry point for the command-line interface
```

1.4.2 pvWebMonitor Package: pvwatch Module

pvWebMonitor.pvwatch

exception pvWebMonitor.pvwatch.CouldNotParseXml

Bases: exceptions.Exception

Could not parse XML file

exception pvWebMonitor.pvwatch.PvNotRegistered

Bases: exceptions.Exception

pv not in pvdb

class pvWebMonitor.pvwatch.PvWatch(configuration)

Bases: object

Core function of the pvWebMonitor package

To call this code, first define `configuration=dict()` with terms as defined in `read_config.read_xml()`, then statements such as:

```
1 watcher = PvWatch(configuration)
2 watcher.start()
```

EPICS_monitor_receiver(*args, **kws)

Response to an EPICS (PyEpics) monitor on the channel

add_file_pattern (*pattern*)

add *pattern* as an additional file extension pattern

Any file with extension matching any of the patterns in `self.upload_patterns` will copied to the WWW directory, if they are newer.

add_pv (*mne, pv, desc, fmt, as_string*)

Connect to a EPICS (PyEpics) process variable

buildReport ()

build the report

get_pvlist ()

get the PVs from the XML file

report ()

write the values out to files

The values of the monitored EPICS PVs (the “raw data”) is written to an XML file. This file is then used with one or more XSLT stylesheets to create HTML pages. An overall “home page” (`index.html`) is created to provide a table of contents of this static web site.

start ()

begin receiving PV updates and posting new web content

update_pvdb (*pv, raw_value*)

log PV value to the cache in `pvdb`

Parameters

- **pv** (*str*) – name of EPICS PV
- **raw_value** (*obj*) – could be str, float, int, or ...

1.4.3 pvWebMonitor Package: read_config Module

read XML configuration file for *pvWebMonitor* package

`pvWebMonitor.read_config.patterns_1_0 (*args)`

`config_1_0` relies on a pre-defined list of file match patterns

`pvWebMonitor.read_config.patterns_1_0_1 (*args)`

`config_1_0_1` uses a user-defined list of file match patterns

`pvWebMonitor.read_config.read_xml (xml_file)`

return the configuration details as a dictionary

Parameters **return** – dictionary

the dictionary WILL contain these definitions for use by `pvwatch.PvWatch()`:

dictionary key	example (type)	description
PVLIST_FILE	pvlist.xml	PVs to be monitored
LOCAL_WWW_LIVEDATA_DIR	./localwww	absolute path to local directory with “web site”
LOG_INTERVAL_S	300 (float)	writing messages to log file
REPORT_INTERVAL_S	10 (float)	updates to HTML pages
SLEEP_INTERVAL_S	0.1 (float)	sleeps at end of main loop
MAINLOOP_COUNTER_TRIGGER	10000 (int)	another logging message interval
PATTERNS	*.html	upload all files that match these patterns

1.4.4 pvWebMonitor Package: setup Module

setup a new project directory

`pvWebMonitor.setup.get_key_value (key, txt)`
find the assignment line in txt: key=value, and return value

`pvWebMonitor.setup.main (new_directory)`
setup a new project directory in *new_directory*
new_directory must exist and not contain any of the files to be copied into it.

Parameters *new_directory* (*str*) – name of existing directory

`pvWebMonitor.setup.modify_manage_script (filename)`
customize the manage.sh script for the current setup

1.4.5 pvWebMonitor Package: utils Module

`pvWebMonitor.utils`

`pvWebMonitor.utils.copyToWebServer (local_file, web_site_path)`
copy local file to web server directory (on a local file system)

This copy routine assumes that it is not necessary to use scp to copy the file.

`pvWebMonitor.utils.getTime ()`
simple wrapper for common `timenow()` function

`pvWebMonitor.utils.logException (troublemaker)`
write an exception report to the log file

Parameters *troublemaker* (*obj*) – instance of Exception

`pvWebMonitor.utils.logMessage (message)`
log a message or report from pvWebMonitor

Parameters *message* (*str*) – words to be logged

`pvWebMonitor.utils.validate (xml_tree, xml_schema_file)`
validate an XML document tree against an XML Schema file

Parameters

- **xml_tree** (*obj*) – instance of `etree._ElementTree`
- **xml_schema_file** (*str*) – name of XML Schema file (local to package directory)

`pvWebMonitor.utils.writeFile (output_file, contents)`
write contents to file

Parameters

- **output_file** (*str*) – file to be written (path is optional)
- **contents** (*str*) – text to write in *output_file*

`pvWebMonitor.utils.xslt_transformation (xslt_file, src_xml_file, result_xml_file)`
transform an XML file using an XSLT

Parameters

- **xslt_file** (*str*) – name of XSLT file
- **src_xml_file** (*str*) – name of XML file

- **result_xml_file** (*str*) – name of output XML file

1.5 CHANGES

2021.0.0 release expected by 2020-12-18

- first python 2.8 release

2020.0.0 released 2020-09-24

- last python 2.7 release

2017.1211.1 use Python versioneer

2017.1211.0 `as_string` attribute

2016.1025.0 revise the versioning process

2016.1003.2 [issue #22](#): correct version number shown now

2016.0907.0 [issue #18](#): check XSLT files for syntax errors, [issue #19](#): let user choose to write waveform strings as string or array of integers, [issue #20](#): add username and host to logging messages

2016.0516.2 [#16](#): accept both version 1.0 & 1.0.1 config.xml files

2016.0427.1 [#12](#): user can add additional file extension patterns, improve the setup of manage.sh on Linux

2016.0414.2 [#9](#): resolve ValueError when creating XML declaration

2015.0117.0 [#6](#): rename project to pvWebMonitor

2015.0116.0 [#13](#): management shell script now uses /bin/bash

2015.0115.0 [#4](#): refactor XSLT infrastructure and web site

2015.0114.1 include XML infrastructure in package

2015.0114.0 packaging update

2015.0113.1 add `--setup` to fill a new project directory with needed files

2015.0113.0 validate all XML files and raise exceptions if invalid

2015.0112.2 documentation at ReadTheDocs, package at PyPI, code at GitHub

2015-01-09 v1.0.0 initial conversion from USAXS livedata project

1.6 Software License

```
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pvWebMonitor  
  
Advanced Photon Source, Argonne National Laboratory  
  
OPEN SOURCE LICENSE
```

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