

PyBoard and WiPy Editor: Small Python Text Editor

Looking for a code editor that would fit onto Pyboard (and now WiPy), I made my way through the Micropython forum and found **pfalkon**'s Python editor code, which I took and ported it to PyBoard. It's really impressive how few lines of code pfalkon needed to implement a reasonable amount of functionality. Since the code looked clean, and it seemed so easy to add features, I could not resist adding a little bit, using some ideas of **dhylands** for screen and keyboard handling, and yes, it got a little bit larger. It still contains the code for the Linux/Darwin environment, so you can run it in Linux/Mac Python3 or MicroPython (if you install the os module). I sprayed C Preprocessor statements in it (arrgh!), so you can use cpp to remove the stuff which is not needed for PyBoard or WiPy. So, what did I change and add:

- Use USB_VCP or UART for input and output on PyBoard, stdin/stdout on WiPy.
- Changed the read keyboard function to comply with slow char-by-char input on serial lines.
- Added support for TAB, BACKTAB, SAVE, FIND, REPLACE, GOTO Line, CUT, COPY, PASTE, REDRAW, UNDO, INDENT, UN-INDENT and GET (file).
- Join lines by Delete Char at the end or Backspace at the beginning, Auto-indent for Enter.
- Moved main into a function with an option for Pipe'ing in on Linux & Python3
- Added a status line and single line prompts for Quit, Save, Find, Replace, Goto, Get file and Flag settings.
- Support the simultaneous editing of multiple files.
- Support of the basic mouse functions scrolling up/down and setting the cursor (*).

The editor works in Insert mode. Cursor Keys, Home, End, PgUp and PgDn work as you would expect. Some functions are available with Ctrl-Keys. Keyboard Mapping:

| Keys | Alternative | Function |
|--------------------|-------------|--|
| Up | | Move the cursor up one line. |
| Down | | Move the cursor down one line. |
| Left | | Move the cursor left by one char; skipping over to the previous line (*). |
| Right | | Move the cursor right by one char; skipping over to the next line. (*) |
| PgUp | | Move the cursor up by one screen height. |
| PgDn | | Move the cursor down by one screen height. |
| Home | | Go to start-of-line , if the Cursor is at start-of-text . Otherwise go to start-of-text . |
| End | | Move to the end-of-line . |
| Mouse Button 1 | | Set the cursor. In the WiPy version this is only supported, if -D MOUSE was set during code stripping. |
| Mouse Button 2 | | Set/Clear the line mark. In the WiPy version this is only supported, if -D MOUSE was set during code stripping. |
| Mouse Scroll Wheel | | Scroll Up/Down the screen content by 3 lines per tick. The cursor stays visible and will be moved in the content if required. In the WiPy version this is only supported, if -D MOUSE was set during code stripping. |
| Enter | \n | Insert a line break at the cursor position. Auto-indent is supported. |
| Backspace | Ctrl-H | Delete the char left hand to the cursor. If the mark is set, just delete the marked line range. At the beginning of the line Backspace joins the previous line. (*) |

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| Del | | Delete char under cursor. At the end of the line join the next line. If the mark is set, delete the marked line range. In line edit prompts, Del deletes the whole entry. |
| Tab | Ctrl-I | Tab. Insert spaces at the cursor position up to the next tab location, moving the cursor. If the mark is set, indent the lines between the mark and cursor. In the WiPy version indent is only supported, if -D INDENT was set during code stripping. |
| BackTab | Ctrl-U | Back Tab. Remove spaces left to the cursor position up to the next tab location or the next non-space char, and moves the cursor. If the mark is set, un-indent the lines between the mark and the cursor. In the WiPy version un-indent is only supported, if -D INDENT was set during code stripping. |
| Ctrl-Q | | Quit a file buffer or the line edit mode. If the edited text was changed, ask for confirmation. If the last buffer is closed, the editor will terminate too. |
| Ctrl-S | | Save to file. The file name will be prompted for. The content will be written to a temporary file ("tmpfile.pye") first and then this will be renamed. If the target file name is invalid, the original file is lost, but "tmpfile.pye" will have its content. |
| Ctrl-E | | Redraw the screen according to the actual screen parameters width, height. With MicroPython, as a side effect, garbage collection is performed and the available memory is shown. With Linux/CPython, window size changes result in an automatic redraw. |
| Ctrl-F | | Find text. The last search string is memorized, even across buffers. Search stops at the end. Whether the search is case sensitive or not, can be set by the Ctrl-A command. |
| Ctrl-N | | Repeat find starting at the column right to the cursor. |
| Ctrl-R | | Find and replace . If the mark is set, it affects the marked region only. In the WiPy version this is only supported, if -D REPLACE was set during code stripping. |
| Ctrl-G | | Go to Line. It prompts for the line number. |
| Ctrl-B | Ctrl-End | Go to the last line |
| Ctrl-T | Ctrl-Home | Go to the first line |
| Ctrl-K | | Go to the matching bracket , if any. The cursor has to be on a bracket symbol. Bracket pairs are (), [], {} and <>. Brackets in comments and strings are not discarded . In the WiPy version this is only supported, if -D BRACKET was set during code stripping. |
| Ctrl-A | | Settings. Sets the state of search case sensitivity, auto-indent, tab size and write-tabs. Enter 'y' or 'n' or a number in up to three, comma separated fields (e.g. n,y,4,n). An empty field leaves the respective value unchanged. The default values are case sensitive: n, auto-indent: y, tab-size: 4, Write Tabs: n In the minimal (WiPy) version, Ctrl-A just toggles the auto-indent flag. |
| Ctrl-L | | Mark/Unmark the current line. The mark affects Delete, Backspace, Cut lines, Copy lines, Insert lines, Tab, Backtab, Save and Replace. |

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| Ctrl-X | Ctrl-Del | Delete the area between the mark and the current line and keep it in the paste buffer. Together with the Ctrl-V this implements the Cut & Paste feature. The mark is cleared. |
| Ctrl-C | Ctrl-D | Copy the area between the mark and the current line to the paste buffer. Together with the Ctrl-V this implements the Copy & Paste feature. The mark is cleared on copy. |
| Ctrl-V | | Insert the content of the paste buffer before the actual line. If the mark is set, delete the marked area first. |
| Ctrl-W | | Switch to the next file buffer . |
| Ctrl-O | | Open a new file buffer. The file name will be prompted for. If the name is left empty, an empty buffer will be opened. If the file cannot be loaded (e.g. because it does not exist), a buffer with that name will still be opened, but will be empty. |
| Ctrl-Z | | Undo the last change(s). Every char add sequence/deleted char sequence/replaced item/deleted line/inserted line(s)/indent sequence/Un-indent sequence counts as a single change. The default for the undo stack size per buffer is 50 with PyBoard/WiPy and 500 with Linux/Darwin systems. It can be changed in the call to <code>pye()</code> . |

Functions denoted with (*) are not supported in the minimal version (WiPy, see below). The editor is contained in the file `pye.py`. Start `pye` from the REPL prompt e.g. with

```
from pye import pye
res = pye(object_1, object_2, ..[, tabsize][, undo][, device][, baud])
```

If `object_n` is a string, it's considered as the name of a file to be edited, and the name of the file will be returned. If `object_n` is a list of strings, these will be edited, and the edited list will be returned. If no object is named, `pye()` will give you an empty screen, creating a list of strings, unless you save to a file. In that case, the file name will be returned. If `object_n` is neither a string nor a list of strings, an empty buffer is opened. It is always the last buffer closed, which will be returned. Optional named parameters:

| | |
|------------------------|---|
| <code>tabsize=n</code> | Tab step (integer). The default is 4 |
| <code>undo=n</code> | Size of the undo stack (integer). A value of 0 or False disables undo. |
| <code>device=n</code> | Device to be used for screen/keyboard on PyBoard (integer). On PyBoard, 0 is USB_VCP. 1 is UART 1, and so on. The default is 0 (USB_VCP). This Option is not available on WiPy. You'll get the output on UART by redirecting the REPL prompt. |
| <code>baud=n</code> | UART baud rate (integer). The default is 115200. |

The Linux/Darwin version can be called from the command line with:

```
python3 pye.py [filename(s)]
```

Obviously, you may use micropython too. Using `python3` (not micropython), content can also be redirected or pipe'd into the editor.

When reading files, tab characters (`\x09`) in the text are replaced by spaces, tab size 8, and white space at the end of a line is discarded. When you save the file, you have the option to replace sequences of spaces by tabs, tab size 8. However, the original state will NOT be restored. So be careful when editing files with tab characters.

The size of a file that can be edited on PyBoard/WiPy is limited by its memory. You may use REDRAW to determine how much space is left. Besides the file itself, both buffer operations and especially undo consume memory. The undo stack can be limited in the call to `pye`, the buffer size can be reduced again by copying a single line into it. Up to about 300 lines on WiPy and 600 lines on PyBoard should be safe to edit. The largest suitable file size is in the same order of what WiPy/PyBoard can handle as source file.

When you save a file on PyBoard/WiPy, these changes may not be visible in the file system of a connected PC until you disconnect and reconnect the Pyboard/WiPy drive. See also the related discussion in the MicroPython Forum.

The file `pye.py` is pretty large for PyBoard and way too large for WiPy. As told, it contains C pre-processor statements allowing trimming it down a little bit. For that reason, comments start with `##` instead of `#`. So for PyBoard, you might run:

```
cpp -D PYBOARD -D DEFINES pye.py >pe.py
```

That will result in a file with all functions supplied, but smaller footprint when loaded. The directive `-D DEFINES` will replace symbolic key names with numeric constants, reducing the file size and the demand for symbol space. You may strip down the file size (not the compiled footprint) by removing comments and empty lines (that's what I do), e.g. by:

```
cpp -D PYBOARD -D DEFINES pye.py | sed "s/#.*$//" | sed "/^$/d" >pe.py
```

Doing that also removes dead code like the one for the Linux environment. If the footprint is still too large, you may choose:

```
cpp -D BASIC -D PYBOARD -D DEFINES pye.py | sed "s/#.*$//" | sed "/^$/d" >pemin.py
```

That removes the code for mouse support, replace, line join by backspace, flag settings except for autoindent toggle, save region, get file, write tabs and scrolling optimization. There are still lines left like: `if sys.platform == "pyboard"`. If you do not like these, delete them manually (and take care of the indents). The smallest WiPy versions will be generated with:

```
cpp -D BASIC -D WIPY -D DEFINES pye.py | sed "s/#.*$//" | sed "/^$/d" >wipye.py
```

Other versions, which either include the indent/un-indent, scrolling optimization, the replace command, the go to Bracket command or mouse support, can be generated by setting the appropriate define:

| | |
|-------------------------|---|
| <code>-D INDENT</code> | Indent/Un-Indent included |
| <code>-D SCROLL</code> | support for fast scroll included |
| <code>-D BRACKET</code> | support for bracket match included (Ctrl-K) |
| <code>-D REPLACE</code> | support for replace included (Ctrl-R) |
| <code>-D MOUSE</code> | support for mouse included |

Example for including indentation:

```
cpp -D BASIC -D WIPY -D DEFINES -D INDENT pye.py | sed "s/#.*$//" | sed "/^$/d" >wipye_indt.py
```

Due to its smaller RAM size, only one of these flags may be set on WiPy. If `-D BASIC` is **not** set, everything but `SCROLL` is included (default for PyBoard and Linux/Darwin variants).

Notes:

- The keyboard mapping assumes VT100. For those interested, I collected the key codes issue by terminal emulators, all claiming VT100 compatible. Picocom seems sometimes to send the Linux Terminal codes. If the KEYMAP is too large, and you know which terminal you are working on, delete or comment out the obsolete lines. If your terminal is different, just change the control codes.

| Key | Putty VT100 & Xterm | Putty esc-[~ | Putty Linux | Minicom | GtkTerm | Picocom | Linux Terminal |
|-----------|---------------------|--------------|-------------|---------|---------|---------|----------------|
| Up | \e[A | \e[A | \e[A | \e[A | \e[A | \e[A | \e[A |
| Down | \e[B | \e[B | \e[B | \e[B | \e[B | \e[B | \e[B |
| Left | \e[D | \e[D | \e[D | \e[D | \e[D | \e[D | \e[D |
| Right | \e[C | \e[C | \e[C | \e[C | \e[C | \e[C | \e[C |
| Home | \e[1~ | \e[1~ | \e[1~ | \e[1~ | \eOH | \eOH | \e[H |
| End | \e[4~ | \e[4~ | \e[4~ | \eOF | \eOF | \eOF | \e[F |
| Ins | \e[2~ | \e[2~ | \e[2~ | \e[2~ | \e[2~ | \e[2~ | \e[2~ |
| Del | \e[3~ | \e[3~ | \e[3~ | \e[3~ | \e[3~ | \e[3~ | \e[3~ |
| PgUp | \e[5~ | \e[5~ | \e[5~ | \e[5~ | \e[5~ | \e[5~ | \e[5~ |
| PgDn | \e[6~ | \e[6~ | \e[6~ | \e[6~ | \e[6~ | \e[6~ | \e[6~ |
| Backspace | \x7f | \x7f | \x7f | \x7f | \x08 | \x7f | \x7f |
| Ctrl-Home | | | | \e[1;5H | | \e[1;5H | \e[1;5H |
| Ctrl-End | | | | \e[1;5F | | \e[1;5F | \e[1;5F |
| Ctrl-Del | | | | \e[3;5~ | \e[3;5~ | \e[3;5~ | \e[3;5~ |
| Tab | \x09 | \x09 | \x09 | \x09 | \x09 | \x09 | \x09 |
| BackTab | \e[Z | \e[Z | \e[Z | \e[Z | \e[Z | \e[Z | \e[Z |

- Since all these key sequences start with the Escape char, typing Escape on the keyboard seem to lock the keyboard. You can unlock it by typing any alpha character.
- For those who wonder why sending data to the screen on PyBoard is more than a simple write(): for USB_VCP.write() stumbles over a large amount of data to be sent in short time. The difference is, that UART.write() waits internally until all has been sent, whereas USB_VCP.write() stops when it cannot send more data. So we have to see what's coming back. And, b.t.w., PyBoard's UART.write() does not like empty strings, which in turn is accepted by USB_VCP.write() or WiPy's UART.write().
- Windows terminal emulators behave inconsistent. Putty does not report the mouse actions at all. TeraTerm, IVT terminal and Xsh20 just report the mouse click, but not the scroll wheel actions. ZOC reports mouse positions constantly, and sends no key codes for Home, End, PgUp, PGDn and Del. The latter holds also for PowerVT. I could not get Qodem working. Hyperterminal's VT100 emulation is crap. So, after all, I consider TeraTerm, Xsh20 or Putty as the best choices for Windows.
- Gnome terminal sometimes does not send the first mouse wheel code, after the pointer was moved into the window. Mate and XFCE4 terminal do, but have slightly different keyboard mappings.
- Serial connection on WiPy is not stable (yet), especially with fast auto-repeat (Maybe flow control is needed). Further analysis is required.
- Saving to internal flash of PyBoard is really slow, so don't get nervous. Watch the red LED.

- Ctrl-C as input in WiPy Telnet sessions is caught, such that the editor is not interrupted, but the next input byte is lost, which causes garbage by cursor/function keys.
- For those who do complain about the enormous long `handle_edit_key()` function: I tried a variant where every if-elif-case of the function was replaced by a little function, and KEYMAP contained the names of the functions as pointers, which then could be called directly. Thus, almost every key had the same handling time. That worked, and the source file was not much longer, but the compiled code size grew by 50% w/o a useful advantage. So I dropped this approach.
- Putting all functions into the single class is a little bit messy. I made a variant of `pye.py`, where all tty related functions are placed in a separate class (and could be placed in a separate file too). That looks much better, but uses about 600 bytes more memory. For WiPy, I'm still fighting for every byte, so I left it aside. Still there are some functions where it's not clear where to place them.