

# The Propeller Based Internet Logging Pill Dispenser, a microMedic 2013 Submission

For my microMedic 2013 Contest project I created the "Propeller Based Internet Logging Pill Dispenser" or simply "the P.I.L. Box". This project demonstrates how today's low cost micro-controllers, sensors and nearly pervasive internet connection can be used to address a common health care issue, that of prescription medication non-compliance. Common forms of drug treatment noncompliance include forgetting to take medications, and altering prescribed medication schedules. Some patients may take more than the prescribed dose of a medication in the mistaken belief that more will speed recovery, some may quit before a prescription runs out believing they are cured. [Studies show](#) the consequences of patients not taking medications according to doctor's orders can be serious, especially in older patients.

The P.I.L Box project is a prototype which can help with many of these medication non-compliance issues.

## ***Currently Supported Features of the P.I.L. Box***

**Dosage Time Reminders** - Automated, clear, reminders to the patient, informing of the proper time to take their medications.

**"Next Dosage" Time Display** – by pressing the red Enter button on the front panel, a user can switch from viewing the current time of day, to viewing the next scheduled medication time

**LED backlighting** - LEDs mounted beneath the dispenser highlight the proper compartment to be opened for the current dosage time.

**Audible English language reminders** are provided by way of the Parallax Voice Synthesizer object and Propeller speaker jack.

**Local and Remote Logging** - The device logs the date and time a patient accesses the dispenser compartments, as well as many non-compliance error situations (such as a missed dosage time). Logs are written to both a web-server accessible file and locally on the Propeller microSD card. I log the file locally to handle the case of a PC server failure or a power-outage (assuming the P.I.L. Box is using the optional 9V battery supply feature).

**Internet Accessible Logs** - Remote logging allows a family member or other care provider to check on a patient remotely and verify that they are taking meds on schedule. A patient may even use the log themselves. Consider the case where a patient arrives at work and can't remember if they took their morning medications, with the *P.I.L. Box* an up to date record of meds taken is available on your smart phone or networked computer.

**Twitter enabled** - the P.I.L. Box is a registered Twitter application and by use of REST APIs, the python-based remote logging server sends Twitter messages to notify care providers about missed dosage events.



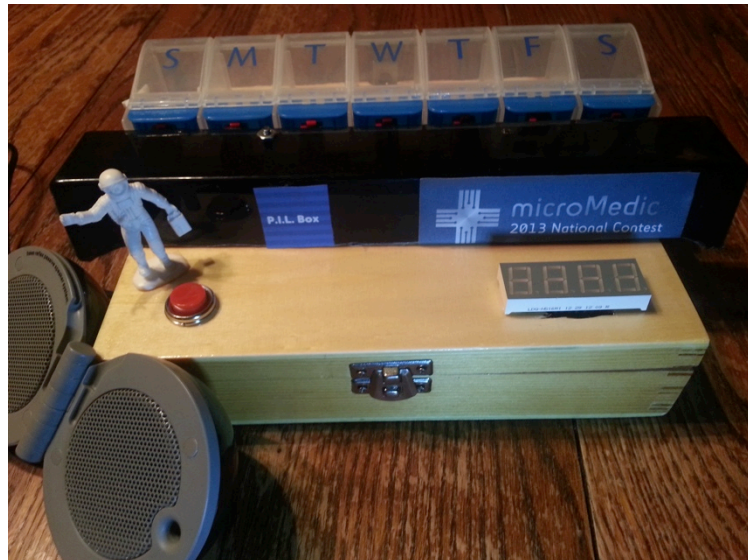
**Low Cost Standard Pill Containers** - *P.I.L. Box* uses inexpensive standard [7 Day Pill Reminders](#) made by Ezy Dose. The prototype design allows the container to easily be removed, enabling a care provider to visit weekly dropping off a new pre-filled med container and collecting the empty container for restocking. Being able to remove the box will help users actually get to their meds as well.

**Non-compliance Error Messages** - If a patient misses a dosage time, forgets to replace the pill container or accesses meds early, visual and audible error messages are generated, and such issues are logged to the local and remote log-files.

**Extendable Design** - The current prototype supports only seven compartments, one for each day of the week, but obviously many patients would require three or even four servings a day. The Propeller has 20 totally free I/O pins and I needed 12 simply to drive the LED display, so I used shift registers to provide additional pins. Because I used the [Tymkrs Shift Me V1](#) shift register board, not only could I control 8 switches and 8 LEDs while only allocating 6 pins, I knew I could also chain together many such boards, thus easily supporting as many containers as desired. For example, with little design change, we could simply add 3 additional shift register boards, allowing us to handle 32 LEDs and 32 Switches and thus support the [Ezy Dose 4X/Day Weekly Pill Organizer](#), which features 28 separate pill compartments.

### **How Does it Work?**

Obviously the *Propeller Based Internet Logging Pill Dispenser (P.I.L. Box)* has the *Parallax Propeller Board of Education* at its heart. (At this point I'd like to thank Parallax and the microMedic sponsors for the use of the microMedic contest kit. It's an amazing kit and I look forward to exploring it more in the future).

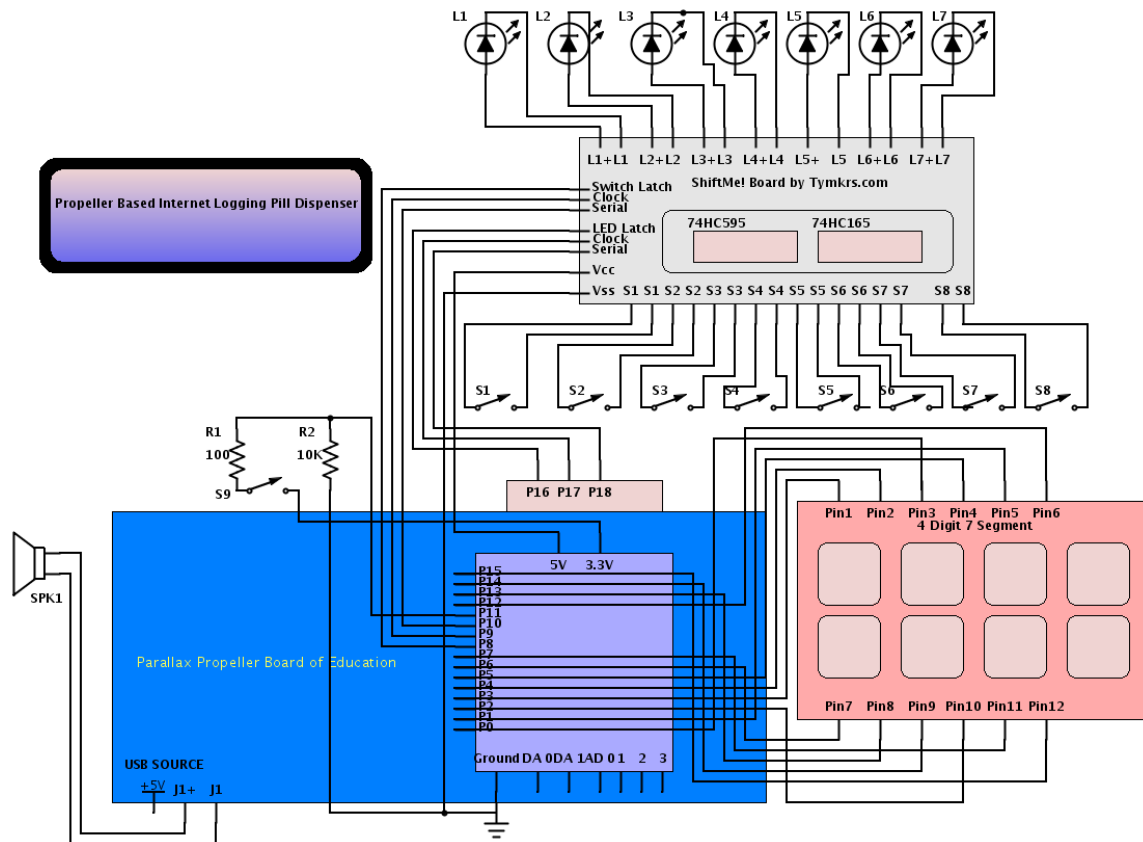


When the *P.I.L. Box* is aware of the current time and the patient dosage time.

- The next dosage time is displayed until we are less than one hour away.
  - Once we are one hour away, a countdown timer is shown on the 4 digit LED display. This timer runs in a separate Propeller cog, allowing the main program to continue checking for buttons, error conditions and log events.
  - When the countdown timer reaches zero, the appropriate LED is turned on indicating which compartment the patient is to access. A voice synthesized reminder is played as well.
  - If the patient opens the proper compartment, a log entry is added to the local and remote log-files.
  - If the patient opens the wrong compartment or does not access the compartment, an error message is played and an error event is logged.
- The Next Dosage time is calculated and we start again.

## Schematics/Wiring Diagram and BOM

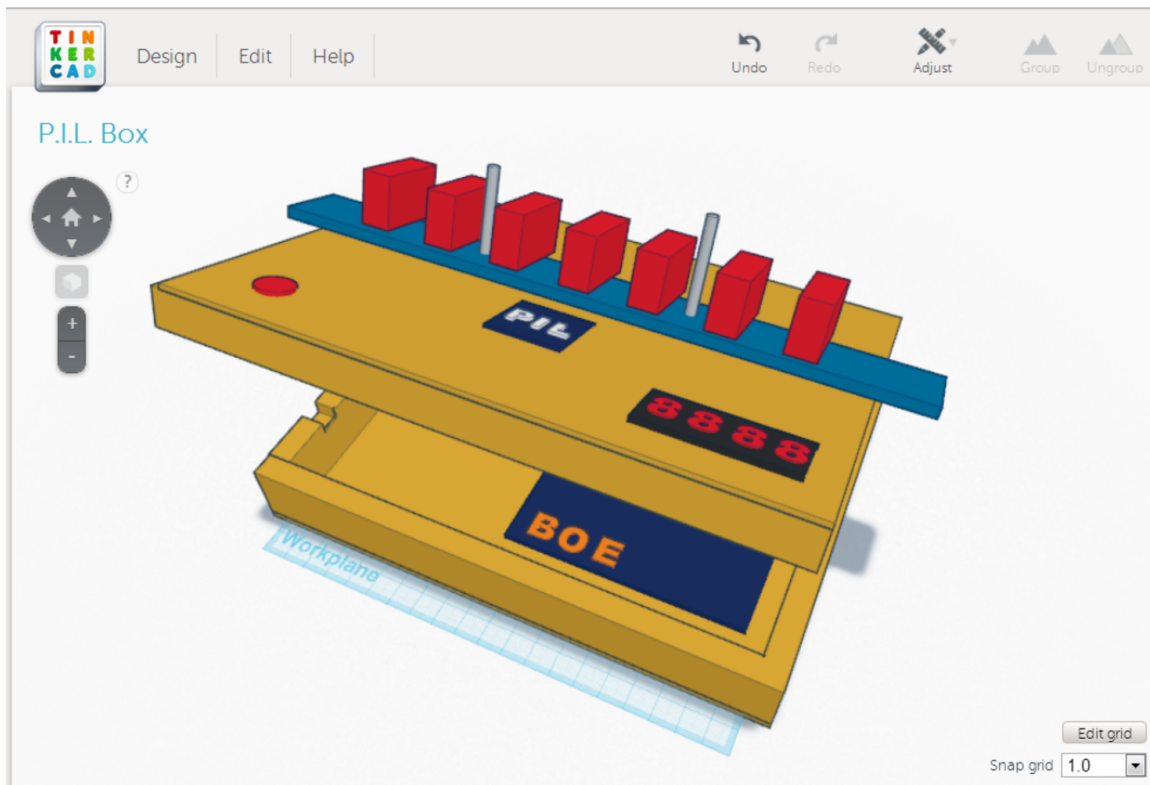
I used an online schematic drawing tool called Schemieit for the P.I.L. Box schematic and wiring diagram. It's very easy to see what goes where when you use the online version so I've shared that here: <http://www.digikey.com/schemieit#fpf>



## ***Design Drawings Made with Tinkercad***

At MakerFaire KC 2013, I noticed Autodesk recently bought and resurrected Tinkercad an online drawing tool, so I decided to try that out for my design drawings. I crated the bottom and top of my project box according to dimensions and also put them together in the diagram shown below. They are publicly available here as well

<https://tinkercad.com/embed/bQTBbDj22pL?editbtn=1>



### ***Video Link:***

If a picture is worth a thousand words, in this case I think a video is even better...so please see my project final video on You Tube

<http://youtu.be/h19vmYhT7wY>

### ***Summary:***

Thanks again for a great contest. This was my first Propeller experience and I am very happy with the progress I've made especially since I found out about this contest late and only had one month to work on it. It's be a fun learning experience, in general there are many good examples in the Object Exchange and Parallax forum, enough for me to get by for this project. I'm looking forward to learning better ways I could have implemented some of the spin code and trying out many of the other pieces of the microMedic Inspiration kit.

**Links:**

- My YouTube video submission for the 2013 microMedic Contest  
<http://youtu.be/h19vmYhT7wY>
- Link to my schematic and wiring diagram  
<http://www.digikey.com/schemeit#fpf>
- Design diagrams for the P.I.L. Box  
<https://tinkercad.com/embed/bQTBbDj22pL?editbtn=1>  
I'll include a .SVG version of the file as well.
- My original microMedic proposal video  
<http://www.youtube.com/watch?v=DYdod8hqOu4>
- How I enabled the Python server for Twitter APIs  
<http://wilsonericn.wordpress.com/2011/08/22/tweeting-in-python-the-easy-way/>
- I used Jukeboxprint.com to create the P.I.L. logos on the prototype