User Manual for sCubes V2

Networked Embedded and Wireless Systems (NeEWS) Laboratory
Electrical and Computer Engineering (ECE)
Michigan State University, East Lansing

Important Notes: This version of the sCubes are delicate prototype instruments that need to be handled with utmost care. Future versions of sCubes are expected to be more rugged. Remember that these devices are research prototypes, and not a commercially store-bought product. So, they will never be as rugged as devices purchased from a store like BestBuy. Please read the following points before moving on through the document.

1. Avoid dropping the sCubes, even from a height as low as a few inches
2. Follow the instruction for battery change as shown in the accompanying video. While changing the battery, the internal electronics and wires of the sCubes will be exposed. Pay special attention to avoid accidental touching of the wires and the electronics.
3. Exercise similar caution while turning the sCubes on and off
4. If possible, have a designated person for changing battery and switching sCubes on and off
5. In case of any problem or any doubts, contact the MSU team as soon as possible and do not try to service/fix the sCubes yourselves. Even if it appears to be a trivial fix. The MSU team will walk you through the fixing process, when feasible.
6. We do not have spare sCubes. So, the experiments will be either halted or scope-reduced as and when sCubes fail. So, please keep that in mind while exercising caution as listed above.

Software Required: Teraterm

- Download the Teraterm software from the link given below (Works for Windows PC):

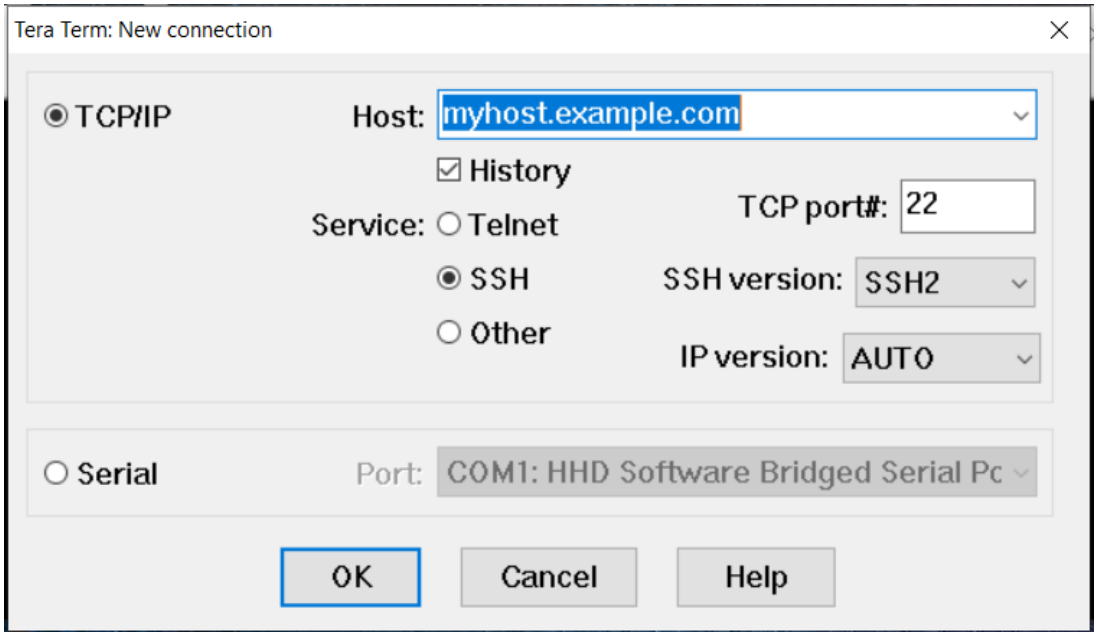
  https://osdn.net/projects/ttssh2/releases/

- The installation guide for the software is provided in the readme file available once you download the zip folder given in the above link.

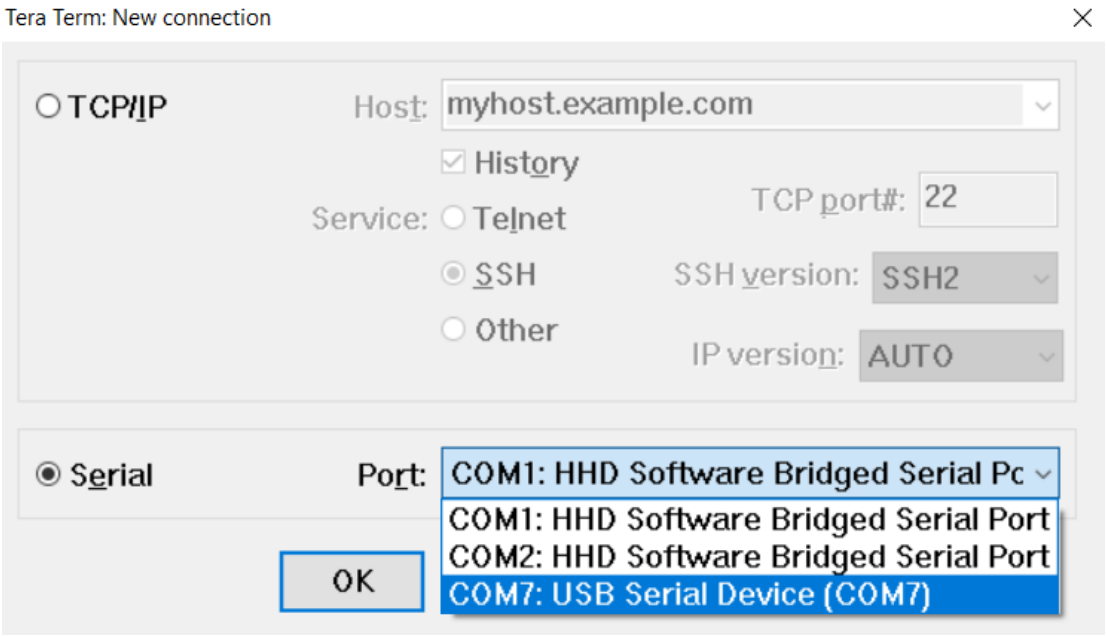
Steps:

A. Setting Up the Base Station

1. Connect the Base Station to a Windows PC using a USB port.
2. Open the Teraterm software. The following screen will show up at the start.



3. Click on the ‘Serial’ Button and Select ‘COMxx: USB Serial Device’ from the dropdown menu and click OK.



4. You will see the Teraterm terminal with the data collected by the base station as shown below:

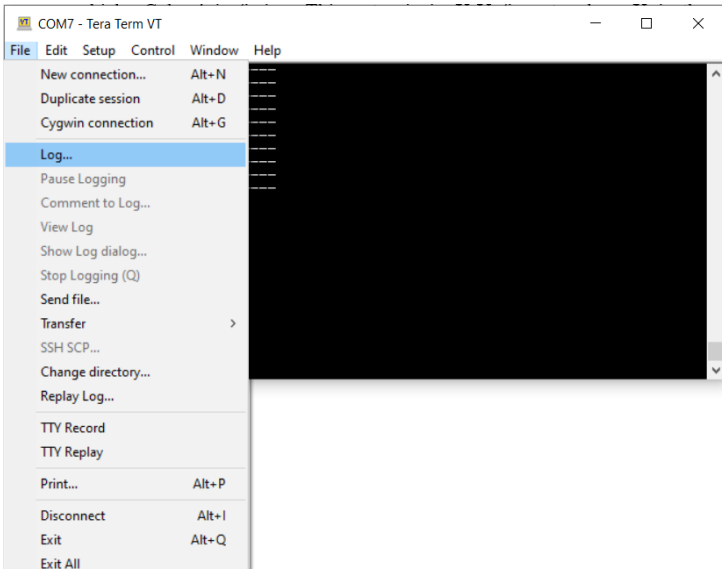
5. Each row represents the data collected by the base station from each sCube. Each entry on a row represents the following:
   a. Column 1: sCube ID (1 to 11) corresponding to which the base station received data from. Let us call it as sCube i for future reference.
   b. Column 2: Face on which the sCube i is standing (bottom face)
   c. Column 3: Time (in millisec) elapsed since the base station is turned On
   d. Column 4: Battery level (in Volts) of the sCube i.
   e. Column 5 to 7: Accelerometer readings of sCube i along 3 axes
      - The three columns represent the accelerometer readings along the three axes $(a_x,\ a_y,\ a_z)$
      - Acceleration along an axis i can be calculated as $\frac{a_i}{255}$

- The unit of acceleration is g (Gravitational acceleration)

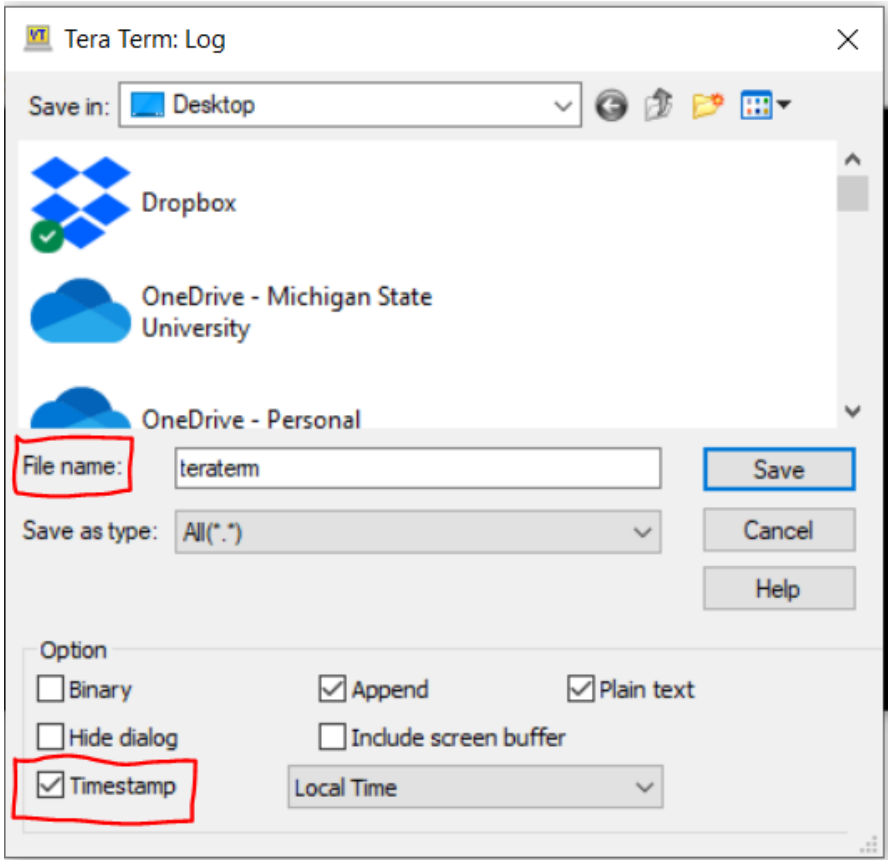
f. Column 8: Time (in millisec) elapsed from the poll request of the base station

g. Column 9 to 14: Starting from 9 till 14 each column corresponds to the face ID of sCube i. The neighboring sCubes ID and the corresponding face ID which sCube i is facing will reflect at one of the columns representing the face of sCube i. This entry is in X-Y format, where X is the neighboring sCube ID and Y is the face of the neighboring sCube which is facing sCube i. The default values of X and Y are 32 and 6 respectively, which means that the sCube i is not close enough to any other sCube faces.

6. To log the data into file, go to File→Log:



7. A dialogue box appears as below. Put the name of the file where you want the readings to be saved.



8. The log file contents look as shown below.

```
[2022-08-30 20:15:43.236] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.236] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.236] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.236] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.236] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.236] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.236] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] On Face: 3    Block ID: 8     2       3.43    255     6       64      2       31-6    31-6    31-6    31-6    31-6    31-6
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
[2022-08-30 20:15:43.252] On Face: 3    Block ID: 8     2       3.43    255     6       64      2       31-6    31-6    31-6    31-6    31-6    31-6
[2022-08-30 20:15:43.252] ------ NO POLL RESPONSE -------
```

B. Setting up the sCubes

1. To start experimentation, switch on the sCubes using the ‘power on’ switch found on Face ID 5 of the sCube. The video demonstration of the procedure for turning on the sCube is given in the link: *https://youtu.be/GIkn7sJ6T3A*
2. The sCubes which are ON are visible on the Teraterm serial monitor

3. If the sCubes are brought close to one another, the information about the sCubes which are facing each other are visible on the Teraterm monitor. The details on the data format are given in Section A.

C. Replacing the Battery

1. Make sure that the battery level of the sCube is above 2.5 Volt
2. If the battery level goes down below this level, replace the battery as shown in the video given in the link: *https://youtu.be/W2luz5B8atY*
3. For taking the battery out, follow the exact steps shown in the video in reverse.

D. Delivered sCubes:

The following sCubes are delivered for experimentation on 04/07/2022:

1. 10 fully functional sCubes
2. 1 Base
3. 1 Base station