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Spectral Forest User Manual

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# Minimum Hardware / Software Requirements:

* To first begin, the user is assumed to have a running Linux-based system with sudo privileges:
  + In Linux, log in as root:
    - <sudo -i> To log in as root in a terminal of your choice.
  + Then type:
    - <usermod -a -G dialout “username”>, 🡪 Enter username without quotes.
  + Then enter:
    - <sudo reboot> This will initiate the user privileges for using the program screen.
  + In a terminal window:
    - Enter <screen>
    - If the program has been installed you are good to go. If not, follow the prompt to install the screen program.
  + In terminal window:
    - Enter <nano ~/.bashrc>
    - Under ‘some more aliases’:
      * Enter <alias run\_pyboard=’screen /dev/ttyACM0’>
    - Save and close file. Close terminal.
    - Open terminal:
    - Enter <alias> verify newly created alias.

# How to Operate the System

* In terminal window:
  + Enter <run\_pyboard>:
    - Note: ensure PYBOARD SD is connected to machine and alias was created.
* User password:
  + Enter the user password:
    - <spectral>
    - Then press <Enter>. Default password is User can change the password by entering selected password on main.py at the top of the script under password.
* Clearing files: To clear all files:
  + Enter <yes>
  + Otherwise press <Enter> to keep files. Note **all** files will be deleted on path “/sd/Spectral\_Forest\_Data”. Path can be changed on main.py under path at the top of the script.
* Auto Integration:
  + User can select auto integration by entering <yes>. To manually select integration, press enter. User will be ported to select integration value from 1 to 9. 1 is the lowest integration time(us) and 9 is fastest integration time(us).
* Sample number:
  + Enter the total number of samples to be captured. Value should be 2 or more.
* Sample interval:
  + Enter the interval time between samples in minutes. Value should be 0.1 minutes or more. Note: this is the time the system will be in sleep mode (power saving mode).
* Date and Time update:
  + Enter <yes> To update time, otherwise press <Enter>. Note: if update is selected system will prompt user to enter 4-digit year, 2-digit month, 2-digit day, day of the week 1 for Monday 7 for Sunday, 2-digit hour in military time, 2-digit minute.
* The system will display the expected run time to complete all samples. Note: led light will blink violet to indicate a sample has been collected and system will go into sleep mode (low power mode).
* To wake the system from standby mode:
  + Insert USB into port. Note: System will reset.

# How to Maintain & Improve the System

Take care when selecting the size of the SD card being used with the spectrometer. If the amount of data recorded during a single run causes the currently on-board card to run out of memory, the program will crash, as there is currently no failsafe for when there is no memory to store to. Be aware of the size of the card you choose to use when determining how many samples you want to take.

Should the responsivity of the spectrometer begin to diminish, the internal circuit board includes a trimmer potentiometer that can be used to manually adjust the gain of the output amplifier.

The spectrometer was unable to be extensively tested within an optical assembly under a known light source, so future calibrations will have to be performed by future project groups.

# System Features and their Functionality

The TCD1304DG chip can detect wavelengths of light in the range of 400 nm to 1000 nm. The linear array produces numerical data based upon the light that is taken in and the time the data was recorded, which is stored in non-volatile memory on the spectrometer.

The spectrometer can operate on its own running off battery and solar power and *does not require the user to be present while collecting data*. The battery will automatically charge while the spectrometer runs off solar power or when it is plugged in via USB. Data can be safely collected from the SD card after a data collection run even if the spectrometer runs out of power during a run (Data will be stored after a hard reset of the spectrometer).

The spectrometer allows for multiple (9) levels of integration to select from to allow for specific application dependent on light level (A higher light intensity requires a lower integration time). The spectrometer also has a built-in auto integration function, which automatically sets the integration time of the linear array based on detected light intensity for each sample, should the user not be able to be present to monitor samples. This can be selected during startup.

The produced csv files are dynamically split up to avoid exceedingly large files, making them easier to work with. The files can be easily worked with to transfer the data into any format the user may want.