

StressCam to detect drought



Getting Started



Precision
Sustainable
Agriculture



Agricultural
Research
Service

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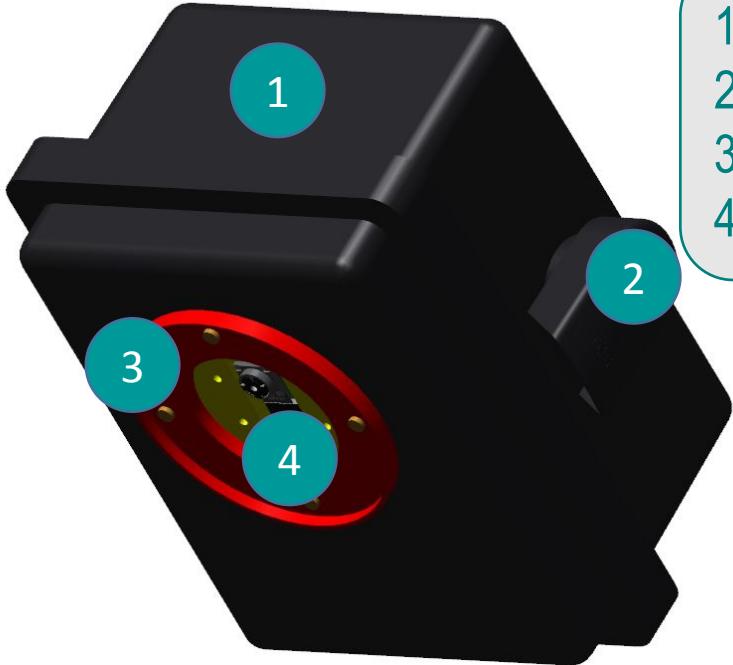


What's in the box?

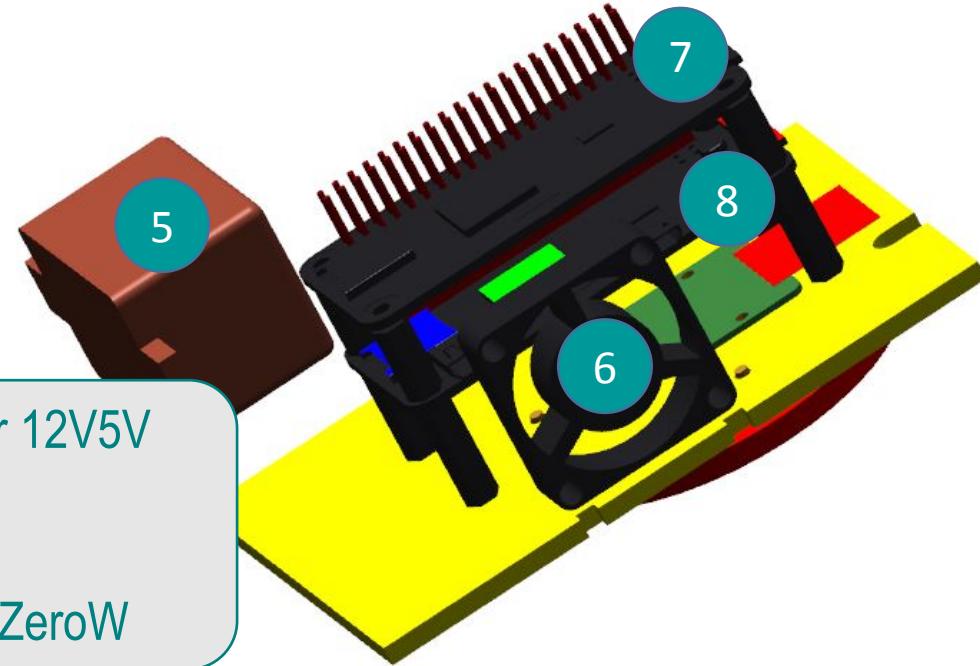
- Box enclosure that holds all the electronics except for the power system.
- UV Lens protector - 58mm.
- Two silica gel packets.
- Two SD card readers. 16GB and 32GB.
- 12V7AH battery.
- Two 5W solar panels or one 10W solar panel.
- Solar charger controller.
- All electronic stuff is pre-wire.
- Battery box with tap and strap.
- 2" PVC piping: one 10 ft pole, one 4 ft pipe, four (or two) 12 in pipes, one 5 in pipe, one 5-way cross PVC fitting connector, one T-connector. (For soybean one 45° joint).



Camera components



- 1 Box
- 2 Air vents
- 3 Lens ring
- 4 Camera board



- 5 Vol. Regulator 12V5V
- 6 Mini fan
- 7 WittyPi
- 8 Raspberry Pi ZeroW

Outside

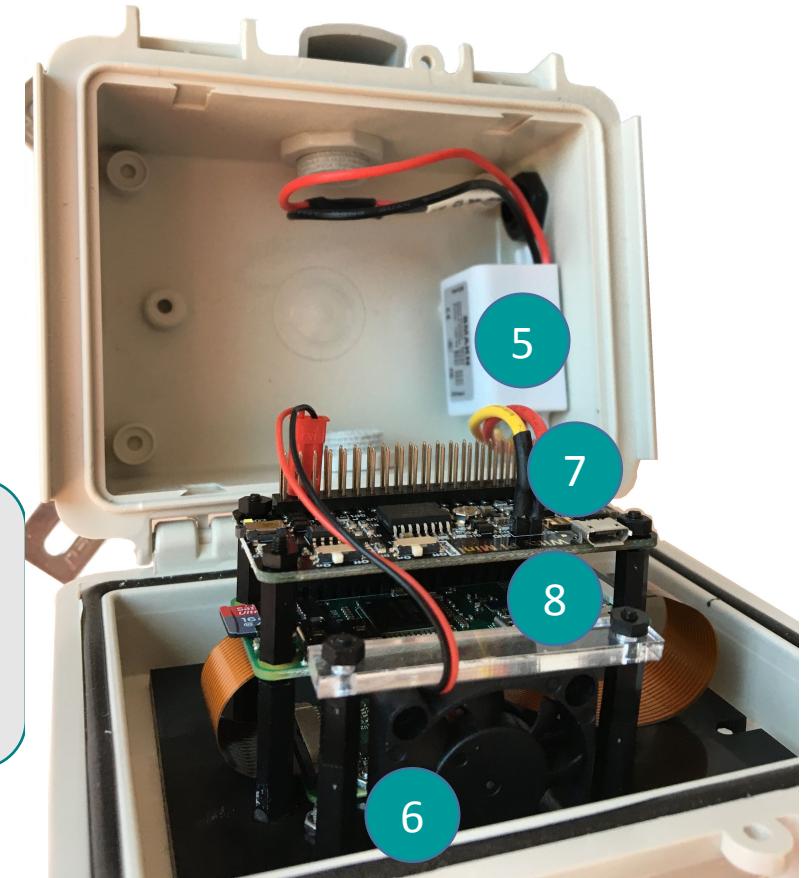
Inside

Camera components - Real device



- 1 Box
- 2 Air vents
- 3 Lens ring
- 4 camera chip

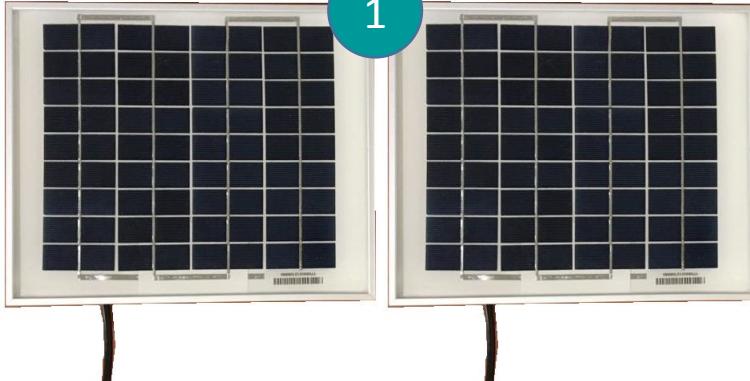
Outside



- 5 Vol. Regulator
- 6 Mini fan
- 7 WittyPi
- 8 RaspberryPi ZeroW

Inside

Power system components



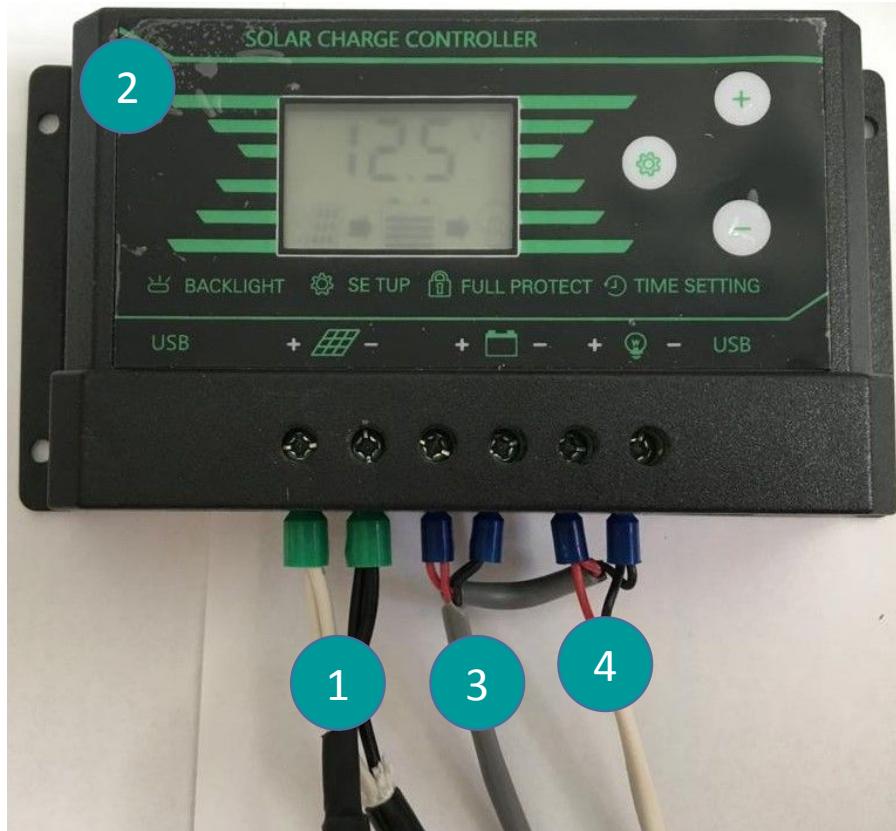
- 1 Solar panel(s)
- 2 Solar charge controller
- 3 Battery
- 4 Battery box



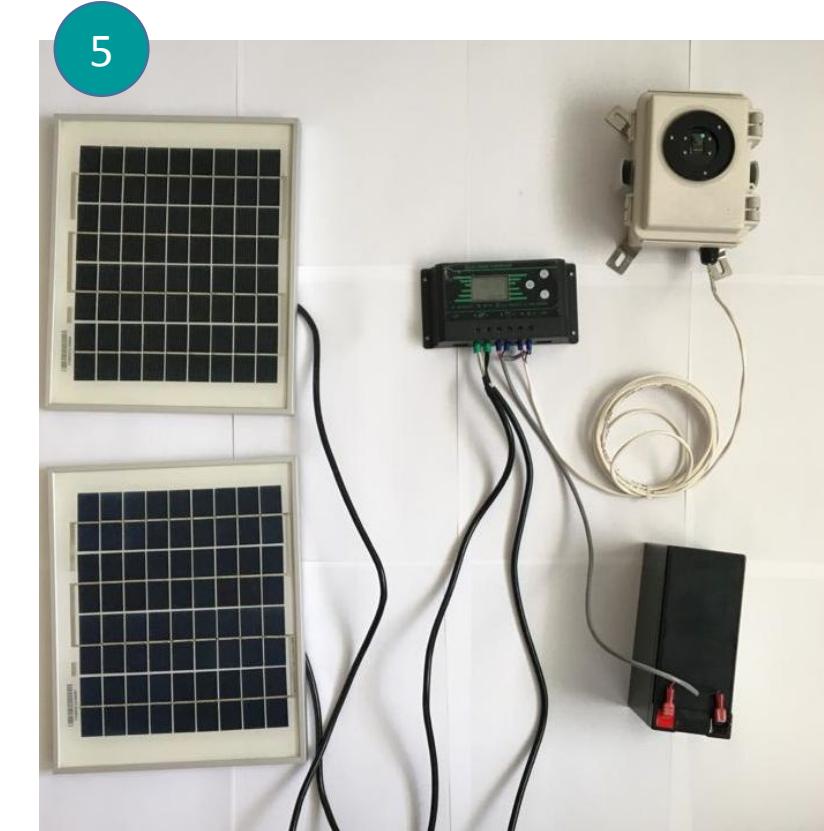
Install in the pole

Install in ground (in the box)

Solar charger connection



- 1 Solar panel(s)
- 2 Solar charge controller
- 3 Battery
- 4 Camera
- 5 Pre-wiring



Solar charger configuration (Pre-made, verify)

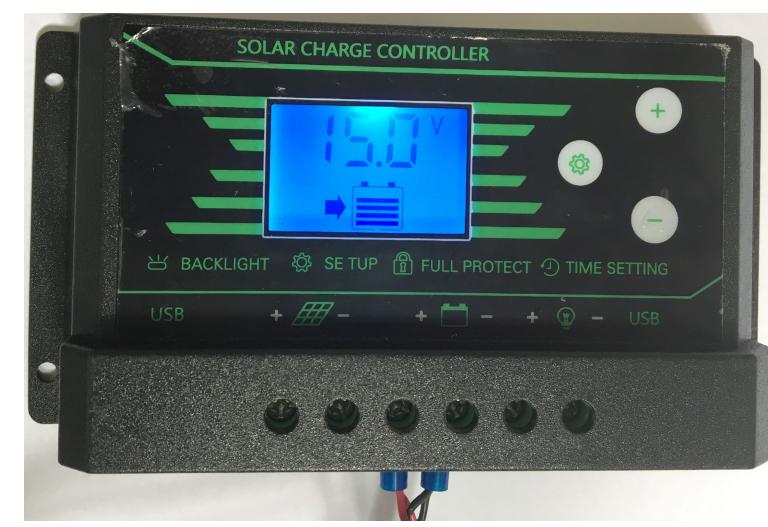
Disconnection voltage, 11.3 V.



Reconnection voltage, 12 V.



Panel input voltage, 15 V.



Make this configuration in the laboratory. Please check all batteries before going to the field. Once the battery is charged, test at least one charge-discharge cycle.

StressCam to detect drought



Installation



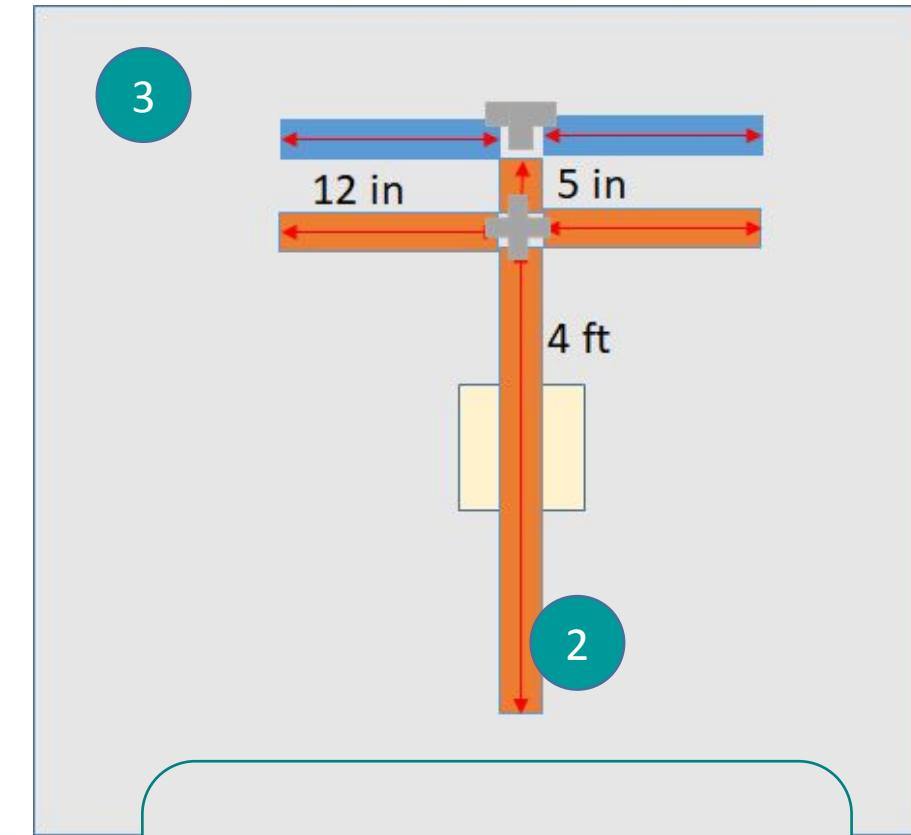
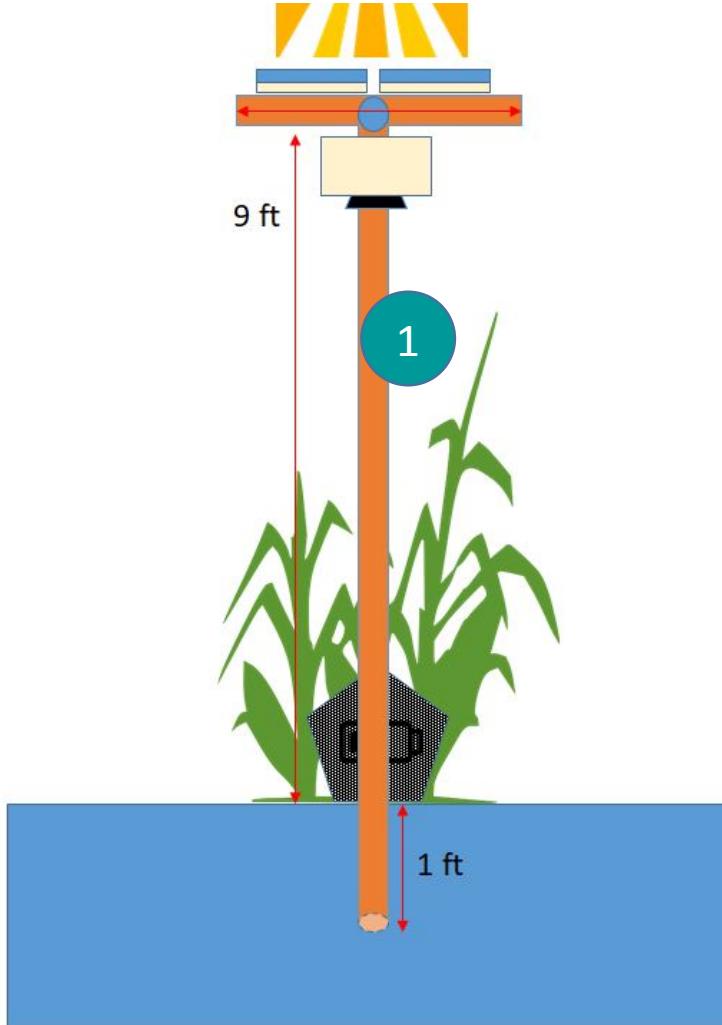
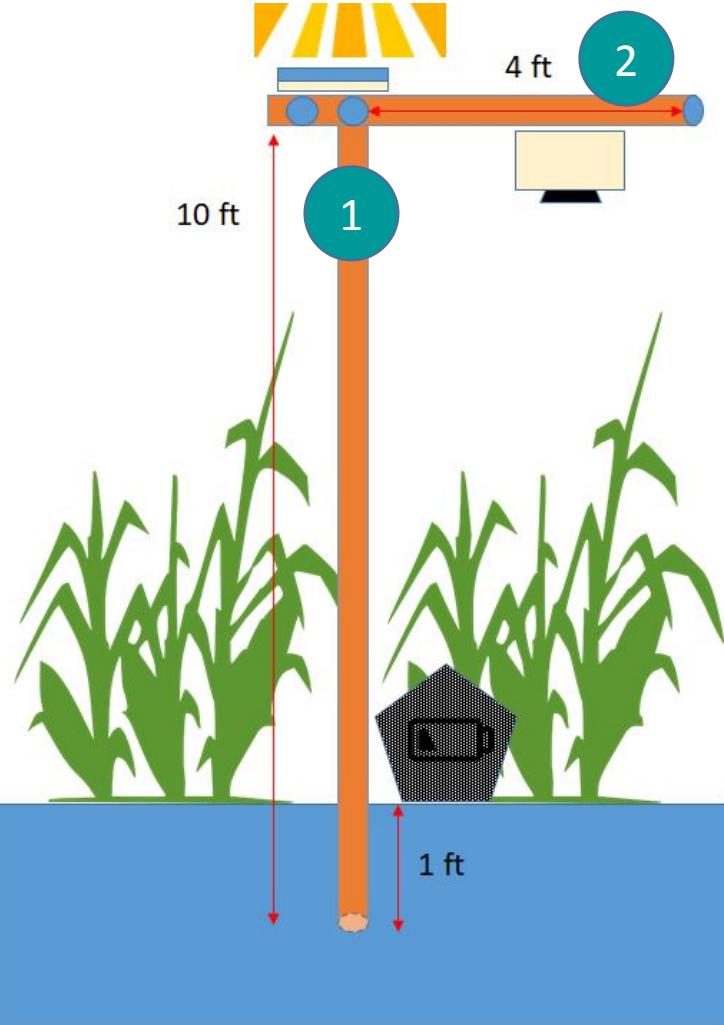
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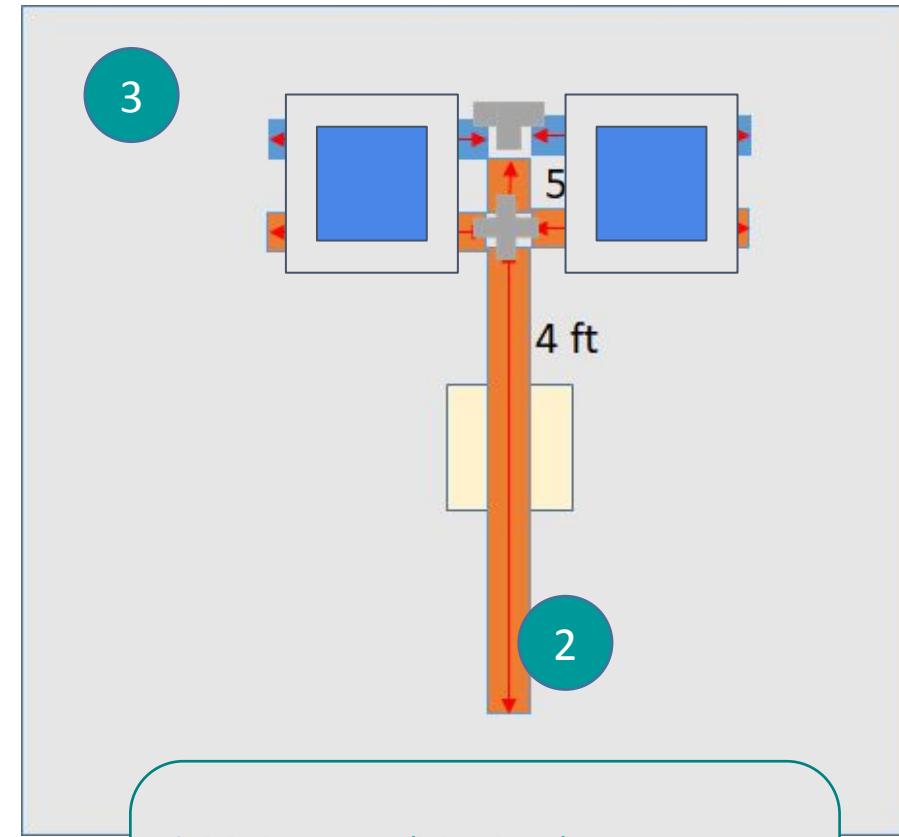
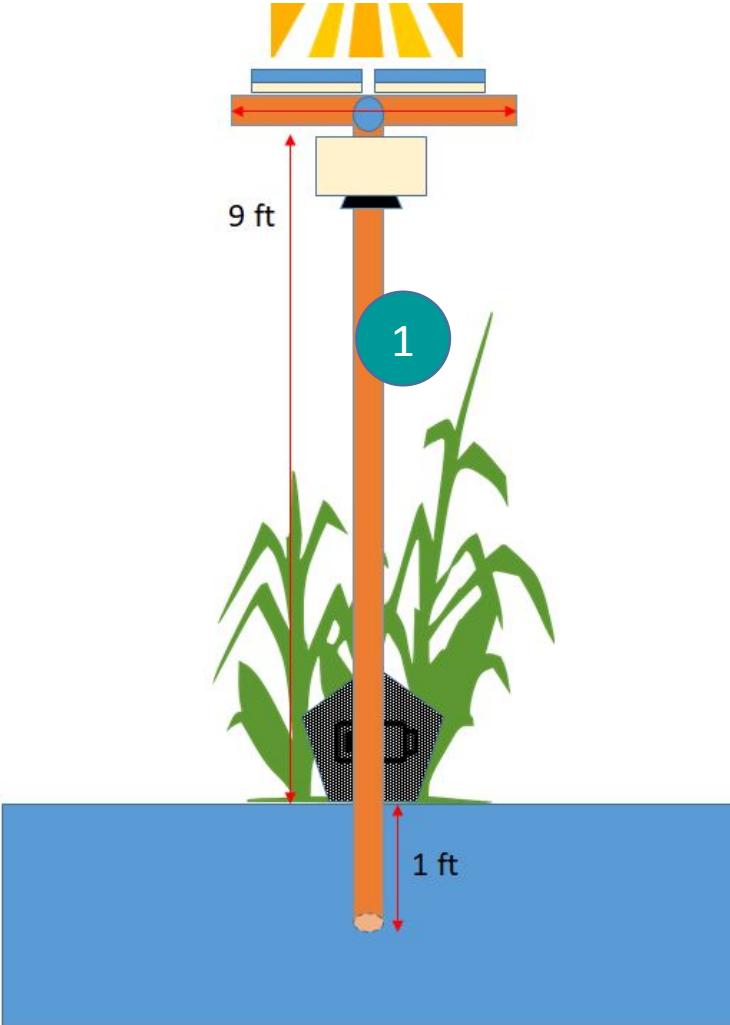
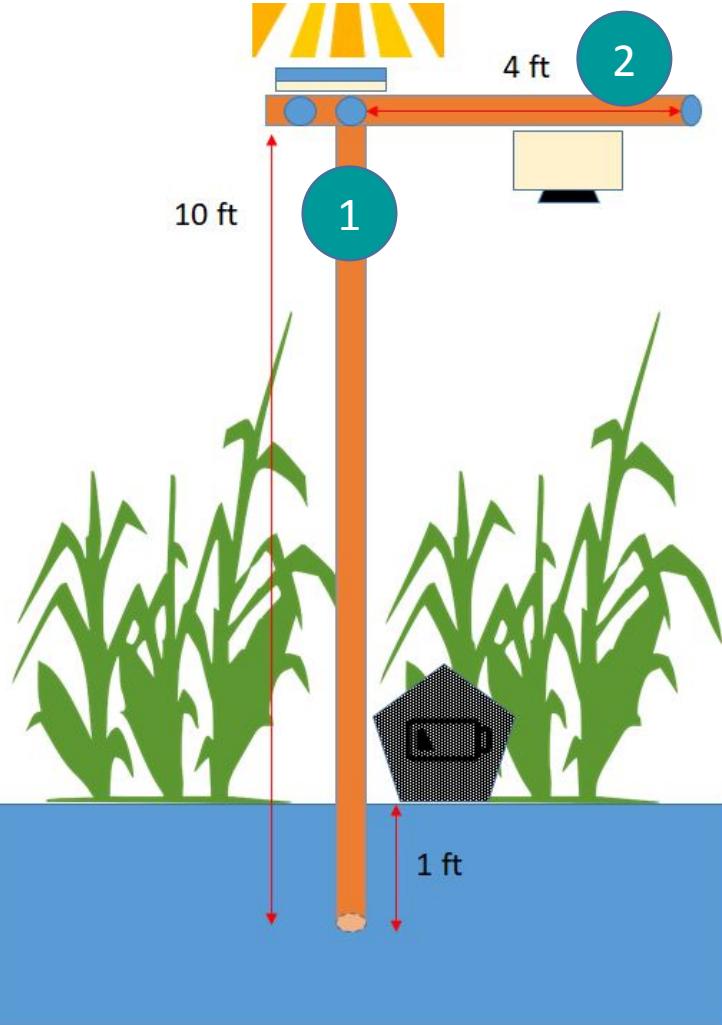


PVC Pipings



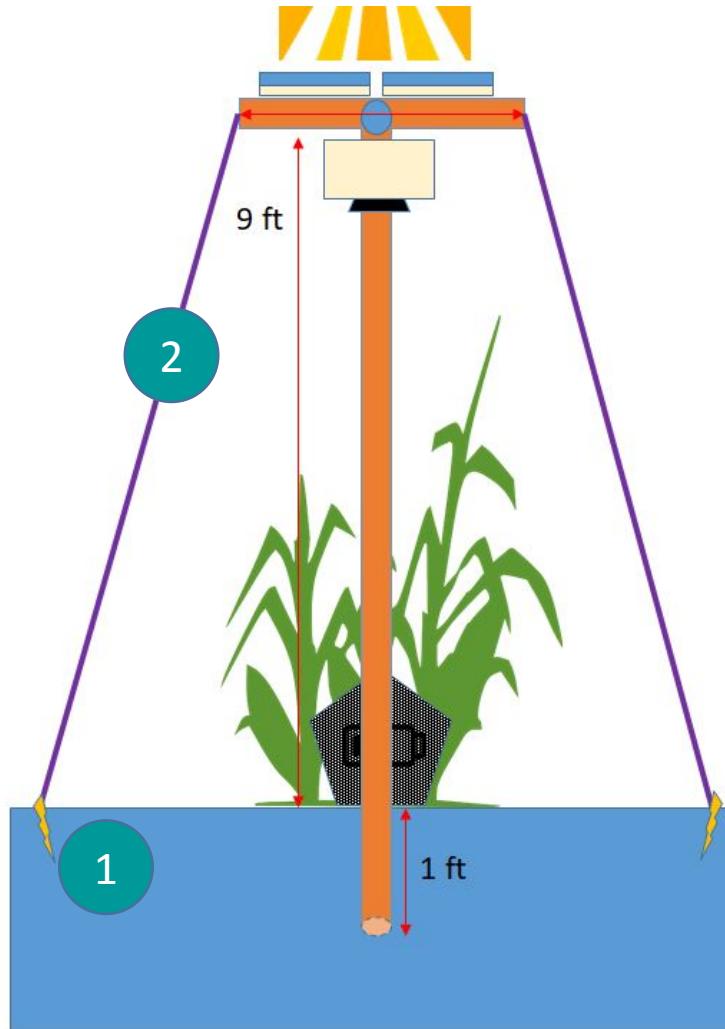
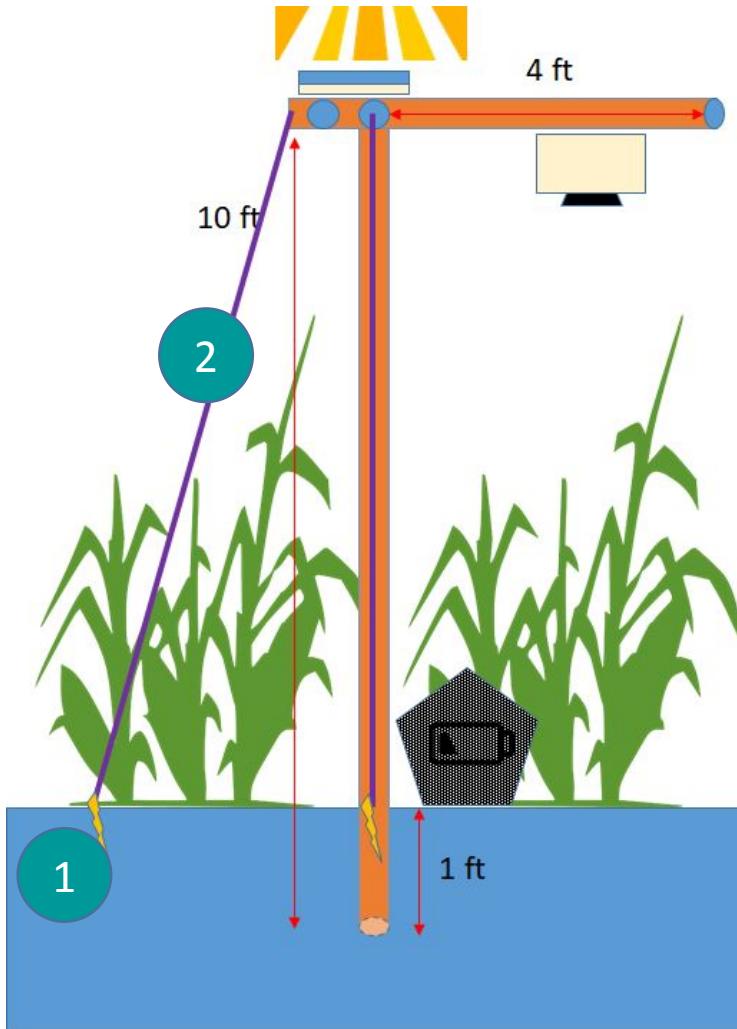
1 Main pole (Vertical)
2 Camera pipe (Horizontal)
3 Support for solar panel(s)

PVC Pipings



1 Main pole (Vertical)
2 Camera pipe (Horizontal)
3 Support for solar panel(s)

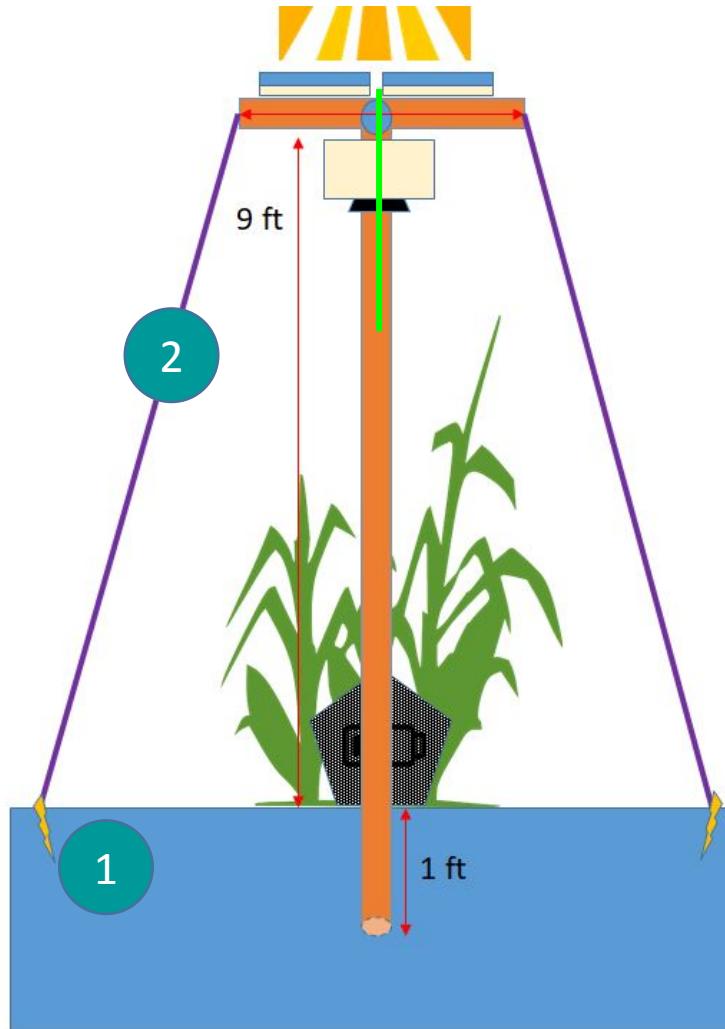
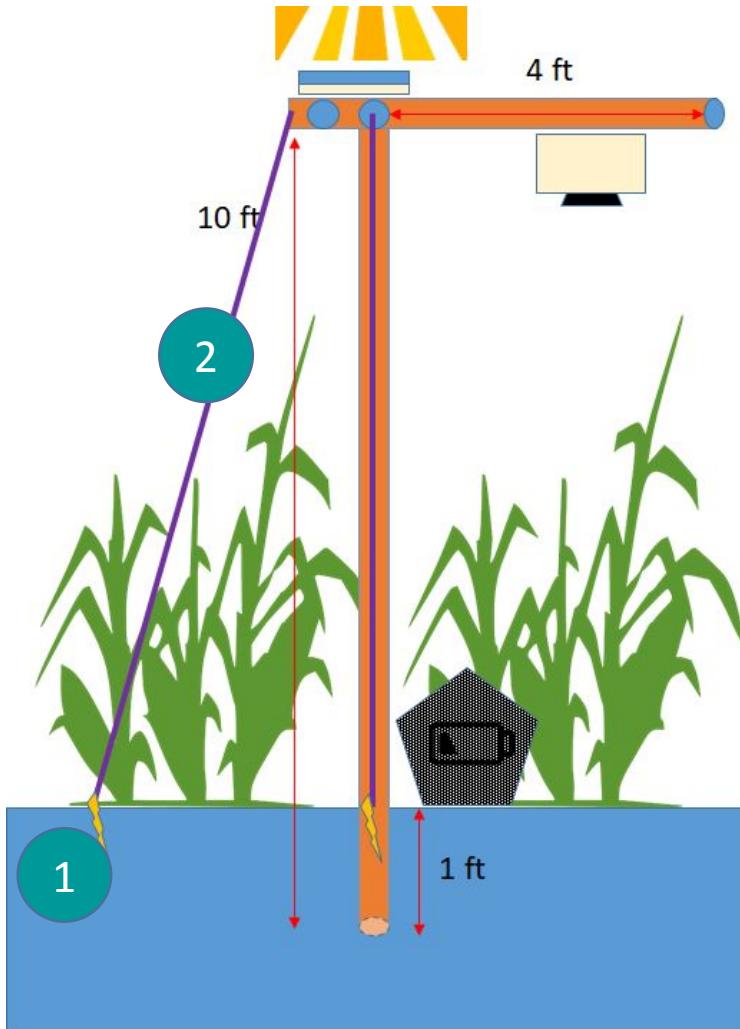
PVC Pipings



1 Stakes
2 Straps

It should be ensured that the main pole is not rotated. If this happens, a strap should be installed at the end of the tube that holds the camera.

PVC Pipings



1 Stakes
2 Straps

It should be ensured that the main pole is not rotated. If this happens, a strap should be installed at the end of the tube that holds the camera.

Electronics assembly and connections



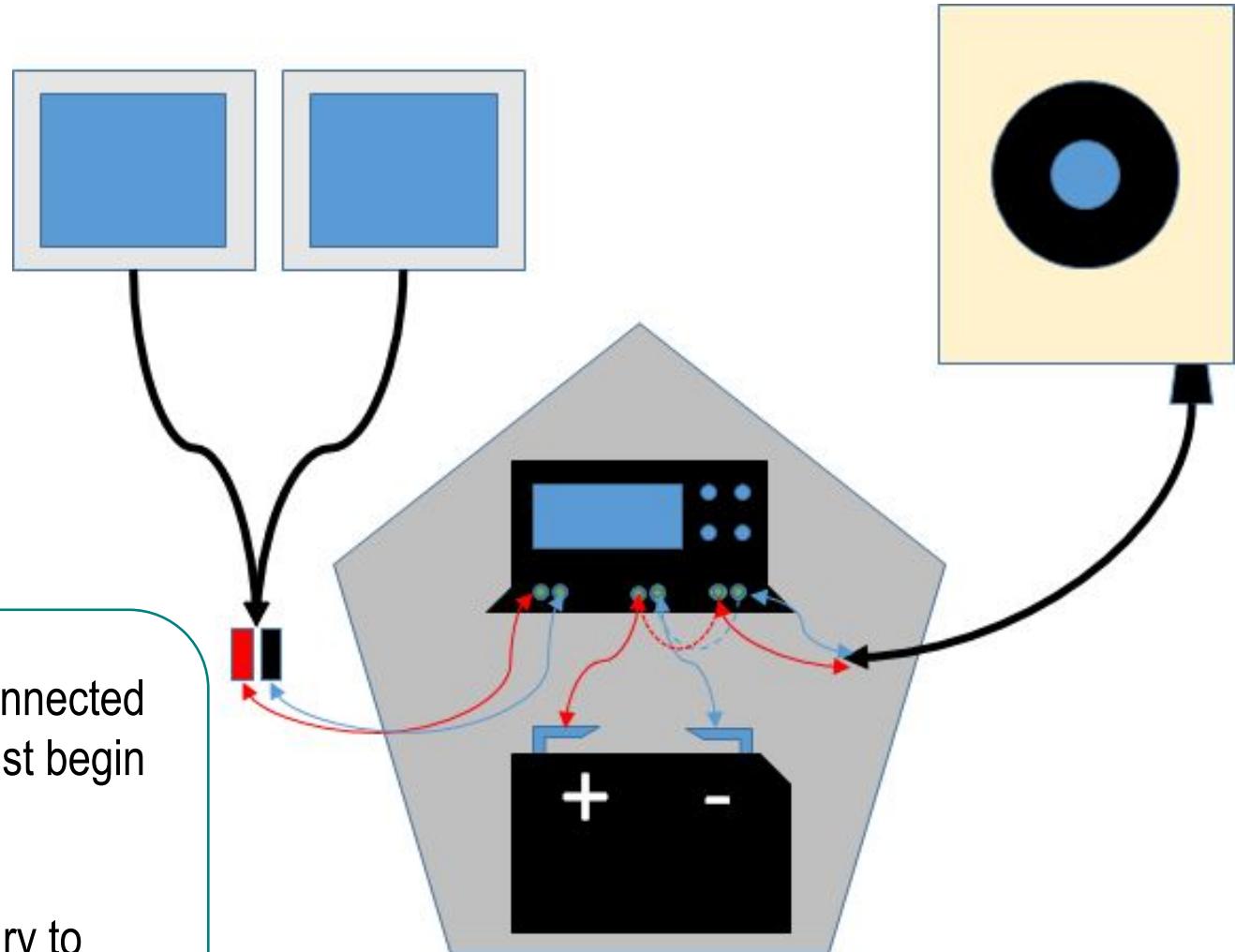
- 1 Box
- 2 Air vents
- 3 Lens ring
- 4 camera chip



Do this only before installing the cameras in the field.

- Remove the sticker that covers the camera lens in 4
- Install the UV Lens protector (58mm)
- Be especially careful with your prints on the UV Lens protector or dust or anything else that might obstruct the images.
- Periodically clean the lens of the cameras and check it for dust, grease or fog.
- If you find the camera cloudy or with water drops inside the lens, remove the lens carefully, clean the lens with Microfiber Lens Cleaning Cloth.
- Replace the two packages of silica gel. Leave the two packages that I remove to dry in a dry place.

Electronics assembly and connections



Since the controller is automatic, the battery must be connected first for it to detect its voltage, and the disconnection must begin with the disconnection of the panels.

Connection order: battery, camera, panel.

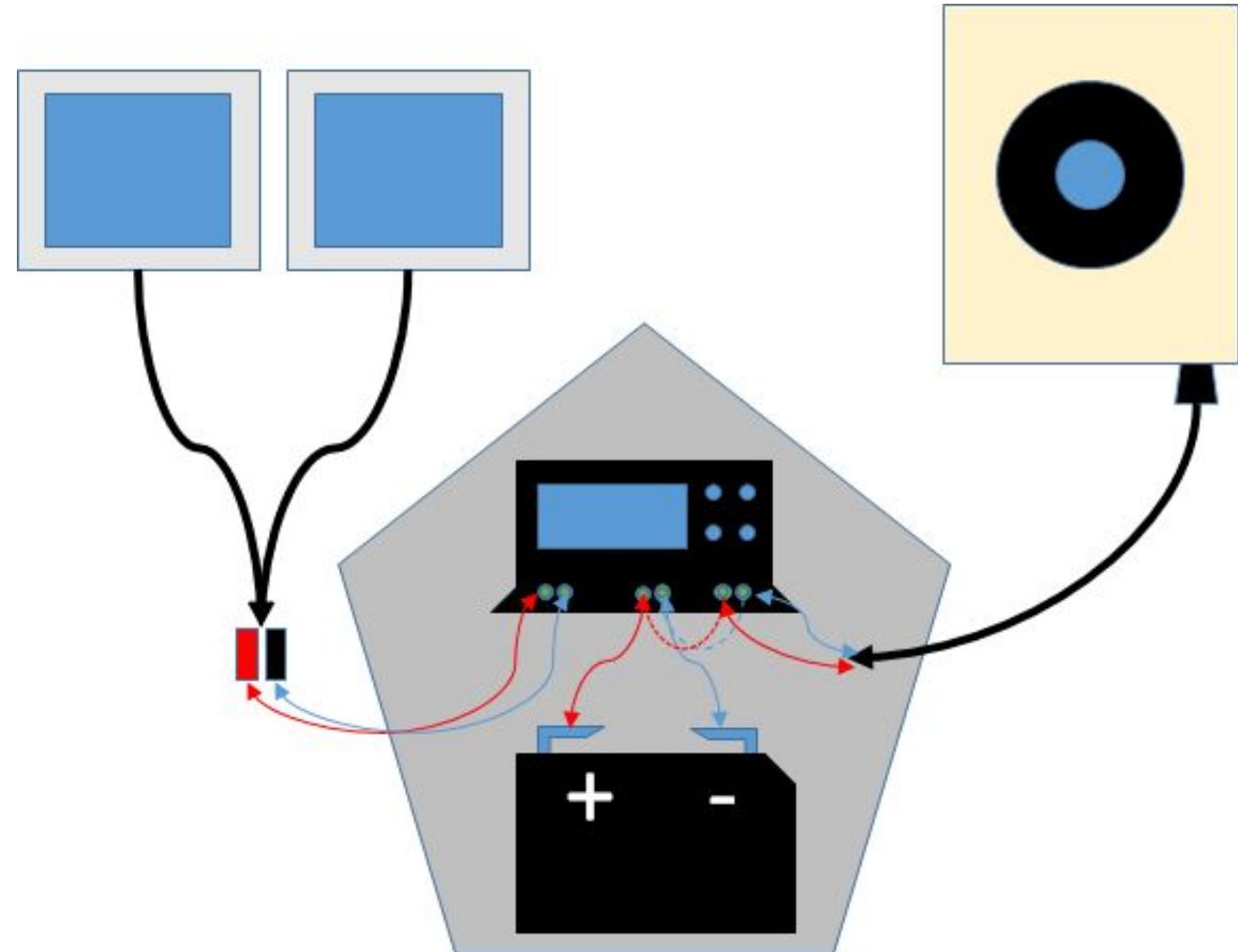
Disconnection order: panel, battery, it is not necessary to disconnect the load.

See slides 6 and 7

Electronics assembly and connections

After connecting everything, you can verify that the camera is working properly if:

- The wittyPi has a red led on.
- The Raspberry Pi has a green led on.
- The fan is working.



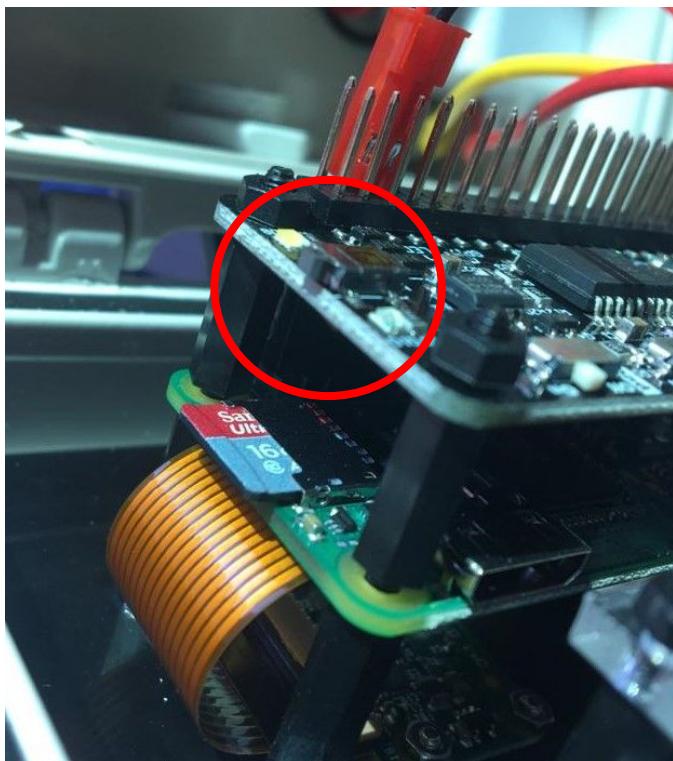
Electronics assembly and connections

After connecting everything, you can verify that the camera is working properly if:

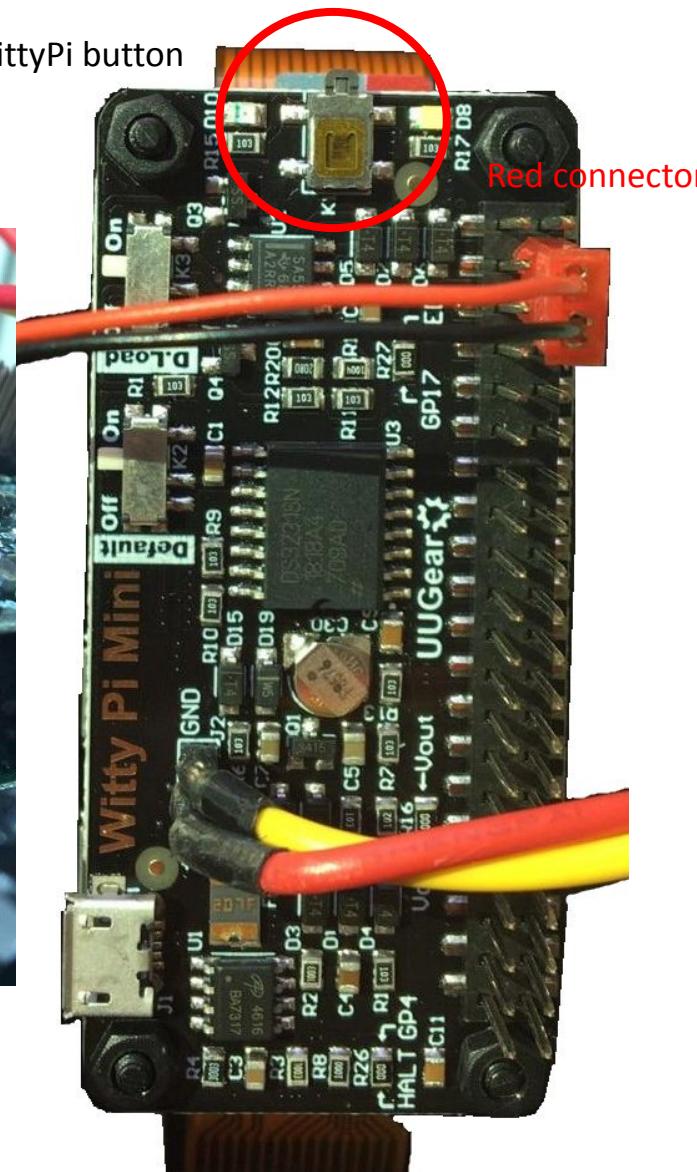
- The wittyPi has a red led on.
 - The Raspberry Pi has a green led on.
 - The fan is working.

What do you do if...?

- The wittyPi shows a flashing white LED or it shows a permanent white led:
 - Long press the wittypi button until shutdown and press again.
 - The wittyPi shows a red led but the green led of the raspberry is not on.
 - Check the mac address.
 - The fan does not turn on and the red (wittyPi) and green (RaspberryPi) leds do.
 - Plug and unplug the red connector verify red cable is in second pin of right column.



WittyPi button



Electronics assembly and connections

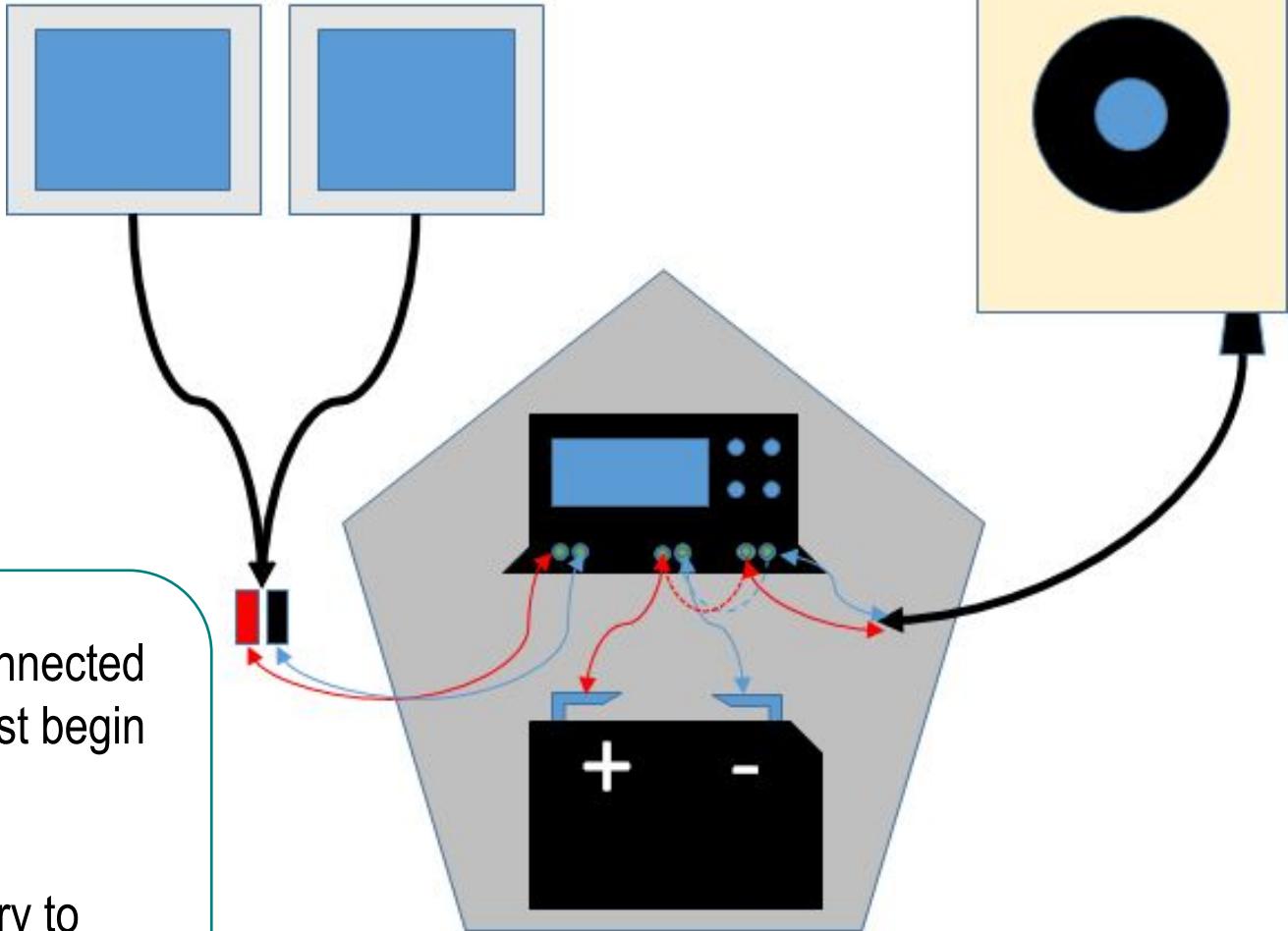


Adjust the camera facing the ground and make sure that the air vents are completely perpendicular to the ground.

Since the controller is automatic, the battery must be connected first for it to detect its voltage, and the disconnection must begin with the disconnection of the panels.

Connection order: battery, camera, panel.

Disconnection order: panel, battery, it is not necessary to disconnect the load.



See slides 6 and 7

Configuration of the camera in the field (Do not do this in the lab)

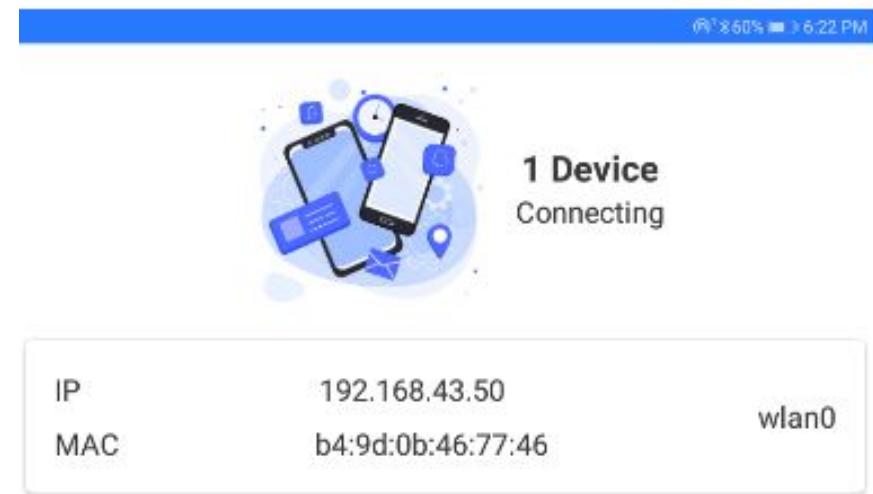
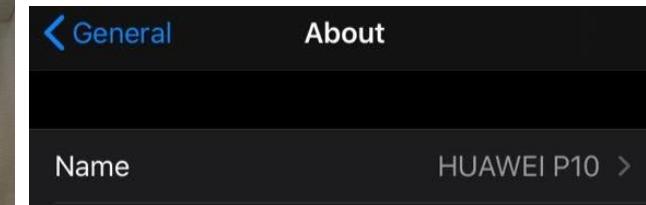
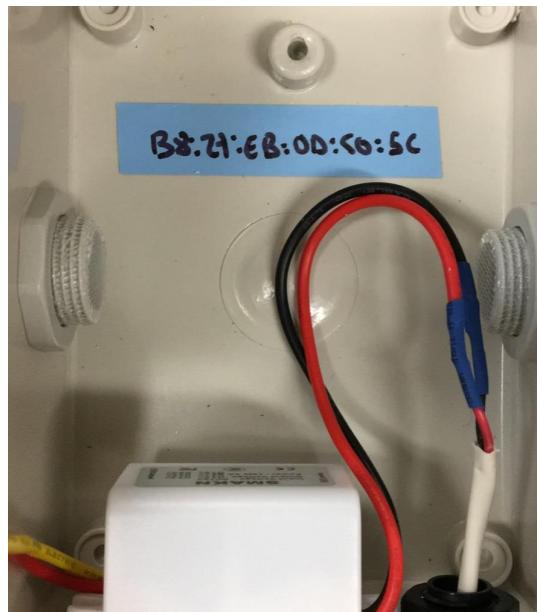
Prerequisites:

Download *termius* to your tablet or cell phone (log in with an email and create a password).

Download *Free WiFi Hotspot*. Find the IP address of the camera you want to configure, guided by the mac address of that camera

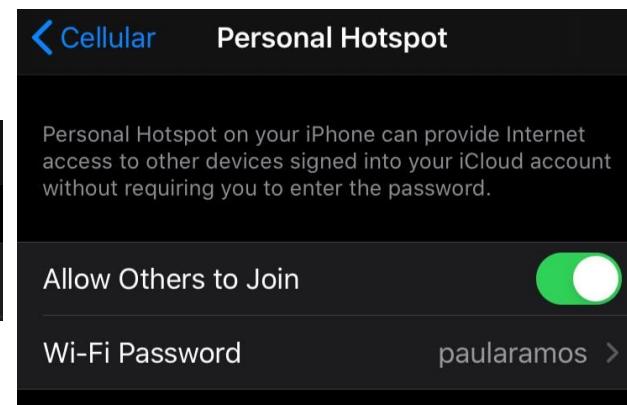
(<https://play.google.com/store/apps/details?id=com.secrettown.wifihotspot>) (You can find this value inside/outside of the camera, see photos).

Create a hotspot access in your device. Network name: HUAWEI P10, password: paularamos. Activate your hotspot.



Creating a hotspot on Iphone:

- Change the name to “HUAWEI P10” in:
Settings → General → About → Name
- Turn on the hotspot in:
Settings → Cellular → Personal Hotspot
- Change the password to “paularamos”.



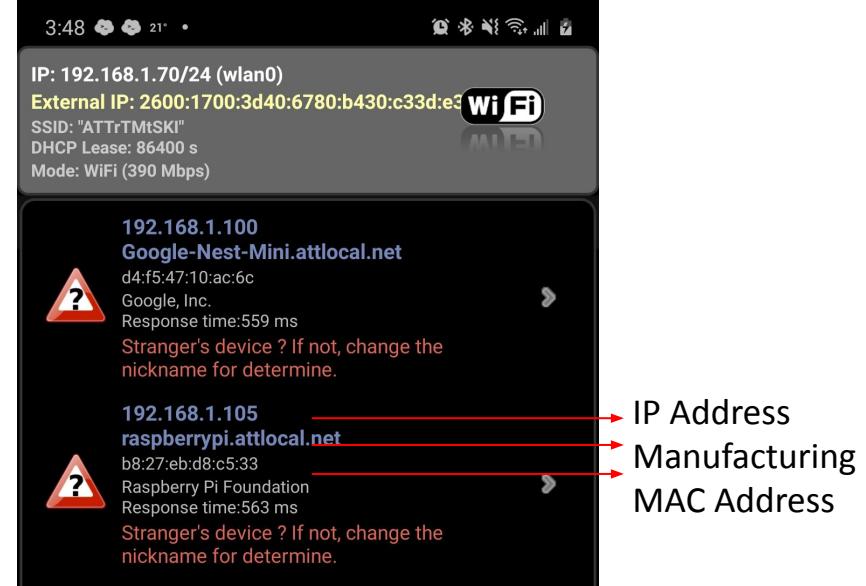
Configuration of the camera in the field (Do not do this in the lab)

Prerequisites:

Download *termius* to your tablet or cell phone (log in with an email and create a password).

Download *Network IP Scanner*. Find the IP address of the camera you want to configure, guided by the mac address of that camera (**You can find this value inside of the camera**).

Create a hotspot access in your device. Network name: HUAWEI P10, password: paularamos. Activate your hotspot.



Step 1:

Open *termius* in your device, click in three lines and select “Terminals”
Type ssh [pi@XXX.XXX.XXX.XXX](ssh://pi@XXX.XXX.XXX.XXX) where Xs are IP address detected by *Network IP Scanner*
password: raspberry

Step 2:

```
Type: date -s "19 APR 2020 11:14:00"
Type: cd wittyPi/
Now type: sudo ./wittyPi.sh
Type option 1
Verify that the system's and RTC's
times are the same
Type option 6
Type option 1 (6:00_on_20:00_off.wpi)
Type option 8 (Exit)
Type: sudo reboot
```

Step 3:

Check that the camera's on again. Wait 2 minutes and then enter the camera again; ssh [pi@XXX.XXX.XXX.XXX](ssh://pi@XXX.XXX.XXX.XXX); password: raspberry

Configuration of the camera in the field (Do not do this in the lab) - Android

Step 1:

Open *termius* in your device, click in three lines and select “Terminals”

Type ssh [pi@XXX.XXX.XXX.XXX](ssh://pi@192.168.43.206) where Xs are IP address detected by *Network IP Scanner*

password: raspberry



Step 2:

Type: date -s "19 APR 2020 11:14:00"

Type: cd wittyPi/

Now type: sudo ./wittyPi.sh

Type option 1

Verify that the system's and RTC's times are the same

Type option 6

Type option 1 (6:00_on_20:00_off.wpi)

Type option 8 (Exit)

Type: sudo reboot

```
4:12 ⓘ ⓘ ⓘ ...  
Linux raspberrypi 4.19.87+ #1294 Thu Jan 30 13:10:54 GMT 2020 armv6l  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*copyright.  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Mon Jun  8 09:34:53 2020  
  
SSH is enabled and the default password for the 'pi' user has not been changed.  
This is a security risk - please login as the 'pi' user and type 'passwd' to set a new password.  
  
pi@raspberrypi: ~ date  
Mon 15 Jun 2020 04:08:43 PM EDT  
pi@raspberrypi: ~ cd wittyPi/  
pi@raspberrypi: ~/wittyPi $ sudo ./wittyPi.sh  
=====  
| Witty Pi - Realtime Clock + Power Management for Raspberry Pi  
| < Version 2.67 > by UUGear s.r.o.  
|  
=====  
>>> Current temperature: 29.75°C / 85.55°F  
>>> Your system time is: Mon 15 Jun 2020 16:09:42 EDT  
>>> Your RTC time is: Mon 15 Jun 2020 16:09:42 EDT  
Now you can:  
1. Write system time to RTC  
2. Write RTC time to system  
3. Synchronize time  
4. Schedule next shutdown [02 08:18:00]  
5. Schedule next startup [02 08:18:00]  
6. Choose schedule script  
7. Reset data...  
8. Exit  
What do you want to do? (1-8) 6  
I can see 7 schedule scripts in the "schedules" directory:  
[1] 6:00_on_20:00_off.wpi  
[2] 7:00_on_7:30_off_21:00_on_21:30_off.wpi  
[3] on_10m_every_2h.wpi  
[4] on_1h_every_2d.wpi  
[5] on_5m_every_20m.wpi  
[6] on_5m_off_10_min_off_10h_55m.wpi  
[7] turn_on_every_hour.wpi  
Which schedule script do you want to use? (1-7) 1  
Copying "6:00_on_20:00_off.wpi" to "schedule.wpi"...  
Running the script...  
----- 2020-06-15 16:12:05 -----  
Schedule next shutdown at: 2020-06-15 18:00:00  
Schedule next startup at: 2020-06-16 07:00:00  
  
Done :-)  
=====  
>>> Current temperature: 30.25°C / 86.45°F  
>>> Your system time is: Mon 15 Jun 2020 16:12:08 EDT  
>>> Your RTC time is: Mon 15 Jun 2020 16:12:08 EDT  
Now you can:  
1. Write system time to RTC  
2. Write RTC time to system  
3. Synchronize time  
4. Schedule next shutdown [15 18:00:00]  
5. Schedule next startup [16 07:00:00]  
6. Choose schedule script [in use]  
7. Reset data...  
8. Exit  
What do you want to do? (1-8) 8  
pi@raspberrypi:~/wittyPi $ |
```

Step 3:

Check that the camera's on again. Wait 2 minutes and then enter the camera again; ssh [pi@XXX.XXX.XXX.XXX](ssh://pi@192.168.43.206); password: raspberry

Configuration of the camera in the field (Do not do this in the lab) - Windows

Step 1:

- Check that your computer is in the same HUAWEI P10 network.
- You can create this hotspot on your computer.: Settings→ Network&Internet→ Mobile hotspot Turn the hotspot on and change the name and password.
- Open cmd (Command Prompt) in the computer.
- Type ssh [pi@XXX.XXX.XXX.XXX](ssh pi@XXX.XXX.XXX.XXX) where Xs are IP address detected by [Advanced IP Scanner](#) or mobile hotspot settings.
- password: raspberry

Mobile hotspot

Share my Internet connection with other devices



Share my Internet connection from



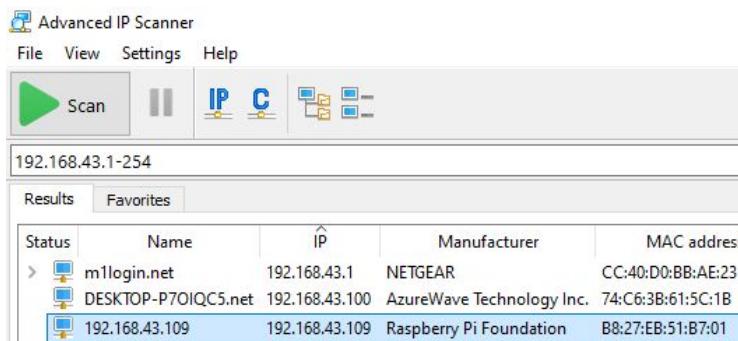
Network name: HUAWEI P10

Network password: paularamos

Edit

Devices connected: 6 of 8

Device name	IP address	Physical address (MAC)
raspberrypi	192.168.137.98	b8:27:eb:51:b7:01



Step 2:

- Type: date -s "19 APR 2020 11:14:00"
- Type: cd wittyPi/
- Type: sudo ./wittyPi.sh
- Type option 1

Verify that the system's and RTC's times are the same

- Type option 6
- Type option 1 (6:00_on_20:00_off.wpi)
- Type option 8 (Exit)
- Type: sudo reboot

Step 3:

Check that the camera's on again. Wait 2 minutes and then enter the camera again;
ssh [pi@XXX.XXX.XXX.XXX](ssh pi@XXX.XXX.XXX.XXX); password: raspberry

If you have some error typing "date" try this:
Type: sudo date -s "19 APR 2020 11:14:00"

```
C:\Users\ANE>ssh pi@192.168.137.98
pi@192.168.137.98's password:
Are you sure you want to continue connecting (yes/no)? yes
pi@raspberrypi:~ $ date
Fri 19 Jun 2020 10:33:50 AM EDT
pi@raspberrypi:~ $ cd wittyPi/
pi@raspberrypi:~/wittyPi $ sudo ./wittyPi.sh
=====
Witty Pi - Realtime Clock + Power Management for Raspberry Pi
< Version 2.67 >      by UUGear s.r.o.

=====
>>> Current temperature: 28.0°C / 82.4°F
>>> Your system time is: Fri 19 Jun 2020 09:51:03 EDT
>>> Your RTC time is:   Wed 25 Mar 2020 01:50:41 EDT
Now you can:

What do you want to do? (1~8) 1
Writing system time to RTC...
Done :-)

>>> Your system time is: Fri 19 Jun 2020 09:51:34 EDT
>>> Your RTC time is:   Fri 19 Jun 2020 09:51:34 EDT

What do you want to do? (1~8) 6
Which schedule script do you want to use? (1~7) 1
Copying "6:00_on_20:00_off.wpi" to "schedule.wpi"...
Running the script...
----- 2020-06-19 09:51:31 -----
Schedule next shutdown at: 2020-06-19 18:00:00
Schedule next startup at: 2020-06-20 07:00:00
-----
Done :-)

What do you want to do? (1~8) 8
pi@raspberrypi:~/wittyPi $ sudo reboot
Connection to 192.168.137.98 closed by remote host.
Connection to 192.168.137.98 closed.
```

StressCam to detect drought



Maintenance



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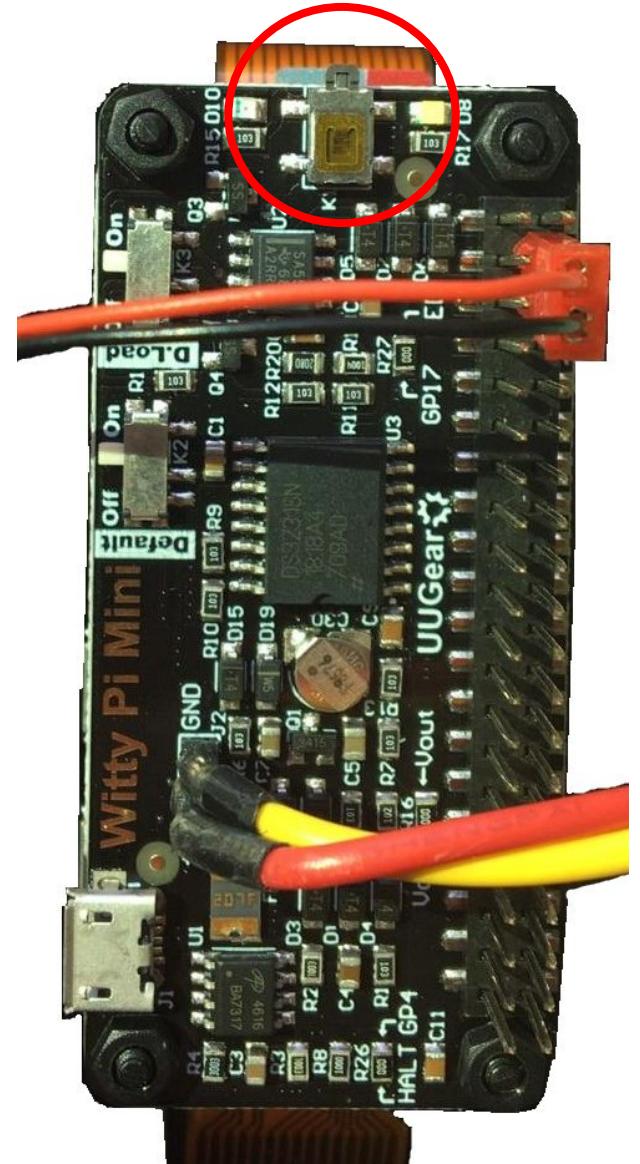
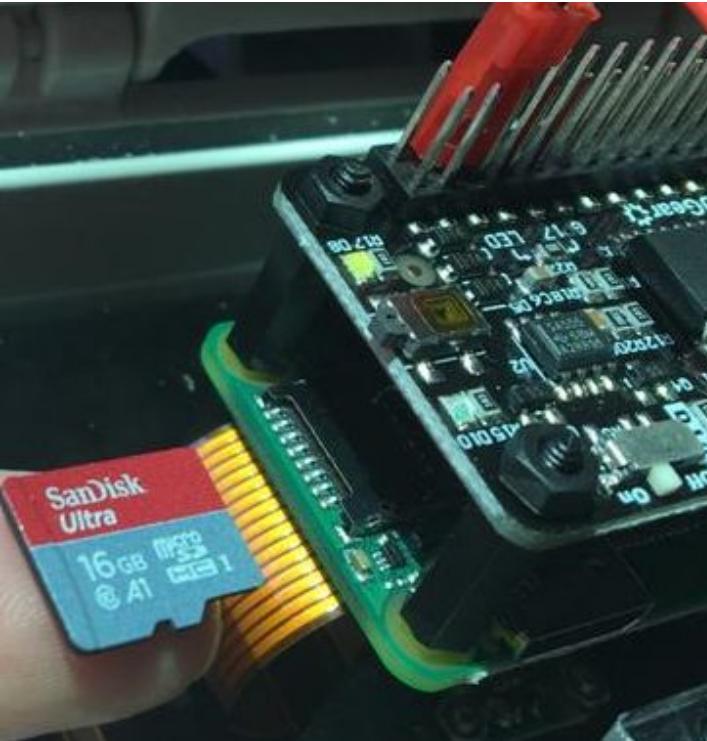
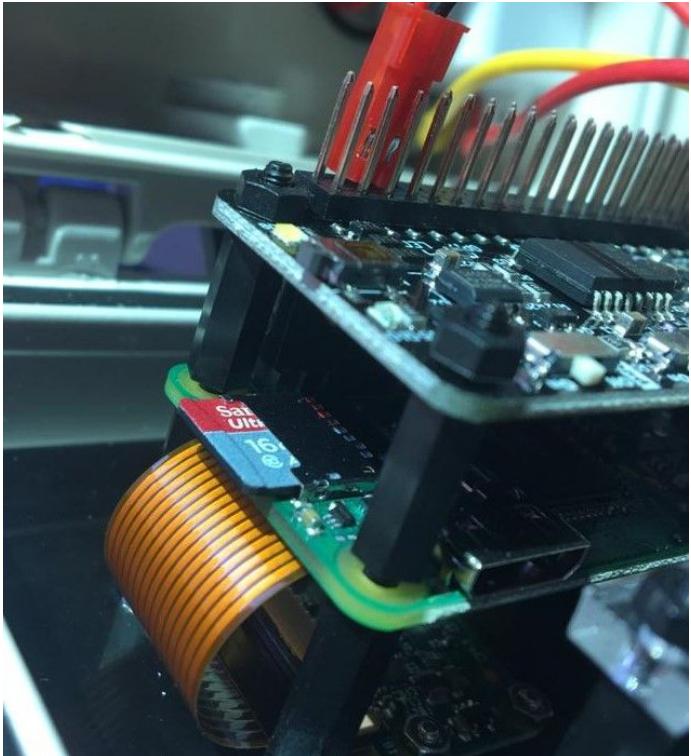


Check ...

- Verify that the solar panels are properly located and clean.
- Be careful of the spiders and other insects/animals inside the battery box or in the air vents of the camera
- Clean the holes in the cameras and regulators with cotton swabs
- Check the air vents, that they are in a good position, that there is good air flow and that there are not obstructions
Check that the battery's voltage shown on the regulator is above 11 Volts. Otherwise the battery must be replaced and the discharged battery should be taken to the lab for charging.
- Check that the solar panel is well connected to the terminals, pull the cable and make sure that it does not disconnect from the regulator. Check the other terminals as well.
- In case that the battery voltage is flashing on the regulator, check the battery voltage, check the connections and change the regulator, in this order of operation.

Replace microSD card in the field

- Turn off the camera by pressing the wittypi button (shown above)
- Remove the SD, put it in a labelled bag
- Put the new SD in
- Press the wittypi button again and repeat all the steps from slide 13
 - See photos removing the SD and reinstalling it



Download images and wittyPi.log file to computer

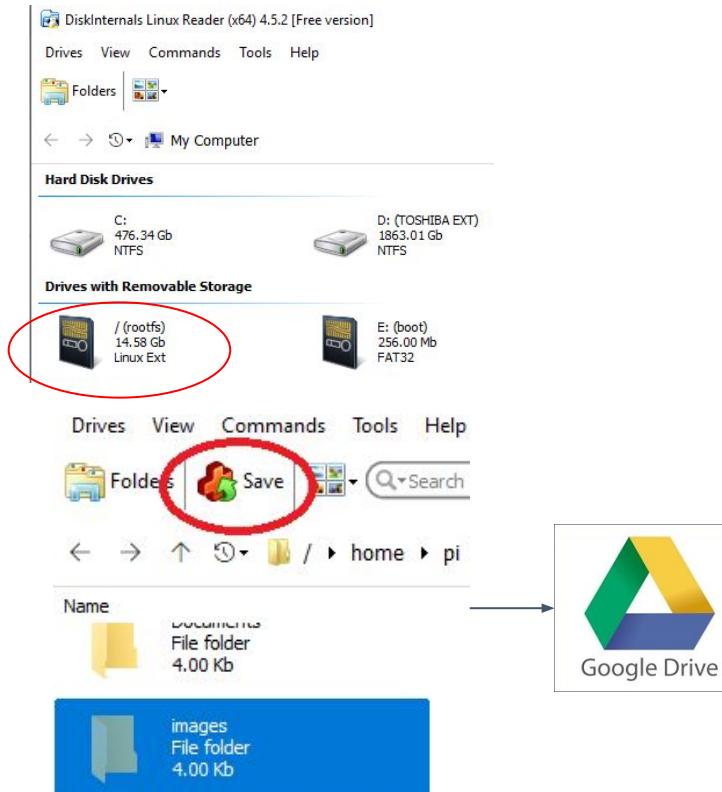
Install *Linux Reader* on the computer:
<https://www.diskinternals.com/linux-reader/>

Steps:

- Insert microSD card with SD adapter on computer
- Open Linux Reader
- Go to: /(rootfs) → home → pi
- Select “Images” folder and save it on the computer
- Go to: /(rootfs) → home → pi → wittyPi
- Select “wittyPi.log” file and save it on the computer

It is not necessary to configure the wittyPi when installing this microSD card again on the raspberry. It's just necessary to check the time doing the next:

Open *termius* in your device, click in three lines and select “Terminals”
Type ssh pi@XXX.XXX.XXX.XXX where Xs are IP address detected by *Network IP Scanner*
password: raspberry



Type: rm -fv /home/pi/images/*
Type: date -s "19 APR 2020 11:14:00"
Type: cd wittyPi/
Now type: sudo ./wittyPi.sh
Type option 1

DATA STRUCTURE IN GOOGLE DRIVE FOLDER

StressCam	NC_LongLat	Exp#	StressCAM1
North Carolina	StressCAM2	...	StressCAM1
ML_LongLat	Exp#	StressCAM2	StressCAM1
Maryland	StressCAM2	...	StressCAM1
AL_LongLat	Exp#	StressCAM2	StressCAM1

StressCam to detect drought



Troubleshooting



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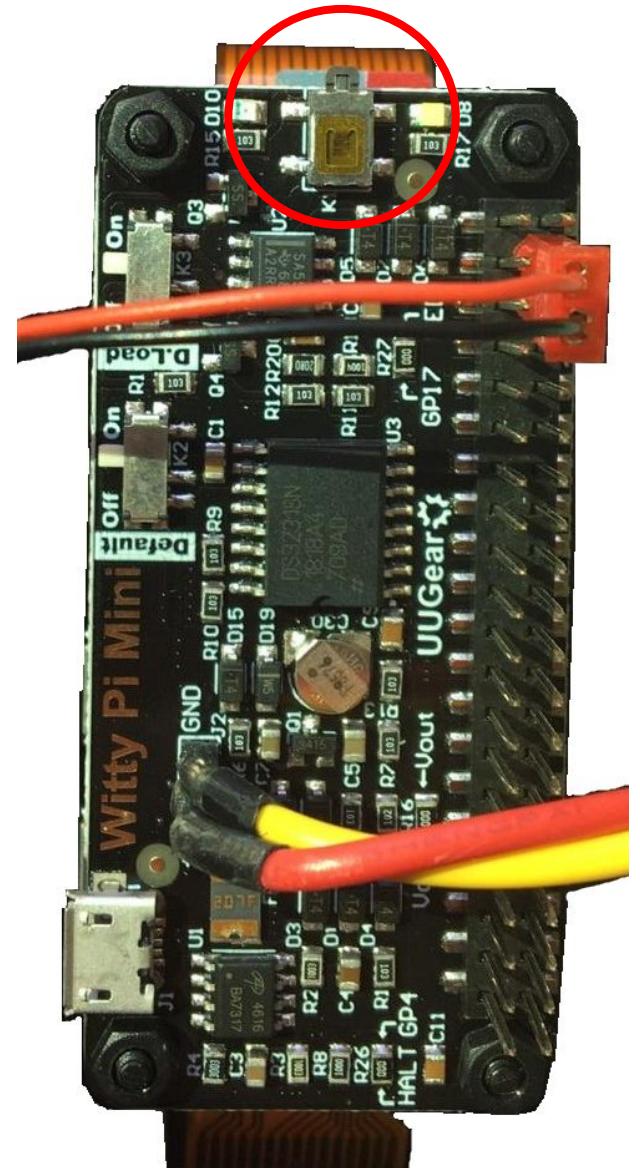
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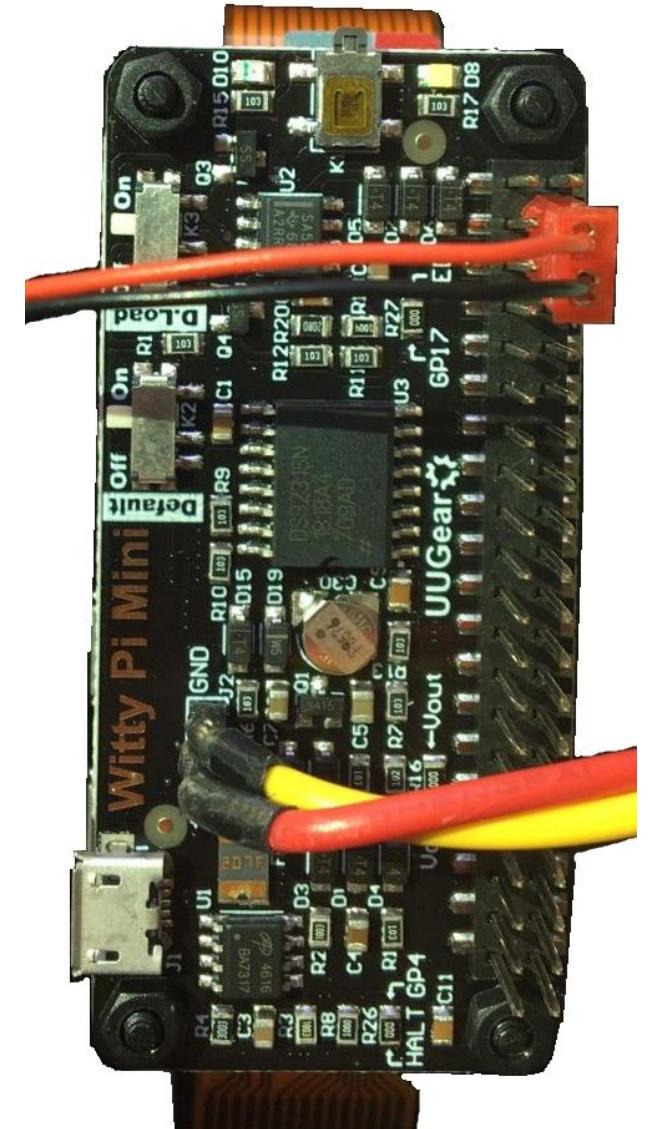
Troubleshooting

- When changing the battery, follow the order of connection and disconnection as shown in slide 12.
- The controller must be replaced if it is wet or if it does not recognize the connected battery.
- If there is a voltage problem (deep battery discharge or panel or battery disconnection problem in the controller, or a controller problem) the timestamp of the raspberry pi must be reconfigured and synchronized with the time of the wittypi.
- It is possible that the camera does not turn on automatically. In this case, turn it on using the button that accompanies the wittypi. **See Photo.**
- If once in the field you notice that the pole of the camera has moved, it must be aligned again and secured with a fourth stake.
- If you check the memory and find that there are no files in it, you should report this event and, on your next field visit, pick up the camera and take it to the lab and do a hardware check.
- Check that the cables are not eaten by animals. Try to fix the problem with duct tape, otherwise replace the camera in the field and take it to the lab for repair. Check all the cables and replace if necessary.

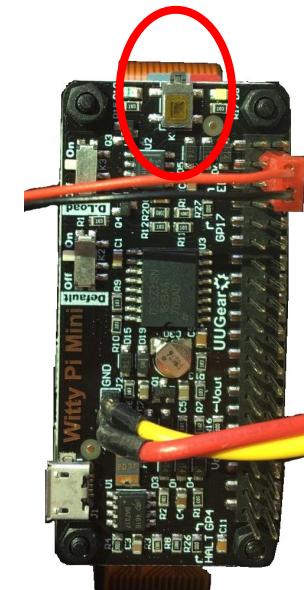
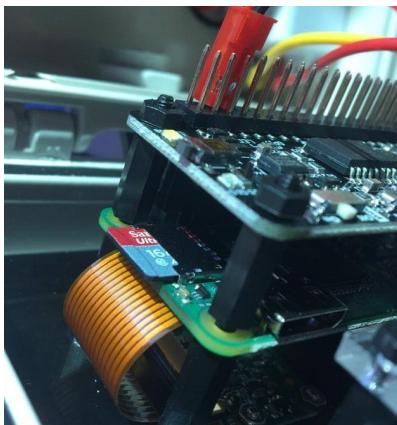


Troubleshooting: WittyPi

- If your Raspberry Pi is not in the correct time zone follow these steps:
 1. Connect to Raspberry Pi terminal via SSH
 2. Type `sudo raspi-config` and press Enter
 3. Down arrow to 4 Internationalisation Options and press Enter.
 4. Highlight 2 Change Timezone and press Enter key.
 5. Follow screen directions to change country and time zone.
 6. When done, use Tab to move to Finish and press Enter.
 7. Type `Exit` in the LXTerminal command box.
- If your wittyPi is not correctly synchronizing the Raspberry Pi time with the correct internet time, follow these steps:
 1. Connect to Raspberry Pi terminal via SSH
 2. `cd wittyPi`
 3. `sudo ./wittyPi.sh`
 4. Select option 1 if the system time is correct and the RTC is incorrect. System time should be correct if the camera is connected to the internet. If it is not select option 3
 5. Enter 8 to exit the WittyPi script



Troubleshooting - What happen if...?



Any issue that you could see in the field please report it by e-mail:
pramosg@ncsu.edu

StressCam to detect drought



Enjoy the field work 2020.
Take some pictures - document the process - yourself with the camera. Save these images [here](#).
The instructions to save camera data will be sending soon.

