Multi Spectral Camera System Resource File

Multi Camera Synchronous Image & GPS Location, Attitude Capturing System

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General Information about System:

Cam1: UI-3241LE-M-GL: monochrome camera; Narrow Blue Bandpass Filter 470 nm
Cam2: UI-3241LE-C-HQ: color camera; No filter
Cam3: UI-3241LE-M-GL: monochrome camera; Dark Red Bandpass Filter 660 nm
Cam4: UI-3241LE-M-GL: monochrome camera; Narrow Green Bandpass Filter 532 nm
Cam5: UI-3241LE-NIR-GL: monochrome NIR camera; NIR Bandpass Filter 850 nm
Cam6: UI-3241LE-NIR-GL: monochrome NIR camera; Bandpass Filter 970 nm

On-board computer password: usl

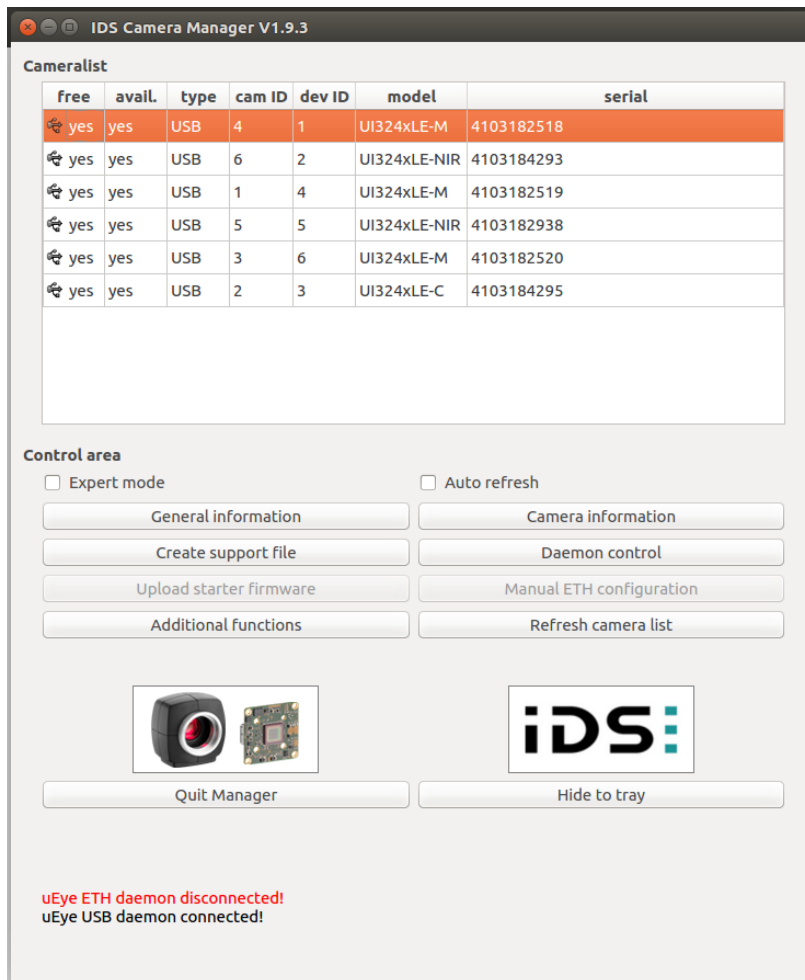Terminal can be opened using 'Right Mouse Click -> Open in Terminal' in a folder or on desktop.

Program saves images in folder '/mnt/dr1/images'. For every run it creates a new folder with name consisting of date and time combination, e.g., '2018-08-03-23-30-40' meaning 3rd Aug 2018 at 23:30:40:
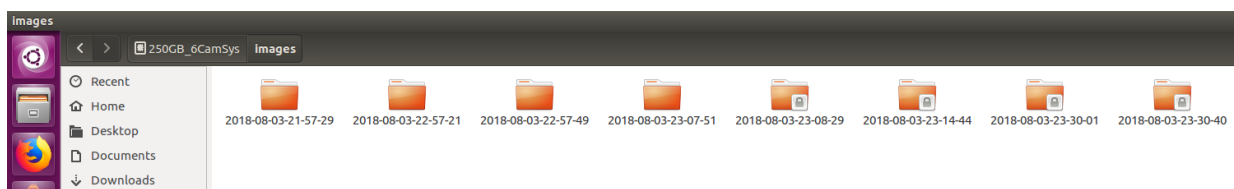
Inside the folder it arranges Camera Images and files like gps log, experiment notes and program running log in the following fashion:
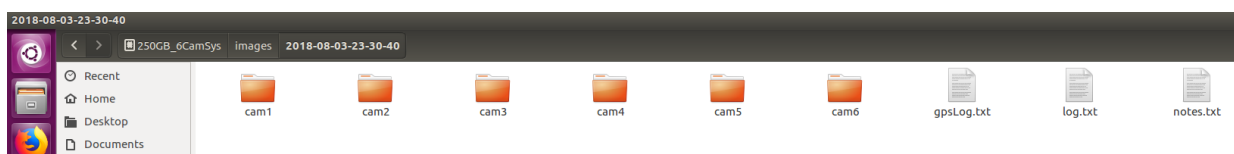
Cameras can be checked by running the program 'idscameramanager' on a terminal. It would open the following:

IDS Camera Manager V1.9.3

Cameralist

free	avail.	type	cam ID	dev ID	model	serial
yes	yes	USB	4	1	UI324xLE-M	4103182518
yes	yes	USB	6	2	UI324xLE-NIR	4103184293
yes	yes	USB	1	4	UI324xLE-M	4103182519
yes	yes	USB	5	5	UI324xLE-NIR	4103182938
yes	yes	USB	3	6	UI324xLE-M	4103182520
yes	yes	USB	2	3	UI324xLE-C	4103184295

Control area

☐ Expert mode   ☐ Auto refresh

General information   Camera information
Create support file   Daemon control
Upload starter firmware   Manual ETH configuration
Additional functions   Refresh camera list

iDS:

Quit Manager   Hide to tray

uEye ETH daemon disconnected!
uEye USB daemon connected!

Cameras can be opened by double clicking the specific cameras. This can be used to focus cameras whenever required. The camera id's represent the physical camera numbers. Do not change the camera id's. To focus the cameras, open one camera, e.g., camera id 2, which is color camera, by double clicking it in the camera manager. Direct the camera to an object which is at a distance at which you want to focus it. If the object appears sharp in the camera output, the camera is focused, otherwise rotate the lens slowly in either directions to attain focus. Do this for all cameras. Close the program after completing this procedure. The camera focus needs to be checked for all cameras whenever they are used after a long time or if the camera focus might have been disturbed.

Running the program will look like this on a terminal:

```
                                          En  ◀))  11:34 PM  ⚙ 6CamSystem
 ⊗ ⊖ ⊙   prashant@udoo: /mnt/dr1/Program
prashant@udoo:/mnt/dr1/Program$ sudo ./mcs

***** Multi Spectral Camera Image Capture Program *****

Important notes:
1. If cameras do not initialize then either remove camera USBs for 5 seconds or shutdown computer, di
sconnect power, reconnect power and restart computer.
2. Folder '/mnt/dr1/images' should exist. Additional folder with current date time will be created an
d all images will be saved in it.
3. To print everything use the command line: './mcs --log' (not recommended).
4. To use single camera, use './mcs --cam n', n being camera number 1-6.
5. To stop program, press 'Esc' key and press Enter.
6. Provide notes at start and end of program when asked for your future reference. Notes will be save
d in file notes.txt
7. To not use mavlink use './mcs --no_mavlink'.

Created save directory: /mnt/dr1/images/2018-08-03-23-30-40/
Camera IDs: Usage:
1 true 2 true 3 true 4 true 5 true 6 true

Setup cameras:
 _settingUpCamID_1_1_cam1 params set. success
 _settingUpCamID_2_2_cam2 params set. success
 _settingUpCamID_3_3_cam3 params set. success
 _settingUpCamID_4_4_cam4 params set. success
 _settingUpCamID_5_5_cam5 params set. success
 _settingUpCamID_6_6_cam6 params set. success

All Camera Setup Result: success

Enter start comments for this imaging session:
Thsi experiment is in front of USL lab to test the system.
Start serial port
Initialize MAVLINK
OPEN PORT
Connected to /dev/ttyUSB0 with 115200 baud, 8 data bits, no parity, 1 stop bit (8N1)

Start api
START READ THREAD

CHECK FOR MESSAGES
Found

GOT VEHICLE SYSTEM ID: 1
GOT AUTOPILOT COMPONENT ID: 1

INITIAL POSITION XYZ = [ -146.7904 , -155.6397 , -8.6991 ]
INITIAL POSITION YAW = -2.3153

START WRITE THREAD

MAVLINK initialized

Start capturing...

        ImgNo_0____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
696ms   ImgNo_1____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
994ms   ImgNo_2____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1002ms  ImgNo_3____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1003ms  ImgNo_4____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
```

It shows cycle time at the left side after capturing starts.
It asks you for comments/notes about the experiment at the start and end of the program for your future reference.

Closing the program (by pressing Esc key and then Enter key) will look like this on the terminal:

```
                                                    En  ◀))  11:34 PM  ⚙ 6CamSystem
⊗ ⊖ ⊙  prashant@udoo: /mnt/dr1/Program
989ms   ImgNo_115____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1007ms  ImgNo_116____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
991ms   ImgNo_117____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1007ms  ImgNo_118____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
993ms   ImgNo_119____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1008ms  ImgNo_120____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
985ms   ImgNo_121____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1006ms  ImgNo_122____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
998ms   ImgNo_123____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1011ms  ImgNo_124____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
994ms   ImgNo_125____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1006ms  ImgNo_126____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
994ms   ImgNo_127____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1000ms  ImgNo_128____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
989ms   ImgNo_129____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1011ms  ImgNo_130____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
983ms   ImgNo_131____Cam1_
26ms    ImgNo_132____Cam2__Cam3__Cam4__Cam5__Cam6_
989ms   ImgNo_133____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1004ms  ImgNo_134____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
994ms   ImgNo_135____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
986ms   ImgNo_136____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1010ms  ImgNo_137____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1006ms  ImgNo_138____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
997ms   ImgNo_139____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
985ms   ImgNo_140____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1012ms  ImgNo_141____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
998ms   ImgNo_142____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1000ms  ImgNo_143____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1000ms  ImgNo_144____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
999ms   ImgNo_145____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
993ms   ImgNo_146____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1006ms  ImgNo_147____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
999ms   ImgNo_148____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
990ms   ImgNo_149____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
1014ms  ImgNo_150____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
^[996ms ImgNo_151____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_

997ms   ImgNo_152____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_
Ecs key pressed..

1005ms  ImgNo_153____Cam1__Cam2__Cam3__Cam4__Cam5__Cam6_CLOSE THREADS

CLOSE PORT


Exit camera: 1... Exited.
Exit camera: 2... Exited.
Exit camera: 3... Exited.
Exit camera: 4... Exited.
Exit camera: 5... Exited.
Exit camera: 6... Exited.

Enter end comments for this imaging session:
This was a good experiment.

Everything saved at location:
/mnt/dr1/images/2018-08-03-23-30-40/

prashant@udoo:/mnt/dr1/Program$ ▮
```
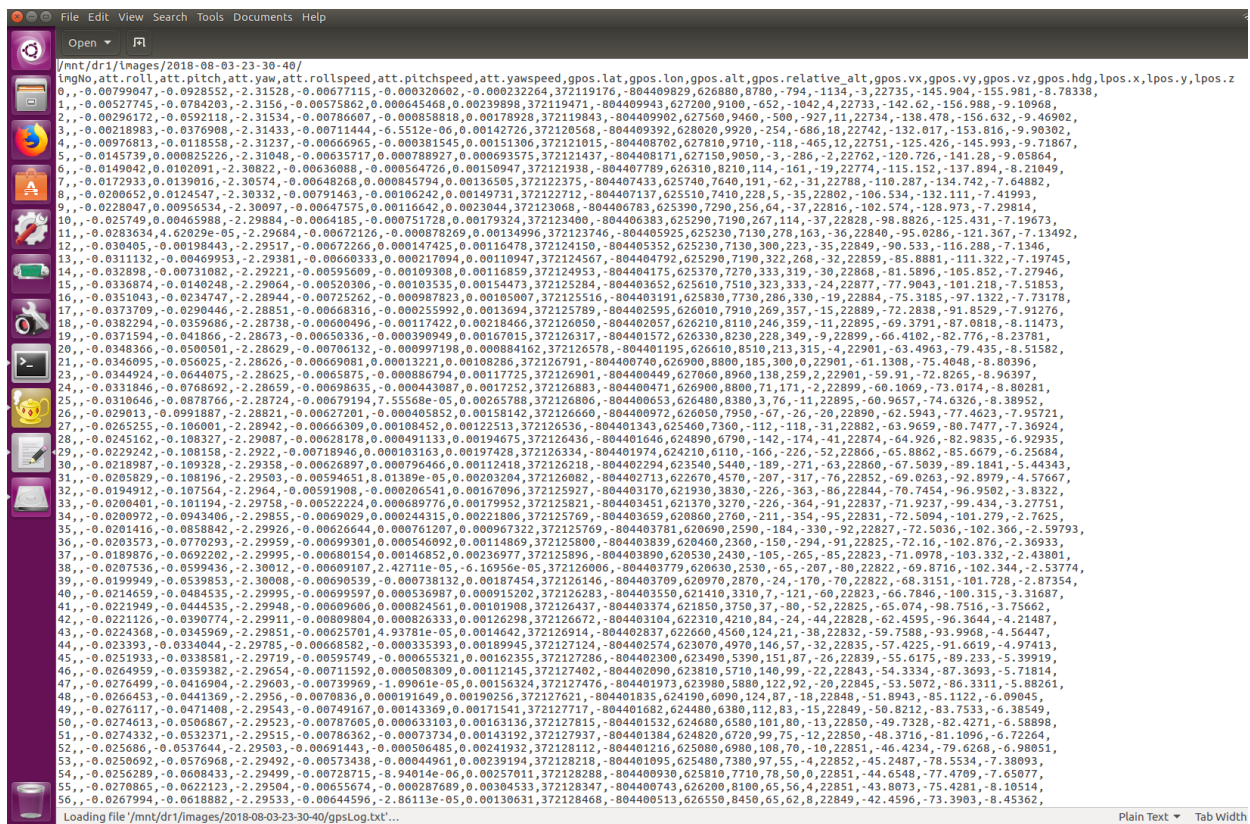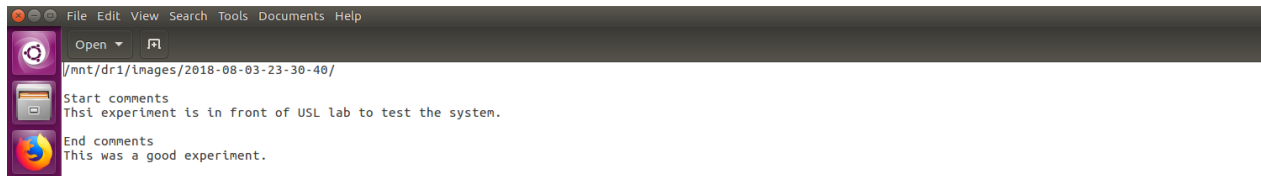
GPS log file is created with the following details about location and attitude for every image number:
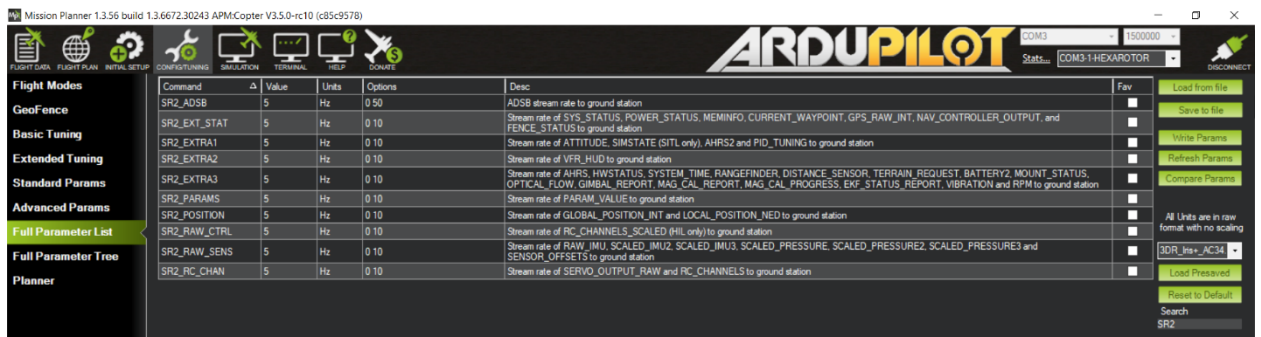
This file can be opened in MS Excel and Text to Columns functionality can be used to make data columnar.
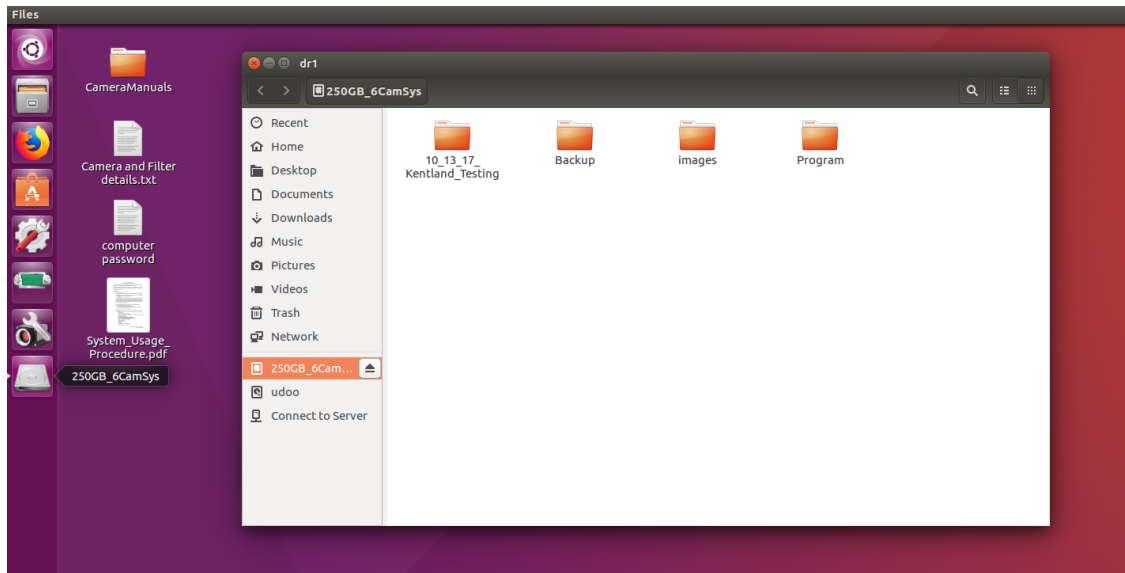
Notes file is saved the following way:

A log file is also created for tracing bugs during program crashes.

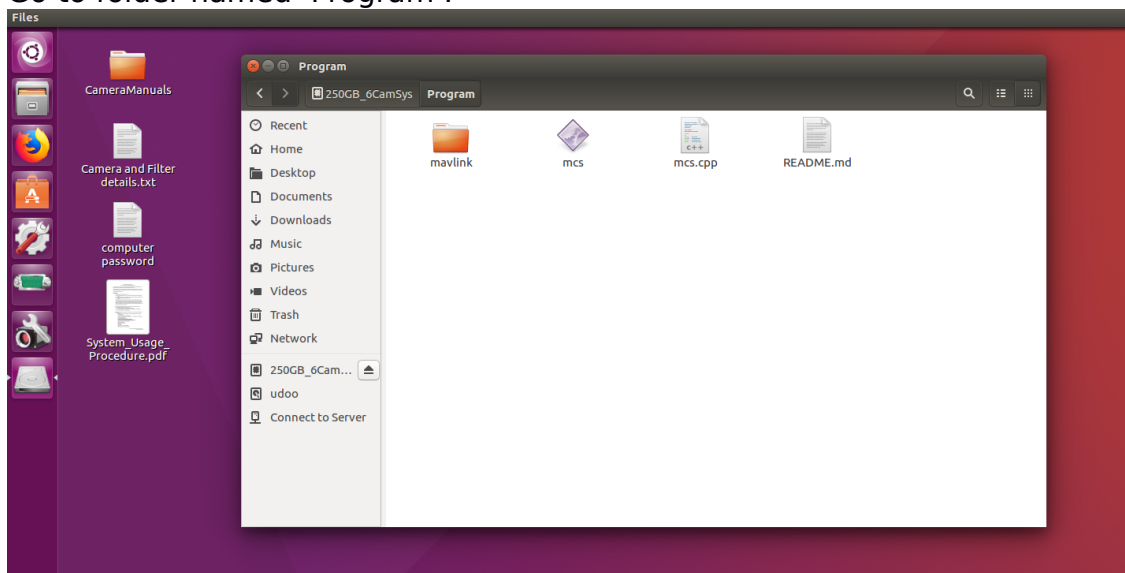PixHawk has been set with the following parameters:

Steps to run Program:

1. Open the 250Gb external hard disk folder named 'dr1' shown as the last icon on the taskbar:

2. Go to folder named 'Program':

3. Open a terminal here by right clicking inside the folder and selecting 'Open in Terminal'.
   Use the following commands on terminal to check if pixhawk is actually sending mavlink data:

       sudo –s

   It will ask for password which is 'usl' as mentioned above. Terminal will change from prashant@udoo~$ to root@udoo~$. Now enter the following command:

       gtkterm

A new blank window with menu items will open. In its menu, go to 'Configuration' and click 'Ports'. Select port 'USB0' at the bottom of dropdown list and baud rate as '115200' also at the bottom of the dropdown. After saving these configuration settings, in the window unreadable data will start showing up. If yes, then mavlink GPS data is being received by the computer. If not then mavlink GPS data is not being received by the computer. Check if the pixhawk is turned on and FTDI cable is correctly connected.

After checking data being received and confirming the port, close the gtkterm window. In the terminal write the following command

'exit'

Terminal will change back to prashant@udoo~$.

This step of checking gtkterm does not need to be performed all the time. If GPS is in lock and sending data, then this does not need to be checked.

4. Run the program by entering the following command in the terminal window:

sudo ./mcs

It will ask you to enter some notes for the experiment. This is for your future reference.

5. Program can be stopped by pressing the 'Esc' key and then 'Enter' key. It will again ask you to enter notes for the experiment for your future reference. You can enter here if the experiment proceeded as you planned or not. Lastly it gives the location of where everything of the experiment was saved.

NOTE: If for some reason the camera crashes, then computer needs to be shut down, its power disconnected, wait 5 seconds, reconnect power and the process needs to be followed again.