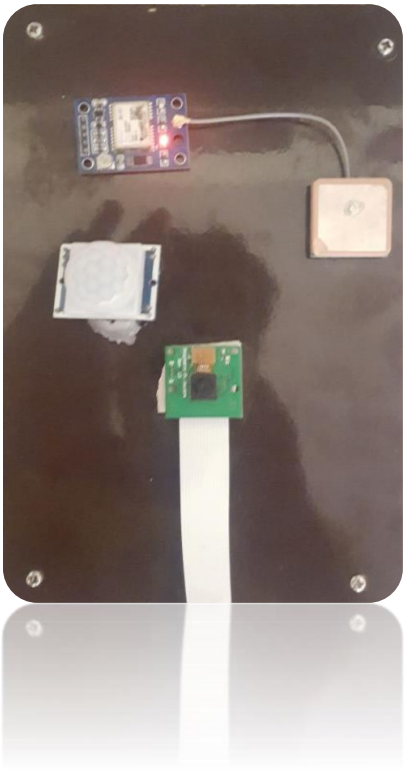
CAMCALT

Complex Animal Movement Capture and Live Transmission



User Manual
V 1.0.0

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I. What is this device?

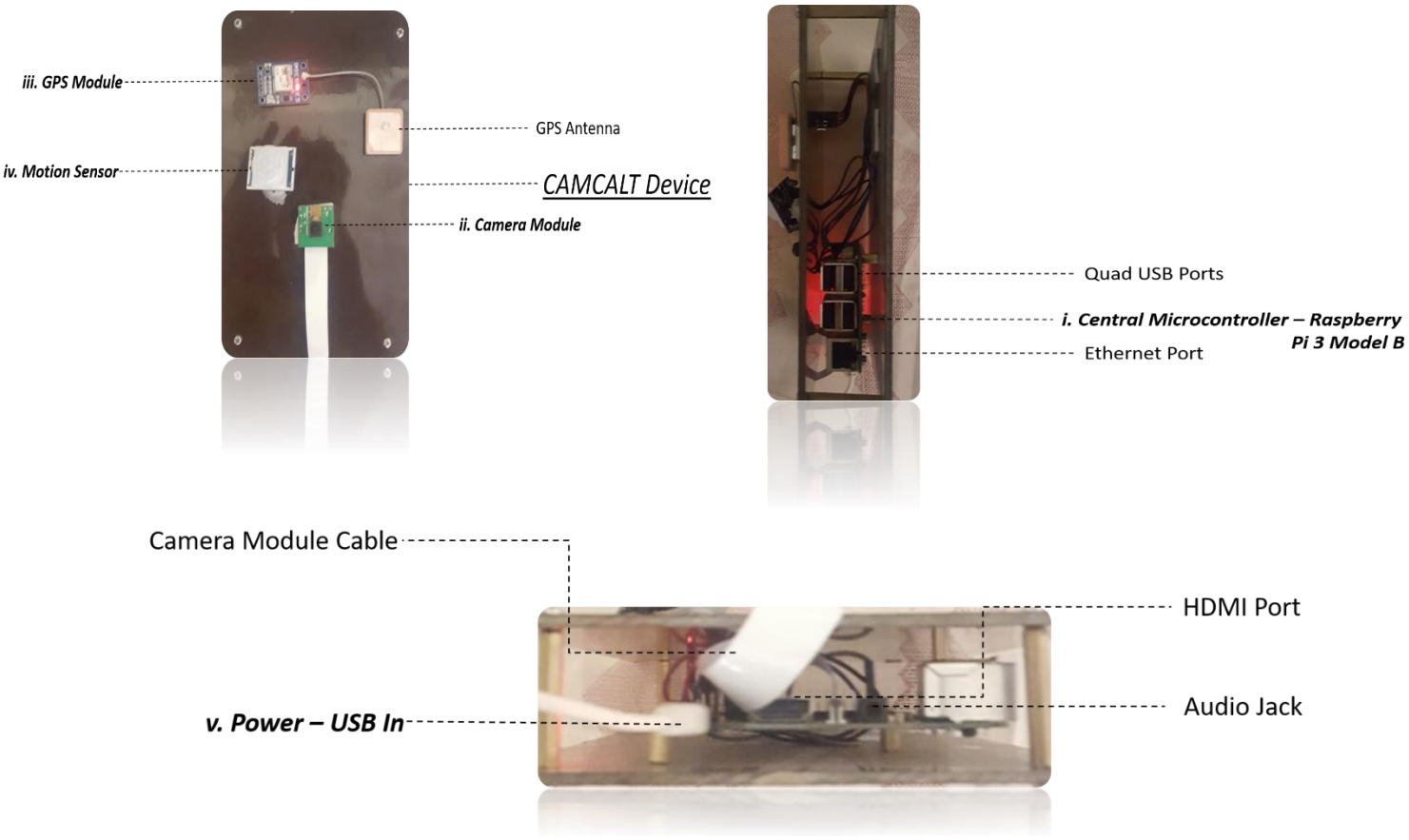
Complex Animal Movement Capture And Live Transmission (CAMCALT) is a device specifically tailored to the need of a forest surveillance and monitoring system. CAMCALT aims to eradicate the existing disadvantages of the Forest Trap Camera's and integrate the latest technologically developed "***Internet of Things***" (**IoT**) into the device for Live feed wirelessly from any part of the world. CAMCALT is used to monitor the forests, animal movements and Poacher Detection. The device uses BCM2837 Integrated chip as the base computer that does the job for the device. With a motion sensor, camera module, GPS and on-board Image Processing Algorithms attached, CAMCALT is an intelligent over watch for the forest landscape. In large numbers, you can have the whole forest under your control.

II. Why CAMCALT?

- Been provided with a high end camera, perfection of your view has been improved drastically.
- Abnormal situations are notified instantly that helps the first department to react with any counter measures as soon as possible.
- 24 hours surveillance has been made possible that hunting and poaching can be prevented.
- The coverage range of our cameras are so high that movement of animals can be tracked and predicted easily.
- No more Poaching of any animal by illegal Poachers in your forests
- With many number of our devices, one can single handedly monitor a whole forest.
- No more retrieving Memory Cards as everything is integrated with "**Internet of Things (IoT)"**
- Forests can be more secure like a military restricted area.

III. Getting to know about the device

CAMCALT is abbreviated as Complex Animal Movement Capture and Live Transmission. As the abbreviated tag elucidates us clearly that it helps in capturing



the complex animal movement under intense period of time providing a live feed of the situation.

i. The prototype is designed with a **Central Microcontroller** – **Raspberry Pi 3 Model B** which has a Broadcom BCM2837 64bit ARMv7 Quad Core Processor powered Single Board Computer running at 1.2GHz, 1 GB RAM, BCM43143 Wi-Fi on board, Bluetooth Low Energy (BLE) on board, 40pin extended GPIO, 4 x USB 2 ports, 4 pole Stereo output and Composite video port, Full size HDMI, CSI camera port for connecting the Raspberry Pi camera, DSI display port for connecting the Raspberry Pi touch screen display, Micro SD port for loading your operating system and storing data. The controller is interfaced with a Passive Infra-red sensor, Global Positioning Sensor, Raspberry Pi Camera.

ii. **Camera Module**

2592 * 1944 pixel static images and also supports 1080p at 30fps @ 60fps and 540 * 480p 60/90 video recording. Camera module is interfaced with the central microcontroller Raspberry Pi 3.

iii. GPS Module

Model : Neo 6M-0-00-1 U-Blox
Operating Voltage : 5V DC

Global Positioning System is used for tracking the location of each Device placed in various parts. The Global Positioning System is connected up with satellites, ground stations, and receivers. Once the receiver calculates its distance from four or more satellites, it knows exactly where you are. GPS locks the exact position of that particular Device if Motion Detected.

iv. Motion Sensor

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) radiation being emitted from objects in its field of view. They are most often used in PIR-based motion detectors. When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. Thus automatically the PIR sensor is trigger when any animal is caught within its radius.

v. USB Power In

Capacity : 2800mAH
Operating Voltage : 5V DC

Recharge power bank can be used to provide supply to central microcontroller. The micro controller used will separate and supply the required amount of power to each hardware components. This battery power pack is rechargeable and can get charged and used again and again.

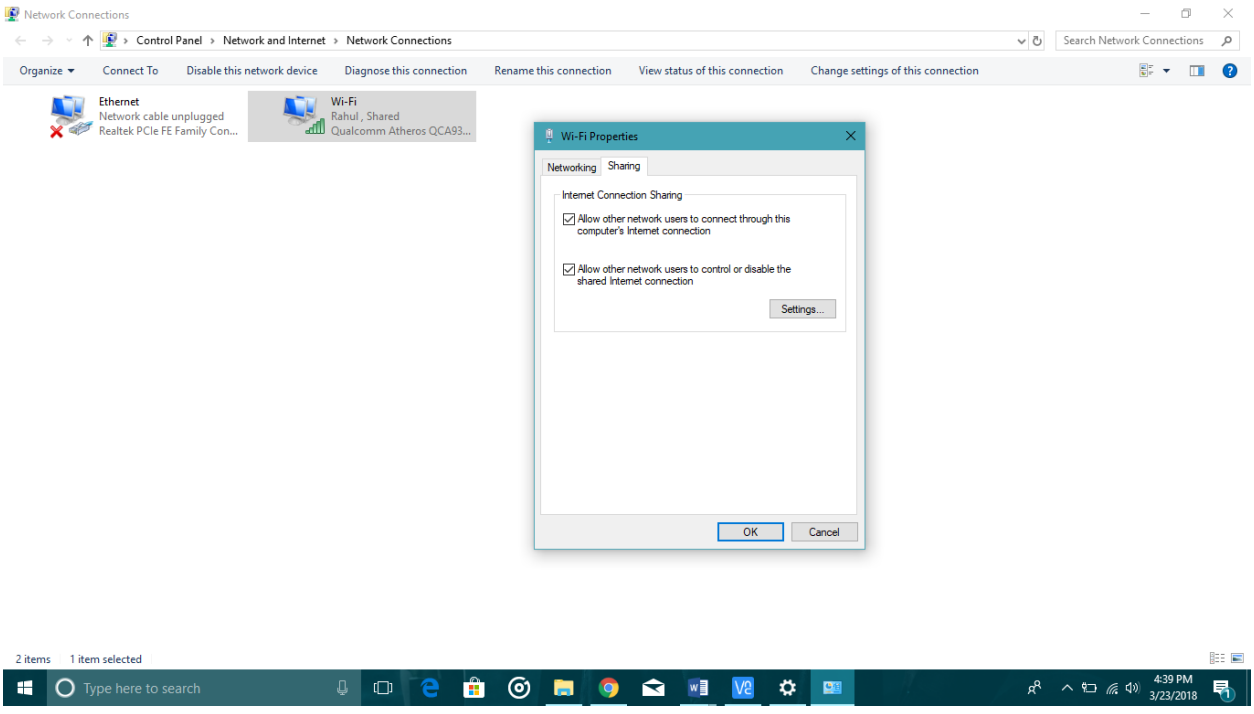
IV. Connecting to Display wirelessly using VNC

- ***Connecting to the device using SSH***

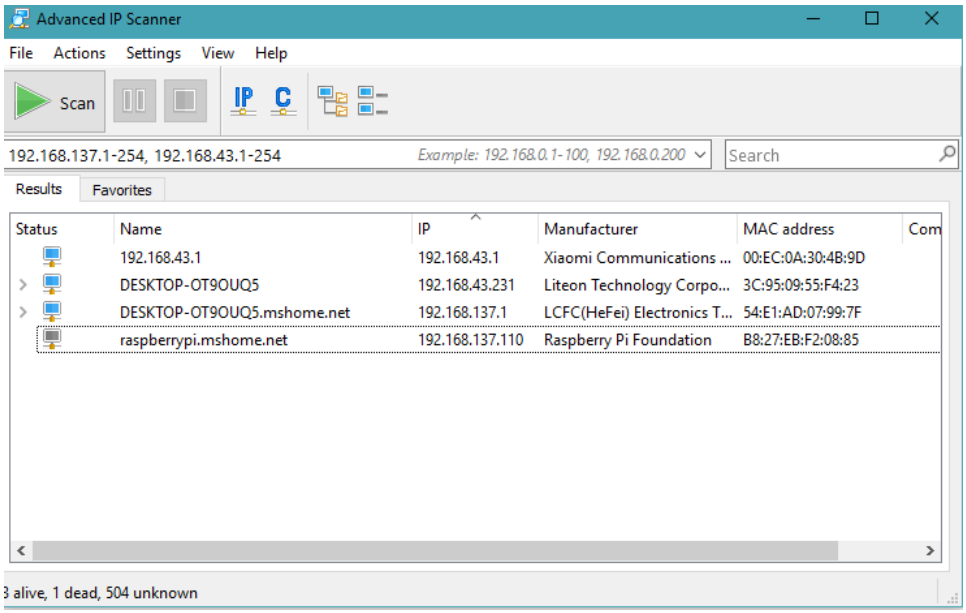
VNC is a free service app designed for wireless access of your computer or mobile phone from any part of the world using Internet as a medium. With an excellent advantage of being cross-platform, we are able to use VNC to view and manipulate the Display of our Camcalt device. Here are the steps to connect using VNC viewer.

1. Connect the LAN cable (Ethernet) from raspberry pi to the Computer. (Required for initial stages only)

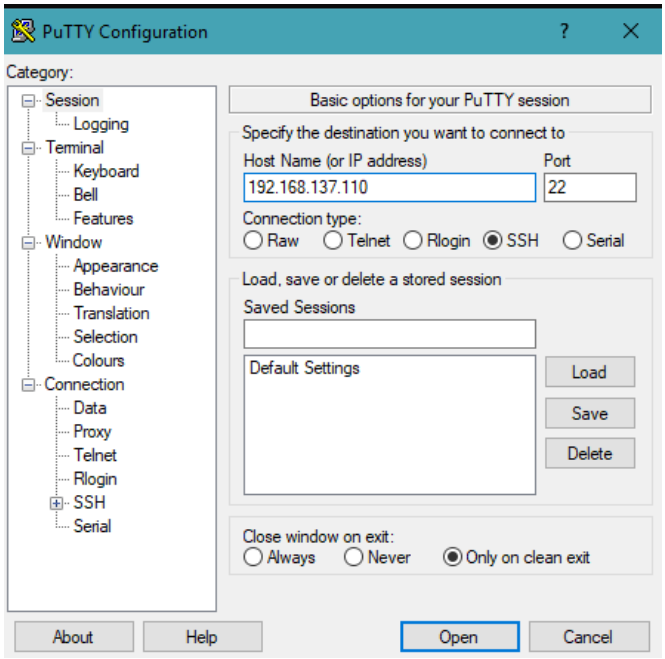
2. Power On the device and Allow Network sharing from your computer



3. Use Advanced IP scanner to scan the IP of the device. The IP can be found near the name of the device.

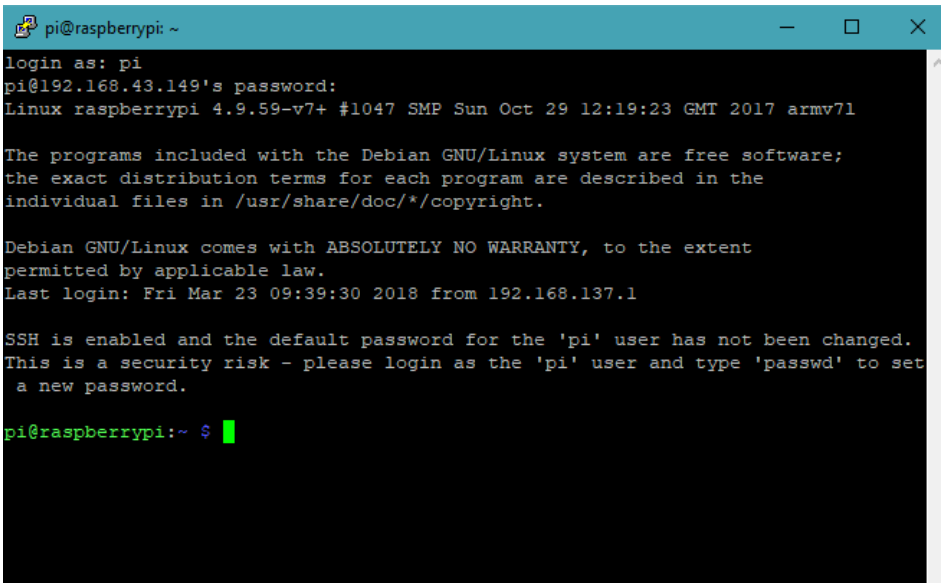


4. Using that IP create a SSH session using PUTTY or any other SSH application. Type the IP address we found at the Hostname box and simply hit Enter.



5. We will be greeted with a warning. Just hit YES and Continue. Then a black Terminal will begin asking the username and password. Type in the

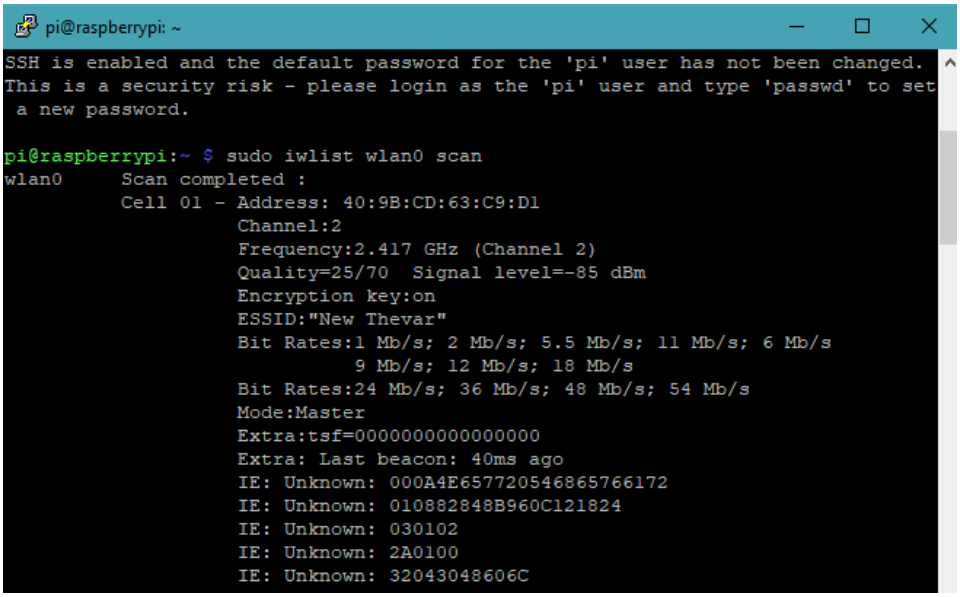
username and password and hit Enter. If a screen like below comes up, then you have successfully SSHed into the device.



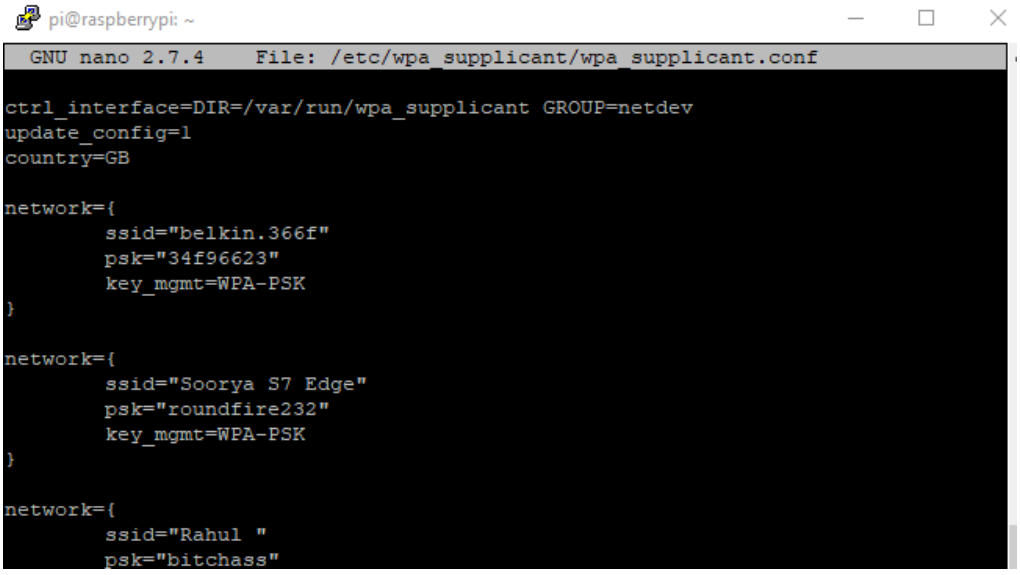
- ***Configuring Wi-Fi for access using VNC Viewer***

Now that you have successfully SSHed into the device, we will use its terminal to set up a Wi-Fi connection on the device for an easier access.

1. Know the exact Wi-Fi SSID name and Password you want the device to connect to.
2. In the terminal type *"sudo iwlist wlan0 scan"* then press Enter. If you get a result like this, then the Wi-Fi of the device is working perfectly



3. Ensure that the Network is broadcasting the Wifi properly.
4. Now type "*sudo nano /etc/wpa_supplicant/wpa_supplicant.conf*" and hit Enter

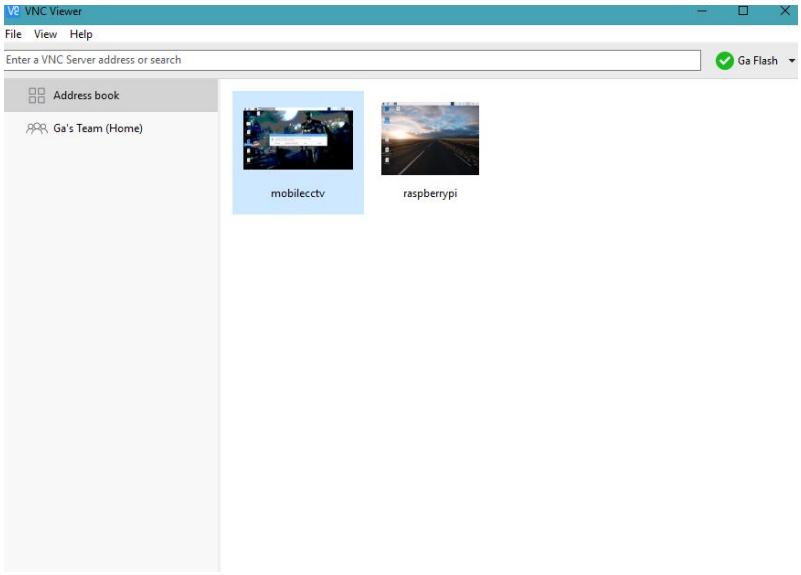


5. You must be getting a window like this. Here at the last line type these

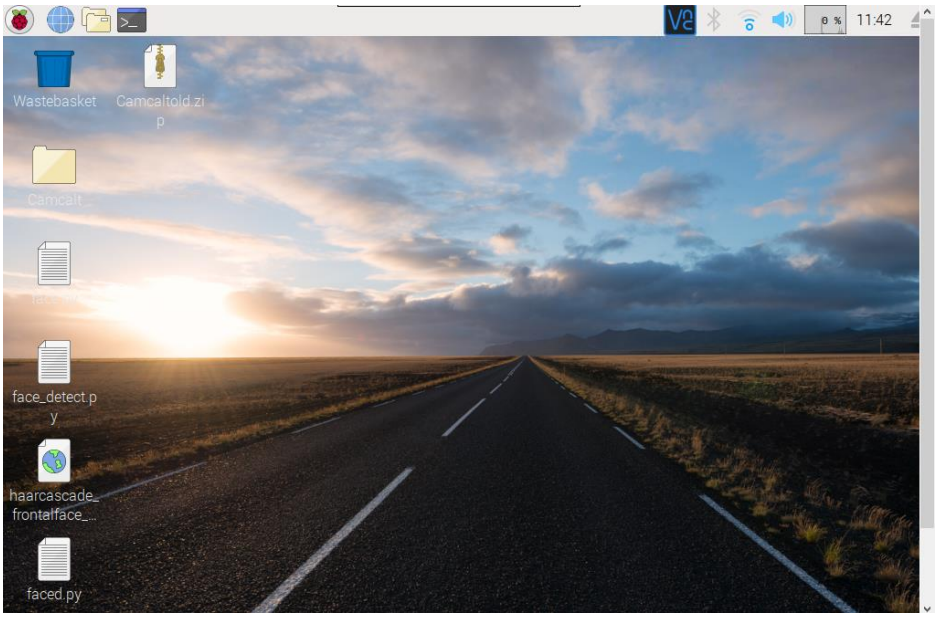
Network={
ssid="YOURWIFINAME"
psk="YOURWIFIP@SS"
key_mgmt=WPA-PSK"
}

6. Type these at the last then press CTRL+X, then Y, then press ENTER.

7. Type “*sudo raspi-config”* and hit Enter
8. Come down to interfaces option and hit enter at VNC Viewer. Enable VNC Viewer.
9. Get back and click finish.
10. Now type “*sudo reboot”*
11. You may now disconnect the LAN cable as the Wi-Fi will now be connected.
12. Ensure that for the first time the Computer and the device are connected to the same Network
13. Open VNC Viewer, create an Account and Sign In.
14. Then Go to File-> New Connection
15. Type in the IP address of the Device, set a Name and Click Ok.
16. Now Double Click on the Device created.



17. You would be greeted with your device’s Desktop Screen

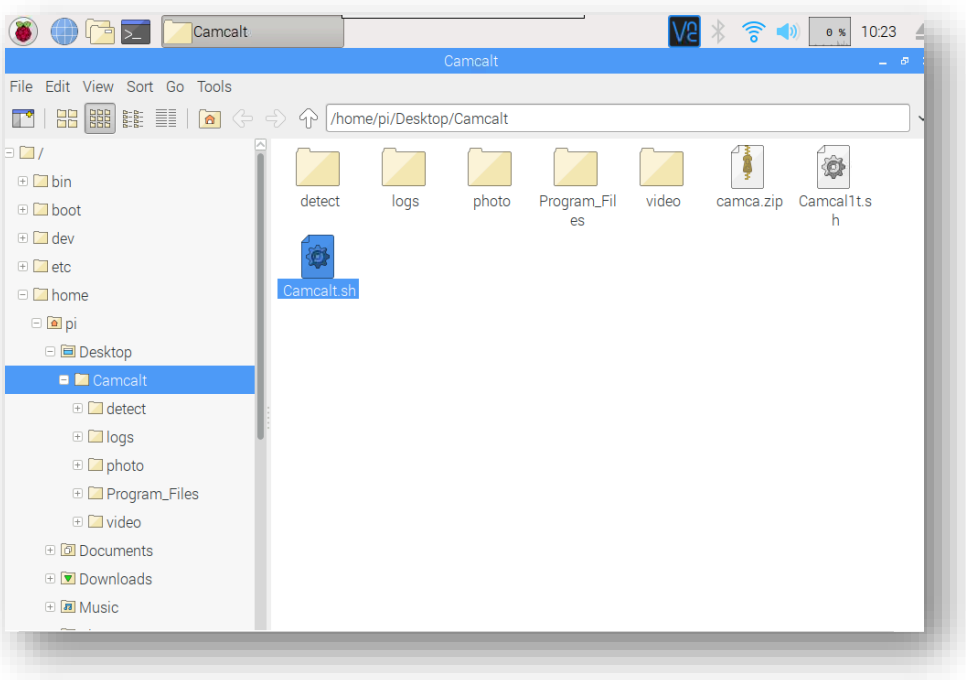


18. Click on VNC on Top Right area of the Task Bar.
19. Click Sign In and enter your VNC account credentials.
20. When asked for Cloud type connection, Click Ok
21. Now if you refresh the VNC Viewer in your Laptop you will find the Device available.
22. Now with the same account from any part of the world, you can access the CAMCALT Device.

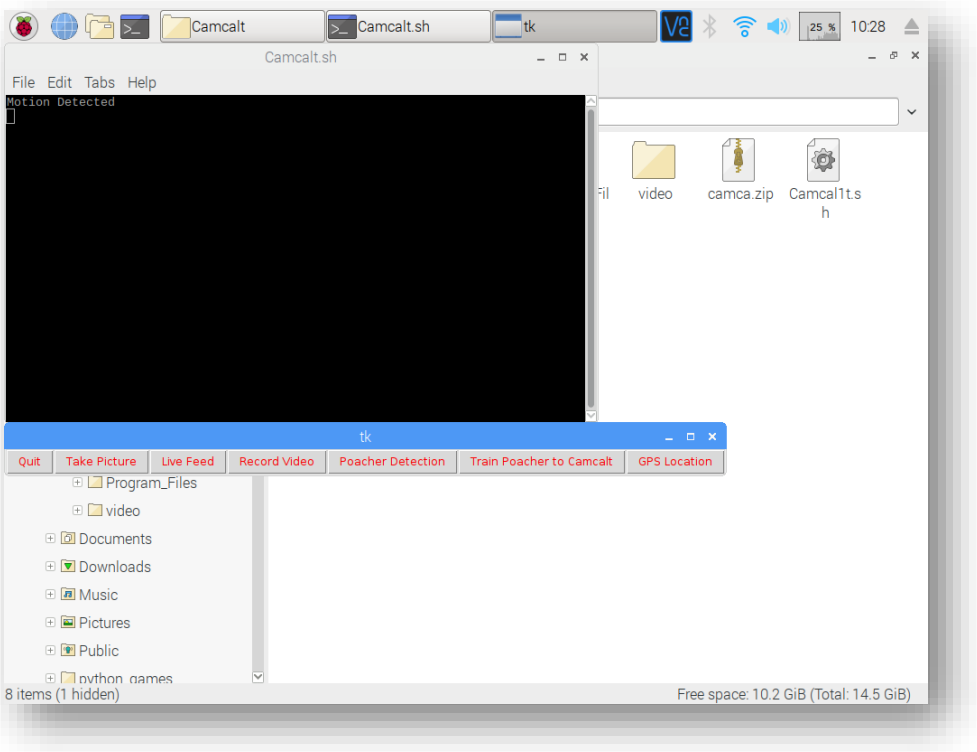
V. Running the Application

Running the application is quite simple, once CAMCALT is placed at appropriate place and the system is enabled and ready to fetch the data. It can be processed with the below mentioned steps.

- **STEP 1:** Once you double click on the **CAMCALT.sh** program from your personal laptop it automatically opens the execution terminal.



- **STEP 2:** The terminal display whether PIR sensor is active or at rest. It operates at two different cases,
  - **CASE 1:** If any warm blooded animal or human interferes the zone of IR rays it automatically displays **Motion detected** and turns on the Camera and GPS and sends a default message to the in charge security personal number.
  - **CASE 2:** If no warm blooded animal or human interferes the zone of IR rays it displays no Animal is detected and set the camera and GPS to rest mode.



- **STEP 3:** Once the Camera and GPS is triggered from the output of the PIR sensor, we are able to take appropriate decision from a Pop- up GUI frame that appears.

VI. Knowing about the User friendly GUI

CAMCALT is designed in such a way that every processing and monitoring is user friendly and can be operated by everyone easily.

As mentioned earlier once a Pop up frame appears, a wide ray of options can be selected according to the in-charge person's requirement.

- The GUI frame is user friendly and the following processes can be done.
    1. **Quit –** Quits the program.
    2. **Take Picture –** We can immediately take a series of photos in a burst, this is automatically saved to a default location.
    3. **Live Feed** – We can get live feed of what the current situation is from our device camera.
    4. **Record Video –** The live feed can be recorded and the video files can be automatically saved to a default location.
    5. **Poacher Detection –** Pre-trained Poachers can be easily recognized by our Image Processing Algorithms.
    6. **Train Poacher to Camcalt –** Repeated Poachers can be trained to the device to be recognized in the future by our Image Processing Algorithms
    7. **GPS Location –** The location of the device can also be found.

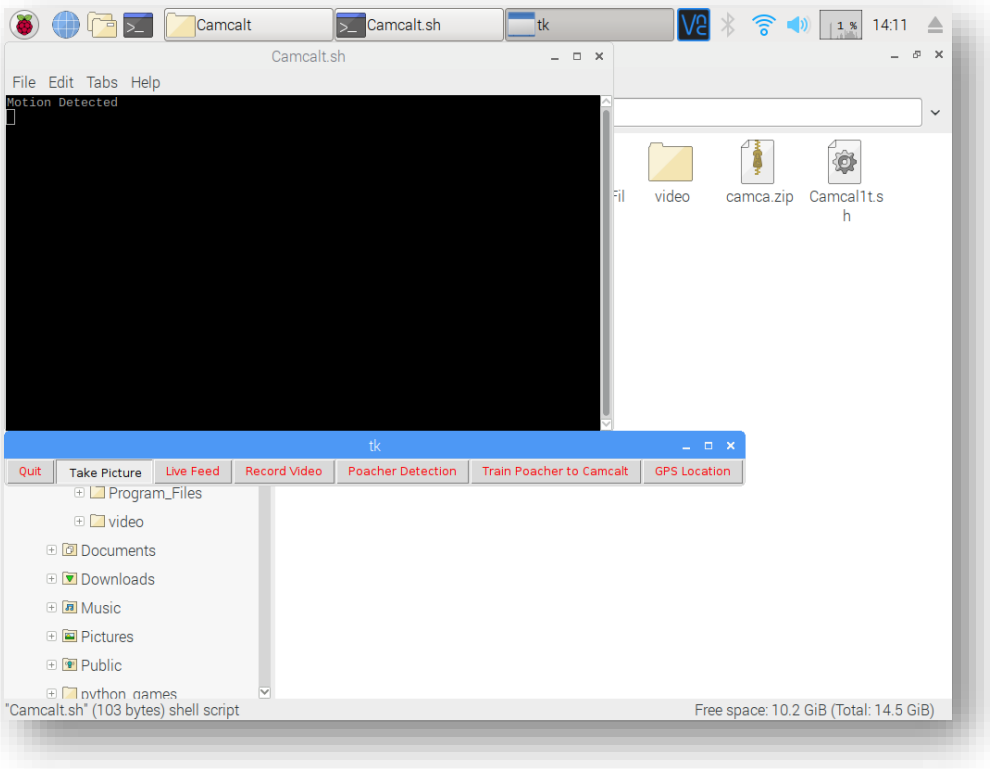
All this functions were made user friendly and can be operated and processed by a common man.

VII. Familiarizing with the options available

As you would have known from the previous section "Knowing about the User-friendly UI", whenever motion is detected in the field of view of the IR sensor a User-friendly UI pops up, with the following options (One can do the following using the camera sensor and GPS module of the project/device)

- ***Take photo***

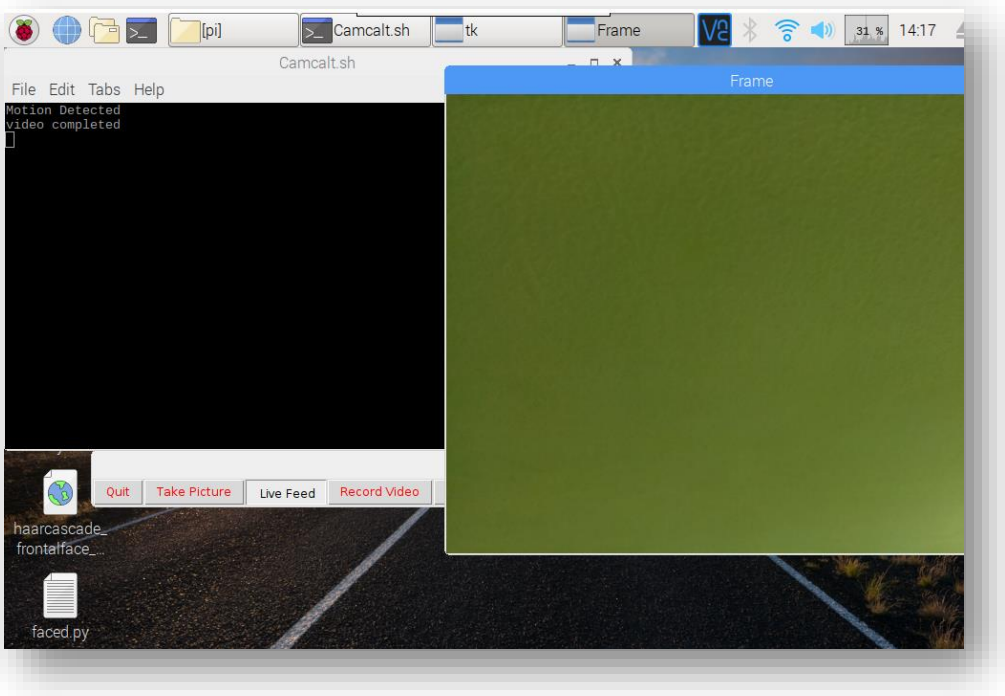
  This button gives the user - in - charge an option to take a high quality photograph/image (so and so mega - pixels) of what is in the field of view of the camera when the motion is detected



- ❖ To use this, Click on Take Picture Button.
- ❖ The Image will be captured to the predefined folder "**photo".**

- ***Live feed***

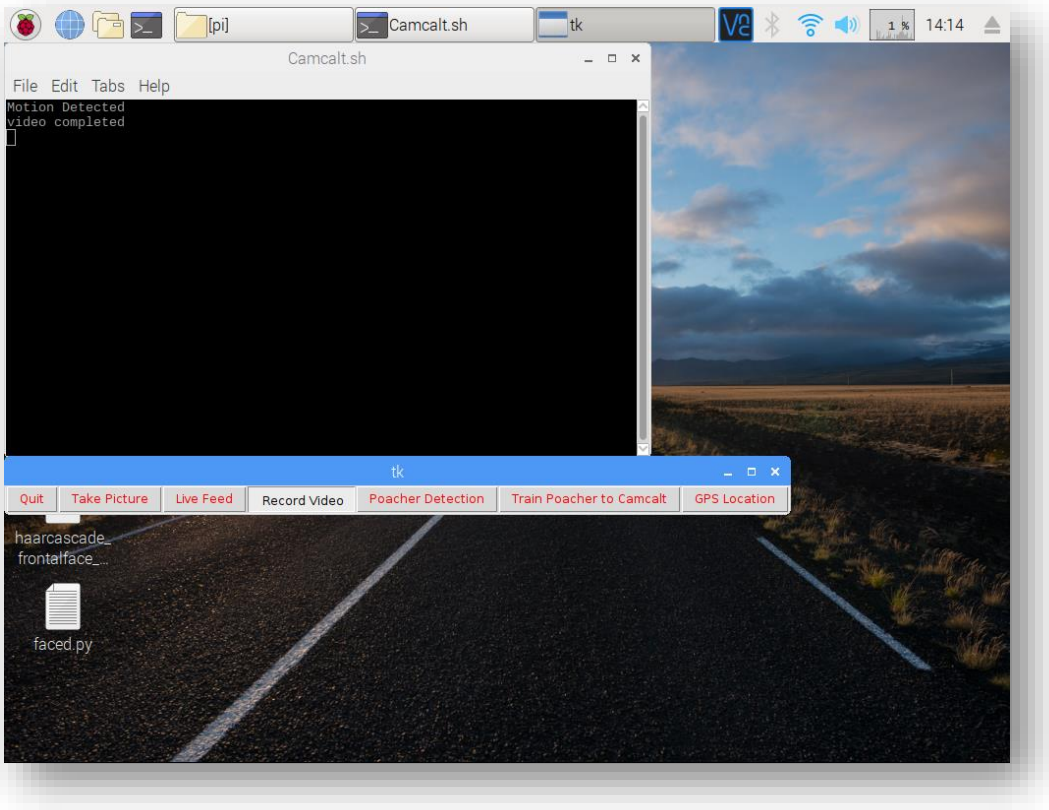
  This button gives the user - in - charge a high quality video feed (1080p __ fps) of whatever is in the field of view of the camera when the motion is detected



- ❖ To use this feature, click on Live Feed Button
- ❖ The Preview Window will be open.
- ❖ You will be able to view the events live
- ❖ For better framerate, use faster Internet Connection
- ❖ Press Q on the Window to Quit

- ***Record video***

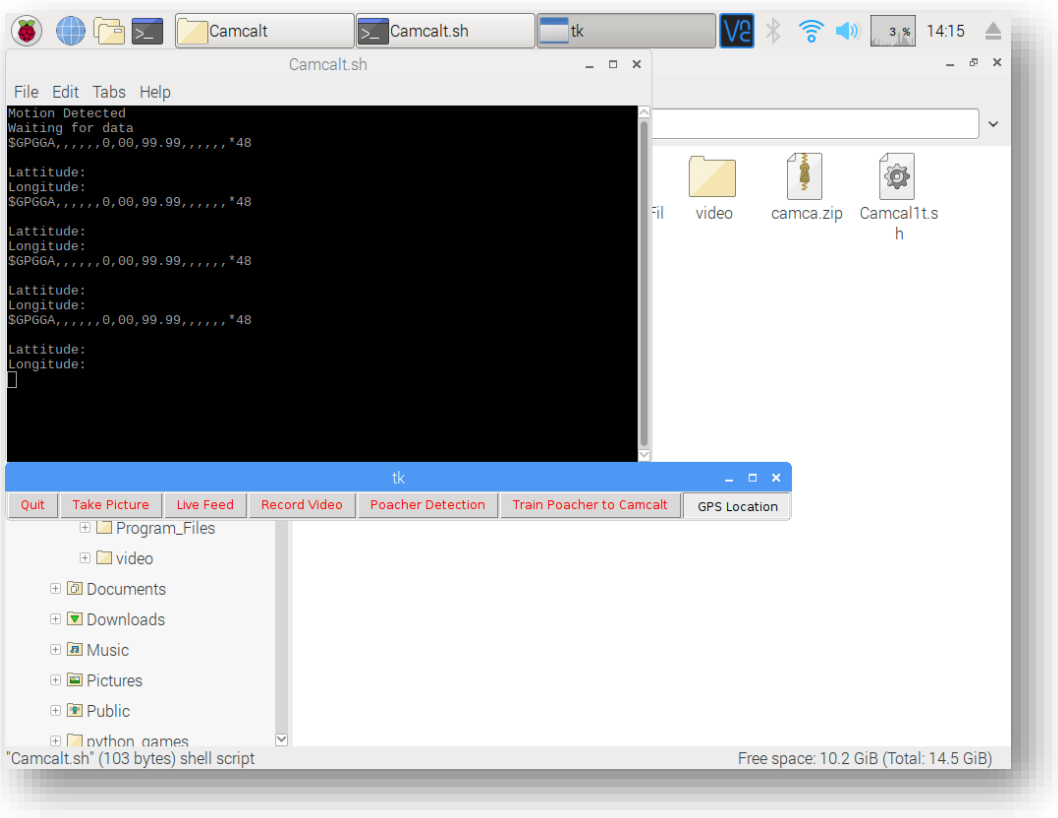
  This button gives the user-in -charge an option to record a high quality 10 second video (1080p __fps) of whatever is in the field of view of the camera when pressed



- To use this feature click on Record Video.
- An .H264 Format Video will be captured for a predefined timing.
- The Video will be stored in the predefined folder "**video**".
- Now to view this video, we recommend to transfer the video file to a Windows Computer and Play with a VLC player
- To Transfer the files, use the VLC file transfer to transfer the files to the Computer Connected.

- ***GPS Location***

  This button gives the user-in -charge an option to get the current GPS location of the CAMCALT device when pressed, this will be useful when we use an array of CAMCALT devices in the forest so as to identify from which device/ location of the forest the motion got detected

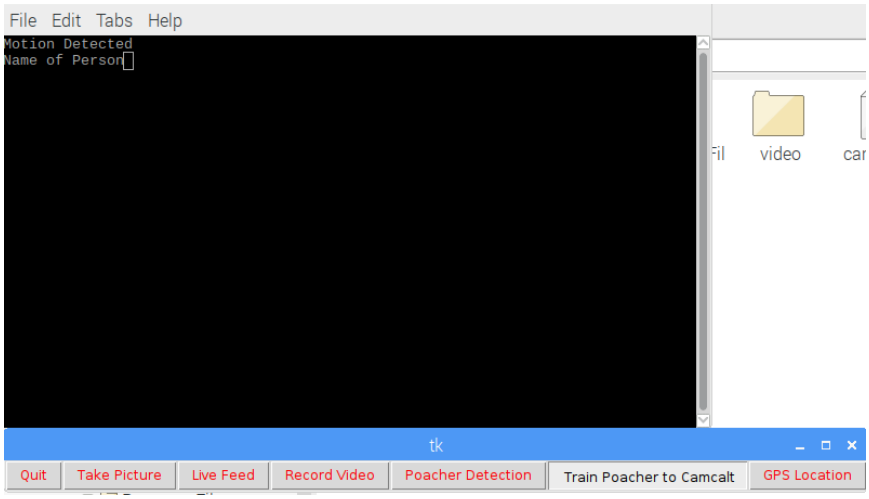


  - ❖ To use this feature, Click on GPS Location.
  - ❖ The Latitude and Longitude values of the Location will be printed repeatedly.
  - ❖ Feed the Latitude and Longitude values to a Lat-Long to Map Converter and you'll get the Exact Location Pin-Pointed on a Map.

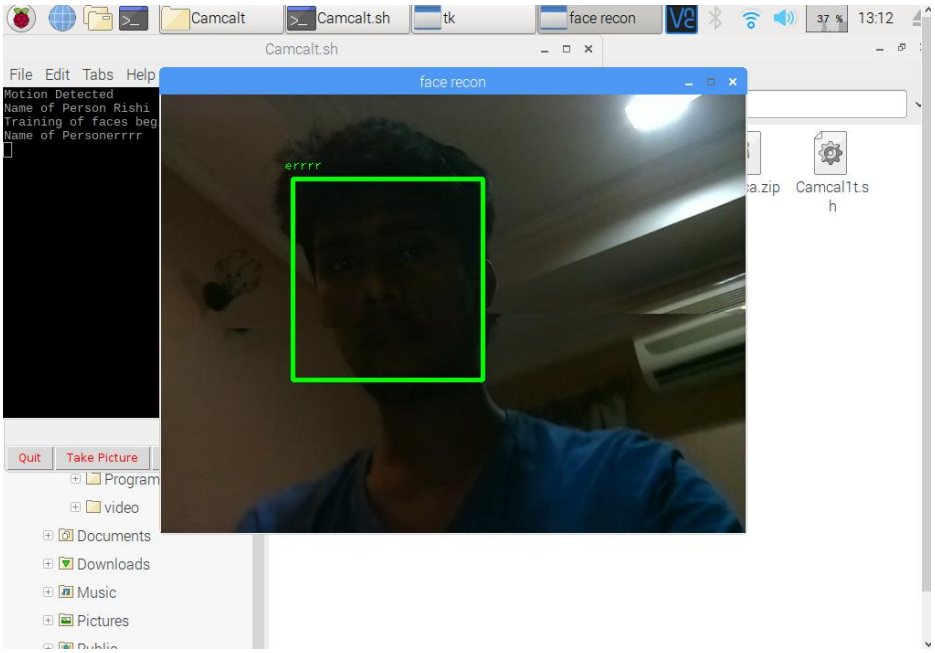
VIII. Train Poacher to CAMCALT

The most special and powerful feature of CAMCALT is Poacher Detection. This Feature uses the Image Processing techniques to detect the Poacher using the 4 cores of the powerful BCM2837 Processor powered by 1 GB RAM. By using HSV to split-analyze the images and Haar Cascade Detection to match the existing samples with the testing image. The process of Poacher Detection is to first Train the Poacher to the Device then followed by Poacher Detection.

1. First Launch the Program CAMCALT.sh
2. Click on “Train Poacher To Camcalt”



3. Type the Name or Identity of that Person and hit Enter. Now the Camera Preview Window will open.
4. Show the Face of the Poacher to the Camera with good brightness. If there is a Face, the Program will detect the Face with a Green Box.

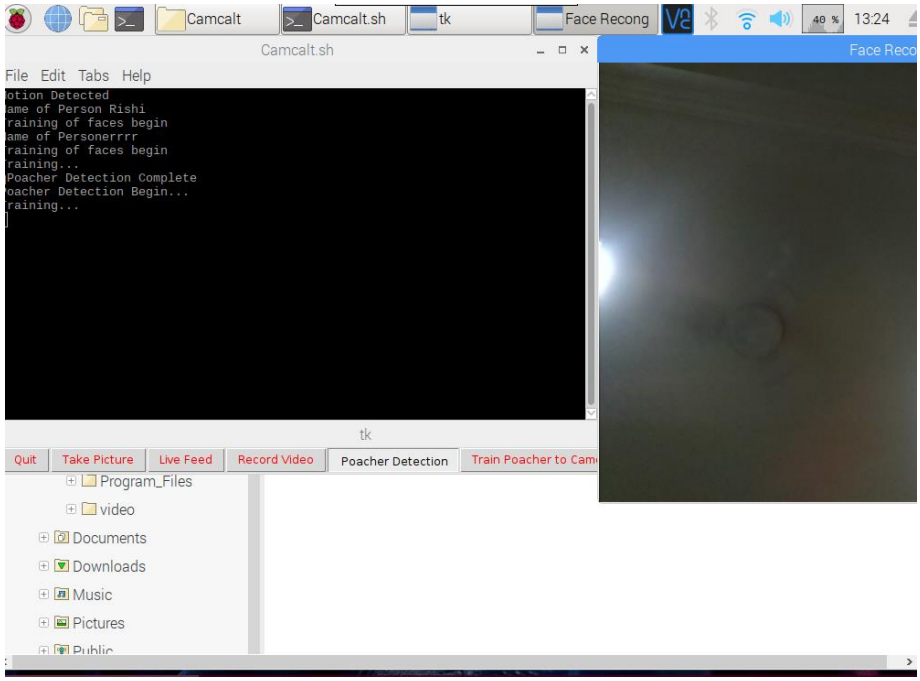


5. Let the program do its work. By Default, the program is set to capture 20 samples. But it can be modified to one's wish. As soon as the program captures the necessary images, the Camera Preview window closes automatically.
6. Now the Poacher is trained to the device successfully.

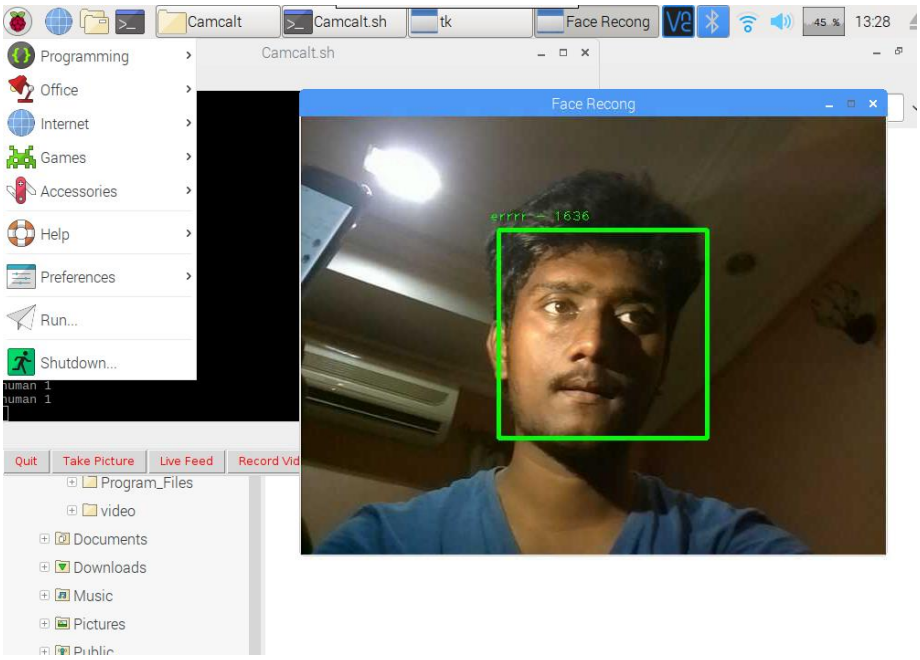
IX. Poacher Detection

Now, the device is trained to that particular poacher, and whenever or wherever (i.e. from any device placed) that poacher is read in any device's camera, he will be automatically detected. That is because that poacher's facial features will be regularly compared and matched with the live person's face to check for a match. If it matches, he will be immediately detected. Everything happens in real-time. There is never a time delay between detections. The program executes in micro-seconds, so the time lapse is negligible. To run the Poacher Detection Program,

1. Run CAMCALT.sh
2. Wait for Motion Detection.
3. After Motion is detected, the GUI begins.
4. Select Poacher Detection



5. The Face Recognition Window Pops up. Now whenever a face is shown, it immediately tries to find a match. IF there is, then it shows with a green box around the face with a name. Else, it displays Unknown.



6. On demand, the program can also be improved to send a notification, if a particular person is caught.

X. Credits to the Developers

We have always been in the state of coming up with social issue related projects and this CAMCALT had been one of it.

CAMCALT will always be close to our hearts because, the brain-wave for this project happened right at the center of the Avalanchi Forests, Ootacamund, Tamilnadu, India.

We wanted to greatly improvise the idea behind the project and as a result, we had been working on a continuous basis to refine the idea repeatedly.

We put our tireless effort to come up with this surveillance system that could be off great help to the forest department. We believe that this new project has overcome all the existing disadvantages.

This project was made by the students of the **Electrical and Electronics Dept., 2014-2018 batch, Sri Sairam Engineering College, Chennai, India.** The developers are namely;

1. Ganeshaanand Balasubramanian
2. Kaviarasan Vasu
3. Shreyas Ramachandran
4. Soorya Sridhar

The Professor who guided this project was **Dr. Azhagumurugan Ramamurthy, Assoiciate Professor, Electrical and Electronics Department, Sri Sairam Engineering College, Chennai, India.**

We wish to thank **Exnora Naturalists Club**, for funding this project and showcasing themselves as a pillar of Support.


Ganeshaanand

Kaviarasan


Shreyas


Soorya