Below are the set of packages installed at SYSTEM level
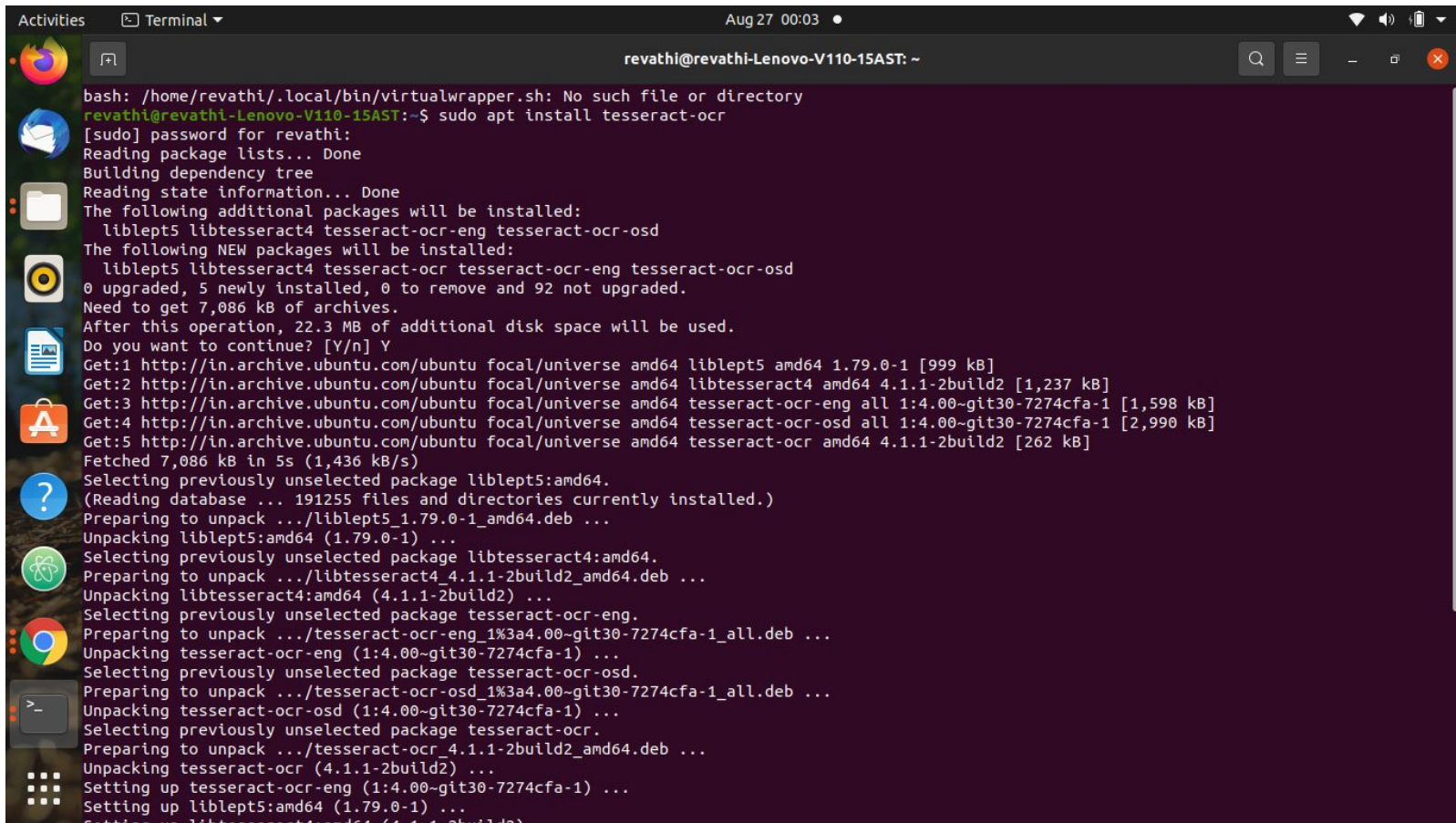
(Outside Virtual Environment)

$ sudo apt install tesseract-ocr

revathi@revathi-Lenovo-V110-15AST: ~

```
bash: /home/revathi/.local/bin/virtualwrapper.sh: No such file or directory
revathi@revathi-Lenovo-V110-15AST:~$ sudo apt install tesseract-ocr
[sudo] password for revathi:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  liblept5 libtesseract4 tesseract-ocr-eng tesseract-ocr-osd
The following NEW packages will be installed:
  liblept5 libtesseract4 tesseract-ocr tesseract-ocr-eng tesseract-ocr-osd
0 upgraded, 5 newly installed, 0 to remove and 92 not upgraded.
Need to get 7,086 kB of archives.
After this operation, 22.3 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 liblept5 amd64 1.79.0-1 [999 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 libtesseract4 amd64 4.1.1-2build2 [1,237 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 tesseract-ocr-eng all 1:4.00~git30-7274cfa-1 [1,598 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 tesseract-ocr-osd all 1:4.00~git30-7274cfa-1 [2,990 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 tesseract-ocr amd64 4.1.1-2build2 [262 kB]
Fetched 7,086 kB in 5s (1,436 kB/s)
Selecting previously unselected package liblept5:amd64.
(Reading database ... 191255 files and directories currently installed.)
Preparing to unpack .../liblept5_1.79.0-1_amd64.deb ...
Unpacking liblept5:amd64 (1.79.0-1) ...
Selecting previously unselected package libtesseract4:amd64.
Preparing to unpack .../libtesseract4_4.1.1-2build2_amd64.deb ...
Unpacking libtesseract4:amd64 (4.1.1-2build2) ...
Selecting previously unselected package tesseract-ocr-eng.
Preparing to unpack .../tesseract-ocr-eng_1%3a4.00~git30-7274cfa-1_all.deb ...
Unpacking tesseract-ocr-eng (1:4.00~git30-7274cfa-1) ...
Selecting previously unselected package tesseract-ocr-osd.
Preparing to unpack .../tesseract-ocr-osd_1%3a4.00~git30-7274cfa-1_all.deb ...
Unpacking tesseract-ocr-osd (1:4.00~git30-7274cfa-1) ...
Selecting previously unselected package tesseract-ocr.
Preparing to unpack .../tesseract-ocr_4.1.1-2build2_amd64.deb ...
Unpacking tesseract-ocr (4.1.1-2build2) ...
Setting up tesseract-ocr-eng (1:4.00~git30-7274cfa-1) ...
Setting up liblept5:amd64 (1.79.0-1) ...
```

Check tesseract-ocr
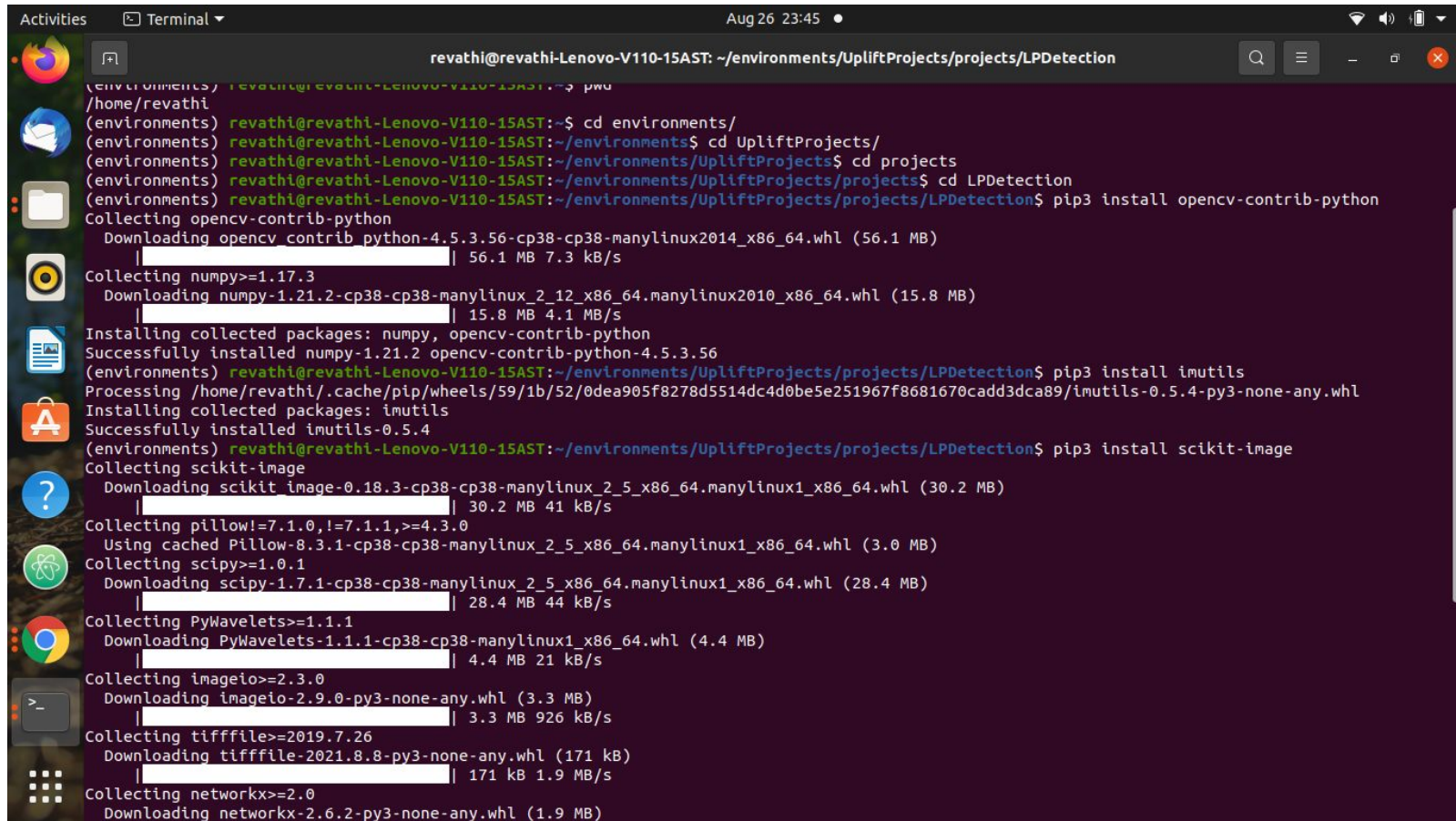
revathi@revathi-Lenovo-V110-15AST: ~

```
Get:2 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 libtesseract4 amd64 4.1.1-2build2 [1,237 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 tesseract-ocr-eng all 1:4.00~git30-7274cfa-1 [1,598 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 tesseract-ocr-osd all 1:4.00~git30-7274cfa-1 [2,990 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal/universe amd64 tesseract-ocr amd64 4.1.1-2build2 [262 kB]
Fetched 7,086 kB in 5s (1,436 kB/s)
Selecting previously unselected package liblept5:amd64.
(Reading database ... 191255 files and directories currently installed.)
Preparing to unpack .../liblept5_1.79.0-1_amd64.deb ...
Unpacking liblept5:amd64 (1.79.0-1) ...
Selecting previously unselected package libtesseract4:amd64.
Preparing to unpack .../libtesseract4_4.1.1-2build2_amd64.deb ...
Unpacking libtesseract4:amd64 (4.1.1-2build2) ...
Selecting previously unselected package tesseract-ocr-eng.
Preparing to unpack .../tesseract-ocr-eng_1%3a4.00~git30-7274cfa-1_all.deb ...
Unpacking tesseract-ocr-eng (1:4.00~git30-7274cfa-1) ...
Selecting previously unselected package tesseract-ocr-osd.
Preparing to unpack .../tesseract-ocr-osd_1%3a4.00~git30-7274cfa-1_all.deb ...
Unpacking tesseract-ocr-osd (1:4.00~git30-7274cfa-1) ...
Selecting previously unselected package tesseract-ocr.
Preparing to unpack .../tesseract-ocr_4.1.1-2build2_amd64.deb ...
Unpacking tesseract-ocr (4.1.1-2build2) ...
Setting up tesseract-ocr-eng (1:4.00~git30-7274cfa-1) ...
Setting up liblept5:amd64 (1.79.0-1) ...
Setting up libtesseract4:amd64 (4.1.1-2build2) ...
Setting up tesseract-ocr-osd (1:4.00~git30-7274cfa-1) ...
Setting up tesseract-ocr (4.1.1-2build2) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for libc-bin (2.31-0ubuntu9.2) ...
revathi@revathi-Lenovo-V110-15AST:~$ tesseract -v
tesseract 4.1.1
 leptonica-1.79.0
  libgif 5.1.4 : libjpeg 8d (libjpeg-turbo 2.0.3) : libpng 1.6.37 : libtiff 4.1.0 : zlib 1.2.11 : libwebp 0.6.1 : libopenjp2 2.3.1
 Found AVX2
 Found AVX
 Found FMA
 Found SSE
 Found libarchive 3.4.0 zlib/1.2.11 liblzma/5.2.4 bz2lib/1.0.8 liblz4/1.9.2 libzstd/1.4.4
revathi@revathi-Lenovo-V110-15AST:~$ 
```

Below are the set of packages installed at Virtual Environment

Activities   Terminal ▼   Aug 26 23:45 ●

revathi@revathi-Lenovo-V110-15AST: ~/environments/UpliftProjects/projects/LPDetection

```
(environments) revathi@revathi-Lenovo-V110-15AST:~$ pwd
/home/revathi
(environments) revathi@revathi-Lenovo-V110-15AST:~$ cd environments/
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments$ cd UpliftProjects/
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects$ cd projects
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects$ cd LPDetection
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ pip3 install opencv-contrib-python
Collecting opencv-contrib-python
  Downloading opencv_contrib_python-4.5.3.56-cp38-cp38-manylinux2014_x86_64.whl (56.1 MB)
     |                                | 56.1 MB 7.3 kB/s
Collecting numpy>=1.17.3
  Downloading numpy-1.21.2-cp38-cp38-manylinux_2_12_x86_64.manylinux2010_x86_64.whl (15.8 MB)
     |                                | 15.8 MB 4.1 MB/s
Installing collected packages: numpy, opencv-contrib-python
Successfully installed numpy-1.21.2 opencv-contrib-python-4.5.3.56
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ pip3 install imutils
Processing /home/revathi/.cache/pip/wheels/59/1b/52/0dea905f8278d5514dc4d0be5e251967f8681670cadd3dca89/imutils-0.5.4-py3-none-any.whl
Installing collected packages: imutils
Successfully installed imutils-0.5.4
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ pip3 install scikit-image
Collecting scikit-image
  Downloading scikit_image-0.18.3-cp38-cp38-manylinux_2_5_x86_64.manylinux1_x86_64.whl (30.2 MB)
     |                                | 30.2 MB 41 kB/s
Collecting pillow!=7.1.0,!=7.1.1,>=4.3.0
  Using cached Pillow-8.3.1-cp38-cp38-manylinux_2_5_x86_64.manylinux1_x86_64.whl (3.0 MB)
Collecting scipy>=1.0.1
  Downloading scipy-1.7.1-cp38-cp38-manylinux_2_5_x86_64.manylinux1_x86_64.whl (28.4 MB)
     |                                | 28.4 MB 44 kB/s
Collecting PyWavelets>=1.1.1
  Downloading PyWavelets-1.1.1-cp38-cp38-manylinux1_x86_64.whl (4.4 MB)
     |                                | 4.4 MB 21 kB/s
Collecting imageio>=2.3.0
  Downloading imageio-2.9.0-py3-none-any.whl (3.3 MB)
     |                                | 3.3 MB 926 kB/s
Collecting tifffile>=2019.7.26
  Downloading tifffile-2021.8.8-py3-none-any.whl (171 kB)
     |                                | 171 kB 1.9 MB/s
Collecting networkx>=2.0
  Downloading networkx-2.6.2-py3-none-any.whl (1.9 MB)
```

Check and install opencv

revathi@revathi-Lenovo-V110-15AST: ~/environments/UpliftProjects/projects/LPDetection

```
Collecting cycler>=0.10
  Using cached cycler-0.10.0-py2.py3-none-any.whl (6.5 kB)
Collecting kiwisolver>=1.0.1
  Using cached kiwisolver-1.3.1-cp38-cp38-manylinux1_x86_64.whl (1.2 MB)
Collecting python-dateutil>=2.7
  Using cached python_dateutil-2.8.2-py2.py3-none-any.whl (247 kB)
Collecting pyparsing>=2.2.1
  Using cached pyparsing-2.4.7-py2.py3-none-any.whl (67 kB)
Collecting six
  Using cached six-1.16.0-py2.py3-none-any.whl (11 kB)
Installing collected packages: pillow, scipy, PyWavelets, imageio, tifffile, networkx, six, cycler, kiwisolver, python-dateutil, pyparsing, ma
tplotlib, scikit-image
Successfully installed PyWavelets-1.1.1 cycler-0.10.0 imageio-2.9.0 kiwisolver-1.3.1 matplotlib-3.4.3 networkx-2.6.2 pillow-8.3.1 pyparsing-2.
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ opencv --version

Command 'opencv' not found, did you mean:

  command 'opencc' from deb opencc (1.0.5+git20190530-1build1)

Try: sudo apt install <deb name>

(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ python3
Python 3.8.10 (default, Jun  2 2021, 10:49:15)
[GCC 9.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import cv2
>>> print (cv2.__version__)
4.5.3
>>> exit
Use exit() or Ctrl-D (i.e. EOF) to exit
>>> exit()
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ lsb_release -a
No LSB modules are available.
Distributor ID: Ubuntu
Description:    Ubuntu 20.04.2 LTS
Release:        20.04
Codename:       focal
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ 
```
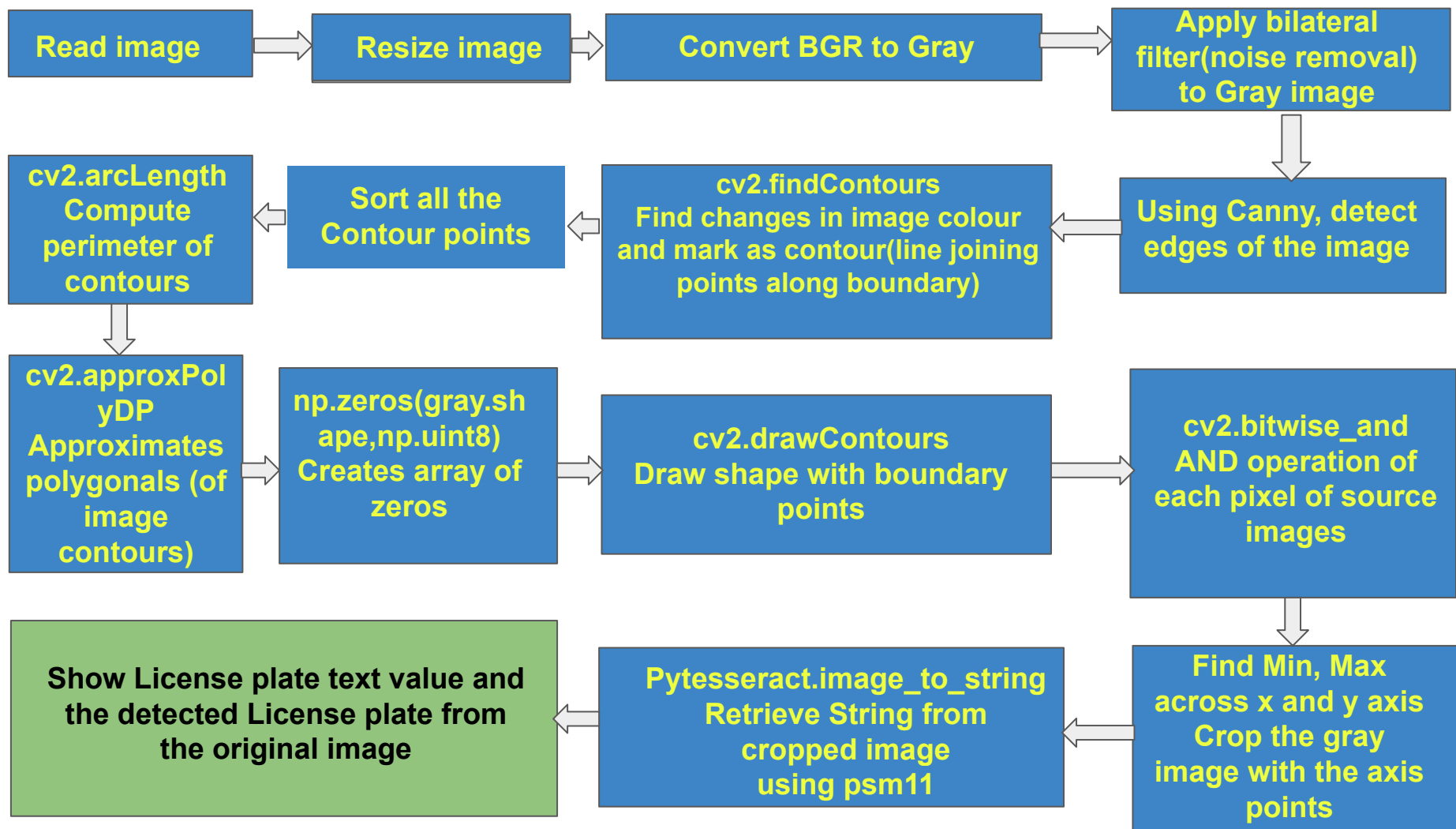
Activities   Terminal ▾   Aug 27 00:06 ●

revathi@revathi-Lenovo-V110-15AST: ~

```
Setting up tesseract-ocr-osd (1:4.00~git30-7274cfa-1) ...
Setting up tesseract-ocr (4.1.1-2build2) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for libc-bin (2.31-0ubuntu9.2) ...
revathi@revathi-Lenovo-V110-15AST:~$ tesseract -v
tesseract 4.1.1
 leptonica-1.79.0
  libgif 5.1.4 : libjpeg 8d (libjpeg-turbo 2.0.3) : libpng 1.6.37 : libtiff 4.1.0 : zlib 1.2.11 : libwebp 0.6.1 : libopenjp2 2.3.1
 Found AVX2
 Found AVX
 Found FMA
 Found SSE
 Found libarchive 3.4.0 zlib/1.2.11 liblzma/5.2.4 bz2lib/1.0.8 liblz4/1.9.2 libzstd/1.4.4
revathi@revathi-Lenovo-V110-15AST:~$ source environments/bin/activate
(environments) revathi@revathi-Lenovo-V110-15AST:~$ pip3 install pillow
Requirement already satisfied: pillow in ./environments/lib/python3.8/site-packages (8.3.1)
(environments) revathi@revathi-Lenovo-V110-15AST:~$ pip3 install pytesseract
Collecting pytesseract
  Downloading pytesseract-0.3.8.tar.gz (14 kB)
Requirement already satisfied: Pillow in ./environments/lib/python3.8/site-packages (from pytesseract) (8.3.1)
Building wheels for collected packages: pytesseract
  Building wheel for pytesseract (setup.py) ... done
  Created wheel for pytesseract: filename=pytesseract-0.3.8-py2.py3-none-any.whl size=14063 sha256=8b6331f5d87b47ddde8ed5ff54d71648149ac537c85
ade954b6800b578fe1ede
  Stored in directory: /home/revathi/.cache/pip/wheels/ed/8a/c6/40c7ec06c2dd3df636832537238128a1471bf9c1b6a3a9bf40
Successfully built pytesseract
Installing collected packages: pytesseract
Successfully installed pytesseract-0.3.8
(environments) revathi@revathi-Lenovo-V110-15AST:~$ pip3 install imutils
Requirement already satisfied: imutils in ./environments/lib/python3.8/site-packages (0.5.4)
(environments) revathi@revathi-Lenovo-V110-15AST:~$ python3
Python 3.8.10 (default, Jun  2 2021, 10:49:15)
[GCC 9.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import cv2
>>> import pytesseract
>>> import imutils
>>> []
```

Source Code - Process Flow

```
Read image → Resize image → Convert BGR to Gray → Apply bilateral filter(noise removal) to Gray image
```

```
cv2.arcLength Compute perimeter of contours ← Sort all the Contour points ← cv2.findContours Find changes in image colour and mark as contour(line joining points along boundary) ← Using Canny, detect edges of the image
```

```
cv2.approxPolyDP Approximates polygonals (of image contours) → np.zeros(gray.shape,np.uint8) Creates array of zeros → cv2.drawContours Draw shape with boundary points → cv2.bitwise_and AND operation of each pixel of source images
```

```
Show License plate text value and the detected License plate from the original image ← Pytesseract.image_to_string Retrieve String from cropped image using psm11 ← Find Min, Max across x and y axis Crop the gray image with the axis points
```

Testing - Sample downloaded images

(Detection - 100%)

revathi@revathi-Lenovo-V110-15AST: ~/environments/UpliftProjects/projects/LPDetection

```
bash: /home/revathi/.local/bin/virtualwrapper.sh: No such file or directory
revathi@revathi-Lenovo-V110-15AST:~$ source environments/bin/activate
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ python3 main.py --input group2/pic4.jpg
Vehicle Number Plate Detection & Recognition

Detected license plate Number is:

^Z
[1]+  Stopped                 python3 main.py --input group2/pic4.jpg
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ python3 main.py --input group2/pic5.jpg
Vehicle Number Plate Detection & Recognition

Detected license plate Number is: MH 20 EE 0-45
```
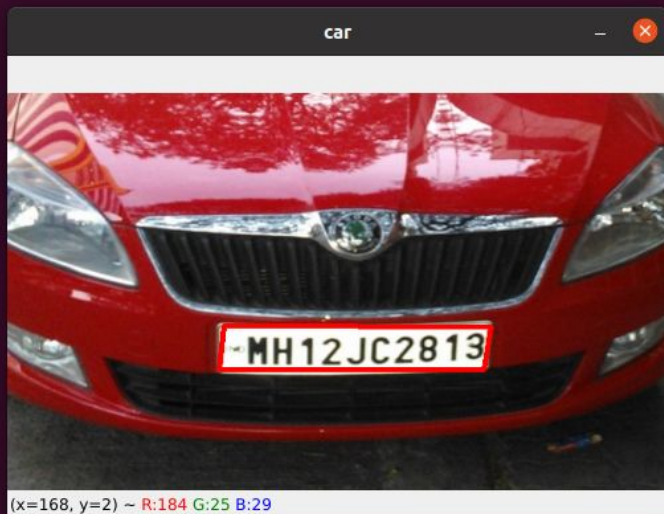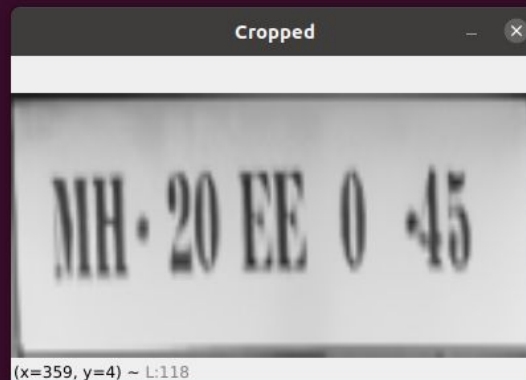
car

(x=429, y=2) ~ R:38 G:37 B:1

Cropped

(x=359, y=4) ~ L:118

Testing - Sample downloaded images

(Detection - noisy images - imperfect Detection)

revathi@revathi-Lenovo-V110-15AST: ~/environments/UpliftProjects/projects/LPDetection

bash: /home/revathi/.local/bin/virtualwrapper.sh: No such file or directory
revathi@revathi-Lenovo-V110-15AST:~$ source environments/bin/activate
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ python3 main.py --input group2/pic4.jpg
Vehicle Number Plate Detection & Recognition

Detected license plate Number is:

^Z
[1]+ Stopped   python3 main.py --input group2/pic4.jpg
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ python3 main.py --input group2/pic5.jpg
Vehicle Number Plate Detection & Recognition

Detected license plate Number is: MH 20 EE 0-45

^Z
[2]+ Stopped   python3 main.py --input group2/pic5.jpg
(environments) revathi@revathi-Lenovo-V110-15AST:~/environments/UpliftProjects/projects/LPDetection$ python3 main.py --input noise/pic2.jpg
Vehicle Number Plate Detection & Recognition

Detected license plate Number is: a

car   _ ✕

Cropped   _ ✕

TN·07 BU 54·27

(x=313, y=6) ~ L:186