PROJECT REPORT ON

“Artificial intelligence techniques for smart city applications”

COURSE: Bachelor of Technology (3rd semester)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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INTRODUCTION

Artificial Intelligence is an approach to make a computer, a robot, or a product to think how smart human think. AI is a study of how human brain think, learn, decide and work, when it tries to solve problems.

The aim of AI is to improve computer functions which are related to human knowledge, for example, reasoning, learning, and problem-solving.

The objectives of AI research are knowledge representation, planning, learning, natural language processing, realization, and ability to move and manipulate objects.

This project is all about the AI technique that we use in smart city applications like license plate number recognition of a vehicle (i.e. extracting the license number from vehicle’s plate). License plate recognition is mostly used in: - *toll booth, car parking management, traffic management, etc.* In this project with the help of python I’ve worked on a code to extract the characters of number plate in given sample data (i.e. a photo of a vehicle with license plate) and according to the number plate I’ve applied few toll tax(fastag) conditions for paying toll tax according to the state.

STATEMENT:

License plate recognition using easy ocr

In the following project, we will understand how to recognize License number plates using the Python programming language.

We will utilize **OpenCV** for this project in order to identify the license number plates and the python **easy ocr** for the characters and digits extraction from the plate. We will build a Python program that automatically recognizes the License Number Plate. And we will understand what is **ANPR** (Automatic Number Plate Recognition) system.

ANPR (Automatic Number Plate Recognition) system:

1. ANPR executed in measured lighting situations with predictable number plate types can utilize basic techniques for image processing.
2. More advanced ANPR systems use dedicated object detectors, like HOG + Linear SVM, YOLO, and Faster R-CNN to localize license number plates in images.
3. State-of-the-art ANPR software uses Recurrent Neural Networks (RNNs) and Long Short-Term Memory networks (LSTMs) in order to aid in better OCRing of the text from the number plates themselves.
4. Even more advanced ANPR systems utilize specialized neural network architectures in order to pre-process and clean images before they are OCRed, thereby developing the accuracy of ANPR.

MOVITATION:

I chose this project on artificial intelligence as I’m interested in AI field and my specialization is Artificial Intelligence and Machine Learning as well and in that we had worked with ocr, computer vision, etc. And I was interested to know how fastag and challans are deducted by AI features, how they really work and are linked by accounts. And by this project I was able to work with OpenCV features and how they really work in extracting characters from an image.

TOOLS USED:

In the following project the ***imultis*** library is used which contains a series of ***Opencv*** functions. It is an open-source library for machine learning and offers a common infrastructure of computer vision. I have also used ***Easyocr*** for the project. Easyocr is a python package that allows image to be converted into text. It is by far the easiest way to implement OCR and has access to over 70+ languages.
I have done my all-project work in Google Colaboratory environment, and it is easy to work with it and it has various features.

FEATURES OF OPENCV USED IN PROJECT:

Contours: contours are the curves that consist of all continuous points of the same intensity. These curves are quite useful utilities for the recognition of the object.

Grayscale: grayscaling is the process of converting an image from other color spaces e.g. RGB, CMYK, HSV, etc. to shades of gray, it varies between complete black and white.

Filter: filter () method filters the given sequence with the help of a function that tests each element in the sequence to be true or not.

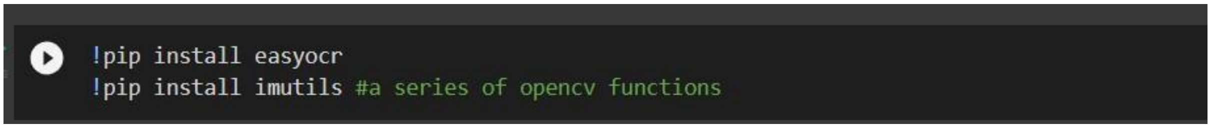
Edge: edge detection is an image processing technique, which is used to identity, which is used to identity the boundaries(edges) of objects, or regions within an image.

METHODOLOGY:

Building up a project on License Plate Recognition was a good experience and I’ve learned a lot from this about artificial intelligence techniques and how to implement them in smart city

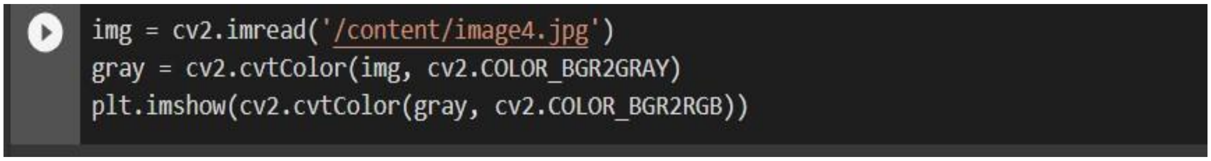
applications.
For implementing this project following methodology needs to be followed: -

- **Install and import dependencies.**



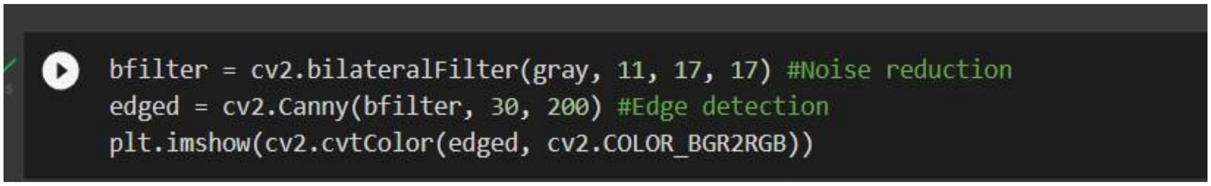
```
!pip install easyocr
!pip install imutils #a series of opencv functions
```

- **Read in image, grayscale and blur.**



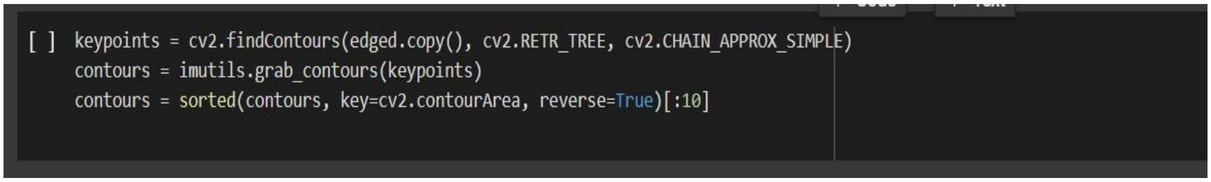
```
img = cv2.imread('/content/image4.jpg')
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(cv2.cvtColor(gray, cv2.COLOR_BGR2RGB))
```

- **Apply filter and find edges for localization.**



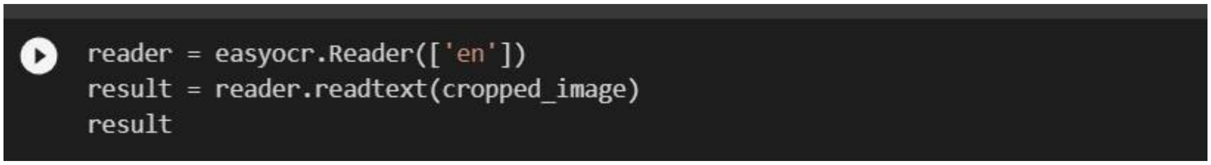
```
bfilter = cv2.bilateralFilter(gray, 11, 17, 17) #Noise reduction
edged = cv2.Canny(bfilter, 30, 200) #Edge detection
plt.imshow(cv2.cvtColor(edged, cv2.COLOR_BGR2RGB))
```

- **Find contours and apply mask.**



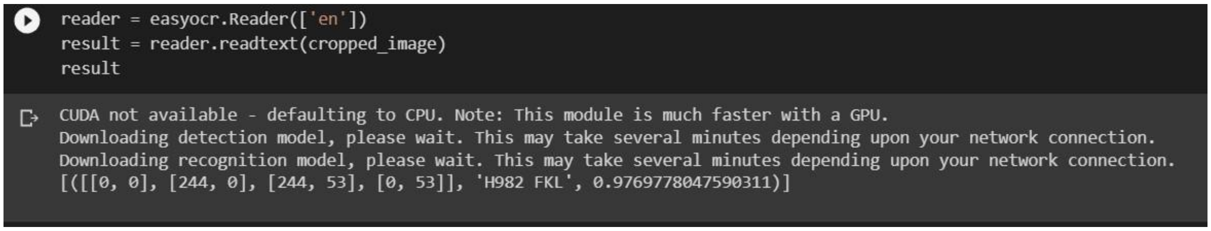
```
[ ]  keypoints = cv2.findContours(edged.copy(), cv2.RETR_TREE, cv2.CHAIN_APPROX_SIMPLE)
     contours = imutils.grab_contours(keypoints)
     contours = sorted(contours, key=cv2.contourArea, reverse=True)[:10]
```

- **Use Easyocr to read text**



```
reader = easyocr.Reader(['en'])
result = reader.readtext(cropped_image)
result
```

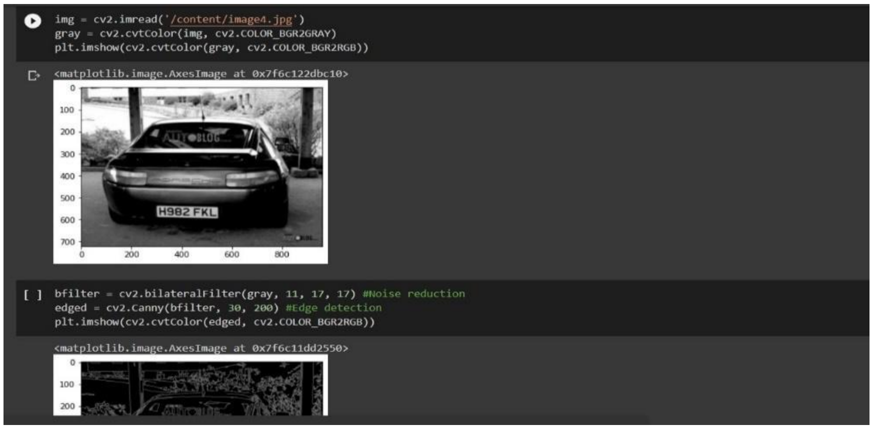
- **Render result**



```
reader = easyocr.Reader(['en'])
result = reader.readtext(cropped_image)
result
```

```
CUDA not available - defaulting to CPU. Note: This module is much faster with a GPU.
Downloading detection model, please wait. This may take several minutes depending upon your network connection.
Downloading recognition model, please wait. This may take several minutes depending upon your network connection.
[([[0, 0], [244, 0], [244, 53], [0, 53]], 'H982 FKL', 0.9769778047590311)]
```

By using mentioned steps and methods in python language I have completed my project.

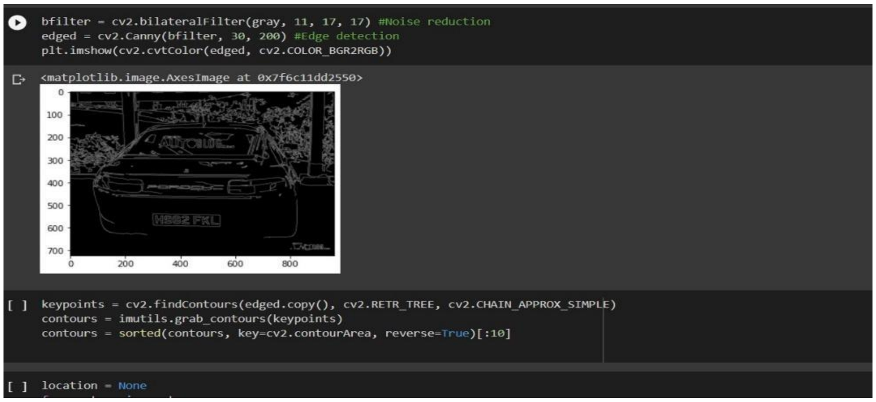


```
img = cv2.imread('/content/image4.jpg')
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(cv2.cvtColor(gray, cv2.COLOR_BGR2RGB))
```

```
<matplotlib.image.AxesImage at 0x7f6c122dbc10>
```

```
[ ] bfilter = cv2.bilateralFilter(gray, 11, 17, 17) #Noise reduction
    edged = cv2.Canny(bfilter, 30, 200) #Edge detection
    plt.imshow(cv2.cvtColor(edged, cv2.COLOR_BGR2RGB))
```

```
<matplotlib.image.AxesImage at 0x7f6c11dd2550>
```

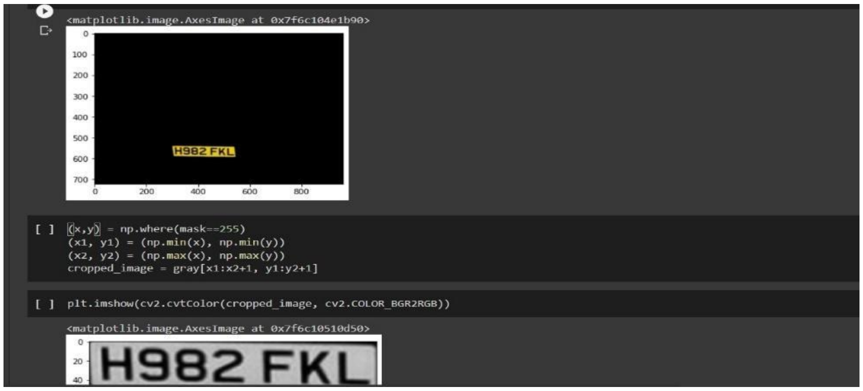


```
bfilter = cv2.bilateralFilter(gray, 11, 17, 17) #Noise reduction
edged = cv2.Canny(bfilter, 30, 200) #Edge detection
plt.imshow(cv2.cvtColor(edged, cv2.COLOR_BGR2RGB))
```

```
<matplotlib.image.AxesImage at 0x7f6c11dd2550>
```

```
[ ] keypoints = cv2.findContours(edged.copy(), cv2.RETR_TREE, cv2.CHAIN_APPROX_SIMPLE)
    contours = imutils.grab_contours(keypoints)
    contours = sorted(contours, key=cv2.contourArea, reverse=True)[:10]
```

```
[ ] location = None
```

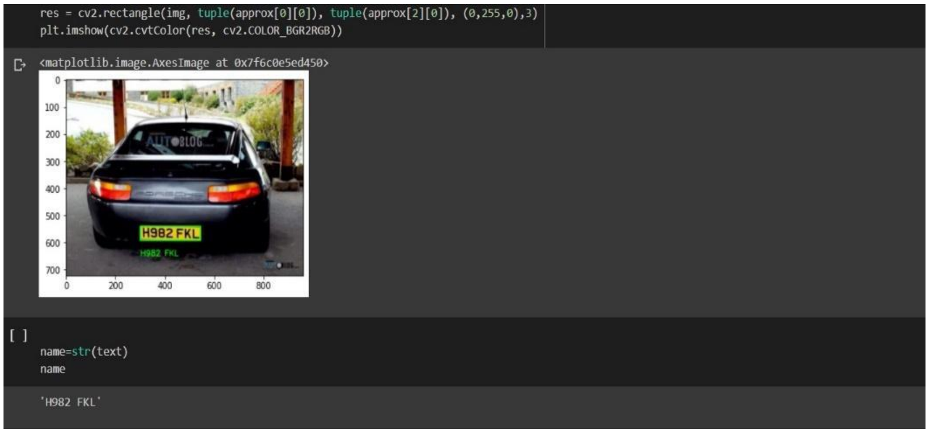


```
<matplotlib.image.AxesImage at 0x7f6c104e1b90>
```

```
[ ] (x,y) = np.where(mask==255)
    (x1, y1) = (np.min(x), np.min(y))
    (x2, y2) = (np.max(x), np.max(y))
    cropped_image = gray[x1:x2+1, y1:y2+1]
```

```
[ ] plt.imshow(cv2.cvtColor(cropped_image, cv2.COLOR_BGR2RGB))
```

```
<matplotlib.image.AxesImage at 0x7f6c10510d50>
```



```
res = cv2.rectangle(img, tuple(approx[0][0]), tuple(approx[2][0]), (0,255,0),3)
plt.imshow(cv2.cvtColor(res, cv2.COLOR_BGR2RGB))
```

```
<matplotlib.image.AxesImage at 0x7f6c0e5ed450>
```

```
[ ]
    name=str(text)
    name
```

```
'H982 FKL'
```

Conclusion:

The completion of the project went quiet well, I learned much new things while I was making it, and I get up to know various platforms which help us to learn about artificial intelligence and about various features of python language. I was able to learn the practical use of AI techniques. The practical helped me to learn the debugging the code and working with various libraries and functions of Python.

Overall working on this project was great experience as I came up with great piece of knowledge and understanding of the topic as this was my first project.

BIBLIOGRAPHY:

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