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Implementation of Optical Character Recognition Technology with Pollution Measurement Using Olfactory Sensor

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Abstract: ***Nowadays with the evolution of science and innovation of modern technologies the world is going into a phase of automation and in this approach we also need to keep in mind that the most delicate organ of nature, environment does not get affected. In everyday life huge amount of damage caused to the environment is due to smoke released from automobiles that run on petrol and diesel. Now we cannot eliminate the use of petrol or diesel run automobiles instantly, but we can ensure that the smoke released from them is within limits and does not increase pollution. The government basically relies on the inspection of pollution card for each and every automobile but our objective is to replace this process with a nano-mechanical olfactory sensor thereby making it autonomous. Olfactory sensors can be installed at toll bridges or parking lots to detect extent of damage caused by the smoke released from the automobiles and thereby using OCR technology to check the license plate number of the automobiles damaging the environment causing pollution.***

Keywords: Environmental Pollution, Nano-mechanical Olfactory sensor, Optical Character Recognition, Automation

1. Introduction

With the rapid advancement of technologies in today's world an important issue is often neglected, the fate of the world and not in the technological aspect but in the environmental aspect .Global Warming is a dangerous question looming over the earth. The main factors responsible for this global warming are the harmful emissions from automobiles. The main focus of this project is to devise a way to control the level of emission of gases. For this we can use olfactory sensors and OCR. The olfactory sensors are equipped to detect the presence of various gases. They are therefore installed to check level of intensity of the harmful gases. A MEMS based nano-mechanical olfactory sensor can work with greater accuracy. With the installation of olfactory sensor we can also install OCR technology which can detect the license plate numbers of the faulty cars and it can be immediately sent to the servers. Through this complete process the entire system can work independent of human help, which is a major leap towards the era of automation.

2. Olfactory Sensor

A nano-mechanical olfactory sensor is one of the best equipment to control pollution using automated system. The nano-mechanical olfactory system is hereby highlighted as the artificial olfaction. Artificial olfaction can be applied in various fields**.** The most efficient way to implement the nano-mechanical olfactory system is by using the sensors. The two best possibilities in this concerned domain are Cantilever array based sensors and the MEMS based sensor. A cantilever array based sensor consists of eight differently coated cantilevers which can be applied as an olfaction to various vapors. The cantilever arrays are sensors which are rectangular micro-fabricated bars of silicon. It is advantageous because it is a miniature model with immense sensitivity and high accuracy.

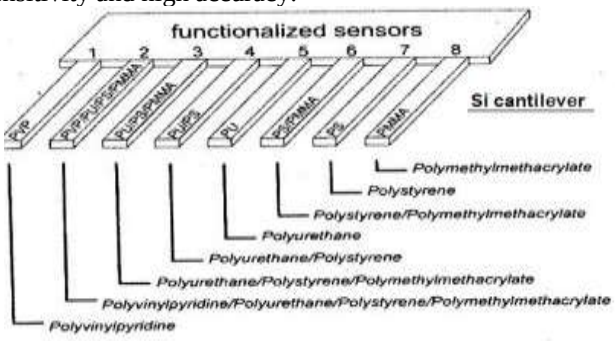

Figure 1 (a)

Figure 1 (b)

Figure 1.a. & 1.b: Cantilever array based sensor

Another type of sensor which are used for olfaction is MEMS based nano-mechanical system. MEMS technology consists of Mechanical and Electro-mechanical micro-fabricated elements. It is composed of micro-electronic structure and actuators. These type of technology is generally small in size but it has a very high working accuracy and provides better performance.

Algorithm for Olfactory sensor

Step 1: To detect analytes cantilever array based sensor is used.
Step 2: Emission of gases from vehicles at various toll tax. It takes raw measurements (of gases), undergoes extraction and pre-processing.
Step 3: Then dimension is reduced significantly.
Step 4: After reduction different types of classification (odour class) takes place.
Step 5: It then converts it (bio-chemical or physical processes) into recordable signal.
Step 6: Output in the form of signal is indicative of the intensity of pollutants present.

3. Optical Character Recognition (OCR)

After detecting the automobiles with faulty gas emissions our next focus is to detect the number plate of car using OCR. We use the MATLAB software to execute the OCR code which basically recognises a set of characters from an image. The execution of the program starts by taking input as image of any vehicle's number plate. The process starts by converting the picture into grayscale form. With the help of OCR technology a better result with more accuracy can be obtained and its performance can be improved by applying more filters like median filter, unsharp mask filtering, etc. and also we have increase the contrast of the image in intermediate steps to achieve better recognition of the image.

Figure 2 (a): Original image of the number plate of the vehicle

Figure 2 (b): Conversion of original image to grayscale image for using OCR

Then the character extraction process is applied on the modified image. After extraction the characters are converted into a text file comprising of the number of the vehicle.

Algorithm for OCR

Step 1: Initialisation of the program by capturing the picture from the desired location.
Step 2: Read the image and resize it for better outcome.
Step 3: Convert the picture from RBG (Red Blue Green) format to gray scale format.
Step 4: Then the image is been dilated for enhancing the pixels.
Step 5: Now apply median filter for reduction of noise in the dilated image.
Step 6: Now increase the contrast to make the picture clear to some extent.
Step 7: Application of unsharp mask filter is required to enhance the contrast for the region of interest (here region of interest is elliptical which include the number plate of the vehicle).
Step 8: Create images of different threshold values and eliminate the background.
Step 9: Specify the each character by individual bounding box.
Step 10: Convert the specified character into text document.

4. System Analysis

As we have stated that we are going to focus on a totally automated system to control the pollution so here we state the steps to achieve it. The following flowchart is going to represent the steps which the automated system is going to follow:-

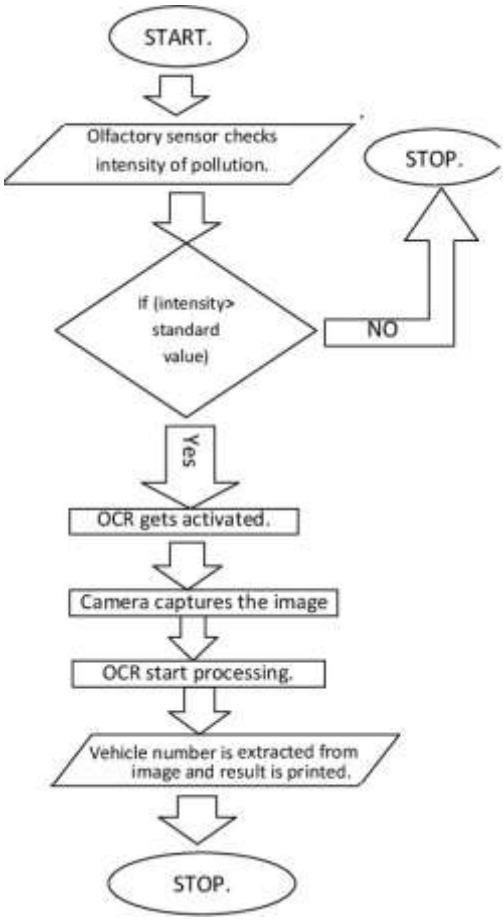

Figure 3: Flowchart

As stated earlier the system can be installed in the toll bridges or in the parking lots so that we can run the whole process when a particular vehicle in collecting the receipt or paying the toll taxes. When the vehicle stops at the counter the olfactory sensor which is fitted to an arm connected to servo motor spans itself and collects the sample gas which the vehicle is emitting from the exhaust. Then the olfactory sensor checks the intensity of the pollution in the sample gas and checks it with the standard value. If the resultant value exceeds the standard value then the Optical Character Recognition (OCR) system gets activated and it clicks a snap of the vehicle number plate. Then the OCR uses different kinds of filter to detect the number in the licence plate from the actual image snapped. After detection of the number the number is converted into a text file and the number is uploaded to the server thus ensuring to take steps to reduce the amount of pollution caused by that very vehicle.

Algorithm

Step 1: Start.
Step 2: We use the olfactory sensor algorithm to check the intensity of pollution gas.
Step 3: If the level of intensity is greater than the standard value then go to step 4 else go to step 7.
Step 4: OCR gets activated.
Step 5: Camera captures the image.
Step 6: OCR processes the image.
Step 7: The vehicle number is extracted from the image captured.
Step 8: Stop.

5. Results

The nano-mechanical olfactory sensor which either uses Cantiliver array based sensor or MEMS based sensor checks the intensity of the gas emitted from the exhaust of the automobile. The intensity of the gas emission is checked by comparing with standardized values. We can plot the intensity curve emitted from the automobiles as below.

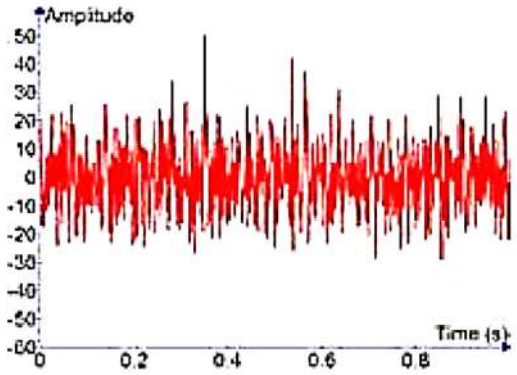

Figure: Intensity curve of olfactory sensor

After getting the signal from olfactory sensor, the data (the picture of the vehicle's number plate) is capture by a camera. Then the image is processed by applying the OCR code which contains application of different filters and noise reduction. Then the output is followed by conversion of the characters in the actual image to a text file format. Further the data can be stored in the database and update the record as per requirement.

Figure 4 (a): After applying Unsharp mask in elliptical shape

Figure 4 (b): After detection of the characters by bounding box

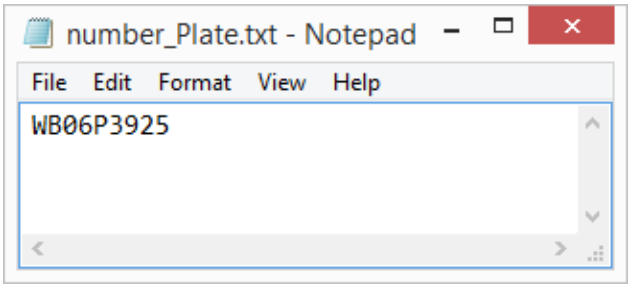

Figure 4 (c): Final output as a text file

6. Conclusion

It is quite evident that an efficient automated system for controlling pollution can be designed using Olfactory sensor and OCR. Here, miniaturized nano-mechanical olfactory sensors are used which are very sensitive in nature and come up with the best output possible. This system on the other hand is accompanied by an extremely efficient OCR technology which not only enhances the process but also helps us to take a big step for making our future beautiful.

References

[1] G.V.S.S.K.Naganjaneyulu;A.V.Narasimhadhan;K.Venkatesh, "Performance evaluation of OCR on poor resolution text document images using different pre-processing steps" TENCON 2014 - 2014 IEEE Region 10 Conference.
[2] 2.Riya Dam; Sahil Sarkar; Rishab Sarbadhikary; Avirup Ghosh; Souvik Ghosh "Evolution of nano-mechanical olfactory sensor as an artificial

nose" 2016 IEEE 7th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON).

[3] Bhonsale Tejas; Dhamal Omkar; Dhumal Rutuja; Khedekar Prajakta; Patil Bhakti, "Number plate recognition and document verification using feature extraction OCR algorithm" 2017 International Conference on Intelligent Computing and Control Systems (ICICCS).

[4] V.Vodyanoy,"Olfactory sensor" Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society.

[5] Poonam A. Wankhede; Sudhir W. Mohod "A different image content-based retrievals using OCR techniques" 2017 International conference of Electronics, Communication and Aerospace Technology (ICECA).

[6] Kartikeya Jain; Tanupriya Choudhury; Nirbhay Kashyap "Smart vehicle identification system using OCR" 2017 3rd International Conference on Computational Intelligence & Communication Technology (CICT).

[7] Siva Shankar Chandrasekaran; Sudharshan Muthukumar; Sabeshkumar Rajendran "Automated Control System for Air Pollution Detection in Vehicles" 2013 4th International Conference on Intelligent Systems, Modelling and Simulation.

[8] T. Nakamoto; M. Kakizaki; Y. Suzuki; H. Mitsuno; R. Kanzaki "Response analysis of odor sensor based upon insect olfactory receptors using image processing method SENSORS", 2014 IEEE.

[9] Natalia Obukhova; Alexandr Motyko; Alexandr Pozdeev "Modern methods and algorithms in digital processing of endoscopic images" 2017 21st Conference of Open Innovations Association (FRUCT).

[10] Bhavin V. Kakani; Divyang Gandhi; Sagar Jani "Improved OCR based automatic vehicle number plate recognition using features trained neural network." 2017 8th International Conference on Computing, Communication and Networking Technologies (ICCCNT).