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Geo-Spatial Approach for an Ambient Air Quality Monitoring in Kanchipuram

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Abstract: ***A pilot study was conducted in Kanchipuram municipality to understand the ambient air quality through the Geo-Spatial analysis. Nowadays Kanchipuram is experiencing an exponential vehicle and population growth, which is one of the major reason for air pollution. In order to monitor the ambient air quality near busy road junctions in Kanchipuram, four road junctions were selected, by using dust sampler machine along with a control station. By using spatial analysis technique, contour maps have been plotted for the obtained results.***

Keywords: Ambient Air Quality, GPS, Spatial analysis, Environment

I. INTRODUCTION

Air pollution is a major problem that has been recognized throughout the world for hundreds of years. In more recent times pollution from motor vehicles has become the most recognized air quality issues. The manufacturing of automobile has a notable impact on people's lives in the industrial revolution. Air pollution is one of the most serious public problems in and around the world. Rapidly growing of vehicles with poor quality emission and poor maintenance are the biggest contributions to air pollution. Emission of chemicals from the vehicles has negative effects on the environment in which we live. Carbon monoxide, particulates, nitrogen oxides, and hydrocarbons are the major pollutants released by the vehicles which cause air pollution. Ozone is a secondary pollutant produced when many of this primary chemicals react in sunlight in the atmosphere.

II. MATERIALS AND METHODS

A. *Principle and Methodology*

1) Oxides of Nitrogen: Nitrogen dioxide is considered annoyance gas, which causes inflammation of the airways at high concentrations. Nitrogen, when released during fuel combustion by the vehicles it combines with atmospheric oxygen in order to form nitric oxide (NO), then it further reacts with available oxygen to form nitrogen dioxide (NO_2). Nitric oxide is not taken into consideration as for hazardous to health at typical ambient concentrations, but nitrogen dioxide is considered. nitric oxide and nitrogen dioxide are together taken into consideration as oxides of nitrogen (NO_x). NOx gases react to cause smoke and acid rain as well as leads to the development of fine particles (PM) and ground-level ozone [1], both of which are associated with adverse health effects [2]. NO_x mainly impacts on respiratory conditions causing inflammation of the airways at high levels. Long-term exposure can affect lung function, causing the risk of respiratory disease and increases the response to allergens.

The method used for finding the content of oxides of nitrogen is Modified Jacobs & Hochheiser Method (IS 5182 Part 6 Methods for Measurement of Air Pollution: Oxides of nitrogen). Nitrogen dioxide (NO_2) is collected from the atmosphere by passing air through a solution of sodium arsenite and sodium hydroxide. The concentration of nitrite ion (NO-2) produced during sampling is determined colorimetrically [3] by reacting the nitrite ion with phosphoric acid, sulfanilamide, and N-(1-naphthyl)- ethylenediamine di-hydrochloride (NEDA) and measuring the absorbance of the highly colored azo-dye at 540 nm. The laboratory analysis of Nitrogen dioxide (NO_2) is shown in Table 1 and graphically represented in Fig.1.

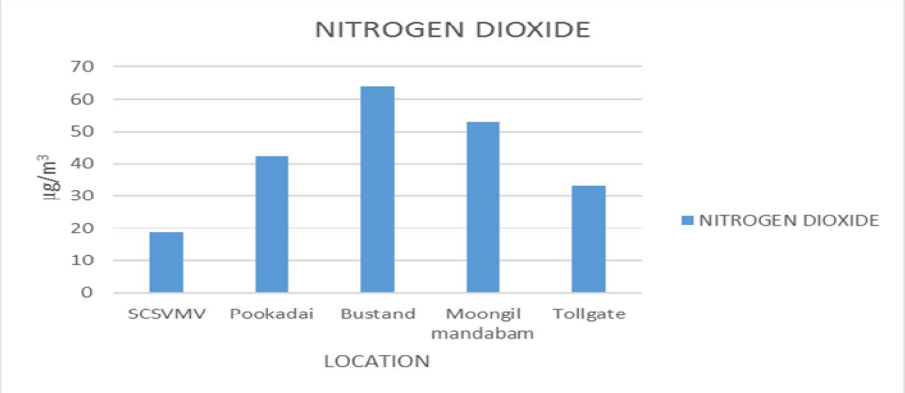

Fig.1 Nitrogen dioxide level in the study area

Table 1
NITROGEN DIOXIDE LEVEL

LOCATION	NITROGEN DIOXIDE µg /m3
SCSVMV	18.6
POOKADAI	42.3
BUS STAND	63.8
MOONGIL MANDABAM	53.0
TOLLGATE	33.0

B. Ozone

Ozone (O3) is a colourless, poisonous gas with a sharp, cold and irritating odour. Ozone is formed in the troposphere as a result of anthropogenic emissions. The process of ozone formation may take several days to complete [4]. Ozone is a photochemical oxidant and is produced in the upper atmosphere by solar radiation. Also, small concentrations of ozone are produced by lightning and forest fires. Ozone is usually accumulated in the upper strata of atmosphere at around 25-40 km range from earth[5] and is known as ―Ozone blanket‖ or ―Ozone layer‖. It does not allow the dangerous incoming UV rays. Life on earth is probably possible only due to this protective umbrella of ozone.

C. Method

Method 411, Air Sampling and Analysis, 3rd Edition (Determination of oxidizing substances in the atmosphere) [6] Micro-amounts of ozone and the oxidants liberate iodine when absorbed in a 1% solution of potassium iodine buffered at pH 6.8 + 0.2. The iodine is determined spectrophotometrically by measuring the absorption of a tri-iodide ion at 352 nm. The laboratory analysis of ozone is shown in Table 2 and graphically represented in Fig.2.

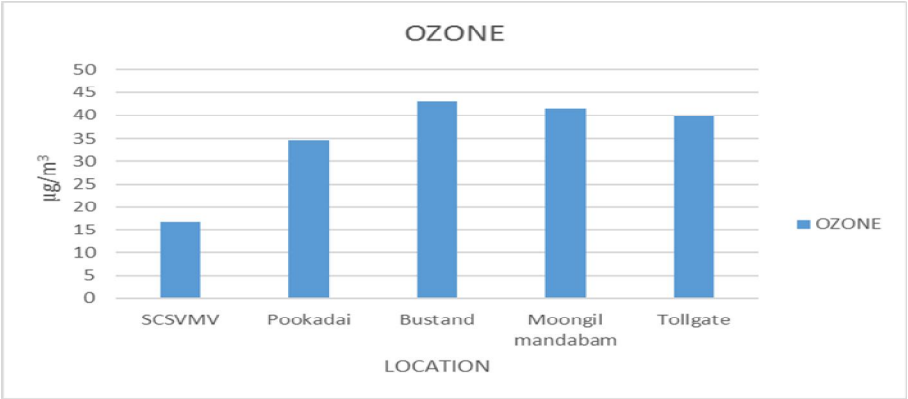

Fig.2 Ozone level in the study area

Table 2
OZONE LEVEL

LOCATION	OZONE µg /m3
SCSVMV	16.7
POOKADAI	34.6
BUS STAND	43.0
MOONGIL MANDABAM	41.5
TOLLGATE	39.8

D. Nickel

Nickel is a chemical element with symbol Ni and atomic number 28. It is a silvery-white lustrous metal with a slight golden tinge. Nickel is one of the transition metals, which is hard and ductile [7]. Pure nickel, powdered to maximize the reactive surface area, shows a significant chemical activity but larger pieces are slow to react with air under standard conditions because an oxide layer forms on the surface and prevents further corrosion [8]. Even so pure native nickel is found in earth's crust only in tiny amounts, usually in ultramafic rocks, and in the interiors of larger nickel-iron meteorites that were not exposed to oxygen when outside earth's atmosphere.

E. Method

The Atomic Absorption Spectroscopy (AAS) technique makes use of absorption spectrometry to assess the concentration in the sample [9]. The method is based on active sampling using PM10 High Volume Sampler and then sample analysis is done by atomic absorption spectrophotometer [10]. The laboratory analysis of Nitrogen dioxide (NO_2) is shown in Table 3 and graphically represented in Fig.3.

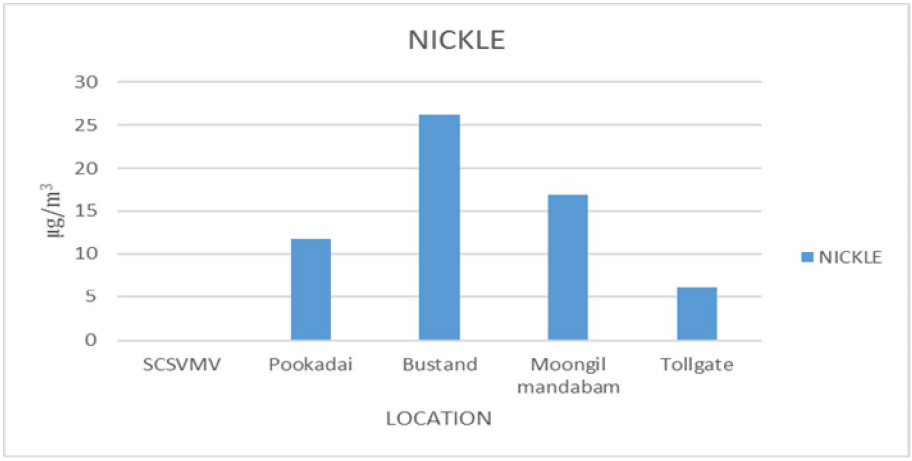

Fig.3 Nickle level in the study area

Table 3 OZONE LEVEL

LOCATION	NICKLE µg /m3
SCSVMV	0.0
POOKADAI	11.78
BUS STAND	26.25
MOONGIL MANDABAM	16.9
TOLLGATE	6.18

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F. Spatial Analysis

The obtained laboratory results have been incorporated in ArcGIS 10.1 software for spatial interpolation. By using Inverse Distance Weightage (IDW) technique, spatial interpolation has been performed. The spatial analysis results show the influence of each pollutant level in the study area. The spatial analysis map is shown in Fig.4 for all the analyzed parameters.

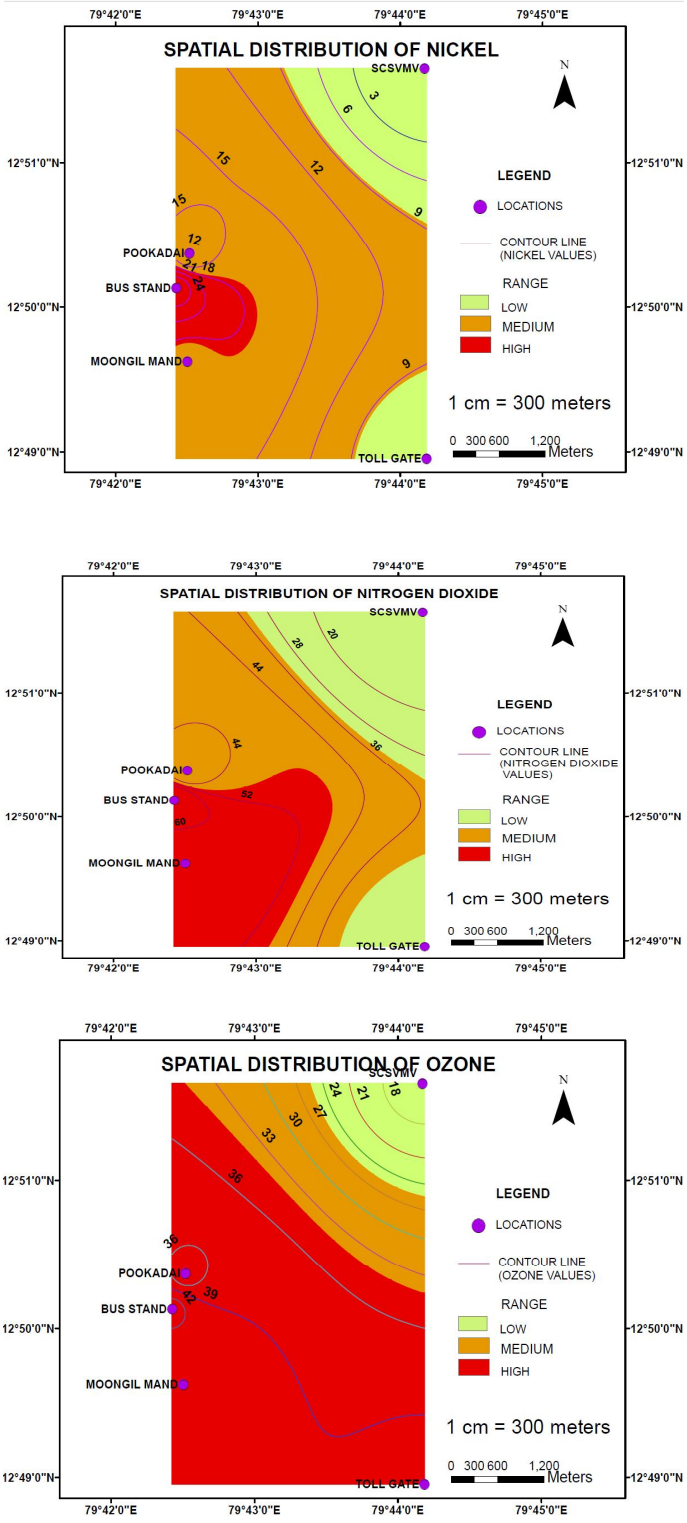

Fig.4 Spatial analysis result in the study area

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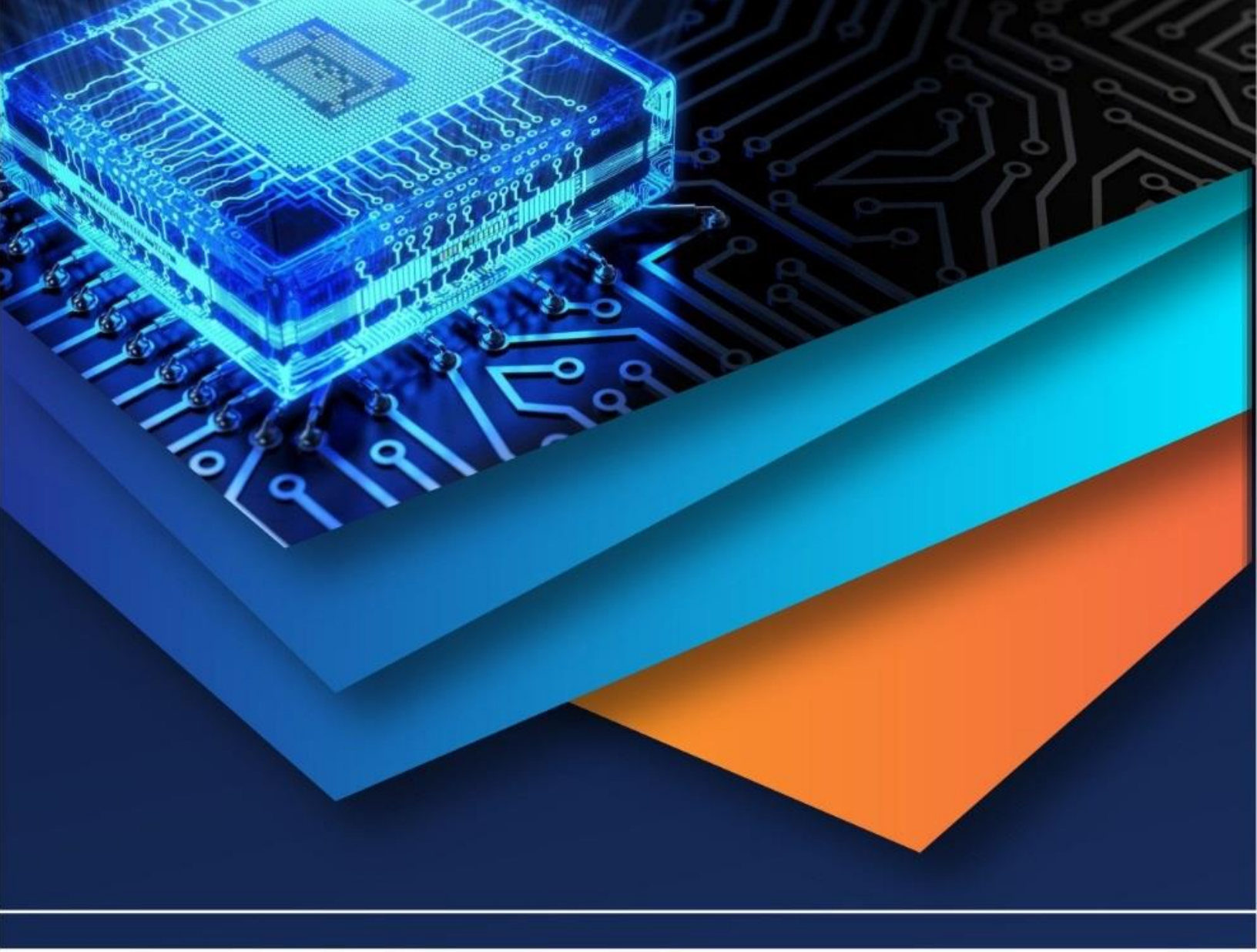

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