Spatial Analysis for an Ambient Air Quality Monitoring in Kanchipuram

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***Abstract*— A traffic volume study was conducted in Kanchipuram municipality to understand the traffic volume in the municipality along with the ambient air quality through the Spatial analysis. Kanchipuram municipality is one of the important pilgrim centre in India. Due to rapid urbanization and increase in vehicle quantity, traffic and air pollution is day to day problem in the city. The traffic volume study and ambient air quality in the municipality was studied to understand the present scenario. By using spatial interpolation technique, thematic maps were prepared for the different air quality parameters.**

***IndexTerms*: Ambient Air Quality, Traffic volume, Spatial analysis, GIS**

I. INTRODUCTION

Air pollution worldwide is a growing threat to human health and natural environment. Air pollution is a gas released in a big enough quantity to harm the health of people or other animals, kill plants or stop them growing properly, damage or disrupt some other aspect of the environment or cause some other kind of nuisance. People involving in combustion are industrial chemicals or large amount of dust causes air pollution. A huge amount of air pollution is caused by traffic, power plants and factories which makes huge contribution. Rapidly growing of vehicles with poor quality emission and poor maintenance are the biggest contributions to air pollution. Emission of chemicals from the vehicles causes a huge air pollution. The major air Pollutant are particulate matter, Sulphur dioxide and ammonia.

II. TRAFFIC VOLUME STUDY

Traffic volume in Kanchipuram city increases in many folds during the past few decades due to rapid urbanization. The growth rate of vehicles causes severe traffic congestion in the city. Due to the traffic congestion the travelling time, even very short distances within the city becomes more time taken. The traffic volume study was conducted in the month of February 2018 in five locations where more traffic congestion occurs. Integration of mobile phones with GIS information is also possible to understand the traffic information. The traffic volume study was made in the junctions. During traffic volume study vehicles are classified as two wheelers, three wheelers, light motor vehicles (LMV) and heavy motor vehicles (HMV). Spatial distribution analysis can be achieved using GIS. The result of the traffic volume study shows the two wheelers in the study area is a dominant factor in volume wise. The traffic volume data of bus stand junction are shown in Table 1.

In pookadai location the survey was made during the peak hours in both forenoon and evening session, and it is observed that the passing of two wheeler is high than other vehicles, is shown in Fig. 1. The traffic volume survey in Pookadai junction is shown in Table 1which is conducted on on 07/02/2018.

Table.1 Traffic volume survey in Pookadai Junction

Time	two wheeler	three wheeler	LMV	HMV
7:15-8:55AM	3124	339	517	368
8:55-10:00AM	3234	497	58	389
3:30-4:30PM	5371	1417	1106	19
4:30-5:28PM	5134	1381	977	20
5:30-6:50PM	5423	1741	1511	22
6:50-8:25PM	5531	1697	1127	11

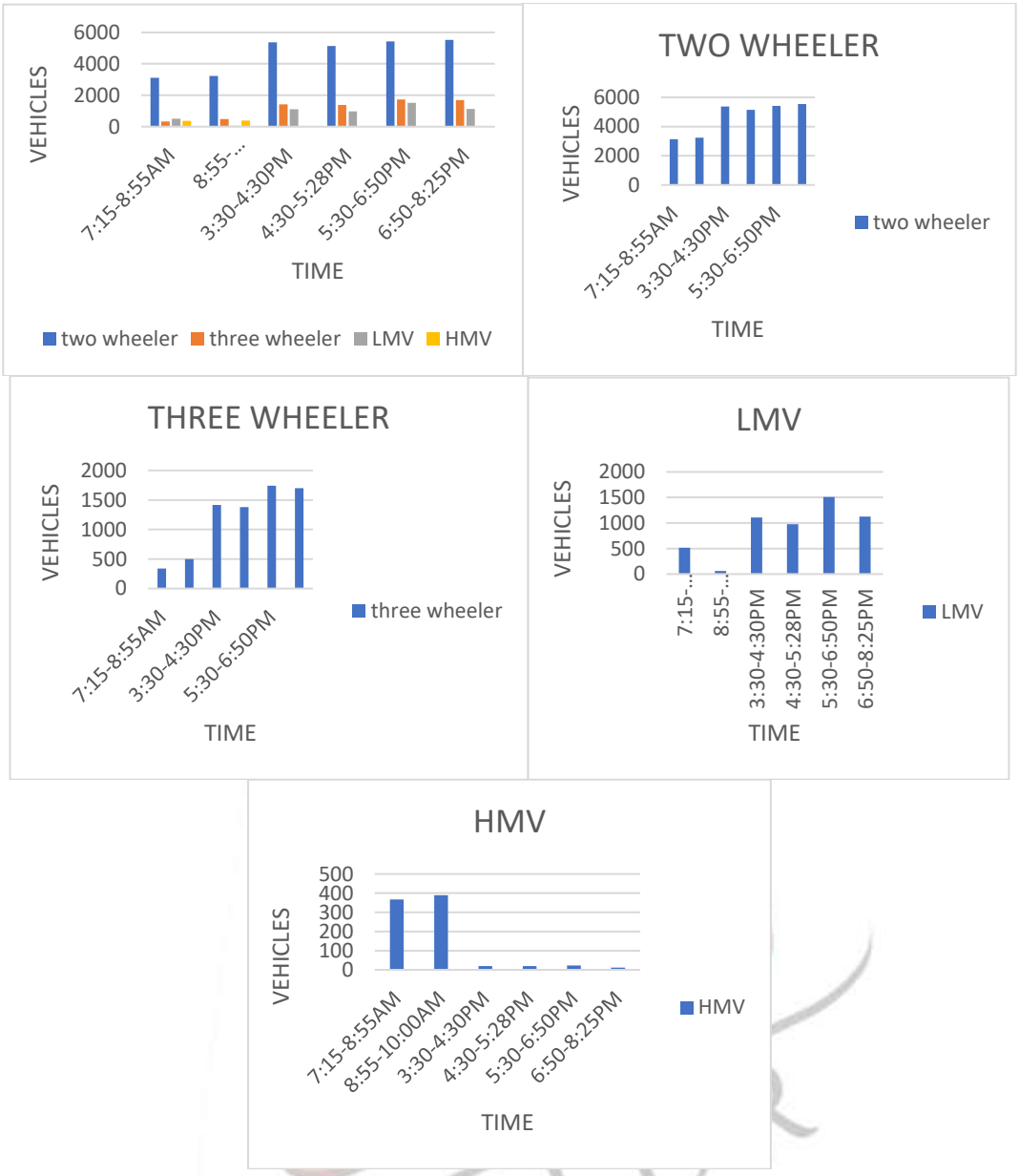

Fig.1 The traffic volume survey at Pookadai

In bus stand location the survey was made during the peak hours in both forenoon and evening session and it is observed that the passing of two wheeler is high than other vehicles is shown in Fig:2. The Traffic volume survey in bus stand on 09/02/2018 is shown in Table.2

Table.2 Traffic volume survey in Bus stand

Time	Two wheeler	Three wheeler	LMV	HMV
5:33-8:07AM	2231	278	382	302
8:07-9:30AM	3104	367	578	374
3:15-4:33PM	5501	1469	1045	12
4:33-5:35PM	5302	1395	964	17
5:35-7:00PM	5623	1674	1123	15
7:00-8:30PM	5324	1543	1095	19

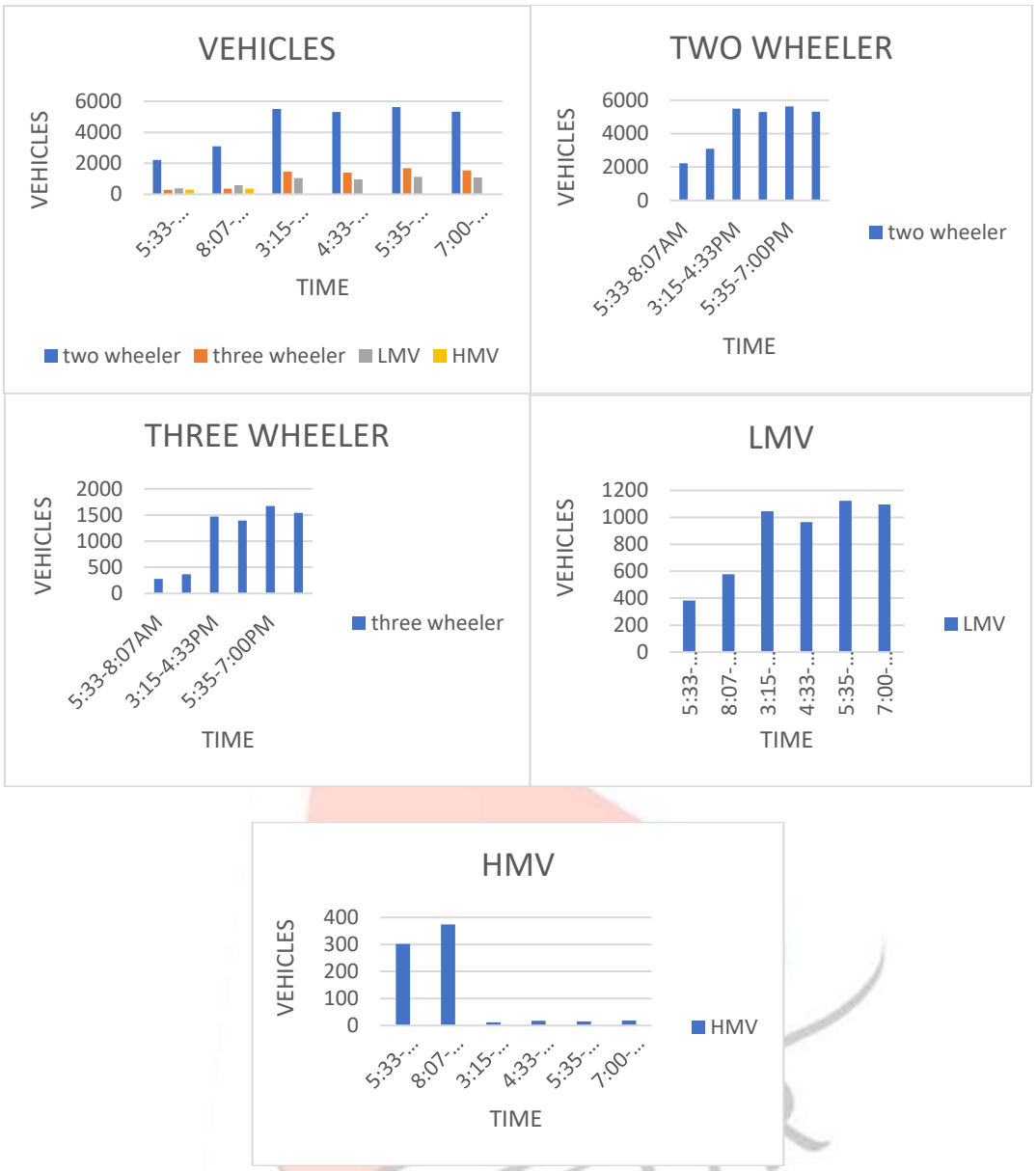

Fig.2 The traffic volume survey at bustand

In Moongilmandabam location the survey was made during the peak hours in both forenoon and evening session, and it is observed that the passing of two wheeler is high than other vehicles is shown in Fig:3. The Traffic volume survey in Moongilmandabam on 09/02/2018 is shown in Table.3

Table.3 Traffic volume survey in Moonkilmandabam

Time	Two wheeler	Three wheeler	LMV	HMV
4:50-7:55AM	2436	294	474	291
7:55-9:30AM	3289	397	669	417
3:34-4:56PM	5391	1437	988	23
4:56-6:10PM	5481	1453	1046	19
6:10-7:42PM	5322	1372	1168	21
7:42-9:44PM	5487	1498	1274	22

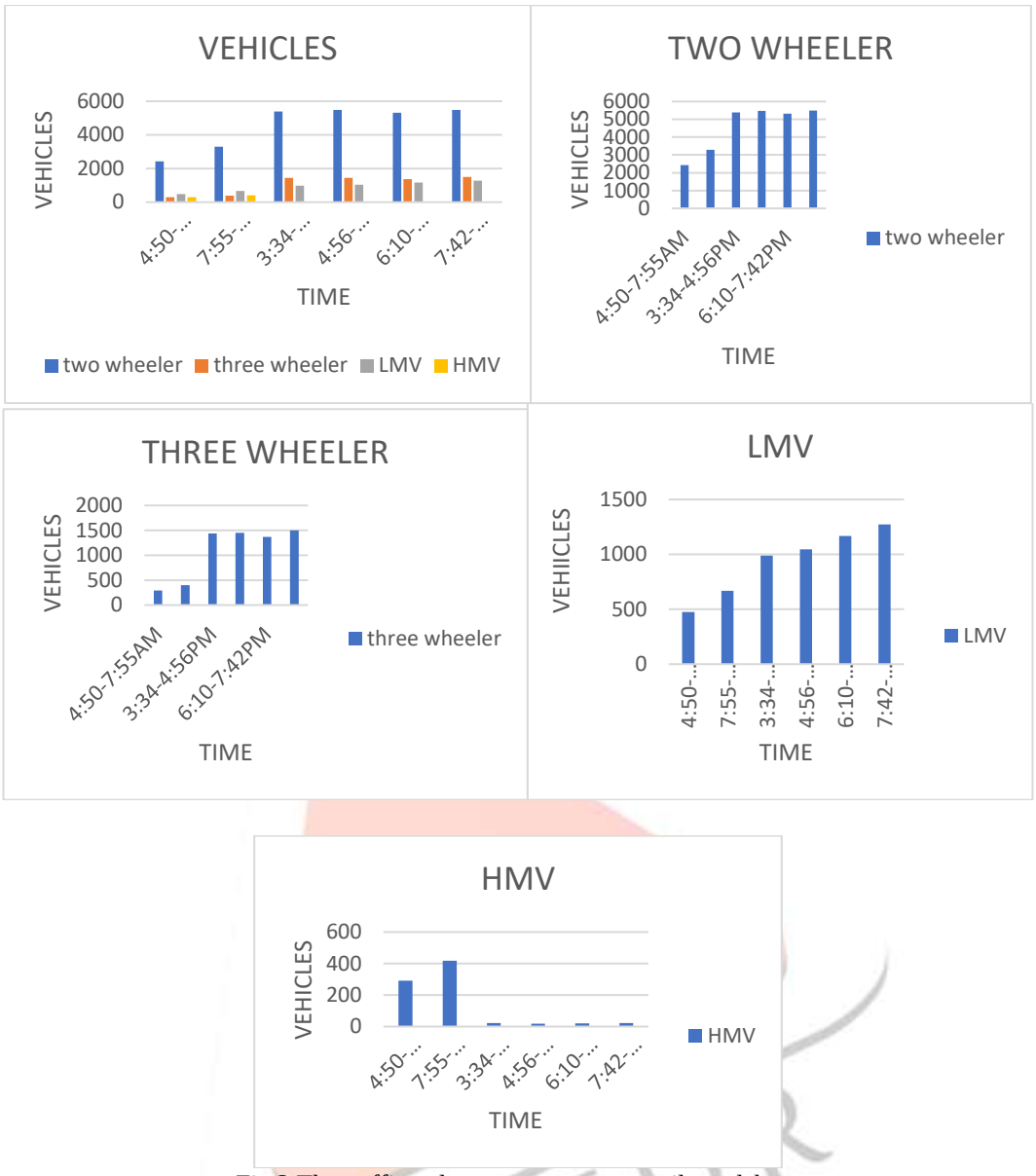

Fig.3 The traffic volume survey at moongilmandabam

In toll gate location the survey was made during the peak hours in both forenoon and evening session, and it is observed that the passing of two wheeler is high than other vehicles as shown in Fig;4. The Traffic volume survey in Tollgate on 12/02/2018 is shown in Table.4

Table.4 Traffic volume survey in Tollgate

Time	Two wheeler	Three wheeler	LMV	HMV
7:18-8:53AM	3223	341	506	357
8:53-9:46AM	2874	352	583	396
3:00-5:00PM	5368	1396	1112	22
5:06-7:36PM	5478	1438	1128	17
7:36-9:18PM	5435	1233	1041	14

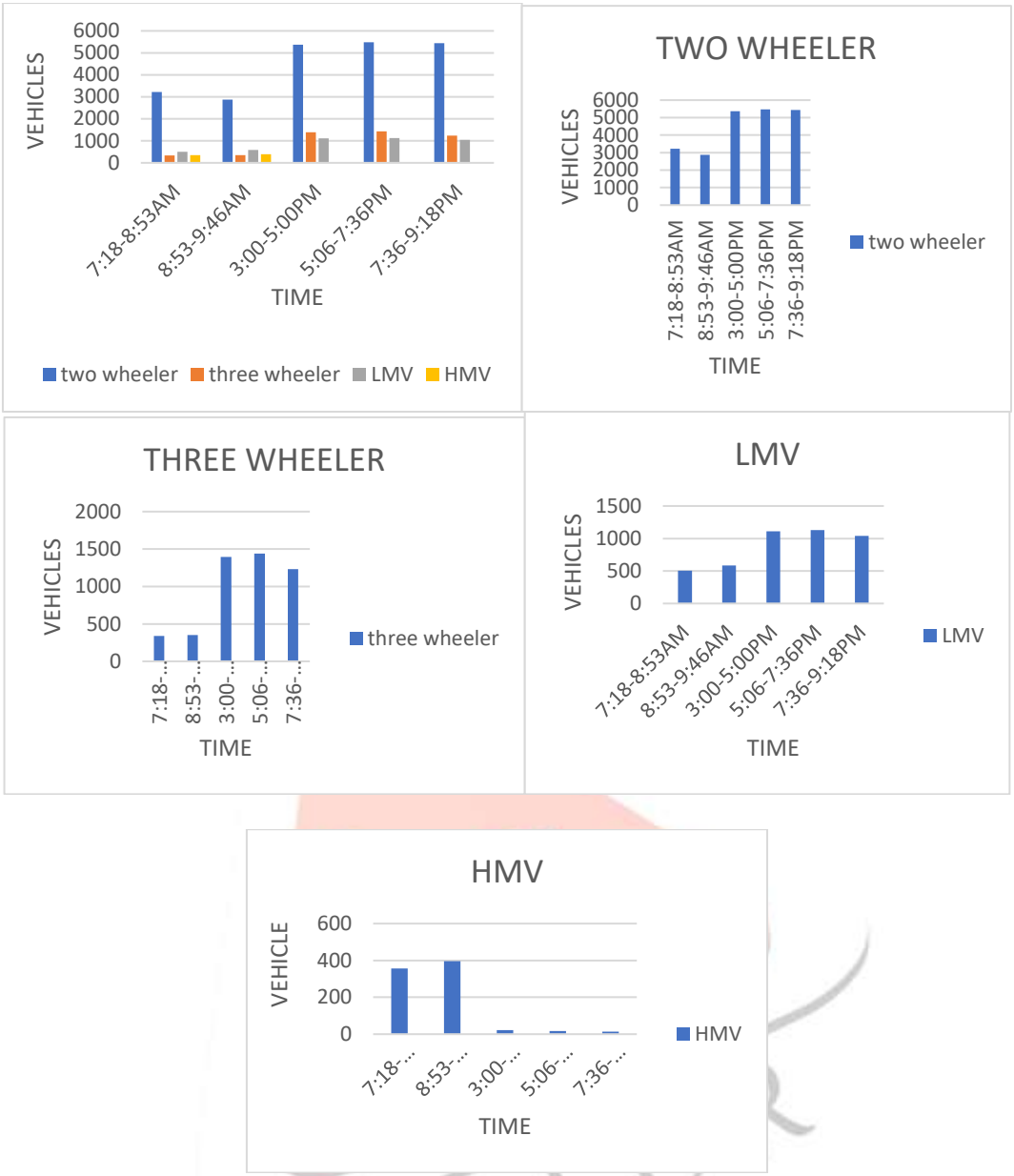

Fig.4 The traffic volume survey at tollgate

III. PRINCIPLE AND METHODOLOGY:

SULPHUR DIOXIDE:

Standards have been set for SO_2 by national ambient air quality to protect against exposure from all forms of sulphur (SOx). SO_2 is the major component among them and is used as the indicator for the entire group of gaseous sulphur oxides (SOx). It can affect the human respiratory system and make breathing difficult,sensitive to asthma.

METHOD:

the method used for identifying the content of sulphur dioxide is Modified West &Gaeke Method (IS 5182 Part 2 Method of Measurement of Air Pollution: Sulphur dioxide). Sulphur dioxide from the air is absorbed using a dust samplerinto potassium tetrachloromercurate (TCM) solution. A dichlorosulphitomercurate complex, which resists oxidation by the oxygen in the air, is formed [1]. Once formed,the absorber solution may be stored for some time prior as this complex is stable to strong oxidants such oxides of nitrogen and ozonefor analysis [2]. This absorbed solution is titrated against para-rosaniline and formaldehyde to form the intensely coloredpararosanilinemethylsulphonic acid. The absorption of the solution is measured by means of suitable spectrometry [3] The laboratory analysis of Sulphur dioxide (SO_2) is shown in Table 5 and graphically represented in Fig.5.

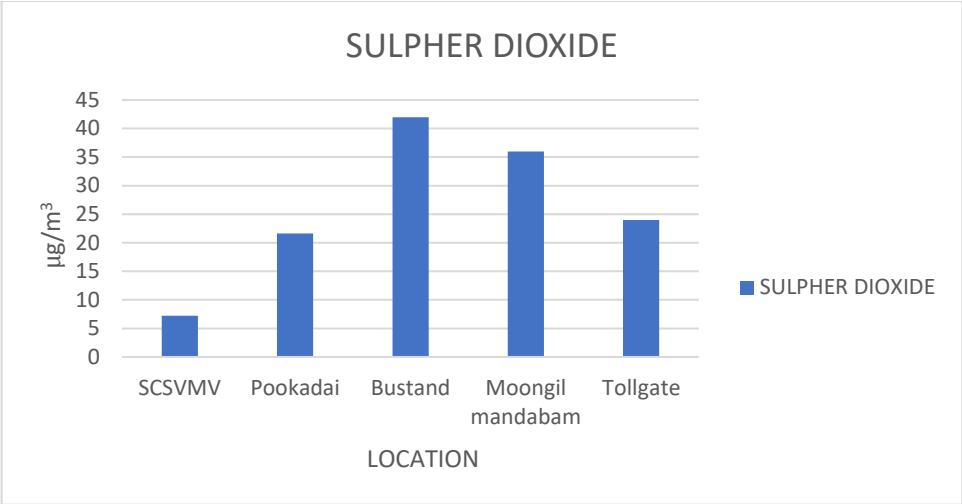

Fig.5sulpher dioxide level in the study area

Table 5 SULPHER DIOXIDE LEVEL

LOCATION	SULPHERDIOXIDE µg /m3
SCSVMV	7.2
POOKADAI	21.6
BUS STAND	42
MOONGIL MANDABAM	36
TOLLGATE	24

PM 10:

Particulate matter (PM10) pollution consists of very small liquid and solid particles floating in the air. Of greatest concern to public health are the particles small enough to be inhaled into the deepest parts of the lung [4]. These particles are less than 10 microns in diameter - about 1/7th the thickness of the human hair - and are known as PM10. This includes fine particulate matter known as PM2.5.PM10 is a major component of air pollution that threatens both our health and our environment.PM10 is among the most harmful of all air pollutants [5]. When inhaled these particles evade the respiratory system's natural defences and lodge deep in the lungs.Health problems begin as the body reacts to these foreign particles. PM10 can increase the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections.

METHOD:

Air is drawn through a size-selective inlet and through a 20.3 X 25.4 cm (8 X 10 in) filter at a flow rate, which is typically 1132 L/min. Particles with an aerodynamic diameter less than the cut-point of the inlet are collected [6], by the filter. The mass of these particles is determined by the difference in filter weights prior to and after sampling. The concentration of PM10 in the designated size range is calculated by dividing the weight gain of the filter by the volume of air sampled.The laboratory analysis of ozone is shown in Table 6 and graphically represented in Fig.6.

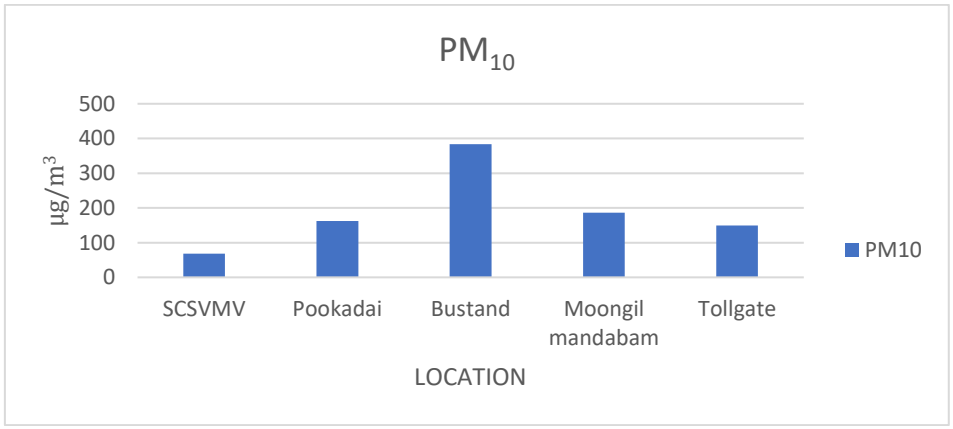

Fig.6PM_{10} level in the study area

Table 6 PM_{10} LEVEL

LOCATION	PM_{10} µg /m3
SCSVMV	68
POOKADAI	162
BUS STAND	384
MOONGIL MANDABAM	186
TOLLGATE	149

AMMONIA:

Ammonia is a mixture of hydrogen and nitro genic compounds which is the colorless gas which has a pungent smell. Ammonia is a building block for pharmaceutical products. It is most caustic hazards units concentrated form [7]. Ammonia emissions are also grouped by NHx. The major source of ammonia emission is agricultural pesticides and animal waste has a huge percentage of contribution to ammonia emissions.

METHOD:

Indophenol method (Method 401, Air Sampling and Analysis, 3rd Edition) Ammonia in the atmosphere is collected by bubbling a measured volume of air through a dilute solution of sulphuric acid to form ammonium sulphate [8]. The ammonium sulphate formed in the sample is analyzed calorimetrically by reaction with phenol and alkaline sodium hypochlorite to produce indophenol. The reaction is accelerated by the addition of Sodium Nitroprusside asa catalyst [9]The laboratory analysis of Ammonia (NH_3) is shown in Table 7 and graphically represented in Fig.7.

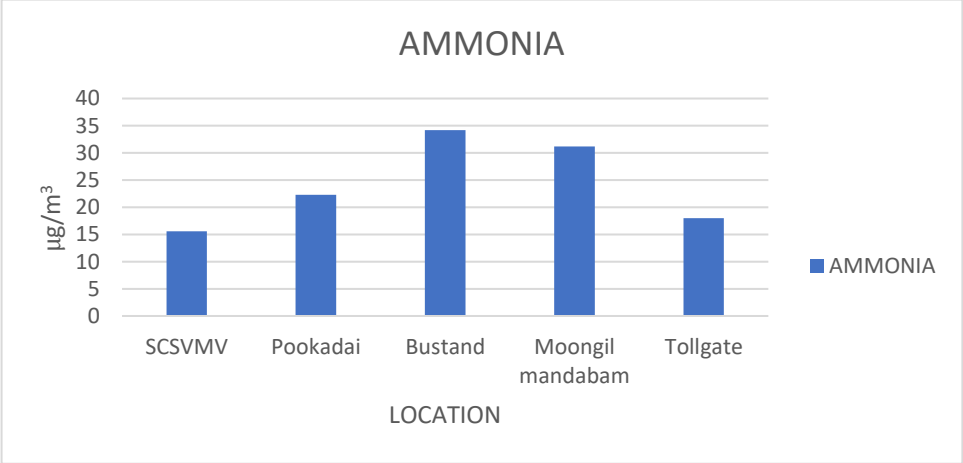

Fig.7Ammonia level in the study area

Table 7 AMMONIA LEVEL

LOCATION	AMMONIA µg /m3
SCSVMV	15.6
POOKADAI	22.3
BUS STAND	34.2
MOONGIL MANDABAM	31.2
TOLLGATE	18

IV. SPATIAL ANALYSIS:

The spatial interpolation was performed by using ArcGIS 10.1 software, the spatial analysis results shows the influence of each pollutant in the study area. The thematic map with the contour line has been plotted based on the laboratory result. The prepared contour map is shown in Fig.8 for understanding the pollutant level in the study area.

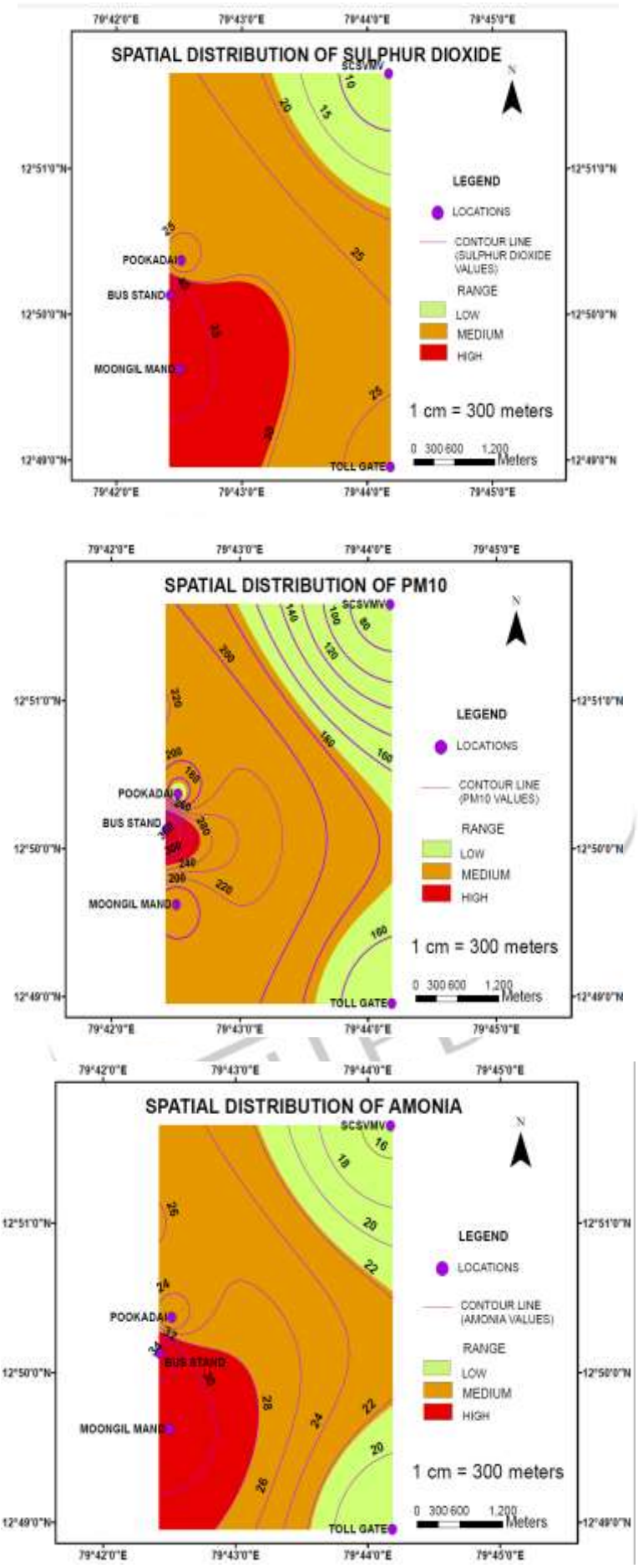

Fig.8 Spatial analysis result in the study area

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