Air Quality Friendly Route Recommendation

Smart Cities of my Nation

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Smart City

Adding layers of smartness, by balancing the environmental ecosystem.

The use of digital technologies, information and communication technologies (ICT) by individuals make the cities smarter.

Along with good and modern infrastructure, protection of environment is important.

Smart Cities ensure healthy citizens.

Aim: Quality of life

Motivation

i जनवरी से 15 जनवरी तक
Odd तारीख को
Odd नंबर की कार

To curb pollution, Delhi government proposes 'odd/even' number formula for cars from 2016
(Source: CNN-IBN, Posted on: Dec 04, 2015)

NATIONAL AIR QUALITY INDEX LAUNCHED

10 cities where people can get information on actual air quality and its health implications:
Delhi, Agra, Kanpur, Lucknow, Varanasi, Faridabad, Ahmedabad, Chennai, Bangalore and Hyderabad

► Most of the **monitoring stations** in these 10 cities **started displaying the index from Monday (April 6)**

► **Index can be accessed from websites** of Union environment ministry or respective state pollution control boards

► AQI scheme reflects **'one colour one code'** for different types of air quality (good, satisfactory, moderate, poor, very poor and severe)

► **46 other million-plus cities** and 20 state capitals will have **similar air quality index** in next one to two years

► Each of these **cities** will have 6-7 monitoring stations with AQI display boards

AQI SCHEME

AQI	Colour code	Likely health implications
1-50	Good	Minimal impact
51-100	Satisfactory	Minor breathing discomfort to sensitive people
101-200	Moderate	Breathing discomfort to people with lungs, asthma & heart disease
201-300	Poor	Breathing discomfort to most people on prolonged exposure
301-400	Very Poor	Respiratory illness of prolonged exposure
401-500	Severe	Effects healthy people & serious impact to those with existing diseases

Source: TNN | Apr 7, 2015, "Choking India gets air quality index"

Comparison of PM 2.5 Concentration (Mumbai, India and Singapore) at indoor locations
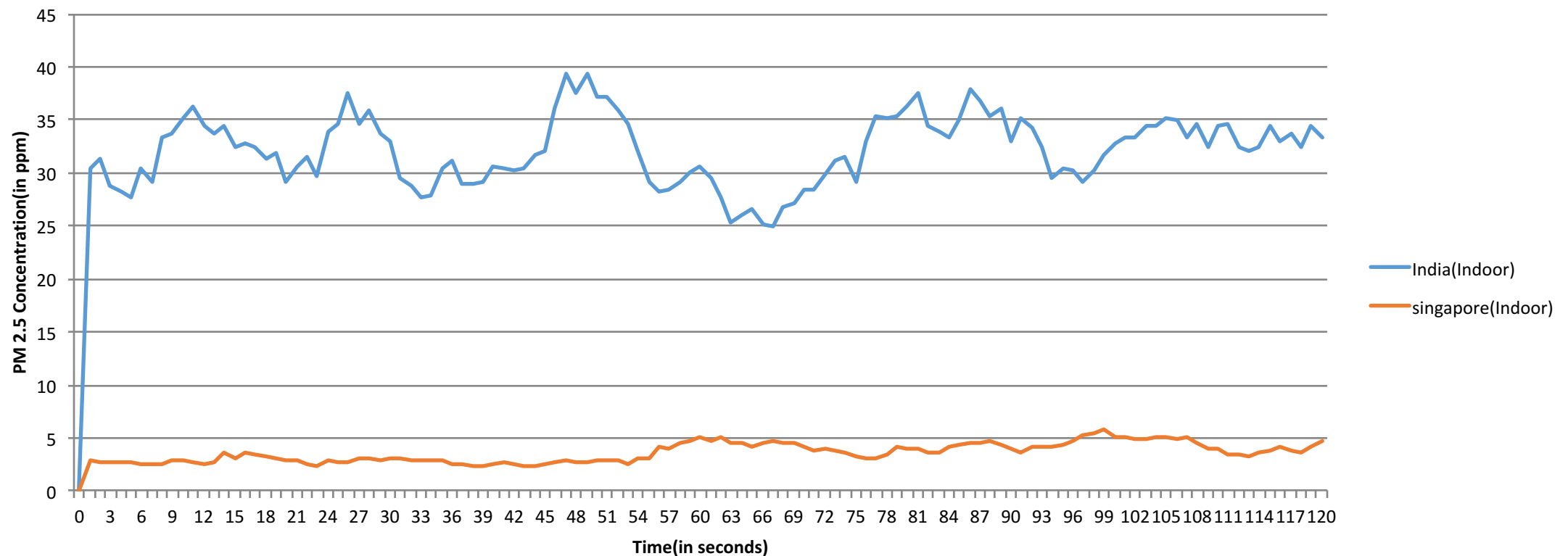
Air Quality Index (India)

AQI Category (Range)	PM₁₀ (24hr)	PM$_{2.5}$ (24hr)	NO$_2$ (24hr)	O$_3$ (8hr)	CO (8hr)	SO$_2$ (24hr)	NH$_3$ (24hr)	Pb (24hr)
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5-1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430+	250+	400+	748+	34+	1600+	1800+	3.5+

levels of poluution in delhi – Google Search

AQI	Associated Health Impacts
Good (0-50)	Minimal impact
Satisfactory (51-100)	May cause minor breathing discomfort to sensitive people.
Moderately polluted (101–200)	May cause breathing discomfort to people with lung disease such as asthma, and discomfort to people with heart disease, children and older adults.
Poor (201-300)	May cause breathing discomfort to people on prolonged exposure, and discomfort to people with heart disease.
Very poor (301-400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases.
Severe (401-500)	May cause respiratory impact even on healthy people, and serious health impacts on people with lung/heart disease. The health impacts may be experienced even during light physical activity.

Research Gaps

- Current Navigation Systems do not consider "Air Quality" as a metric for route computation.

- Real time personalized recommendations are not given based on ones health and activity performed.

- Air Quality indices vary from country to country and require extensive investigation.

Research Questions

- Finding the most optimal and cost effective vector V {f1,f2,f3 ... fn }, on the basis of which the best route is chosen.

- To what extent the overall inhalation of the pollutants be reduced.

- Mapping the most optimal model which meets ones personal health and conditions, based on different age groups, medical conditions and health sensitivity.

- How to select suitable subjects, based on their age, medical history etc.

Challenges

- Portable air monitors are still expensive.

- Integration with Fixed air monitors and smartphones for measurements.

- Identifying factors influencing pollution like humidity, wind speed, location etc.

- Finding out users to be experimental subjects based on some medical expert's advice or surveys.

- Maintaining privacy of the user as the medical history of an individual and his/her movement in the city can be purely confidential.

Balancing the Ecosystem

Power of our nation is : **The Crowd**

And the power of the crowd is: ownership of **SMART DEVICES**

CAN THIS POWER BE EXPLOITED IN BUILDING AN ECOSYSTEM ?
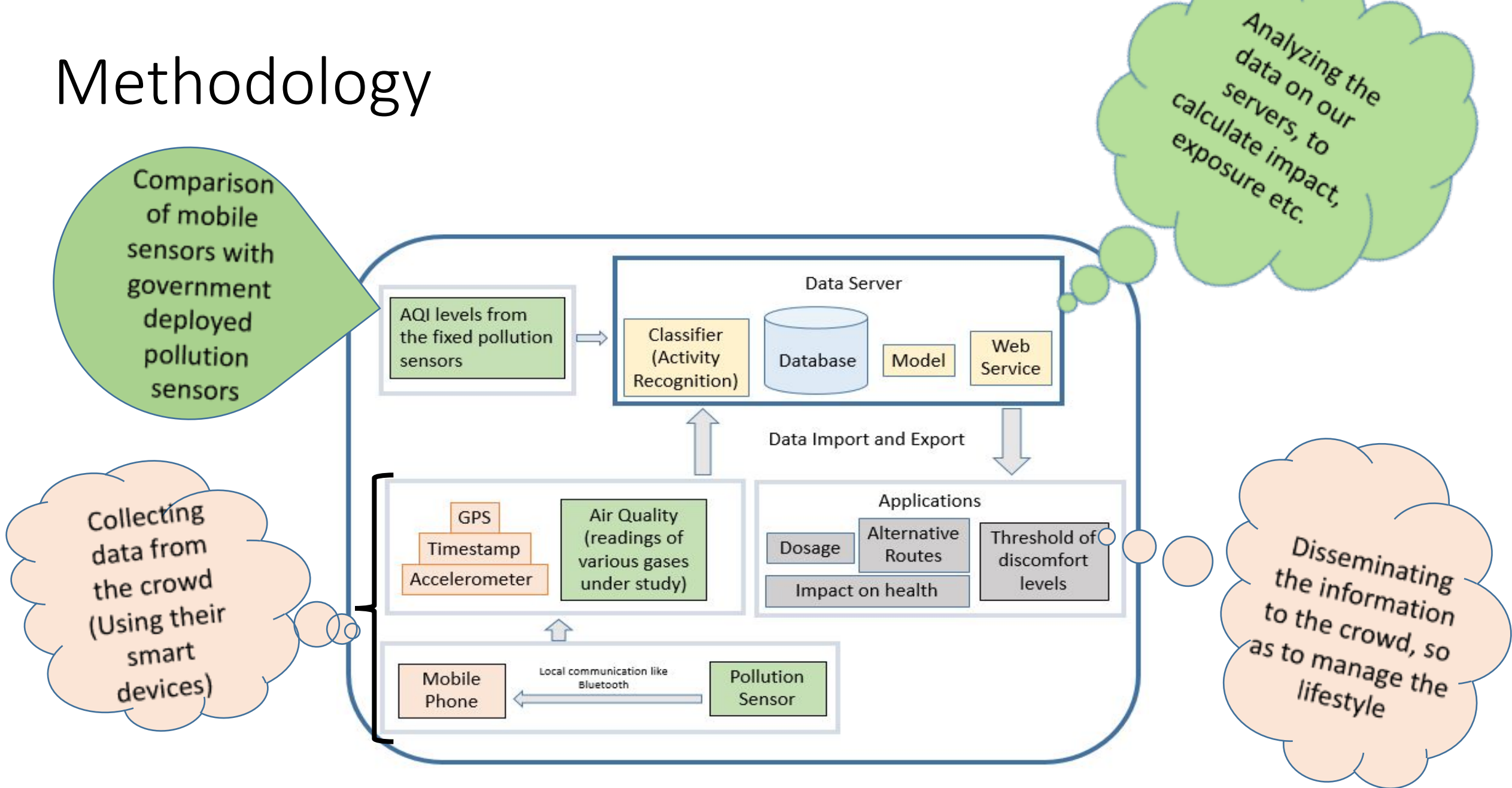

And the answer is: **YES**

Collecting the city wide information from the moving users (crowd), and disseminating the information back to the crowd is a brilliant **IDEA**.

Environmental Data like Air Quality Index can be measured at each and every latitude and longitude of the city.

Methodology

Impact

Citizens of the smart city should be aware of the **impact of their activities** and **actions** on the environment.

Exploiting the smart devices like phones and tabs:

Smart devices have sensors, and sensors sense all.

Then why not to sense all ?

Yes, Smart devices can be used to make the individuals aware of their activities, and their impact on the environment.

Pollution is human created, and humans should know their contribution towards it.

This realization can help, to fight against it.

Exposure

Citizens are the assets of a city and the assets are valuable.

The information flow in a smart city, should also contain the exposure of an individual to air pollution.

Mobile Sensors can again be used to provide such information.

BENEFITS

This information can lead to lifestyle management and taking appropriate decision.

Most beneficial for sensitive groups like small children, patients with asthmatic and cardiovascular diseases.

Use Cases

- Encourage use of public transportation by providing them indicative comparisons of AQ across various routes.

- Alternative Bus Boarding Options based on AQI
  - Encourage walking
  - Suggest alternative routes/timings to support better air quality

- Benefits
  - Personalized Air Quality Monitoring based on individual's health (asthma, pregnant women, lungs related diseases)
  - Aid in taking informed decisions about how to move in the city (for Private Vehicles as well as PTS)
  - Monitor daily levels of inhaled PM levels thus aiding in Lifestyle adjustment.

Healthy citizens are the greatest asset any country can have.

-Winston S. Churchill

Thankyou