When we say the word "Air",

11 out of 10 people think it purposes Wi-Fi

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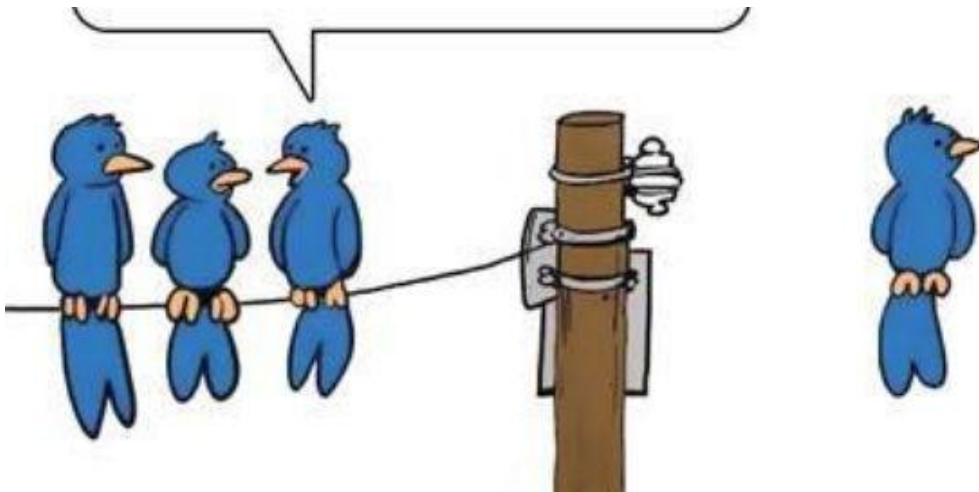
Sakthivel M Sundharam
9 hrs · ❄ ▼

If WiFi is installed in planet Mars, will it be habitable ?

👍 Like   💬 Comment   ➤ Share

Poornima Sakthivel LoL
Like · Reply · 2 hrs

SELF-ACTUALIZATION
Pursue Inner Talent
Creativity Fulfillment

SELF-ESTEEM
Achievement Mastery
Recognition Respect

BELONGING - LOVE
Friends Family Spouse Lover

SAFETY
Security Stability Freedom from Fear

PHYSIOLOGICAL
Food Water Shelter Warmth

WiFi

In 21st Century, we are more concerned about free Wi-Fi, than free Air

Eye in the sky – Solution to observe air pollution

Sakthivel Manikandan SUNDHARAM
Arun ANNAIYAN
Jan Eric DENTLER

- Around 90% of city residents in European Union (EU) are exposed to air pollutants[*]

	EU limit values	WHO guidelines
$PM_{2.5}$	31%	96%
PM_{10}	33%	88%
O_3	14%	98%
NO_2	5%	5%
BaP	31%	94%
SO_2	<1%	46%

Headache and anxiety (SO_2)
Impacts on the central nervous system (PM)

Irritation of eyes, nose and throat
Breathing problems (O_3, PM, NO_2, SO_2, BaP)

Cardiovascular diseases (PM, O_3, SO_2)

Impacts on the respiratory system:
Irritation, inflammation and infections
Asthma and reduced lung function
Chronic obstructive pulmonary
disease (PM) Lung cancer (PM, BaP)

Impacts on liver, spleen and blood (NO_2)

Impacts on the reproductive
system (PM)

- Primary air pollutants – Particulate Matter, COx, NOx, SOx

- Secondary air pollutants – Ozone (O_3)

- Sources : Automobiles, Industry, Power plants etc.

- *European Environment Agency : http://www.eea.europa.eu/

Existing approach

- EU nations installed interactive monitoring system for air pollution[*example]

- Measuring stations to capture pollutant level

- Using static dust collector and sensor network

- For vehicles – annual emission certificates to comply Euro6 norms

- Rolling-road dynamometer test for New European Driving Cycle (NEDC)

- * http://www.environnement.public.lu/air_bruit/dossiers/PA-reseaux_mesure_air/

Challenges in existing approach
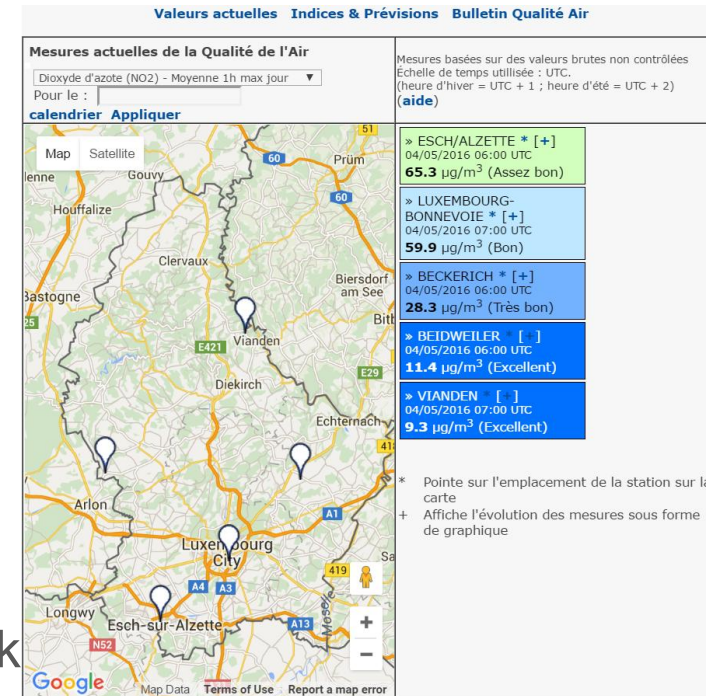
- Number of measuring stations are inadequate due to cost
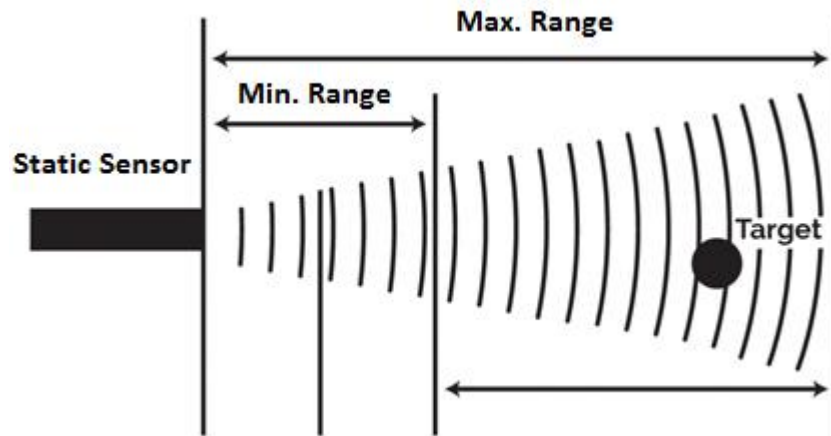
- Difficult to cover complete geography of interest

- Range of static sensors sensing is limited, accuracy restricted

- Period emission checks not sufficient for air pollution caused by vehicles

- Emission data is just the result of date of test of automobiles

- Temporary pollution increase factors

Our Integrated approach

- Low cost Drones interfacing with smart system

- Smart system : embedded controllers with sensors to measure pollutant gases

- System engineering - CPAL environment

- Cyber Physical Action Language (CPAL)

- Design, simulation and optimization

- Gas sensors : Light weight sensors to sense COx, NOx, Sox

- Android application to monitor real time data

System Engineering

- CPAL is for automotive and aerospace system → software development

- Model Driven Engineering(MDE) for real world problems

- Brainchild of LASSY lab of Uni.lu

- The language CPAL is to model, simulate, develop and verify real world embedded problems

- Industry use cases demonstrated in the past →

- Details : https://www.designcps.com/about-us/

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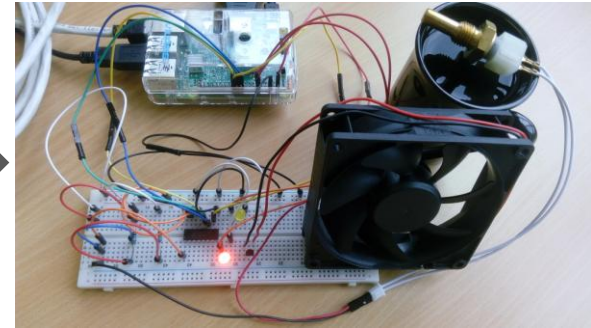
Smart Drones

- Automation and Robotics Laboratory:

- Drones can reach the places and altitude where humans can not

- In drone, there is enough room to mount all kinds of sensors, capable to carry pay loads

- Example, Infra Red(IR), Thermal sensor, LIDAR are already interfaced

- Highly stable and controlling approaches are simple to use

- Easy to adapt according to the user need

- http://wwwen.uni.lu/snt/research/automation_robotics_research_group/projects/isruav

Summary and Conclusion

- EU cities are fighting against air pollution

- Government is super concern in bringing social and economic activities to keep air pollution under control

- Global warming and it's consequences are alarming

- In this project supplement to existing methods, we propose an integrated solution

- Smart drones with efficient sensors(well system engineered)to monitor complete realistic data

- We have proved practically both system engineering and drone control in our experiments

Thank you