

SHAASRA SMART CITY CHALLENGE

(S2C2)

June 25, 2015, a highly ambitious project named the 'Smart City Mission', an urban renewal and retrofitting program was taken up by the Government of India with the mission to develop 100 cities across the country making them citizen friendly and sustainable. The idea was to use the Engineering skills and knowledge of the nation to make it more sustainable and habitable.

Look around yourself and judge how much success have we achieved in reaching the target. The truth is "There's a lot to be done".

Ever wondered how could you contribute to this ever-growing phase of development and mark yourself in the golden books of the nation. SO here's your opportunity to create a "TRUE IMPACT" and contribute to the nation building. Shaastra 2019 brings you for the first time the SHAASRA SMART CITY CHALLENGE (S2C2) where you will put your ideas and solutions to solve one of the most crucial problems involved in the building of sustainable and "SMART" cities of India.

Given are the 5 different problem statements involving various aspects of the smart city concept. The task of the participant is to formulate a solution for "AT LEAST ONE" of them and come up with a circuit/model that solves the problem or at least some part of it. Registrations will be accepted based on a short write-up proposed during the registration of the event. The shortlisted teams (based on the quality and feasibility of the proposed solution) will be notified and called here at IIT Madras during Shaastra 2019 to present their solution (a circuit or a model) for the problem in front of the eminent judge panel that will involve professors from IIT Madras.

The following are the problem statements*:-

- Air Pollution Detection
- EK KADAM SWACHHATA KE AUR(Smart Garbage Bins)
- SMART ENERGY MANAGEMENT
- SMART PARKING SYSTEM
- Make DUMB street lights "SMART ".

Note: (Please go through them before proceeding)

- The circuit should be cost effective, easy to implement and robust with varying environmental conditions
- Each shortlisted team/individual (whichever applies) will be given a reimbursement of **maximum of ₹ 2,500** for the circuit based on the **BILLS THEY PRODUCE for the circuit they make.**
- Each team should create a small testing environment/model for their own circuit and present it during the final round
- The selection of the winners will be done based on the quality, cost-effectiveness and implementation difficulty of the circuit
- The selection on winner, runner-up etc. will solely be the decision of the judges and can't be reverted

For any other queries please write to us at s2c2@shaastra.org

GIVEN BELOW IS THE DESCRIPTION OF THE PROBLEM STATEMENTS:-

AIR POLLUTION DETECTION



Picture describing practical application of the air pollution sensors!

Why (drawback and solution):

In December 1952, London's Great Smog led to the deaths of thousands of people. This event became one of the great turning points in our environmental history because it brought about a radical re-think in pollution control across the United Kingdom and other parts of the world. To avoid such horrible situations, it's our responsibility to update air pollution status to foresee things and take necessary actions!!!

What to do:

- The major pollution provoking gases ozone, carbon di oxide, particulate matter, carbon monoxide, sulphur dioxide, TVOC (total volatile organic compounds), nitrogen dioxide and nitrous oxide.
- You are supposed to create a circuit to detect the presence of any of these gases and display the output (basically the concentration of the gas) from the sensor.
- Provide these sensors with a mode of communication, so that the data can be transferred to the control centre of the city.
- Setup a presentation illustrating your ideas and describing your circuit.
- A self-powered sensor is preferable, but something that is easy to install and that can be powered without noticeable hurdles is also welcome.

Bonus Points:

- Bonus points for measuring the temperature and humidity and displaying it.
- Bonus points for cost effective circuits.
- Bonus points for detecting multiple gases.
- Bonus points for those circuits which are more reliable and could withstand all the adverse climatic situations.

Basic technical requirements:

- The sensor should be IoT enabled to share the data with the control centre of the city.

- The circuit should be automatic and need no human intervention unless an error in system has occurred.

EK KADAM SWACHHATA KE AUR (Smart Garbage Bins)



MOTIVATION:

“Cleanliness becomes more important when Godliness is unlikely” –P.J.O'Rourke.

India generates over 150,000 tonnes of municipal solid waste (MSW) per day. Yet only 83% of waste is collected and less than 30% is treated. According to World Bank, India's daily waste generation will reach 377,000 tonnes by 2025. A noteworthy step from the Indian government were propelling sanitation under flagship **Swachh Bharat Abhiyan**.

Municipalities in locality won't clean garbage bins in proper time. And they won't know which bins are filled. Most of recyclable wastage is thrown into dump yards uselessly. Dirtying our surroundings not only cause harm to us but also leads to land and environmental pollution. So, let us keep our surroundings clean and live hygienic lives.

DESIGN:

Design a circuit for smart garbage bin which should be placed in public places and should play key role in proper disposal of wastage.

DESIGN SPECIFICATIONS:

- The circuit should able to alert when the bin is full by sending a message to nearest municipal office so that they can clean it.
- Should not disturb the mobility of the bin.
- Power consumption should be as low as possible.
- It should withstand at all practical climatic situations. There should be an alert message if it goes faulty.

EXTRA CREDITS:

If the circuit can classify materials like 10% plastic, 30% glass, 20% organic waste, we can separate them and recycle some. It would be better if smart bin has LED screen over it so we can have the details of what's inside the bin on it. Lid should open when a person passes hand on lid cap.

SMART ENERGY MANAGEMENT

Have you ever felt annoyed by your dad scolding you for too much usage of electricity for your personal needs(Gaming ,not switching off fans & lights etc...).



After getting irritated for so long... YOU an Engineer decide to make your home smarter by inventing a device that monitors and regulates your energy (here assume electricity) usage around the house. Importance:

- As we know Electricity is one of important resources, which we can't get back when depleted.
- India is the world's third largest consumer of electricity, to meet the needs of the people we have to produce more energy (indirectly we are consuming a lot of resources like coal etc...).
- There were Blackouts in past that affected around 230 million people around India (ref: https://en.wikipedia.org/wiki/2012_India_blackouts).
- You might be thinking what would happen for saving electricity in just one household, That's where you come into picture you need to build a device/circuit that monitors and regulates energy consumption around the house and which can be easily installed in any house.

TECHNICAL REQUIREMENTS:

- The most important thing is, it must be cost efficient.
- It should operate itself once installed, No intervention must take place.
- It must be more reliable i.e. having more service time, less power consumption.
- It must warn the user if more than required energy is being consumed(Misbehaving devices consume more power- A Machine learning based model that can predict the desired power input based on the conditions should do)
- It must automatically switch off appliances in a room if it is empty.
- Make sure your prototype works properly before coming.

BONUS:

- Extra credits if this device can be installed in huge apartments, mansions etc...
- The most cost effective ones are more appreciated.

SMART PARKING SYSTEM

Did u ever felt irritating for searching a parking slot??

Do u know how much time it may save you if u have any assistance and finally don't end up like....?



Have you ever thought of a solution for any technical assistance using some cool stuff.....Here's your chance?

Motivation

It is of greatest importance in current increasing automobiles and has been encouraged by many companies. According to a research conducted by BPA, the average time motorists spend looking for a space is 5.9 minutes, adding up to a total of 90.5 hours – or four days – spent searching for a parking spot over the year.

WHAT TO DO (technical requirements)

- Parking sensors for smart parking system
- This is to know the availability of parking space for a car in a city, or in a shopping mall or in a parking centre. The sensor should be IoT enabled to share the data with the appropriate agency. Other requirements are -
 - It should be totally automatic; no human intervention is required to operate it.
 - Cost of the unit should be as low as possible.
 - Power consumption should be kept as low as possible.
 - Reliability should be high, it should withstand and operate under rainy, and summer weather (say up to 45°C atmospheric temperature).
 - Easy to install (should not require a new wiring)
 - If goes faulty, a suitable message should be generated

BONUS

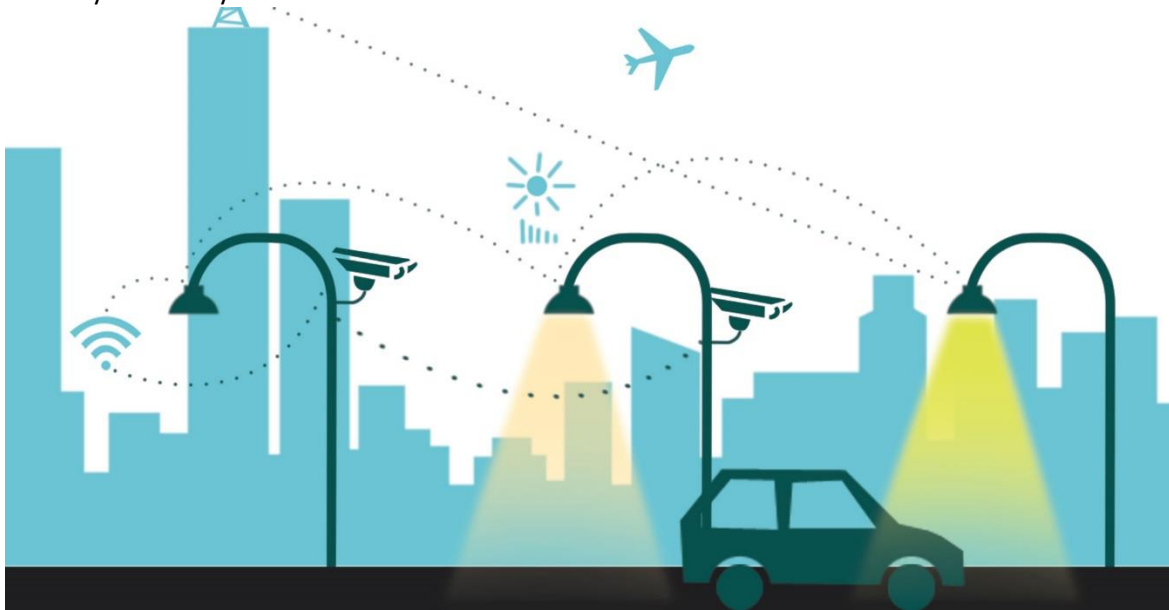
- Extra credits if works for a large area to be recognised for parking slots.

- Appreciated If testing method brought alongside

Make DUMB street lights “SMART “

MOTIVATION

With approximately 415 million street lights in our country, there is a huge necessity in making them SMART which will also be a huge stepping stone for today's smart city uprisings. With digital networks, computer vision and embedded processors and sensors, we can collect and transmit information that can help cities monitor and respond to any circumstances from traffic, crime, air quality to crowds and noise. They can detect traffic congestion and track available parking spaces. Those very same networks can remotely control LED lights to turn on and off, flash, dim and more, offering cities a chance to maximize low-energy lighting benefits while also improving pedestrian and bicyclist safety.



With street lights creating mesh network canopy, those networks of data can be used by more than just lightning departments, empowering even schools and business via a lightning infrastructure that brightens the future of the digital city. They can also be used to provide internet to citizens using the same light by using Power over Ethernet (POE) and Li-Fi (Light Fidelity) concept (HIGH PREP IDEA). Also, if they are built on a scalable platform, they can reduce crime up to 10% and make roadways safer through improved visibility. So, overall automated and networked control can further save energy, lower cost, reduce maintenance and can offer better services to citizens at a reduced carbon foot print.

YOUR ROLE

To create a breakthrough in the existing DUMB street lighting system, we call upon innovators who can deliver a working prototype for any one (or your own) of the ideas mentioned above to make the street lights smarter, thereby increasing the lighting efficiencies. Rapid prototypes which demonstrate any of the operational benefits mentioned above in an efficient way can really help making this ambitious idea reach a market level. Your work can modernize our infrastructure.

TECHINCAL DETAILS

You can use any of the off the shelf components like Arduino, esp32 etc. for computing and any other sensors for data acquisition. You must be able to show a functional working prototype that

addresses any one (MINIMUM) or many of the ideas mentioned above or your own that makes street lights SMART.

Reference videos:

1. <https://youtu.be/6IC5QekFAn0> - diming of street lights;
2. <https://www.youtube.com/watch?v=NaoSp4NpkGg> – what is Li-Fi;
3. <https://youtu.be/t1xgQUCiDoA> - eco-friendly lights with zero energy needs;
4. <https://youtu.be/3ruXevD4Teo> – generic smart street lights.

ALL THE BEST AND SEE YOU ALL AT
SHA Astra 2019!!