RECENT TRENDS OF TECHNOLOGY ACHIEVING SUSTAINABLE DEVELOPMENT GOALS

BY

PROF. M. AFSHAR ALAM

DEAN & HOD,

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING,

SCHOOL OF ENGINEERING SCIENCES & TECHNOLOGY,

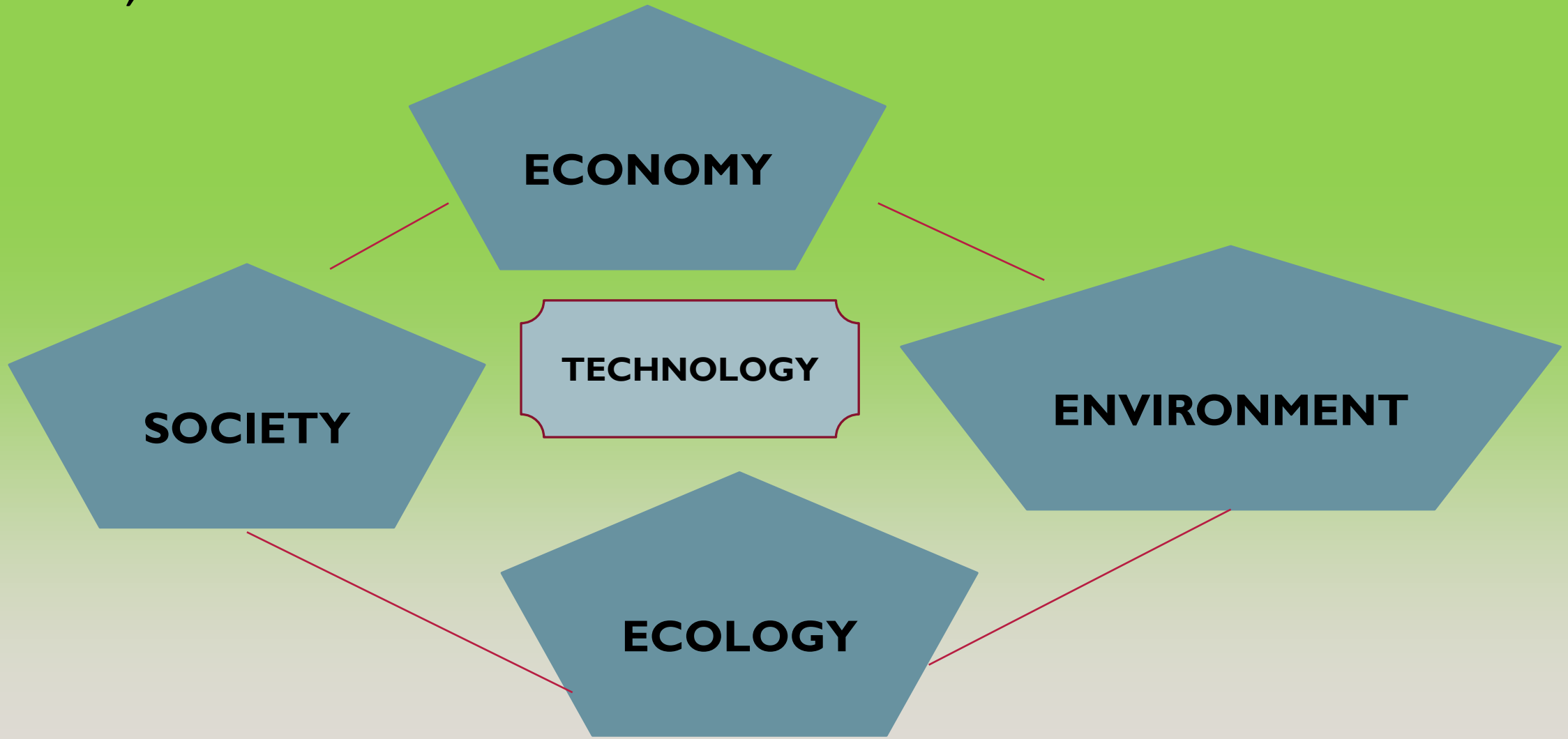
JAMIA HAMDARD

NEW DELHI

TOIPCS COVERED-

- SUSTAINABLE DEVELOPMENT GOALS
- DEEP LEARNING WITH ARTIFICIAL INTELLIGENCE (GOAL 3)
- SMART CITIES (GOAL11)
- IOT FOR SMART AGRICULTURE (GOAL 2)

THREE DIMENSIONS OF SUSTAINABLE DEVELOPMENT –ECONOMY, SOCIETY,ENVIRONMENT



SDGs — The Five Ps

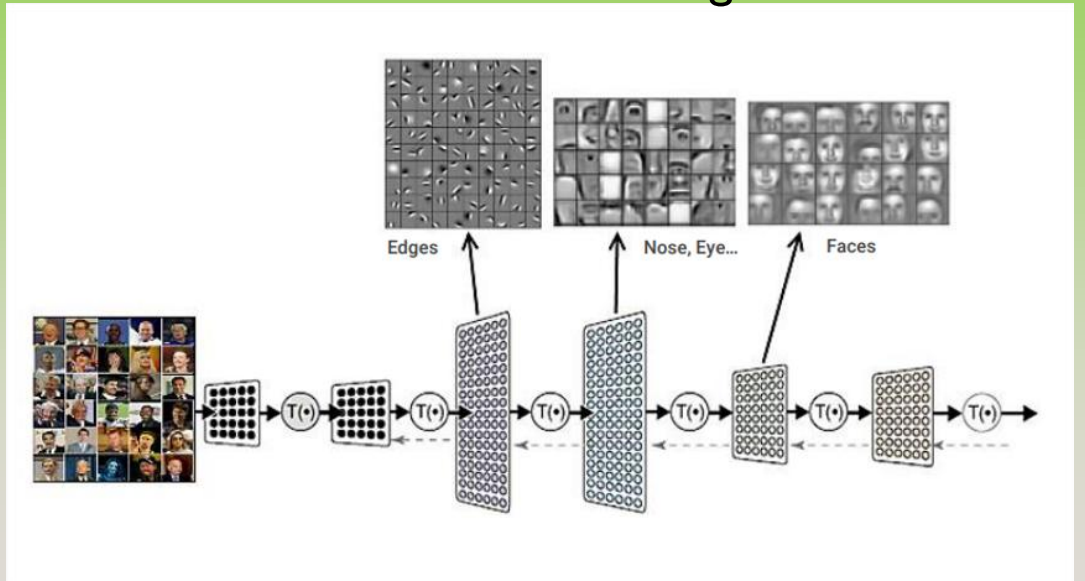

SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

SUSTAINABLE DEVELOPMENT GOALS

GOAL 3: ENSURE HEALTHY LIVES AND PROMOTE WELL- BEING FOR ALL AT ALL AGES - DEEP LEARNING AND ARTIFICIAL INTELLIGENCE

WHAT IS DEEP LEARNING

- **Part of the machine learning field** of learning representations of data. Expectably effective at finding patterns
- Utilizes learning algorithms that derive meaning of day by using **hierarchy** of multiple layers that **mimic the neural network of our brain**
- If you provide the system with tons of information it begins to understand it and respond in useful ways.



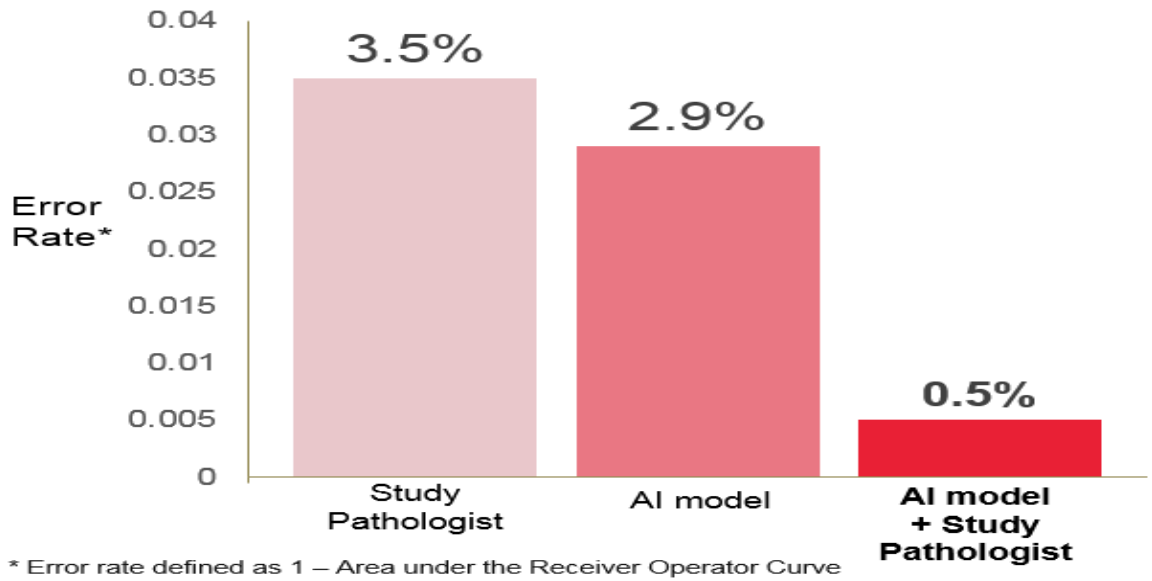
APPLICATIONS OF DEEP LEARNING WITH ARTIFICIAL INTELLIGENCE -**LUNG CANCER DETECTION**

- Lung cancer is the most common cancer worldwide. It's also one of the most deadly. More than 80 percent of people with lung cancer die within five years of being diagnosed, and half die within a year. H. Michael Park, co- founder of startup Innovation DX, is working to improve those odds.
- In December, his St. Louis-based medical analytics company plans to release its first product — a GPU-accelerated AI system that detects lung cancer in its early stages from a simple chest X-ray.

BREAST CANCER DETECTION

Breast Cancer Diagnoses

(AI + Pathologist) > Pathologist

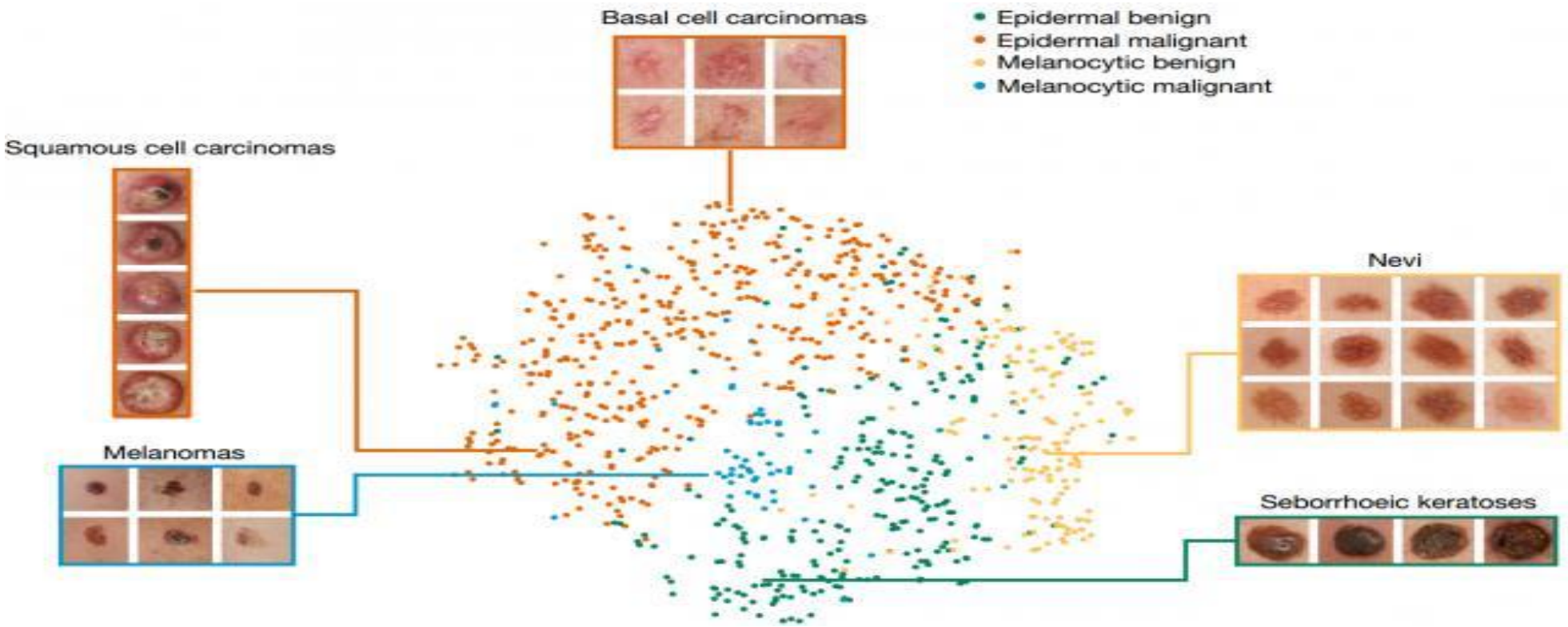


* Error rate defined as 1 – Area under the Receiver Operator Curve
** A study pathologist, blinded to the ground truth diagnoses, independently scored all evaluation slides.

Deep Learning drops error rate for breast cancer Diagnoses by 85% Researchers trained their models with millions of labeled images to find the probability that a patch contains cancer, eventually creating tumor probability heatmaps.

SKIN CANCER DETECTION

Skin Cancer Diagnoses



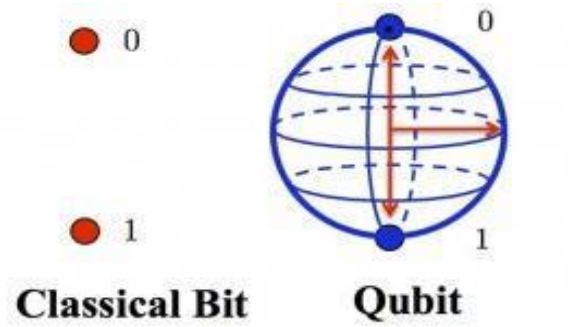
The CNN performed just as well as almost two dozen veteran dermatologists in deciding whether a lesion needed further medical attention.

ARTIFICIAL QUATUM INTELLIGENCE

Outlook

Artificial Quantum Intelligence

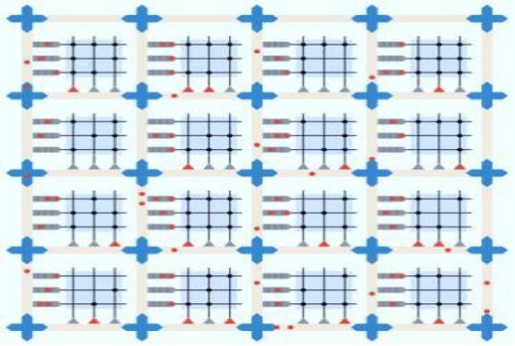
Quantum Artificial Intelligence Lab is a joint initiative of NASA and Google to study how quantum computing might advance machine learning. This type of computing may provide the most creative and parallelized problem-solving process under the known laws of physics.



Quantum computers handle what are called **quantum bits** or qubits that can readily have a value of one or zero or anything in between.

Outlook

Neuromorphic Chips



IBM TrueNorth is a brain-inspired computer chip that implements networks of integrate-and-fire spiking artificial neurons and uses only a tiny 70 mw of power —orders of magnitude less energy than traditional chips. The system is designed to be able to run deep-learning algorithms.

Traditional computers focus on language and analytical thinking

(Left brain)

(Right brain)

Neurosynaptic chips address the senses and pattern recognition

Over the coming years, IBM scientists hope to meld the two capabilities together to create a **holistic computing intelligence**

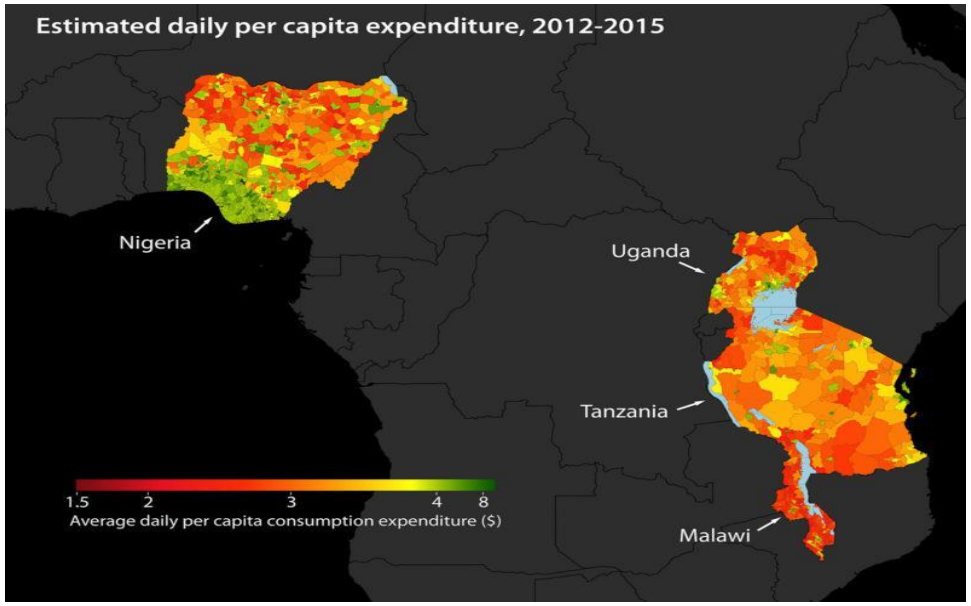
1 million
Programmable
Neurons

256 million
Programmable
Synapses

4096
Neurosynaptic
Cores

MAPPING POVERTY

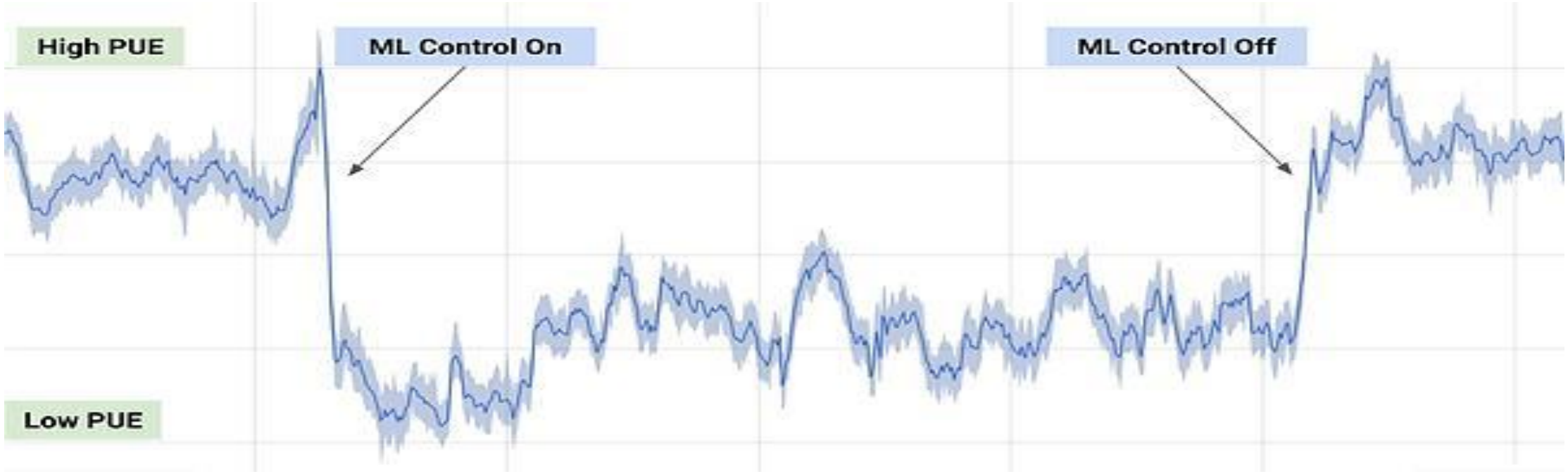
Mapping Poverty



Combining satellite imagery and machine learning to predict poverty. A deep-learning algorithm that can recognize signs of poverty in satellite images – such as condition of roads – by sorting through a million images to accurately identify economic conditions in five African countries.

SAVING ENERGY

Saving Energy



DeepMind AI reduces data center cooling bill by 40% using a system of neural networks trained on different operating scenarios and parameters within Google's data centers.

GOAL 2: END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE – IOT FOR SMART AGRICULTURE

The structure and principle of the IoT agriculture


irrigation


storage


raceability& anti-fake

Alarm management

Remote control

Expert system

data center

Adapter gateway

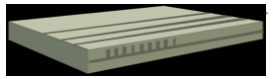
Identity management

Internet

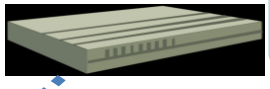
Mobile network

The fixed network

gateway



gateway



controller

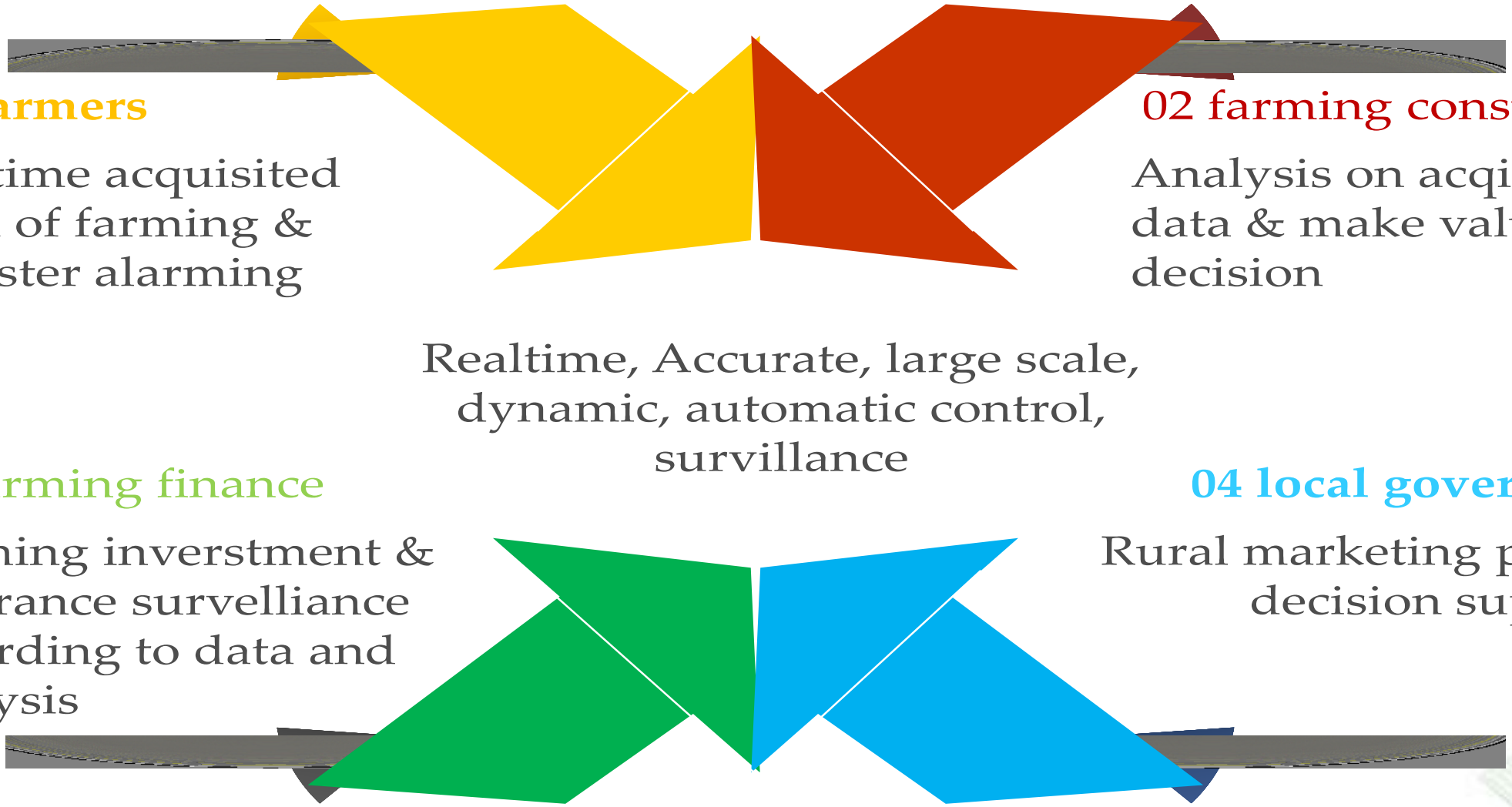
collector

Facilities

Sensors

- ✓ Personalized portal
- ✓ Common service platform
- ✓ Communication service + information operations
- ✓ The convergence of fixed and mobile Internet capabilities
- ✓ Standardization of the underlying sensor and controller interface, support hierarchical domain networking

IOT: various farming scenarios benefits



01 farmers

realtime acquisited data of farming & disaster alarming

02 farming consultants

Analysis on acqisited data & make valuable decision

Realtime, Accurate, large scale, dynamic, automatic control, survillance

03 farming finance

Farming inverstment & insurance survelliance according to data and anlaysis

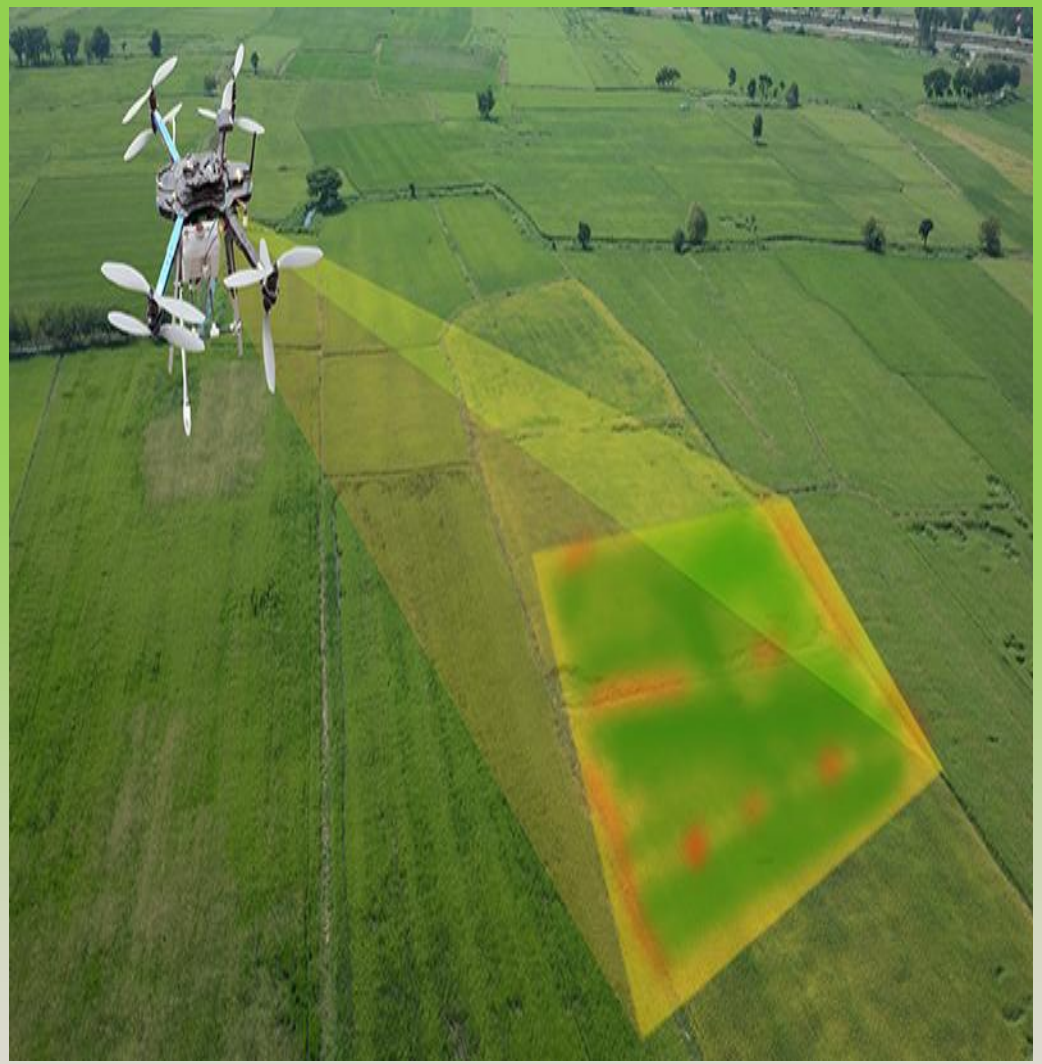
04 local goverment

Rural marketing policy decision support

ROBOTIC FARMING

DRONES

- Drones equipped with sensors and cameras are used for imaging, mapping and surveying the farms. There are **ground based drones** and **aerial drones**. Ground drones are bots that survey the fields on wheels. **Aerial drones**- formally known as unmanned aerial vehicles **(UAVs)** or unmanned aircraft systems (UASes) are flying robots. Drones can be remotely controlled remotely or they can fly automatically through software-controlled flight plans in their embedded systems, working in coordination with sensors and GPS. From the drone data, insights can be drawn regarding crop health, irrigation, spraying, planting, soil and field, plant counting and yield prediction and much more. Drones can either be scheduled for farm surveys **(drone as a service) or can be bought and stored near farms where they can be recharged and maintained**. After the surveys the drones need to be **taken to nearby labs to analyse the data** that has been collected.



MONITORING OF CLIMATE CONDITIONS- EXAMPLES OF SUCH AGRICULTURE IOT DEVICES ARE ALLMETEO, SMART ELEMENTS, AND PYCNO.

GREENHOUSE AUTOMATION

- Farmapp and Growlink are also IoT agriculture products offering such capabilities among others.
- GreenIQ is also an interesting product that uses smart agriculture sensors. It is a smart sprinklers controller that allows you to manage your irrigation and lighting systems remotely.
-

CROP MANAGEMENT

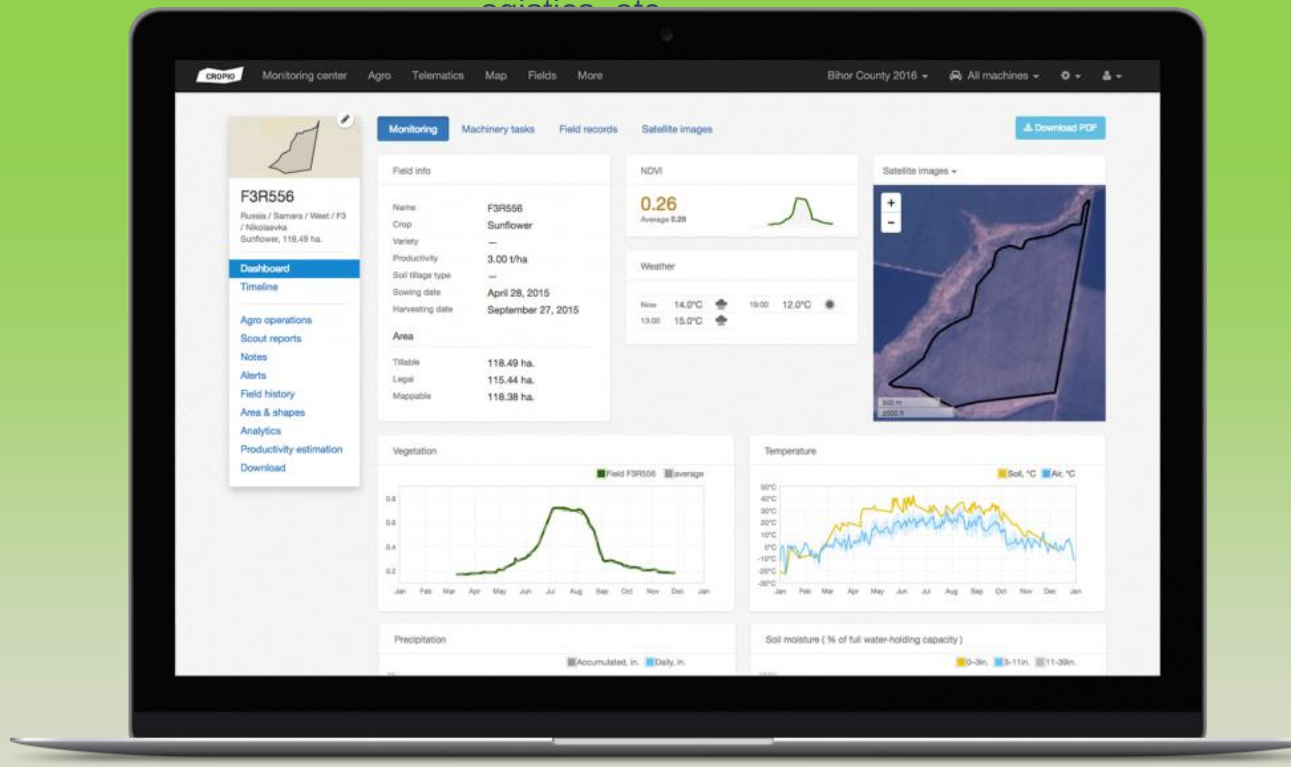
- IoT product in agriculture and another element of precision farming are crop management devices. Just like weather stations, they should be placed in the field to collect data specific to crop farming; from temperature and precipitation to leaf water potential and overall crop health.

CATTLE MONITORING AND MANAGEMENT

- SCR by Allflex and Cowlar use smart agriculture sensors (collar tags) to deliver temperature, health, activity, and nutrition insights on each individual cow as well as collective information about the herd.

END-TO-END FARM MANAGEMENT SYSTEMS

- IoT products in agriculture can be represented by the so-called farm productivity management systems. They usually include a number of agriculture IoT devices and sensors, installed on the premises as well as a powerful dashboard with analytical capabilities and in-built accounting/reporting features.
- This offers remote farm monitoring capabilities and allows you to streamline most of the business operations. Similar solutions are represented by FarmLogs and Cropio.



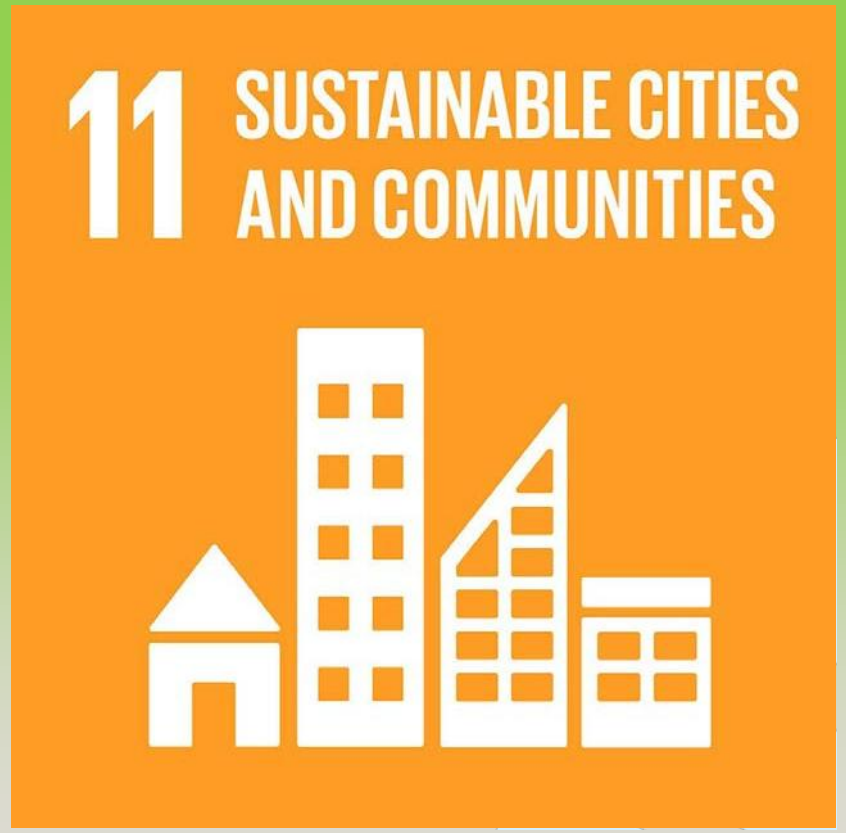
WEEDING ROBOTS

- These smart agribots use digital image processing to look through the images of weeds in their database to detect similarity with crops and weed out or spray them directly by their robotic arms. With increasing number of plants becoming resistant to pesticides they are a boon to the environment and also to farmers who used to spread the pesticides throughout the farm-an estimated 13000 kgs (3 billion pounds) of herbicides applied at a cost of 1725 crores ($25B) each year, thus reducing their overall cost.

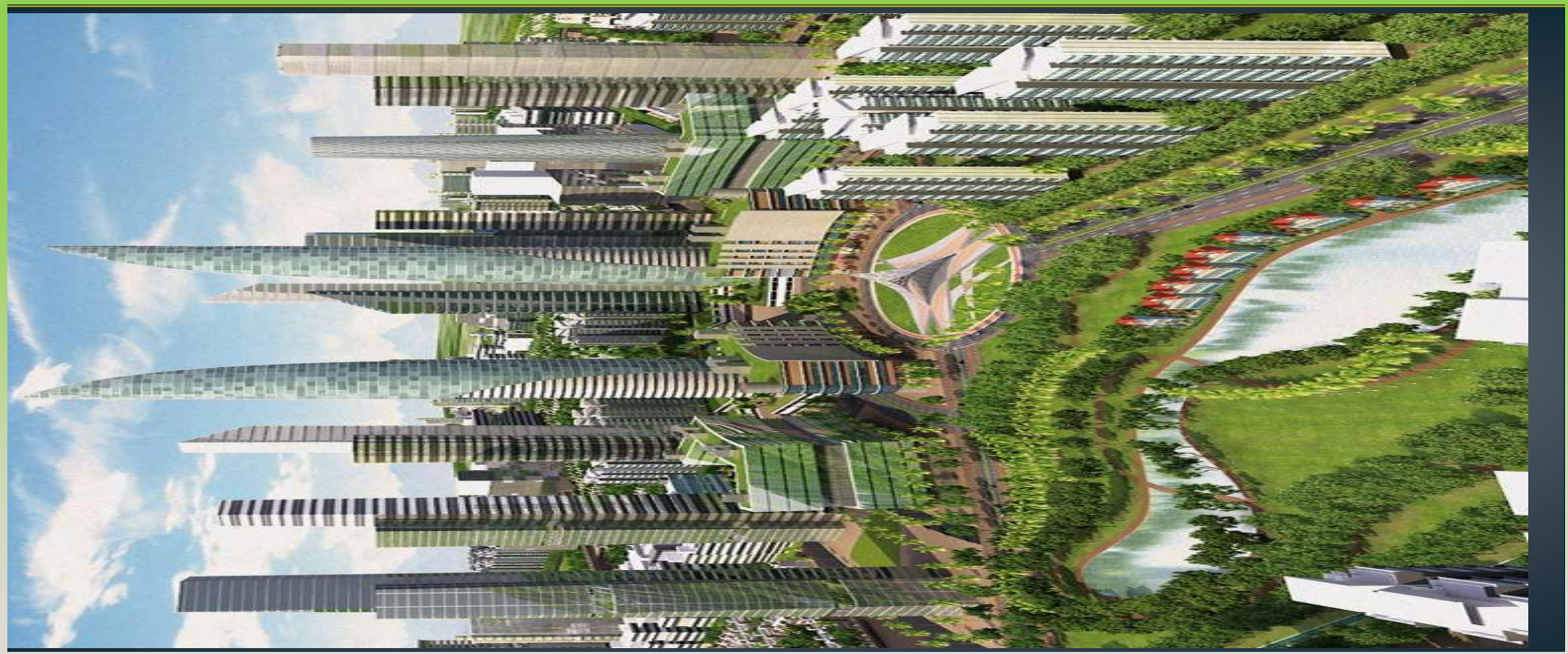
COMPUTER IMAGING

- Computer imaging involves the use of sensor cameras installed at different corners of the farm or drones equipped with cameras to produce images which undergo digital image processing. Digital image processing is the basic concept of processing an input image using computer algorithms. Image processing views the images in different spectral intensities such as infrared, compares the images obtained over a period of time and detects anomalies thus analysing limiting factors and helps better management of farms.

GOAL 11: MAKE CITIES INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE - SMART CITIES



A **SMART CITY** IS AN ENVIRONMENTALLY CONSCIOUS CITY THAT USES INFORMATION TECHNOLOGY (IT) TO UTILIZE ENERGY AND OTHER RESOURCES EFFICIENTLY.



haracteristics of smart city

Characteristics of smart city

- Uses physical infrastructure more efficiently supporting strong and healthy economic, social, cultural development.
- reduce usage of environmental capital and support smart growth.
- promotes the use of information and communication technologies
- Provides High quality of life

COMPONENTS OF THE SMART CITY – SMART LIGHTING

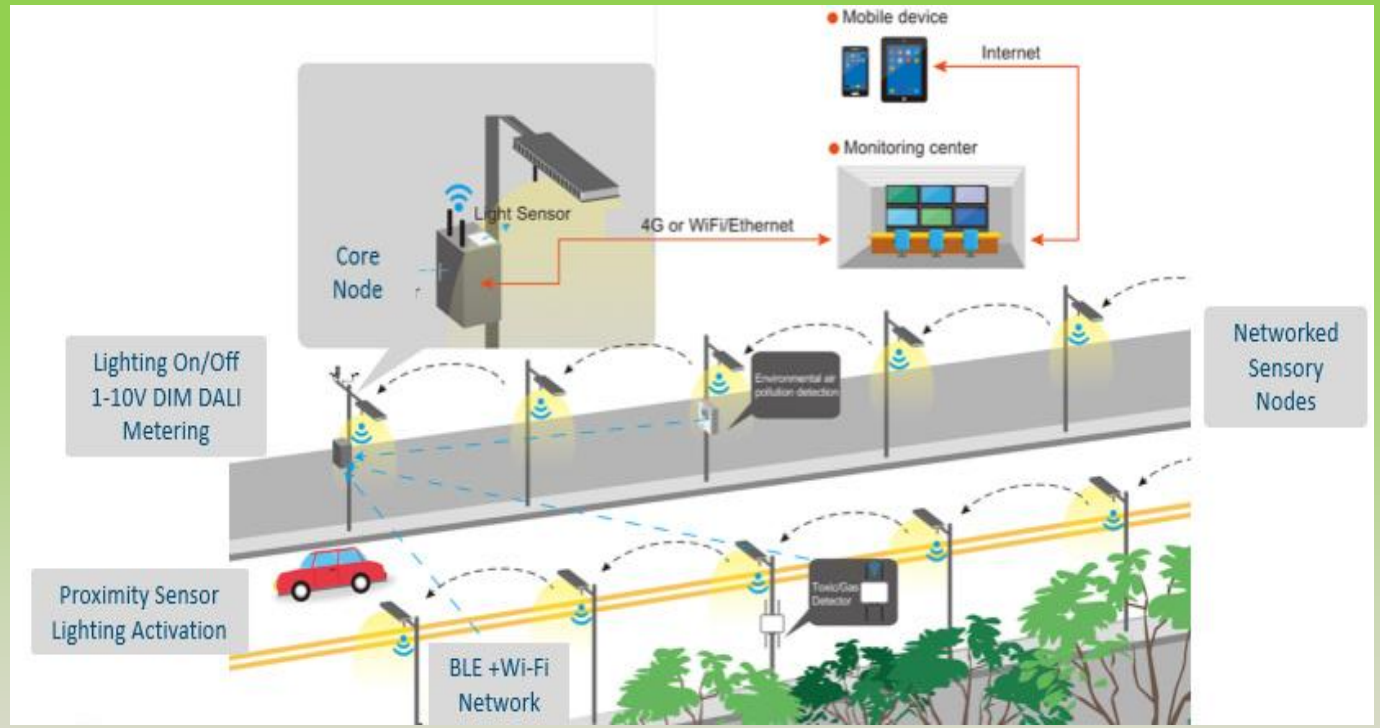
- With smart lighting, city authorities can keep real-time tracking of lighting to ensure optimized illumination and deliver demand-based lighting in different zones. Smart lighting also helps in daylight harvesting and save energy by dimming out sectors with no occupancies For e.g. parking lots can be dimmed during work hours and when a car is entering, it will be detected and appropriate sectors can be illuminated, while others can be kept at diffused setting.

COMPONENTS OF THE SMART CITY – VIDEO ANALYTICS IN TRAFFIC CONTROL

- Video surveillance system, enabled with video analytics, work on two key concepts:
- ***Movement based analytics / Moving object base analysis***: The analytics software helps to pick up the exact movement of the vehicle, while it is in transit. This helps to detect any traffic rule violations, such as lane departure, over speeding & signal jumping.
- ***Pattern generation & recognition:*** Video analytics help to recognize the object within a video frame. Specific pattern or objects can be programmed to be recognized within the frame. This helps in vehicle classification, pedestrian detection, etc.

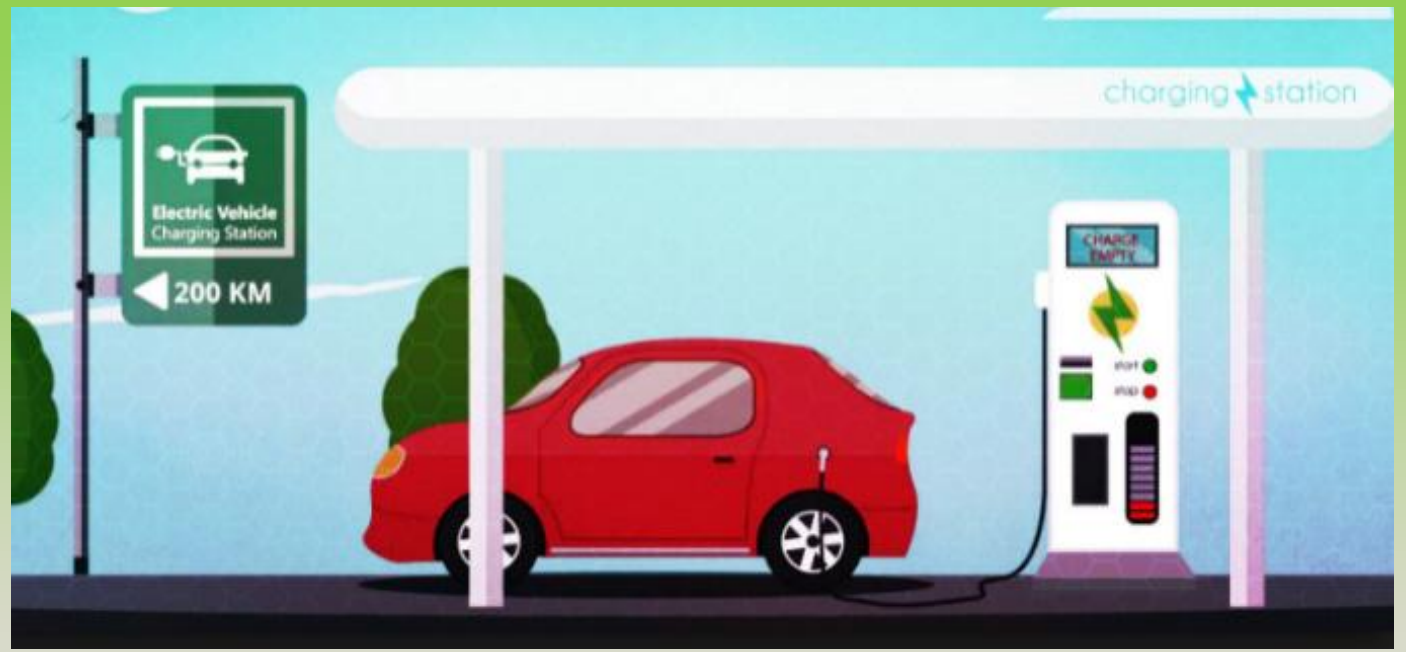
COMPONENTS OF THE SMART CITY- SMART PARKING MANAGEMENT

- **:** Smart parking management system can be used to find the vacant location for a vehicle at different public places. Smart Parking's In-Ground Vehicle Detection Sensors are core technologies, playing a key part in the Smart Parking solution that is revolutionizing how drivers in the malls and city centers can find an available parking space. Wireless sensors are embedded into parking spaces, transmitting data on the timing and duration of the space used via local signal processors into a central parking management application



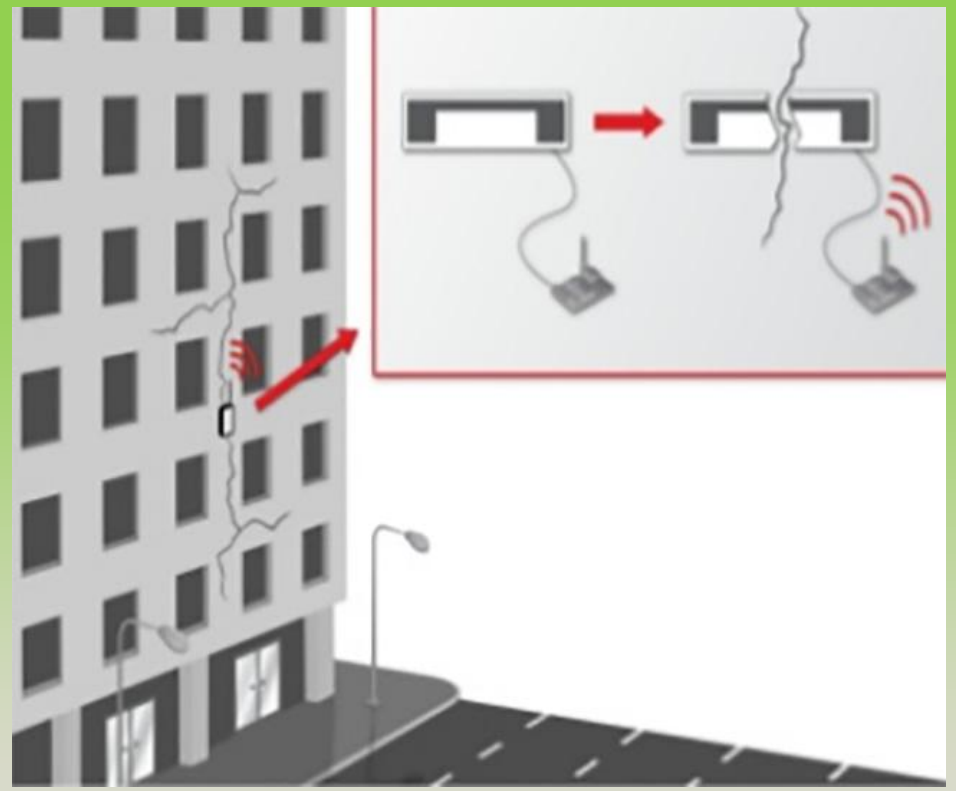
COMPONENTS OF THE SMART CITY- CONNECTED CHARGING STATIONS

- Smart infrastructure also includes implementing charging stations in parking systems, city fleets, shopping malls and buildings, airports, and bus stations across the city. Electronic vehicle (EV) charging platforms can be integrated with IoT to streamline the operations of EV charging and addresses the impact of the power grid.



COMPONENTS OF THE SMART CITY- SMART HEATING & VENTILATION

- Smart heating and ventilation systems monitor various parameters such as temperature, pressure, vibration, humidity of the buildings and properties such as movie theatres, and historical monuments. Wireless sensor network deployment is the key to ensuring appropriate heating and ventilation. These sensors also collect data to optimize the HVAC systems, improving their efficiency and performance in the buildings.

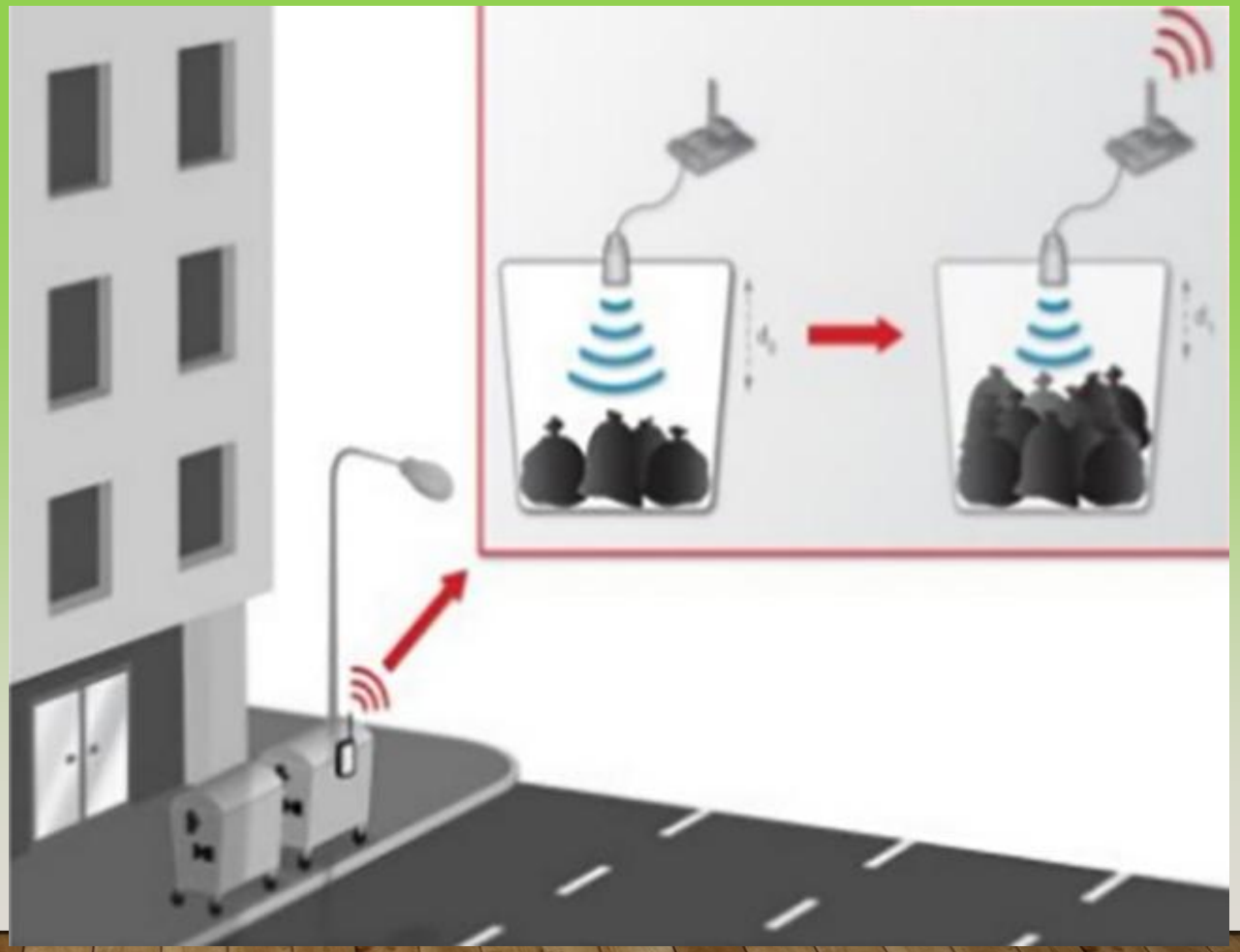


COMPONENTS OF THE SMART CITY- SMART INDUSTRIAL ENVIRONMENT

- Industrial environments present unique opportunities for developing applications associated with the Internet of things and connected technologies which can be utilized in the following areas:
- **Forest Fire Detection:** Helps in the monitoring of combustion gases and preemptive fire conditions to define alert zones.
- **Air/Noise Pollution:** Helps in controlling of CO2 emissions of factories, pollution emitted by cars and toxic gases generated on farms.

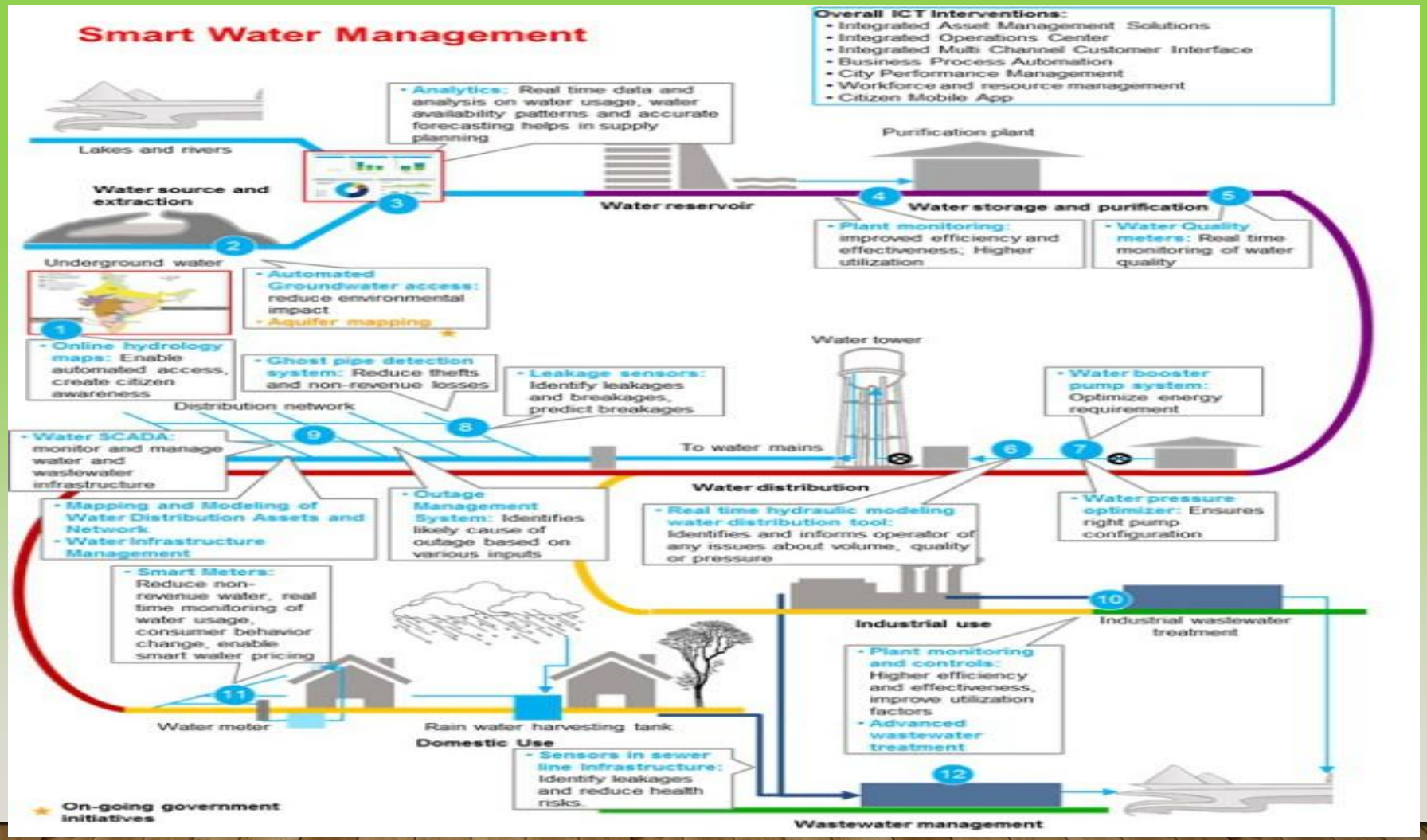
COMPONENTS OF THE SMART CITY-SMART WASTE MANAGEMENT

- Smart solutions for tracking wastes help municipalities and waste service managers the ability to optimize wastes, reduce operational costs, and better address the environmental issues associated with an inefficient waste collection.



COMPONENTS OF THE SMART CITY-SMART WATER MANAGEMENT

Internet of Things technology also helps in scheduling the maintenance as well as the shutdown of pumps on a regular basis. There are optimization techniques that can beforehand convey to the residents of a city regarding the unavailability of water during any particular point in time. This helps the water regulation authorities not only in meeting the adequate water demands in a city; rather it also aids in the conservation of resources and energy.



THANK YOU

QUESTIONS