Unit - 3

Smart City

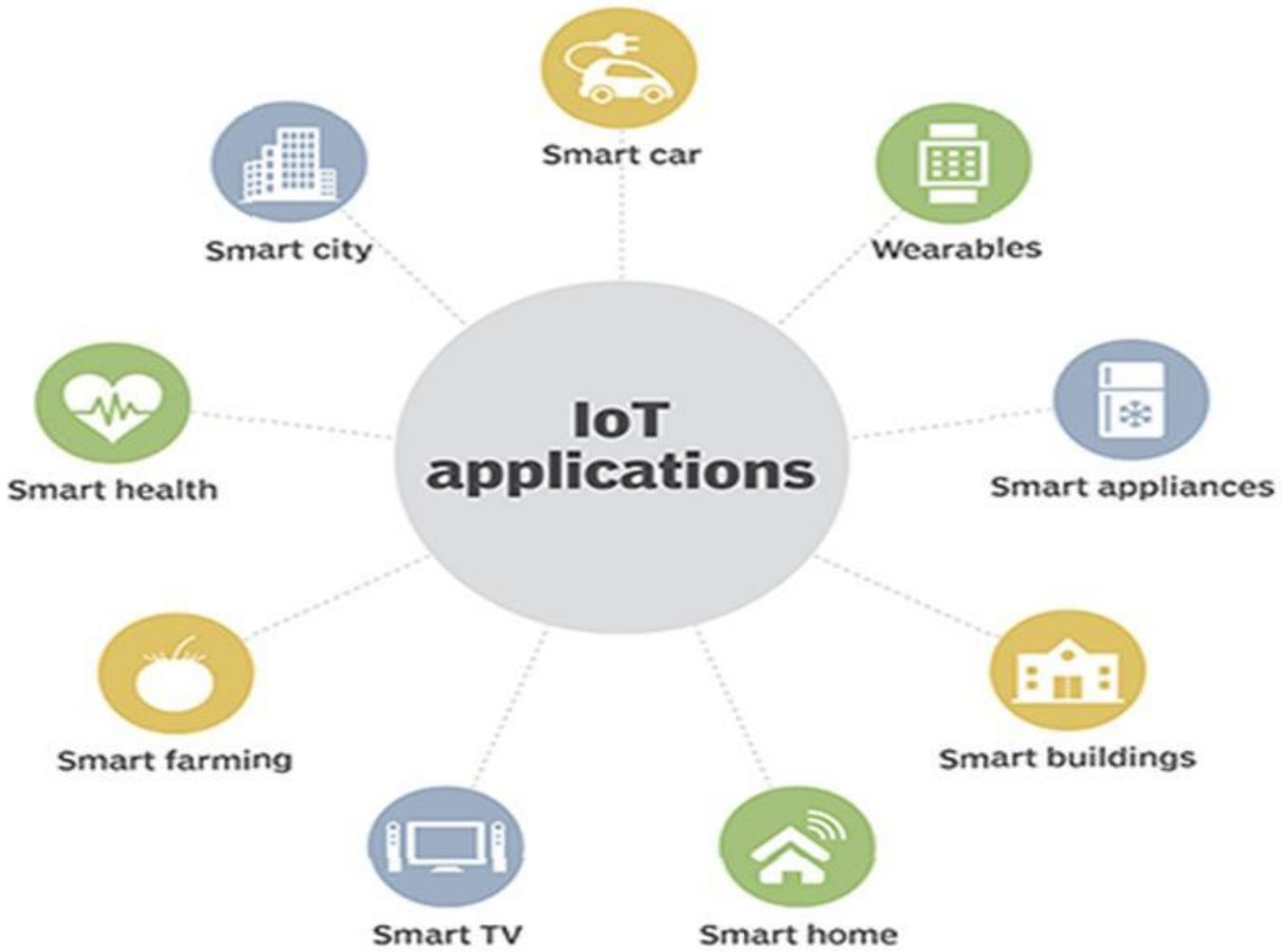
National Forensic Sciences University

Knowledge | Wisdom | Fulfilment

An Institution of National Importance
(Ministry of Home Affairs, Government of India)

M.Tech AIDS SEM 2
Intelligent System and Security

Prof. Drashti Garadharia
NFSU,Gandhinagar


IoT applications
Smart car
Smart city
Wearables
Smart health
Smart appliances
Smart farming
Smart buildings
Smart TV
Smart home

Population Growth in **Cities**: The population density in cities has increased significantly, with cities accommodating 54% of the global population in 2014 and expected to reach 68% by 2050.

WHAT IS A SMART CITY?

A Framework, predominantly composed of ICT, to develop, deploy, and promote sustainable development practices to address growing urbanization challenges:

1. Essentially an intelligent network of connected objects and machines that transmit data using wireless technology and the cloud
2. Cloud-based IoT applications receive, analyse, and manage data in real-time to help municipalities, enterprises, and citizens make better decisions that improve quality of life.
3. Collaboration required at all tiers of government, the private sector, and community, to work together towards shared goals.

History of Smart City

The concept of a smart city can be traced back to 1974, when Los Angeles launched its first urban big data project, "A Cluster Analysis of Los Angeles".

Seoul, South Korea is considered to be one of the world's first smart cities, with its smart technology campaigns beginning in 2014.

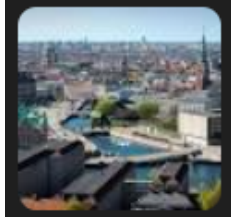
Smart City Index according to technological, economic and human criteria (e.g., the quality of life, the environment and inclusiveness). In the Smart City Index 2023, the top 15 smart cities were, in order, Zürich, Oslo, Canberra, Copenhagen, Lausanne, London, Singapore, Helsinki, Geneva, Stockholm, Hamburg, Beijing, Abu Dhabi, Prague, and Amsterdam

Singapore

Consistently ranks as one of the world's smartest cities and was the only city in the top 10 of the IMD's rankings to not change position from 2020 to 2021.

Oslo

The Norwegian capital uses sensors to control lighting, heating, and cooling to address climate change.



Copenhagen

In 2016, Copenhagen became the first city to implement a Big Data system to manage public and private information.

Zürich

Zürich's smart city journey began with a streetlight project that uses sensors to adjust brightness based on traffic levels.

Helsinki

Helsinki aims to be carbon neutral by 2035 and in 2017, the city lowered emissions by 27% from 1990.

Geneva

Geneva launched its Smart City Geneva initiative in 2018 with a focus on energy, mobility, digital, and waste.

The Hangzhou - metropolis of 7 million people once ranked fifth among China's most congested cities, but it had dropped to 57th on the list in 2019.

Alibaba dubbed the **City Brain**, which uses artificial intelligence to gather information across Hangzhou, such as video from intersection cameras and GPS data on the locations of cars and buses.

China[edit]

China's smart cities movement began with a pilot program launched in 2012 through its Ministry of Housing and Urban-Rural Development.[35]:58–59 China's National New-Type Urbanization Plan for 2014-2020 included smart cities.[35]:59–60 It identified six important aspects for developing smart cities:[35]:60

- information network and broadband
- digitization of planning management
- smart infrastructure
- convenience of public services
- modernizing industrial development
- sophisticated social governance.

As of 2016, approximately 500 smart city projects had launched.[35]:59 In 2021, China took first in all categories of the International AI City Challenge – "by some estimates, China has half of the world's smart cities".[139]

JAPAN

Woven City

Toyota is building a $10 billion smart city at the base of Mount Fuji called Woven City. The city is designed to be a living laboratory that tests the concept of a harmonious urban life that integrates technology, sustainability, and human life.

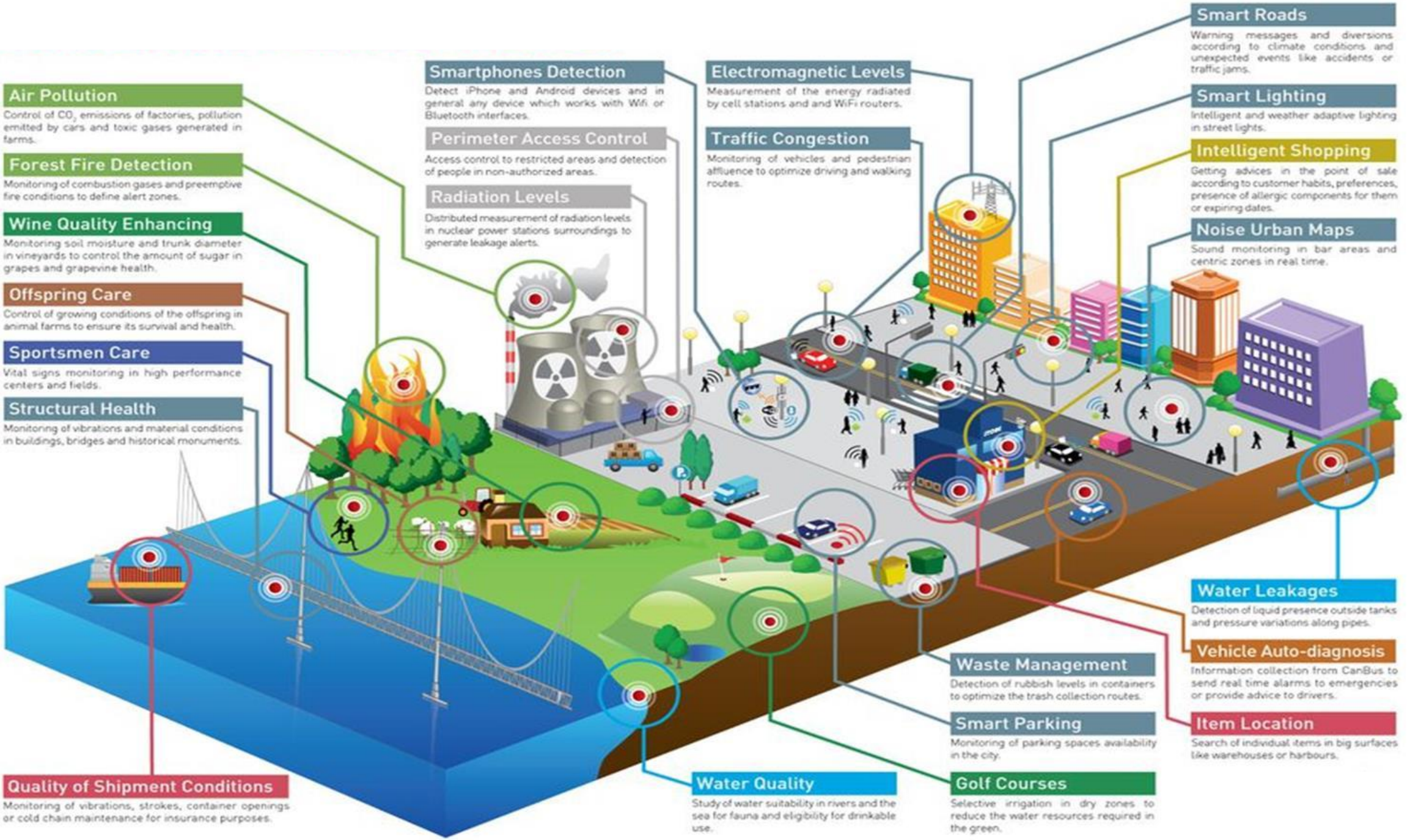
Japan's smart cities are oriented toward **free, trustworthy and credible norms**. Under the norms, major companies are not allowed to monopolize data handling, excessive regulations are not imposed on the usage of data.

https://tokyoesque.com/smart-cities-in-japan/

https://www.kantei.go.jp/jp/singi/keikyou/pdf/Japan's_Smart_Cities-1(Main_Report).pdf

Smart Cities Mission

- Prime Minister Narendra Modi at the launch of Smart Cities Mission in 2015
- The Union Ministry of Urban Development is responsible for implementing the mission in collaboration with the state governments of the respective cities.
- The mission was planned to include 100 cities, with the deadline for completion of the projects set between 2019 and 2023.
- As of December 2024, 7380 out of a total 8075 tendered projects have been completed, utilizing ₹147,704 crores out of the total tendered amount of ₹164,687 crore


Air Pollution
Control of CO_2 emissions of factories, pollution emitted by cars and toxic gases generated in farms.
Forest Fire Detection
Monitoring of combustion gases and preemptive fire conditions to define alert zones.
Wine Quality Enhancing
Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.
Offspring Care
Control of growing conditions of the offspring in animal farms to ensure its survival and health.
Sportsmen Care
Vital signs monitoring in high performance centers and fields.
Structural Health
Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.
Quality of Shipment Conditions
Monitoring of vibrations, strokes, container openings or cold chain maintenance for insurance purposes.
Smartphones Detection
Detect iPhone and Android devices and in general any device which works with Wifi or Bluetooth interfaces.
Perimeter Access Control
Access control to restricted areas and detection of people in non-authorized areas.
Radiation Levels
Distributed measurement of radiation levels in nuclear power stations surroundings to generate leakage alerts.
Electromagnetic Levels
Measurement of the energy radiated by cell stations and and WiFi routers.
Traffic Congestion
Monitoring of vehicles and pedestrian affluence to optimize driving and walking routes.
Water Quality
Study of water suitability in rivers and the sea for fauna and eligibility for drinkable use.
Smart Roads
Warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.
Smart Lighting
Intelligent and weather adaptive lighting in street lights.
Intelligent Shopping
Getting advices in the point of sale according to customer habits, preferences, presence of allergic components for them or expiring dates.
Noise Urban Maps
Sound monitoring in bar areas and centric zones in real time.
Water Leakages
Detection of liquid presence outside tanks and pressure variations along pipes.
Vehicle Auto-diagnosis
Information collection from CanBus to send real time alarms to emergencies or provide advice to drivers.
Item Location
Search of individual items in big surfaces like warehouses or harbours.
Waste Management
Detection of rubbish levels in containers to optimize the trash collection routes.
Smart Parking
Monitoring of parking spaces availability in the city.
Golf Courses
Selective irrigation in dry zones to reduce the water resources required in the green.

M.T
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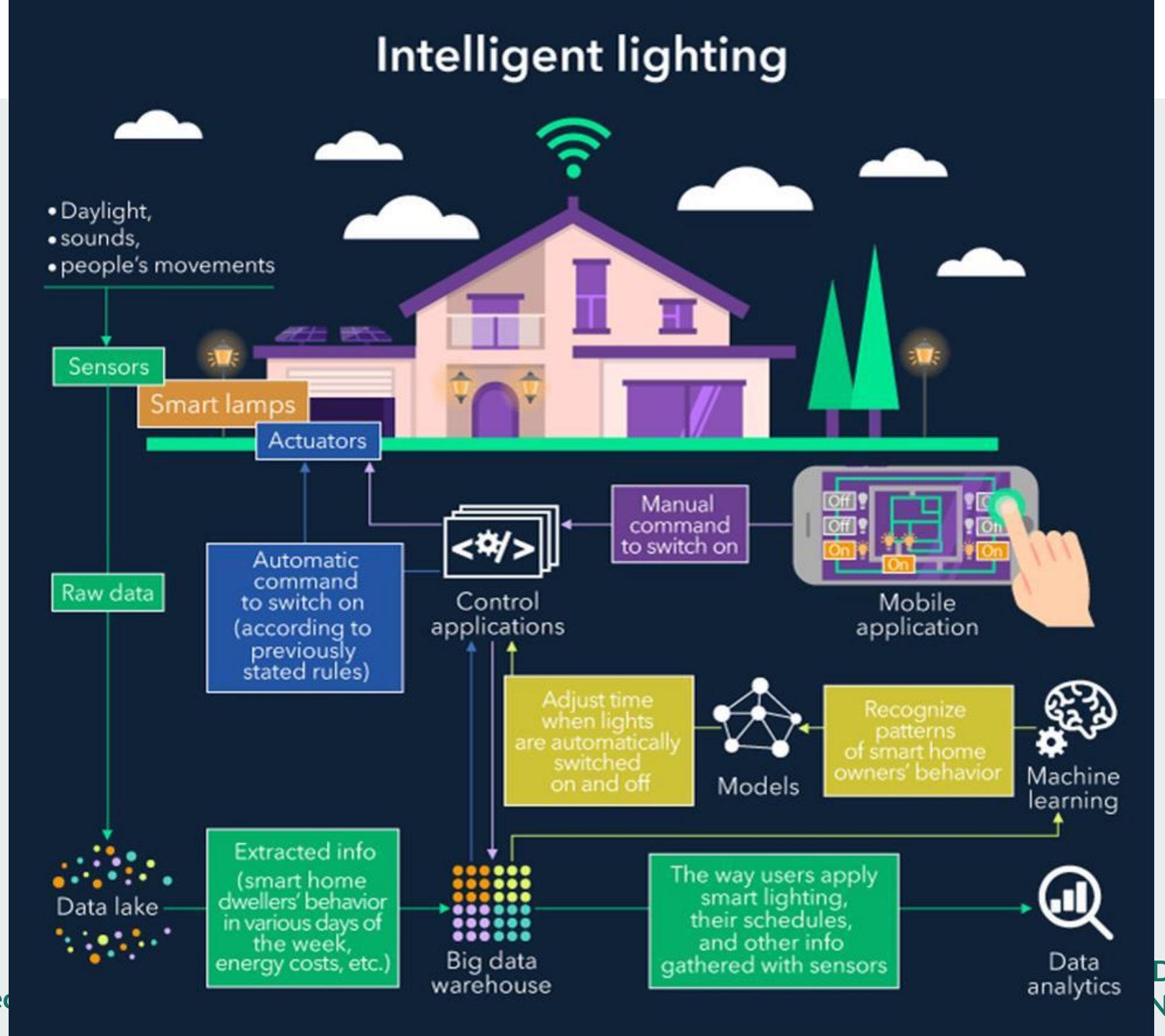
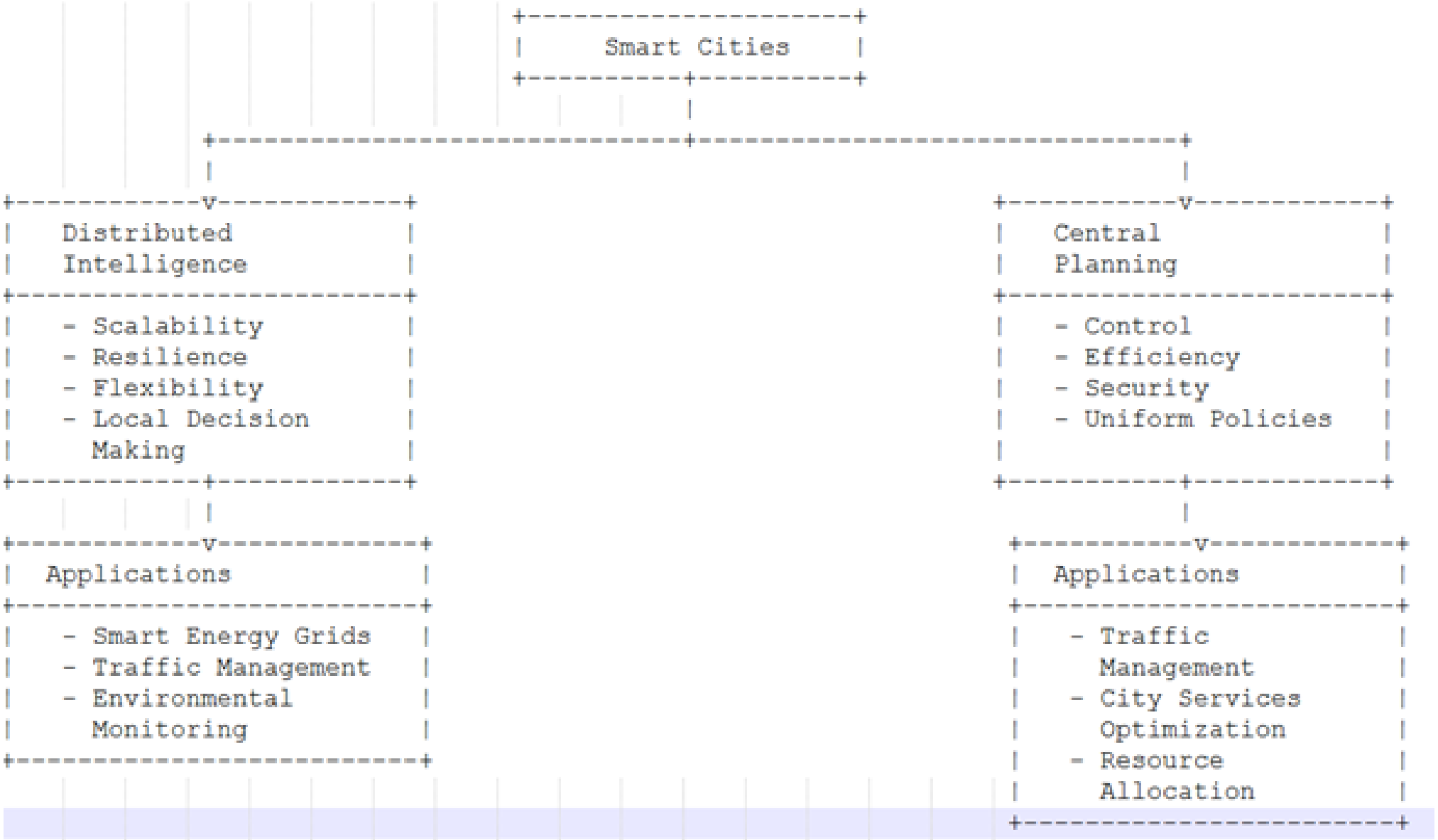

Intelligent lighting
• Daylight,
• sounds,
• people's movements
Sensors
Smart lamps
Actuators
Raw data
Automatic command to switch on (according to previously stated rules)
Control applications
Manual command to switch on
Mobile application
Off
Off
On
On
On
On
Adjust time when lights are automatically switched on and off
Models
Recognize patterns of smart home owners' behavior
Machine learning
Data lake
Extracted info (smart home dwellers' behavior in various days of the week, energy costs, etc.)
Big data warehouse
The way users apply smart lighting, their schedules, and other info gathered with sensors
Data analytics

Smart City Definition

- A **smart city** is a urban area that utilizes linked data and information and communication technology (ICT) to optimize its operations, manage resources efficiently, and enhance the quality of life for its residents.
- This involves integrating physical infrastructure, such as transportation and buildings, with social and commercial infrastructure, as well as engaging in ICT-enhanced governance and participatory decision-making processes.
- The goal of a smart city is to create a sustainable and intelligent environment that promotes socio-economic growth and improves overall well-being

Prof. Drashti Garadharia
NFSU,Gandhinagar


Smart Cities
Distributed Intelligence
- Scalability
- Resilience
- Flexibility
- Local Decision Making
Applications
- Smart Energy Grids
- Traffic Management
- Environmental Monitoring
Central Planning
- Control
- Efficiency
- Security
- Uniform Policies
Applications
- Traffic Management
- City Services Optimization
- Resource Allocation

Adoption of AI in Smart City

- **Smart** Cities for Comfort and Cost-effectiveness: To improve lifestyles in cities, they must become smart and intelligent, which involves using computational intelligence-based technologies for intelligent decision-making processes.
- Role of Artificial Intelligence (AI): AI is playing a crucial role in the smart city concept, with significant impacts observed **in healthcare, mobility, privacy and security, and energy sectors.**
- AI Adoption Trends: The healthcare industry has significantly increased its adoption of AI-based technologies, with a 60% increase since the onset of the epidemic in 2019.
- Key AI Algorithms: AI algorithms such as **ANN, RNN/LSTM, CNN/R-CNN, DNN, and SVM/LS-SVM** are having a high impact on various smart city domains, including healthcare, education, environment, and waste management, among others

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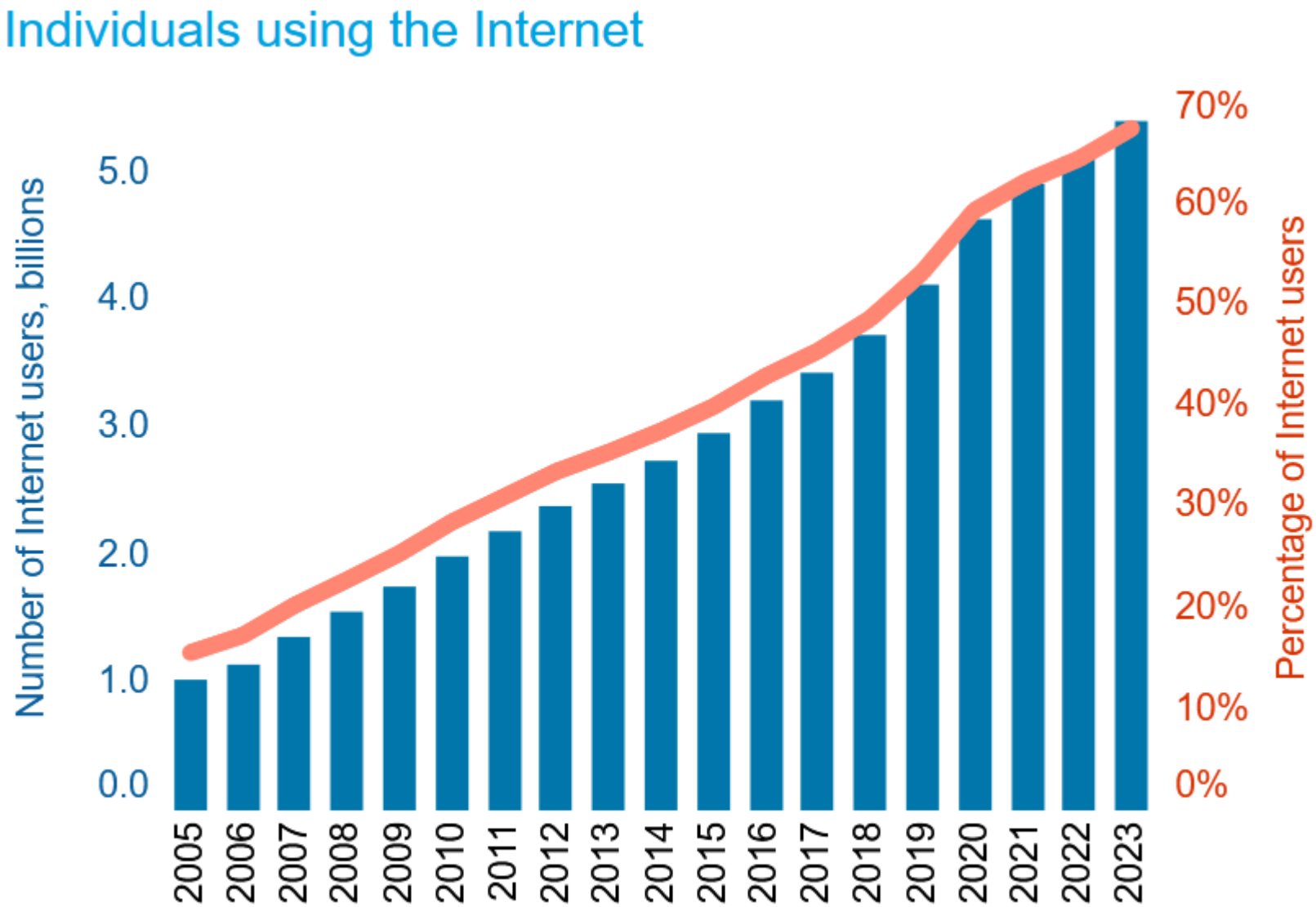
Individuals using the Internet
Number of Internet users, billions
5.0
4.0
3.0
2.0
1.0
0.0
70%
60%
50%
40%
30%
20%
10%
0%
Percentage of Internet users
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

Table 3
Top ranked smart cities of the world in 2021, *(Source: Smart city index 2021* (Smart City Observatory Web, 2021).

City	Rank in 2021	Rating 2021	Structure 2021	Technology 2021	Rank in 2020
Singapore	1	AAA	AAA	AAA	1
Zurich	2	AA	AAA	A	3
Oslo	3	AA	AAA	A	5
Taipei City	4	A	A	A	8
Lausanne	5	A	AAA	A	New
Helsinki	6	A	AA	A	2
Copenhagen	7	A	AA	A	6
Geneva	8	A	AA	A	7
Auckland	9	A	A	A	4
Bilbao	10	BBB	A	BBB	24

IMD Smart City Index 2024: Results

In 2024 City Ranking Order with HDI Context and 2023 Ranking Comparison (2023 Methodology Appli

City	Smart City Rank 2024	Smart City Rating 2024	Structure 2024	Technology 2024	Smart City Rank 2023	Change
Zurich	1	AAA	AAA	AA	1	—
Oslo	2	AA	AA	A	2	—
Canberra	3	AA	AAA	A	3	—
Geneva	4	AAA	AAA	AA	9	+5▲
Singapore	5	A	A	A	7	+2▲
Copenhagen	6	AA	AA	A	4	-2▼
Lausanne	7	AA	AA	A	5	-2▼
London	8	A	BBB	AA	6	-2▼
Helsinki	9	AA	AA	A	8	-1▼
Abu Dhabi	10	BB	BB	BB	13	+3▲
Stockholm	11	A	A	A	10	-1▼
Dubai	12	BB	BB	BB	17	+5▲
Beijing	13	BB	BB	BB	12	-1▼
Hamburg	14	BBB	BBB	BBB	11	-3▼
Prague	15	A	A	A	14	-1▼
Taipei City	16	A	BBB	A	29	+13▲
Seoul	17	AA	BBB	AAA	16	-1▼
Amsterdam	18	A	BBB	A	15	-3▼
Shanghai	19	BB	BB	BB	25	+6▲
Hong Kong	20	A	BBB	AAA	19	-1▼
Munich	21	A	A	A	20	-1▼
Sydney	22	A	BBB	A	18	-4▼

Categorization of AI Tech in Smart Cities

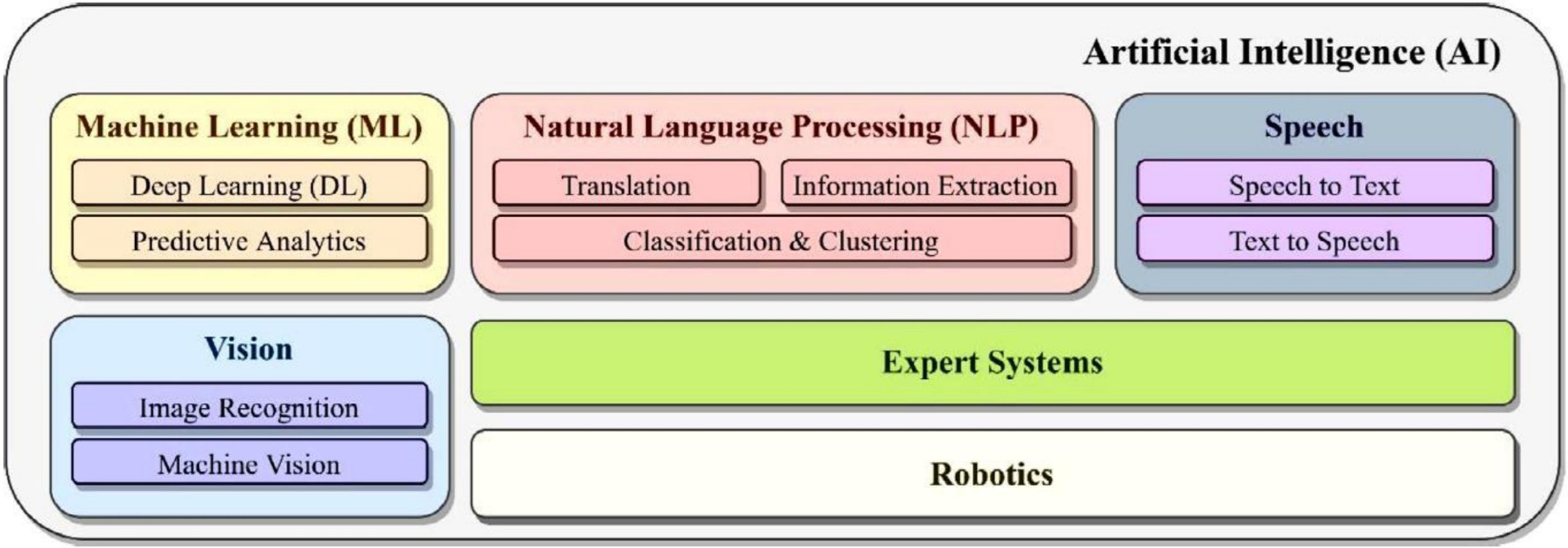

Fig. 4. Categorization of AI technologies in modern smart cities.

- **Machine Learning (ML)**: Subset of AI that enables software programs to predict outcomes without explicit programming, using past data as input.
- **Natural Language Processing (NLP)**: Branch of AI that studies how computers interact with human languages, aiming to create programs or algorithms that understand language nuances in context.
- **Speech Recognition**: Interdisciplinary topic using AI to generate results, also known as voice recognition, speech-to-text, and text-to-speech.
- **Computer Vision**: Branch of AI enabling computers to extract information from digital photos, videos, and other visual inputs, allowing them to act or make suggestions based on that data.
- **Expert Systems**: Computer programs using AI to handle specific subject issues that typically require human expertise.

  Here are some examples of expert systems:

  - **DENDRAL**: A tool for predicting molecular structures in chemical analysis
  - **PXDES**: A system for predicting the type and extent of lung cancer
  - **MYCIN**: A medical diagnosis system for infectious blood diseases
  - **Stock market prediction**: An example of an expert system
- **Robotics**: Production of robots capable of performing tasks without human involvement, distinct from AI, which focuses on systems imitating human decision-making and learning.

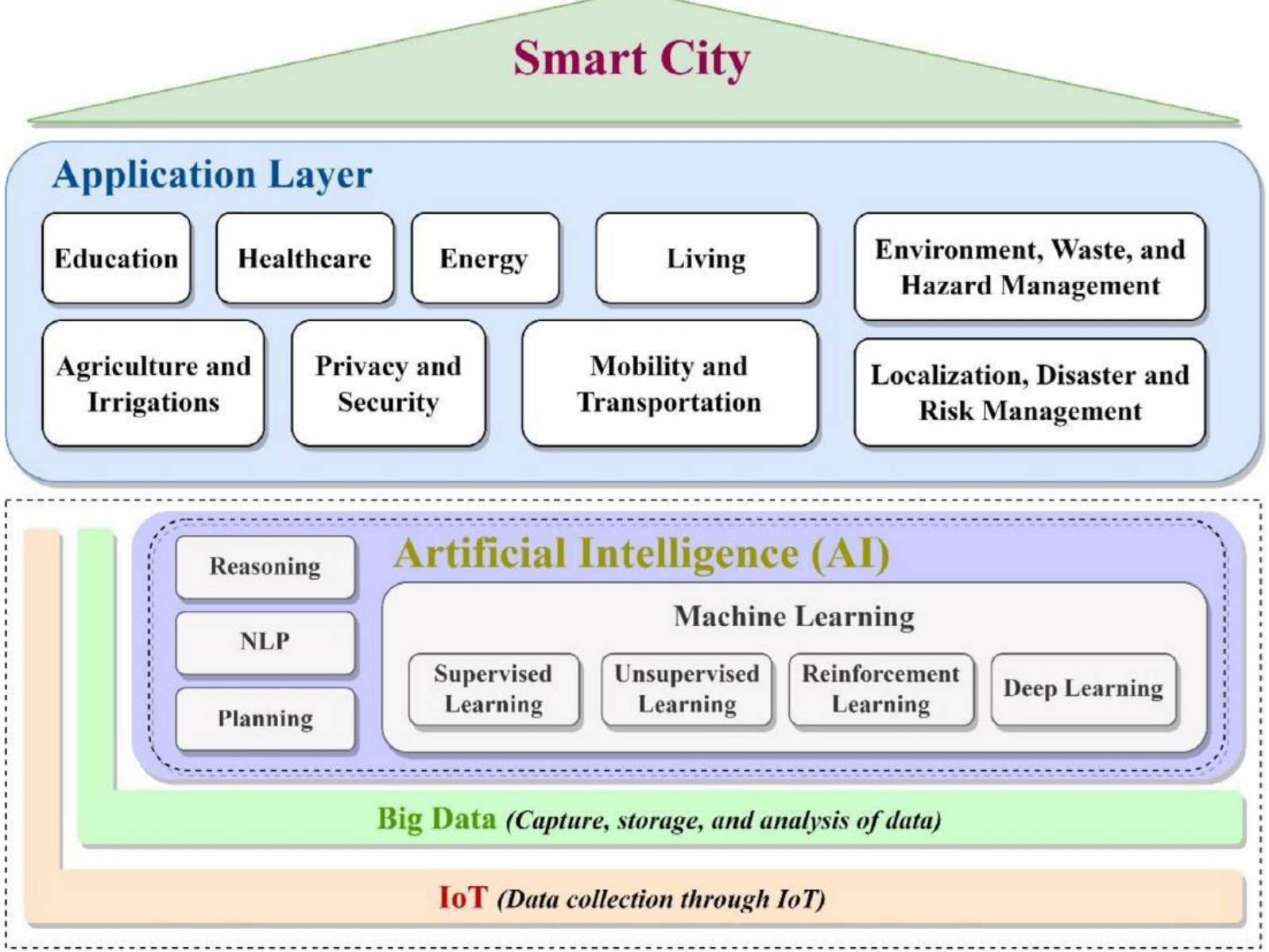

Fig. 5. Conceptual smart city-AI framework.

Adoption of AI in Smart Cities

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NFSU,Gandhinagar

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Adoption of artificial intelligence in smart cities: A comprehensive review

H.M.K.K.M.B. Herath [a,*], Mamta Mittal [b]

[a] Faculty of Computing and IT, Sri Lanka Technological Campus, Padukka, Sri Lanka
[b] Delhi Skill and Entrepreneurship University, New Delhi, India

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Prof. Drashti Garadharia
NFSU,Gandhinagar

Emerging Smart Cities

Role of Technology in Smart Cities: Technology plays a crucial role in smart cities, automating processes and improving quality of life. It enables responsive governance and improves municipal infrastructure.

Criteria for Smart Cities: Cities can be classified as "Smart" if they meet specific criteria, such as utilizing ICT to automate processes and improve efficiency in various areas like healthcare, transportation, and energy.

Use of DRL and ML in Analyzing Data: Deep Reinforcement Learning (DRL), and Machine Learning (ML) are sophisticated methodologies used to analyze complex data in smart cities.

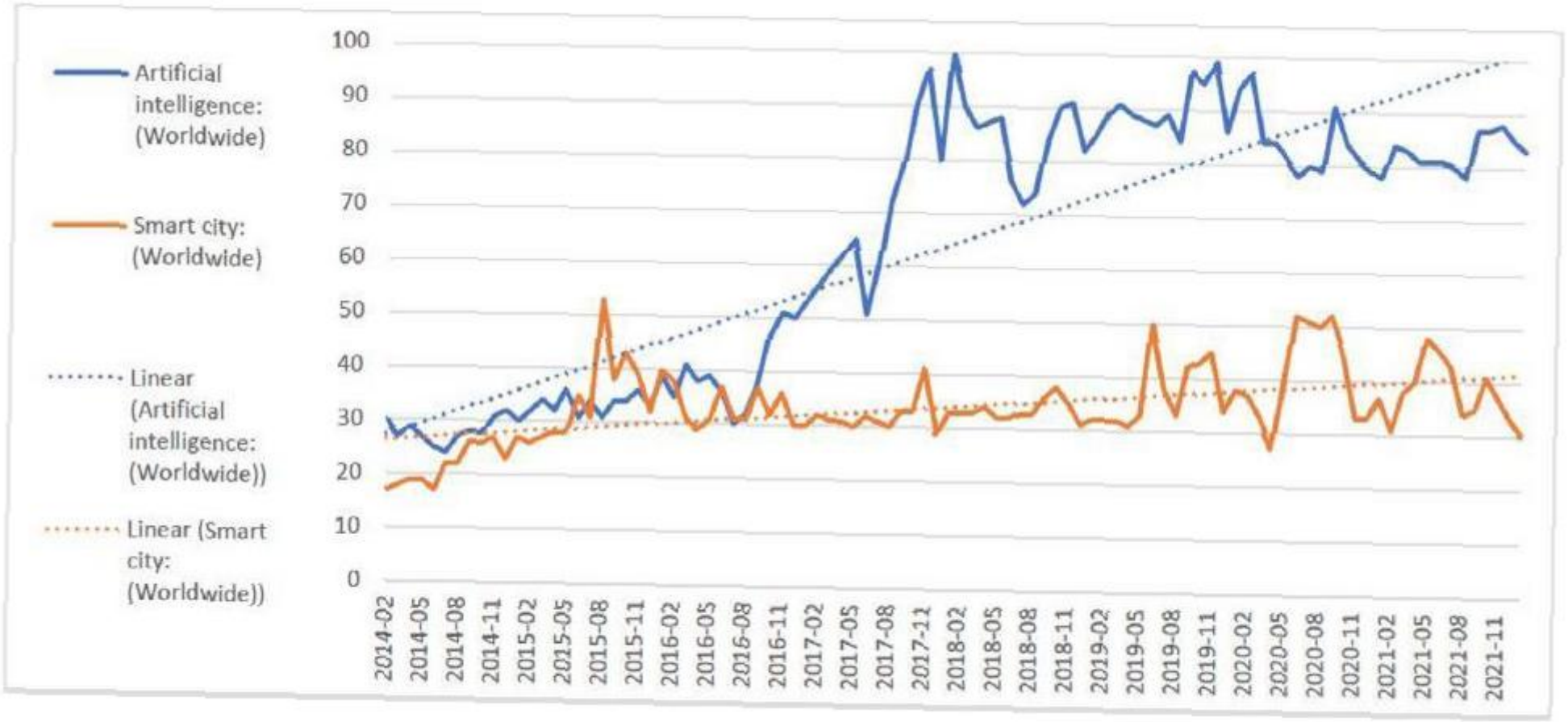


Fig. 1. The popularity of the keywords "*Smart City*" and "*Artificial Intelligence*" since 2014, *(Source: Google Trend)*.

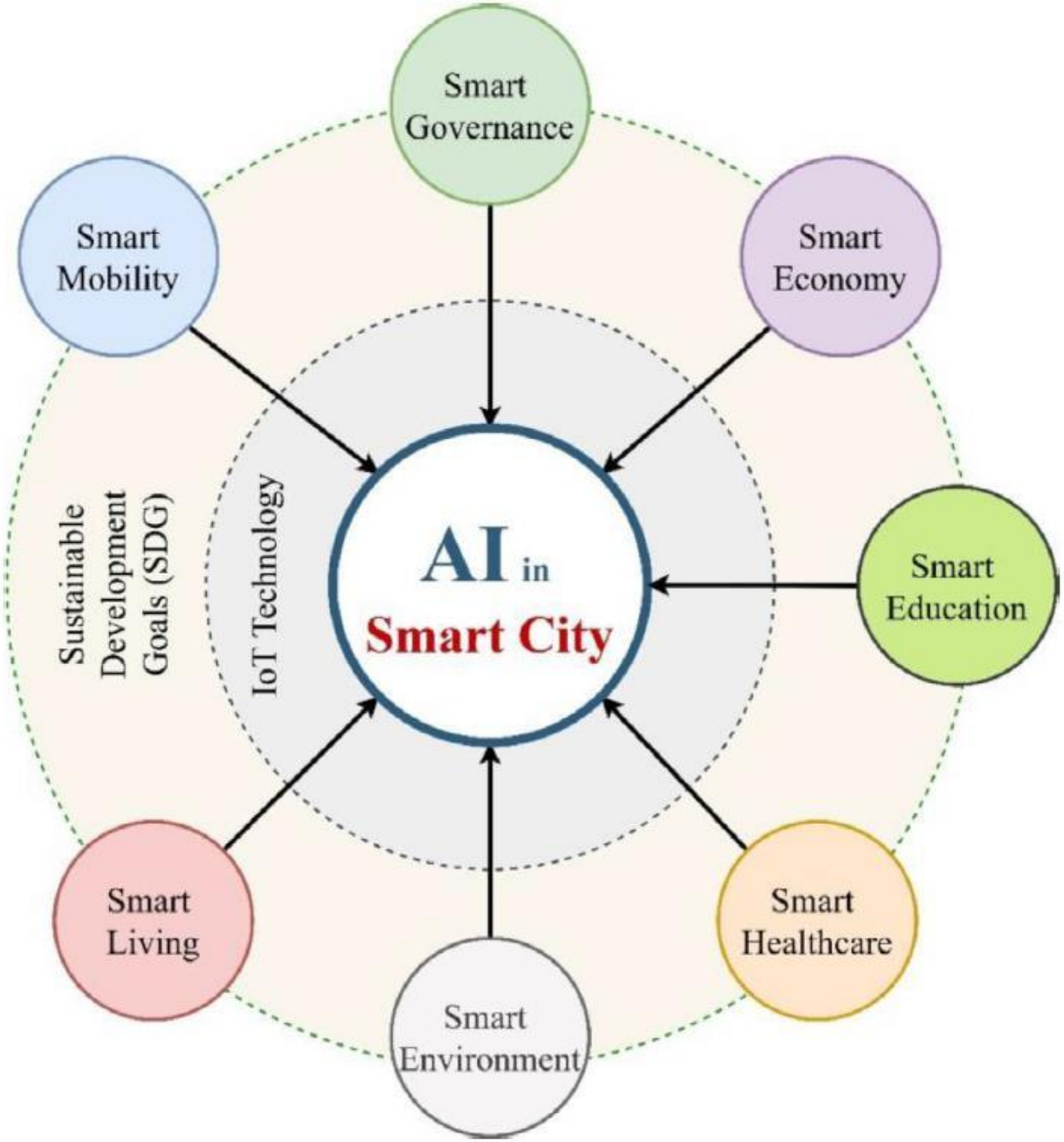


Fig. 2. Major domains of smart city.

AI Involvement in different domains of a city

1. Smart Mobility
2. Education
3. Healthcare
4. Environment
5. Governance
6. Living & Infrastructures
7. Economy

Prof. Drashti Garadharia
NFSU,Gandhinagar

Smart Mobility

- **Description**: A smart mobility network is a network of intelligent transportation and mobility.
- **Involvements**: **Traffic management, Autonomous and sustainable mobility, Supply chain resiliency, Smart routing and parking.**

Education

- **Description**: Smart education is a learning paradigm tailored to the needs of emerging digital native generations.
- **Involvements**: **Smart classroom, Virtual reality-based learning platforms, Student tracking management, Learning tools for special needs students, Smart library**.

Healthcare

- **Description**: Smart healthcare is a healthcare delivery method that uses wearable tech, the IoTs, and mobile internet to constantly access data and connect people, resources, and institutions.
- **Involvements**: **Smart hospital, Telemedicine, Telenursing, Smart healthcare tracking, E-health record, Patient monitoring, Pandemic predictions**.

Environment

- **Description**: The concept of creating an environment with integrated sensors, displays, and computer devices to let people comprehend better and manage their environment.
- **Involvements**: **Air quality monitoring, Weather monitoring, Waste management, Water management, Smart irrigation, Photovoltaics**.

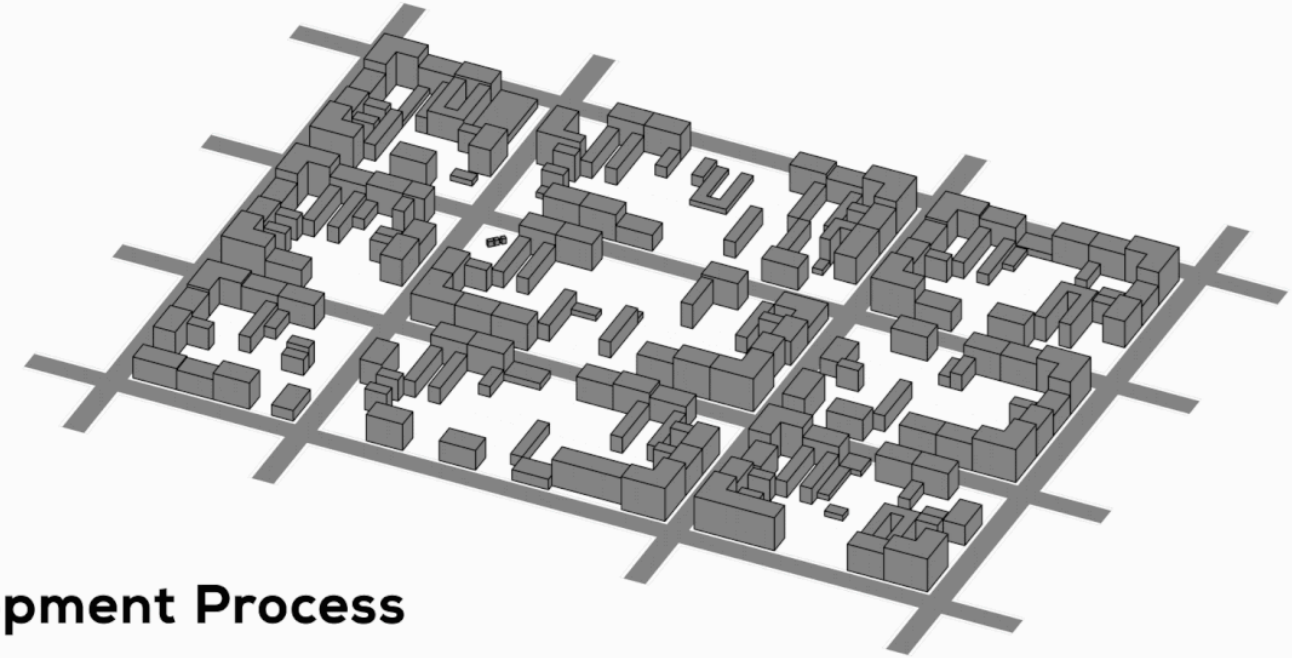
Governance

- **Description**: Smart governance is the application of technology and innovation to improve decision-making and planning in governing organizations.
- **Involvements**: **E-governance, Decision-making policies, Disaster prevention and management, Urban planning**.

Living & Infrastructures

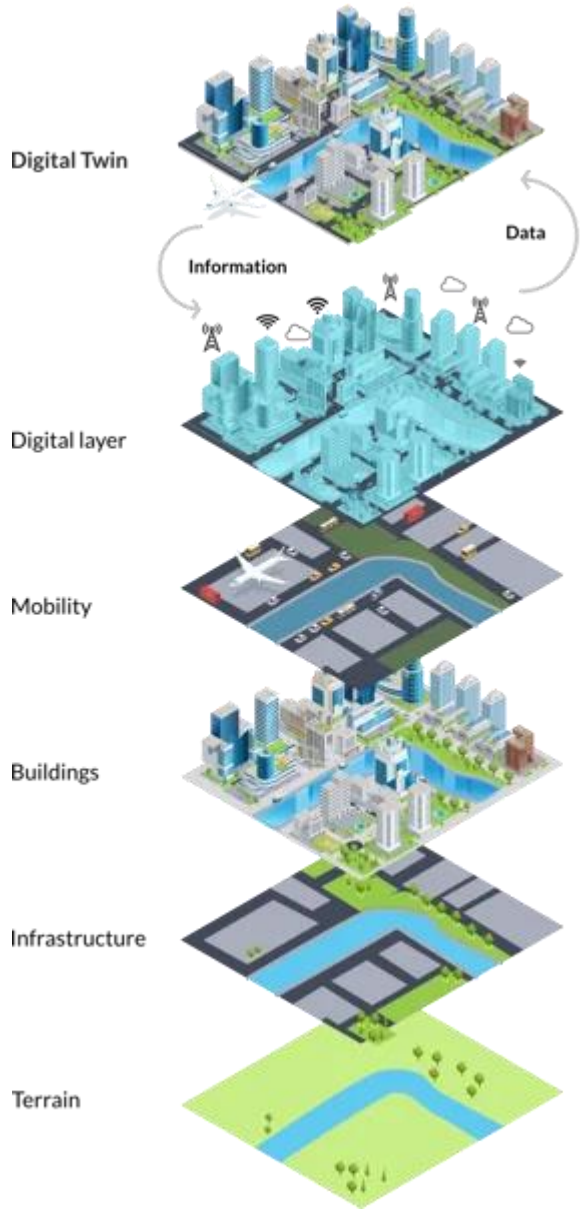
- **Description**: Smart living is an approach that uses the city's infrastructure while simultaneously enhancing people's quality of life.
- **Involvements**: **Smart Grid, Smart building, Smart home, Smart tourism, Smart policing, Digital Twin Technology**

kiosk



Development Process

Adjusting the city centre
to the needs of its residents.



Economy

- **Description**: A smart economy is an economy centered on technical innovation, sustainability, a high level of social well-being, and resource efficiency as factors for success.
- Involvements: **Smart business, E-commerce, Retail, Smart shopping, Peer-to-peer marketplace, Peer-to-peer labor services, Smart supply chains, Smart sharing services**.

AI In Smart Education

- **Smart Education Initiatives Worldwide**: Countries like Malaysia, Singapore, Finland, Australia, South Korea, and the United States have initiated smart education projects incorporating IoT and AI technologies.

- **Research on AI in Smart Education**: Studies have explored the adoption of AI and computational intelligence to enhance education quality, including the role of Artificial Intelligence Applications (AIA) and AI-based smart learning frameworks.

- **Technological Developments in Smart Education**: Innovations include the use of robotics AI in education, emotionally aware AI smart classroom paradigms, and frameworks for assessing students' learning styles using AI approaches.

- **Importance of Learning Styles**: Consideration of individual learning styles is crucial, with proposed frameworks for assessing learning styles using AI in e-learning platforms to provide personalized learning experiences.

AI in Smart Energy

- **Introduction of AI in Energy Sector**: AI applications have revolutionized the energy sector, leading to the development of smart energy models focused on energy efficiency and sustainability in smart cities.
- **AI-Based Energy Forecasting:** AI techniques such as machine learning are used for energy forecasting, cost optimization, and renewable energy solutions, improving the efficiency of smart grids.
- **Machine Learning in Energy Efficiency:** Machine learning algorithms are utilized for predicting electric load, building energy performance, and optimizing energy consumption, contributing to greenhouse gas emissions reduction.
- **AI Approaches for Energy Prediction:** Various AI approaches, including Support Vector Machines (SVM), Artificial Neural Networks (ANN), and Genetic Algorithms (GA), are employed for energy consumption prediction and building energy usage forecasting. electric vehicle charging infrastructure
- **Technological Advances in Smart Grids:** Reinforcement learning-based decision systems and IoT integration with AI and Blockchain technologies enhance smart grid services, ensuring reliability, stability, security, and sustainability.

Prof. Drashti Garadharia
NFSU,Gandhinagar

AI in Transportation

- **Transportation Challenges**: Growing populations and increasing vehicle numbers have led to transportation challenges in urban areas worldwide, highlighting the need for sustainable transportation systems.
- **AI-Based Traffic Management**: AI is used in traffic management for decision-making, monitoring, forecasting, routing, and mobility optimization, enhancing the efficiency of transportation networks.
- **Intelligent Transportation Systems (ITS)**: ITS integrates control systems, sensors, actuators, and ICTs to generate real-time data, influencing the next generation of transportation in smart cities.
- **AI Applications in Traffic Flow Prediction**: AI techniques like machine learning and deep learning are employed for predicting traffic flow, congestion, and routing, improving traffic management and efficiency.

AI in Transportation

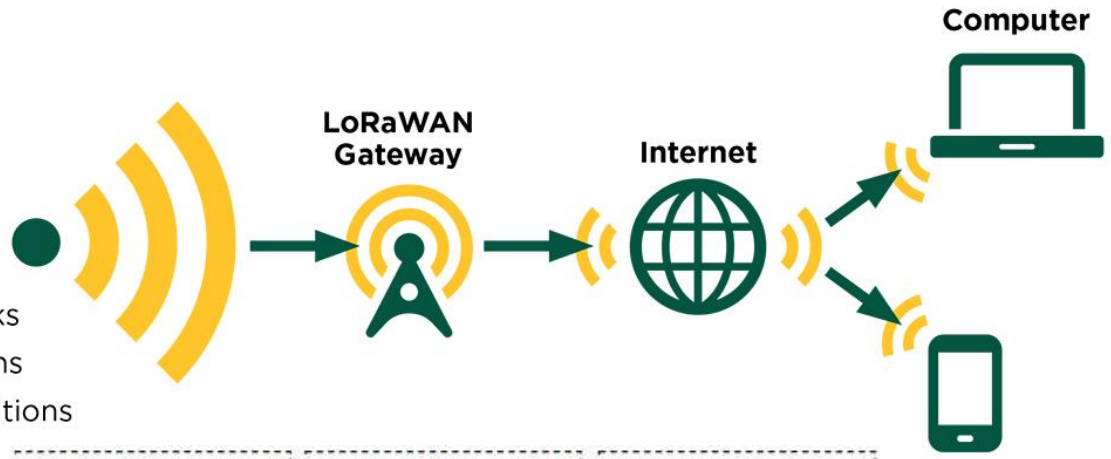
- **AI in Public Transit and Logistics**: AI is used in public transit for route optimization, employee engagement, and logistics management, enhancing overall efficiency and effectiveness.
- **AI for Safety and Surveillance**: AI-based models are developed for identifying safety issues like distracted driving, pedestrian risks, and human-centered threats, improving safety in transportation systems.
- **Personal Rapid Transit (PRT)**: PRT systems, a mode of self-driving transportation, have been developed using AI, with projects like CyberCab, ULTra PRT, and Skycube showcasing advancements in this field.

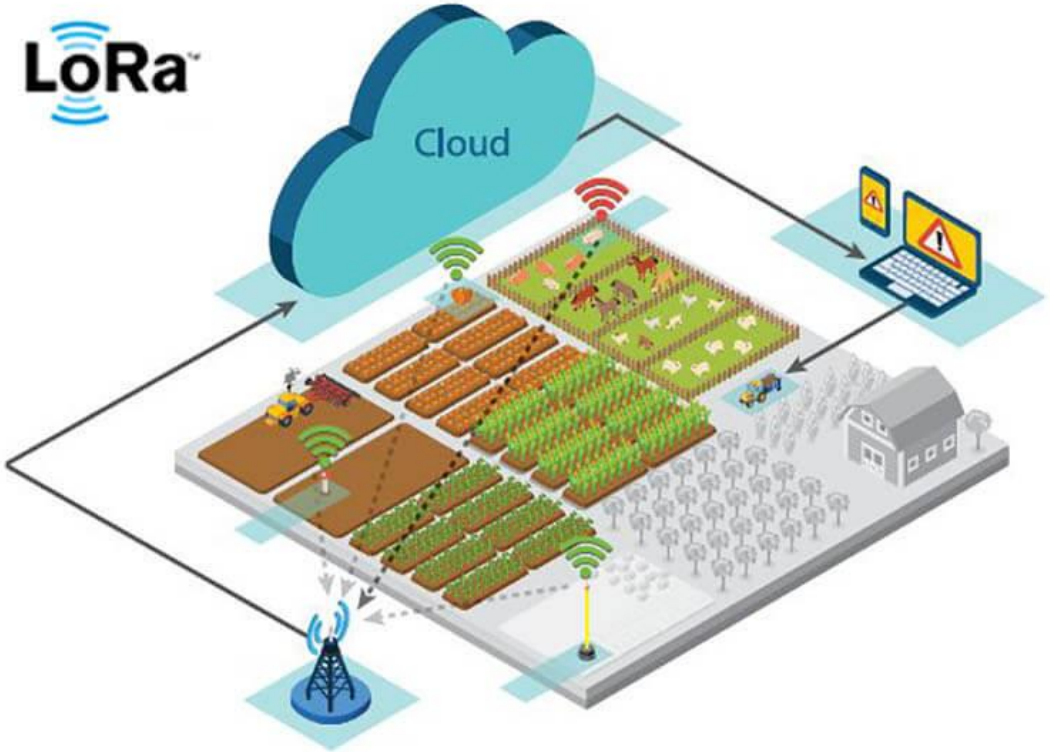
LoRaWAN Wireless Technology

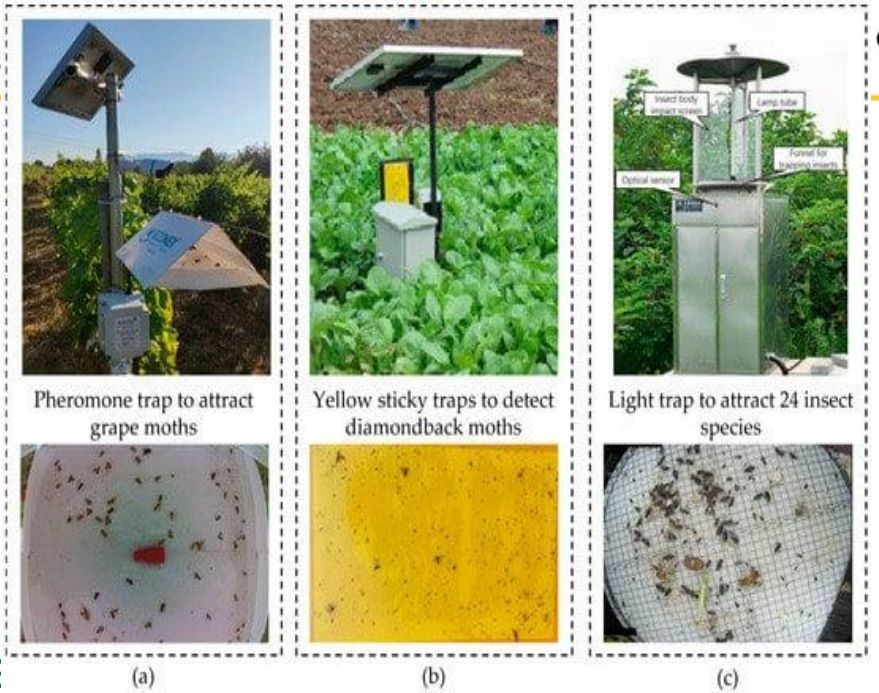
Nodes

LoRaWAN (Long Range Wide Area network)

Air temperature
Relative humidity
Soil moisture
Rainfall
Wind speed
Wind direction
CO_2 emissions
Liquid level in tanks
Machinery locations
Stored grain conditions
Building security
Livestock locations







Prof. Drashti Garadharia
NFSU,Gandhinagar

Prof. Drashti Garadharia
NFSU,Gandhinagar

AI in Agriculture and Irrigation

- **Importance of Agriculture**: Agriculture plays a crucial role in the economy, and with the growing population, the demand for food and jobs increases, leading to the need for more efficient farming practices.
- **AI Revolution in Agriculture**: Traditional farming practices are being revolutionized with the introduction of AI-based automated techniques, which help improve agricultural yields and mitigate challenges such as labor shortages, climate change, and food security.
- **Smart Agriculture Applications**: Researchers have explored AI-based applications in smart agriculture, combining digital technologies like robotics, IoT, Big Data, AI, and Blockchain to develop sustainable agricultural systems.
- **Smart Irrigation Systems**: AI-based smart irrigation systems have been developed to optimize water consumption in agriculture. These systems use technologies like fuzzy logic, neural networks, and IoT to automate irrigation processes and improve efficiency.
- **Sensor-Based AI Techniques**: Sensors and AI algorithms are being used in smart agriculture for various purposes, including assessing agricultural land suitability, monitoring plant growth dynamics, and deploying agrobots for planting seeds.

Prof. Drashti Garadharia
NFSU,Gandhinagar

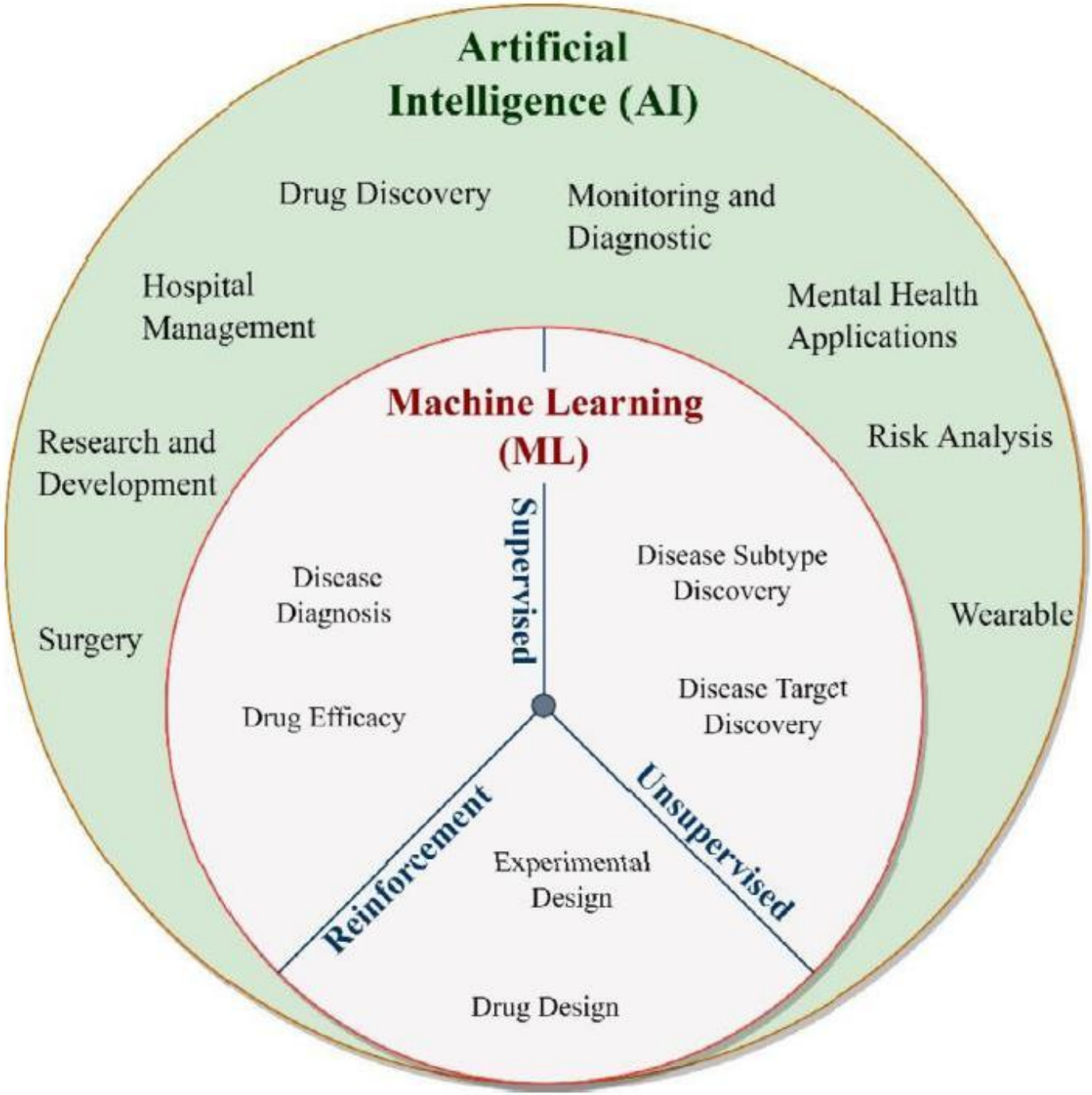
AI in Smart Health

- **Smart Healthcare in Smart Cities**: Smart healthcare is a subset of e-health, integrating medical resources with AI-integrated solutions. AI has been instrumental in improving healthcare systems by providing innovative solutions.
- **AI in Healthcare Systems**: Researchers have developed AI-based models to predict, detect, and diagnose various diseases and infections. These models use techniques like machine learning, deep learning, and IoT convergence to improve healthcare outcomes.
- **Disease Detection and Diagnosis**: AI has been used for disease detection and diagnosis, such as diabetes and heart-related diseases. Models like CSO-LSTM and CNN are used to analyse medical imagery and make accurate predictions.
- **Patient Health Monitoring**: AI is used for patient health status prediction, particularly for chronic diseases like diabetes. LSTM neural networks and Decision Support Systems (DSSs) are used for homecare assistance and de-hospitalization procedures.

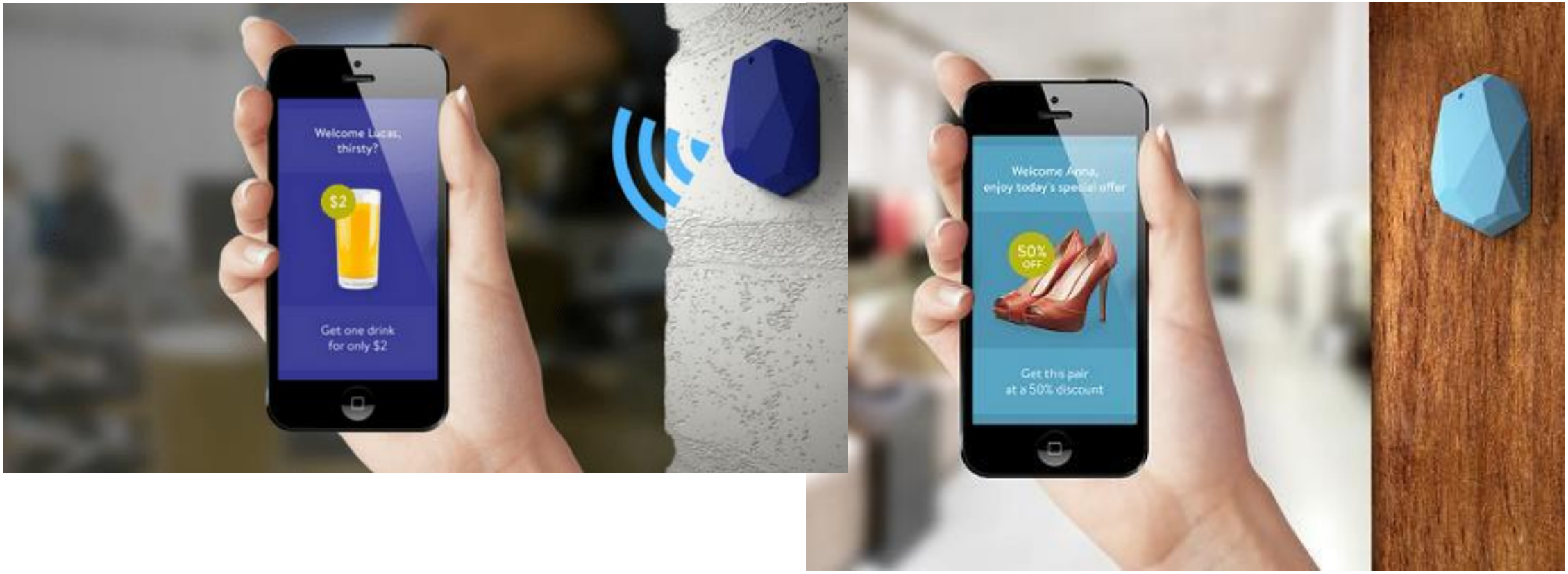
AI in Smart Health

- **Telemedicine and Remote Healthcare**: Machine learning-based telemedicine services help hospitals and medical institutions track and discharge patients more efficiently, especially during pandemics. AI chatbots are used for frequently asked queries in hospitals, improving patient engagement and support.
- **AI in Immunology and Drug Discovery**: AI plays a significant role in immunology and drug discovery, offering new possibilities for pharmaceutical research and development operations.
- **Community Health Systems**: AI provides precise information about the population's health status in remote areas, enabling better healthcare planning and support. Social media and imagery data are used to develop systems for healthcare support and improved public health.
- **Challenges and Future Directions**: Despite the advancements, challenges such as reliability, network latency, and bandwidth need to be addressed to fully realize the potential of AI in healthcare. Future directions include further integration of AI with IoT and edge computing to create responsive, reliable, and low-latency healthcare systems.

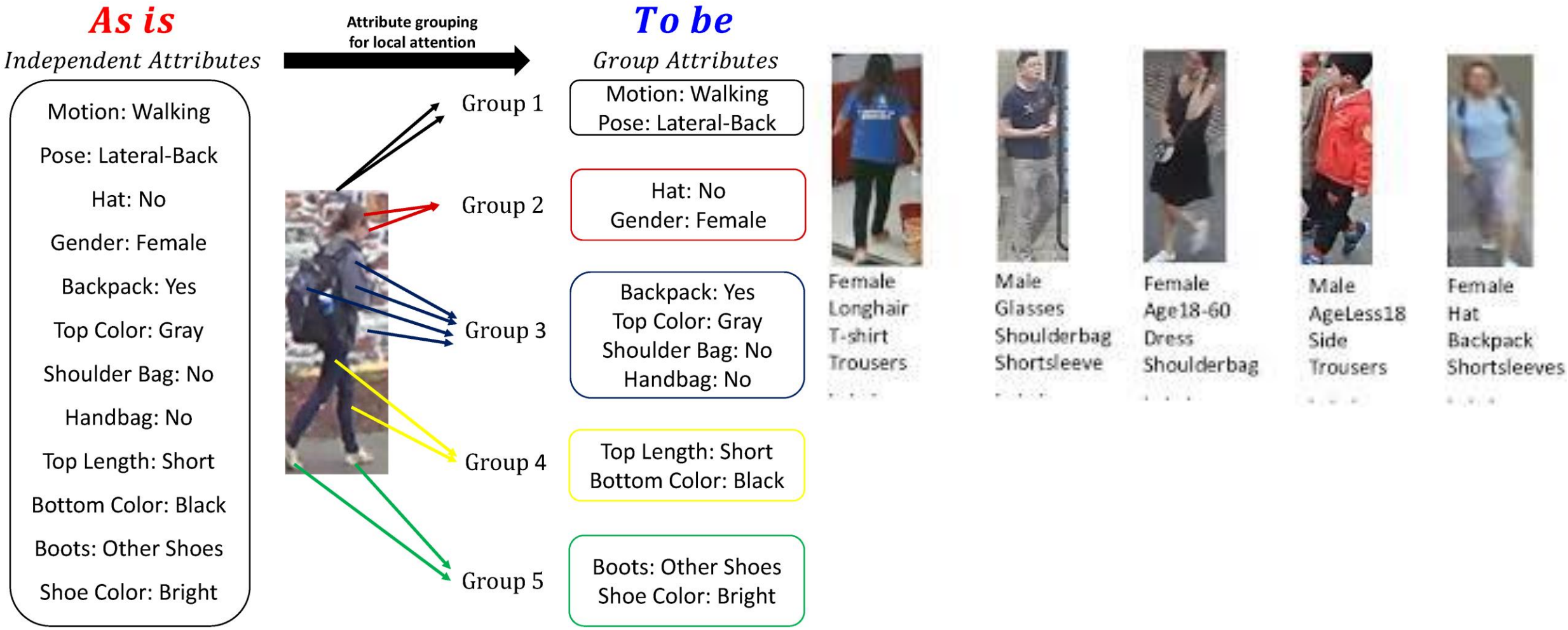
Prof. Drashti Garadharia
NFSU,Gandhinagar


Artificial Intelligence (AI)
Drug Discovery
Monitoring and Diagnostic
Hospital Management
Mental Health Applications
Machine Learning (ML)
Research and Development
Risk Analysis
Supervised
Disease Diagnosis
Disease Subtype Discovery
Surgery
Wearable
Drug Efficacy
Disease Target Discovery
Reinforcement
Unsupervised
Experimental Design
Drug Design

Beacon Technology



PAR - Pedestrian attribute recognition (PAR)



AI adoption for security, rescue and hazards

1. **Crime Prediction and Detection**: AI-based systems are used to predict and detect crime, violence, and other security incidents in smart cities. Techniques like deep reinforcement learning (DRL), artificial neural networks (ANN), and machine learning (ML) are employed for accurate recognition and investigation of illegal behavior.
2. **Cyber Security**: AI-based solutions for cyber security in smart cities are essential for protecting against cyber assaults. Methods such as Black Networks, machine learning-based intrusion detection systems, and deep learning (DL) are used to secure IoT-enabled smart cities.
3. **Environmental Hazard Detection**: AI is used for early detection of environmental threats like fire hazards. Big Data analysis, fuzzy inference, and DL techniques are used to compute potential fire risks and provide early warnings for disasters like wildfires and cold/heat waves.
4. **Safety Precaution Procedures**: AI is employed for safety precaution procedures in smart cities. Methods like deep learning, IoT data analysis, and DL are used for early detection of hazards, disasters, and environmental causes, aiding decision-makers in making quicker and more accurate judgments.
5. **Application in Other Areas**: AI is also used for other applications such as beach attendance forecasting, live spoofing detection in human activity identification systems, and pedestrian semantic attributes detection in smart surveillance. These applications enhance security, rescue, health, and environmental aid services in smart cities

Prof. Drashti Garadharia
NFSU,Gandhinagar

AI adoption for environment and waste management

1. **Trash Generation and Management**: The increase in urbanization and population growth has led to a rise in municipal solid waste (MSW) generation globally. AI-based applications are being investigated for their role in managing waste and addressing environmental challenges in smart cities.
2. **Environmental Monitoring**: AI is being used for environmental monitoring systems in smart cities. These systems help in monitoring pollution levels and assessing surface water quality, aiding in pollution control efforts.
3. **Waste Management Solutions**: AI is being applied to waste management in smart cities. Techniques like dual image-based CNN ensemble models, Gabor Wavelet Transformation (GWT), and machine learning (ML) models such as Multilayer Perceptron (MLP) and Convolutional Neural Networks (CNN) are used for garbage categorization, solid waste classification, and predicting waste generation.
4. **Predictive Models**: AI is used to develop predictive models for waste generation, which can help in optimizing waste collection and transportation processes. Support Vector Machine (SVM) and hybrid Wavelet Transform-Support Vector Machine (WT-SVM) models are used for solid waste generation forecasting.

Prof. Drashti Garadharia
NFSU,Gandhinagar

AI-Based Crime Prediction and Detection

- Problem Statement: Develop an AI algorithm to predict the occurrence of specific crimes in a smart city based on historical data and real-time inputs.
  - Potential Solution: Utilize machine learning techniques, such as supervised learning with historical crime data, to train a model that can predict the likelihood of future crimes based on various factors, such as time of day, location, and past criminal activity patterns.
- Problem Statement: Improve the accuracy of crime detection in urban areas by integrating AI with surveillance cameras and sensor networks.
  - Potential Solution: Implement computer vision algorithms, such as object detection and behavior analysis, to enhance the capabilities of surveillance systems in identifying suspicious activities or individuals in real-time.

AI-Based Crime Prediction and Detection

- **Cybersecurity for IoT Devices in Smart Cities:**
  - Problem Statement: Enhance the security of IoT devices in smart cities to protect against cyber attacks and unauthorized access.
    - Potential Solution: Develop AI-driven intrusion detection systems that can monitor network traffic and behavior patterns of IoT devices to detect and mitigate potential threats, such as malware or denial-of-service attacks.
  - Problem Statement: Address vulnerabilities in IoT devices through AI-based security measures.
    - Potential Solution: Implement AI algorithms that can automatically update and patch IoT devices to protect against known vulnerabilities, reducing the risk of cyber attacks targeting these devices.

Input: Real-time video feeds from traffic cameras at key intersections in a smart city.

Output: Automated detection and prediction of traffic congestion and accidents to enable efficient traffic management.

Methodology:

- **Object Detection and Tracking:** Utilize computer vision algorithms, such as YOLO (You Only Look Once), to detect and track vehicles and pedestrians in the video feeds.
- **Traffic Flow Analysis:** Analyze the detected objects' movement patterns to determine traffic flow rates and identify congested areas.
- **Congestion Prediction:** Use historical traffic data and current flow rates to predict future congestion at specific intersections.
- **Accident Detection:** Implement algorithms to detect sudden changes in traffic flow or the presence of stopped vehicles, indicating potential accidents.
- **Alert Generation:** Automatically generate alerts to traffic management authorities and emergency services for prompt response to accidents or congested areas.

Potential Solution:

Develop an AI-based system that integrates computer vision, machine learning, and real-time data processing to provide actionable insights for traffic management and surveillance in smart cities. This system would continuously monitor traffic conditions, predict congestion and accidents, and assist in optimizing traffic flow to improve overall urban mobility and safety.