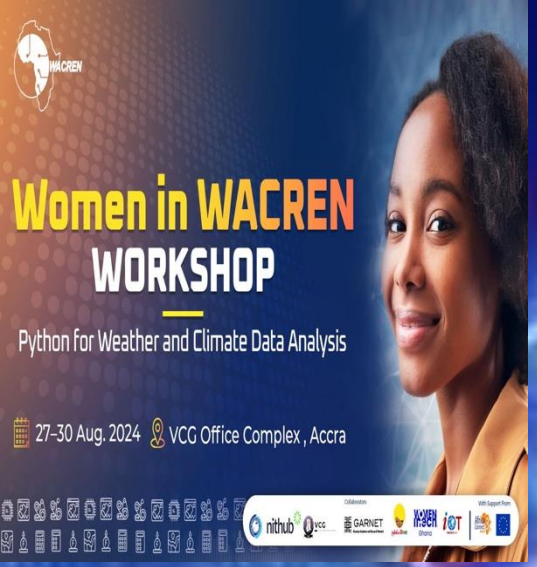
Overview of IoT Technologies:

Concepts and Applications



OUTLINE

Introduction

History and Definition

How it works and Why

Applications

Benefits and Challenges

INTRODUCTION

What is Internet of Things (IoT)? - a giant network of connected things. (Ben, 2003, HIR 2020)

Key Components:

- Sensors and Actuators
- Connectivity (Wi-Fi, Bluetooth, Cellular e.t.c)
- Data processing (Edge or Cloud Computing)
- User Interface (Apps, Dashboards)

A BRIEF HISTORY OF IoT

1969 — ARPANET, the precursor to the internet, is developed.

1982 — Carnegie-Mellon researches connect a vending machine to the Internet so they can remotetly check for cold sodas

1990 — John Romkey demonstrates the first toaster controlled via internet.

1995 — The GPS satellite network (version 1) is completed.

1998 — IPv6 adds 2^128 new IP addresses, whic even

1999 — The term "Internet of Things" is first used by Kevin Ashton of MIT.

2000 — LG announce the first smart fridge. It's cool (literally) but also too expensive to sell well.

2007 — The first Iphone is released.

2008 — The First International IoT conference is held. Also, there are now more online devices than there are humans on earth.

2009 — Google starts testing self-driving cars.

2013 — Google Glass is released. Too soon, apparently, VR and AR are still in early stages.

2014 — Amazon releases the Echo, whic sets off a scramble to enter the smart home hub market.

2016 — GM, Lyft, Uber and Tesla are all testing self-driving cars now. Mirai, the first large-scale IoT attack, also takes place.

2017-2019 — Iot continues to grow as internet penetration. AI, blackchain, edge computing, and cheap devices and sensors proliferate.

2019 — 5G

WHY IoT?

- ✓ Data deluged
- ✓ Decrease in energy required to operate intelligent devices
- ✓ Miniaturization of devices
- ✓ Autonomic management
- ✓ IPv6 as an integration layer

WORKABILITY OF IOT

1. A group of physical devices is wired or wirelessly linked to each other and/or a central area.
2. The devices collect data from the external world using some kind of sensor.
3. That data is stored somewhere (cloud, an intermediary network location, the device itself)
4. The data is processed (machine learning and artificial intelligence)
5. The processed data is used by the physical device to perform some action.
6. The interconnectedness of physical devices allows for the collection and sharing of data from a vast network of devices

ENABLERS OF IOT

Sensors (Temp, Motion, image, gyro, obstacle, IR, RF, Ultrasonic Distance, Gas etc.)

Actuators (Adding lighting, heat, sound, etc. Controlling motors to move objects, Displaying messages etc)

Connectivity technologies:

Cloud computing:

Big data analytics:

Security and privacy technologies:

RFIDs:

Nanotechnology:

Smart networks: (ex: mesh topology).

IOT ARCHITECTURE






APPLICATION LAYER

SMART LIVING | SMART CITIES | SMART ENERGY | SMART TRANSPORT | SMART HEALTH | SMART INDUSTRY | SMART BUILDINGS | SMART HOMES

IOT APPLICATIONS

SERVICE SUPPORT & APPLICATION SUPPORT LAYER

VIRTUAL ENTITY	VIRTUAL ENTITY & IOT SERVICE MANAGMENT	VIRTUAL ENTITY SERVICE	
IOT BUSINESS PROCESS MANAGMENT	BUSINESS PROCESS EXECUTION	BUSINESS PROCESS MODELING	
MANGMENT CAPABILITIES	GENERIC/SPECIFIC MANAGMENT	DEVICE MANAGER	QOS MANAGER
SECURITY	AUTHENTICATION	IDENTITY MANGMT	ACEESS CONTROL	ENCRYPTION
DATA MANGMENT	DATA GOVERNENCE	DATA QUALITY MANGMT	DATA MINING
ANLYTICS PLATFORM	IN MOTION ANALITICS	PREDICTIVE ANALITICS	STATISTICAL ANALITICS

NETWORK / COMMUNICATION LAYER

NETWORKING CAPABILITY | TRANSPORT CAPABILITY

GATEWAY NETWORK: WI-FI | GSM/GPRS | LTE | ETHERNET

GATEWAY: EMEDDED & SIGNALPROSESSOR | OS | SIM MODULE | MICROCONTROLLER

SMART DEVICE / SENSOR LAYER

SENSOR NETWORKS

WI-FI | ZigBee | ETHERNET | BLUETOOTH | UWB | WIRED

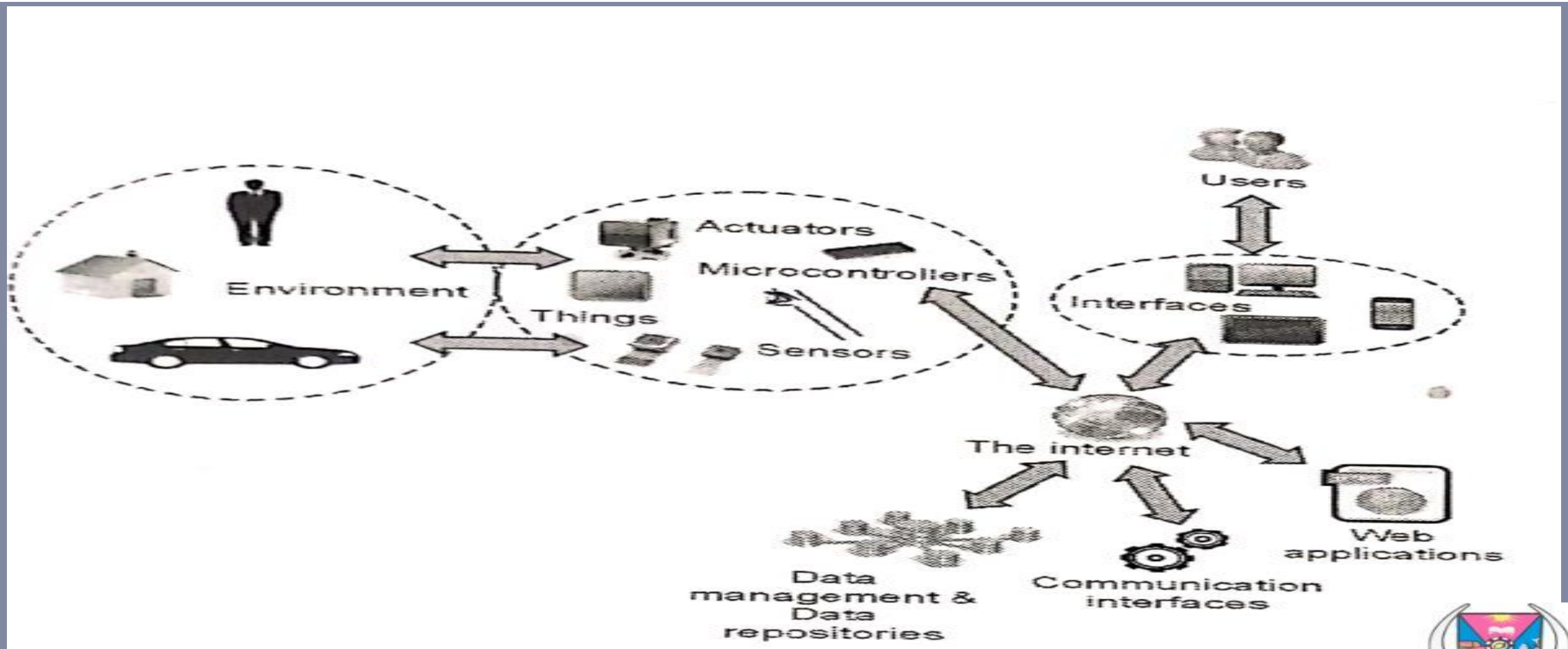
SENSORS: ANALOG | DIGITAL | RFID | ELECTRO-MECH | PHOTO-ELECTRIC

GPS | SOLID STATE | INFRA-RED | GYROSCOPE | ELECTRO-CHEMIC

WSN

devices

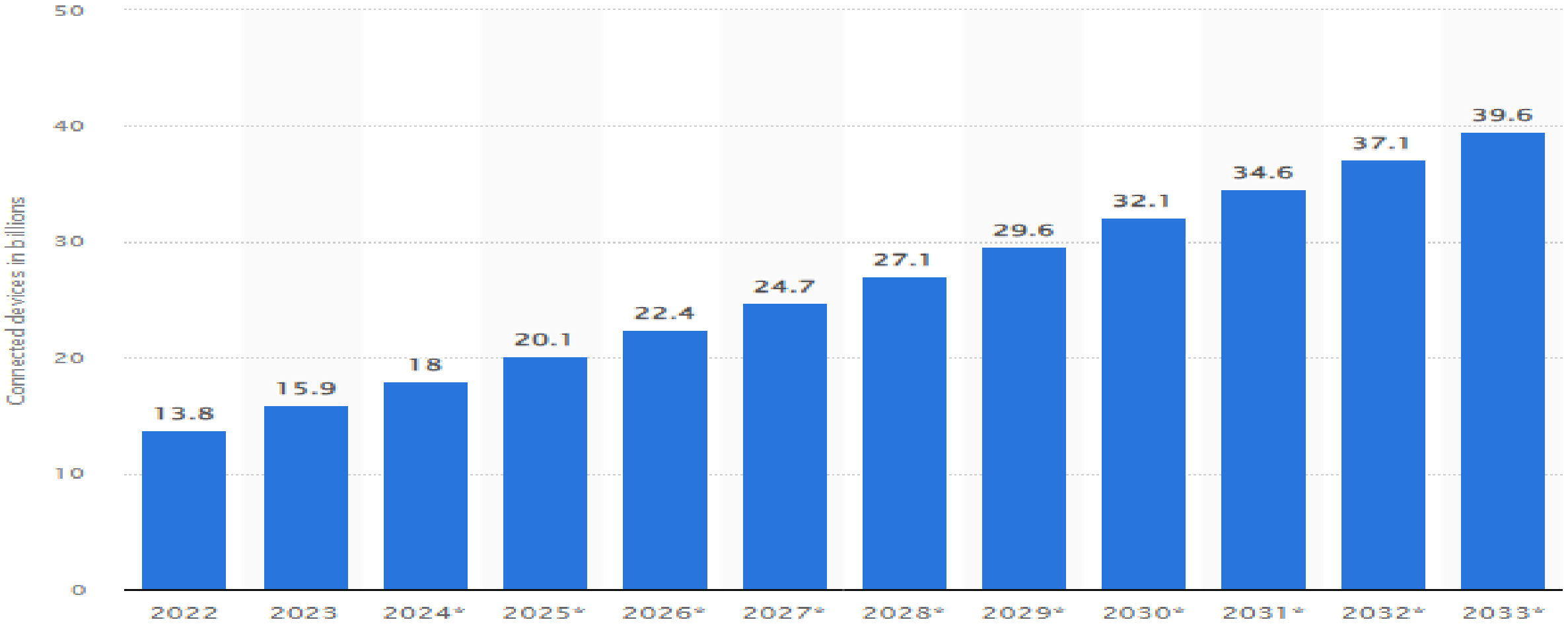
WORKINGS WITH IoT



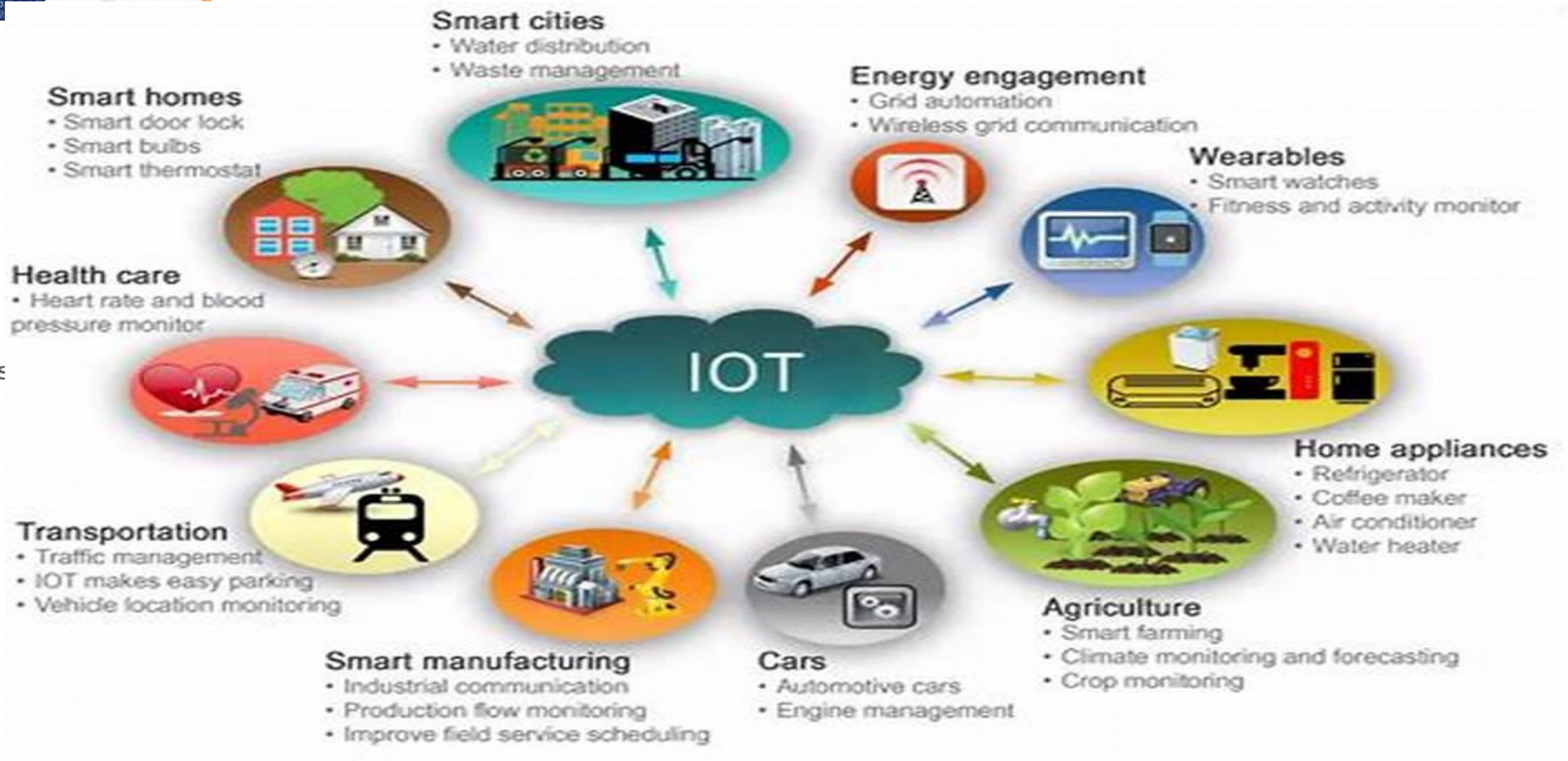
CHARACTERISTICS OF IoT

Interconnectivity.	Heterogeneity	Dynamic in Nature
Self-adapting and self configuring technology	Intelligence	Scalability
Identity	Safety	Architecture

IOT GROWTH CHART



APPLICATION DOMAINS



IoT VS EMBEDDED SYSTEM

Embedded systems refer to the combination of hardware and software designed to perform specific tasks within a larger system.

On the other hand, IoT refers to the network of interconnected devices that communicate and share data with each other.

KEY DIFFERENCES

1. Scope and Connectivity
2. Data Processing and Analysis
3. Flexibility and Expandability
4. User Interaction and Interface
5. Network Requirements

ADVANTAGES OF IoT

Data-driven Decision Making

Automation and Efficiency

Enhanced User Experience

Scalability and Customization

IoT APPLICATION TO WEATHER FORECAST

- ✓ Traditional weather reporting methods suffer from delays in data collection and transfer. IoT, in turn, gathers data from sensors in real time.
- ✓ IoT predict the weather accurately and quickly for different geographic locations.
- ✓ IoT-based weather monitoring systems seamlessly integrate data from a multitude of sources.
- ✓ IoT brings precision to weather insights.

SECTORS THAT BENEFITS FROM IoT-BASED WEATHER FORECAST SYSTEM

1. Manufacturing
2. Aviation
3. Agriculture
4. Automotive
5. Warehouse Management
6. Laboratories

BENEFITS OF IoT FOR WEATHER FORECAST

- Real-time data collection.
- Higher accuracy.
- Wider coverage.
- Predictive analytics.
- Reduced response time.
- Cost-effectiveness.
- Increased safety.

CHALLENGES

- ✓ Security and Privacy
- ✓ Interoperability.
- ✓ Data Management and Analytics
- ✓ Reliability and Availability

FUTURE OF IoT AND WEATHER FORECASTING

- Integration with AI and Machine Learning:
  - Advanced AI models can analyze IoT data for even more accurate predictions.
  - Example: AI-driven models that can predict climate change impacts on a local level.
- Expansion of IoT Networks:
  - Broader deployment of IoT devices across urban and rural areas.
  - Example: Nationwide IoT networks for comprehensive weather monitoring

FUTURE OF IoT AND WEATHER FORECASTING

- Enhanced Predictive Capabilities:
  - Combining IoT data with historical weather patterns for improved long-term forecasts.
  - Example: Predictive models that forecast seasonal weather trends.
- Collaboration across sectors
  - Partnership between governments, private companies, and research institutions to expand IoT weather forecasting capabilities.
  - Example: Public-private partnership to deploy IoT weather stations in disaster prone areas

REFERENCES

Ben Lutkevich (2003) IoT basics and fundamentals: A guide for beginners

HIR 2020 version (eps.ieee.org/hir)

Lionel Sujay Valheri (2024) IoT connections worldwide 2022-2033 | Statista

Martijn Koot, Martijn R.K. Mes, Maria E. Iacob, (2021), A systematic literature review of supply chain decision making supported by the Internet of Things and Big Data Analytics, Computers & Industrial Engineering, Volume 154,2021, 107076, ISSN 0360-8352, https://doi.org/10.1016/j.cie.2020.107076.

THANK YOU

Alowolodu Olufunso Dayo

odalowolodu@futa.edu.ng

https://sites.google.com/view/alowolodu-od