Introduction to Internet Of Things (IoT)

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History

- Kevin Ashton is an innovator and consumer sensor expert who coined the phrase “the **Internet of Things**” to describe the network connecting objects in the physical world to the Internet.

- The world's **first IoT** device was invented in the **early** 1980s at the Carnegie Melon University. A group of students from the university created a way to get their campus Coca-Cola vending machine to report on its contents through a network in order to save them the trek if the machine was out of Coke

History

- The need to integrate data is urgent and non-trivial, says the **Father of IoT**. Kevin Ashton has been an executive director and visiting engineer at Massachusetts Institute of Technology (MIT) where he led work on the next generation of computing.
- First IOT device used in public –
- John Romkey creates the **first** smart toaster that could be controlled from the internet. He showcased his invention at the INTEROP conference.

What is The Internet of Things ?

The term has recently been added to the Oxford dictionary and is defined as:-

The interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.

Wiki - The internet of things (IoT) is the network of physical devices, vehicles, buildings and other items—embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data.

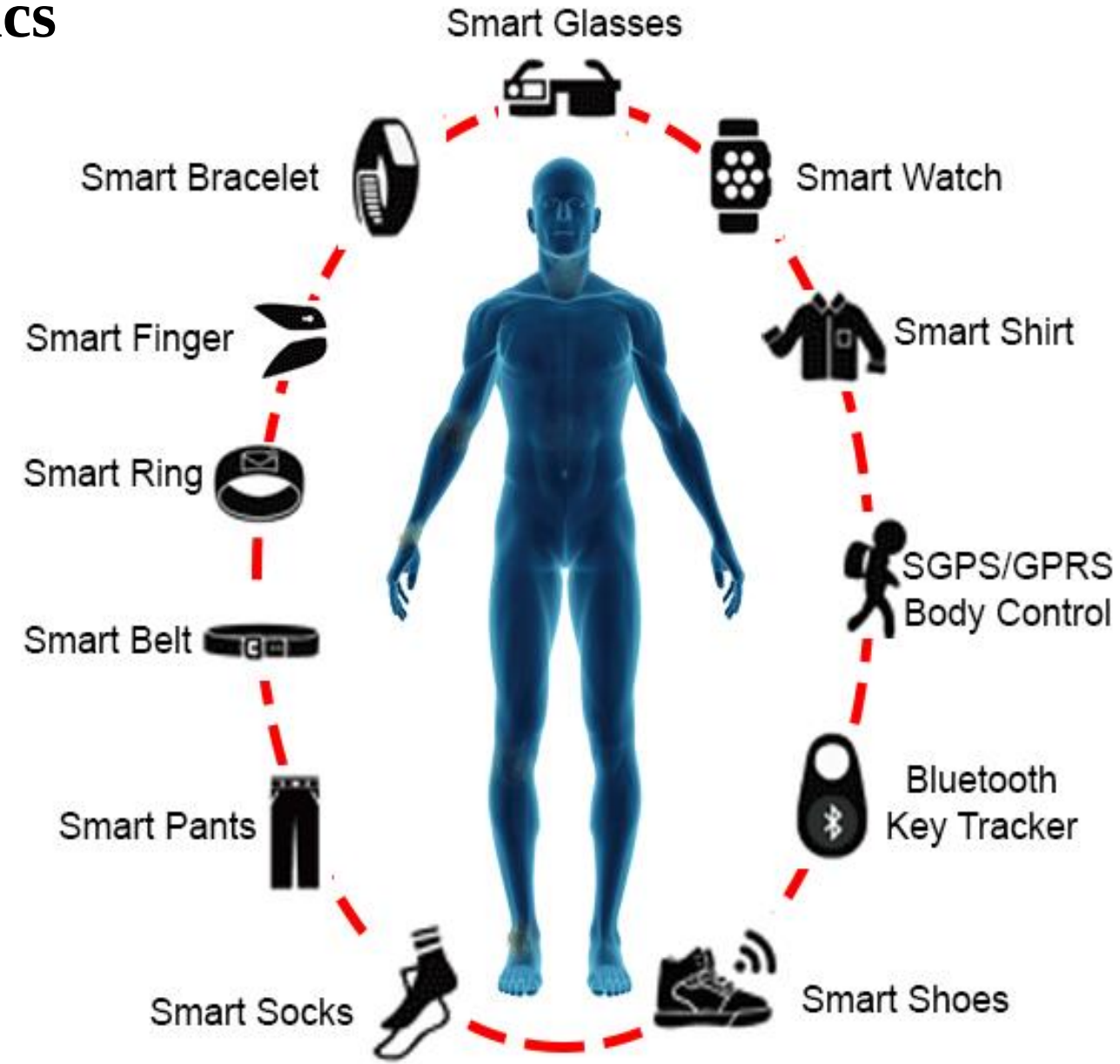
The IOT will affect many areas of day to day life. Some of the main sectors are:

Industry/Area	**Use**
Home	Control of heating,lights,door locks etc
Health medical	Patient Monitoring etc
Fitness and wellness	Tacking heart rate and Training plans
Factory and Industry	Production line control ,asset tracking etc
Agriculture	Automatic watering, soil monitoring etc
Cars and Roads	Connected cars, parking spaces,
Smart Cities	Traffic management, parking space tracking and availability

Wearable Electronics

- Wearable electronic devices are small devices worn on the head, neck, arms, torso, and feet.
- *Smartwatches not only help us stay connected, but as a part of an IoT system, they allow access needed for improved productivity.*
- current smart wearable devices include −
  - **Head** − Helmets, glasses
  - **Neck** − Jewellery, collars
  - **Arm** − Watches, wristbands, rings
  - **Torso** − Clothing, backpacks
  - **Feet** − Socks, shoes

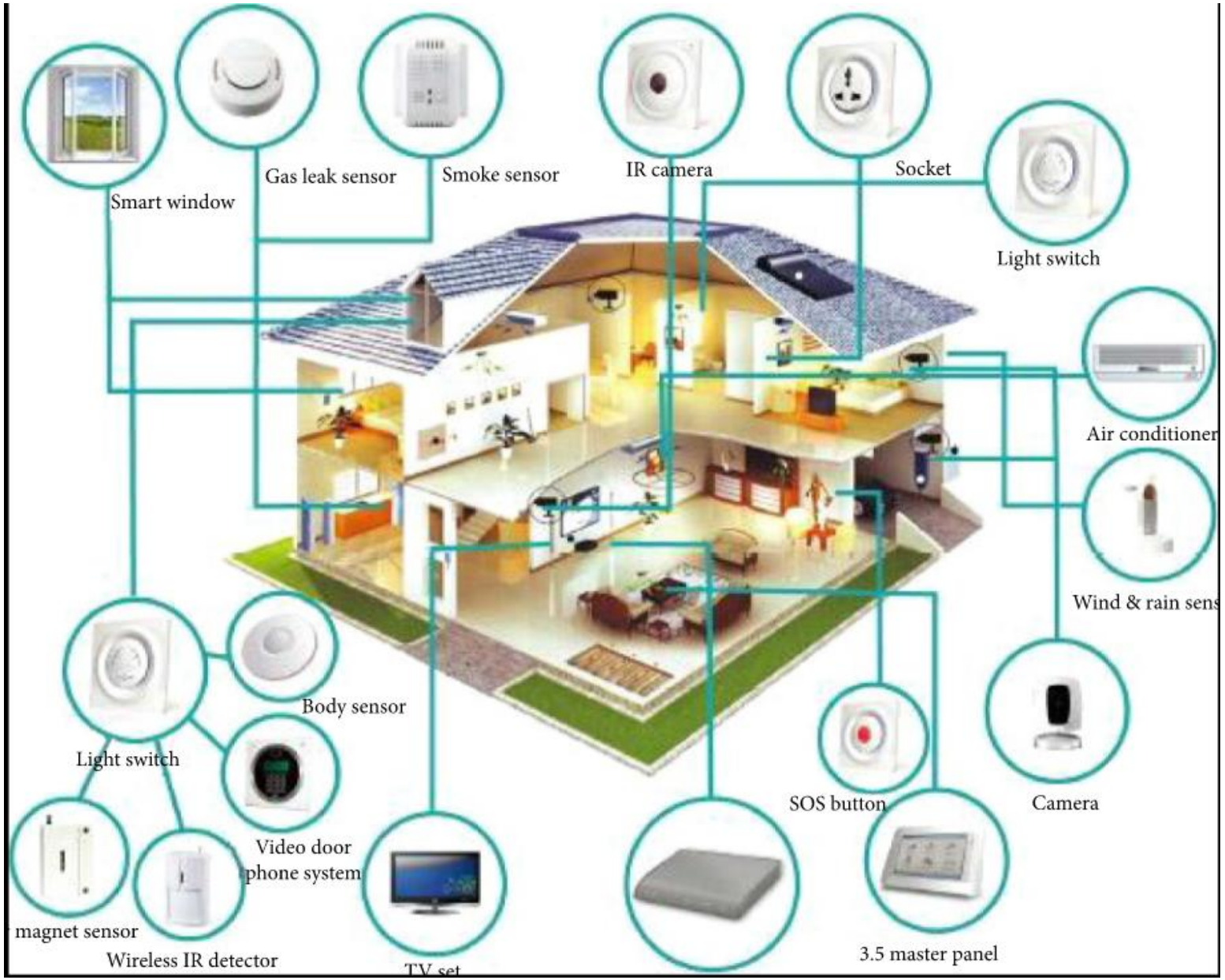
Wearable Electronics



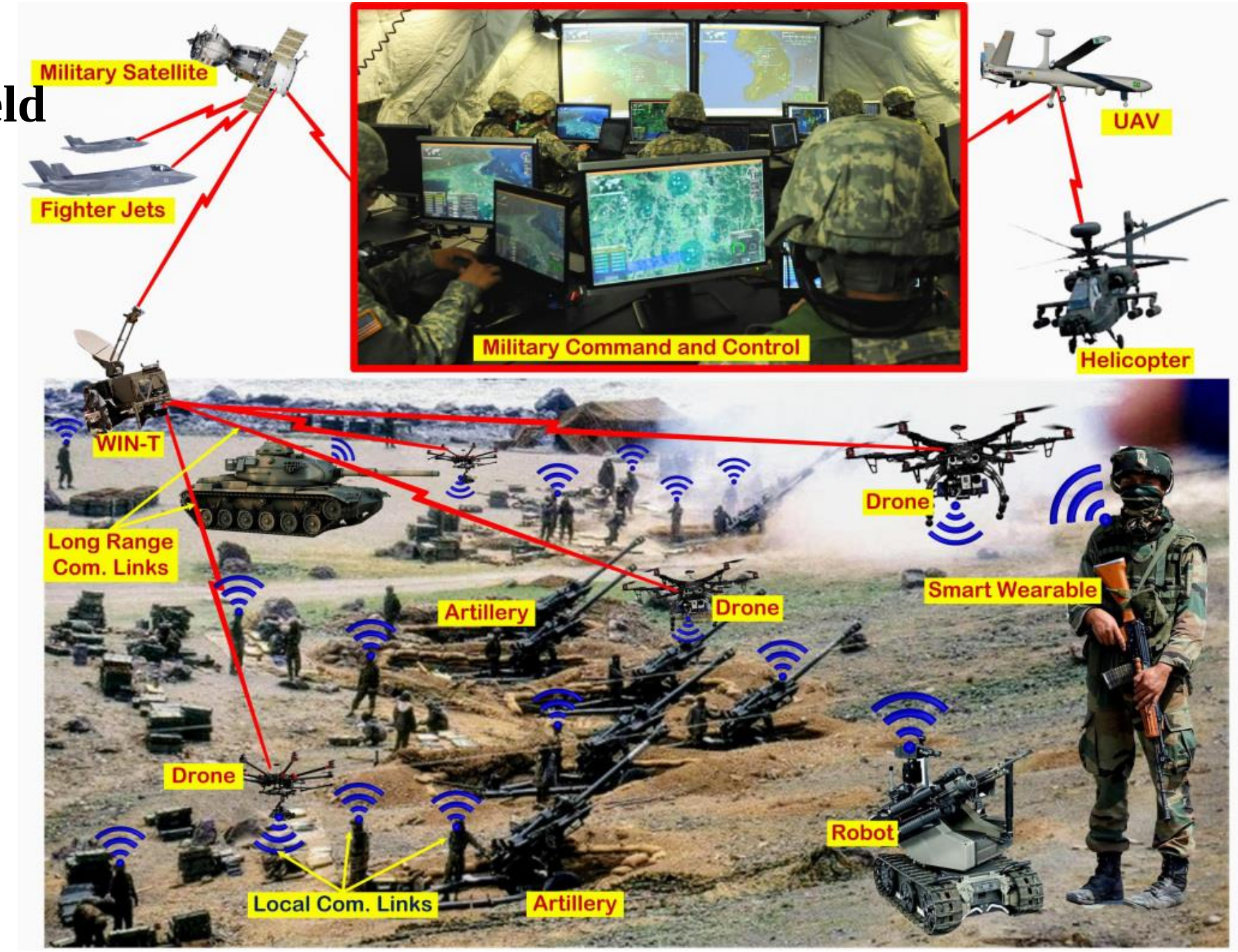
Applications of IoT


Today, IoT has many use cases in Agriculture
The Smart Agriculture market is expected to reach $18.45 Billion in 2022, at a CAGR of 13.8%
- Business Intelligence
DRONES
Health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis
Precision Farming
With IoT, all data from different sensors is accessible to the agriculturist on their mobile phones
Soil Management
Analyze soil status, temperature and humidity
Livestock Management
Monitor livestock productivity and health
Water Management with Automated Irrigation

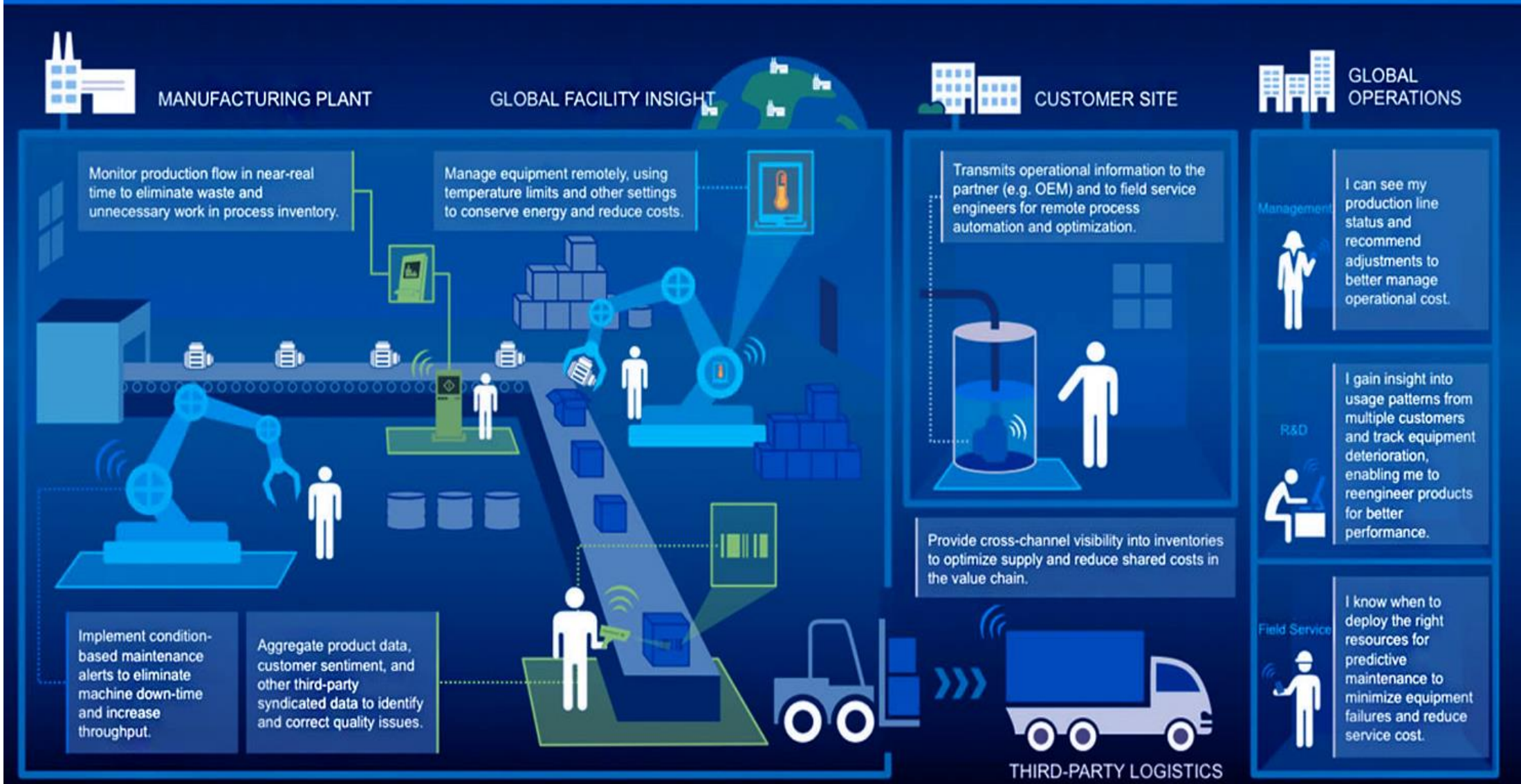
IoT in Home Automation



IoT in Battlefield



Internet of Things in Manufacturing



IOT Development Phases

The growth of the IOT is expected to go through several stages of development.

- Passive – RFID sensors etc –
- Active- Responds to sensor data
- Aware- can make choices based on data.
- Autonomous -e.g. self driving cars

IOT Components

An IOT system comprises three basic Components.

1. The Things -sensors actuators etc
2. The Network and protocols
3. The Platforms, Apps and services

1. The Things – Sensors and Devices

In contrast to computers and tablets which are the main devices currently connected to the Internet.

Internet of things devices will mainly be:

- Low Power- Power usage and computational Power.
- Low cost
- Wireless

Examples are Simple sensors – temperature, pressure etc

To turn an everyday object like a house or a car into a smart house or car or a **“thing”** will require that the object has:

- A unique address – IPv6 address
- A way to connect to a network – Wireless

2. IOT Networks And Protocols

- The Internet of things will utilize the existing networking infrastructure, technologies and protocols currently used in homes/offices and on the Internet, and will introduce many more.

- Protocols are designed to operate at a particular level in the networking stack.

- TCP/IP uses a 4 level model and we will discuss IOT networking using this model.

- However because of the requirement for low powered end devices there will be major developments in the Wireless connectivity protocols.

- Wi-Fi and Bluetooth are being actively developed for low powered applications and there are new connection technologies like LPWAN, ZigBee, 6LoWpan and Thread.

- At the networking level IPv6 is set to become the standard, but in the intermediate time frame IPv4 will also be used. See IPV6 Basics and IPv4 addressing basics

- At the application level there are a host of new protocols. Some have been available for a long time like ,HTTP and MQTT, whereas others have been developed especially for the IOT e.g. COAP.

- On this site I concentrate on MQTT but you should be aware of the other IOT protocols.

3. IOT Platforms, Apps and Services

An IOT platform combines several IOT functions in one.

It can collect and distribute data, convert data between protocols, store and analyse data.

They are available as **cloud based** and standalone platforms and are available from many companies both large and small.

Examples

- Amazon Web services (AWS)
- IBM Watson Bluemix
- Microsoft Azure
- ThingWrox

IOT and The Cloud

- The cloud will have an important role to play in the IOT as it will enable companies to create networks, store data, automate processes without having to build the infrastructure themselves.

- This will enable IOT services to be developed much quicker, and at lower cost than using traditional in house systems and services.

Common IOT Terms

- **M2M** – Machine to machine
- **P2P** – Person to Person
- **P2M** – Person to Machine
- **IIOT**– Industrial Internet of Things
- **HIOT**– Home Internet of Things
- **CIOT**– Consumer Internet of Things
- **Big Data** – Very large data sets that can be analyzed to reveal insights and trends
- **RFID**– Radio Frequency Identification
- **NFC**– Near field communication

INTRODUCTION TO IOT

- IoT (Internet of Things) is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system.

- IoT systems have applications across industries through their unique flexibility and ability to be suitable in any environment. They enhance data collection, automation, operations, and much more through smart devices and powerful enabling technology.

OVERVIEW

- IoT systems allow users to achieve deeper automation, analysis, and integration within a system. They improve the reach of these areas and their accuracy. IoT utilizes existing and emerging technology for sensing, networking, and robotics.
- IoT exploits recent advances in software, falling hardware prices, and modern attitudes towards technology. Its new and advanced elements bring major changes in the delivery of products, goods, and services; and the social, economic, and political impact of those changes.

Key Features

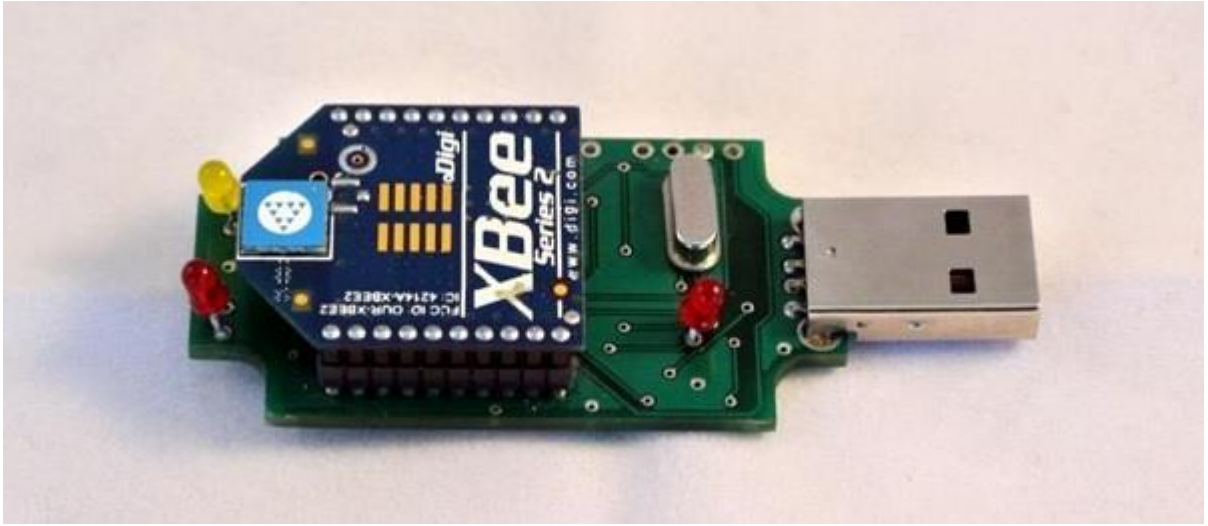
- **Sensors** − IoT loses its distinction without sensors. They act as defining instruments which transform IoT from a standard passive network of devices into an active system capable of real-world integration.
- **Active Engagement** − Much of today's interaction with connected technology happens through passive engagement. IoT introduces a new paradigm for active content, product, or service engagement.
- **Small Devices** − Devices, as predicted, have become smaller, cheaper, and more powerful over time. IoT exploits purpose-built small devices to deliver its precision, scalability, and versatility.

IOT HARDWARE

- The hardware utilized in IoT systems includes devices for a remote dashboard, devices for control, servers, a routing or bridge device, and sensors.
- These devices manage key tasks and functions such as system activation, action specifications, security, communication, and detection to support-specific goals and actions.

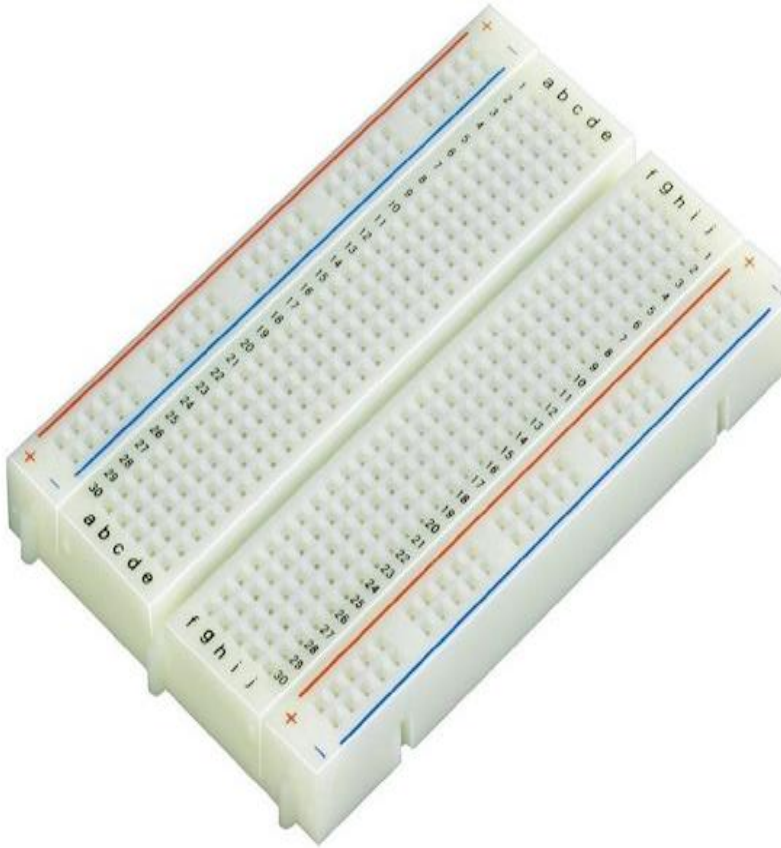
IoT – Sensors

- The most important hardware in IoT might be its sensors. These devices consist of energy modules, power management modules, RF modules, and sensing modules. RF modules manage communications through their signal processing, WiFi, ZigBee, Bluetooth, radio transceiver, duplexer, and BAW.



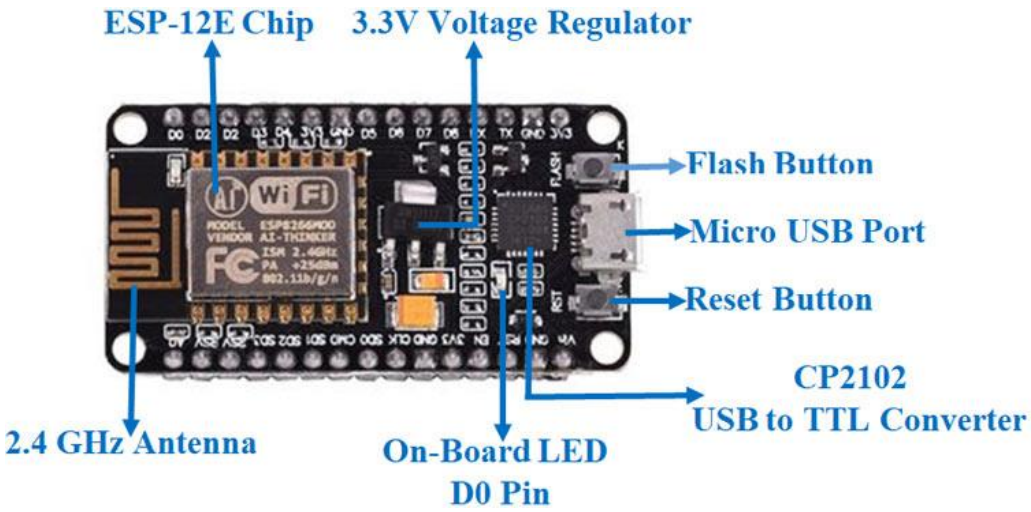
Breadboard

- The **purpose** of the **breadboard** is to make quick electrical connections between components- like resistors, LEDs, capacitors, etc- so that you can test your circuit before permanently soldering it together.
- Breadboards have many small sockets on them, and some groups of sockets are electrically connected to each other.
- Because the solderless **breadboard** does not require soldering, it is reusable.
- This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education.



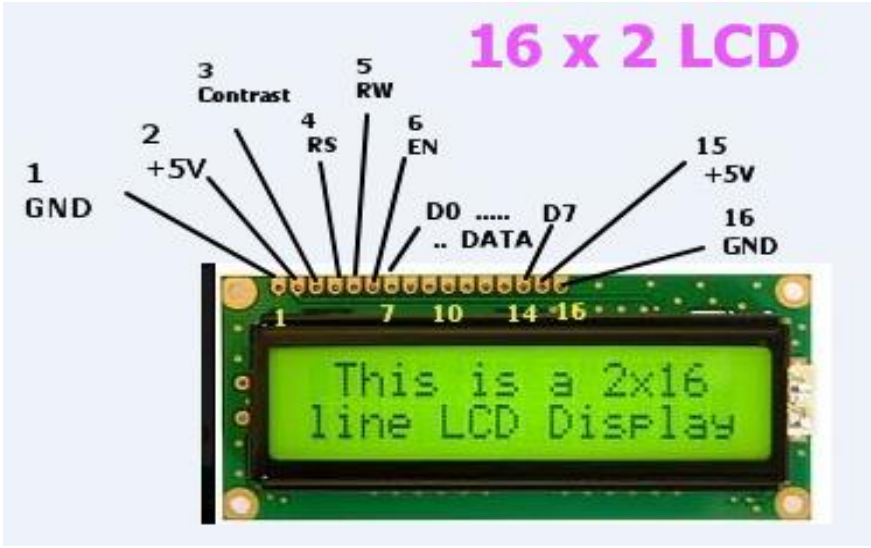
NodeMCU Controller

- The **NodeMCU ESP8266 development board** comes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor.
- This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency.
- NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs.
- Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.
- NodeMCU can be powered using Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.



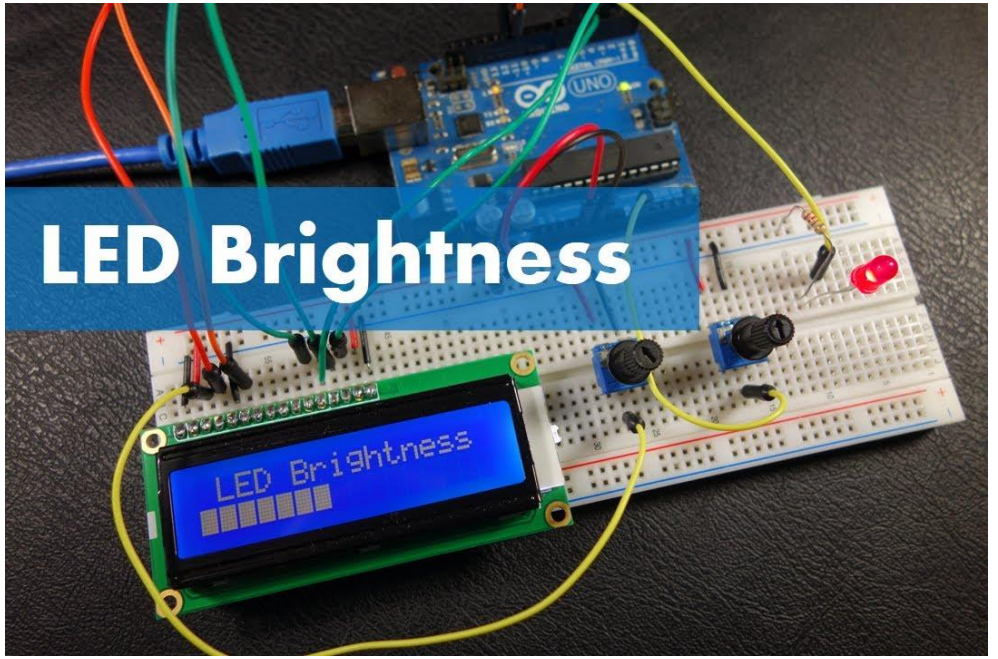
2X16 LCD Display

- Pins 1& 16 are GND pins.
- 2nd & 15th pins are power supply pins.15th pin is supply pin for Back light.
- 3rd pin is Contrast pin.This is connected to center pin of a 10k potentiometer to vary the contrast.
- 4th pin is **RS.(Register Select**). LCDs have 2 Registers,a Data Register & a Command Register.
- Data Register holds what goes on to the LCD screen.The Command Register holds the Instructions & the LCDs controller looks here for what to do next. **RS = 1 means Data Input.**
- The 5th pin is **RW –Read/Write** pin.A Low on this pin means Write mode & High to this pin means read mode. As we use the LCD to display message (WRITE mode),generally 5th pin is connected to GND .i.e.. made Low. **RW = 0 means LCD in Write mode**
- The 6th pin is Enable pin, which enables writing to Registers.The EN pin is used to tell the LCD when data is ready for reading.
- The three control lines that control the LCD are **EN**, **RS**, and **RW**.
- The **EN** "Enable" control line is used to tell the LCD that you are sending in data.



2X16 LED Display

- The simplest and inexpensive way to display information is with an LCD (liquid crystal display). These are found in everyday electronics devices such as vending machines, calculators, parking meters, printers, and so on, and are ideal for displaying text or small icons. The figure below shows a 16×2 LCD front and the back view.
- This LCD has 2 rows, and each row can display 16 characters. It also has LED backlight to adjust the contrast between the characters and the background.
- When you buy a 16×2 LCD, usually it doesn't come with breadboard friendly pins. So, you may need some headers.

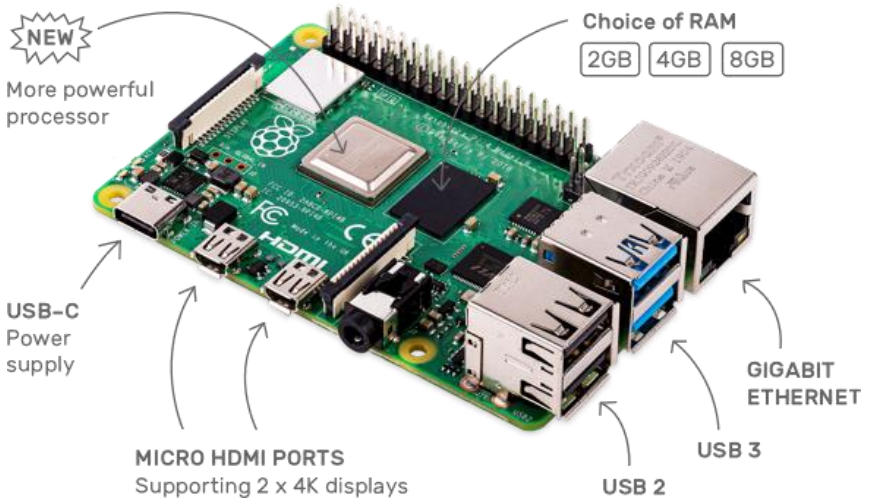


Arduino uno R3

- The Arduino Uno R3 Compatible Board is a microcontroller board which is based on the ATmega328. Arduino Uno has 14 digital input or output pins(where 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It has everything needed to support the microcontroller, you need to simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.
- **Features:**
- Easy application programming using open source IDE
- Easy to learn Microcontroller using Arduino boards.
- 256k Flash
- Easy application programming using open source IDE
- Ready Library for most of the sensors and application modules.

Raspberry Pi

- The speed and performance of the new Raspberry Pi 4 is a step up from earlier models.
- Silent, energy-efficient - the fanless, energy-efficient Raspberry Pi runs silently and uses far less power than other computers.
- Fast networking - Raspberry Pi 4 comes with Gigabit Ethernet, along with onboard wireless networking and Bluetooth.
- USB 3 - Your new Raspberry Pi 4 has upgraded USB capacity: along with two USB 2 ports you'll find two USB 3 ports, which can transfer data up to ten times faster.
- Your choice of RAM - We're making different variants of the Raspberry Pi 4 available, depending on how much RAM you need — 2GB, 4GB, or 8GB.



Temperature Sensor

- LM35 Temperature Sensor The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius or Centigrade temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in Kelvin.

Water Level Indicator

- **Water level indicator** definition: A **water level indicator** is a system that relays information back to a control panel to indicate whether a body of **water** has a high or low **water level**. Some **water level indicators** use a combination of probe sensors or float switches to sense **water levels**.

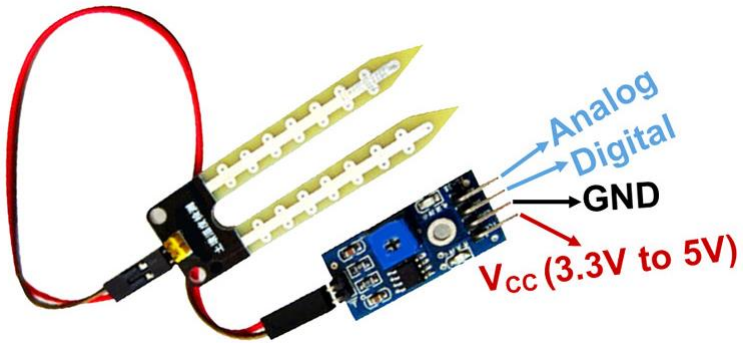
Gas/Smoke Sensor

MQ2 gas **sensor** is an electronic **sensor** used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, **smoke** and carbon monoxide. MQ2 gas **sensor** is also known as chemiresistor.

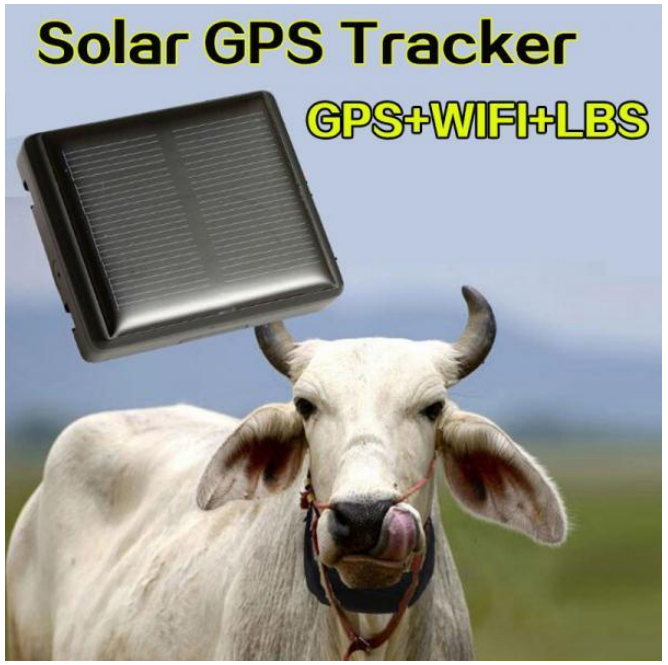
- Analog gas sensor MQ2
- Used in gas leakage like smoke methane and liquefied flammable gas
- Wide detecting scope, fast response and high sensitivity
- Simple drive circuit, stable and long life
- Detecting LPG, i-butane, propane, methane, alcohol, hydrogen and smoke

Soil Sensor

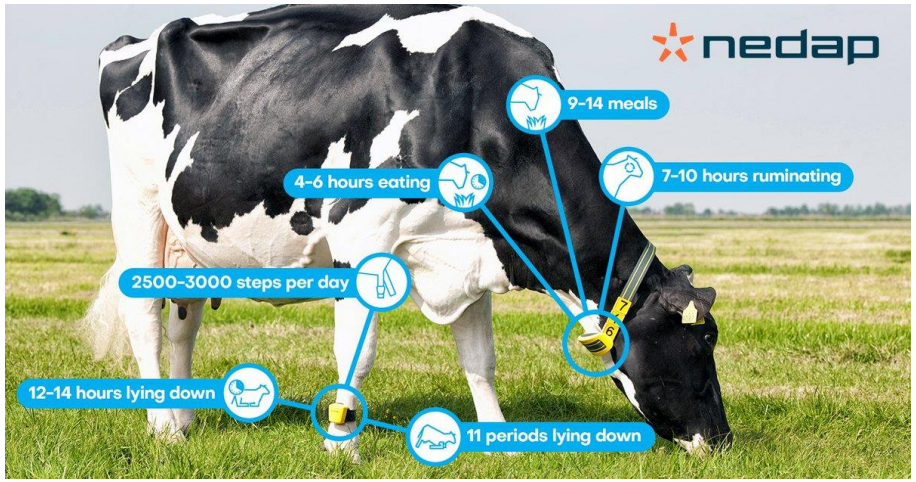
- This **soil moisture sensor module** is used to detect the moisture of the soil. It measures the volumetric content of water inside the soil and gives us the moisture level as output. The module has both digital and analog outputs and a potentiometer to adjust the threshold level.



GPRS/WIFI location



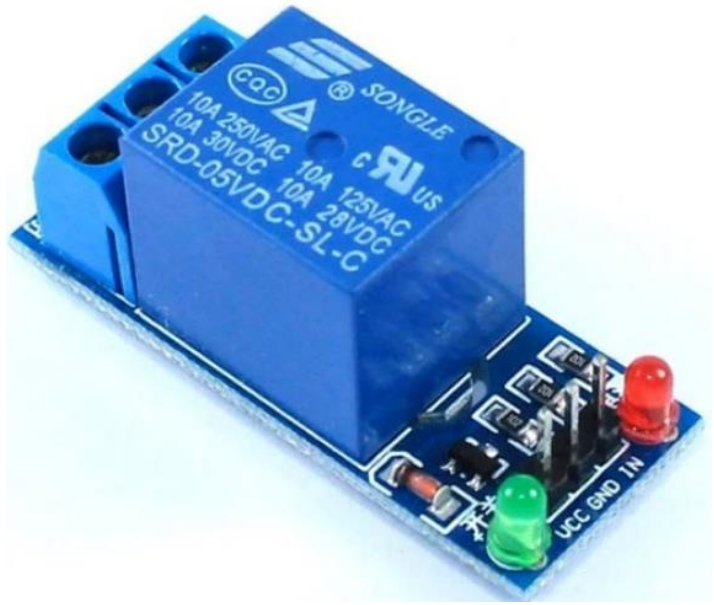
- The implementation of precision agriculture relies on the acquisition of large amounts of spatially distributed data from a remote area. Specifically closed-loop irrigation systems requires the installation of a large group of sensor nodes distributed over a crop area, in order to measure soil moisture and climatic variables.
- Wireless sensor network (WSN) based on Zigbee protocol represents a popular communication solution for precision agriculture applications.
- Due its popularity in the personal mobile communication domain, GPRS (general packet radio service) represents an adequate technology to provide Internet access for a group of devices that comprises a sensor network.




Crop yield Analysis
Spreading
Dianosis of Diseases
Smart Data
water Stress
Soil Erosion
Field Monitoring
Variable rate of Fertility

Relay

- A **Relay** is an electromechanical **device** that can be used to make or break an electrical connection.
- There are many types of **relay** and each **relay** has its own application, a standard, and generally used **relay** is made up of electromagnets which in general used as a switch.



Jumper wire

- A **jump wire** (also known as jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.
- Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

THANK YOU..!!