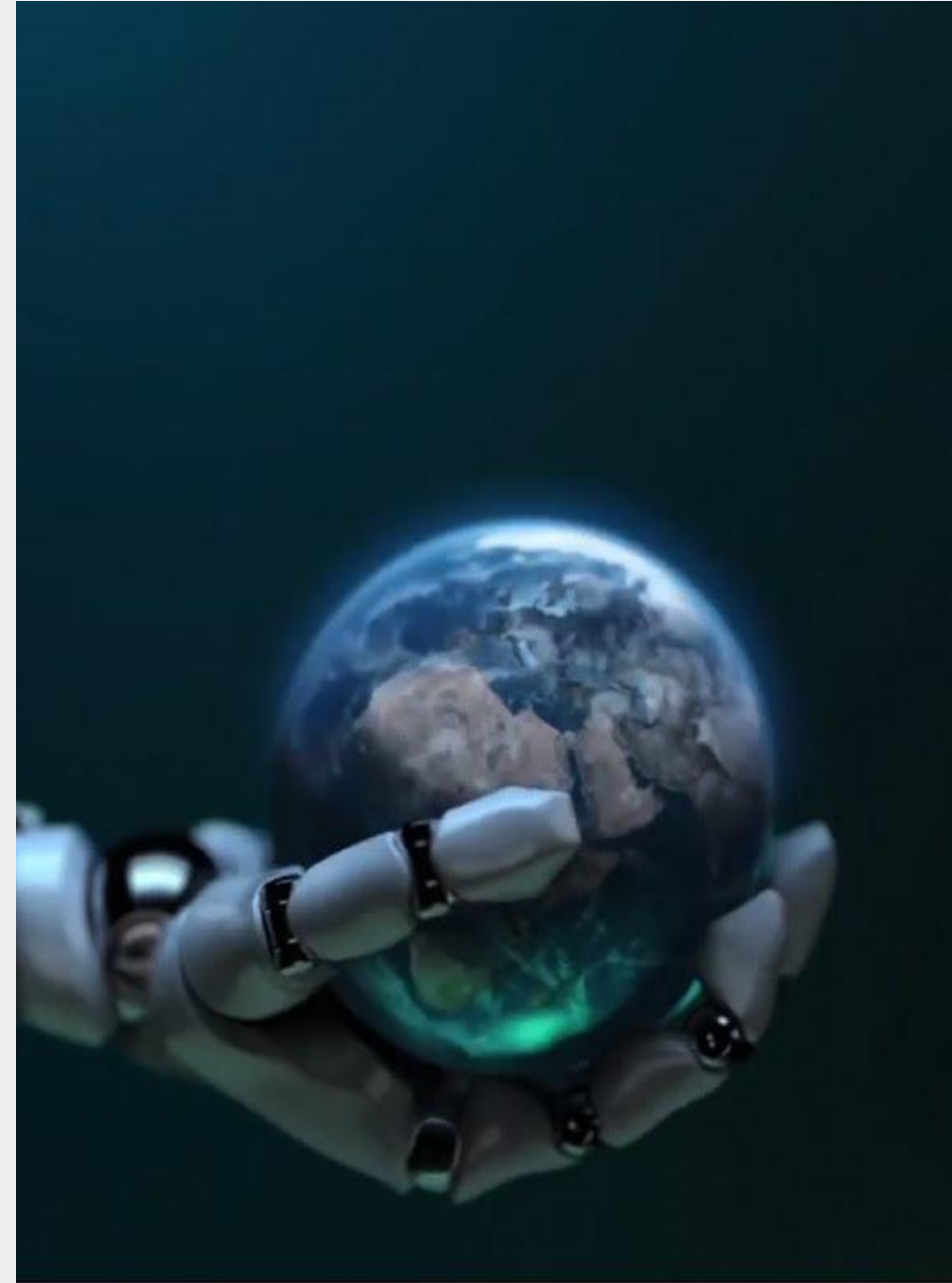


Machine Vision & Self-driving Cars

CSE 463: Computer Vision: Fundamentals & Applications

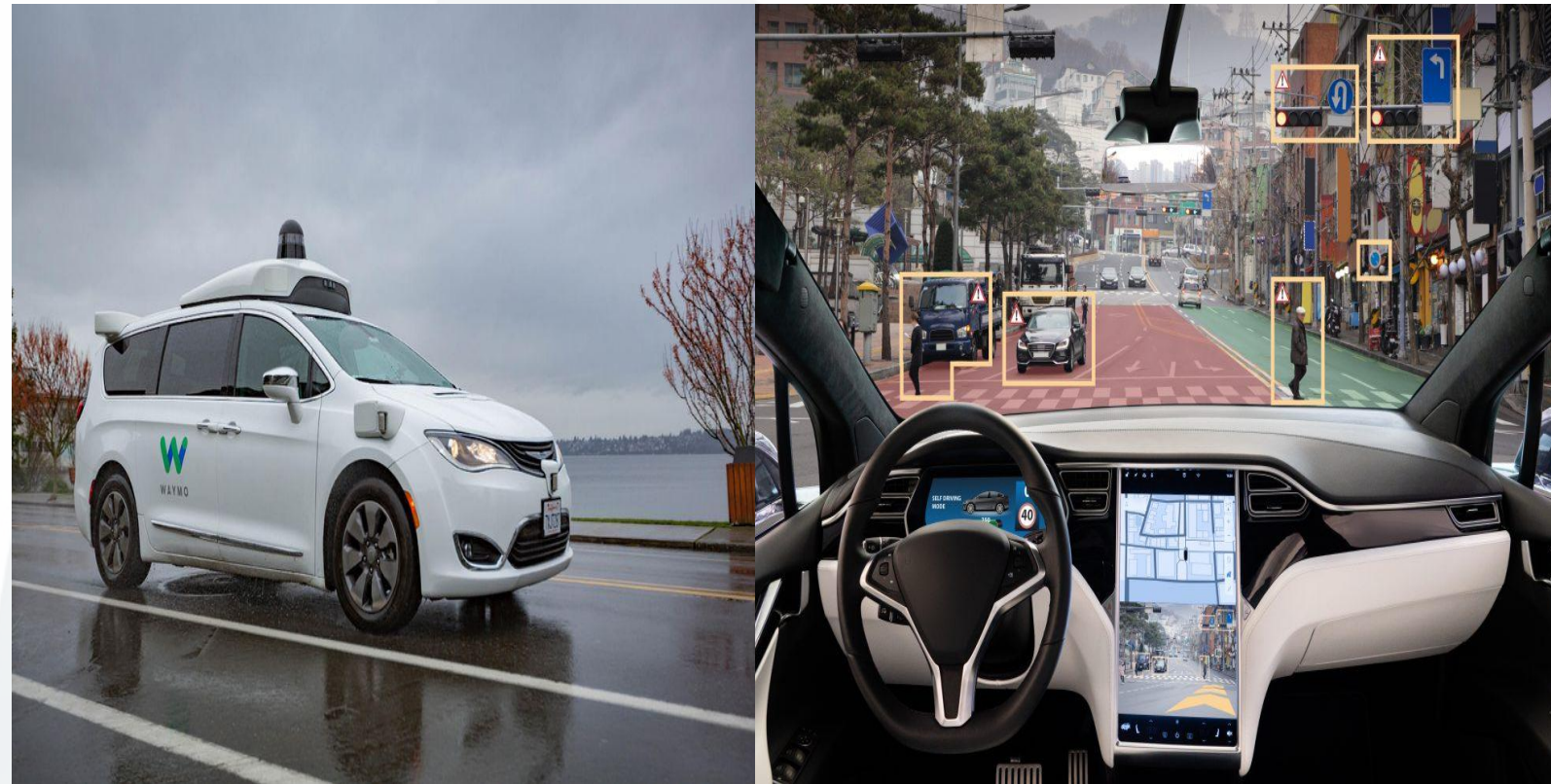


Self-driving Cars

The self-driving cars available today are still not up to the mark. They work fine in empty roads with different turns and traffic lights, but they start to struggle in a real world scenario.

Drawbacks:

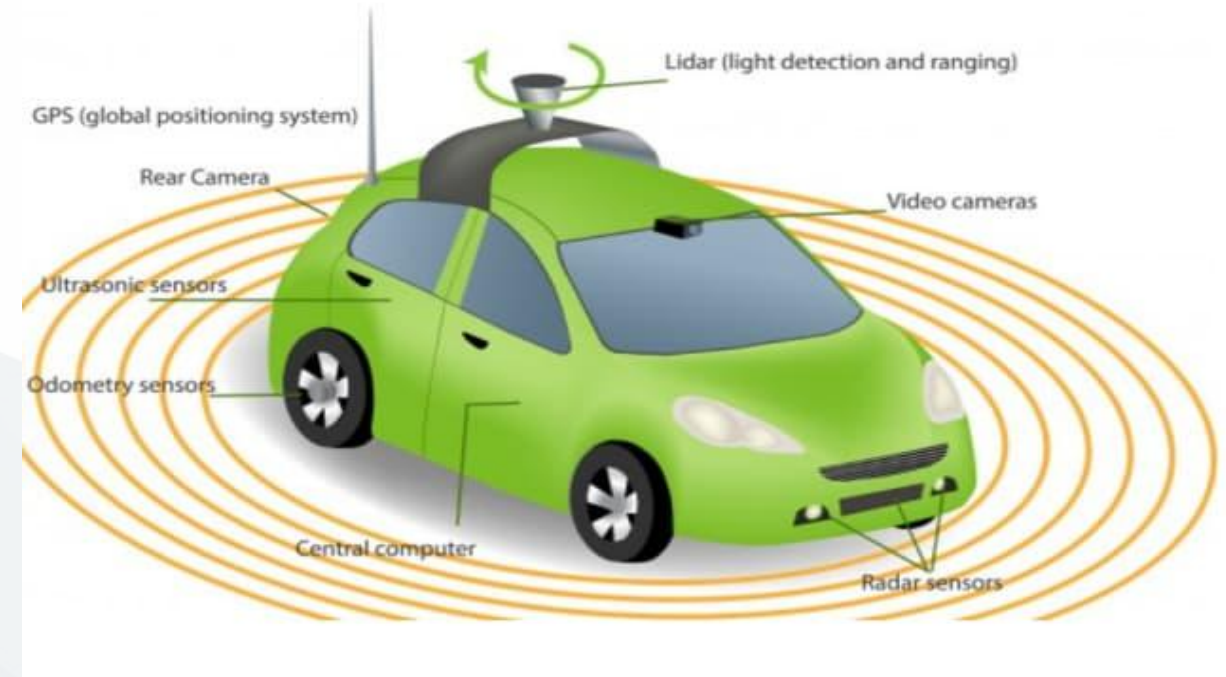
- Cannot make decisions in a split second
- More accidents are happening since self driving cars cannot completely handle real situation where cars suddenly stop or someone crosses the road

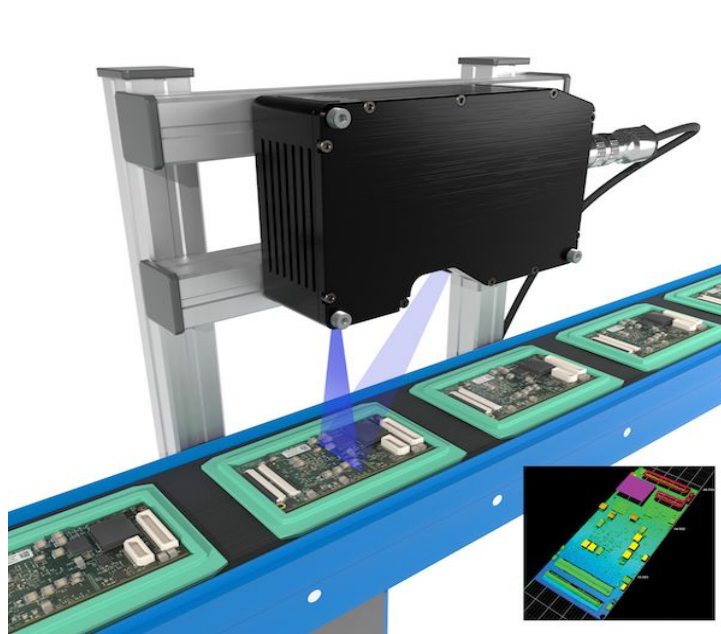


Self-driving Cars

Primary Sensors:

- **Camera:** placed on every side of the car to create a 360 degree view of the environment and also detect objects.
- **Radar:** Supplement camera visions in times of low visibility like night driving and improve detection
- **LIDAR:** helps to have a 3D view of the environment by providing shape and depths to surrounding cars, and also works in low-light conditions





Machine Vision



What is Machine Vision(MV)?

The process of extracting information from visual sensors to enable machines to make intelligent decision.

Components of MV

- **Light source**-LED, Fluorescent, Halogen lamps
- **Lens** – Telecentric , Macro lens
- **Sensors** – Optic ,Magnetic type
- **Vision processing unit**
- **Communication unit**

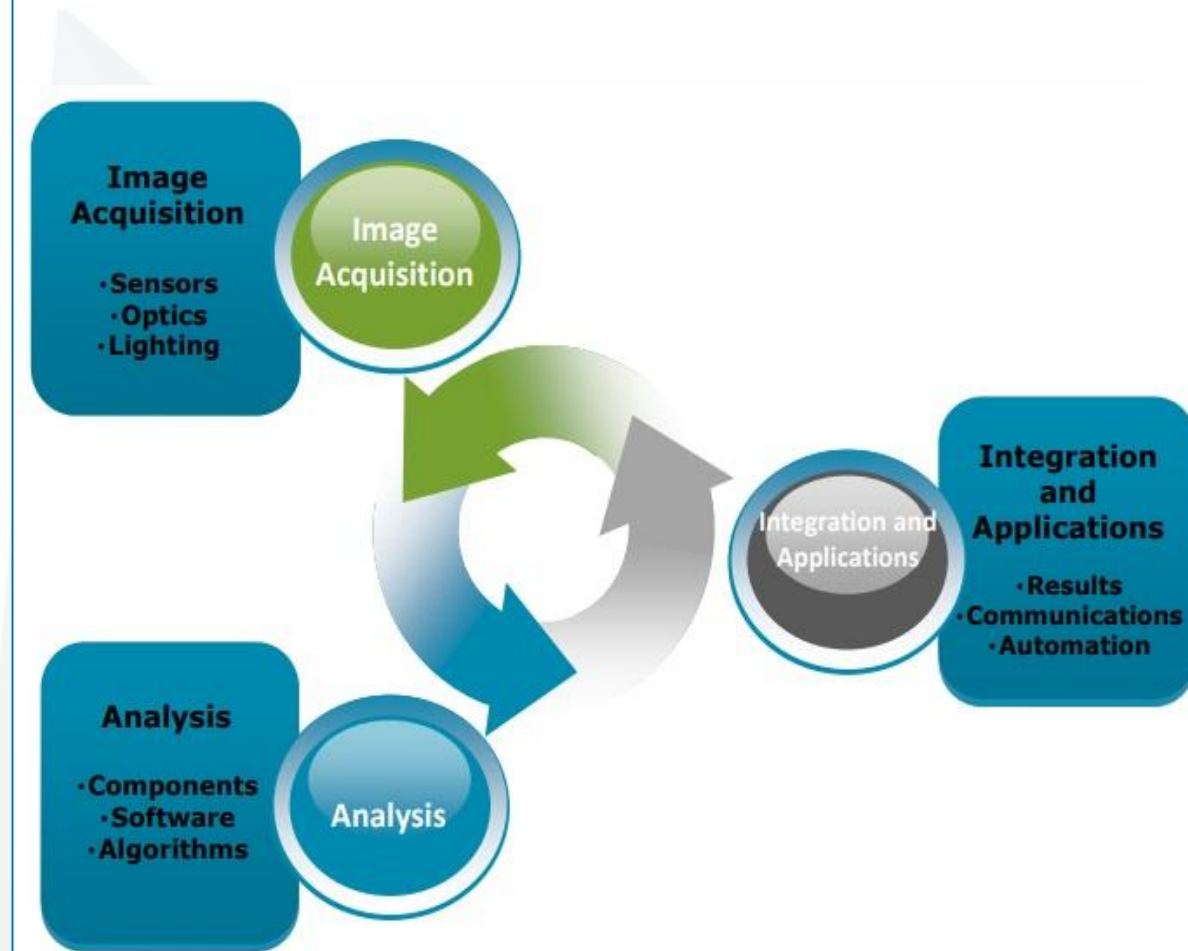


Fig. : Concept of machine vision

Working Principle of MV

Step 1: A camera takes a picture of the object to be tested in the presence of lens with suitable intensity of light source, and sends it to a computer for image processing.

Step 2: The computer will define and analysis the characteristics of images/visual data and make a decision on image analysis.

Step 3: After analysis the computer system will communicate with rejection unit if any defects in the part, or else if it is defect free it will send to the next station for processing.

Machine Vision vs Computer Vision

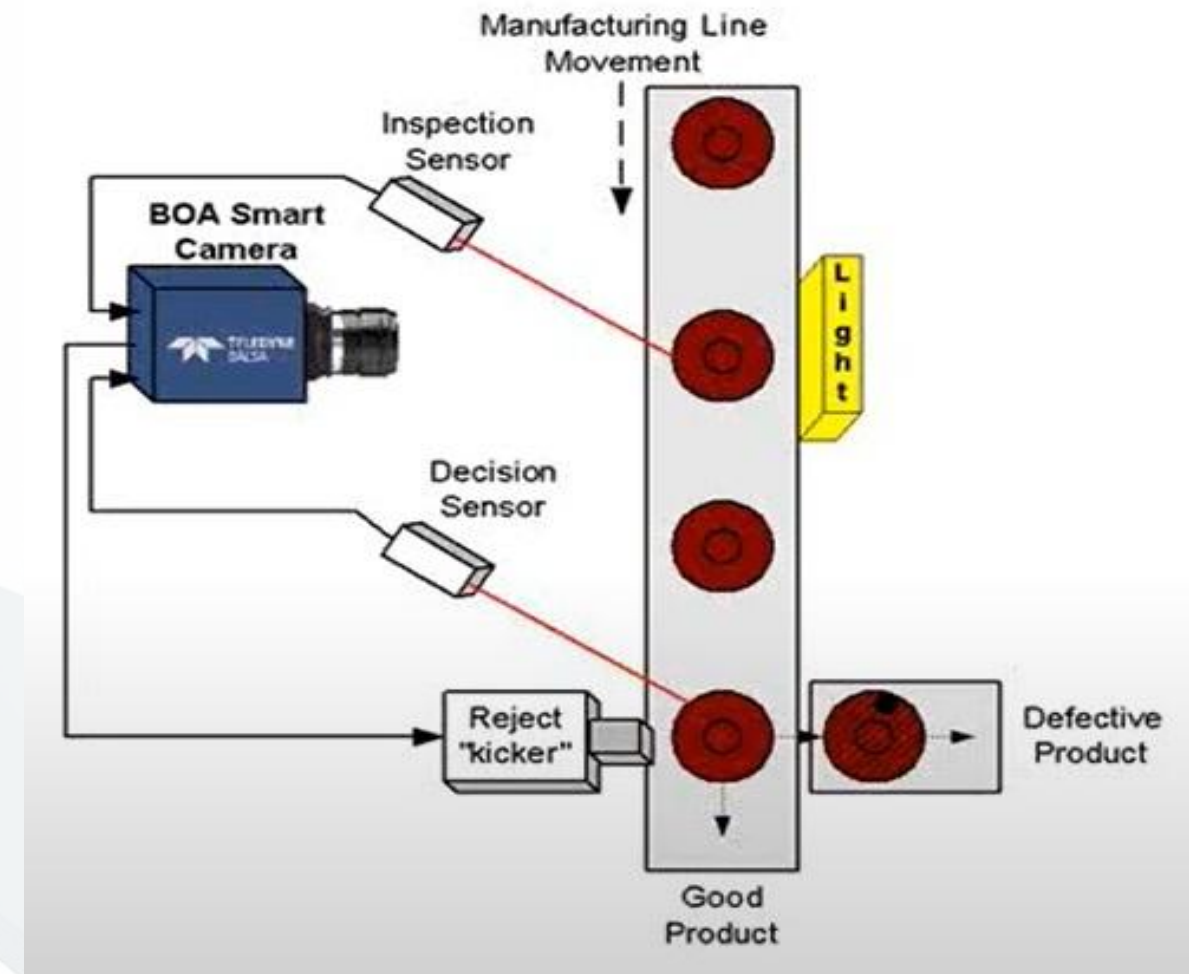
- ✓ A **machine vision** system uses a camera to view an image, **computer vision** algorithms then process and interpret the image, before instructing other components in the system to act upon that data.
- ✓ **Computer vision** can be used alone, without needing to be part of a larger **machine** system.

Machine Vision Inspection Technology

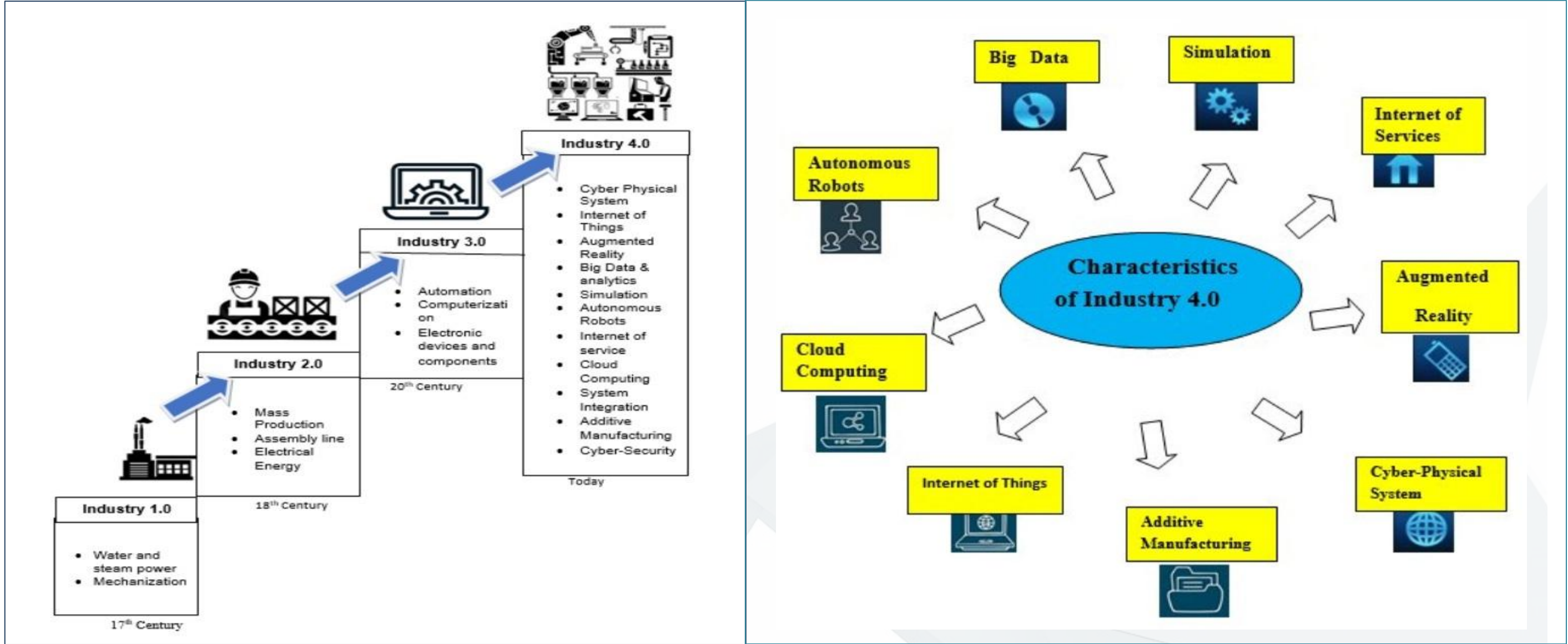
Machine vision inspection technology improves your facility's quality control processes by utilizing cameras with image processing software to inspect parts for flaws or potential defects.

When you invest in machine vision inspection technology for your facility, you will have fewer mistakes reaching your customers, and you can free up your engineers for more critical tasks or projects.

Now that you know what machine vision inspection technology is, let's dive deeper into how it works.



MV is a Key of Fourth Industrial Revolution: Industry 4.0



Application of MV

Application Fields of Machine Vision

- ✓ Automotive
- ✓ Electronics
- ✓ Food
- ✓ Logistics
- ✓ Manufacturing
- ✓ Robotics
- ✓ Packaging
- ✓ Pharmaceutical
- ✓ Mining

Applications of Machine Vision System



- ✓ Measurement
- ✓ Counting
- ✓ Location
- ✓ Decoding
- ✓ so on

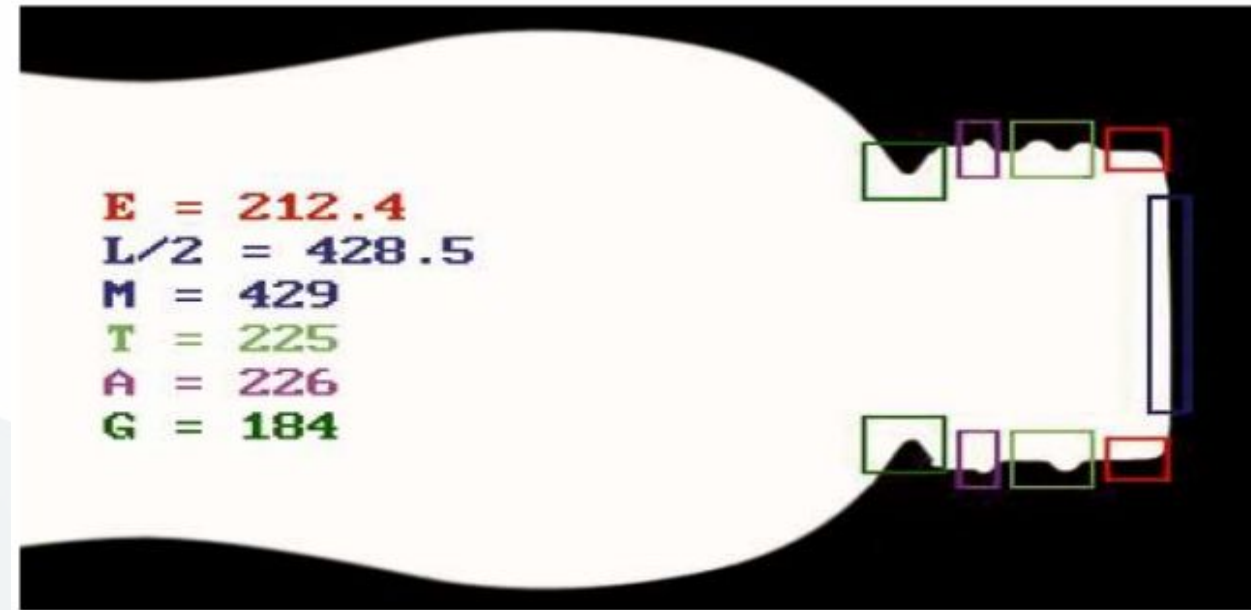
Applications of Machine Vision System

Measurement:

In measurement applications the purpose of the vision system is to measure physical dimensions of the object.

Examples of physical dimensions are distance, diameter, curvature, area, height, and volume.

Example: A camera measures multiple diameters of a bottleneck



Applications of Machine Vision System

Counting:

Counting is another typical machine vision application

Basically counting means look for number of parts over number of features on a part, this allows us to locate missing part and ensure the products are assembled properly.

Example 1: counting of holes on the aluminium flange

Example 2: Identifying the presence or absence of the part.

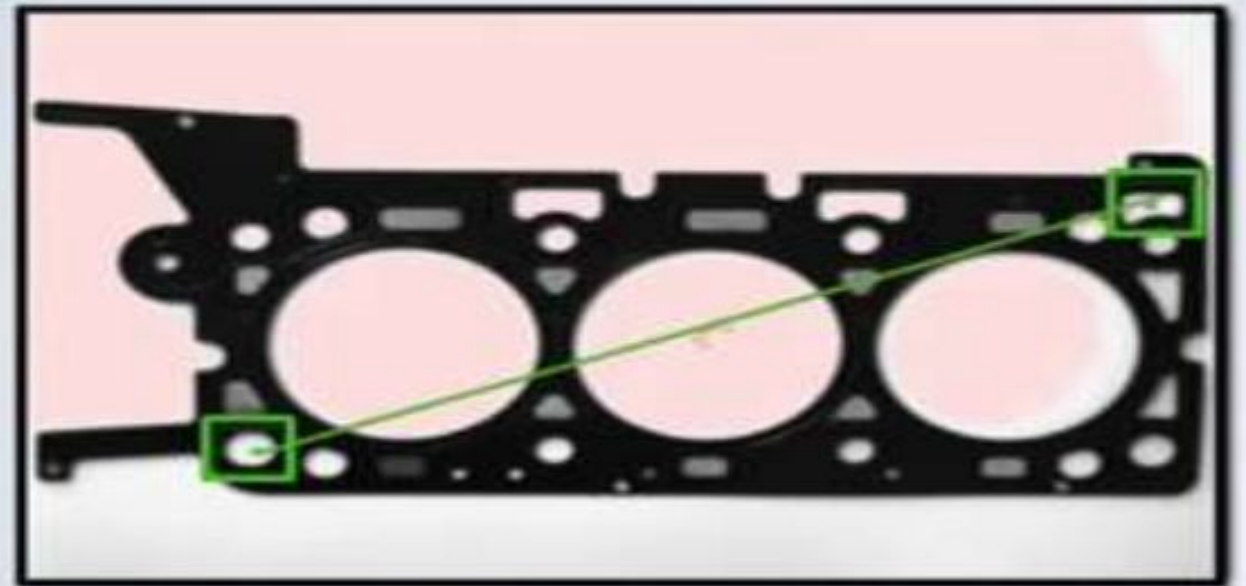


Applications of Machine Vision System

Location:

Machine vision also used to report the location and orientation of the parts.

LOCATION: Locate position and orientation, check to specified tolerances



Applications of Machine Vision System

Decoding

It is an identification application in which the vision system reads various codes and alphanumeric characters (text and numbers) and decodes the codes to get the product features .

It is used to record information as historical data, track products, validate data, verify correctness of data and verify the product.



Advantages of Machine Vision

- ✓ Machine vision system works faster than manual system.
- ✓ Machine vision is consistent.
- ✓ Perform beyond human vision
- ✓ High repeatable in controlled environment
- ✓ No fatigue – 24/7
- ✓ Reliable
- ✓ Good for unsafe and hazardous environment
- ✓ Operate well in space constrained environments