

# AUTOMATED & EMERGING TECHNOLOGIES

Fritz Eugene Bansag



# Objectives

- Gain understanding on automated systems and its processes
- Identify the application of automated systems.
- Gain knowledge and understanding on expert systems.



# KNOWING WHAT YOU KNOW

## STARTER

**GO TO:**

<https://joinmyquiz.com>

Join Code: \_\_\_\_\_

## LEARNING FOCUS

- What Automated System is
- What Expert System is
- Application of Automated and Expert Systems

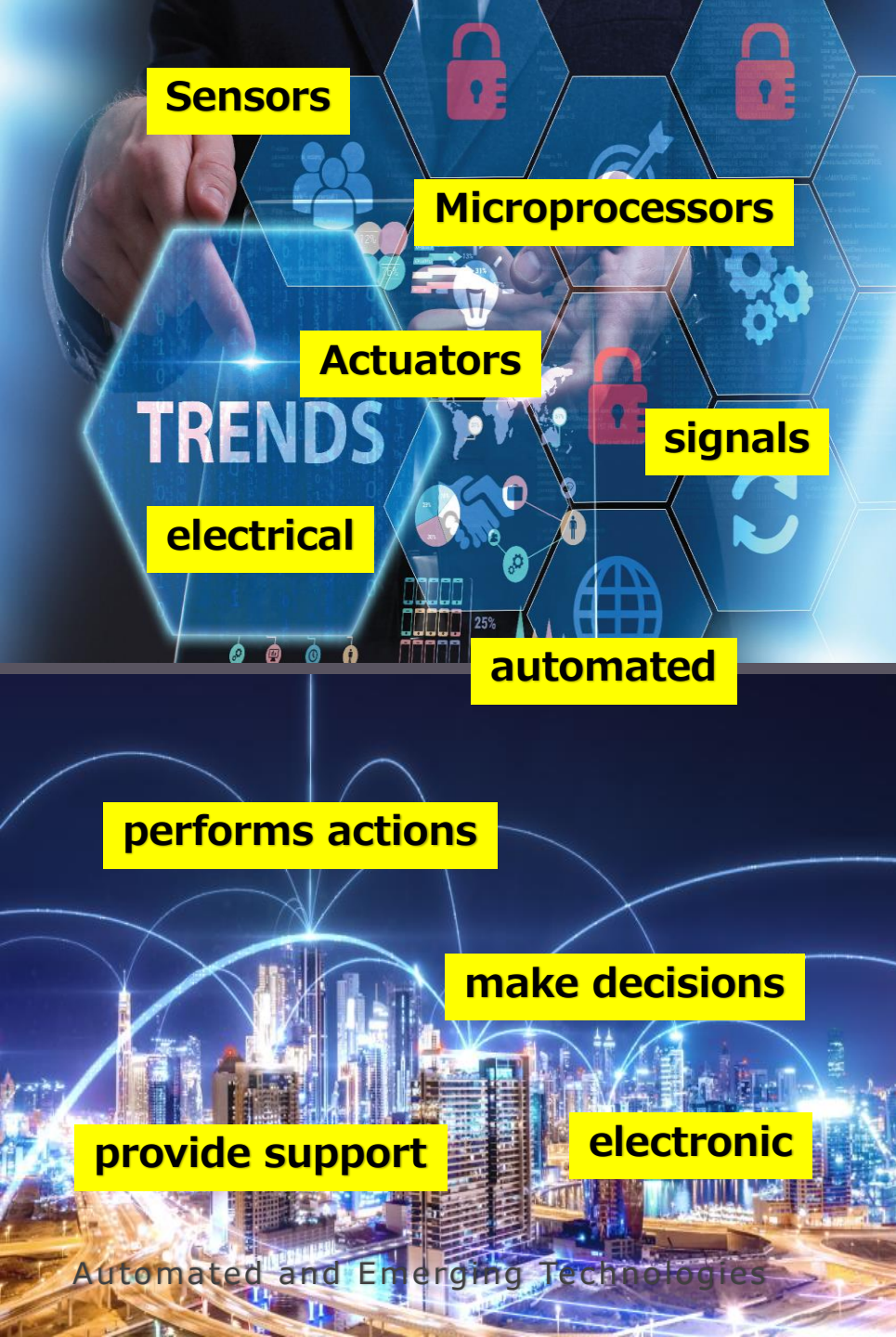




## What Automated System is

Automated Systems is the integration and application of hardware, software, sensors and actuators as unit and independently function in performing and accomplishing given tasks.





# Automated Systems components and its function

**1** \_\_\_\_\_ detect changes in the environment and **convert them into** **2** \_\_\_\_\_ **signals** that can be processed by a microprocessor

**3** \_\_\_\_\_ analyse the signals from the sensors and **4** \_\_\_\_\_ based on pre-programmed logic

**5** \_\_\_\_\_ receive **6** \_\_\_\_\_ from the microprocessor and **7** \_\_\_\_\_ such as opening a valve or turning on a motor



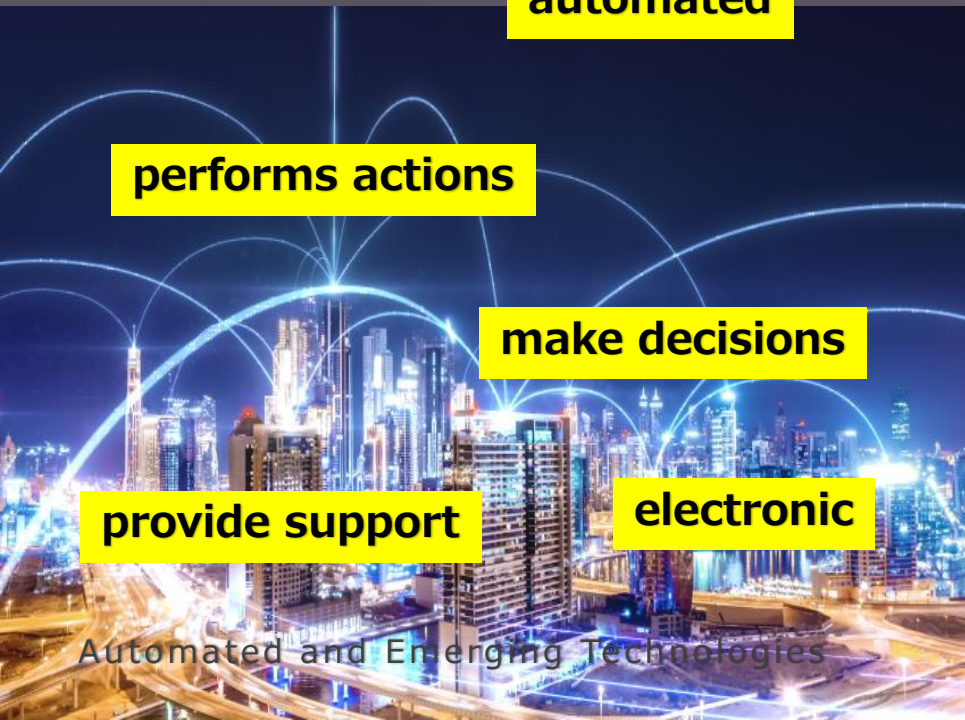


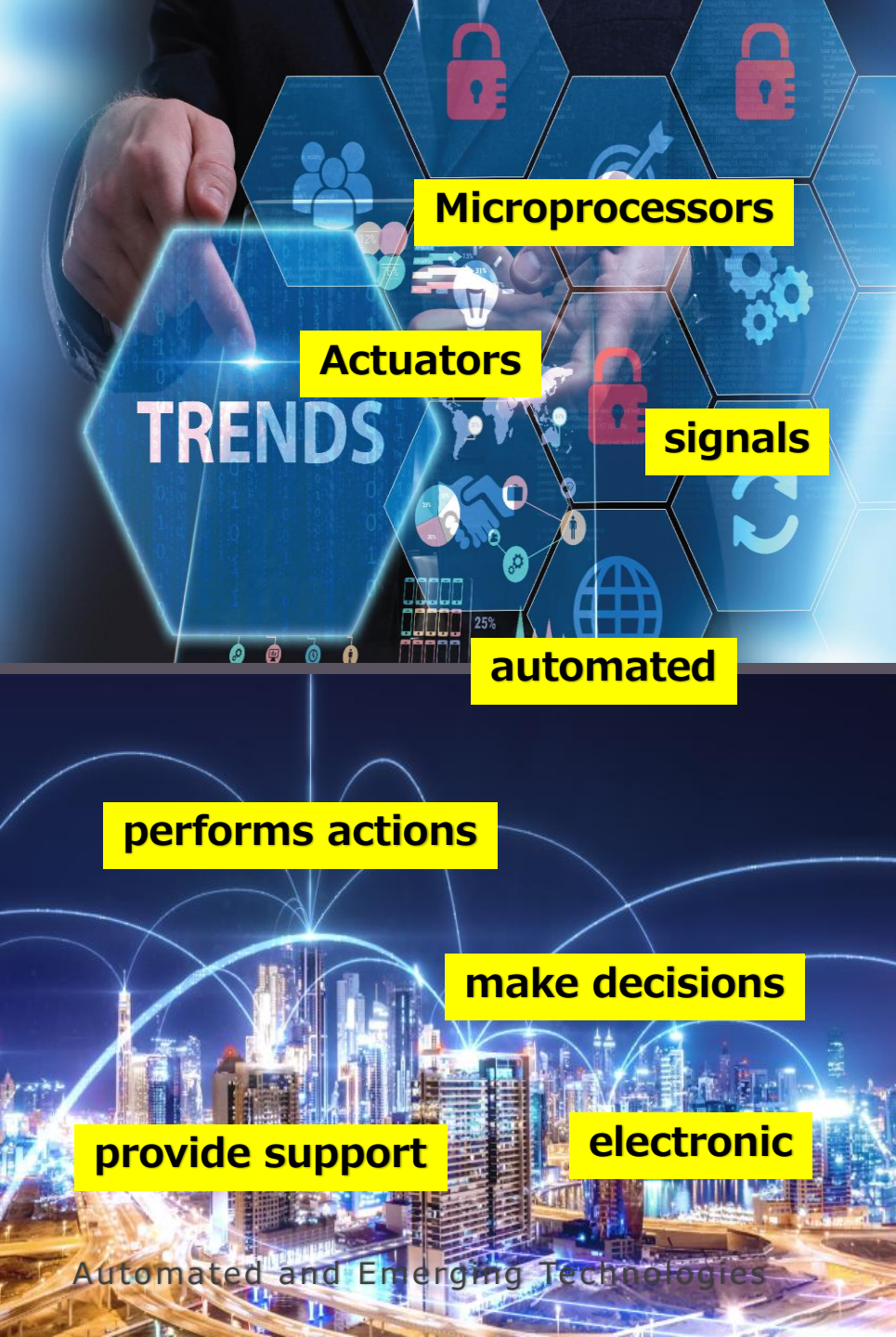
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# Automated Systems components and its function

**Sensors** detect changes in the environment and **convert them into electrical signals** that can be processed by a microprocessor

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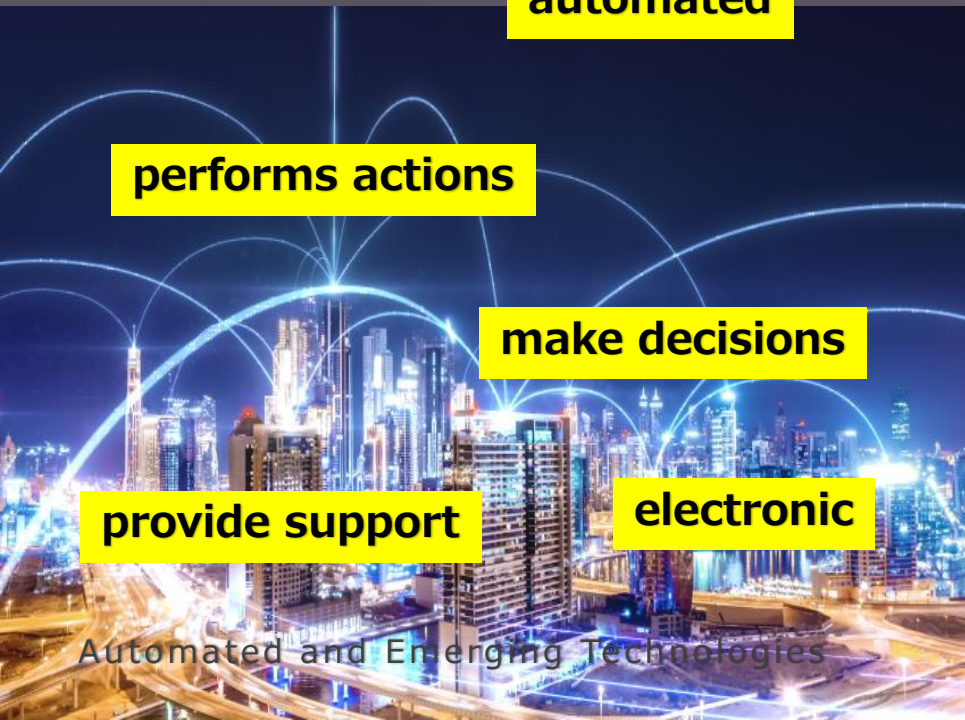


Actuators

TRENDS

signals

automated



performs actions

make decisions

provide support

electronic

# Automated Systems components and its function

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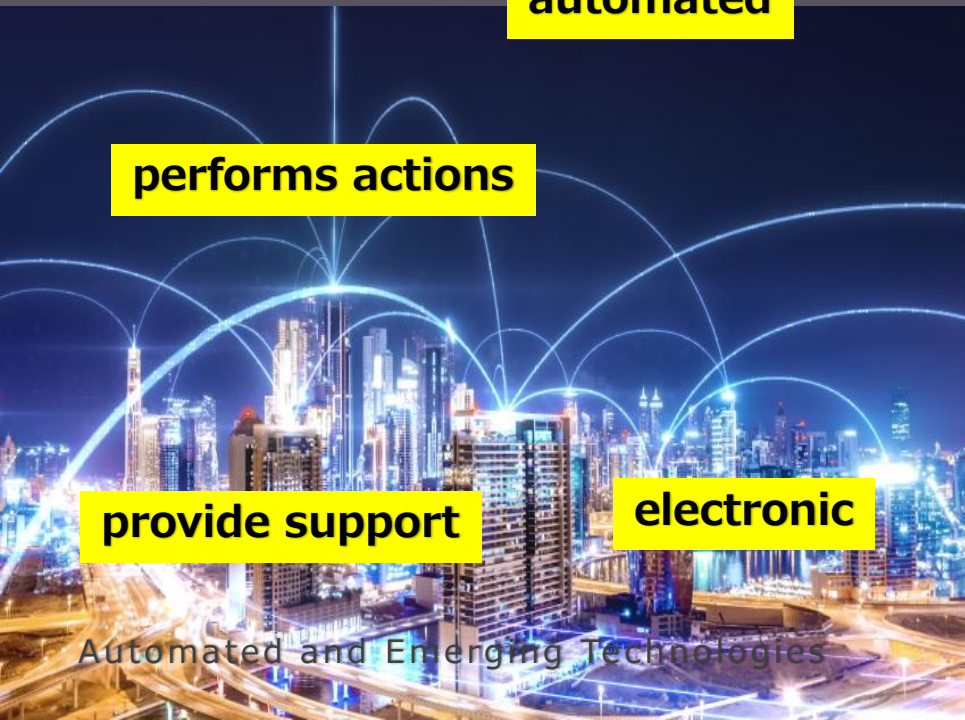


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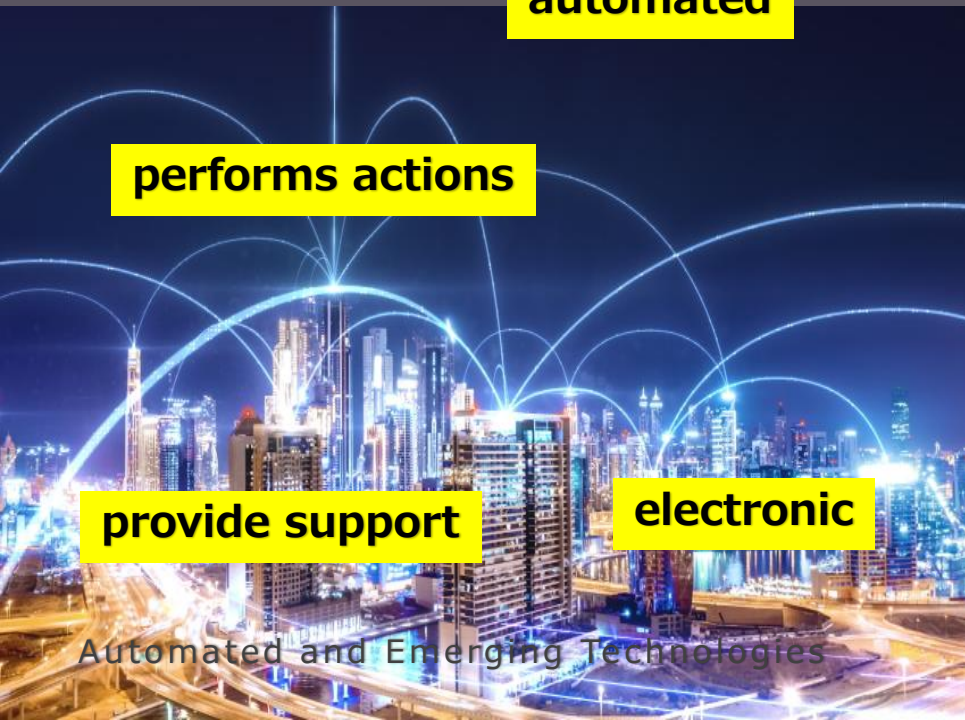


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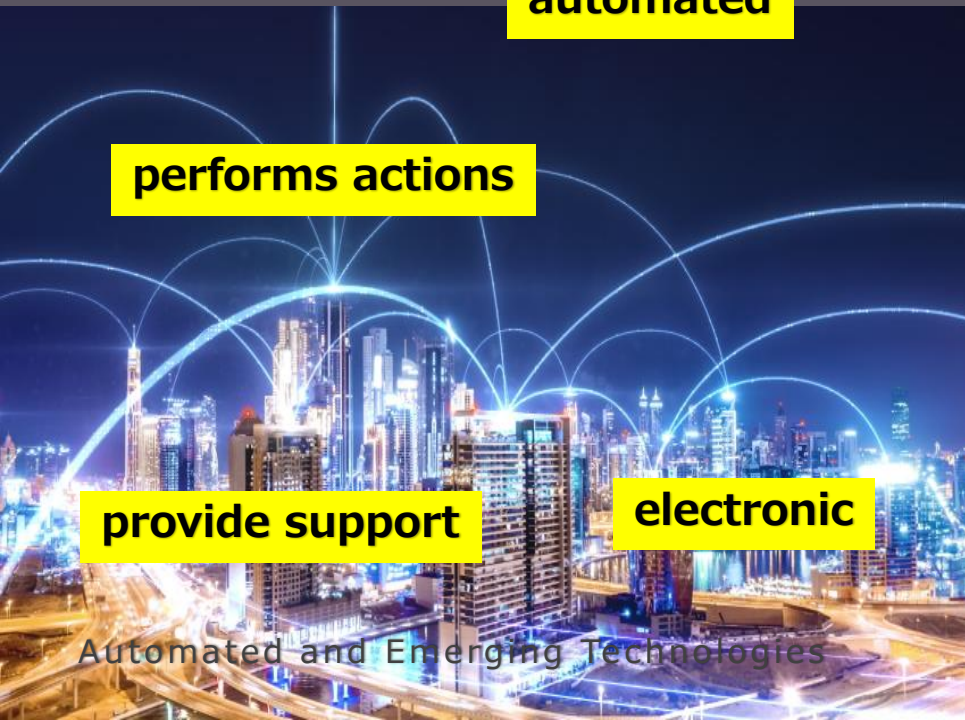






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**automated**



**provide support**

**electronic**

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# Automated Systems

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**Sensors** detect changes in the environment and **convert them into electrical signals** that can be processed by a microprocessor

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# Cambridge Exam Style Questions

- 1. Industrials**
- 2. Weather**
- 3. Science**
- 4. Lighting**
- 5. Transport**
- 6. Gaming**
- 7. Agriculture**



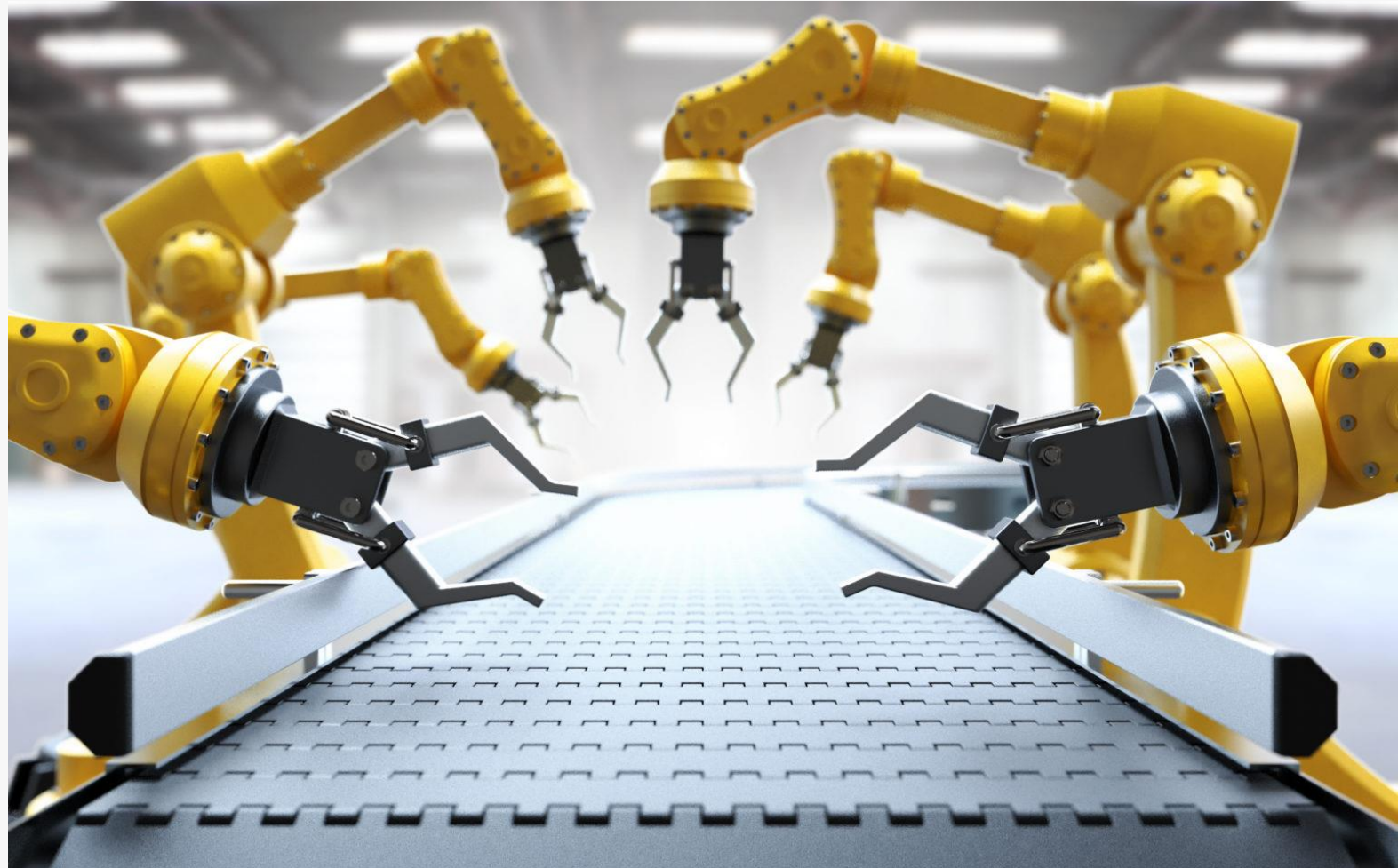


# Automated Systems Applications

Where does Automated  
Systems are applied?

# Automated Systems Application

1. **Industrials**
2. **Weather**
3. **Science**
4. **Lighting**
5. **Transport**
6. **Gaming**
7. **Agriculture**

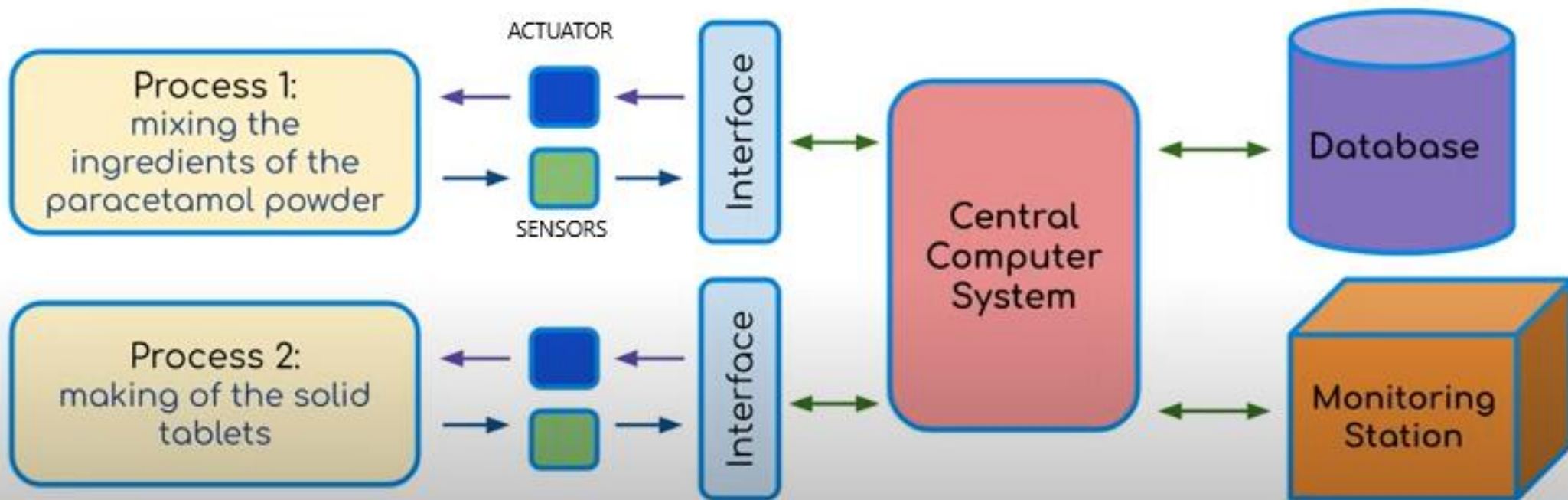




# Industrial



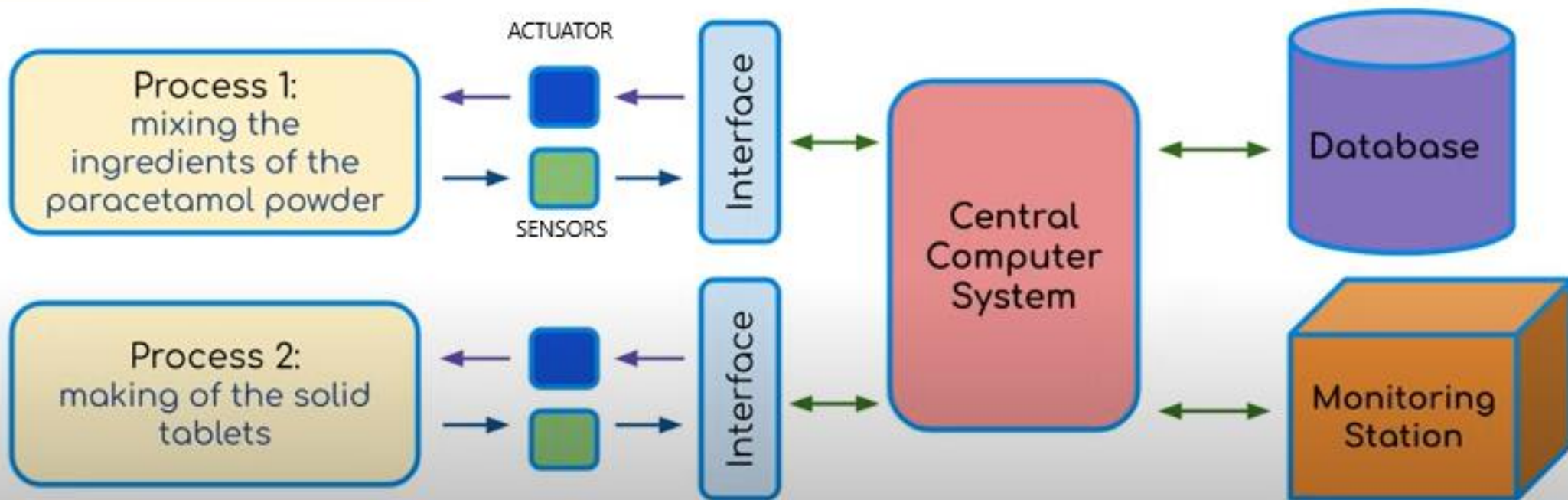
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# Industrial

This automated system depends on sensors, a computer, actuators and software.

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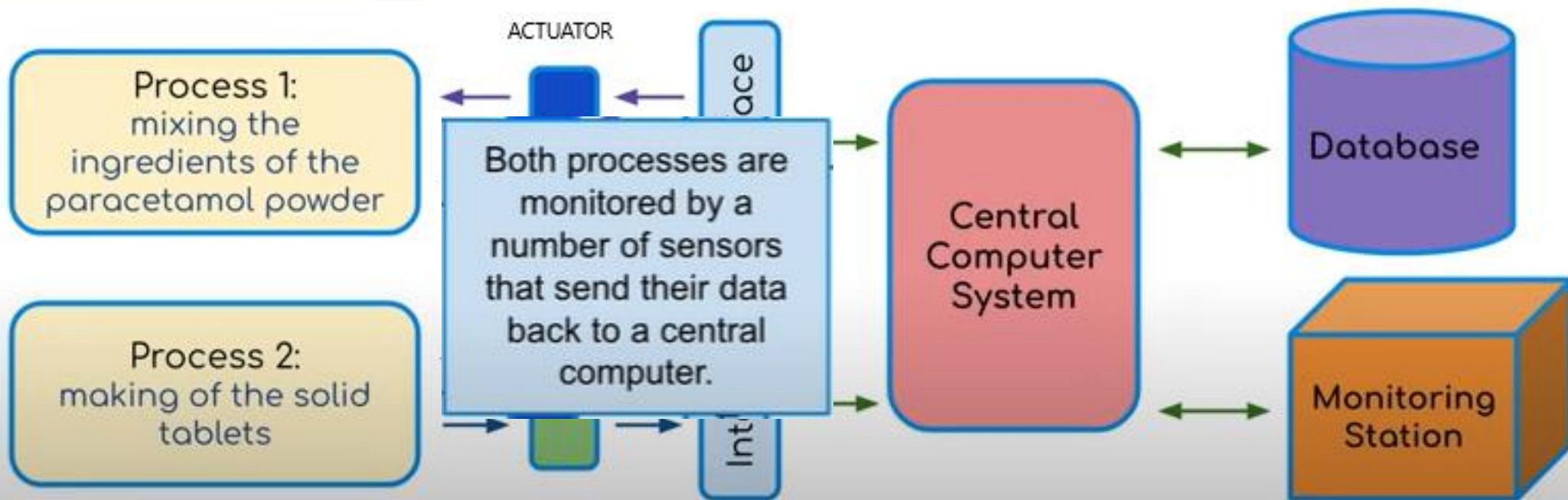




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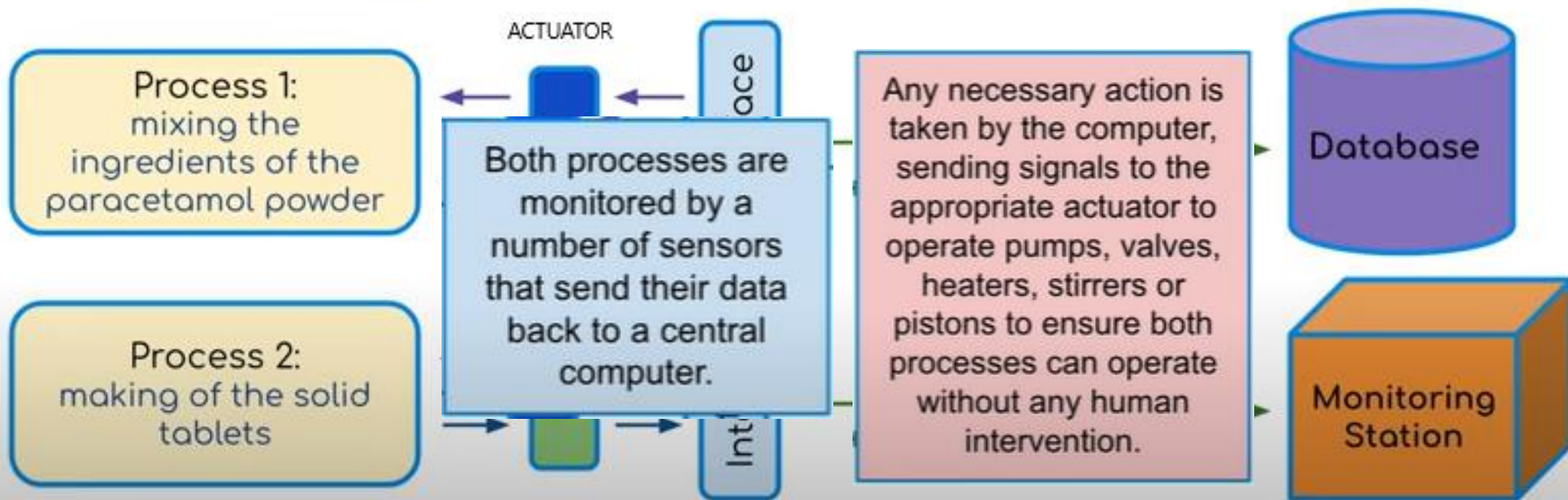
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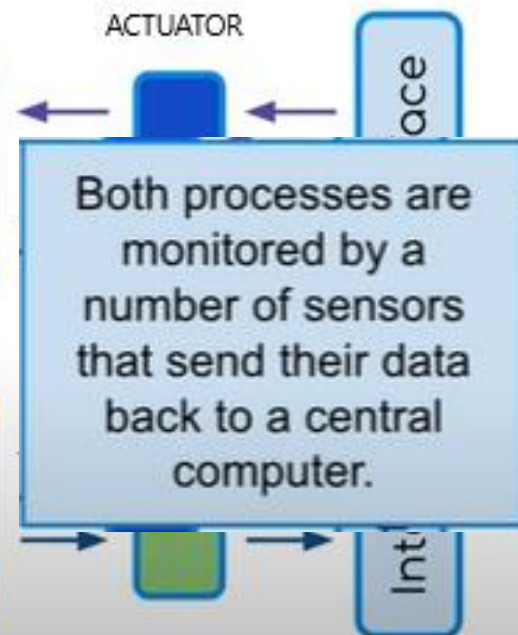
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## INDUSTRIAL AUTOMATED SYSTEM

Example 1- manufacturing paracetamol

Process 1:  
mixing the ingredients of the paracetamol powder

Process 2:  
making of the solid tablets



Any necessary action is taken by the computer, sending signals to the appropriate actuator to operate pumps, valves, heaters, stirrers or pistons to ensure both processes can operate without any human intervention.

The computer consults its database to ensure both processes are operating within correct parameters.

This system uses a remote monitoring station manned by an operator.

# Industrial

## The advantages of this automated system are:

- It is much faster than a human operator to take any necessary action
- It is much safer (an automated system is more likely to make correct interventions than a human if necessary; and it also keeps humans away from a potentially dangerous environment)
- the process is much more likely to run under optimum conditions since any changes needed can be identified very quickly and action taken
- long term, it is less expensive (an automatic system replaces most of the workforce)
- that there is more efficient use of materials
- that there is higher productivity
- more consistent results.

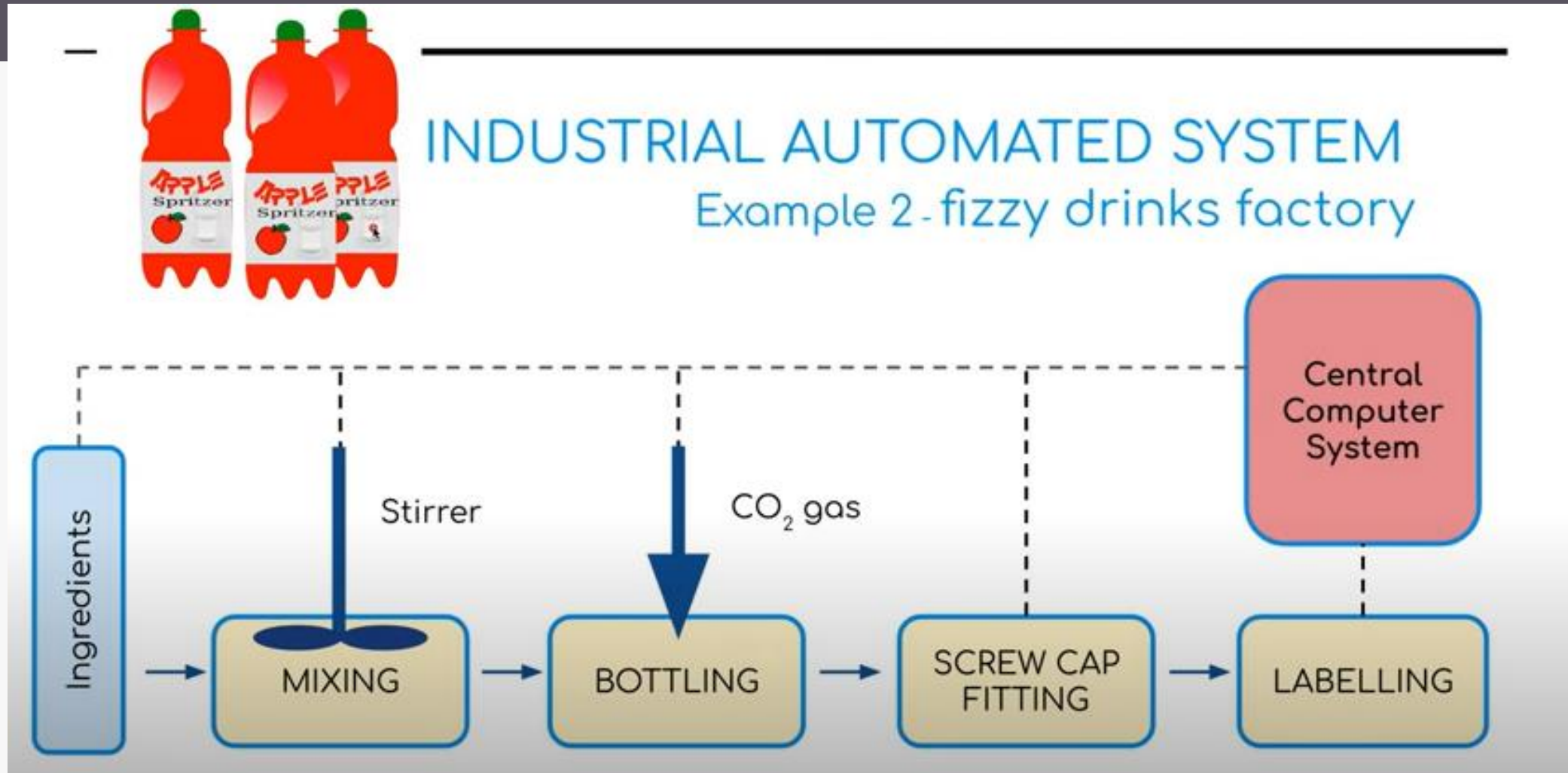


# Industrial

## The disadvantages of this automated system are:

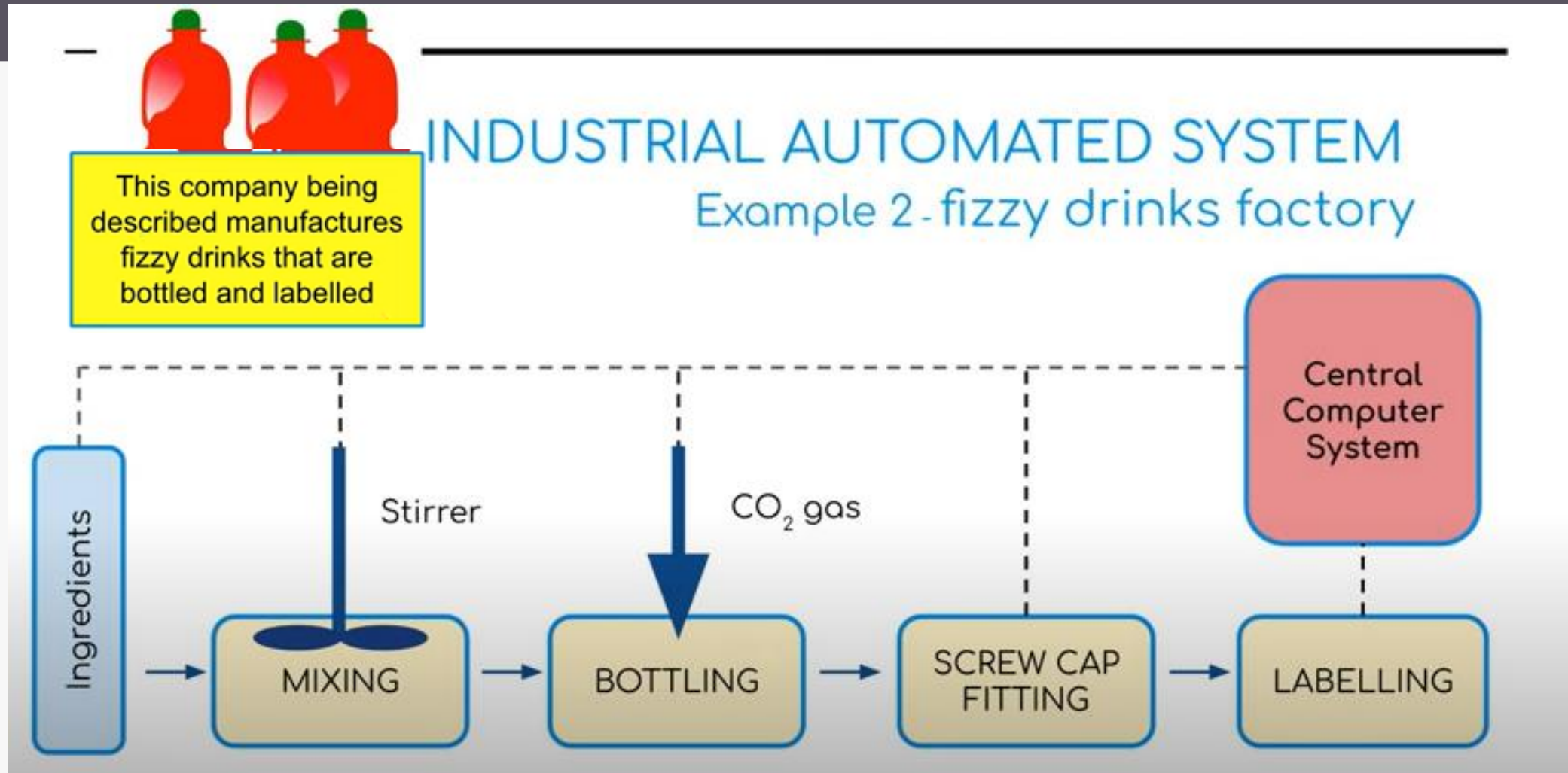
- it is expensive to set up in the first place and needs considerable testing
- always possible for a set of conditions to occur that were never considered during testing which could have safety implications (hence there is the need for a monitoring station)
- automated systems usually always need enhanced/specialist maintenance which can be expensive
- any computerised system is subject to criminal cyberattacks despite how good the system is.

# Industrial

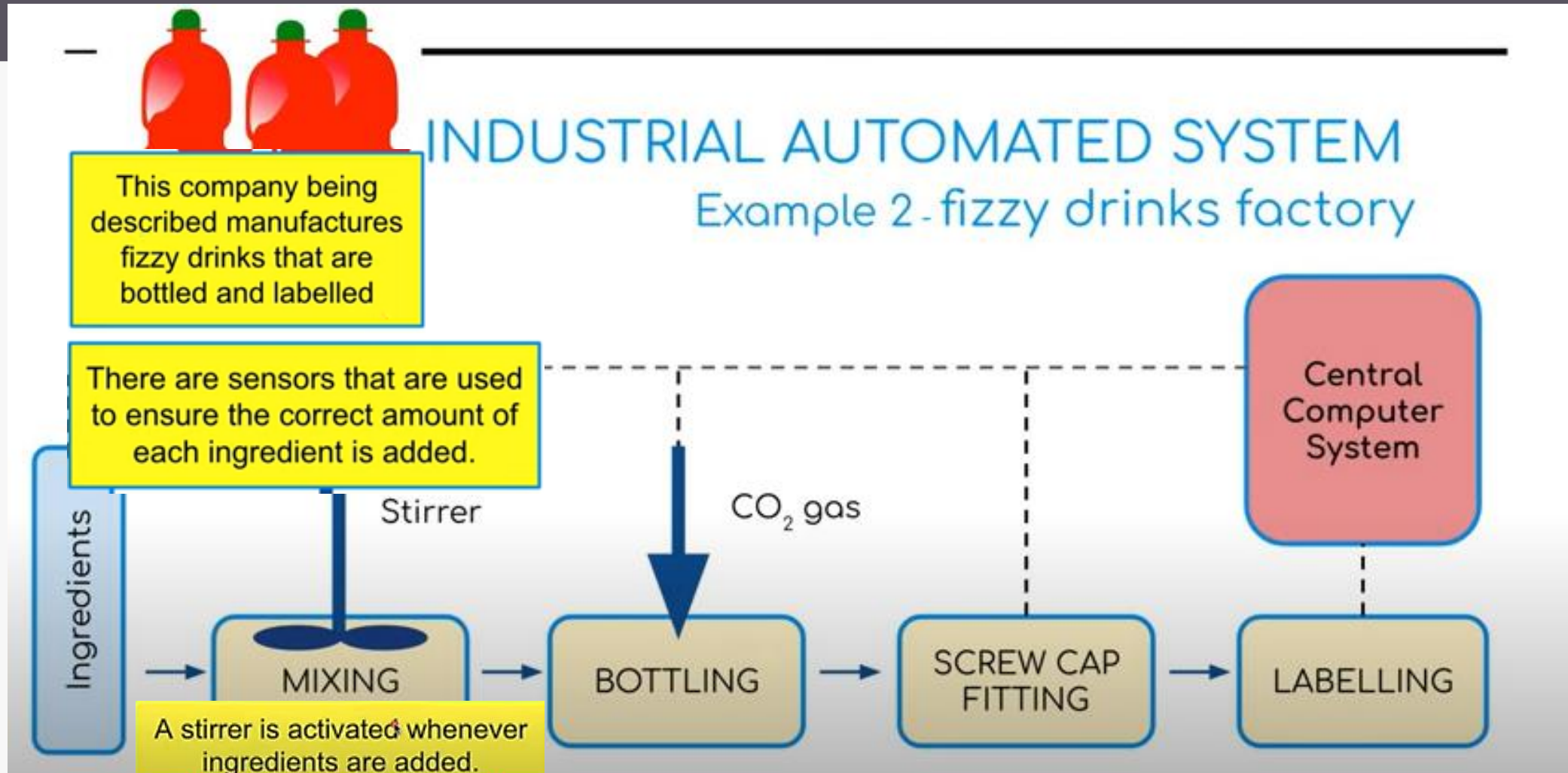




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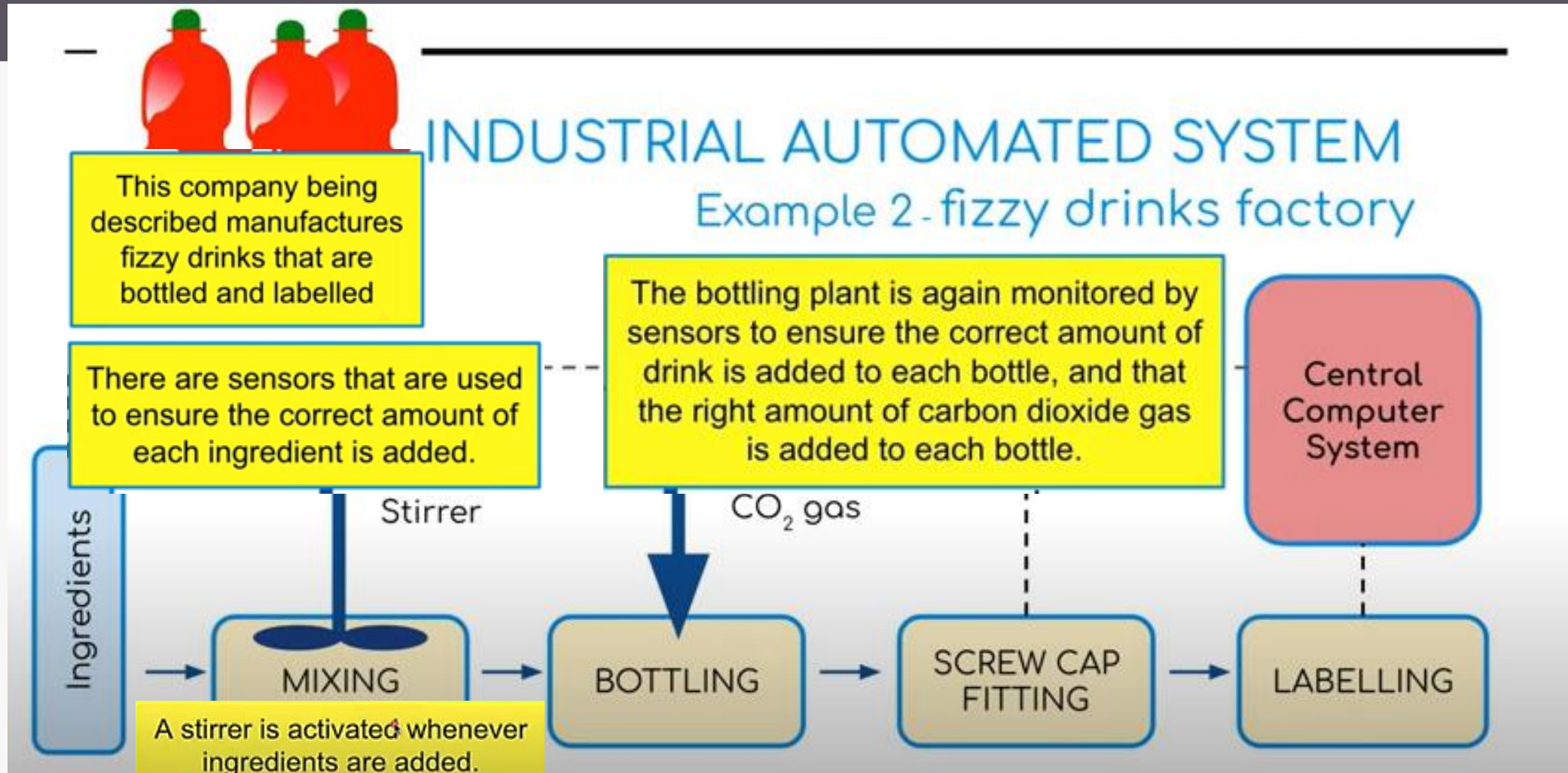


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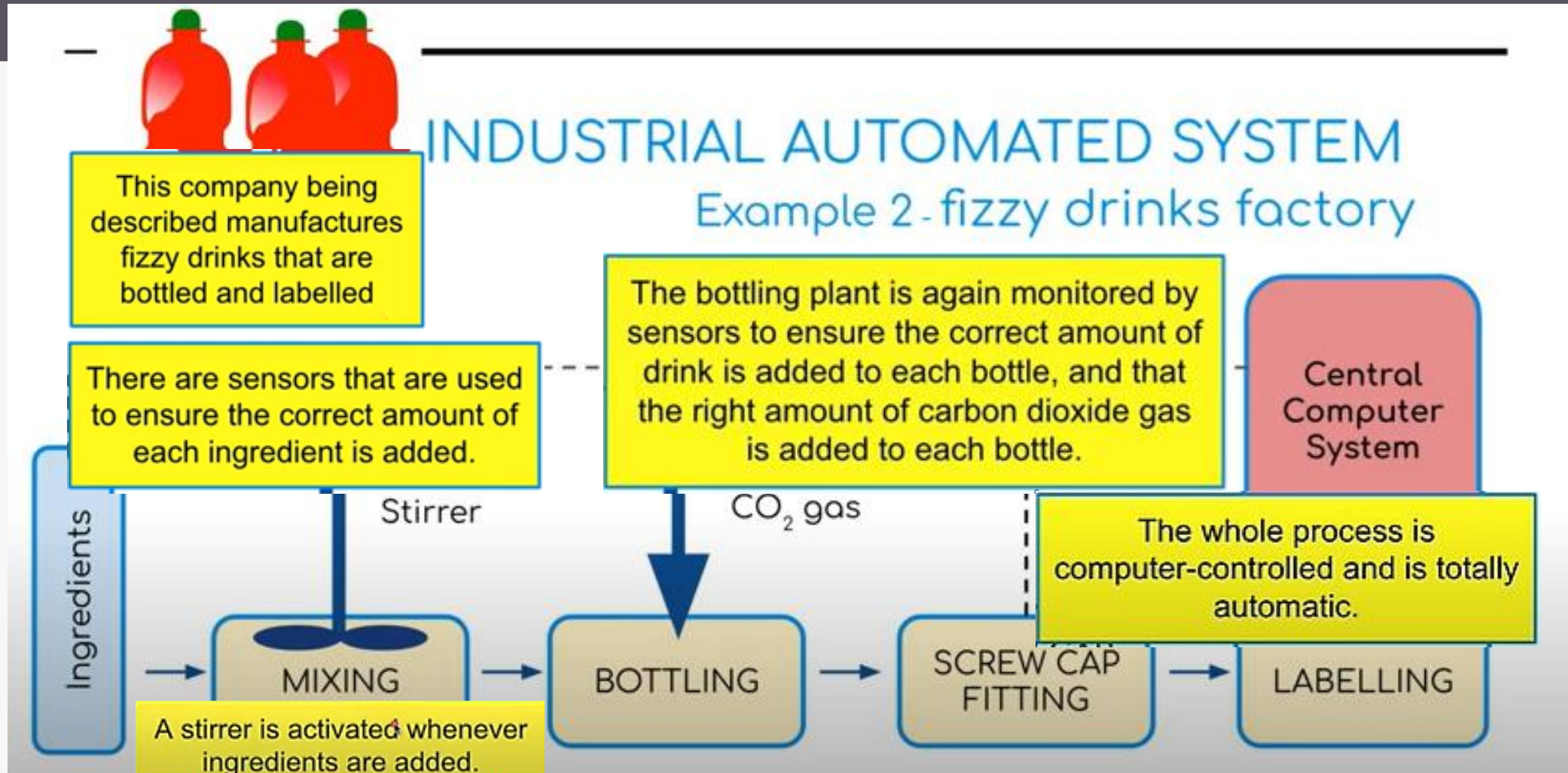




# Industrial



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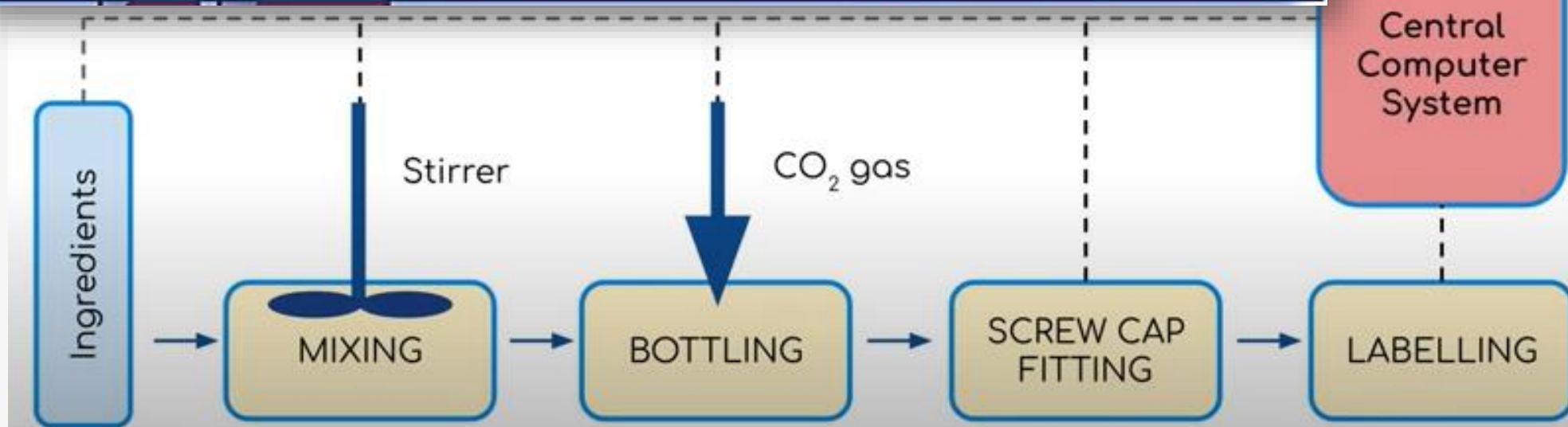
# Industrial



## INDUSTRIAL AUTOMATED SYSTEM

Example 2 - fizzy drinks factory

A. Describe how the sensors, actuators and central computer would be used to monitor and control this bottling plant automatically.



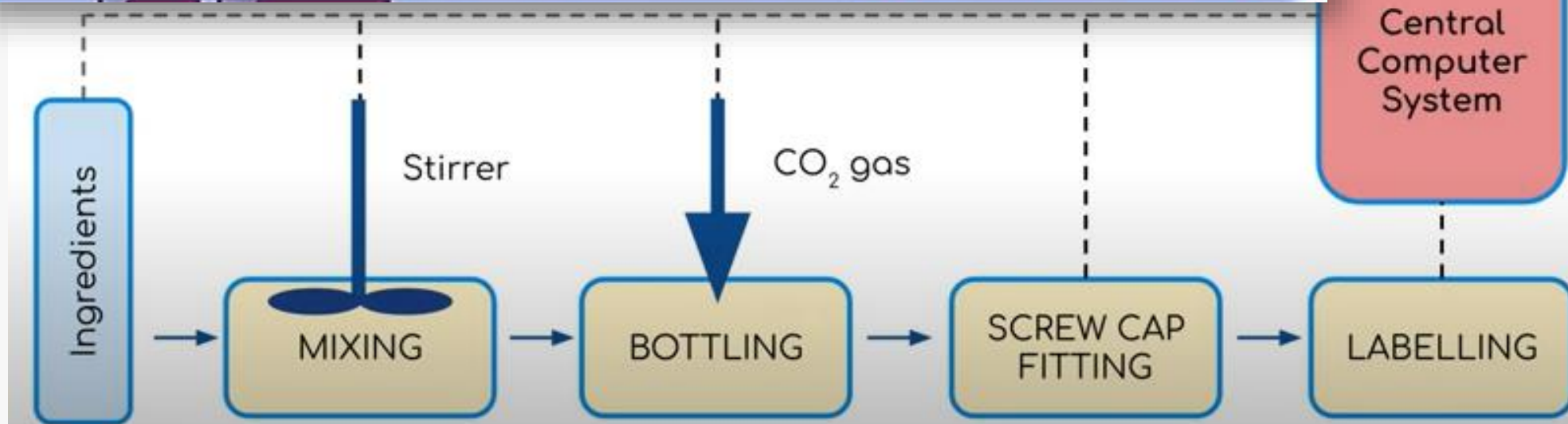
# Industrial



## INDUSTRIAL AUTOMATED SYSTEM

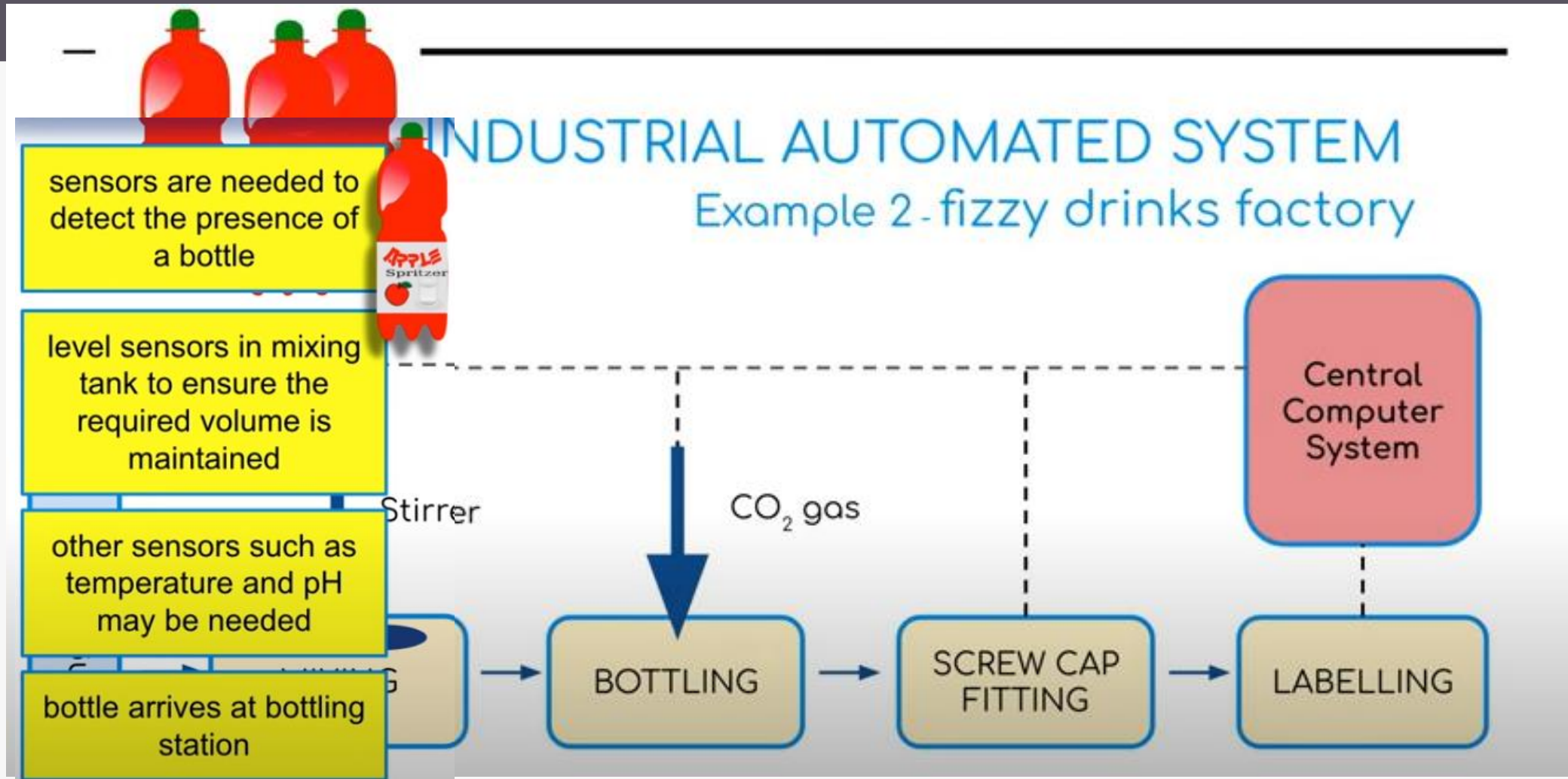
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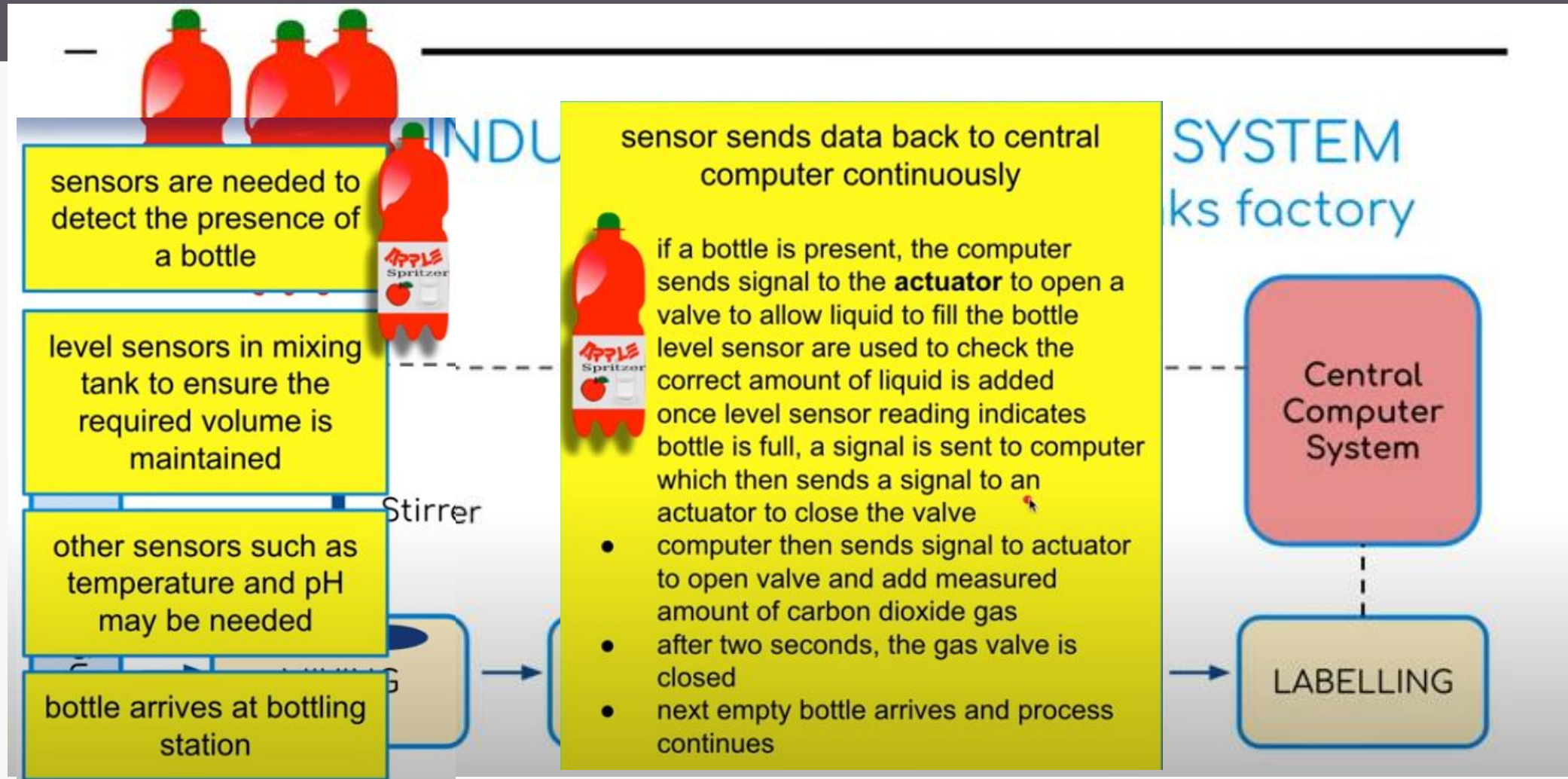




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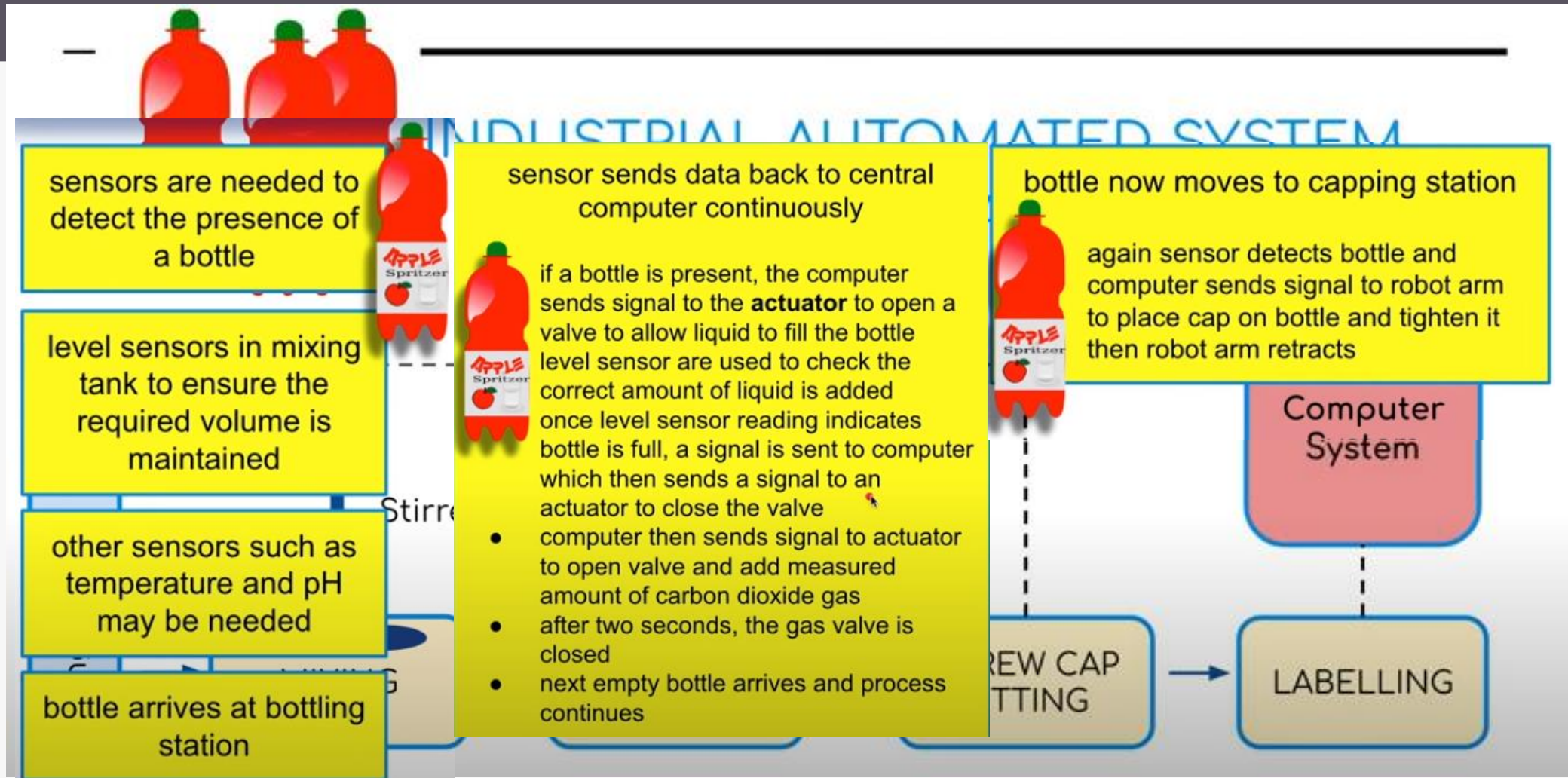


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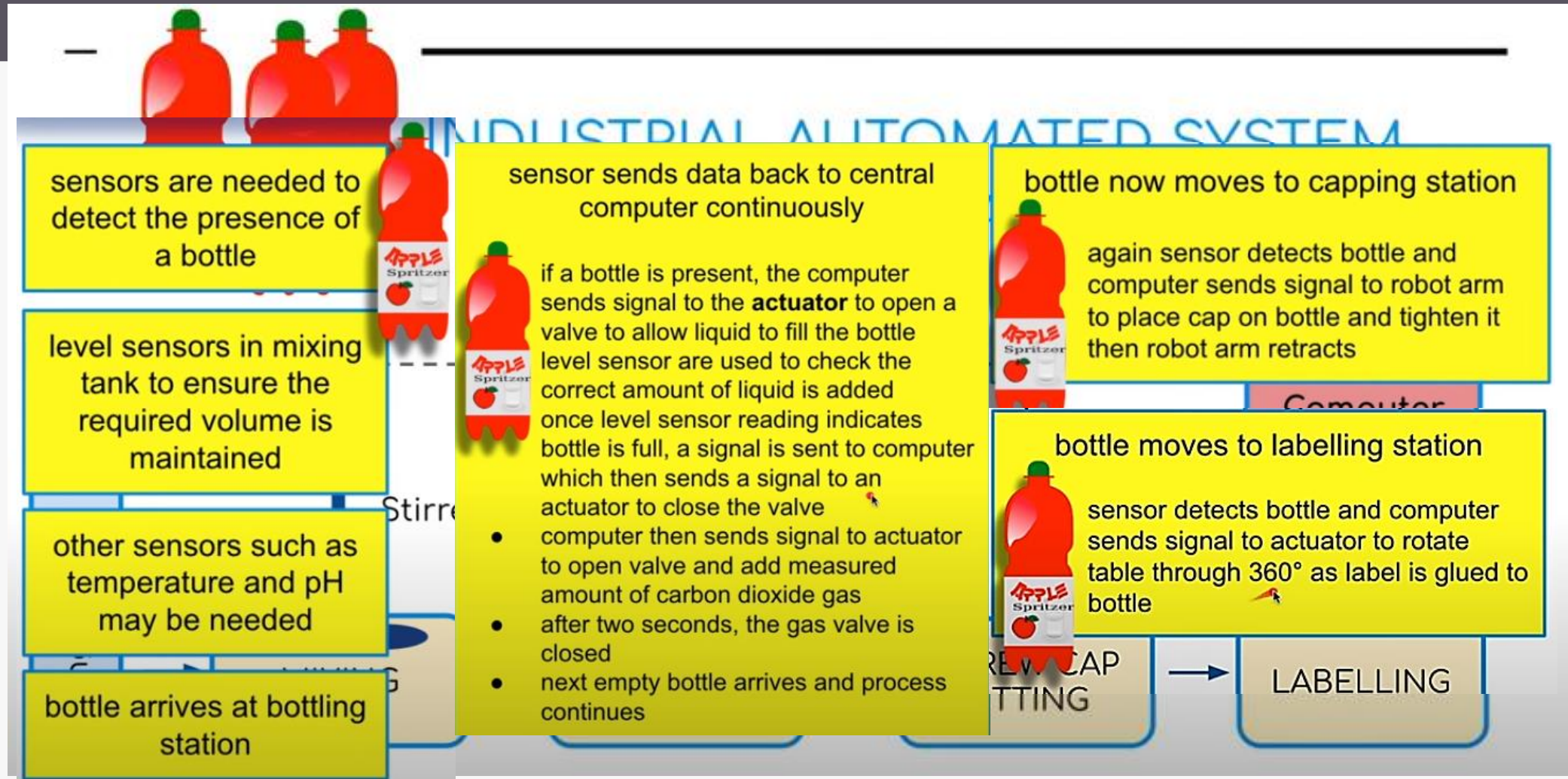


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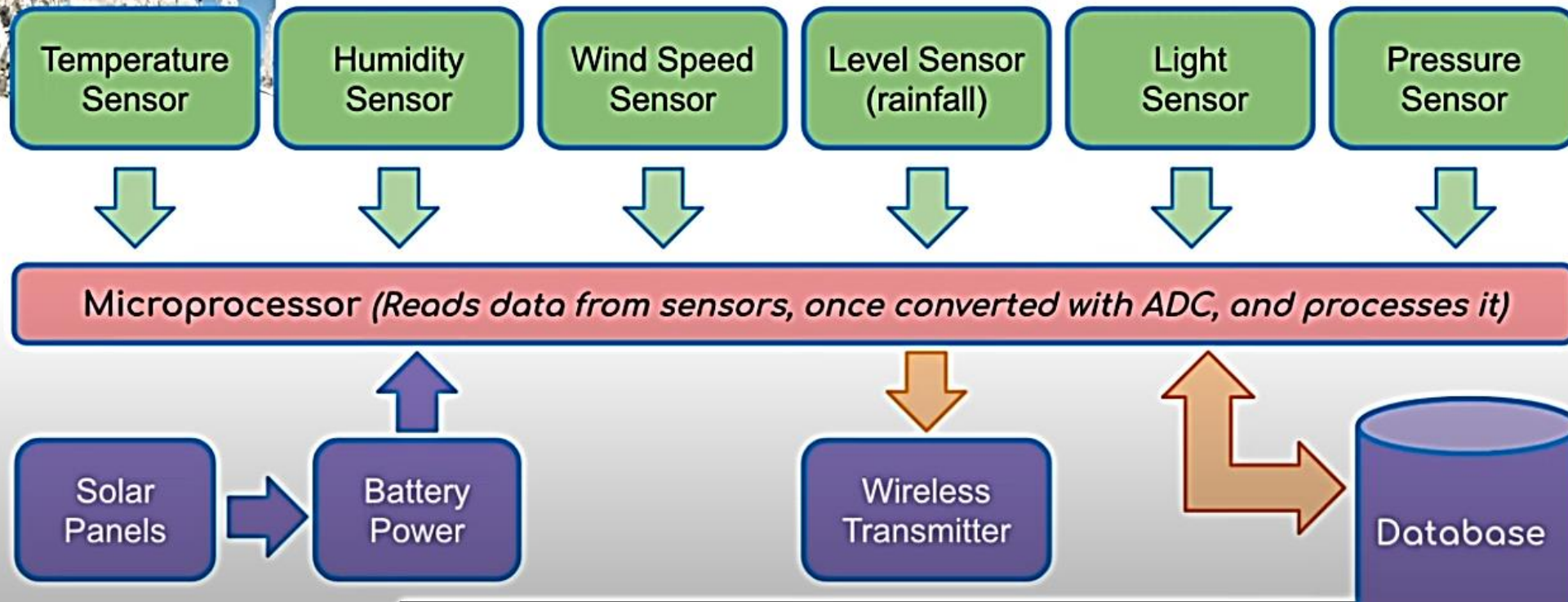
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# Industrial



## WEATHER (Station) AUTOMATED SYSTEM

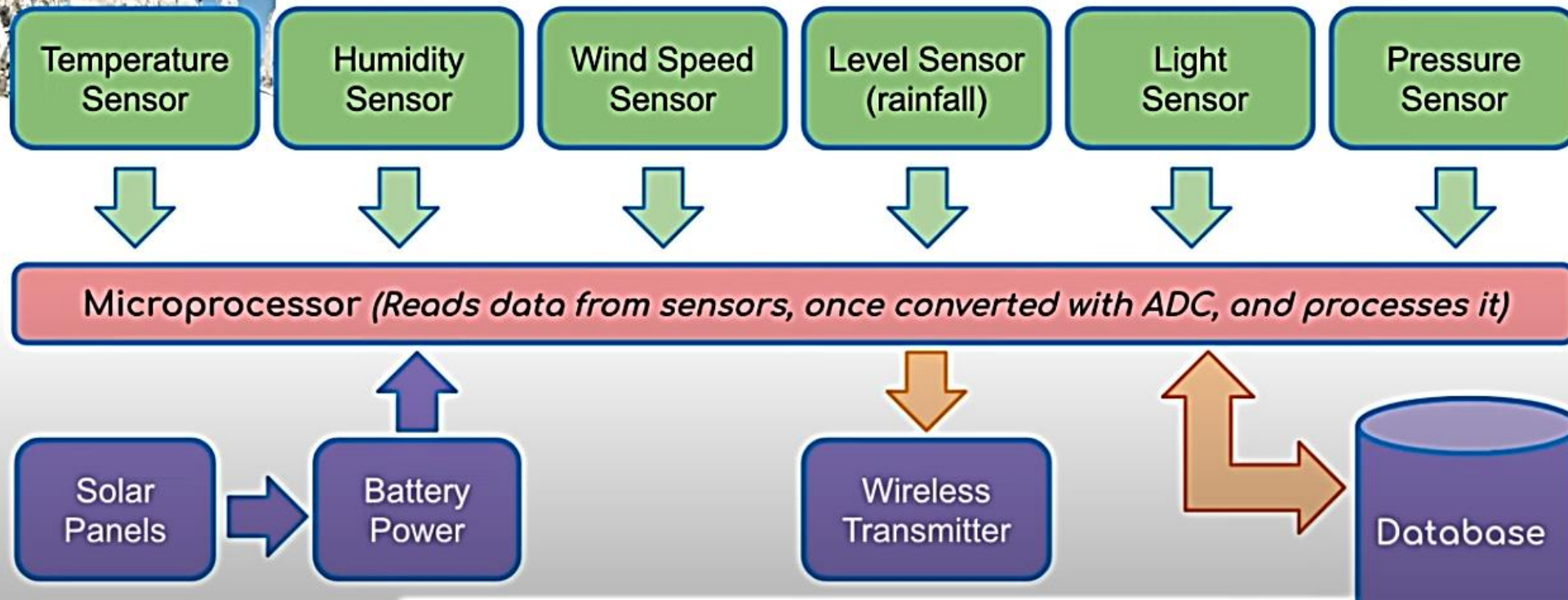




# Industrial

Automated weather stations are designed to gather information from remote regions (where people don't want to be), or where constant weather data is a requirement.

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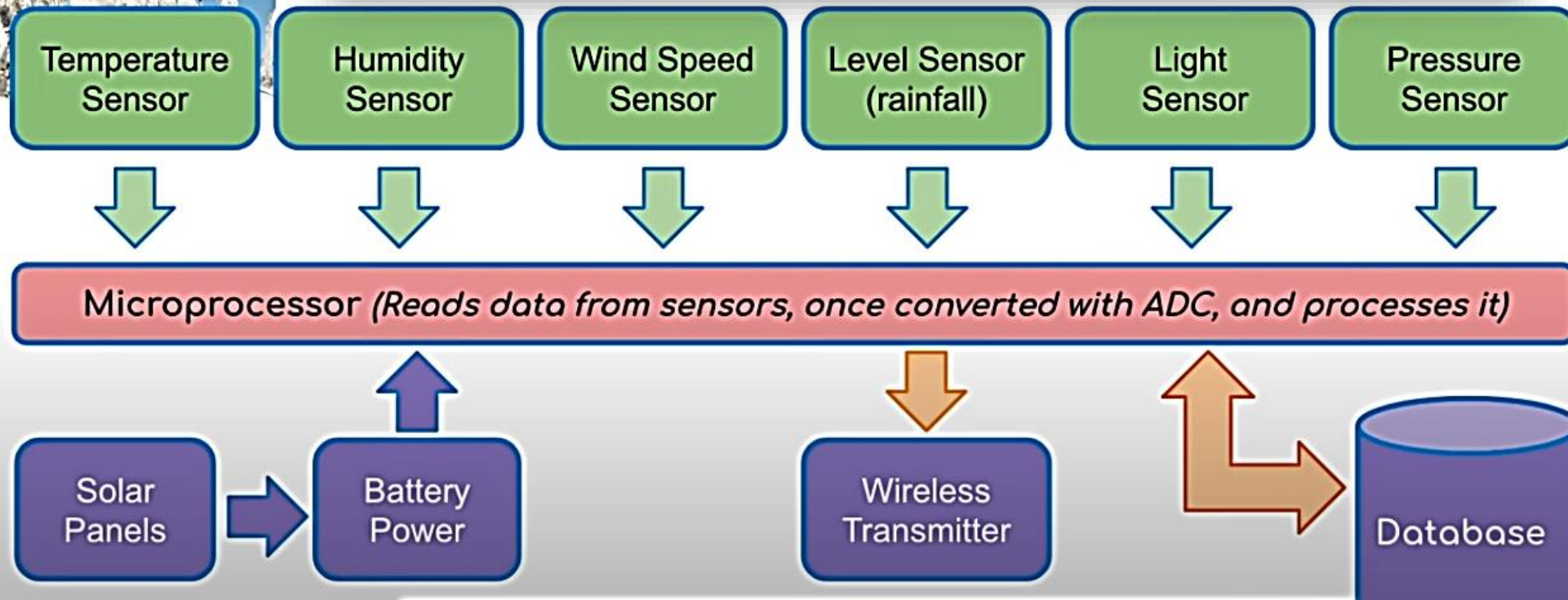




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Automated weather stations are designed to gather information from remote regions (*where people don't want to be*), or where constant weather data is a requirement.

These automated weather stations require a microprocessor, storage (database), battery (usually with solar-powered charging) and a range of sensors



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Temperature Sensor

Humidity Sensor

Wind Speed Sensor

Level Sensor (rainfall)

Light Sensor

Pressure Sensor

The information collected from sensors is sent to the microprocessor; any calculations are then done (*for example, calculate hours of daylight, amount of rainfall and wind direction*). The data from the sensors and the calculated values are then stored on a central database.

from sensors, once converted with ADC, and processes it)

Solar Panels

Battery Power

Wireless Transmitter

Database



# Industrial



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Some automated weather stations are sited near airports, where reports are sent out automatically every five minutes to pilots in the vicinity of the airport.

Wireless Transmitter

Database



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The only part of the weather station that might need to use actuators is the 'tipping bucket rain gauge'.

At a preset time interval, the microprocessor sends a signal to an actuator, which tips a bucket that has been collecting rainwater.


Solar Panels

Battery Power

Transmitter

with ADC, and processes it)

Database



# **AUTOMATED SYSTEMS & EMERGING TECHNOLOGIES**

**Fritz Eugene Bansag**



# Automated Systems Summary

## TRUE OR FALSE

Automated Systems leads to less consistent result products.

**ANSWER**



# Automated Systems Summary

## TRUE OR FALSE

Automated Systems leads to less consistent result products.

**FALSE**

# Automated Systems Summary

## TRUE OR FALSE

Automated Systems are more expensive to setup than traditional manual systems



# Automated Systems Summary

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**TRUE**

# Automated Systems Summary

## TRUE OR FALSE

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# Automated Systems Summary

## TRUE OR FALSE

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# Automated Systems Summary

## TRUE OR FALSE

Automated Systems generally require enhance maintenance when compared to manual systems.

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# Automated Systems Summary

## TRUE OR FALSE

Automated Systems allow processes to run at optimum conditions at all time.



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**TRUE**

# Automated Systems Summary

## TRUE OR FALSE

Software failures, due to unforeseen conditions, are unlikely to impact on an automated systems

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**FALSE**



# Automated Systems Summary

## TRUE OR FALSE

Automated Systems will react more quickly to unusual process conditions.

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## TRUE OR FALSE

Automated Systems will react more quickly to unusual process conditions.

**TRUE**

# Cambridge Exam Style Question (8 Pts.)

A theme park has a game where a player tries to run from the start to the finish without getting wet. The system for the game uses sensors and a microprocessor to spray water at a player as they run past each sensor. Describe how the sensors and the microprocessor are used in this system.

- A motion sensor collects analogue data [1]
- This data is converted to digital using ADC [1]
- The sensor sends data to the microprocessor [1]
- where the data is compared to stored data [1]
- If the value is outside range water will be sprayed [1]
- A signal is sent to the actuator to spray water [1]
- If the value is within range no action is taken [1]
- This runs in a continuous loop [1]



# AUTOMATED & EMERGING TECHNOLOGIES

Fritz Eugene Bansag



# Objectives

- Identify the advantages of automated systems.
- Identify the disadvantages of automated systems.
- Describe what robots are and its characteristics
- Advantages and disadvantages of robots



# KNOWING WHAT YOU KNOW

## STARTER

### LEARNING FOCUS

Go to:

<https://joinmyquiz.com>

Join Code: \_\_\_\_\_

- What Automated System is
- What robot & robotics are
- Characteristics of Robots



# Automated Systems Key Areas of Application

- 1. Industrials**
- 2. Weather**
- 3. Science**
- 4. Lighting**
- 5. Transport**
- 6. Gaming**
- 7. Agriculture**

- 1. Can you think on what impact will automated systems can have on the different areas of application?**
- 2. What are the benefits automated systems can bring?**
- 3. What drawbacks does automated systems have?**

# AUTOMATED SYSTEMS APPLICATIONS

## INDUSTRY

### Advantages

- Reduced labour costs
- Improved efficiency and accuracy
- Increased production rate

### Disadvantages

- High initial investment
- Limited flexibility to changes in production processes
- Maintenance costs can be high

# AUTOMATED SYSTEMS APPLICATIONS

## TRANSPORT

### Advantages

- Improved safety and reliability
- Reduced labour costs
- Improved fuel efficiency

### Disadvantages

- High initial investment
- May not be suitable for all types of transportation
- Maintenance costs can be high



# AUTOMATED SYSTEMS APPLICATIONS

## AGRICULTURE

### Advantages

- Increased efficiency in planting and harvesting crops
- Improved crop yield and quality
- Reduced labour costs

### Disadvantages

- High initial investment
- May not be suitable for all types of crops or terrain
- Maintenance costs can be high

# AUTOMATED SYSTEMS APPLICATIONS

## WEATHER

### Advantages

- Improved accuracy in weather prediction
- Ability to issue warnings in a timely manner
- Ability to collect large amounts of data quickly

### Disadvantages

- May be affected by external factors like interference or equipment failure
- May not be 100% accurate all the time
- May require continuous monitoring and calibration

# AUTOMATED SYSTEMS APPLICATIONS

## GAMING

### Advantages

- Improved speed and efficiency in game development
- Ability to create complex and interactive games
- Reduced labour costs

### Disadvantages

- May not be suitable for all types of games or game development
- May require significant programming expertise
- May be affected by technical glitches or bugs

# AUTOMATED SYSTEMS APPLICATIONS

## LIGHTING

### Advantages

- Improved energy efficiency
- Ability to program lighting to suit different needs
- Reduced labour costs

### Disadvantages

- High initial investment
- May not be suitable for all types of lighting needs
- Maintenance costs can be high



# AUTOMATED SYSTEMS APPLICATIONS

## SCIENCE

### Advantages

- Improved speed and accuracy in data collection and analysis
- Ability to carry out complex experiments
- Reduced labour costs

### Disadvantages

- High initial investment
- May not be suitable for all types of experiments
- May require significant technical expertise

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# Emerging Technologies ROBOTICS

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AUTOMATED SYSTEMS & EMERGING TECHNOLOGIES



# KNOWING WHAT YOU KNOW

## STARTER

**GO TO:**

<https://joinmyquiz.com>

Join Code: **570664**

## LEARNING FOCUS

- What automated system is
- What robots and robotics are and its characteristics.
- Advantages and Disadvantages of robots



# Emerging Technologies

## ROBOTS & ROBOTICS

- A robot is a term coined by Karel Capek in the 1921 play RUR (Rossum's Universal Robots).
- A robot describes a computerized machine designed to respond to input received manually or from its surroundings. Today, robots perform repetitive and often difficult tasks, such as building cars or computer equipment
- Robotics is an interdisciplinary field that integrates science, engineering and technology. It involves design, construction, operation and use of machines called robots to perform tasks done traditionally by human beings or substitute for human actions.
- The goal of robotics is to design machines that can help and assist humans.

# Emerging Technologies

## LAWS OF THE BOTS

- 1. The Three Laws of Robotics**, as quoted from Asimov's writings, are as follows:
  1. First law of robotics — A robot may not injure a human being or, through inaction, allow a human being to come to harm.
- 2. Second law of robotics** — A robot must obey the orders given it by human beings, except where such orders would conflict with the first law.
- 3. Third law of robotics** — A robot must protect its own existence, as long as such protection does not conflict with the first or second laws.

# ROBOTS VERSUS COMPUTERS

- A robot is a machine capable of manipulating or navigating its environment, and a computer is not. For example, a robot at a car assembly plant assists in building a car by grabbing parts and welding them onto a car frame.
- A computer helps track and control the assembly but cannot make any physical changes to a car.
- Another example would be to think of your human body as a robot and your brain as a computer. Your brain helps control your arms and legs to manipulate physical objects and move around. If you wanted to throw a ball, your brain visualizes and plans the actions required. When it is ready, your arm performs those tasks. Your arm throwing a ball is similar to a robotic arm at an assembly plant putting a car together

# ROBOT CHARACTERISTICS

- **Body**

Robots have physical parts. They have a structure that holds it together and mechanical parts that allow it to move. Without a body a robot would just be software (program).

- **Brain**

Robots have a control unit on-board that receives information from sensors and sends out commands to actuators. This part of the robot uses the program to know what to do. Without an on-board control unit (brain) it would just be a remote-controlled machine.

- **Sensors**

Robots have sensors that can gather information about the environment and sent that information to the control unit (brain)



# Emerging Technologies

## ROBOT CHARACTERISTICS

- **Actuators**

Robots have the ability to move. The parts of the robot that create the motion are called the actuators (also known as Prime Movers). Examples of actuators are motors, servos, solenoids, pumps and compressors

- **Program(Logic)**

Robots follow the instructions provided to it in a program. The program tells the brain when to turn on motors, lights, or make sound. The program also tells the brain what to do with the sensor information it is receiving. The program will tell the robot how to use sensor data to make decisions

# ADVANTAGES OF ROBOTS

- In many situations robots can increase productivity, efficiency, quality and consistency of products:
  - Unlike humans, robots don't get bored
  - Until they wear out, they can do the same thing again and again
  - They can be very accurate – to fractions of an inch (as is needed for example in manufacturing of microelectronics)
- Robots can work in environments which are unsafe for humans – in the nuclear or chemical industries for example
- Robots don't have the same environmental requirements that humans do – such as lighting, air conditioning or noise protection
- Robots have some sensors/actuators which are more capable than humans

# DISADVANTAGES OF ROBOTS

- The use of robots can create economic problems if they replace human jobs
- Robots can only do what they are told to do – they can't improvise
  - *This means that safety procedures are needed to protect humans and other robots*
- Although robots can be superior to humans in some ways, they are less dexterous than humans, they don't have such powerful brains, and cannot compete with a human's ability to understand what they can see.
- Often robots are very costly – in terms of the initial cost, maintenance, the need for extra components and the need to be programmed to do the task.

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# KNOWING WHAT YOU LEARNED

## PLENARY (PROGRESS CHECK)

**GO TO:**

<https://joinmyquiz.com>

Join Code: **421011**

### LEARNING REFLECTION

- Discuss with your seatmate 3 things that you have learned in the lesson topic.

# Emerging Technologies ROBOTICS

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AUTOMATED SYSTEMS & EMERGING TECHNOLOGIES



# Objectives

- You could complete the **Robotics & Computer Vision** activity
- You should complete the **AI Inference**
- You must complete **chatbots**





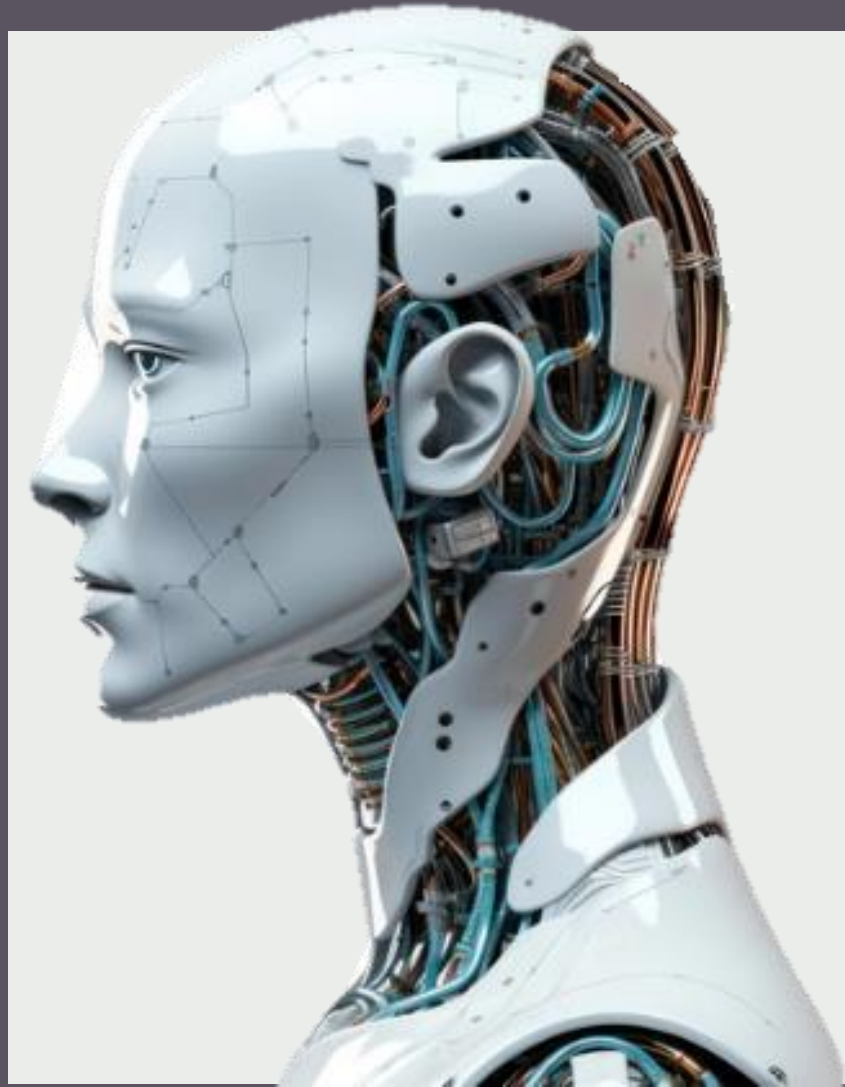
# Past Paper Questions

6 Four scenarios are given.

Identify the most suitable sensor for each scenario.

A **different** sensor must be used for each scenario.

Sensor	Scenario
	Detecting when a person is approaching an automatic door system
	Monitoring the pollution level in a river
	Checking if a tropical aquarium is 25 degrees Celsius
	Counting the number of cars that cross a bridge



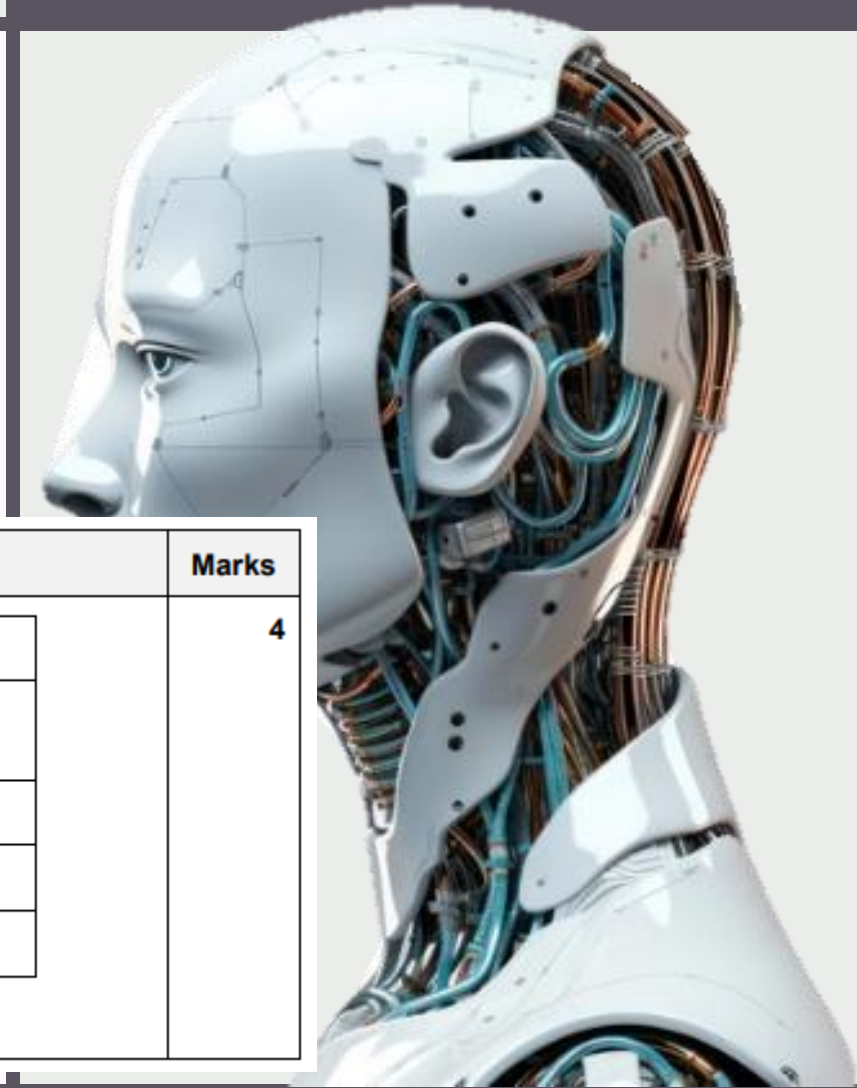


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Question	Answer	Marks										
6	<table border="1"> <thead> <tr> <th>Sensor</th> <th>Scenario</th> </tr> </thead> <tbody> <tr> <td>Pressure / motion / infra-red</td> <td>Detecting when a person is approaching an automatic door system</td> </tr> <tr> <td>pH / light</td> <td>Monitoring the pollution level in a river</td> </tr> <tr> <td>Temperature</td> <td>Checking if a tropical aquarium is 25 degrees Celsius</td> </tr> <tr> <td>Magnetic field / pressure / motion / infra-red</td> <td>Counting the number of cars that cross a bridge</td> </tr> </tbody> </table> <p>One mark per each correct sensor (each sensor <b>must</b> be different)</p>	Sensor	Scenario	Pressure / motion / infra-red	Detecting when a person is approaching an automatic door system	pH / light	Monitoring the pollution level in a river	Temperature	Checking if a tropical aquarium is 25 degrees Celsius	Magnetic field / pressure / motion / infra-red	Counting the number of cars that cross a bridge	4
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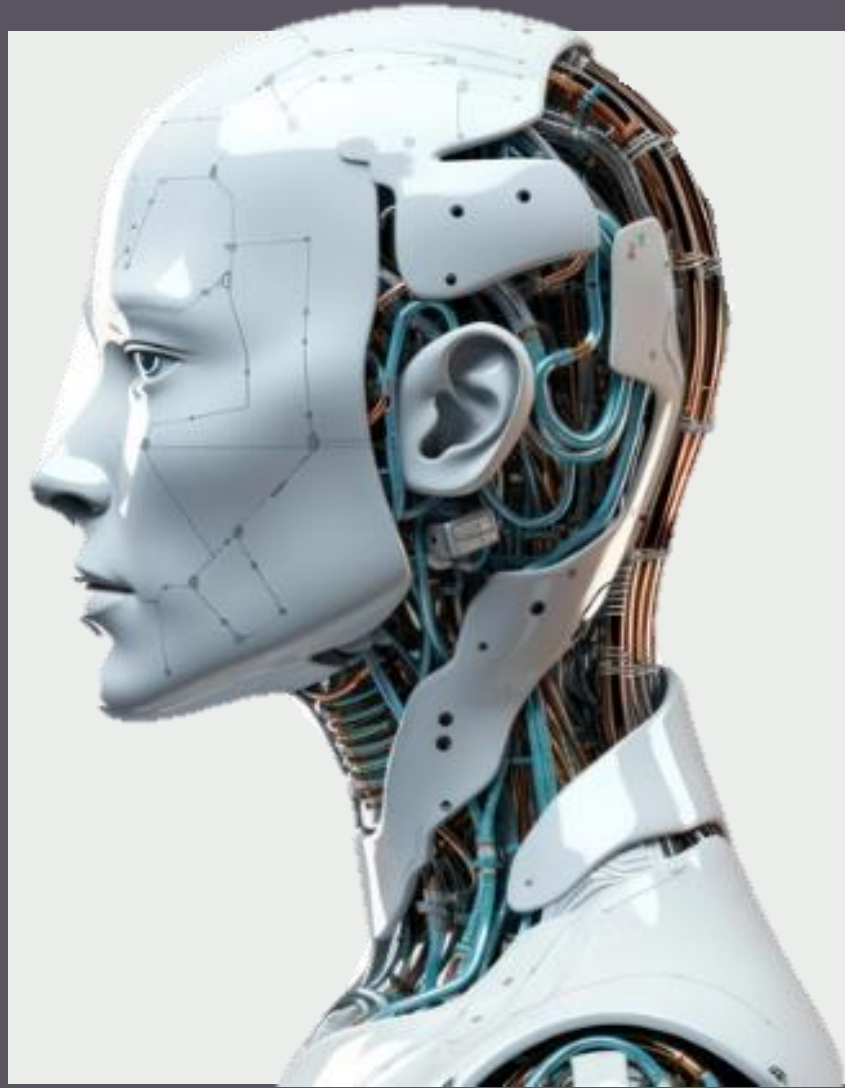
# Past Paper Questions

10

- 7 A room has an automatic lighting system. Electric lights are automatically turned on when a person enters the room and the natural light level in the room is 10 or less.

Explain how sensors and a microprocessor are used to control the electric lights in the room.

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# Past Paper Questions

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Question	Answer	Mark
7	<p>Any <b>seven</b> from:</p> <ul style="list-style-type: none"><li>• Uses light sensor <b>and</b> Infrared / Motion / Pressure sensor</li><li>• Sensors send data to the microprocessor</li><li>• Data is converted from analogue to digital (using ADC)</li><li>• Microprocessor compares both values to stored values</li><li>• If motion value is out of range/in range, light value is checked // If light value is <math>\leq 10</math>, motion value is checked</li><li>• If light value is <math>\leq 10</math> lights are turned on // If motion value is out of range/in range lights are turned on ...</li><li>• ... by sending a signal to actuator</li><li>• Lights remain on for set period (and then turn off) // If motion is in range/out of range or light is <math>&gt; 10</math> then signal sent to turn lights off</li><li>• Process repeats / is continuous</li></ul>	7

# Complete the following

- You could complete the **Robotics & Computer Vision** activity
- You should complete the **AI Inference**
- You must complete **chatbots**





# THANK YOU

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