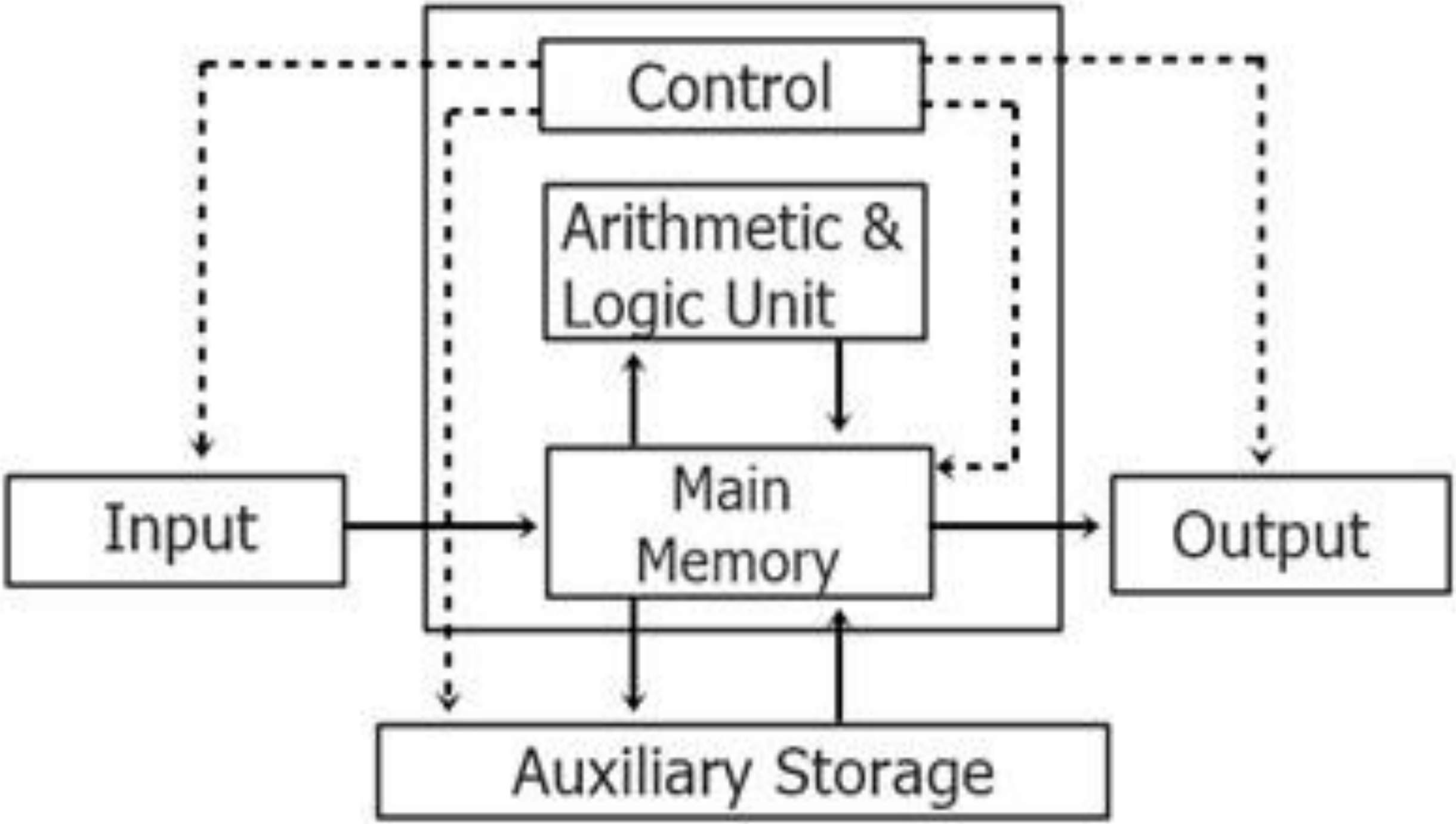
ST CLEMENT'S SECONDARY SCHOOL

COMPUTER SYSTEMS

SENIOR SECONDARY GRADE 11

COMPUTER SYSTEMS

- A computer system is a set of integrated devices that input, output, process, and store data and information.
- Computer systems are currently built around at least one digital processing device.
- There are five main hardware components in a computer system: Input, Processing, Storage, Output and Communication devices.


Control
Arithmetic &
Logic Unit
Input
Main
Memory
Output
Auxiliary Storage

TYPES OF COMPUTER SYSTEMS

- Batch processing systems
- Interactive systems
- Control systems
- Satellite navigation Systems
- Expert Systems
- Automated systems

Batch processing systems

- It is a computerized system that processes transactions accumulated over a period of time.
- This means that in batch processing, there is no interaction with the user when the program is being executed.
- It is useful for operations that require the computer or a peripheral device for an extended period of time.
- Batch jobs can be stored during working hours then processed during the evening.

Applications of batch systems

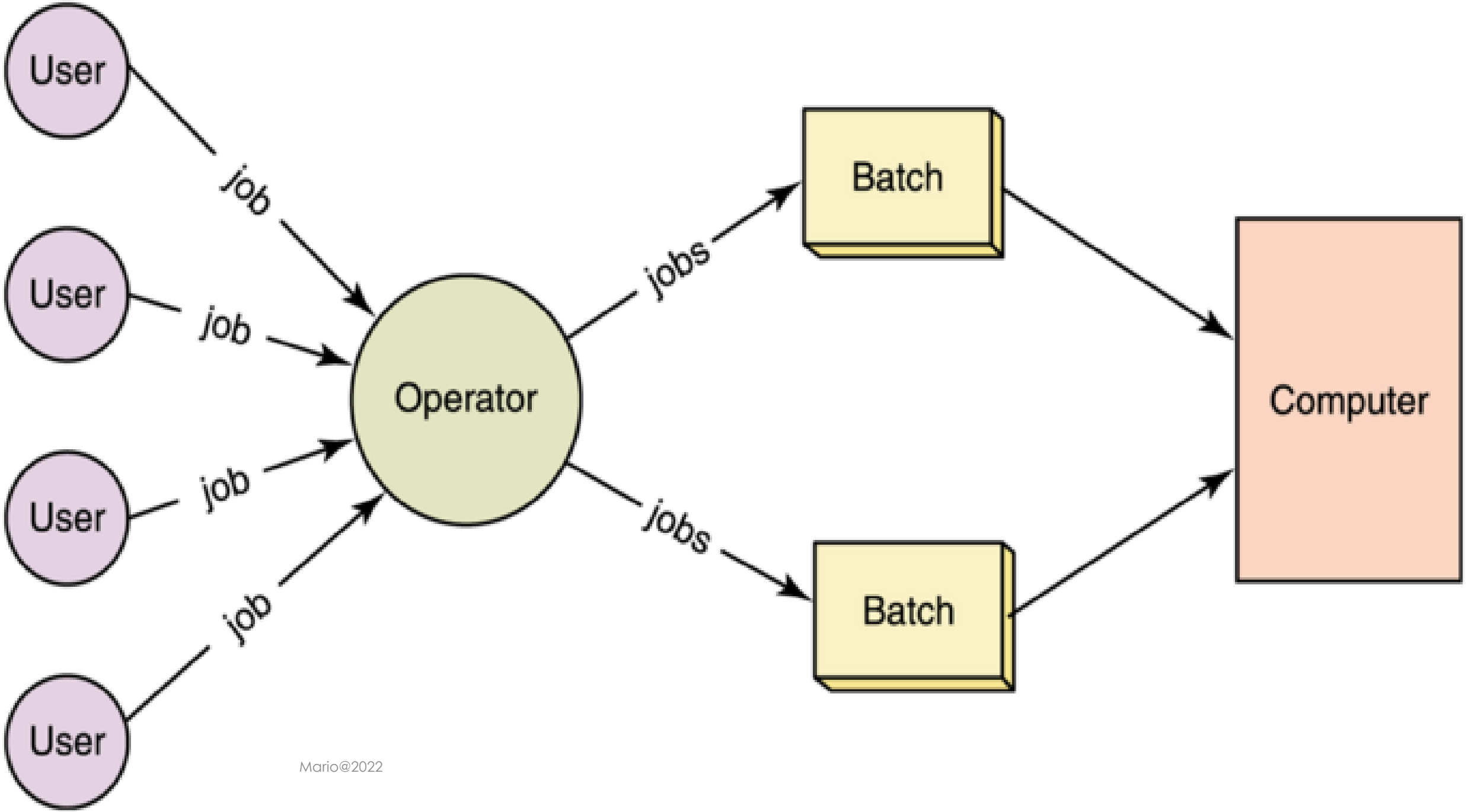
- Retail outlets
- Stock control programs
- Utility bills
- Producing monthly bank account statements.
- Payroll processing.

Benefits of batch processing

- Tasks to be processed can be scheduled during time when the computer is idle.
- The operator can delay or easily optimize different batches depending on need or urgency.
- Batch jobs are standard computer files containing commands, programs and data.
- Can run the program only once for many transactions.
- It avoids under utilization of computing resources.

Limitations of batch processing

- Time delay between collecting the input data and getting an output.
- If data is not checked properly during or before input, even minor errors and program crushes that occur during batch processing may bring the whole process to halt.
- Once the process starts, the user has less control and limited access to the system.
- It requires expensive computers that may not break easily due to long processing hours.


User
User
User
User
job
job
job
job
Operator
jobs
jobs
Batch
Batch
Computer

Exercise

Aeroplanes use on-board computer power to allow them to operate more efficiently and safely.

(a) Why computer systems thought to be safer than human pilots?

(b) Despite having computer systems in plane. Why still pilots needed?

(c) State two application of Batch processing systems.

Interactive systems

- Interactive systems refers to computer and technology systems consisting of interactive components.
- The components often take the form of user interfaces that allow the user of a particular computer or software to effectively work with the system.
- Interactive system is a computing device in which the user and the computer communicate by issuing instructions where the computer responds or prompts for a response.

Ways of interacting with the system

- Command line
- Menu list
- Graphical user interface
- Speech interaction

Examples of tasks that require interactive systems

- Transaction data entry
- Games
- Web browsing

Forms of interactive system software

- Operating system
- Banking software
- Software used to create graphics or manipulating audio and video
- Google glass and motion sensors that track the movement of the user.

- The basic idea behind most of these interaction technologies is to enhance user experience by minimizing typing using input devices such as keyboard.

Benefits of interactive systems

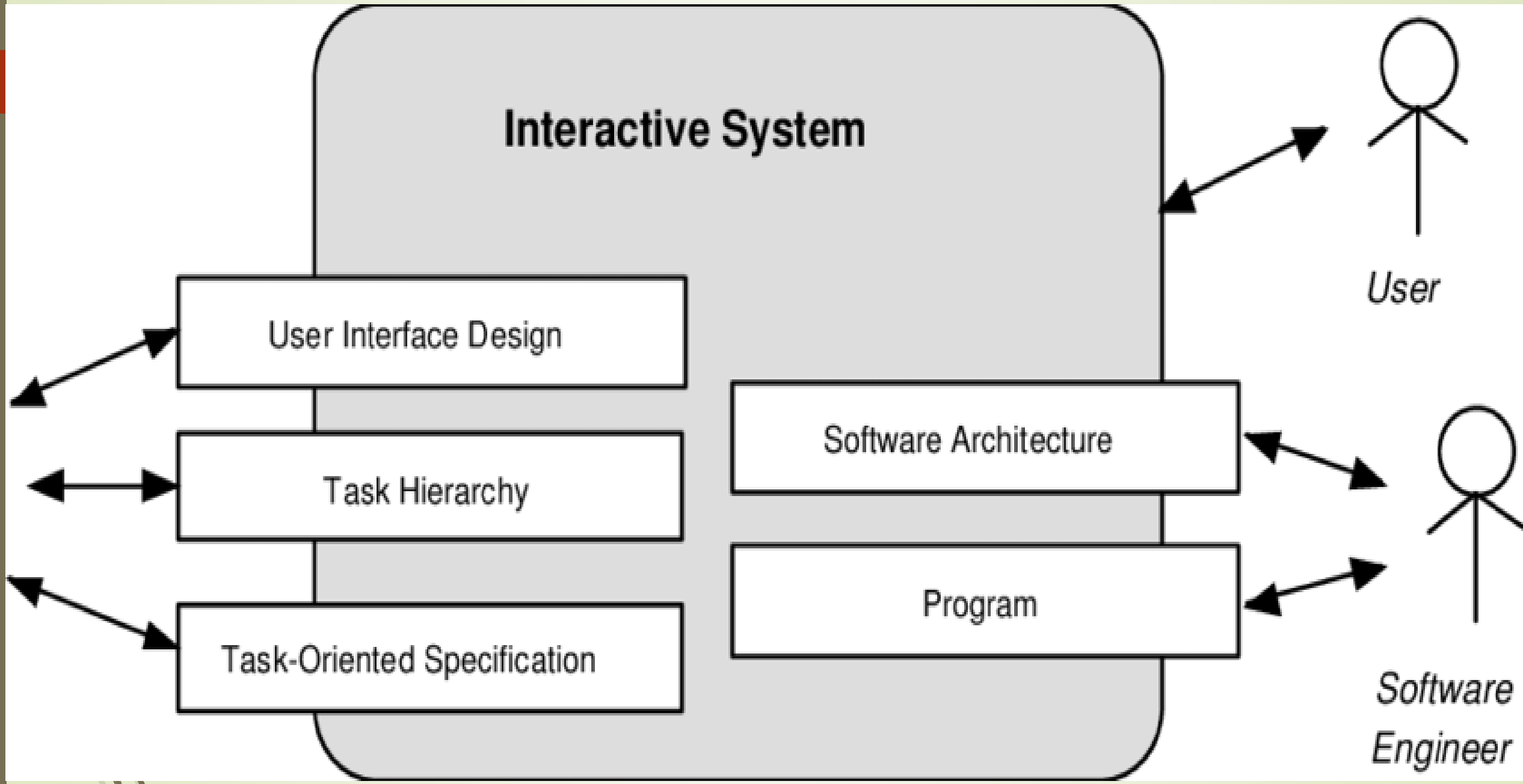
Visibility of the system status user is informed about what is going on and appropriate feedback is provided within a reasonable time about the user's action.

- **Match between the system and the real world:** in most systems, the language used to interact with users is simple with words, phrases and concept used being familiar to the user.
- **user control and freedom:** most interactive systems allow users to easily navigate the system.

- **Consistency and standards:** most systems provide similar ways of performing similar actions.
- **Help users recognize, diagnose, and recover from errors:** the system provide users with error message.
- **Help and online documentation:** the come with online help and documentation that are used to learn the system.

Limitations of interactive systems

- Expensive to acquire
- Poorly designed and tested interactive system may fail to respond due to software or hardware problem, invalid input or illegal operations.
- Those using voice recognition may have problems recognizing some words hence, making it difficult for the user to operate them.


Interactive System
User Interface Design
Task Hierarchy
Task-Oriented Specification
Software Architecture
Program
User
Software Engineer

Network/Online systems

- Network systems are automated processing systems that are operated using terminals or computers that are remote from the central processing unit via a computer network.
- They may be real-time, that is processing take place as the data is input, the system can provide responses after some time in the case where time is not a critical factor.
- They support multiple users and involve updating a remote database accessible through LAN or WAN.

Application

- Airline reservation systems
- Automatic teller machines (ATMs)
- Online order entry
- e-Learning
- Online shopping
- Cloud computing

Benefits of online systems

- Timeless
- Error handling
- Cost is low
- Large storage and processing capacity
- Platform independence
- Larger geographical coverage

Limitations of online systems

- It hard to check if what you buy is exactly the quality you want.
- There is an increase in cybercrime.
- A breakdown in the network connection may disrupt services.
- Sometimes it is expensive and insecure.

Monitoring and Control systems

- This is an automated system designed to monitor and regulate a process to ensure the optimal performance.
- **The processes include**
- crop management,
- patient monitoring, such as pulse, respiration rate, blood pressure.
- human resource management
- Industrial processes.

Monitoring system

- A monitoring system is a software that helps the system administrators monitor their infrastructure.

Types of monitoring systems

- System monitoring
- Integrated and API monitoring
- Business Activity monitoring
- Web performance monitoring
- Real User Monitoring
- Security monitoring

Control system

- This is a type of computer system that manages, commands and directs other devices or systems.

Types of control systems

1. Open loop control system (non-feedback)
2. Closed loop control system (feedback)

Application

- In agriculture
- In healthcare
- In business sector
- In manufacturing industry

Benefits of monitoring and control systems

- It minimizes the time required to check for proper operations, take readings and make adjustments.
- They provide information that would otherwise be unavailable, enabling personnel to quickly identify malfunctions before a complete failure occurs.
- It reduces maintenance cost.
- Information management.
- Improved working conditions
- Worker's safety

Limitations of monitoring and control systems

- Software may be expensive
- If the computer system malfunctions, monitoring and control operations affected.
- The system can only responds in the way it has been programmed.
- In case of patients, computers are unable to read the physical variables directly because sensors are analogue, however, computers are digital.

Exercise

A hospital uses a computer system to control and monitor a patient's condition.

a) State the difference between control system and monitoring system.

b) Name two physical variables that could be monitored to check the patient's condition.

c) Explain why computers cannot read physical variables directly.

SATELLITE NAVIGATION SYSTEMS

Satellite navigation system

- Satellite navigation system is a system of artificial satellites capable of providing geospecific positioning everywhere in the world

Use of Satellite systems

- Small electronic receivers calculate their position, including latitude, longitude, and height from the mean sea level with utmost precision.

Core satellite navigation systems

There are four core **satellite navigation systems**, currently

1. GPS (United States)
2. GLONASS (Russian Federation)
3. Beidou (China)
4. Galileo (European Union).

The Global Positioning System (GPS)

- The Global Positioning System (GPS) is a space-based radio-navigation system consisting of a constellation of satellites broadcasting navigation signals and a network of ground stations and satellite control stations used for monitoring and control.
- It estimates time of arrival to destinations
- It warns the drivers/pilots if he/she exceeds the speed limit.

Benefits or advantages of Satellite Navigation System

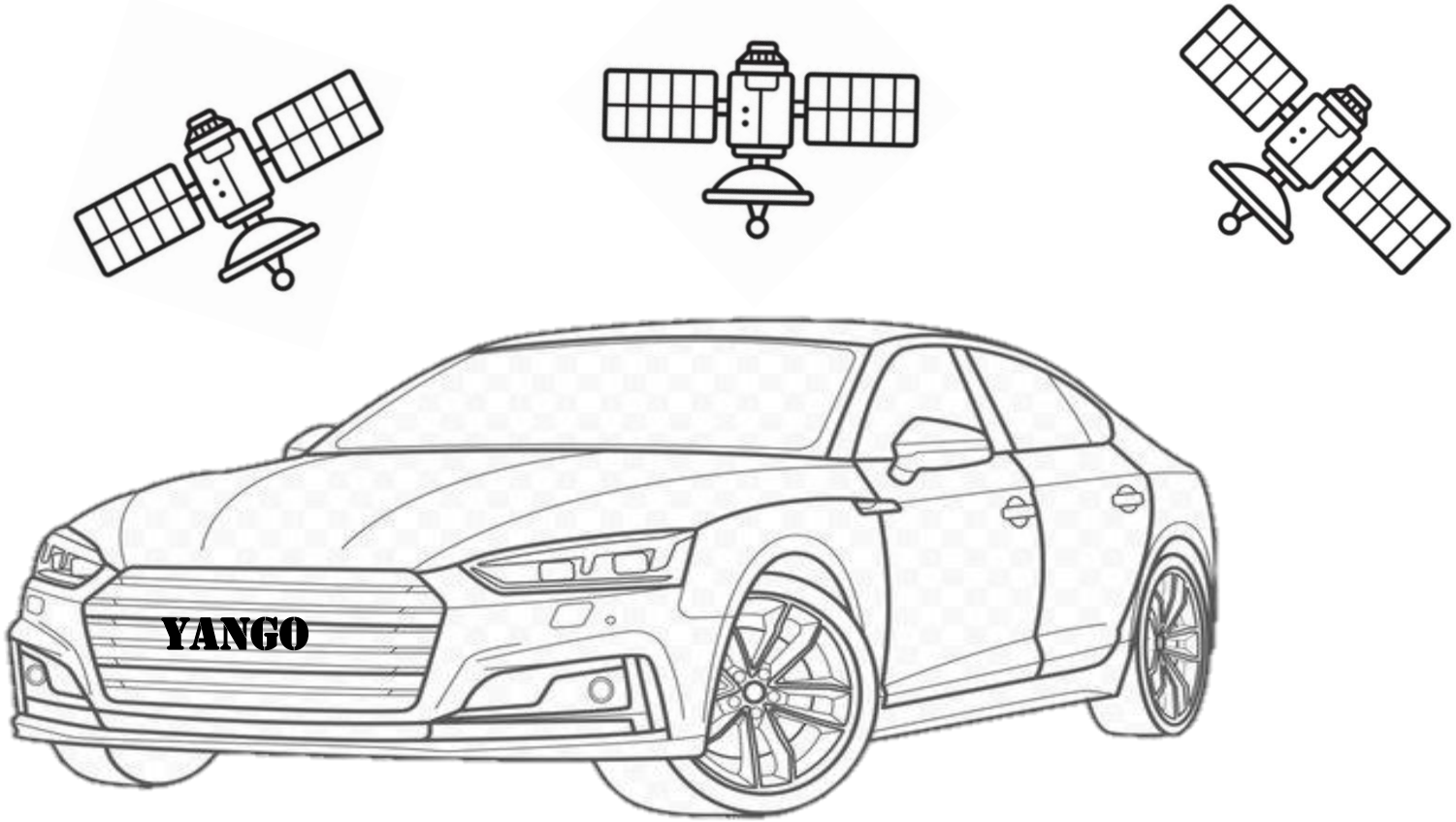
- It helps people to reach their destinations.
- It helps to track parcels, stolen vehicles, missing persons, properties etc.
- It helps to improve vehicle traffic flow by guiding drivers about possible congested routes.
- It helps in scientific research in meteorology, troposphere, geodesy.
- It helps users in shopping by providing nearby retail outlet and not need to read the Maps or memorise routes
- There is no charge or fees to be paid by users to avail this service.

Drawbacks or disadvantages of Satellite Navigation System

- The receiver on the device consumes more power and hence need battery or recharging.
- The GPS signal can not pass through walls or solid structure. Hence it is difficult to make use of this service in indoor locations such as underground store
- GPS accuracy depends on several factors such as multipath, interference from EM waves and so on. Hence it gives error of about 5-10 meters.
- It is in the hand of USA to allow or deny the GPS service to the users.

Exercise

The picture below shows Yango Transport and Satellite navigation systems that are used to give the vehicle direction to the driver. study it and answer the questions



(a) What does GPS stand for?

(b) How does the system know the exact position of the vehicle?

(c) Give two advantages to the driver of using this system.

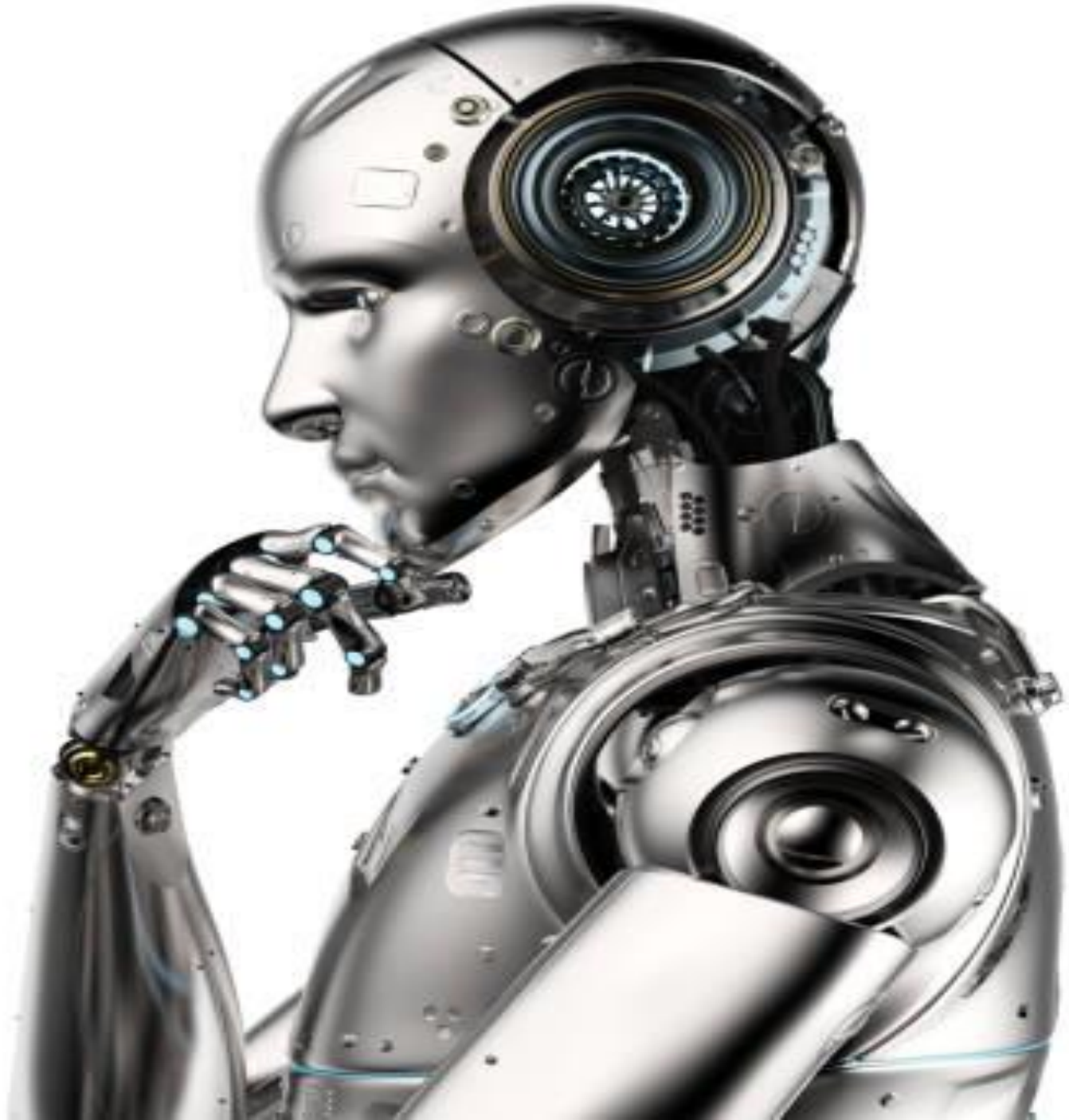
(d) Give one problem associated with satellite navigation systems.

(e) Name one other different form of transport which could use satellite navigation system.

(f) Describe how the computer on board the car uses GPS to find its exact location.

Automated systems and Robots

- Automation refers also to as automatic control is the use of control systems to operate equipment such as machinery, industrial processes, telephone networks, aircraft and other applications that require minimal human intervention.
- Computer controlled systems and equipment such as robots have revolutionised the way tasks that are difficult and hazardous to human are executed.
- A robot is an automated device designed to intelligently carryout routine tasks.



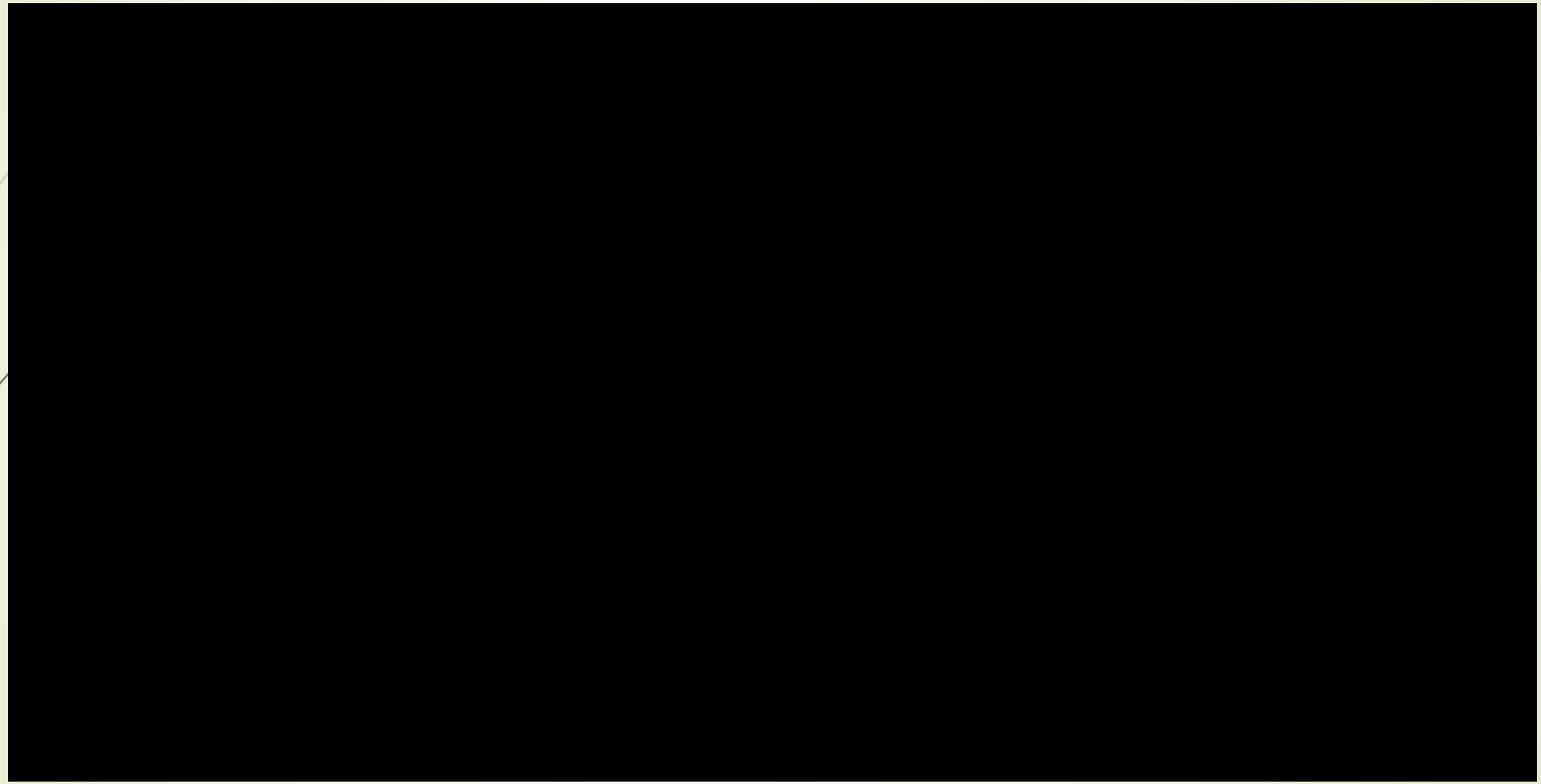
Routine tasks carried out by Robots

- Lifting heavy items
- Assemble part together
- Join parts using glue
- Spray painting

Application of Robots

- Industries, such as automobile manufacturing to perform repetitive tasks.
- Spraying car parts
- Many aspects of robotics involve artificial intelligence by being equipped with equivalent of human sense of motion, vision, touch, smell and ability to sense temperature.
- Some robots are capable of reasoning, such as avoiding obstacles on the pathway.

Video of a robot



Benefits of Automated systems and Robots

- Robots can work all time with no break.
- Robots are accurate
- Robots can perform tasks more quickly
- Robots do not get tired.

Limitations of Automated systems and Robots

- Robots cannot easily adapt to unusual conditions.
- People are rendered unemployed
- People are deskilled
- Robots are expensive

Exercise

In the near future, most of the work by human being will be taken over by robots.

a) Give two advantages of robots.

b) Give two disadvantages of robots.

c) State two industrial applications of robots

d) State two major differences between a human being and a robot in performing tasks.

Multimedia systems and applications

- Multimedia is the field concerned with computer controlled integration of text, graphics, drawings, still and moving images(video), audio and animation.
- Multimedia systems can be defined as any application that combines text, graphics, drawings, still and moving images(video), audio and animation or virtual reality.

Examples of multimedia systems

- Computer games
- Computer-assisted design
- Flight simulators
- Screencast
- Animation still photo

Elements of multimedia systems

Hardware elements

- Signal/ data source
- Signal capture equipment
- Storage
- Compressors
- Synchronizers
- integrator

Multimedia Software

- Presenter software
- Multimedia-browser
- videoScriber
- Proclaim online
- Adobe premiere

Benefits of multimedia systems

- They provide information is a multimodal manner to the user.
- They present information in more appealing manner to the user.
- They are easier to learn and use.

Limitations of multimedia systems

- They require special hardware which can be expensive and difficult to configure.
- They require upto date hardware and software to avoid incompatibility issues.
- They require powerful computers with large processing power and memories.
- Require large bandwidth to transmit.

Exercise

Multimedia systems are popular among teachers in preparing and presenting lessons.

a) State two elements of a multimedia lesson.

b) Give an example of the software that would help to produce a multimedia lesson.

c) Give one benefit of using multimedia in a lesson

EXPERT SYSTEMS

Expert systems

- An expert system is a computer program that uses artificial intelligence (AI) technologies to simulate the judgment and behavior of a human or an organization that has expertise and experience in a particular field.

Components of expert system

1. **A knowledge base** -Knowledge-based systems usually contain three components: a human-computer interface , a Rules base, and an inference engine program.
2. **The search or inference system**,
3. **A knowledge acquisition system**
4. **The user interface or communication system.**
5. **Explanation module.**

Applications of Expert Systems

- Information management.
- Hospitals and medical facilities.
- Help desks management.
- Employee performance evaluation.
- Loan analysis.
- Virus detection.
- Useful for repair and maintenance projects.
- Warehouse optimization.

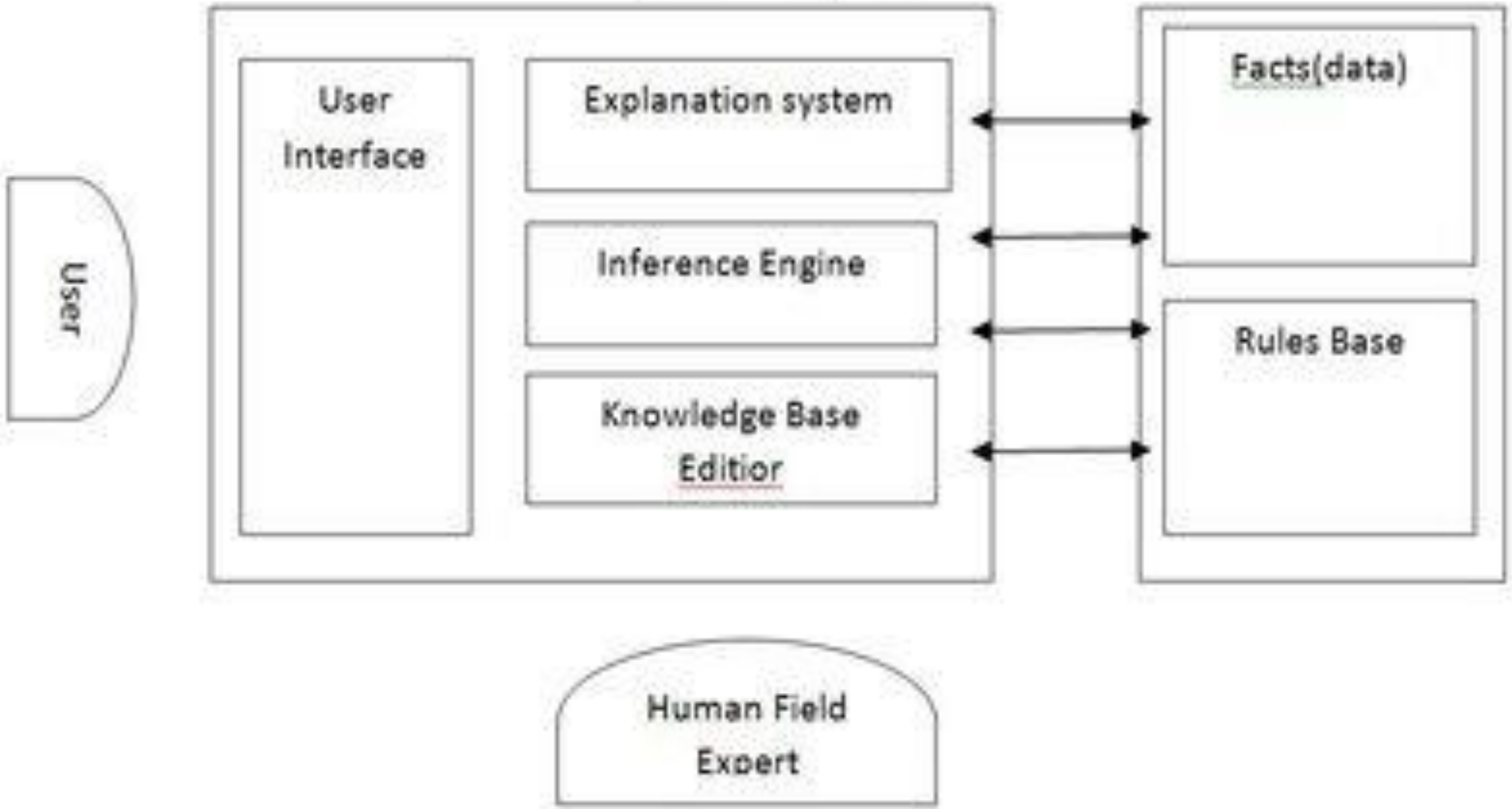
Benefits of an expert system

- Improves decision-making quality.
- Cost-effective, as it trims down the expense of consulting human experts when solving a problem.
- Provides fast and robust solutions to complex problems in a specific domain.
- It gathers scarce knowledge and uses it efficiently.

Disadvantages

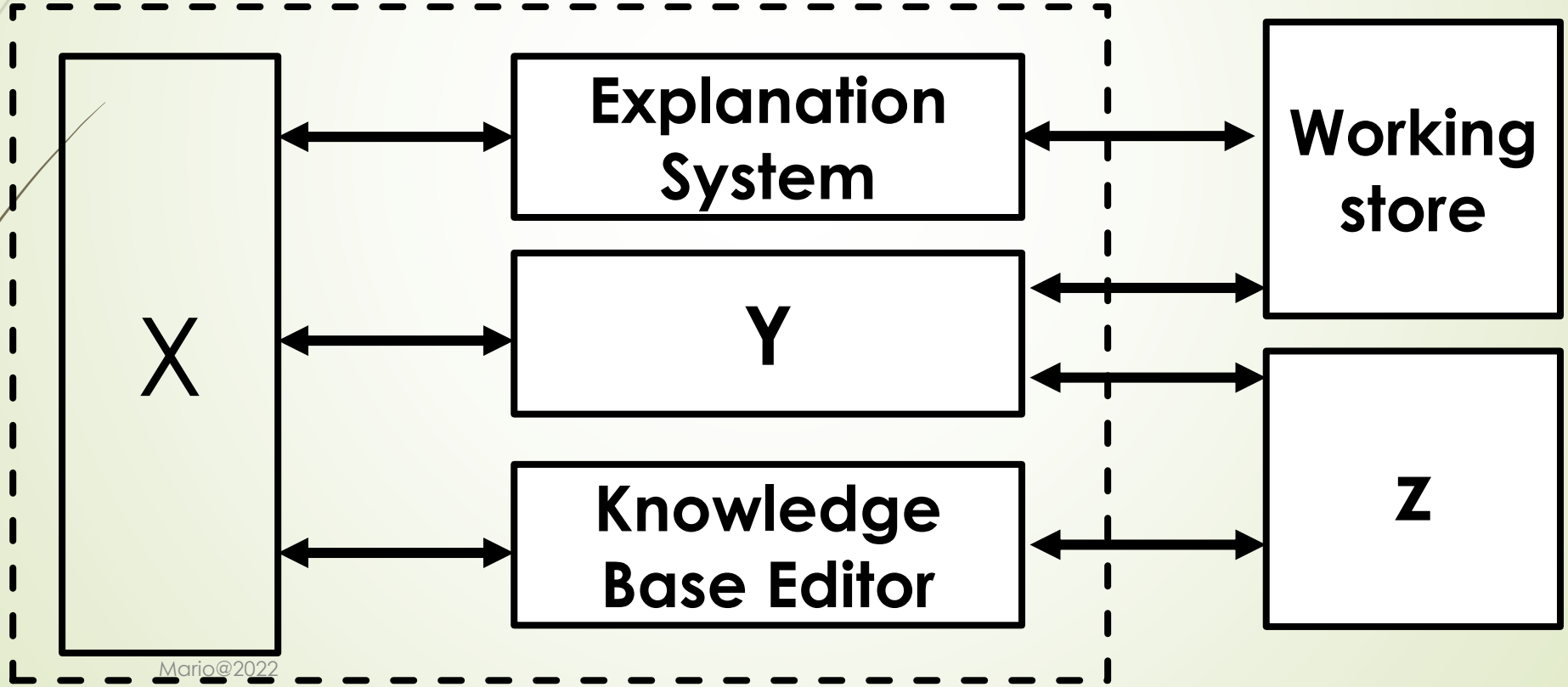
- No common sense used in making decisions.
- Lack of creative responses that human experts are capable of.
- Not capable of explaining the logic and reasoning behind a decision.
- It is not easy to automate complex processes.
- There is no flexibility and ability to adapt to changing environments.

Expert system



EXERCISE

The following diagram shows the a typical expert system.



(a) Explain the Expert system.

(b) Name the missing labels X, Y and Z .

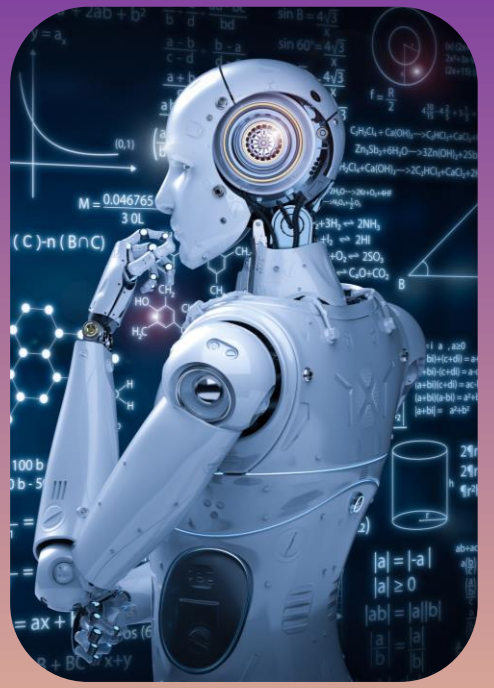
(c) Name one component makes up the knowledge base.

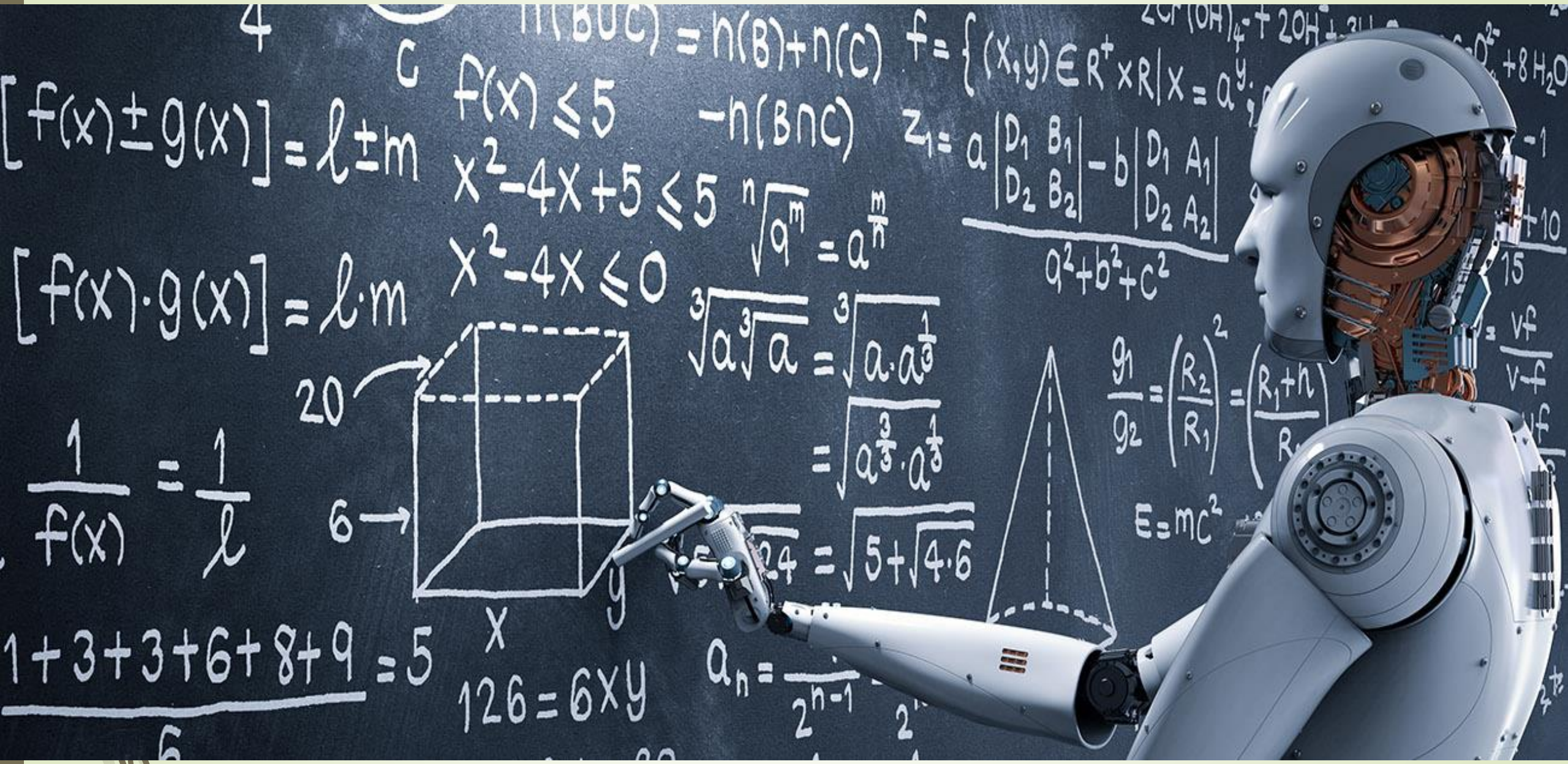
(d) Give two advantages of Expert Systems

(e) Give two disadvantages of Expert systems.

(f) Give two applications of Expert systems.

ARTIFICIAL INTELLIGENCE




[f(x)±g(x)]=ℓ±m
[f(x)·g(x)]=ℓ·m
1/f(x) = 1/ℓ
1+3+3+6+8+9/6 = 5
f(x) ≤ 5
x²-4x+5 ≤ 5
x²-4x ≤ 0
20
6
x
y
126=6xy
n(B∪C) = n(B)+n(C) - n(B∩C)
f = {(x,y) ∈ R⁺ × R | x = a^y}
z₁ = a|D₁ B₁; D₂ B₂| - b|D₁ A₁; D₂ A₂| / a²+b²+c²
ⁿ√(a^m) = a^(m/n)
E=mc²

- Artificial Intelligence, or AI, is a technology that allows a computer program to learn, reason, and act on its own.
- It's a machine-to-machine emulation of human intellect that makes them do things that humans normally do.
- In simplest terms, AI refers to a device's ability to function similarly to human intelligence and perform tasks that humans would perform.

Specific applications of AI

- Expert systems,
- Natural language processing,
- Speech recognition
- Machine vision.

Examples of AI-Artificial Intelligence

- Google Maps and Ride-Hailing Applications.
- Face Detection and recognition.
- Text Editors and Autocorrect.
- Chatbots.
- E-Payments.
- Search and Recommendation algorithms.
- Digital Assistant.
- Social media.

Pros of AI

- AI is highly accurate and its use reduces human error
- AI allows automating repetitive tasks in different industries
- AI can easily handle and process Big Data
- AI can fetch insights faster from processed data which allows faster Decision-Making. AI also has continuous availability and does not require breaks like humans.
- AI-powered Digital Assistants can easily interact with customers and reduce workloads of customer service staff by resolving customer queries through chats.

- AI helps to mitigates risks as AI systems can be deployed in environment which are hazardous to humans.
- AI can uncover trends and patterns from a given dataset faster than humans which makes AI suitable for decision-making.
- AI systems can assist organizations in designing and improving processes as well as workflows

Drawbacks/Cons of AI

- AI increases human dependency on machines which can lead to laziness.
- AI implementation requires businesses to invest in advanced infrastructure and training the employees which makes AI expensive.
- AI implementation can likely cause an increase in unemployment as AI systems can perform work of multiple human workers at once

- AI uses a set of algorithms for predictions which makes AI systems practical. These are less creative and innovative in challenging situations.
- AI cannot understand emotions which is a key aspect in sales and marketing
- It is difficult to implement ethics in AI systems.

MANAGEMENT OF COMPUTER SYSTEMS.

Managing computer

- Managing computer systems means understanding and controlling risks, which is necessary whether computers are managed by in-house staff, computer vendors, or intergovernmental technology collaborations.
- Managers of computer systems should have security policies based on identified risks.

Common problems in managing computer systems

- failure to strategize
- meeting organizational needs
- hiring and retaining good employees,
- staying current
- integrating all your technologies.

KABULA MAKHANGA
BICTed