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NPTEL ONLINE CERTIFICATION COURSE

An Initiative of MHRD

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Week 5:
Signal conditioning and Microprocessor Technology

Lecture 4: Microprocessor Technology

r of week five in this week we will be studying the in this week we will be studying the in this week we will be studying the important building block important building block important building block of an automated system that is of an automated system that is of an automated system that is microprocessor

Outline

- technology microprocessor technology microprocessor technology let us look at the outline of this let us look at the outline of this let us look at the outline of t

Outline

❖ Microprocessors: introduction

his lecture lecture lecture at start of the lecture we will see the at start of the lecture we will see the at start of the lecture we will see the definition of definition of definition of a micro

Outline

- Microprocessors: introduction
- Architecture, elements, operation

processor then we will see its architecture then we will see its architecture then we will see its architecture it has various elements it has various elements it has various elements how these ele

Outline

❖ Microprocessors: introduction
❖ Architecture, elements, operation
❖ Micro-controllers: definition and difference
❖ Micro-computers

ments operate how these elements operate how these elements operate then we will learn what is the then we will learn what is the then we will learn what is the difference between difference between difference between a microcontroller and a microprocessor a microcontroller and a microprocessor a microcontroller and a microprocessor the definition of microcontroller will the definition of microcontroller will the definition of microcontroller will be studied be studied be studied after that we will study after that we will study after that we will study the microcomputers which we are using the microcomputers which we are using the microcomputers which we are using for our regular day-to-day activities at the end of the lecture we will study at the end of the lecture we will study at the end of the lecture we will study about about about the plcs the programmable logic the plcs the programmable logic the plcs the programmable logic controllers controllers controllers which are used in the automation which are used in the automation which are used in the automation industry.

Outline

❖ Microprocessors: introduction

❖ Architecture, elements, operation

❖ Micro-controllers: definition and difference

❖ Micro-computers

❖ Programmable logic controllers (PLCs): elements, configuration and operation

Programmable Logic Devices (PLD)

- Programmable Logic Devices (PLD) - to perform different control functions, according to the programs written in its memory, using low level languages of commands.

its elements configuration and operation its elements configuration and operation its elements configuration and operation will be studied in detail will be studied in detail will be studied in detail fine let us begin in this lecture fine let us begin in this lecture fine let us begin in this lecture we will be studying various programmable we will be studying various programmable we will be studying various programmable logic devices logic devices logic devices in a in our previous lectures we have in a in our previous lectures we have in a in our previous lectures we have seen the elements of measurement system the elements of measurement system the elements of measurement system such as the sensors and such as the sensors and such as the sensors and the signal conditioning devices the signal conditioning devices the signal conditioning devices after that we have also seen how we can convert the signals from one form to the convert the signals from one form to the convert the signals from one form to the another form now let us look at another form now let us look at another form now let us look at the fundamentals of programmable logic the fundamentals of programmable logic the fundamentals of programmable logic devices as the name suggests the programmable as the name suggests the programmable as the name suggests the programmable logic devices logic devices logic

devices has two words these are programmable and logic these are programmable and logic these are programmable and logic the devices which are carrying out the devices which are carrying out the devices which are carrying out logical operations on the data logical operations on the data logical operations on the data are called as the logic devices are called as the logic devices are called as the logic devices but when we are able to program them but when we are able to program them but when we are able to program them when the users are able to program when the users are able to program when the users are able to program these logic devices then we are call these logic devices then we are call these logic devices then we are call them as them as them as the programmable logic devices the programmable logic devices the programmable logic devices programmable means programmable means programmable means we can teach we can instruct we can teach we can instruct we can teach we can instruct we can train these logic devices to we can train these logic devices to we can train these logic devices to carry out carry out carry out a certain set of instructions in a certain set of instructions in a certain set of instructions in the given sequence so what kind of operations these so what kind of operations these so what kind of operations these programmable logical programmable logical programmable logical logic devices are carrying out they are logic devices are carrying out they are logic devices are carrying out they are carrying out various carrying out various carrying out various control functions according to control functions according to control functions according to the instructions written in its memory the instructions written in its memory the instructions written in its memory so whatever the commands that we are so whatever the commands that we are so whatever the commands that we are giving they are giving they are giving they are the low level language commands the low level language commands the low level language commands we will see what is the meaning of the we will see what is the meaning of the we will see what is the meaning of the low level and the high level language low level and the high level language low level and the high level language in the ne

Programmable Logic Devices (PLD)

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  - Microprocessor, a digital integrated circuit - digital functions necessary to *process* information

xt few slides in the next few slides in the next few slides the first pld is the microprocessor the first pld is the microprocessor the first pld is the microprocessor microprocessor is a digital microprocessor is a digital microprocessor is a digital integrated circuit it is integrated circuit it is integrated circuit it is an electronic circuit and it carries out an electronic circuit and it carries out an electronic circuit and it carries out various digital functions which are various digital functions which are various digital functions which are necessary necessary necessary to process the information which are to process the information which are to process the information which are necessary necessary necessary to process the data given to the to process the data given to the to process the data given

Programmable Logic Devices (PLD)

- Programmable Logic Devices (PLD) - to perform different control functions, according to the programs written in its memory, using low level languages of commands.
  - Microprocessor, a digital integrated circuit - digital functions necessary to *process* information
  - Microcomputer - uses microprocessor as its central processing unit and contains all functions of a computer

to the microprocessor microprocessor microprocessor the microcomputer is the microcomputer is the microcomputer is utilizing the microprocessor utilizing the microprocessor utilizing the microprocessor as its cpu that is a central processing as its cpu that is a central processing as its cpu that is a central processing unit unit unit and it contains all functions of a and it contains all functions of a and it contains all functions of a computer computer computer so micro computer may have memory so micro computer may have memory so micro computer may have memory it can communicate with the outside it can communicate with the outside it can communicate with the outside world world world with input output devices with input output devices with input output devices so here you must know the difference so here you must know the difference so here you must know the difference between between between the processor and a computer processor the processor and a computer processor the processor and a computer processor is a simple is a simple is a simple circuit while computer is a system circuit while computer is a system circuit while computer is a system it has processor as the cpu central it has processor as the cpu central it has processor as the

Programmable Logic Devices (PLD)

- Programmable Logic Devices (PLD) - to perform different control functions, according to the programs written in its memory, using low level languages of commands.
  - Microprocessor, a digital integrated circuit - digital functions necessary to *process* information
  - Microcomputer - uses microprocessor as its central processing unit and contains all functions of a computer
  - Programmable Logic Controller (PLC) - to control the operation of *electro-mechanical* devices

cpu central processing unit third pld which is very third pld which is very third pld which is very widely used which is very important as widely used which is very important as widely used which is very important as far as far as far as the automated system is concerned is the automated system is concerned is the automated system is concerned is plc that is programmable logic plc that is programmable logic plc that is programmable logic controller programmable logic controller also programmable logic controller also programmable logic controller also incorporates incorporates incorporates the microprocessor as the central processing unit and it the central processing unit and it the central processing unit and it controls the operations controls the operations controls the operations of electromechanical devices of electromechanical devices of electromechanical devices but plc is working in very harsh but plc is working in very harsh but plc is working in very harsh condition condition condition so the construction of the plc must be so the construction of the plc must be so the construction of the plc must be very rugged very rugged very rugged v

Use of Microprocessors in automation

- Embedded microprocessor
    - Dedicated to controlling a specific function
    - Self-starting

ery robust the general microprocessors which are the general microprocessors which are the general microprocessors which are used in used in used in automation industry are the embedded automation industry are the embedded automation industry are the embedded microprocessor some of the features of this some of the features of this some of the features of this microprocessor microprocessor microprocessor are first are first are first these kind of microprocessors are these kind of microprocessors are these kind of microprocessors are dedicated to a specific function dedicated to a specific function dedicated to a specific function control of a specific function for control of a specific function for control of a specific function for example example example we want to have an automatic control we want to have an automatic control we want to have an automatic control system system system to control the temperature of an to control the temperature of an to control the temperature of an electric furnace electric furnace electric furnace here the function is to control the here the function is to control the here the function is to control the temperature of temperature of temperature of the furnace if the temperature the furnace if the temperature the furnace if the temperature if the inside temperature of the furnace if the inside temperature of the furnace if the inside temperature of

the furnace is above the set value is above the set value is above the set value the microprocessor should cut off the microprocessor should cut off the microprocessor should cut off the supply of electricity to that the supply of electricity to that the supply of electricity to that electric furnace electric furnace electric furnace so a simple electronic circuitry so a simple electronic circuitry so a simple electronic circuitry which is embedded inside the electric which is embedded inside the electric which is embedded inside the electric furnace furnace furnace is nothing but the embedded is nothing but the embedded is nothing but the embedded microprocessor microprocessor microprocessor so it is dedicated to carry out specific so it is dedicated to carry out specific so it is dedicated to carry out specific functions functions functions second feature of the embedded second feature of the embedded second feature of the embedded microprocessor is microprocessor is microprocessor is they are self starting they are self starting they are self starting so the processors are starting on their so the processors are starting on their so the processors are starting on their own own own as we switch on the system the processor as we switch on the system the processor as we switch on the system the processor will start will start will sta

Use of Microprocessors in automation

- Embedded microprocessor
  - Dedicated to controlling a specific function
  - Self-starting
  - Requires no human intervention

rt on its own why we are incorporating why we are incorporating why we are incorporating the microprocessor is in automation as the microprocessor is in automation as the microprocessor is in automation as we have seen we have seen we have seen the definition of automation that we the definition of automation that we the definition of automation that we want to want to want to reduce the human intervention we want to reduce the human intervention we want to reduce the human intervention we want to have no intervention have no intervention have no intervention so to carry out the operations in auto so to carry out the operations in auto so to carry out the operations in auto mode mode mode we are taking help of the electronic we are taking help of the electronic we are taking help of the electronic spec circuitry spec circuitry spec circuitry that is nothing

Use of Microprocessors in automation

- **Embedded microprocessor**
  - Dedicated to controlling a specific function
  - Self-starting
  - Requires no human intervention
  - Completely self-contained

but the microprocessors these are completely self-contained these are completely self-contained these are completely self-contained the embedded microprocessor has their the embedded microprocessor has their the embedded microprocessor has their own memory own memory own memory has may have their own battery backup as has may have their own battery backup as has may have their own battery backup as well well well they may have their own energy sourc

Use of Microprocessors in automation

- **Embedded microprocessor**
  - Dedicated to controlling a specific function
  - Self-starting
  - Requires no human intervention
  - Completely self-contained
  - Own operating system

e as well well well the microprocessor which are used in the microprocessor which are used in the microprocessor which are used in automation automation automation which are embedded in in the products or which are embedded in in the products or which are embedded in in the products or systems systems systems has their own operating system so we can say an embedded microprocessor so we can say an embedded microprocessor so we can say an embedded microprocessor will be dedicated to a specific function will be dedicated to a specific function will be dedicated to a specific function it is self-starting it doesn't require it is self-starting it doesn't require it is self-starting it doesn't require any human intervention any human intervention any human intervention these are completely self-contained these are completely self-contained these are completely self-contained everything is there inside the system everything is there inside the system everything is there inside the system and they do have their own operating and they do have their own operating and they do have their own operating

Microprocessor

- a multi-purpose, programmable device
  - reads binary instructions from a storage device called memory

system the microprocessor a multi-purpose the microprocessor a multi-purpose the microprocessor a multi-purpose programmable device programmable device programmable device it basically reads the binary it basically reads the binary it basically reads the binary instructions instructions instructions from a storage device that called memory from a storage device that called memory from a storage device that called memory the memory may be the temporary memory the memory may be the temporary memory the memory may be the temporary memory or it may be or it may be or it may be the permanent memory so whatever the the permanent memory so whatever the the permanent memory so whatever the signals which are signals which are signals which are getting in will be stored in a temporary getting in will be stored in a temporary getting in will be stored in a temporary memory memory memory the microprocessor process this the microprocessor process this the microprocessor process this information information information as per the need as per the instructions as per the need as per the instructions as per the need as per the instructions given in the program it process that information according to it process that information according to it process that information according to the instructions the instructions the instructions and it provides the results as and it

provides the results as and it provides the results as the output so getting the output so getting the output so getting the information reading the information the information reading the information.

Microprocessor

- a multi-purpose, programmable device
  - reads binary instructions from a storage device called memory
  - processes data according to the instructions
  - provides results as output