

Internet of Things and Its Applications

Based on NIELIT 'O' Level Revised Syllabus for M4-R5.1

Second Edition

Author

VIPIN KUMAR SARAOGI

(ME, BITS PILANI)

(Associate Professor BKBIET, Pilani)

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Preface

Today most of our work of life are completed with the help of computer, internet, mobile and others IoT devices. Today, you can sent the information easily and quickly anywhere in the world with the help of these devices or Services. Besides this, you can also access the data and information about any subject with the help of internet. For this, it is necessary, you have the knowledge of computer, Internet of Things and devices and IoT services. Many government organization launches some programs to provides the knowledge of given topics . 'O' Level is also a IT program that is managed and run by NIELIT (National Institute of Electronics and Information Technology) New Delhi.

The book is prepare on the basis of revised syllabus of the fourth paper (M4-R5: Internet of Things and its Applications) of 'O' Level Program. This book is design specially Internet of Things (IoT) and developing IoT applications by using Embedded 'C' Language. This book provides a depth knowledge of IoT, Things and connections, Sensors, actuators, Micro controllers, Security System for IoT Devices, Future of IoT Devices and Soft skills with Personality Development.

This book is divide into 6 parts and each part of this book describe a special topic, such as Introduction to IoT, Things and Connections, Sensors and Microcontrollers, Building of IoT Applications, Security and Future of IoT ecosystem, Soft skills-Personality Development. Each topic of this book has theory, examples and questions. Some important practical/Case study of these topics are given at the end of this book.

We express our sincere thanks to the learns for their valuable suggestions for improving the quality of the book. Suggestions for further improvement of the book will be thankfully received and acknowledged.

Author

Internet of Things and its Applications

Introduction

The module is designed to equip the students to understand the basics of connected world that is Internet of Things (IoT) and its applications. IoT primarily refers to the connected and smarter world having physical and virtual objects with some unique identities. IoT applications span across domains of industrial control, retail, energy, agriculture, etc.

This module provides the theoretical and practical aspects of interfacing sensors and actuators, making informed world of Things speaking to each other. The different type of communication modes and models are discussed in detail. The in-depth knowledge of software and packages is provided to make applications in IoT paradigm.

Objectives

After completing the module, the learner will be able to:

- Understand how connected devices work together to update other applications.
- Acquire knowledge to interface sensors and actuators with microcontroller Based Arduino platform.
- Writing C programs in Arduino IDE .
- Understand the Communication between microcontroller and PC .
- Build IoT based applications and understand how data flows between things.
- Understand how electronic devices control electrical appliances working at 220v AC.
- Understand security aspect of IoT devices.
- Enhance skill set towards better personality development.

Duration

120 Hours - (Theory: 48hrs + Practical: 72 hrs)

Sr.	Module Unit or Chapter name	Duration		Marks (Max.)
		Theory	Practical	
1.	Introduction to IoT	4	6	10
2.	Things and Connections	4	6	10
3.	Sensors, Actuators and Microcontrollers	8	12	15
4.	Building IoT Applications	20	30	40
5.	Security and Future of IoT Ecosystem	4	6	05
6.	Soft skills- Personality Development	8	12	20
	Total	48	72	100

DETAILED SYLLABUS

1. Introduction to Internet of Things – Applications/Devices, Protocols and Communication Model

Introduction - Overview of Internet of Things(IoT), the characteristics of devices and applications in IoT ecosystem, building blocks of IoT, Various technologies making up IoT ecosystem, IoT levels, IoT design methodology, The Physical Design/Logical Design of IoT, Functional blocks of IoT and Communication Models, Development Tools used in IoT.

2. Things and Connections

Working of Controlled Systems, Real-time systems with feedback loop e.g. thermostat in refrigerator, AC, etc. Connectivity models – TCP/IP versus OSI model, different type of modes using wired and wireless methodology, The process flow of an IoT application.

3. Sensors, Actuators and Microcontrollers

Sensor - Measuring physical quantities in digital world e.g. light sensor, moisture sensor, temperature sensor, etc.

Actuator - moving or controlling system e.g. DC motor, different type of actuators

Controller- Role of microcontroller as gateway to interfacing sensors, microcontroller vs microprocessor, different type of microcontrollers in embedded ecosystem.

4. Building IoT applications

Introduction to Arduino IDE - writing code in sketch, compiling-debugging, uploading the file to Arduino board, role of serial monitor.

Embedded 'C' Language basics - Variables and Identifiers, Built-in Data Types, Arithmetic operators and Expressions, Constants and Literals, assignment. Conditional Statements and Loops - Decision making using Relational Operators, Logical Connectives- conditions, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement.

Arrays – Declaring and manipulating single dimension arrays, Functions - Standard Library of C functions in Arduino IDE, Prototype of a function: Formal parameter list, Return Type, Function call.

Interfacing sensors – The working of digital versus analog pins in Arduino platform, interfacing LED, Button, Sensors-DHT, LDR, MQ135, IR. Display the data on Liquid Crystal Display(LCD), interfacing keypad

Serial communication – interfacing HC-05 (Bluetooth module) Control/handle 220V AC supply – interfacing relay module.

5. Security and Future of IoT Ecosystem

Need of security in IoT - Why Security? Privacy for IoT enabled devices- IoT security for consumer devices- Security levels, protecting IoT devices

Future IoT eco system - Need of power full core for building secure algorithms, Examples for new trends - AI, ML penetration to IoT.

6. Soft skills-Personality Development

Personality Development - Determinants of Personality- self-awareness, motivation, self-discipline, etc., building a positive personality, gestures.

Self-esteem-self-efficacy, self-motivation, time management, stress management, Etiquettes & manners.

Communication and writing skills- objective, attributes and categories of communication, Writing Skills – Resume, Letters, Report, Presentation, etc. Interview skills and body language.

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