# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

## New Scheme Based On AICTE Flexible Curricula

## CSE-IOT/IOT, V-Semester

## IO 501- EMBEDDEDSYSTEM FOR IoT

**UnitI**

FundamentalsofEmbeddedSystems:EmbeddedsystemsvsGeneralComputingsystems,Classification,Applications,Coreoftheembeddedsystems,Memory,Sensors(resistive,optical,position,thermal)andActuators(solenoidvalves,relay/switch,optocouplers),CommunicationInterface,Embeddedfirmware(RTOS,Drivers,Applicationprograms),Power supply(Batterytechnology,Solar).

Fundamentals of IoT, Functional Blocks of IoT systems, Logical and Physical Designs of IoT systems.

**UnitII**

8051 Microcontroller Basics: Block Diagram, PSW and Flag Bits, 8051 RegisterBanks and Stack, Internal Memory Organization, IO Port Usage in 8051, Types of Special FunctionRegisters and their use in 8051, Pins of 8051. Memory Address Decoding, 8031/51 Interfacing with ExternalROMandRAM.8051AddressingModes.

**Unit III**

Assembly programming and instructions of 8051: Introduction, Assembling andrunning an 8051 program, Data types and Assembler directives, Arithmetic & logic instructions and programs,Jump, loop and call instructions, IO port programming. Programming 8051 timers, Counter programming,Programming timers 0 and 1. Basics of serial communication, 8051 connection to RS232, 8051 serialport programming in assembly, 8051 interrupts programming: timer, externalhardware,serialcommunicationinterrupt, Interruptpriorityin8051/52.

**Unit IV**

Interfacing: LCD interfacing, Keyboard interfacing. ADC, DAC and sensor interfacing**:** ADC 0808 interfacingto 8051, Serial ADC Max1112 interfacing to 8051, DAC interfacing, Sensor interfacing and signalconditioning. Motor control: Relay, PWM, DC and stepper motor, Relays and opt isolators, stepper motorinterfacing,DCmotorinterfacingandPWM.8051interfacingwith8255: Programmingthe8255,8255interfacing.

**Unit V**

PIC, AVR family of Microprocessors & ARM processors:Introduction, Salient features andArchitectureof8bitPIC andAVRMicrocontrollersand32bitARMProcessor.

Introduction to Prototyping Boards like Raspberry Pi, Arduino, MSP430 etc. Communications used in IoT: Wifi, LiFi, Cellular, Bluetooth, RFID/NFC, Zigbee, LoRa etc. IoT Protocols: http, MQTT, CoAP, XMPP etc. Development Tools and platforms for IoT: Node-RED, Bluemix, Eclipse, AWS, Azure, Google Cloud etc.

**Books Recommended:**


1. AyalaJ.K.,The8051Microcontroller:Architecture,programmingandapplications,PenramInternational.
2. Mazidi,E.andMazidi,F.,The8051MicrocontrollerandEmbeddedSystems,Prentice-HallofIndia.
3. PeatmanJ.,EmbeddedsystemDesignusingPIC18Fxxx, PrenticeHall.
4. RajKamal,"Microcontroller-ArchitectureProgrammingInterfacingandSystemDesign", PearsonEducation.
5. Perry Xiao, DesigningEmbedded Systems and the Internet of Things (IoT) with the ARM mbed, John Wiley & Sons.
6. JosephYiu, TheDefinitiveGuidetotheARMCortex-M3, Elsevier.
7. Dr.K.V.K.Prasad,Embedded/Real-TimeSystems:Concepts,DesignandProgrammingBlackBook,Dreamtech Press.
8. AjayDeshmukh,Microcontroller-Theory&Applications, TataMcGrawHill.
9. ShibuK.V,IntroductiontoEmbeddedsystems,TataMcGrawHill.

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

## New Scheme Based On AICTE Flexible Curricula

## CSE-IOT/IOT, V-Semester

## IO 502- Database Management Systems

**COURSE OBJECTIVES:** The objective of this course is to enable students in developing a high level understanding of the concepts of Database management systems in contrast with traditional data management systems with emphasis on skills to apply these concepts in building, maintaining and retrieving data from these DBMS.

**COURSE OUTCOMES:**

**After completing the course student should be able to:**

1. Describe design of a database at various levels and compare andcontrast traditional data processing with DBMS.
2. Design a database using Entity Relationship diagram and other design techniques.
3. Apply fundamentals of relational model to model and implement a sample Database Management System for a given domain.
4. Evaluate and optimize queries and apply concepts of transaction management.

**COURSE CONTENTS:**

**UNIT I**: DBMS Concepts and architecture Introduction, Database approach v/s Traditional file accessing approach, Advantages of database systems, Data models, Schemas and instances, Data independence, Data Base Language and interfaces, Overall Database Structure, Functions of DBA and designer, ER data model: Entitles and attributes, Entity types, Defining the E-R diagram, Concept of Generalization, Aggregation and Specialization. Transforming ER diagram into the tables. Various other data models object oriented data Model, Network data model, and Relational data model, Comparison between the three types of models.Storage structures: Secondary Storage Devices, Hashing & Indexing structures: Single level & multilevel indices.

**UNIT II:** Relational Data models: Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Intension and Extension, Relational Query languages: SQL-DDL, DML, integrity con straints, Complex queries, various joins, indexing, triggers, assertions , Relational algebra and relational calculus, Relational algebra operations like select, Project ,Join, Division, outer union. Types of relational calculus i.e. Tuple oriented and domain oriented relational calculus and its operations.

**UNIT III:** Data Base Design: Introduction to normalization, Normal forms- 1NF, 2NF, 3NF and BCNF, Functional dependency, Decomposition, Dependency preservation and lossless join,

problems with null valued and dangling tuples, multivalued dependencies. Query Optimization: Introduction, steps of optimization, various algorithms to implement select, project and join operations of relational algebra, optimization methods: heuristic based, cost estimation based.

**UNIT IV:** Transaction Processing Concepts: -Transaction System, Testing of Serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Checkpoints deadlock handling. Concurrency Control Techniques: Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction. Introduction to Distributed databases, data mining, data warehousing, Object Technology and DBMS, Comparative study of OODBMS Vs DBMS . Temporal, Deductive, Multimedia, Web & Mobile database.

**UNIT V:** Case Study of Relational Database Management Systems through Oracle/PostgreSQL /MySQL: Architecture, physical files, memory structures, background process. Data dictionary, dynamic performance view. Security, role management, privilege management, profiles, invoker defined security model. SQL queries, Hierarchical quires, inline queries, flashback queries. Introduction of ANSI SQL, Cursor management: nested and parameterized cursors. Stored procedures, usage of parameters in procedures. User defined functions their limitations. Triggers, mutating errors, instead of triggers.

TEXT BOOKS RECOMMENDED:


1. Korth H.F. &Silberschatz A., Sudarshan, “Database Systems”, McGraw-Hill
2. Chris J. Date, with Hugh Darwin, Addison-Wesley, “A Guide to SQL Standard”.
3. Elmasri R., Navathe S.B., “Fundamentals of Database Systems”, Pearson.


REFERENCE BOOKS:


1. Rob, “ Database System: Design Implementation & Management”, Cengage Learning.
2. AtulKahate , “Introduction to Database Management System”, Pearson Educations
3. Oracle 9i Database Administration Fundamental-I, Volume I, Oracle Press, TMH.
4. Paneerselvam,”Database Management System”, PHI Learning

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## New Scheme Based On AICTE Flexible Curricula

## CSE-IOT/IOT, V-Semester

## IO – 503 (A) Security Assessment and Risk Analysis

**Course Outcomes: After completion of course, students would be able:**

1. To apply contingency strategies including data backup and recovery and alternate site selection for business resumption planning
2. To Skilled to be able to describe the escalation process from incident to disaster in case of security disaster.
3. To Design a Disaster Recovery Plan for sustained organizational operations.

**Course Objective:**
Describe the concepts of risk management in information security Define and differentiate various Contingency Planning components. Define and be able to discuss incident response options, and design an Incident Response Plan for sustained organizational operations.

**Course Contents:**

**Unit I** :
SECURITY BASICS: Information Security (INFOSEC) Overview: critical information characteristics – availability information states – processing security countermeasures-education, training and awareness, critical information characteristics – confidentiality critical information characteristics – integrity, information states – storage, information states – transmission, security countermeasurespolicy, procedures and practices, threats, vulnerabilities.

**Unit II :**
Threats to and Vulnerabilities of Systems: Threats, major categories of threats (e.g., fraud, Hostile Intelligence Service (HOIS). Countermeasures: assessments (e.g., surveys, inspections). Concepts of Risk Management: consequences (e.g., corrective action, risk assessment), cost/benefit analysis and implementation of controls, monitoring the efficiency and effectiveness of controls (e.g., unauthorized or inadvertent disclosure of information).

**Unit III :**
Security Planning: directives and procedures for policy mechanism. Contingency Planning/Disaster Recovery: agency response procedures and continuity of operations, contingency plan components, determination of backup requirements, development of plans for recovery actions after a disruptive event.

**Unit IV :**
Personnel Security Practices and Procedures: access authorization/verification (need- to-know),

contractors, employee clearances, position sensitivity, security training and awareness, systems maintenance personnel.
Auditing and Monitoring: conducting security reviews, effectiveness of security programs, investigation of security breaches, privacy review of accountability controls, review of audit trails and logs.

**Unit V :**

Operations Security (OPSEC): OPSEC surveys/OPSEC planning INFOSEC: computer security – audit, cryptography-encryption (e.g., point-to-point, network, link). Case study of threat and vulnerability assessment.

**Text Books/References:**

1. Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best Practices, Nina Godbole, John Wiley & Sons.
2. Principles of Incident Response and Disaster Recovery, Whitman & Mattord, Course Technology ISBN: 141883663X.

**Corresponding Online Resources:**
1. Introduction to Cyber Security, https://swayam.gov.in/nd2_nou20_cs01/preview
2. (Web Link) http://www.cnss.gov/Assets/pdf/nstissi_4011.pdf

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## New Scheme Based On AICTE Flexible Curricula

## CSE-IOT/IOT, V-Semester

## 503 (B) -Software Engineering

**Unit I : The Software Product and Software Process**

Software Product and Process Characteristics, Software Process Models: Linear Sequential Model, Prototyping Model, RAD Model, Evolutionary Process Models like Incremental Model, Spiral Model, Component Assembly Model, RUP and Agile processes. Software Process customization and improvement, CMM, Product and Process Metrics

**Unit II : Requirement Elicitation, Analysis, and Specification**

Functional and Non-functional requirements, Requirement Sources and Elicitation Techniques, Analysis Modeling for Function-oriented and Object-oriented software development, Use case Modeling, System and Software Requirement Specifications, Requirement Validation, Traceability

**Unit III : Software Design**

The Software Design Process, Design Concepts and Principles, Software Modeling and UML, Architectural Design, Architectural Views and Styles, User Interface Design, Function- oriented Design, SA/SD Component Based Design, Design Metrics.

**Unit IV : Software Analysis and Testing**

Software Static and Dynamic analysis, Code inspections, Software Testing, Fundamentals, Software Test Process, Testing Levels, Test Criteria, Test Case Design, Test Oracles, Test Techniques, Black-Box Testing, White-Box Unit Testing and Unit, Testing Frameworks, Integration Testing, System Testing and other Specialized, Testing, Test Plan, Test Metrics, Testing Tools. , Introduction to Object-oriented analysis, design and comparison with structured Software Engg.

**Unit V : Software Maintenance & Software Project Measurement**

Need and Types of Maintenance, Software Configuration Management (SCM), Software Change Management, Version Control, Change control and Reporting, Program Comprehension Techniques, Re-engineering, Reverse Engineering, Tool Support. Project Management Concepts, Feasibility Analysis, Project and Process Planning, Resources Allocations, Software efforts, Schedule, and Cost estimations, Project Scheduling and Tracking, Risk Assessment and Mitigation, Software Quality Assurance (SQA). Project Plan, Project Metrics.

**Books Recommended:**


1. Pressman R.S., “Software Engineering – A Practitioners Approach”, McGraw Hill.
2. Sommerville, “Software Engineering”, Pearson Education

3. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Narosa Publishing House.
4. Stephen Schach, “Software Engineering”, Tata McGraw Hill.
5. Waman S. Jawadekar, “Software Engineering – Principles and Practice”, McGraw Hill.
6. Stephen H. Kan, “Matrix and Models in Software Quality Engineering”, Addison Wesley.

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## New Scheme Based On AICTE Flexible Curricula

## CSE-IOT/IOT, V-Semester

## 503 (C) - Microprocessors and Microcontrollers

**OBJECTIVES:**

- To design a microcontroller based system
- To study the Architecture of 8051 microcontroller.
- To interface microprocessors with supporting chips.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To understand the Architecture of 8086 microprocessor.

**UNIT I THE 8086 MICROPROCESSOR**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

**UNIT II 8086 SYSTEM BUS STRUCTURE**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III I/O INTERFACING**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV MICROCONTROLLER**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

**UNIT V INTERFACING MICROCONTROLLER**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARMprocessors

**OUTCOMES:**

At the end of the course, the students should be able to:

- Design and implement 8051 microcontroller based systems.
- Design and interface I/O circuits.
- Design Memory Interfacing circuits.
- Understand and execute programs based on 8086 microprocessor.

**TEXTBOOKS:**

1. Yu-Cheng Liu, Glenn A.Gibson, ―Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design‖, Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C‖, Second Edition,Pearsoneducation,2011.

**REFERENCES:**

1. Doughlas V.Hall, ―Microprocessors and Interfacing, Programming and Hardware‖,TMH,2012
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012

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## New Scheme Based On AICTE Flexible Curricula

## CSE-IOT/IOT, V-Semester

### 504 (A) - Data Analytics

**UNIT-I:**
DESCRIPTIVE STATISTICS :Probability Distributions, Inferential Statistics ,Inferential Statistics through hypothesis tests Regression & ANOVA ,Regression ANOVA(Analysis of Variance)

**UNIT-II:**
INTRODUCTION TO BIG DATA: Big Data and its Importance, Four V's of Big Data, Drivers for Big Data, Introduction to Big Data Analytics, Big Data Analytics applications.
BIG DATA TECHNOLOGIES: Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics, Information Management.

**UNIT-III:**
PROCESSING BIG DATA: Integrating disparate data stores, Mapping data to the programming framework, Connecting and extracting data from storage, Transforming data for processing, subdividing data in preparation for Hadoop Map Reduce.

**UNIT-IV:**
HADOOP MAPREDUCE: Employing Hadoop Map Reduce, Creating the components of Hadoop Map Reduce jobs, Distributing data processing across server farms, Executing Hadoop Map Reduce jobs, monitoring the progress of job flows, The Building Blocks of Hadoop Map Reduce Distinguishing Hadoop daemons, Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

**UNIT-V:**
BIG DATA TOOLS AND TECHNIQUES: Installing and Running Pig, Comparison with Databases, Pig Latin, User- Define Functions, Data Processing Operators, Installing and Running Hive, Hive QL, Querying Data, User-Defined Functions, Oracle Big Data.

**REFERENCES:**
1. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
2. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation, 2012.1. Rajaraman, A., Ullman, J. D., Mining of Massive Datasets, Cambridge University Press, United Kingdom, 2012

3. Berman, J.J., Principles of Big Data: Preparing, Sharing and Analyzing Complex Information, Morgan Kaufmann, 2014
4. Barlow, M., Real-Time Big Data Analytics: Emerging Architecture, O Reilly, 2013
5. Schonberger, V.M. , Kenneth Cukier, K., Big Data, John Murray Publishers, 2013
6. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", 1st Edition, Wiley and SAS Business Series, 2012.

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## CSE-IOT/IOT, V-Semester

## 504 (B) -Internet and Web Technology

**COURSE CONTENTS:**

**UNIT-I**

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol: Request, Response, header and methods. Web browser and Web servers, Features of Web 2.0 Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Web site, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation.

**UNIT-II**

HTML :Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Web Sockets: Overview and features of HTML5. MIME type and content encoding, Session tracking and Cookies. Browser: Working of a Browser, Plug-ins; Search Engines. Client Side Programming: Java Script, JavaScript Regular expressions, web servers.

**UNIT-III**

Style sheets : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3 JavaScript : Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML : Combining HTML, CSS and JavaScript, Events and buttons.

**UNIT-IV**

XML : Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT

PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP.

**UNIT-V**

PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database error handling. Case study: Web based application development.

**Books Recommended:**


1. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India
2. Moller, ”An Introduction to XML and Web Technologies”, Pearson Education, 2012
3. Web Technologies, Black Book, dreamtech Press
4. HTML 5, Black Book, dreamtech Press
5. Web Design, Joel Sklar, Cengage Learning
6. Harwani, Developing Web Applications in PHP and AJAX, McGrawHill
7. Internet and World Wide Web How to program, P.J. Deitel& H.M. Deitel , Pearson

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## CSE-IOT/IOT, V-Semester

### 504 (C) - COGNITIVE IOT

**Course Objectives:**

1. To emphasis the students from shifting their mindset from theoretical to practical multidisciplinary skills through installing the know-how of actual practice in industry field 2. Impart the knowledge to log the sensor data and to perform further data analytics
3. Make the students to apply Internet of Things (IoT) data for business solution in various domain in secured manner

**Expected Course Outcome:**

1. Integrate the aspects of human cognitive processes in the system design
2. Comprehend the underlying cognitive process can have many abstractions of a cognitive cycle such as 'Sense', 'Understand', 'Decide' and 'Act'.
3. Detect any failures of system components and re-configure itself which provides a graceful degradation through self-healing.
4. Accomplish knowledge about the application, system architecture, resources, system state and behavior
5. Incorporate recent advancements in the machine learning including deep learning in IOT
6. Analyze security issues in IoT applications

**UNIT :1** Cognitive IoT – Introduction, Need for Cognitive IoT, Current and Future trends of IoT, Cognitive computing and applications. Data Analytics for IoT Regression, Data Analytics for IoT ANN Classification, Data Analytics for IoT Modern DNN's.

**UNIT:2** Decentralized Computing, Cloud computing, Cloudlets and fog computing, Cloud and edge computing for large scale IoT applications.

**UNIT 3**: Introduction to GPU's Parallel programming for GPU, Parallel programming in CUDA, CNN Inference in GPU, CNN Training in GPU.

**UNIT 4**: FPGA for Internet of Things,Benefits of FPGA, Interfacing FPGAs with IoT-based edge devices, IoT-FPGA based applications, Microsemi's SmartFusion2 SoC FPGA. Enabling Technologies and Devices Big data, Digital twin, Cloud Computing, Sensors, Communications, Analytical software, Edge Devices.

**UNIT 5:** Security in Cognitive IoT, Security Issues in IoT, A hardware assisted approach for security, Architectural level overview for providing security, Security threats. Recent Trends

**Text Book(s)**


1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange and Stefan Meissner, Enabling things to talk –Designing IoT solutions with the IoT Architecture Reference Model, 1 st edition ,Springer Open, 2016
2. Matin, Mohammad Abdul, ed. Towards Cognitive IoT Networks, 1 st edition ,Springer International Publishing, 2020.


**Reference Books** .


1. Arshdeep Bahga and Vijay Madisetti, Cloud Computing: A Hands-on Approach, 1 st edition, CreateSpace Independent Publishing Platform, 2013.
2. John Mutumba Bilay, Peter Gutsche, Mandy Krimmel and Volker Stiehl, SAP Cloud Platform Integration: The Comprehensive Guide, 2nd edition, Rheinwerg publishing.2019.
3. Mahalle, Parikshit Narendra, and Poonam N. Railkar, Identity management for internet of things, 1st edition , River Publishers, 2015.