GURU NANAK INSTITUTIONS TECHNICAL CAMPUS

(AUTONOMOUS)
School of Engineering and Technology

III B.Tech. CSE (Internet of Things)

COURSE STRUCTURE
(Applicable for the batch admitted from 2022-23)
R22 REGULATION

III Year II Semester

S.No.	Course Code	Course Title	L	T	P	Credits
1	22PC0CI14	IoT Security	3	0	0	3
2	22PC0CI15	Computer Vision and Robotics	3	0	0	3
3	22PC0CI16	IoT Cloud Processing and Analytics	3	0	0	3
4		Professional Elective - II	3	0	0	3
5		Open Elective - I	3	0	0	3
6	22PC0CI17	IoT Security Lab	0	0	3	1.5
7	22PC0CI18	Computer Vision Lab	0	0	3	1.5
8	22SD0CI04	Industrial Oriented Mini Project / Internship / Skill Development Course (Big data-Spark)	0	0	4	2
9	22MC0MB03	Intellectual Property Rights	3	0	0	0
		Total	**18**	**0**	**10**	**20**

GURU NANAK INSTITUTIONS TECHNICAL CAMPUS
(AUTONOMOUS)
School of Engineering and Technology

B.Tech. CSE (Internet of Things)

PROFESSIONAL ELECTIVES
(Applicable for the batch admitted from 2022-23)
R22 REGULATION

Professional Elective - II

1. Machine Learning - 22PE0CI2A
2. Real Time Systems - 22PE0CI2B
3. Embedded Hardware Design - 22PE0CI2C
4. Energy Sources and Power Management - 22PE0CI2D

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B.Tech. III Year II Sem **L T P C**

3 0 0 3

IOT SECURITY

Course Objectives

- Understand the various attacks and importance of Security aspects in IoT
- Understand the techniques, protocols and security towards Gaming models
- Understand security and privacy challenges of IoT
- Understand the application of block chain technology for IoT Security

Course Outcomes

- Incorporate the best practices learnt to identify the attacks and mitigate the same
- Adopt the right security techniques and protocols during the design of IoT products
- Assimilate and apply the skills learnt on ciphers and block chains when appropriate
- Describe the essential components of IoT
- Find appropriate security/privacy solutions for IoT

SYLLABUS

UNIT - I

Fundamentals of IoT and Security and its need, Prevent Unauthorized Access to Sensor Data, Block ciphers, Introduction to Blockchain, Introduction of IoT devices, IoT Security Requirements, M2M Security, Message integrity Modeling faults and adversaries Difference among IoT devices, computers, and embedded devices.

UNIT - II

IoT and cyber-physical systems RFID Security, Authenticated encryption Byzantine Generals problem sensors and actuators in IoT, IoT security (vulnerabilities, attacks, and countermeasures), Cyber Physical Object Security, Hash functions Consensus algorithms and their scalability problems Accelerometer, photoresistor, buttons

UNIT - III

Security engineering for IoT development Hardware Security, Merkle trees and Elliptic curves digital signatures, verifiable random functions, Zero-knowledge systems motor, LED, vibrator, IoT security lifecycle, Front-end System Privacy Protection, Management, Secure IoT Databases, Public-key crypto (PKI), blockchain, the challenges, and solutions, analog signal vs. digital signal

UNIT - IV

Data Privacy Networking Function Security Trees signature algorithms proof of work, Proof of stake, Networking in IoT Device/User Authentication in IoT IoT Networking Protocols, Crypto-currencies, alternatives to Bitcoin consensus, Bitcoin scripting language and their use Real-time communication

UNIT - V

Introduction to Authentication Techniques, Secure IoT Lower Layers, Bitcoin P2P network, Ethereum and Smart Contracts, Bandwidth efficiency, Data Trustworthiness in IoT, Secure IoT Higher Layers, Distributed consensus, Smart Contract Languages and verification challenges, Data analytics in IoT - simple data analyzing methods

TEXT BOOKS

1. B. Russell and D. Van Duren, Practical Internet of Things Security, Packt Publishing, 2016.
2. FeiHU, Security and Privacy Internet of Things (IoTs): Models, Algorithms and Implementations, CRC Press, 2016
3. Narayanan et al., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.

REFERENCE BOOKS

1. A. Antonopoulos, Mastering Bitcoin: Unlocking Digital Crypto currencies, O'Reilly, 2014.
2. T. Alpcan and T. Basar, Network Security: A Decision and Game-theoretic Approach, Cambridge University Press, 2011.
3. Security and the IoT ecosystem, KPMG International, 2015.
4. Internet of Things: IoT Governance, Privacy and Security Issues European Research Cluster.
5. Ollie Whitehouse, Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond, NCC Group, 2014.
6. Josh Thompson, Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.

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B.Tech. III Year II Sem **L T P C**

3 0 0 3

COMPUTER VISION AND ROBOTICS

Course Objectives

- To understand the Fundamental Concepts Related To sources, shadows and shading
- To understand the The Geometry of Multiple Views

Course Outcomes

- Implement fundamental image processing techniques required for computer vision
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques and Implement motion related techniques.
- Develop applications using computer vision techniques.

SYLLABUS

UNIT - I

CAMERAS: Pinhole Cameras

Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases

Sources, Shadows, and Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models

Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT - II

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates

Edge Detection: Noise, Estimating Derivatives, Detecting Edges

Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT - III

The Geometry of Multiple Views: Two Views

Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More

Cameras **Segmentation by Clustering:** Segmentation, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT - IV

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations

Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization

UNIT - V

Introduction to Robotics: Social Implications of Robotics, Brief history of Robotics, Attributes of hierarchical paradigm, Closed world assumption and frame problem, Representative Architectures, Attributes of Reactive Paradigm, Subsumption Architecture, Potential fields and Perception

Common sensing techniques for Reactive Robots: Logical sensors, Behavioural Sensor Fusion, Pro- prioceptive sensors, Proximity Sensors, Topological Planning and Metric Path Planning

TEXT BOOKS

1. David A. Forsyth and Jean Ponce: Computer Vision, A Modern Approach, PHI Learning (Indian Edition), 2009.
2. Robin Murphy, Introduction to Al Robotics, MIT Press.

REFERENCE BOOKS

1. E. R. Davies: Computer and Machine Vision - Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. The Robotics premier, Maja J Matari, MIT Press.
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.

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B.Tech. III Year II Sem **L T P C**

3 0 0 3

IOT CLOUD PROCESSING AND ANALYTICS

Course Objectives

- To analyze the data generated from IoT device, store in cloud, to be able to manage IoT data stored in cloud.

Course Outcomes

- Learn IoT Big data challenges.
- Integrate Cloud and Big Data for IOT analytics.
- Analyze sensor data streams for events.
- Know open-source framework for IoT analytics.
- Review tools for semantic and data stream analytics.

SYLLABUS

UNIT - I

Introducing IoT Analytics

IoT Data and Big Data, Challenges of IoT Analytics, Applications, IoT Analytics Lifecycle and Techniques IoT

Cloud and Big Data Integration for IoT Analytics

Introduction, IaaS, PaaS and SaaS Paradigms, Requirements of IoT Big Data Analytics, Platform 3, Functional Architecture, Data Analytics for the IoT, Data Collection Using Low-power, Long-range Radios, WAZIUP Software Platform, iKaaS Software Platform

UNIT - II

Searching the Internet of Things

Introduction, A Search Architecture for Social and Physical Sensors, Local Event Retrieval, Using Sensor Metadata Streams to Identify Topics of Local, Events in the City, Venue Recommendation

UNIT - III

Development Tools for IoT Analytics Applications

Introduction, Related Work, The VITAL Architecture for IoT Analytics Applications, VITAL Development Environment, Development Examples

UNIT - IV

An Open-Source Framework for IoT Analytics as a Service

Introduction, Architecture for IoT Analytics-as-a-Service, Sensing-as-a-Service Infrastructure Anatomy, Scheduling, Metering and Service Delivery, Sensing-as-a-Service Example, From Sensing-as-a- Service to IoT-Analytics- as-a-Service

UNIT - V

A Review of Tools for IoT Semantics and Data Streaming Analytics
Introduction, Related Work, Semantic Analysis, Tools and Platforms

Data Analytics for Smart Cities
Introduction, Cloud-based IoT Analytics, Cloud-based City Platform, Solutions, Edge, State of the Art, Edge-based City Platform, Workflow, Task and Topology, IoT-friendly Interfaces, Use Case of Edge- based Data Analytics

TEXT BOOKS

1. Building Blocks for IoT Analytics by John Soldatos, River Publisher

REFERENCE BOOKS

1. Analytics for the Internet of Things (IoT), Andrew miller, Packt Publishing.
2. Big Data Analytics for Internet of Things, Tausifa Jan Saleem, Mohammad Ahsan Chishti, Wiley Publishing.

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B.Tech. III Year II Sem **L T P C**

3 0 0 3

MACHINE LEARNING

Professional Elective - II

Course Objectives

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability-based learning techniques

Course Outcomes

- Distinguish between, supervised, unsupervised and semi-supervised learning
- Understand algorithms for building classifiers applied on datasets of non-linearly separable classes
- Understand the principles of evolutionary computing algorithms
- Design an ensembler to increase the classification accuracy

SYLLABUS

UNIT - I

Learning - Types of Machine Learning - Supervised Learning - The Brain and the Neuron - Design a Learning System - Perspectives and Issues in Machine Learning - Concept Learning Task - Concept Learning as Search - Finding a Maximally Specific Hypothesis - Version Spaces and the Candidate Elimination Algorithm - Linear Discriminants: Perceptron - Linear Separability - Linear Regression.

UNIT - II

Multi-layer Perceptron - Going Forwards - Going Backwards: Back Propagation Error - Multi-layer Perceptron in Practice - Examples of using the MLP - Overview - Deriving Back-Propagation - Radial Basis Functions and Splines - Concepts - RBF Network - Curse of Dimensionality - Interpolations and Basis Functions - Support Vector Machines

UNIT - III

Learning with Trees - Decision Trees - Constructing Decision Trees - Classification and Regression Trees - Ensemble Learning - Boosting - Bagging - Different ways to Combine Classifiers - Basic Statistics - Gaussian Mixture Models - Nearest Neighbor Methods - Unsupervised Learning - K means Algorithms

UNIT - IV

Dimensionality Reduction - Linear Discriminant Analysis - Principal Component Analysis - Factor Analysis - Independent Component Analysis - Locally Linear Embedding - Isomap - Least Squares Optimization

Evolutionary Learning - Genetic algorithms - Genetic Offspring: Genetic Operators - Using Genetic Algorithms

UNIT - V

Reinforcement Learning - Overview - Getting Lost Example Markov Chain Monte Carlo Methods - Sampling - Proposal Distribution - Markov Chain Monte Carlo - Graphical Models - Bayesian Networks - Markov Random Fields - Hidden Markov Models - Tracking Methods.

TEXT BOOKS

1. Stephen Marsland, Machine Learning - An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

REFERENCE BOOKS

1. Tom M Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
3. Jason Bell, Machine learning - Hands on for Developers and Technical Professionals, First Edition, Wiley, 2014
4. Ethem Alpaydin, Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.

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3 0 0 3

REAL TIME SYSTEMS

Professional Elective - II

Course Objectives

- To provide a broad understanding of the requirements of Real Time Operating Systems.
- To make the student understand, applications of these Real Time features using case studies.

Course Outcomes

- Understand the key concepts of Real-Time systems.
- To facilitate task scheduling and designing concurrency within an application using Semaphores, Message queues.
- Explore other kernel objects common to embedded system development.
- Attain knowledge of exception and interrupt handling in real time systems
- Understand real time operating systems like RT Linux, VxWorks, MicroC /OSII, TinyOs

SYLLABUS

UNIT – I

Introduction: Introduction to UNIX/LINUX, Overview of Commands, File I/O,(open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

UNIT - II

Real Time Operating Systems: Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use

UNIT - III

Objects, Services and I/O: Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem

UNIT - IV

Exceptions, Interrupts and Timers: Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

UNIT - V

Case Studies of RTOS: RT Linux, MicroC/OS-II, VxWorks, Embedded Linux, and Tiny OS.

TEXT BOOK

1. Real Time Concepts for Embedded Systems, Qing Li, Elsevier, 2011
2. Embedded Systems Architecture, Programming and Design by Rajkamal, 2007, TMH.

REFERENCE BOOKS

1. Advanced UNIX Programming, Richard Stevens
2. Embedded Linux: Hardware, Software and Interfacing, Dr. Craig Hollabaugh

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EMBEDDED HARDWARE DESIGN

Professional Elective - II

Course Objectives

- Knowledge on fundamental concepts on building hardware, Serial ports, AVR Microcontrollers and CAN.

Course Outcomes

- Understand and analyze Forth/Open Firmware, interaction with hardware and memory
- Discussion on how to add Peripherals Using SPI and I^2C
- Understand the significance of serial ports, IrDA and USB
- Understand various microcontrollers.

SYLLABUS

UNIT - I

An Introduction to Computer Architecture - Processors, Basic System Architecture, Interrupts, CISC and RISC, Digital Signal Processors, Memory and its types, Input/Output, DMA, Parallel and Distributed Computers, Embedded Computer Architecture

Forth/Open Firmware - Introducing Forth, String Word, Stack Manipulation, Creating New Words, Comments, if ... else, Loops, Data Structures, Interacting with Hardware and Memory, Forth Programming Guidelines

UNIT - II

Building Hardware - Tools, Soldering, Quick Construction, Printed-Circuit Boards, Building it, JTAG

Adding Peripherals Using SPI - Serial Peripheral Interface, SPI-Based Clock/Calendar, SPI-Based Digital Potentiometer

Adding Peripherals Using I2C - Overview of I^2C, Adding a Real-Time Clock with I^2C, Adding a Small Display with I2C

UNIT - III

Serial Ports – UARTs, Error Detection, Old Faithful: RS-232C, RS-422, RS-485

IrDA - Introduction to IrDA, An IrDA Interface, Other Infrared Devices

USB - Introduction to USB, USB Packets, Physical Interface, Implementing USB Interface

UNIT - IV

Networks - Controller Area Network (CAN), Ethernet

Analog - Amplifiers, A to D conversion, Interfacing an External ADC, Temperature Sensor, Light sensor, Accelerometer, Pressure Sensor, Magnetic-Field Sensor, D to A conversion, PWM, Motor Control,

The PIC Microcontrollers - A Tale of Two Processors, Starting simple, A Bigger PIC, Motor control with a PIC

UNIT - V

The AVR Microcontrollers - The AVR Architecture, The ATtiny15 Processor, Downloading Code, A Bigger AVR, Bus interfacing

68000-Series Computers – Architecture, A Simple 68000-Based Computer

DSP-Based Controllers - The DSP 56800, A DSP 56805-Based Computer, JTAG

TEXT BOOK

1. John Catsoulis, Designing Embedded Hardware, 2nd Edition, O'Reilly Media, Inc.

REFERENCE BOOK

1. K. Shibu, Introduction to Embedded Systems, McGraw Hill Education.

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3 0 0 3

ENERGY SOURCES AND POWER MANAGEMENT

Professional Elective - II

Course objectives

- To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of Conventional energy Sources, Power distribution management system.

Course Outcomes

- Understand conventional energy sources and energy management system.
- Understand the significance of intelligent electronic devices
- Knowledge on energy distribution management system
- Understand the importance of smart meters

SYLLABUS

UNIT - I

Introduction to Energy Sources: Conventional energy sources - Thermal, Hydel, Nuclear, Gas power stations (Single line diagrams - qualitative approach only)

UNIT - II

Renewable energy sources - Solar, wind, Tidal, wave, OTEC, Fuel cells, Geothermal, Energy Storage.

UNIT - III

Energy Management System: Energy Management System (EMS) - SMART GRID - Smart Grid Concept - Definitions and Need for Smart Grid - Functions - Opportunities - Benefits and challenges, Difference between conventional & Smart Grid, Smart substations - Substation Automation - Feeder Automation, SCADA - Remote Terminal Unit - Intelligent Electronic Devices - Protocols, Phasor Measurement Unit - Wide area monitoring protection and control, Smart integration of energy resources

UNIT - IV

Distribution Management System: Distribution Management System (DMS) - Volt / VAR control - Fault Detection, Isolation and Service Restoration, Network Reconfiguration, Outage management System, Customer Information System, Geographical Information System, Effect of Plug in Hybrid Electric Vehicles

UNIT - V

Smart Meters: Introduction to Smart Meters - Advanced Metering infrastructure (AMI), AMI protocols - Standards and initiatives, Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.

TEXT BOOKS

1. Stuart Borlase Smart Grid: Infrastructure, Technology and Solutions, CRC Press 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Smart Grid: Technology and Applications, Wiley, 2012
3. Generation, distribution and utilization of Electric power, C. L. Wadhwa, New Age Publications
4. Renewable sources and emerging technologies, D.P. Kothari, K.C. Singal, Rakesh Ranjan, PHI 2/e.

REFERENCE BOOKS

1. Mini S. Thomas, John D McDonald, Power System SCADA and Smart Grids, CRC Press, 2015
2. Kenneth C. Budka, Jayant G. Deshpande, Marina Thottan, Communication Networks for Smart Grids, Springer, 2014.

E BOOKS

1. https://books.google.co.in/books?isbn=1119969093
2. https://books.google.co.in/books?isbn=135123093X

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B.Tech. III Year II Sem **L T P C**

3 0 0 3

INTRODUCTION TO IOT

Open Elective - I

Course Objectives

The objectives of the course are to:

- Understand the concepts of Internet of Things and able to build IoT applications
- Learn the programming and use of Arduino and Raspberry Pi boards.
- Known about data handling and analytics in SDN.

Course Outcomes

Upon completing this course, the student will be able to:

- Known basic protocols in sensor networks.
- Program and configure Arduino boards for various designs.
- Python programming and interfacing for Raspberry Pi.
- Explore IoT applications in different domains.

SYLLABUS

UNIT - I

Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT - II

Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

UNIT - III

Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi, Case studies.

UNIT - IV

Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics.

UNIT - V

Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT.

Case Study: Agriculture, Healthcare, Activity Monitoring

TEXT BOOKS

1. Pethuru Raj and Anupama C. Raman, The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases, (CRC Press)
2. Terokarvinen, kemo, karvinen and villey valtokari, Make sensors: 1st edition, maker media, 2014.

REFERENCE BOOKS

1. Vijay Madisetti, Arshdeep Bahga, Internet of Things: A Hands-On Approach
2. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice
3. Beginning Sensor networks with Arduino and Raspberry Pi, Charles Bell, Apress, 2013

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B.Tech. III Year II Sem **L T P C**

3 0 0 3

IOT SENSORS

Open Elective - I

Course Objectives

- Understand the concepts of Internet of Things and able to build IoT applications
- Learn the programming and use of Arduino and Raspberry Pi boards.
- Known about data handling and analytics in SDN.

Course Outcomes

- Understand the basic protocols in sensor networks.
- Program and configure Arduino boards for various designs.
- Implement interfacing Raspberry Pi with sensors using python programming
- Design IoT applications in different domains.

SYLLABUS

UNIT - I

Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT - II

Basics of Sensors: Introduction- Sensor Vs Transducer, Nature of Sensors, Sensor Output Characteristics, Sensing Technologies, Digital Output Sensors.

UNIT - III

Application Specific Sensors: Occupancy and motion detectors: ultrasonic - microwave - capacitive detectors - optical presence sensor, Light Detectors: Photo diodes - phototransistor - photoresistor- CCD and CMOS image sensors, Temperature Sensors: thermos-resistive sensors - thermoelectric contact sensor

UNIT - IV

Sensor with Microcontroller: Introduction, Amplification and Signal Conditioning, Integrated Signal Conditioning, Digital
Conversion, MCU Control, MCUs for Sensor Interface, Techniques and Systems Considerations, Sensor Integration

UNIT - V

Wireless Sensing: Wireless Data and Communications, Wireless Sensing Networks, Industrial Wireless Sensing Networks, RF Sensing, Telemetry, RF MEMS, Complete System Consideration.

TEXT BOOKS

1. Frank, Randy, Understanding smart sensors, Artech House integrated microsystems series, 3rd Edition, 2013.
2. Jacob Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications, 5th Edition, Springer, 2016
3. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

REFERENCE BOOKS

1. Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler, David Boyle, Catherine Mulligan, Internet of Things: Technologies and Applications for a New Age of Intelligence, Academic Press, 16- Nov- 2018.
2. Henry Leung, Subhas Chandra Mukhopadhyay, Intelligent Environmental Sensing, Springer, 22-Jan-2015.

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B.Tech. III Year II Sem **L T P C**

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IOT SECURITY LAB

Course Objectives

- Understand the various attacks and importance of Security aspects in IoT
- Understand the techniques, protocols and security towards Gaming models
- Understand security and privacy challenges of IoT
- Understand the application of block chain technology for IoT Security

Course Outcomes

- Incorporate the best practices learnt to identify the attacks and mitigate the same
- Adopt the right security techniques and protocols during the design of IoT products
- Assimilate and apply the skills learnt on ciphers and block chains when appropriate
- Describe the essential components of IoT
- Find appropriate security/privacy solutions for IoT

List of Experiments

1. Implement a basic block cipher algorithm to understand how encryption secures data in IoT devices.
2. Create a simple blockchain to understand its structure and relevance in IoT security.
3. Set up an IoT device (like a Raspberry Pi) and identify potential security vulnerabilities.
4. Integrate various sensors and actuators into an IoT system, understanding their role in cyber- physical systems and exploring common security challenges.
5. Conduct experiments to read RFID tags, and discuss security implications.
6. Use cryptographic libraries to create digital signatures using elliptic curves, understanding their application in IoT security.
7. Implement Merkle trees and experiment with elliptic curve digital signatures to secure communication on basic IoT hardware like Arduino.
8. Simulate the working of Proof of Work and Proof of Stake algorithms in the context of cryptocurrencies and IoT.
9. Set up different IoT networking protocols and analyze their security features.
10. Create a simple smart contract using Ethereum to understand its application

and the challenges in verification.

TEXT BOOKS

1. B. Russell and D. Van Duren, Practical Internet of Things Security, Packt Publishing, 2016.
2. FeiHU, Security and Privacy Internet of Things (IoTs): Models, Algorithms and Implementations, CRC Press, 2016
3. Narayanan et al., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.

REFERENCE BOOKS

1. A. Antonopoulos, Mastering Bitcoin: Unlocking Digital Crypto currencies, O'Reilly, 2014.
2. T. Alpcan and T. Basar, Network Security: A Decision and Game-theoretic Approach, Cambridge University Press, 2011.
3. Security and the IoT ecosystem, KPMG International, 2015.
4. Internet of Things: IoT Governance, Privacy and Security Issues European Research Cluster.
5. Ollie Whitehouse, Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond, NCC Group, 2014.
6. Josh Thompson, Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.

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0 0 3 1.5

COMPUTER VISION LAB

Course Objectives

- To make students acquainted with practical aspects of computing with images.
- To improve quality of image by applying enhancement techniques.
- To understand Feature Extraction algorithms.

Course Outcomes

- Understand the basic image processing techniques and enhance images by adjusting contrast.
- Detect edges using various kernels using transformation.
- Apply histogram processing, convert between various colour spaces.
- Partition dataset by classification and clustering.
- Comprehend computer vision system for real world problems.

Description: Use any tool like OpenCV/ Scilab/ python/R Programming etc.

List of Programs

1. Familiarization of the tool used for computer vision.
2. Implement basic image operations
    a. Loading and displaying an image.
    b. Color formats
    c. Image enhancement.
3. Implement smoothing filters on an image using
    a. Gaussian filter
    b. Median filter
    c. Mean Filter
4. Demonstrate fourier Transformations.
5. Implement histogram calculation and equalization for the given image.
6. Implement morphological operations like dilation, erosion, opening and closing on the given image
7. Implement edge detection on images using any two edge detection masks.
8. Detection of motion from structure.
9. Implement texture extraction of a given image.
10. Implement object detection like recognizing pedestrians.
11. Implement face recognition of an image using K-Means clustering.
12. Implement dimensionality reduction using PCA for the given images.
13. Demonstrate model-based reconstruction using tensor flow.

TEXT BOOKS

1. Gary Bradski and Adrian Kaehler, Learning OpenCV, O'Reilly Media, Inc., 1st Edition, 2008.
2. Talita Perciano and Alejandro C Frery, Introduction to Image Processing Using R: Learning by Examples, Springer, 1st Edition, 2013.
3. Computer Vision: Algorithms and Applications by Richard Szeliski; Springer-Verlag London Limited 2011.

REFERENCE BOOKS

1. R C Gonzalez and R E woods, Digital Image Processing, Addison Pearson, 3rd Edition, 2013.
2. David A. Forsyth and Jean Ponce, Computer Vision-A Modern Approach, PHI, 1st Edition, 2003.

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B.Tech. III Year II Sem **L T P C**

0 0 4 2

BIG DATA - SPARK

Course Objectives

- The main objective of the course is to process Big Data with advance architecture like spark and streaming data in Spark

Course Outcomes

- Develop MapReduce Programs to analyze large dataset Using Hadoop and Spark
- Write Hive queries to analyze large dataset Outline the Spark Ecosystem and its components
- Perform the filter, count, distinct, map, flatMap RDD Operations in Spark.
- Build Queries using Spark SQL
- Apply Spark joins on Sample Data Sets
- Make use of sqoop to import and export data from hadoop to database and vice-versa

List of Experiments

1. To Study of Big Data Analytics and Hadoop Architecture
   (i) know the concept of big data architecture
   (ii) know the concept of Hadoop architecture

2. Loading DataSet in to HDFS for Spark Analysis Installation of Hadoop and cluster management
   In stalling Hadoop single node cluster in ubuntu environment
   (i) Knowing the differencing between single node clusters and multi-node clusters
   (ii) Accessing WEB-UI and the port number
   (iii) Installing and accessing the environments such as hive and sqoop

3. File management tasks & Basic linux commands
   (i)Creating a directory in HDFS
   (ii) Moving forth and back to directories
   (iii) Listing directory contents
   (iv) Uploading and downloading a file in HDFS
   (v) Checking the contents of the file
   (vi) Copying and moving files
   (vii) Copying and moving files between local to HDFS environment
   (viii) Removing files and paths

(ix) Displaying few lines of a file
(x) Display the aggregate length of a file
(xi) Checking the permissions of a file
(xii) Zipping and unzipping the files with & without permission pasting it to a location
(xiii) Copy, Paste commands

4. Map-reducing
   (i)Definition of Map-reduce
   (ii) Its stages and terminologies
   (iii)Word-count program to understand map-reduce (Mapper phase, Reducer phase, Driver code)
5. Implementing Matrix-Multiplication with Hadoop Map-reduce

6. Compute Average Salary and Total Salary by Gender for an Enterprise.

7. (i) Creating hive tables (External and internal)
   (ii)Loading data to external hive tables from sql tables(or)Structured c.s.v using scoop
   (iii) Performing operations like filterations and updations
   (iv) Performing Join (inner, outer etc)
   (v)Writing User defined function on hive tables

8. Create a sql table of employees Employee table with id,designation Salary table (salary ,dept id) Create external table in hive with similar schema of above tables,Move data to hive using scoop and load the contents into tables,filter a new table and write a UDF to encrypt the table with AES-algorithm, Decrypt it with key to show contents

9. (i) Pyspark Definition(Apache Pyspark) and difference between Pyspark, Scala, pandas
   (ii)Pyspark files and class methods
   (iii) get(file name)
   (iv) get root directory()

10. Pyspark -RDD'S
    (i)what is RDD's?
    (ii) ways to Create RDD
    (iii) parallelized collections
    (iv) external dataset
    (v) existing RDD's
    (vi) Spark RDD's operations (Count, foreach(), Collect, join,Cache()

11. Perform pyspark transformations

(i)map and flatMap

(ii) to remove the words, which are not necessary to analyze this text.

(iii) groupBy

(iv) What if we want to calculate how many times each word is coming in corpus ?

(v) How do I perform a task (say count the words ‘spark’ and ‘apache’ in rdd3) separatly on each partition and get the output of the task performed in these partition?

(vi) unions of RDD

(vii) join two pairs of RDD Based upon their key

12. Pyspark sparkconf-Attributes and applications

(i)What is Pyspark spark conf ()

(ii)Using spark conf create a spark session to write a dataframe to read details in a c.s.v and later move that c.s.v to another location

TEXT BOOKS

1. Spark in Action, Marko Bonaci and Petar Zecevic, Manning.
2. PySpark SQL Recipes: With HiveQL, Dataframe and Graphframes, Raju Kumar Mishra and Sundar Rajan Raman, Apress Media.

WEB LINKS

1. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301505844518912251 82_shared/overview
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01258388119638835242_shared/overview
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012605268423008256169 2_shared/overview