

<p style="text-align: center;">Savitribai Phule Pune University Third Year of Computer Engineering (2015 Course) 310258: Embedded Systems & Internet of Things Lab</p>		
Teaching Scheme: PR: 02 Hours/Week	Credit 01	Examination Scheme: TW: 50 Marks
Companion Course -Embedded Systems & Internet of Things (310252)		
Course Objectives: <ul style="list-style-type: none"> To understand functionalities of various single board embedded platforms fundamentals To develop comprehensive approach towards building small low cost embedded IoT system. To understand different sensory inputs. 		
Course Outcomes: On completion of the course, student will be able to– <ul style="list-style-type: none"> Design the minimum system for sensor based application Solve the problems related to the primitive needs using IoT Develop full fledged IoT application for distributed environment 		
<p style="text-align: center;">Guidelines for Instructor's Manual</p> <p>The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.</p>		
<p style="text-align: center;">Guidelines for Student Journal</p> <p>The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and <u>handwritten write-up</u> of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, <u>Theory- Concept in brief, algorithm, flowchart, test cases, conclusion/analysis.</u> <u>Program codes with sample output of all performed assignments are to be submitted as softcopy.</u></p> <p>As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.</p>		
<p style="text-align: center;">Guidelines for Assessment</p> <p>Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.</p>		
<p style="text-align: center;">Guidelines for Practical Examination</p> <p>Both internal and external examiners should jointly set problem statements. <u>During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement.</u> The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.</p>		

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications.

In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Set of suggested assignment list is provided in groups- A, B, C, D, and E. Each student must perform at least 11 assignments as at least 3 from group A, 3 from group B, 2 from group C, 2 from group D and 1 from group E. **UML diagrams are to be drawn for group E assignment.**

References:

1. Nitesh Dhanjani, “Abusing the Internet of Things”, O'REILLY, ISBN: 13:978-93-5313-217-1
2. Cuno Pfister, “Getting Started with the Internet of Things”, O'REILLY, ISBN: 13:978-93-53023-413-6
3. Massimo Banzi and Michael Shiloh, “Getting Started with Arduino”, MAKER MEDIA, ISBN: 13:978-93-5110-907-5
4. Don Wilcher, “BASIC Arduino Projects”, MAKER MEDIA, ISBN: 13:978-93-5110-503-9
5. Cefn Hoile, Clare Bowman, Sjoerd Dirk Meijer, Brian Corteil, Lauren Orsini, “Raspberry Pi and AVR Projects”, MAKER MEDIA, ISBN: 13:978-93-5110-914-3
6. Wolfram Donot, “A Raspberry Pi Controlled Robot”, MAKER MEDIA, ISBN: 13:978-93-5110-913-6
7. Kimmo Karvinen and Tero Karvinen, “Arduino Bots and Gadgets”, O'REILLY, ISBN: 13:978-93-5023-374-0
8. Derek Molley, “Exploring Beaglebone”, Willey, ISBN: 978-1-118-935125
9. Matt Richardson and Shawn Wallace, “Getting with Raspberry Pi”, MAKER MEDIA, ISBN: 978-93-5213-450-2
10. Dr. Simon Monk, “Raspberry PiCook-Book”, O'REILLY, ISBN: 978-93-5213-389-5

Suggested List of Laboratory Assignments

Group A

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| 1. | Study of Raspberry-Pi, Beagle board, Arduino and other micro controller (History & Elevation) |
| 2. | Study of different operating systems for Raspberry-Pi /Beagle board. Understanding the process of OS installation on Raspberry-Pi /Beagle board |
| 3. | Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDS. Understanding GPIO and its use in program. |
| 4. | Understanding the connectivity of Raspberry-Pi /Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicated user using LEDSs |

Group B

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| 5. | Understanding the connectivity of Raspberry-Pi /Beagle board circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs. |
| 6. | Understanding and connectivity of Raspberry-Pi /Beagle board with camera. Write an application to capture and store the image. |
| 7. | Understanding and connectivity of Raspberry-Pi /Beagle board with a Zigbee module. Write a network application for communication between two devices using Zigbee. |
| 8. | Study of different CPU frequency governors. Write an application to change CPU frequency of Raspberry-Pi /Beagle board |

Group C	
9.	Write an application using Raspberry-Pi /Beagle board to control the operation of stepper motor.
10.	Write an application using Raspberry-Pi /Beagle board to control the operation of a hardware simulated traffic signal.
11.	Write an application using Raspberry-Pi /Beagle board to control the operation of a hardware simulated lift elevator
Group D	
12.	Write a server application to be deployed on Raspberry-Pi /Beagle board. Write client applications to get services from the server application.
13.	Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe.
14.	Create a simple web interface for Raspberry-Pi/Beagle board to control the connected LEDs remotely through the interface.
Group E	
15.	Develop a Real time application like smart home with following requirements: When user enters into house the required appliances like fan, light should be switched ON. Appliances should also get controlled remotely by a suitable web interface. The objective of this application is student should construct complete Smart application in group.
16.	Develop a Real time application like a smart home with following requirements: If anyone comes at door the camera module automatically captures his image send it to the email account of user or send notification to the user. Door will open only after user's approval.