Bangladesh University of Business and Technology (BUBT)
Faculty of Engineering& Applied Sciences (FEAS)
Department of Computer Science and Engineering (CSE)

LAB COURSE OUTLINE

1	Program	B.Sc. Engg. in CSE
2	Course Code	CSE 426
3	Course Title	IoT Lab
4	Course Type	Core Course
5	Academic Session	Summer 2021
6	Credit Hour	1.50
7	Intake	39
8	Section	1
9	Campus	Permanent Campus

<table>
<tr><td>10</td><td>Course Teacher</td><td colspan="3">Name: Md. Hasibur Rahman</td><td colspan="2">Designation: Lecturer</td></tr>
<tr><td></td><td></td><td colspan="5">Specialization: Machine Learning, Internet of Things</td></tr>
<tr><td></td><td></td><td colspan="2">Room No. 503/B3</td><td colspan="2">Email: hasibur@bubt.edu.bd</td><td>Cell No. 01751362424</td></tr>
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11	Class Schedule			
		Class Day	**Class Hours**	**Class Room**
		Wednesday	8:30 to 11:30	B3:R-506

12	Course Objectives	This course is based on 'CSE-425 Internet of Things' theory course. The objectives of this course is to apply the theoretical knowledge by allowing students to experiment with IoT systems (techniques and tools for integrating hardware and software components) in a hands-on manner. It also emphasizes on testing and debugging features for verification of IoT systems and finally they can implement this knowledge as a project.
13	Text Book	1. Science and Engineering Projects Using the Arduino and Raspberry Pi: Explore STEM Concepts with Microcomputers - Paul Bradt, David Bradt
14	Reference Book	1. Programming Arduino: Getting Started with Sketches - Simon Monk
15	Course Outcomes (COs)	Upon completing this course students will be able to: **CO1 :** **Demonstrate** the functionality of Arduino. **CO2 :** **Analyze** various standard IoT techniques and apply it to make a proper design for real life problem solution. **CO3 :** **Design** and **implement** an IoT project.

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2			√									
CO3									√			

CO No.	PO No.	Bloom's Domain / Level	Delivery Methods / Activities	Assessment Tools
CO1	PO1	Cognitive / Understanding	Lectures, Lab Task, Assignment.	Lab Performance
CO2	PO3	Cognitive / Applying	Lectures, Lab Task, Assignment.	Lab Performance
CO3	PO9	Psychomotor / Guided Response	Lectures, Lab Task, Assignment.	Project

16	Teaching Strategy	Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

17	Assessment and Marks Distribution:	Class Attendance	:	10%
		Assignment	:	20%
		Lab Performance	:	30%
		Final Project	:	40%

18 Weekly Schedule

Week	Lab	Topics	CO
Week1	Lab1	Introduction to Arduino, Arduino IDE, Proteus & Tinkercad.	
Week2	Lab2	Simple program to start with Arduino: Led Blinking and switch. *Lab performance will be measured on the Lab1 and Lab2.*	**CO1**
Week3	Lab3	Introduction to Arduino with analogue computation.	
Week4	Lab4	Interfacing Arduino with Seven Segment Display. *Lab performance will be measured on the Lab3 and Lab4.*	**CO1**
Week5	Lab5	LCD and hex keypad interfacing with Arduino. *Lab performance will be measured on the Lab5.*	
Week6	Lab6	Interfacing DC motor with Relay in Arduino. Discussion on project proposal.	**CO2**
Week7	Lab7	Interfacing Servo Motor and ultrasonic sensor with Arduino to implement an automatic door on-off system. *Lab performance will be measured on the Lab6 and Lab7.*	**CO2**
Week8		**Mid-term week**	
Week9	Lab8	Controlling home appliances using Relay, Bluetooth, Arduino, and blynk app. *Lab performance will be measured on the Lab8.*	**CO2**
Week10	Lab9	Controlling home appliances online using ESP8266 WiFi Module and Arduino. *Lab performance will be measured on the Lab9.*	**CO2**
Week11	Lab10	Halfway Project Show and Discussion	
Week12	Lab11	Interfacing two or more sensors with Arduino, store their value in Thingspeak and provide notification to mobile phone.	
Week13	Lab12	**Project/ Team Work:** Students will work in a team to implement the project.	

Week14	Lab13	**Final Project Evaluation**		**CO3**
Week 15		**Final Term Week**		

| 19 | **Overall CO Assessment Criteria** | Assessment methods of COs are given below: |

Assessment methods of COs are given below:

Assessment Area	Course Outcomes CO			Assessment Area Mark
	CO1	**CO2**	**CO3**	
Attendance				
Lab Assignment				
Lab Performance	10	20		30
Project Evaluation			40	40
Total Mark	**10**	**20**	**40**	**70**

20	**Lab Performance Assessment Details**	Will be added after finalization.

21	**Lab Project Assessment Details**	Will be added after finalization.

22	**Grading Policy**	The following chart will be followed for grading. This has been customized from the guideline provided by the School of Engineering and Computer Science.

A+	A	A-	B+	B	B-	C+	C	D	F
≥ 80	75-<80	70-<75	65-<70	60-<65	55-<60	50-<55	45-<50	40-<45	<40

23	**Additional Course Policies**	**Assignments**	There will be at least two assignments. Average marks of the assignments will be counted. No late homework will be accepted. *Any kind of copy/manipulation in assignment will carry zero mark.* Two or more copied assignments will carry zero mark in all assignments. **Zero tolerance will be shown in this regard.** Solutions to assignment problems will be provided through web and on hand.
		Lab Performance	There will be at least six lab performance evaluations. These will be taken as per the weekly schedule. During evaluation, following instructions will be strictly maintained: 1. Every student is expected to be regular in Lab classes. 2. Do NOT copy lines of code from anybody else. 3. Do NOT ask to see another student's code. 4. Do NOT pass code or program to other members of the class 5. If the instructor is at all uncomfortable about the originality of student's work, no mark will be given.

25				6. There will be no make-up evaluation of lab performance (except, at the discretion of the instructor, in the case of documented medical or family emergencies).
			Project	**Introduction** In this course CSE - 426, you will develop a small scale project exploiting the technology and features of Python. **Instructions** • Project must be based on advanced knowledge of AI and Python programming in order to use modern AI tools and techniques. • You can propose your project proposal but that must be up to the standard. • Focus on real life problems while finalizing your proposal. **Problem Definition** In your project report you should present the situation you have tackled while implementing your project and how you managed to solve it. Your document should start by: • Illustrate the problem. • Specify how you will solve the problem. • You must have at least five features for your intended project. • Mention the object oriented principles (Encapsulation, Polymorphism, Inheritance, Abstraction) used in your project. **Design and Programming** • You can use standard packages, but provide proper reference in the report. • You may use python (or other language) to write program by exploiting AI models in your project. • The graphical user interface is not mandatory but for representation purpose you can incorporate it. • Your data in your project report. **Team Work** • A group can be formed with maximum four members • Every member of a group should have equal contribution to the project (N.B. They will be asked about their individual role) **Project Submission** Remember to properly indent your code and add comments as required before submitting your full project source code. You also have to submit your Project report, Project presentation Slide along with your project source code. Note: By following the above points, you will be meeting the basic requirements. Make sure the Project report reflects also good word-processing skills (headers/footers/page numbering, etc.) as marks will be rewarded for that as well in your report.

24	**Additional Information**	a. Academic Calendar Summer 2020: http://www.bubt.edu.bd/academics/academic-calendar. b. Academic Policies: http://www.bubt.edu.bd/academics/academic-rules-a-regulations. c. Grading & Evaluation: http://www.bubt.edu.bd/academics/academic-rules-a-regulations. d. Proctorial Rules: http://www.bubt.edu.bd/administrator/proctors-office.
25	**Bloom's Taxonomy for Teaching-Learning** Bloom's Taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. The three lists cover the learning objectives in Cognitive, Affective and Psychomotor domains. The Cognitive domain list has been the primary focus of most education and is frequently used to structure curriculum learning objectives, assessments and activities. The three domains and respective levels are illustrated below.	

Cognitive [C] (Knowledge-based)	Affective [A] (Emotion-based)	Psychomotor [P] (Action-based)
1. Remembering	1. Receiving	1. Perception
2. Understanding	2. Responding	2. Set
3. Applying	3. Valuing	3. Guided Response
4. Analyzing	4. Organizing	4. Mechanism
5. Evaluating	5. Characterizing	5. Complex Overt Response
6. Creating		6. Adaptation
-		7. Origination

26	**Descriptions of Cognitive Domain (AndersonandKrathwohl'sTaxonomy2001):** The **cognitive domain** involves the development of our mental skills and the acquisition of knowledge.

Level	Category	Meaning	Keywords
C1	Remembering	Recognizing or recalling knowledge from memory. Remembering is when memory is used to produce or retrieve definitions, facts, or lists, or to recite previously learned information.	Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write
C2	Understanding	Constructing meaning from different types of functions be they written or graphic messages or activities like interpreting, exemplifying, classifying, summarizing, inferring, comparing, or explaining.	Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report
C3	Applying	Carrying out or using a procedure through executing, or implementing. Applying relates to or refers to situations where learned material is used through products like models, presentations, interviews or simulations.	Apply, change, choose, compute, dramatize, implement, interview, prepare, produce, role play, select, show, transfer, use
C4	Analyzing	Breaking materials or concepts into parts, determining how the parts relate to one another or how they interrelate, or how the parts relate to an overall structure or purpose. Mental actions included in this function are differentiating, organizing, and attributing, as well as being able to distinguish between the components or parts. When one is analyzing, he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations.	Analyze, characterize, classify, compare, contrast, debate, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, structure
C5	Evaluating	Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation.	Appraise, argue, assess, choose, conclude, critique, decide, evaluate, judge, justify, predict, prioritize, prove, rank, rate, select, Monitor
C6	Creating	Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way, or synthesize parts into something new and different creating a new form or product. This process is the most difficult mental function.	Construct, design, develop, generate, hypothesize, invent, plan, produce, compose, create, make, perform, plan, produce

27	**Descriptions of Affective Domain (Krathwohl, Bloom, Masia, 1973)** The **affective domain** includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

Level	Category	Meaning	Keywords
A1	Receiving	Awareness, willingness to hear, selected attention.	acknowledge, asks, attentive, courteous, dutiful, follows, gives, listens, understands

		A2	Responding	Active participation on the part of the learners. Attend and react to a particular phenomenon. Learning outcomes may emphasize compliance in responding, willingness to respond, or satisfaction in responding (motivation).	answers, assists, aids, complies, conforms, discusses, greets, helps, labels, performs, presents, tells
		A3	Valuing	The worth or value a person attaches to a particular object, phenomenon, or behavior. This ranges from simple acceptance to the more complex state of commitment. Valuing is based on the internalization of a set of specified values, while clues to these values are expressed in the learner's overt behavior and are often identifiable.	appreciates, cherish, treasure, demonstrates, initiates, invites, joins, justifies, proposes, respect, shares
		A4	Organizing	Organizes values into priorities by contrasting different values, resolving conflicts between them, and creating an unique value system. The emphasis is on comparing, relating, and synthesizing values.	compares, relates, synthesizes
		A5	Characterizing	Has a value system that controls their behavior. The behavior is pervasive, consistent, predictable, and most important characteristic of the learner. Instructional objectives are concerned with the student's general patterns of adjustment (personal, social, emotional).	acts, discriminates, displays, influences, modifies, performs, qualifies, questions, revises, serves, solves, verifies

28 Descriptions of Psychomotor Domain (Simpson, 1972)

The psychomotor domain includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution.

Level	Category	Meaning	Keywords
P1	Perception	The ability to use sensory cues to guide motor activity. This ranges from sensory stimulation, through cue selection, to translation.	chooses, describes, detects, differentiates, distinguishes, identifies, isolates, relates, selects.
P2	Set	Readiness to act. It includes mental, physical, and emotional sets. These three sets are dispositions that predetermine a person's response to different situations (sometimes called mindsets).	begins, displays, explains, moves, proceeds, reacts, shows, states, volunteers.
P3	Guided Response	The early stages in learning a complex skill that includes imitation and trial and error. Adequacy of performance is achieved by practicing.	copies, traces, follows, react, reproduce, responds
P4	Mechanism	This is the intermediate stage in learning a complex skill. Learned responses have become habitual and the movements can be performed with some confidence and proficiency.	assembles, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.
P5	Complex overt Response	The skillful performance of motor acts that involve complex movement patterns. Proficiency is indicated by a quick, accurate, and highly coordinated performance, requiring a minimum of energy. This category includes performing without hesitation, and automatic performance.	assembles, builds, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.
P6	Adaptation	Skills are well developed and the individual can modify movement patterns to fit special requirements.	adapts, alters, changes, rearranges, reorganizes, revises, varies.
P7	Origination	Creating new movement patterns to fit a particular situation or specific problem. Learning outcomes emphasize creativity based upon highly developed skills.	arranges, builds, combines, composes, constructs, creates, designs, initiate, makes, originates.

29 Graduate Attributes (Program Outcomes) for B.Sc. in Engineering Program based on Washington Accord

Program Outcomes (POs) are narrower statements that describe what students are expected to know and be able to do by the

Time of graduation. These relate to the knowledge skills and attitudes that students acquire while progressing through the program. The students of the B.Sc. in CSE program are expected to achieve the following graduate attributes or program outcomes at the time of graduation.

PO1–Engineering knowledge (Cognitive): Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2–Problem analysis (Cognitive): Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.

PO3–Design/development of solutions (Cognitive, Affective): Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.

PO4–Investigation (Cognitive, Psychomotor): Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

PO5–Modern tool usage (Psychomotor, Cognitive): Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6–The engineer and society (Affective): Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7–Environment and sustainability (Affective, Cognitive): Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

PO8–Ethics (Affective): Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.

PO9–Individual work and teamwork (Psychomotor, Affective): Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.

PO10–Communication (Psychomotor, Affective): Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.

PO11–Project management and finance (Cognitive, Psychomotor): Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.

PO12–Life-long learning (Affective, Psychomotor): Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

30	**Social & Moral Capital**

Our promises are based on the three cardinal principles:
   (a) What we do believe (b) What we do practice, and (c) What we will promote

However, students are advised to undertake the following commitments for moral development.

1. To be punctual and attentive in class	8. Try to follow and review day to day class	15. To be sincere for class preparation
2. To maintain inclusive learning environment	9. To avoid conspiracy	16. Do not forget to switch-off the cell phone in class
3. To ensure mutual respect	10. To prioritize honesty & faith	17. Do not forget to carry course pack and learning stuffs in class
4. To be cooperative in group learning.	11. To be motivated for asking question and encourage feedback	18. To maintain loyalty and trust to the university
5. To be innovative and Creative	12. To develop attitude for speaking in English	19. Must avoid unfair means and plagiarism in exam, reports and assignments
6. To follow dress code and wearing ID card	13. Do not ignore to carry out any assignments or commitments	20. Must maintain eco-friendly environment in the campus.
7. To be always proactive	14. To be clean and decent in all levels.	

Prepared by: **Checked by:**   **Approved by:**