EMBEDDED SYSTEM DEVELOPMENT

1.Thông tin về học phần (General Information):

Tên học phần (Course name): Embedded System Development

Mã học phần (Course code): INT1461

Số tín chỉ (Number of credits): 3

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Phòng học lý thuyết (Lecture room): Projector, microphone and speaker, black board or white board.
- Phòng thực hành (Laboratory): Computers

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 32h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 0h
- Thực hành (Labs): 4h
- Tự học (Individual reading): 1h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Địa chỉ (Address): Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội
  Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.
- Điện thoại (Phone number): (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

The aim of this course is to provide learners with the fundamentals of embedded systems, including:

- basic concepts and fundamental tasks in embedded system development
- embedded system development models
- various kinds of embedded systems

Kỹ năng (Skills):

Learners will learn skills to develop various kinds of embedded systems using Arduino platform. These skills consist of:

- analyzing the requirement of an embedded system.
- designing hardware and software architecture of the system.
- evaluating the system.

Thái độ, Chuyên cần (Attitude):

- Learners are required to attend all classes, do exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course is focused on giving the learners practical embedded system development process and hands-on projects with Andruino platform. The learner will learn how to implement software configuration management and develop embedded software applications. Course assignments include creating various kinds of applications using C++ language on Arduino-based processors. On completion of this course, the learners will be able to understand the fundamentals of embedded systems as well as to develop a working embedded system.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Introduction to Embedded Systems

1.1. Basic concepts
- 1.1.1. Embedded systems
- 1.1.2. Processor
- 1.1.3. Embedded hardware
- 1.1.3. Embedded software

1.2. Embedded system design
- 1.2.1. Examples of embedded systems
- 1.2.2. Embedded system-on-chip and Use of VLSI circuit design technology
- 1.2.3. Complex system design and processor
- 1.2.4. Design process in embedded system
- 1.2.5. Formalization of system design
- 1.2.6. Design process and design examples
- 1.2.7. Classification of embedded systems
- 1.2.8. Skill required for an embedded system designer

Chapter 2: Introduction to Arduino Platform

2.1. Getting started with Arduino
- 2.1.1. Introduction
- 2.1.2. Arduino Variants
- 2.1.3. Install the drivers
- 2.1.4. Arduino IDE

2.2. Basic functions
- 2.2.1. Overview
- 2.2.2. Structure
- 2.2.3. Digital I/O functions
- 2.2.4. Analog I/O functions
- 2.2.5. Advanced I/O functions
- 2.2.6. Timer functions
- 2.2.7. Communication functions
- 2.2.8. Interrupt functions
- 2.2.9. Math functions
- 2.2.10. Programming language reference

Chapter 3: Using Sensor with Arduino

3.1. Introduction

3.2. Analog sensors
- 3.2.1. Light sensitive sensors
- 3.2.2. Temperature sensors
- 3.2.3. Gas sensor
- 3.2.4. Analog sound sensor
- 3.2.5. Triple axis acceleration sensor

3.2.6. Joystick module
3.3. Digital sensor
3.3.1. Digital Tilt sensor
3.3.2. Digital temperature sensor
3.3.3. Digital Infrared motion sensor
3.3.4. Digital ultrasonic
3.3.5. Digital vibration sensor
3.4 Case study: student projects on sensor reading

Chapter 4: Electromechanical Control using the Arduino
4.1. DC motor
4.1.1. Overview
4.1.2. Driven circuit design
4.2. Stepper motor
4.2.1. Overview
4.2.2. Working principle of stepper motor
4.2.3. Driven circuit design
4.2.4. Demonstration
4.3. Servo setting
4.3.1. Overview
4.3.2. Driven circuit design
4.4 Case study: student projects on motor controlling

Chapter 5: Wireless Control using the Arduino
5.1. Infrared Transmitter and Receiver module
5.1.1. Introduction
5.1.2. IR transmitter/receiver module
5.1.3. IR Kit
5.2. 2.4G Wireless radio frequency module
5.2.1. Introduction
5.2.2. 2.4G Wireless RF transmitter module
5.2.3. Demonstration
5.3. Bluetooth module
5.3.1. Introduction
5.3.2. HC-05 module
5.3.3. Modify HC-05 module default using a command
5.4. GSM/GPRS module
5.4.1. Introduction
5.4.2. A6 GSM/GPRS module
5.4.3. Demonstration
5.5. Wifi module
5.5.1. Introduction
5.5.2. Wi-fi module
5.5.3. Demonstration
5.6. Case study: Student project on wireless communication

Chapter 6: Embedded System Applications
6.1. PM2.5/Air Quality Monitor using Arduino
6.1.1. Introduction
6.1.2. System design
6.1.3. Production demonstration
6.2. Intelligent Lock System using Arduino
6.2.1. Introduction
6.2.2. System design

6.2.3. Production demonstration

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Embedded systems – Raj Kamal, Tata McGraw-Hill Education, 2011, ISBN: 0070667640.
[2] Designing Embedded Systems with Arduino – Tianhong Pan and Yi Zhu, Springer Singapore, 2018, ISBN: 978-981-13-5131-0.

5.2. Học liệu tham khảo (Reference Textbooks)

[3] Making Embedded Systems: Design Patterns for Great Software - Elecia White, O'Reilly Media, Inc, 2011, ISBN: 1449302149.

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term exam	20%	Group or individual
- Final examination	60%	Individual

Trưởng Bộ môn **(Head of Department)**	**Giảng viên biên soạn** **(Lecturer)**
Ngô Xuân Bách	**Vũ Hoài Nam**