CS4289: PERVASIVE COMPUTING

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Pervasive Computing

Subject Code
CS - Computer Science
Course Number
4289

Academic Unit
Computer Science (CS)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
(CS3103 Operating Systems or equivalent) AND (CS3201 Computer Networks or equivalent)

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract
This course aim is to introduce the latest concepts of computing applications in pervasive computing, and the important mechanisms and methods for development and design of high performance pervasive computing systems. The topics to

be covered are divided into four main areas: systems issues, architectures and tools; positioning, mobility and mobile data management; context-aware and proactive computing; and sensors and embedded computing.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the characteristics of pervasive computing applications including the basic computing application problems, performance objectives and quality of services, major system components and architectures of the systems.		x	x	
2	Analyse the strengths, problems and limitations of the current tools, devices and communications for pervasive computing systems.		x	x	
3	Apply the newly developed techniques for designing high performance pervasive computing systems such as in the areas in context-aware computing, proactive computing, mobile and real-time data/media management, multimedia data and sensing dissemination, mobility management, location-dependent query processing, and positioning.		x	x	
4	Investigate the mechanisms for management of multimedia sensor data and performance evaluation over sensors.			x	
5	Explore the trends and problems of current pervasive computing systems using examples.				
6	Develop an attitude to propose solutions with comparisons for problems related to pervasive computing through investigation.		x		

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	The basic concepts will be covered in the lectures, which will include case studies on pervasive computing systems.	1, 2, 3, 4	Lecture: 3 hours/week

| 2 | Design and programming assignment | Assignments aimed at helping with the students' learning the concepts and techniques, will be given. The assignment results will also serves as feedback so that the lecturer can pace the presentations accordingly. In particular, as one of the major assignments, students will be requested to explore the design a pervasive systems using application-orientation approach where existing wireless/mobile networks and related computing algorithms and protocols will be explored. In the process, the students will be given opportunity to demonstrate the novelty of their design on the application-oriented pervasive system in terms of system devices, architecture, protocols and performance improvements. | 2, 4 | |
| 3 | Presentation and class discussion | Class participation and knowledge sharing is an important part of the learning process. Students will be grouped to present their studies on a selected topic on pervasive computing systems. This activity helps develop their ability to investigate the trends and problems of pervasive computing systems. System design project and system survey on selected topics can be used as a measure on the understandings of the students on the basic concepts and problems, design issues and techniques in pervasive computing systems. | 1, 3, 5, 6 | Tutorial: 8 hours/semester |

| 4 | Mid-term quiz and class discussion | Students will be encouraged to discuss the key concepts in the design of novel pervasive computing systems. | 1, 3, 4 | |

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Presentation and report	1, 3, 5, 6	15	
2	Design and programming assignment	2, 4	10	
3	Mid-term quiz and class participation	1, 3, 4	15	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)

Assessment Task

Presentation and report

Criterion

ABILITY to EXPLAIN the trend of pervasive computing

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Programming assignment

Criterion

ABILITY to APPLY the newly developed techniques for designing high performance pervasive computing systems

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Mid-term quiz and class participation

Criterion

ABILITY to EXPLAIN the key concepts in pervasive computing

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

Software architectures, sensing technology and applications, volatile and adaptability, mobile computing devices and tools, mobile networks and communication, positioning, moving objects, location management, data/media dissemination, mobile data management, location-dependent services, context-aware computing, proactive computing and real-time monitoring, smart objects and smart spaces, temporal consistency and real-time data management, update stream processing, real-time scheduling and control systems, sensors and embedded systems, sensor data management and routing algorithms.

Syllabus

- Basic issues and problems: support for context-awareness, smart objects and spaces, directory management, dynamic and volatile systems, embedded systems, adaptive services and transparent interaction, integration and diversification, real-time control systems, balance between performance, energy-efficiency and quality of services.
- Mobile components and system architectures: strengths and limitations of mobile devices and tools, object identifications, mobile communications and system architectures, and sensors and sensor networks.
- System technologies: context-aware computing and modelling, proactive and responsive computing, location management and positioning, push and pull approaches for multimedia data dissemination, location update and mobility management, location dependent queries processing, continuous queries, temporal consistency and real-time data management, update streaming processing, sensor devices and sensor data management, multimedia sensor networks or routing algorithms.
- Case studies of current projects and pervasive computing systems to identify their strengthens, limitations and the future directions: Smart Home, Smart camera networks, etc.

Reading List

Compulsory Readings

	Title
1	Apostolos Malatras. Pervasive computing and communications design and deployment: technologies, trends and applications.
2	Varuna Godara. Strategic pervasive computing applications: emerging trends.
3	Mohammad S. Obaidat, Mieso Denko, Isaac Woungang. Pervasive computing and networking.
4	Francisco Milton Mendes Neto, Pedro Fernandes Ribeiro Neto. Designing solutions-based ubiquitous and pervasive computing : new issues and trends.

Additional Readings

	Title
1	M. Satyanarayanan (August, 2001). Pervasive Computing: Vision and Challenges. IEEE Personal Communications.
2	K. Edwards and R. Grinter (2001). At Home with Ubiquitous Computing: Seven Challenges. Proc. Ubiquitous Computing.
3	J. Hightower and G. Borriello (August 2001). Location Systems for Ubiquitous Computing. IEEE Computer.