Peruvian Computing Society (SPC)
School of Computer Science
Sillabus 2021-I

1. COURSE

CS366. Robotics (Elective)

2. GENERAL INFORMATION

2.1 Credits	:	4
2.2 Theory Hours	:	2 (Weekly)
2.3 Practice Hours	:	4 (Weekly)
2.4 Duration of the period	:	16 weeks
2.5 Type of course	:	Elective
2.6 Modality	:	Face to face
2.7 Prerrequisites	:	CS262. Machine learning. (7^{th} Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

That the student knows and understands the concepts and fundamental principles of control, road planning and the definition of strategies in robotics as well as concepts of robotic perception in a way that understands the potential of robotic systems

5. GOALS

- Synthesize the potential and limitations of the state-of-the-art of today's robotic systems.
- Implement Simple Motion Planning Algorithms.
- Explain the uncertainties associated with sensors and how to treat them.
- Designing a Simple Control Architecture.
- Describes several navigation strategies
- Describe the importance of recognizing images and objects in intelligent systems
- Outline the main techniques of object recognition
- Describe the different characteristics of the technologies used in perception

6. COMPETENCES

a) An ability to apply knowledge of mathematics, science. (**Usage**)

b) An ability to design and conduct experiments, as well as to analyze and interpret data. (**Usage**)

c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. (**Usage**)

d) An ability to function on multidisciplinary teams. (**Usage**)

g) The broad education necessary to understand the impact of computing solutions in a global, economic, environmental, and societal context. (**Usage**)

i) An ability to use the techniques, skills, and modern computing tools necessary for computing practice. (**Usage**)

l) Develop principles research in the area of computing with levels of international competitiveness. (**Usage**)

p) Improve the conditions of society by putting technology at the service of the human being. (**Usage**)

7. SPECIFIC COMPETENCES

a51) Apply mathematics in robotics projects.

b1) Apply computational thinking effectively to the solution of everyday problems

b2) Evaluate different proposals for computational thinking for the same problem.

b3) Apply robotics as a means to develop computational thinking.

b25) Analyze and understand the context of a problem to solve it through robotics.

c23) Design a robotic-based solution to a specific problem.

d9) Analyze the strengths and weaknesses of a team to build an efficient and ethical solution to a problem.

f28) Apply team leadership tools such as: effective communication, emotional intelligence, time management, decision making, creativity and innovation, mentoring.

g9) Analyze the impact of automation produced by robotics on the creation and transformation of existing jobs.

i2) Use programming languages and environments that allow the implementation and debugging of solutions.

l4) Investigate new solutions to existing problems based on robotics

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8. TOPICS

Unit 1: Robotics (5)	
Competences Expected: a,b	
Topics	**Learning Outcomes**
• Overview: problems and progress – State-of-the-art robot systems, including their sensors and an overview of their sensor processing – Robot control architectures, e.g., deliberative vs. reactive control and Braitenberg vehicles – World modeling and world models – Inherent uncertainty in sensing and in control • Configuration space and environmental maps	• List capabilities and limitations of today's state-of-the-art robot systems, including their sensors and the crucial sensor processing that informs those systems [Familiarity] • Integrate sensors, actuators, and software into a robot designed to undertake some task [Usage]
Readings : [**Siegwart04**], [**Trun05**], [**Stone00**]	

Unit 2: Robotics (15)	
Competences Expected: a,b,i,h	
Topics	**Learning Outcomes**
• Interpreting uncertain sensor data • Localizing and mapping	• Program a robot to accomplish simple tasks using deliberative, reactive, and/or hybrid control architectures [Usage] • Implement fundamental motion planning algorithms within a robot configuration space [Usage]
Readings : [**Siegwart04**], [**Trun05**]	

Unit 3: Robotics (20)	
Competences Expected: h,i	
Topics	**Learning Outcomes**
• Navigation and control • Motion planning	• Characterize the uncertainties associated with common robot sensors and actuators; articulate strategies for mitigating these uncertainties [Usage] • List the differences among robots' representations of their external environment, including their strengths and shortcomings [Usage]
Readings : [**Siegwart04**]	

Unit 4: Perception and Computer Vision (10)	
Competences Expected: a,b,c,f	
Topics	**Learning Outcomes**
• Computer vision – Image acquisition, representation, processing and properties – Shape representation, object recognition and segmentation – Motion analysis • Modularity in recognition	• Summarize the importance of image and object recognition in AI and indicate several significant applications of this technology [Usage] • Implement 2d object recognition based on contour- and/or region-based shape representations [Usage]
Readings : [**Sonka07**], [**Gonzales07**]	

Unit 5: Robotics (10)	
Competences Expected: a,b,i,h	
Topics	**Learning Outcomes**
• Multiple-robot coordination	• Compare and contrast at least three strategies for robot navigation within known and/or unknown environments, including their strengths and shortcomings [Familiarity] • Describe at least one approach for coordinating the actions and sensing of several robots to accomplish a single task [Familiarity]
Readings : [**Stone00**]	

9. WORKPLAN

9.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

9.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

9.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

10. EVALUATION SYSTEM

********* EVALUATION MISSING ********

11. BASIC BIBLIOGRAPHY