San Pablo Catholic University (UCSP)
Undergraduate Program in
Computer Science
SILABO

Universidad Católica San Pablo
2023-II

CS362. Robotics (Elective)

1. General information		
1.1 School	:	Ciencia de la Computación
1.2 Course	:	CS362. Robotics
1.3 Semester	:	10^{mo} Semestre.
1.4 Prerrequisites	:	CS361. Topics in Artificial Intelligence. (9^{th} Sem)
1.5 Type of course	:	Elective
1.6 Learning modality	:	Face to face
1.7 Horas	:	2 HT; 4 HP;
1.8 Credits	:	4
1.9 Plan	:	Plan Curricular 2016

2. Professors

Lecturer

- Yván Jesús Túpac Valdivia <ytupac@ucsp.edu.pe>
  - PhD in Ingeniería Eléctrica, Pontificia Universidad Católica de Rio de Janeiro, Brasil, 2005.

3. Course foundation

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

4. Summary

1. Robotics 2. Robotics 3. Robotics 4. Perception and Computer Vision 5. Robotics

5. Generales 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. Contribution to Outcomes

This discipline contributes to the achievement of the following outcomes:

1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. (**Usage**)

5) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline. (**Usage**)

6) Apply computer science theory and software development fundamentals to produce computing-based solutions. (**Usage**)

7. Content

UNIT 1: Robotics (5)

Competences:

Content	**Generales Goals**
• 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: Siegwart and Nourbakhsh (2004), S, W, and D (2005), Stone (2000)

UNIT 2: Robotics (15)

Competences:

Content	**Generales Goals**
• 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: Siegwart and Nourbakhsh (2004), S, W, and D (2005)

UNIT 3: Robotics (20)

Competences:

Content	**Generales Goals**
• 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: Siegwart and Nourbakhsh (2004)

UNIT 4: Perception and Computer Vision (10)	
Competences:	
Content	**Generales Goals**
• 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: M, V, and B. R (2007), G. R C. and W. R E. (2007)	

UNIT 5: Robotics (10)	
Competences:	
Content	**Generales Goals**
• 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: Stone (2000)	

8. Methodology

1. El profesor del curso presentará clases teóricas de los temas señalados en el programa propiciando la intervención de los alumnos.
2. El profesor del curso presentará demostraciones para fundamentar clases teóricas.
3. El profesor y los alumnos realizarán prácticas
4. Los alumnos deberán asistir a clase habiendo leído lo que el profesor va a presentar. De esta manera se facilitará la comprensión y los estudiantes estarán en mejores condiciones de hacer consultas en clase.

9. Assessment

Continuous Assessment 1 : 20 %

Partial Exam : 30 %

Continuous Assessment 2 : 20 %

Final exam : 30 %

References

M, Sonka., Hlavac. V, and Boile. R (2007). *Image Processing, Analysis and Machine Vision*. Cengage-Engineering.

R C, Gonzales. and Woods. R E (2007). *Digital Image Processing*. Prentice Hall. ISBN: 013168728X,978013168728B.

S, Thrun., Burgard. W, and Fox. D (2005). *Probabilistic Robotics*. Intelligent Robots and Autonomous Agents. The MIT Press.

Siegwart, R. and I. Nourbakhsh (2004). *Introduction to Autonomous Mobile Robots*. The MIT Press. ISBN: 0-262-19502-X.

Stone, Peter (2000). *Layered Learning in Multiagent Systems*. Intelligent Robots and Autonomous Agents. The MIT Press. ISBN: 9780262194389.