

Energy Harvesting in Smart Urban Solutions

Study programme	YUFE Joint Bachelor in Urban Sustainability Studies
Academic year	2026/2027
Curriculum component	Minor: Urban Ecology
Year and semester	2nd year, summer semester
Course type	Elective
ECTS credits	5
Contact hours (L+S+E)	20 + 40 + 0
Language of instruction	English

Contact

Course coordinator

Prof. Dr. Saša Zelenika
szelenika@uniri.hr

Teaching assistant/associate

Assit. Prof. Dr. Petar Gljušćić
pgljuscic@riteh.uniri.hr

Prerequisites

No requirements.

Course objectives

The course aims at introducing the concepts of smart solutions which use autonomous sensor networks based on energy harvesting, i.e., transducing low level environmental energy of various origin and their conversion into electrical energy. Via project work, students will investigate the possibility to use this concept in smart cities as well as other potential uses, with focus not only on applications but also on societal, economic and environmental aspects.

Learning outcomes

- Distinguish and characterize the basic terms, specificities and advantages of energy harvesting (P_ILO 2.2). Validate and plan the use of energy harvesting principles and their integration into autonomous sensor networks (P_ILO 3.2
- P_ILO 4.2). Implement the acquired knowledge in the generation of smart city and other advanced solutions (P_ILO 3.2 P_ILO 4.2 P_ILO 2 P_ILO 12).
- Critically evaluate the ethical, societal and economic impact of the proposed solutions (P_ILO 5.2 P_ILO 12 P_ILO 13).

Course content

- Basic energy harvesting (EH) notions. Principles of light-based, kinetic, thermal and radio-frequency EH. Various modalities of kinetic EH (electro-magnetic, piezoelectric, triboelectric). Light and thermal EH. Hybrid EH solutions. Power management and duty cycles. Application of EH principles in sustainable urban environments.
- Development of a proof-of-concept solution in a specific green technology application in urban environment.

Teaching and learning methods

lectures and seminars and workshops.

Assessment and grading

Continuous class activity, project work, seminar paper. Active participation to classes. Independent but supervised project work on a concrete application of EH principles to power autonomous sensor systems; fostering the synergistic use of green and digital technologies in urban settings. Independent work may involve laboratory and/or fieldwork and should result; in two written seminars and the respective presentations to be shared with peers. If several students are interested in the same application, team work on; developing the respective solution would be welcome.

Grading scale

Grade	Percentage
5 (A)	90-100%
4 (B)	75-89.9%
3 (C)	60-74.9%
2 (D)	50-59.9%
1 (F)	0-49.9%