

Course Title	Ubiquitous Computing				
Course Code	WSS503				
Course Type	Compulsory				
Level	Master (2nd Cycle)				
Year / Semester	1 / 1 (Fall)				
Teacher's Name	Andreas Constantinides, PhD				
ECTS	10	Lectures / week	3	Laboratories / week	0
Course Purpose and Objectives	<p>Ubiquitous Computing (<i>UbiComp</i>) touches on a wide range of topics including distributed computing, mobile computing, location computing, mobile networking, context-aware computing, sensor networks and many more, expands beyond the traditional challenges of those areas and more importantly demonstrates its value and importance through a device that lies on the backbone of UbiComp. That is, the cell phone, or more precisely the smartphone where its advanced capabilities in terms of processing power and memory, extended number of connection modalities and with an unlimited number of sensors, made it the most widely adopted and ubiquitous computer ever existed.</p> <p>The purpose of this course is to provide students with the knowledge of the essential tools and techniques in order to extend critical awareness of the issues and challenges associated with ubiquitous computing, and enhance their understanding on mobile systems. Moreover, it enables students to practice in various development platforms and toolkits to successfully design and develop mobile applications. Emphasis is also given to extend students critical awareness regarding ubiquitous systems business aspect.</p>				
Learning Outcomes	<p>By the end of the course, students should be able to:</p> <ul style="list-style-type: none"> • Describe the emerging topics of ubiquitous computing, next generation mobile systems (e.g., smartphones, tablets) and their application areas. • Identify and clearly describe the main challenges and issues of those areas. • Apply appropriate methods and tools to tackle those issues and challenges. • Creatively design and develop substantial smartphone applications involving distributed, peer-to-peer, client/server architectures. • Show the ability to design and develop smartphone applications using various platforms, toolkits and third-party libraries on, for example, Android operating system and Universal Windows Platform. • Formulate and implement ideas and business strategies on smartphones to provide solutions to challenging business oriented and real-world problems. 				

Prerequisites	None	Required	None
Course Content	<p>This course consists of the following ten units:</p> <ul style="list-style-type: none"> • Unit 1 is the introductory session for the whole module • Units 2 & 3 deal with topics related to computing areas that lie at the foundations of ubiquitous computing such as distributed and mobile computing. • Unit 4 deals with topics associated with challenges and applications of pervasive and ubiquitous computing. • Unit 5 covers topics on context-aware computing and systems with focus on how mobile systems can sense the environment and adapt according to the available resources on their surroundings. • Units 6-9 deal with several special topics related to Ubiquitous Computing and Smartphone Systems, including Location-Awareness and localization for both outdoor and indoor environments, Mobile Social Networks, Personalization and Privacy as well as Crowdsourcing with Smartphones. • Unit 10 deals with software development on smartphone systems with major focus on smartphone application development on Windows & Android operating systems. 		
Teaching Methodology	<p>Mode of Delivery: Distance Learning</p> <p>The course is designed to introduce and explain the material students are expected to learn through an on-line learning environment. The on-line environment provides an opportunity for receiving on-line feedback from the Course Instructor during their study. In addition, students will be encouraged to interact both with other students and the instructor so as to feel part of an on-line community of learners that belong to the University network.</p> <p>The course content will be delivered through online material/notes, recorded lectures and/or narrated presentations. Therefore, students may be asked to download and study notes, tutorials and numerical exercises as well as watch recorded lectures/demonstrations or narrated presentations posted on the web addressing the main concepts of a particular unit.</p> <p>Furthermore, the planned communication and the dynamic/online interaction activities between the course instructor and the students will include asynchronous communication tools (Discussion Forum) that students may be asked to participate, wherever appropriate, in an online forum posting their views on certain topics covered in a particular unit; and synchronous communication tools (instant messaging, such as Skype, chat rooms, video-conferencing, etc.), that students may discuss on-line with the Instructor (s) and/or other students specific issues covered in a given unit.</p> <p>Moreover, a number of case study readings are also considered, so as to demonstrate the relevance and practical applicability of mobile and ubiquitous computing methods and systems covered in the various units of this course. Case-studies can illustrate that what students have studied in each unit is not just of academic or theoretical value but also has value in terms of improving real-life challenges.</p>		

Bibliography

The following textbooks are associated with topics considered at various points throughout this course.

- Jia W. and Zhou W. (2005) Distributed Network Systems: From Concepts to Implementations (Network Theory and Applications) 2005th Edition, Springer
- Dan Chalmers (2011) Sensing and Systems in Pervasive Computing: Engineering Context Aware Systems, Springer
- John Krumm (2016), Ubiquitous Computing Fundamentals, CRC Press
- Pitoura E. and Samaras G. (1998), Data Management for Mobile Computing Kluwer Academic Publishers,

The above textbooks are recommended as sources of additional reading for students so as to elaborate on the course's material. Students can also find additional examples that they can use for practice.

Furthermore, students are also encouraged to explore other online / print sources that are related to topics covered in this course such as the following:

- Y. Gu, A. Lo, and I. Niemegeers, "A survey of indoor positioning systems for wireless personal networks," Communications Surveys Tutorials, IEEE, vol. 11, no. 1, pp. 13–32, First 2009.
- H. Liu, H. Darabi, P. Banerjee, and J. Liu, "Survey of wireless indoor positioning techniques and systems," Systems, Man, and Cybernetics, Part C: Applications and Reviews, IEEE Transactions on, vol. 37, no. 6, pp. 1067–1080, Nov 2007.
- C. Laoudias, G. Constantinou, M. Constantinides, S. Nicolaou, D. Zeinalipour-Yazti, and C. Panayiotou, "The airplace indoor positioning platform for android smartphones," in MDM, 2012
- A. Konstantinidis, G. Nicolaidis, G. Chatzimilioudis, G. Evagorou, D. Zeinalipour-Yazti and P. Chrysanthis, "Radiomap Prefetching for Indoor Navigaiton in Intermittently Connected WiFi Networks", IEEE 16th Intern. Conference on Mobile Data Management (MDM '15), IEEE Press, 2015.
- Online Textbook: Hanneman, Robert A. and Mark Riddle. 2005. Introduction to social network methods. Riverside, CA: University of California, Riverside.
- Andreas Konstantinidis, Demetrios Zeinalipour-Yazti, Panayiotis Andreou, George Samaras, and Panos Chrysanthis, "Intelligent Search in Social Communities of Smartphone Users", Distributed and Parallel Databases, Springer Press, Vol: 31, No: 2 Pages: 115-149, 2013.
- Chellappa, R.K. and Sin, R.G., 2005. Personalization versus privacy: An empirical examination of the online consumer's dilemma. Information Technology and Management, 6(2-3), pp.181-202.
- L. Sweeney. K-anonymity: A model for protecting privacy. Int. J. Uncertain. Fuzziness Knowl.-Based Syst., 10(5):557–570, Oct. 2002.
- M. Gruteser and D. Grunwald. Anonymous usage of location-based services through spatial and temporal cloaking. In Proceedings of the 1st Intl. Conference on Mobile Systems, Applications and Services, MobiSys '03, pages 31–42, 2003.
- Andreas Konstantinidis, Georgios Chatzimilioudis, Demetrios Zeinalipour-Yazti, Paschalis Mpeis, Nikos Pelekis, Yannis Theodoridis, "Privacy-Preserving Indoor Localization on Smartphones." IEEE Trans. on Knowledge and Data Engineering (TKDE '15), IEEE Computer Society, USA, 2015

	<ul style="list-style-type: none"> • G. Chatzimilioudis, A. Konstantinidis, C. Laoudias and D. Zeinalipour-Yazti,, "Crowdsourcing with Smartphones", IEEE Internet Computing, SI: Crowdsourcing, 2012. • Wu, C., Yang, Z. and Liu, Y., 2015. Smartphones based crowdsourcing for indoor localization. Mobile Computing, IEEE Trans. on, 14(2), pp.444-457.
Assessment	<p>The formal assessment of this course consists of</p> <ul style="list-style-type: none"> • Participation Activities (10% of total marks for module) • One marked (group) project (40% of total marks for module) • One closed-book, 3-hour exam (50% of total marks for module)
Language	English