Tamkang University Academic Year 2012, 2nd Semester
Course Syllabus

Course Title	Simultaneous Localization and Mapping		Instructor		包傑奇

Department/Year/Class		Course Details			
Electrical Engineering/ Master TETEM1A	☐Required ■Selective	■0（One Semester） ☐1（1st Semester） ☐2（2nd Semester） ☐3（3rd Semester）		Credits	3

Aim of Education	Core Competences
1. Teach students how to solve problems with electrical engineering/robotic/computer science knowledge. 2. Teach students creative thinking and how to be an engineer/scientist with ability to independently complete the assigned job and to work together in a team. 3. Teach students a global perspective and the necessary skills to achieve global competitiveness and to face various challenges in the career environment.	A. Have the ability to solve electrical engineering problems applying professional knowledge. B. Have the ability to manage and execute electrical engineering/scientific projects. C. Have the ability to write professional technical papers. D. Have the ability to solve electrical engineering/scientific problems independently. E. Have the ability to cooperate with people from different professional areas. F. Have a global perspective. G. Have the ability to lead, manage and plan. H. Have the lifetime ability to self education.

Course Introduction (50 to 100 words)	This course will teach students the necessary concepts, theory, and practice to implement localization and mapping systems for intelligent mobile robots. The course will also use the problem of robot localization and mapping as a sample problem to introduce students to probabilistic robotics, a powerful and versatile technique for other problems as well.

The Relevance among Teaching Objectives, Objective Levels and Core Competences

I.Objective Levels (select applicable ones)：

(I) **Cognitive Domain**：**C1 Remembering、C2 Understanding、C3 Applying、C4 Analyzing、C5 Evaluating、C6 Creating**

(II) **Psychomotor Domain**：**P1 Imitation、P2 Mechanism、P3 Independent Operation、P4 Linked Operation、P5 Automation、P6 Origination**

(III) **Affective Domain**：**A1 Receiving、A2 Responding、A3 Valuing、A4 Organizing、A5 Charaterizing、A6 Implementing**

II.The Relevance among Teaching Objectives, Objective Levels and Core Competences：

(I)Determine the objective level(s) in any one of the three learning domains (cognitive, psychomotor, and affective) corresponding to the teaching objectives. Each objective should correspond to the objective level(s) of ONLY ONE of the three domains.

(II)If more than one objective levels are applicable for each learning domain, select the highest one only. (For example, if the objective levels for Cognitive Domain include C3, C5, and C6, select C6 only and fill it in the boxes below. The same rule applies to Psychomotor Domain and Affective Domain.)

(III)Determine the core competences that correspond to each teaching objective. Each objective may correspond to one or more core competences at a time. (For example, if one objective corresponds to three core competences: A, AD, and BEF, list all of the three in the box.)

Teaching objectives	Relevance	
	Objective Levels	**Core Competences**
1 Theory of SLAM systems	C5	ADFH
2 Python Programming	C3	ADFH
3 Implementation of SLAM system	A6	ADEFGH
4 Implementation of Computer Vision system	A6	ABCDEFGH
5 Implementation of Visual SLAM system	A6	ABCDEFGH
6		
7		
8		

Teaching Objectives, Teaching Methods and Assessment		
Teaching Objectives	Teaching Methods	Assessment
1 Theory of particle filters	Lecture	Quiz and homework
2 Introduction to Python programming	Lecture	Quiz and homework
3 Implementation of sensor and motion models	Implementation	Quiz and Project
4 Implementation of visual SLAM system	Simulation and Implementation	Project
5		

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This course has been designed to cultivate the following essential qualities in TKU students.

Essential Qualities of TKU Students	Description
■global perspectives	
■a vision for the future	
■information literacy	
■ethical and moral principles	
■independent thinking	
□an awareness of healthy living	
■effective teamwork	
□an appreciation of the arts	

Course Schedule

Week	Date	Subject/Topics	Note
1	2/22	Introduction to Robot Navigation	
2	3/1	Introduction to Python Programming	
3	3/8	Dead Reckoning Errors	
4	3/15	Kalman Filters	
5	3/22	Motion Models	
6	3/29	Sensor Models	
7	4/5	Particle Filters	
8	4/12	Particle Filters	
9	4/19	Midterm Demonstration	
10	4/26	Midterm Exam Week	
11	5/3	Particle Filters	
12	5/10	EKF Maps, FastSLAM, Rao-Blackwell Normalization	
13	5/17	Introduction to Computer Vision	
14	5/24	Bundle Adjustment	
15	5/31	Visual SLAM	
16	6/7	Final Project Reports and Demonstration	
17	6/14	Final Project Reports and Demonstration	
18	6/21	Final Exam Week	

Requirement	
Teaching Facility	■Computer　■Overhead Projector　□Other（＿＿＿＿＿＿）
Textbook(s)	Sebastian Thrun, Wolfram Burgard and Dieter Fox. Probabilistic Robotics, MIT Press, ISBN: 9780262201629, August 2005.

Suggested Readings	
Number of Assignment(s)	2 (Filled in only for those courses that apply)
Grading Policy	Assignments 20% Midterm Presentation 30% Final Project 50%
Note	This syllabus may be uploaded at the website of Course Syllabus Management System at http://info.ais.tku.edu.tw/csp or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at http://www.acad.tku.edu.tw/index.asp. ※**Unauthorized photocopying is illegal. Using original textbooks is advised. It is a crime to improperly photocopy others' publications.**