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Inventory of Robotics Education in Europe

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Inventory of Robotics Education in Europe

<http://euron.upc.edu/rcdb/>

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Objectives

This initiative has been addressed not only to help the mobility of students and professors by means of the personal search of information of existing courses, but also to extract information about what is getting on in Robotics higher education in Europe.

The collected data is aimed to drawing up some recommendations for the elaboration of future courses and European programs in robotics.

Courses in the database can also be a source of inspiration for new subjects' contents, and probably this will serve to unify these contents.

The database will facilitate the interchange of educational materials between the teachers having similar courses and will help the administration in the recognition of foreign courses ECTS.

Contents and Search Fields:

In order to avoid demanding for a big questionnaire to teachers, we decided to do an Inventory of websites. So the database only contains essential information to perform the searches on it. In this way, all other information about the courses is contained in the course webpage itself, so it can be changed in a dynamic way by the teachers.

The database permits the search of courses based on the following essential information:

- Contents keywords/Topics
- Course language
- Level
- Country
- Materials Availability

Activities summary:

During the first year the Data Base was created and several courses were posted for test. In the beginning of the second year the real process of submitting courses started. Knowing that it is hard to get submissions, and trying to minimize the contributors' effort avoiding the risk of losing time or interest working with a not enough efficient system, the procedure for filling the DB was as follows:

- Call to the E&T committee to contribute, as individuals motivated by the E&T aspects and prone to contribute not only with courses but also with comments and suggestions

- Make improvements in the computer platform and introduce slight changes in the questionnaire to fill in
- Study of the statistics of interest and its implementation
- Presentation of the system (half filled) to the community, mainly through the national representatives, to ask for new contributions
- Detect the relevant data and the ill posed questions, sometimes not too precise due to the great diversity of courses and curricula
- New corrections in the computer platform
- Evaluation and interpretation of the results, by the steering team
- Public presentation at the Euron annual meeting, as well as organization of a special session to present the interpretation and discuss on it to prepare the recommendation
- Further work on evaluation of the courses based on statistical data

As a result of the hard work of the general and personalized call, the Courses Data Base contains now more than **100 courses**. The number of contributions has increased from 60 on March-2006 to 100 on May-2006. From these data we observed that the statistics do not change, neither the ratio of topics-degrees, so, we believe that we have data enough to prepare some first conclusions or recommendations. But since the goal is also to know who is who, we will keep collecting courses.

The fact of the inclusion of the EURON RCDB Logo in the indexed webpages has helped this initiative to get a better position in the web searchers (as Google)

Statistics of the courses in the Data Base

From the courses available in May 2006 the statistics of courses by countries are shown in Fig. 1. The non balanced distribution is due to the fact that some countries have more active members or someone helping the call. The call is open and from the E&T Key area a continuous work of searching potential people for contributing is being done.

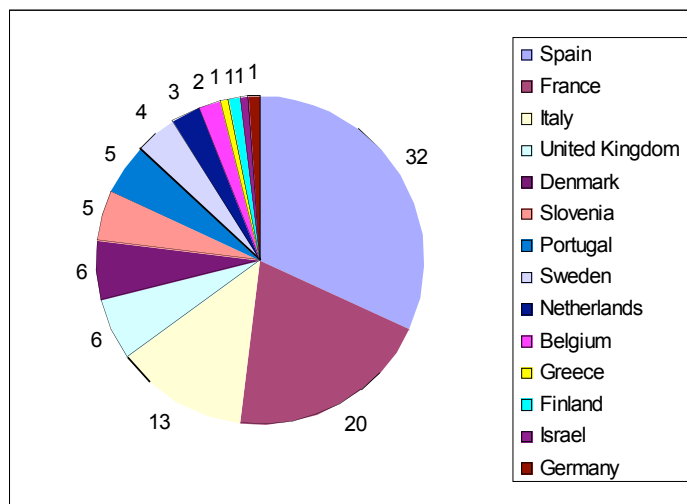


Fig. 1 Distribution of courses by country

The kind of studies seems important information, and it is explicitly requested in the questionnaire. Fig 2 shows the kind of studies and its percentage. Fig. 3 shows the availability or not of teaching material. The availability of teaching material in the web

of the course constitutes useful information for the user searching such a help for teaching or learning.

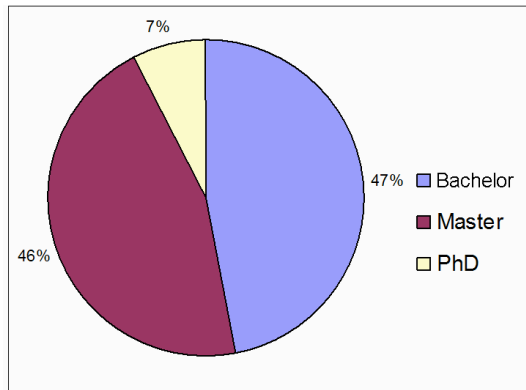


Fig. 2 Distribution of the different kind of studies

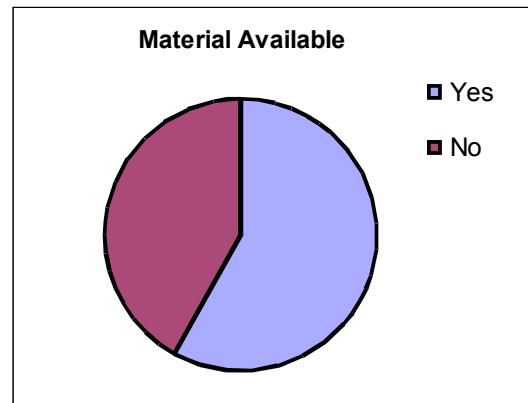


Fig. 3 Availability or not of teaching material in the web

Information for the conclusions and recommendations

From the courses and data collected an analysis has been done to know what kind of courses and in which curricula they are taught, and from this information a conclusion on what is being done, and presumably what would have to be taught in a Robotics curricula has been extracted.

The E&T board elaborated the list of topics representative of most courses contents, taking advantage of the effort devoted to the webook index. The selected topics are the following:

- Fundamentals of Robotics
- Control
- Trajectory planning
- Sensors, Power and Actuators
- Manipulation
- Navigation
- Architectures
- Sensing
- Application Areas
- Biologically inspired
- Human –Machine Interfaces
- Micro- Nano Technology

And the percentage of courses in which these topics are specially relevant are shown in fig. 4

The curricula in which each course in the Data Base is taught are very diverse (Table I), for that reason a clustering has been done, in the same way as the topics above.

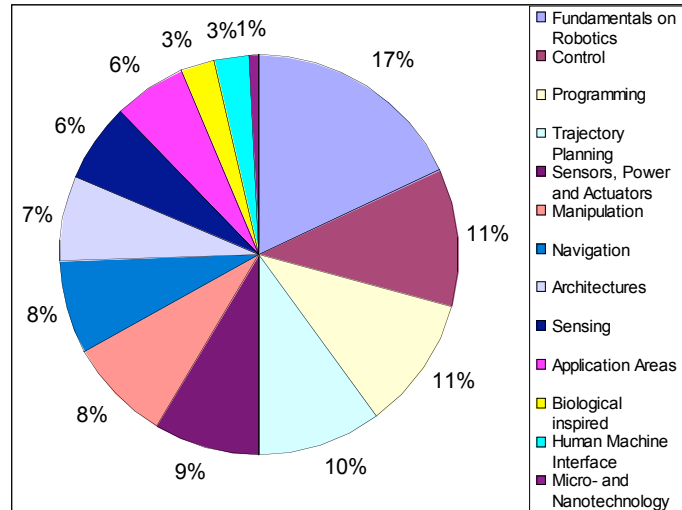


Fig. 4 Percentage of relevant topics in the robotic courses

Table I Curricula resulting from the contributions to the Data Base

Degree	Number
	29
computer science	11
System Engineering	7
Industrial Electronics	6
Mechanical Engineering	3
second year of master	3
Industrial Engineering	3
Laurea Specialistica in Ingegneria dell\	2
5-year degree in Mechanical Engineering	2
Computer Science - Industrial Electronics	1
Ms (1st year)	1
MSc - Mres	1
BEng (Hons) Robotics & Automated Systems	1
BEng/MEng Mechatronics	1
Engineer	1
M.Sc.	1
Computer Engineering	1
B.Sc. (Hons) Intelligent Robotics	1
electronic engineering	1
Information Engineering	1
licence in biomedical sciences	1
Master in Engineering	1
Master / Post-graduation in Industrial Electronics	1
Manufacturing Engineering	1
BSc Computer Science with Robotics	1
master	1
Electrical and Computers Engineering	1
Mechatronics Engineering and Informatics	1

Engineering	
Mater	1
Ms (2nd year)	1
Engineering, Artificial Intelligence, Computer Science	1
informatica (computer science)	1
916;953;960;955;969;956;945;924;951;967;945;957;	1
First level	1
Ingegneria Elettrica Elettronica e dei Sistemi	1
First year of Master	1
Basic	1
Electronic Engineering	1
Laurea Specialistica (corresponds to master)	1
BSc (4th Year), MSc, PhD	1
Information Engineering, Electrical Engineering	1
M.Sc. CS / EE	1

The curricula considered from those above are related to the following big areas:

- Computer Engineering
- Electrical and Electronics Engineering
- Industrial Engineering / Automatic Control
- Mechanical Engineering

Based on these classes, the distribution of courses submitted according to these curricula is shown in fig. 5, which includes courses missing this data.

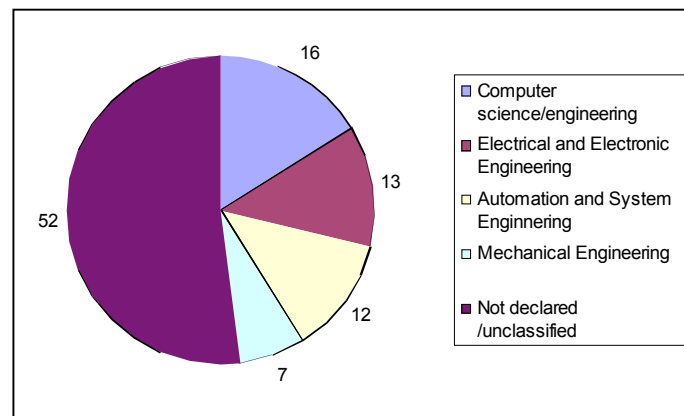


Fig. 5 Distribution of courses within the curricula considered

Searching the relations among topics within the different curricula, the results obtained are shown in fig. 6.

Finally, the credits per course are indicated in fig.7, where it can be seen that most of them have 6 credits.

	Computer	Electrical and Electronics	Automatic Control	Mechanical
Fundamentals on Robotics	10	9	8	2
Programming	6	7	9	1
Control	6	7	4	1
Trajectory Planning	6	7	6	1
Sensors, Power and Actuators	3	4	7	2
Navigation	7	3	3	1
Architectures	2	4	3	3
Sensing	4	3	1	2
Application Areas	4	3	4	2
Manipulation	6	1	2	2
Biological inspired	2	0	0	1
Human Machine Interface	1	0	0	1
Micro- and Nanotechnology	0	0	0	0

Fig. 6 Distribution of topics within the courses considered in relation to the

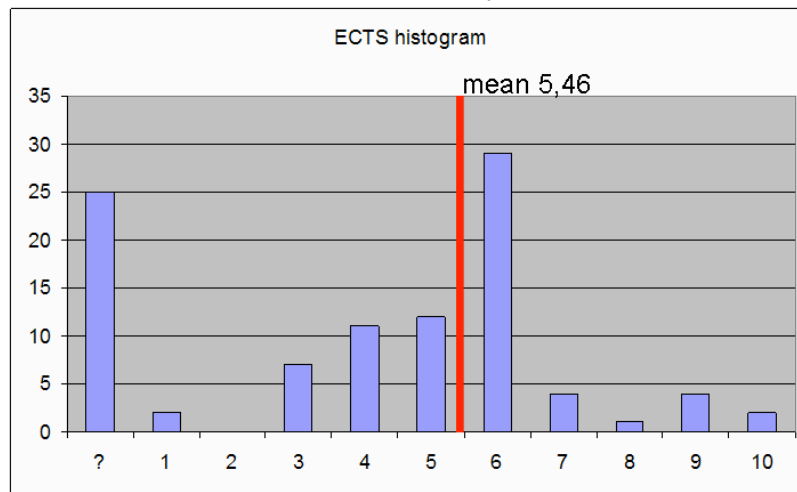


Fig. 7 Distribution of courses within the curricula considered

Consequently, the recommended number of hours for each topic, in a 6 credits course, is shown in fig. 8

Recommended number of hours for each Robotics issue v.s. degree	Mechanical	Electrical and Electronics	Automatic Control	Computer
Introduction	2	2	2	2
Basic Robot Components	10	8	4	6
Control Unit	8	12	12	8
Robot Programming	2	2	4	6
Robot Applications	6	4	6	6

Fig. 8 Number of hours recommended for each topic in a robotics course of 6 credits in each one of the curricula considered.