Introduction to embedded systems

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Course description

The course "Introduction to embedded systems" provides students with the basis for studying the other courses of the Module "Embedded microprocessor systems". It forms basic skills in embedded systems design. Those skills is usable in designing digital control units for consumer electronics, industrial automation, telecommunication systems, etc. This course includes lectures, laboratory work and an individual project. The practical part of the course is conducted in a specialized laboratory equipped with the National Instruments (NI) training stands and Lab View development environment.

Course aim

To provide students with basic knowledge and skills in embedded systems design.

Course objective:

- To make students familiar with the basic concepts and terminology of the target area, the embedded systems design flow.
- To give students an understanding of the embedded system architecture.
- To acquaint students with methods of executive device control and to give them opportunity to apply and test those methods in practice;
- To teach students to make measurements with the specified accuracy.

Learning outcomes

At the end of the course student will be able to:

- understand basic concepts in the embedded computing systems area;
- determine the optimal composition and characteristics of an embedded system;
- design and program an embedded system at the basic level;
- develop hardware-software complex with the use of the National Instruments products.

Outline of content

Week	Lectures	Practice Sessions / Assignments	Hours
1	Introduction to embedded systems. Terms definition, features, characteristics, application, design route.	Preparation software model of measuring equipment in NI LabView environment, presentation	18
1	Fundamentals of control and executive automation.	Lab 1. Development of a hardware/software counter. Lab 2. Development of a simple alarm system	36
2	Basics of measurement equipment. Types of sensors, the principles of it's operation. Measurement accuracy.	Lab 3. Production characteristics of the electrical signal with an oscilloscope and multimeter. The Course Project development and defence	54

Assessments and assessments methods

Students will be required to complete 3 laboratory assignments and to perform an individual project.

Students will have to carry out research on "my measuring device", to implement the model of the device and make a report.

Student's grades will be based on the following scheme:

Lab reports – 40%

Research, model and presentation – 20%

Project report– 40%

Attendance policy

There is the opportunity of distance learning of the theoretical material. Practical work and the course project are carried out in the specialized laboratory, so attendance at the laboratory classes is advisable.

Recommended reading

1. D.P. Kothari, K.V. Shiram, Sundaram. Embedded Systems. New age international, 2012
2. Yik Yang. LabView graphical programming cookbook. Packt Publishing Ltd, 2014
3. Slaev V., Chunovkina A., Mironovsky L. Metrology and theory of measurement. De Gruyter, 2013
4. Extensive course manual compiled by professors and teachers of the laboratory of Microprocessor Systems of Siberian Federal University (Under Development).

The manual includes detailed course program, guidelines for seminars and self-study, various thematic materials, including lecture handouts, PowerPoint presentations as well as other additional materials required to complete the assignments.