

Project Based Learning

in Course: Applications of Digital Signal Controllers

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Agenda

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- Project Based Learning (PBL) a.k.a. Learning by Doing
 - simply said, student's effort and tasks during the whole semester should incline to fulfill one goal – to complete a project
- PBL in mechatronic education at KEM TUKE:
 - Application of digital signal controllers – implemented
 - Control systems with PLCs – to be done
 - Control of power electronics systems (new course from 2025/2026) – to be done
- Necessary conditions for PBL:
 - a good equipped laboratory with free access for students
 - students willing to learn :-)



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- How is PBL implemented in the course “Applications of Digital Signal Controllers” ?
- Aims of PBL is to:
 - imitate real work life
 - experience a team-work
 - learn basics of project management
 - improve hard and soft skills
 - connect theoretical knowledge with practical implementation
- Projects are created and assigned by a teacher to fulfill the aims
- Teacher tasks is to provide necessary theoretical knowledge and continuous demand-based support



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- Projects requirements
 - **difficulty** – project should be difficult enough that it cannot be done by a single student → necessary team-work
 - **specification** – project must not contain all required information and specifications → necessary communication with customer
 - **customer** – every project have a customer from industry (the customer role is played by fellows and friends, who are employed in industrial sector) → imitating real world
 - **payment for a project** – payment is in the form of points for the whole team, which is distributed among team members:
 - 75% of payment is distributed equally between team members
 - 25% of payment are allowances, distributed by a team leader



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- EduVerter – Inverter designed for education, now in version 1.01 (version 1.0 was not manufactured)
- Contains:
 - inverter with IGBTs – from 24 V up to 600 V in DC-Bus
 - fuses (of course :-))
 - current sensors in every phase and DC-bus
 - voltage monitoring of DC bus
 - over-current lockout
 - improper switching lockout
 - LCD display (SPI interface)
 - user buttons and potentiometers
 - interfaces for incremental encoder, BiSS-C encoder, I2C bus, general IOs
 - slot for TI C2000 control card



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- TI C2000 control card with TMS320F28379D
 - 200 MHz dual core microcontroller with FPU
 - dedicated peripherals for power electronics and motor control
 - pulse-width modulator with dead-band
 - 3x quadrature decoder unit
 - 4x a/d converter, which can be triggered by PWM module
 - HW support for sine / cosine calculations
 - communication peripherals: SCI, SPI, I2C, CAN, McBSP, USB
 - on-board isolated JTAG



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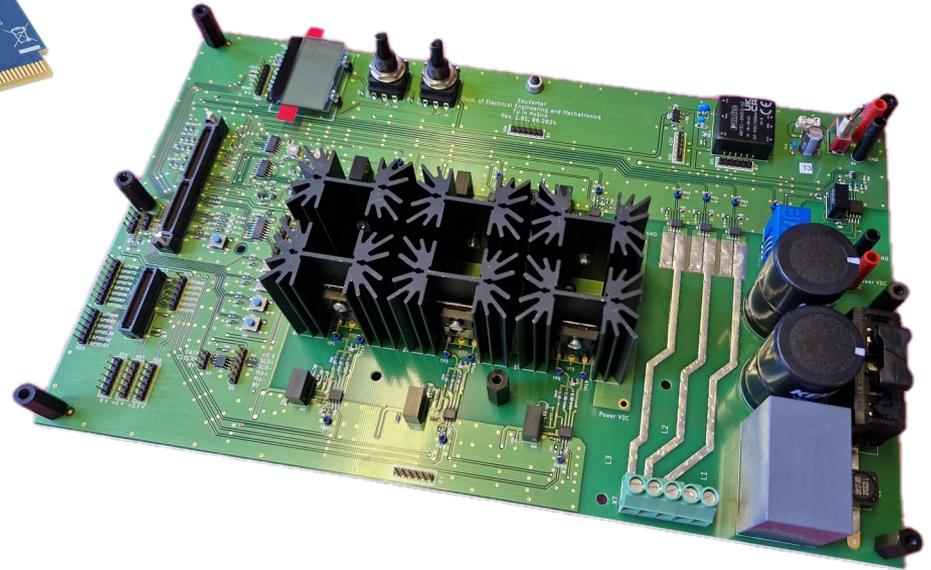


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TMDSCNCD28379D
Source: Texas Instruments Inc.,
www.ti.com

EduVerter v1.01





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Workshop task 1 - Projects assignment, missing infos

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- read the assignments
- find out, what information are not provided but are required at the beginning of the project, e.g. for work planning or basic concept design



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Workshop task 2 - Time schedule, project management

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- choose a team-leader (although the project contains a lot of programming, the team-leader may not be a best programmer)
- assign other roles
- prepare a time schedule (Gantt chart) with very basic tasks and milestones
- assign tasks to members



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Workshop task 3 - First contact with “customer”

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- try to prepare a meeting agenda
- think about, how to keep customer informed during the project, prepare suggestions
- what should be done during the meeting and after the meeting?



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Workshop task 4 - Firmware architecture & Harmonogram revision

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- try to prepare a concept or basic architecture of the firmware, think about program modules
 - identify partial tasks (e.g. setting peripherals, position evaluation, ramp generator, etc.)
 - assign partial task to individual program modules
 - think about program modules timings – identify required sample times
- revise time-schedule and add partial tasks according to program architecture, divide task between team members



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Workshop task 5 – Create similar project description

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- try to prepare a similar project description for the presented course or for your courses at home



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- Do presented projects imitate the real world?
- Are the presented projects difficult enough for a team with 4 or 5 students? Are they too difficult?
- What are your experience? Is the presented concept usable at your department / courses?
- Any ideas to improve PBL?



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Thank you for your participation in this
workshop



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