DECEL Project
Training activity C1

Porto, 25-27 January 2023

Universidad de Alcalá

Co-funded by
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Overview in Alcalá

- All Engineering degrees are conducted by one Faculty (Escuela Politécnica Superior).

- Engineering Degrees are building under a 4 years Scheme (240 ECTS)

- Regarding Master's Degree are two types:
  - Professional Ones: 2 years (120 ECTS)
  - Others: 1 year (60 ECTS)

- PhD is based on European Regulation: 3+1 year (full time). In Spain no courses based on ECTS are regulated.

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Overview in Alcalá

- We have 3 main pillars of Engineering:

Telecommunication

Computer Science

Industrial

Overview in Alcalá

- Informatics:
  - Computer Engineering
  - Informatic Engineering
  - Information Systems Engineering

- Industrial:
  - Industrial Automation Engineering
  - Industrial Technology Engineering

- Telecommunication:
  - Telecommunication Technology Engineering
  - Telematics Engineering
  - Telecommunication Systems Engineering
 - Electrical and Electronics Engineering

Overview in Alcalá

- Other degrees in Engineering Faculty:
  - Double Degree in Electrical and Industrial Automation
  - Double Degree in Business and Computer Science

- Other teaching and research duties from this Faculty:
  - Degree in Criminalistics: Forensic Sciences and Technologies
  - Degree in Physics and Space Instrumentation

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Overview in Alcalá
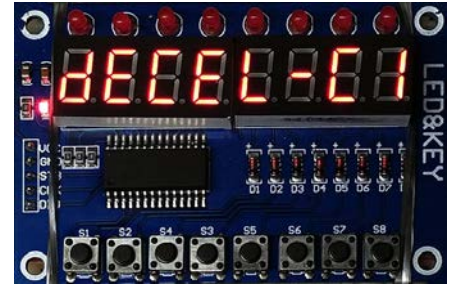
Some figures:

- ≈2.700 students

- ≈ 300 Academic Staff

- ≈ 175 Researchers

- ≈ 10 BSc. Degrees

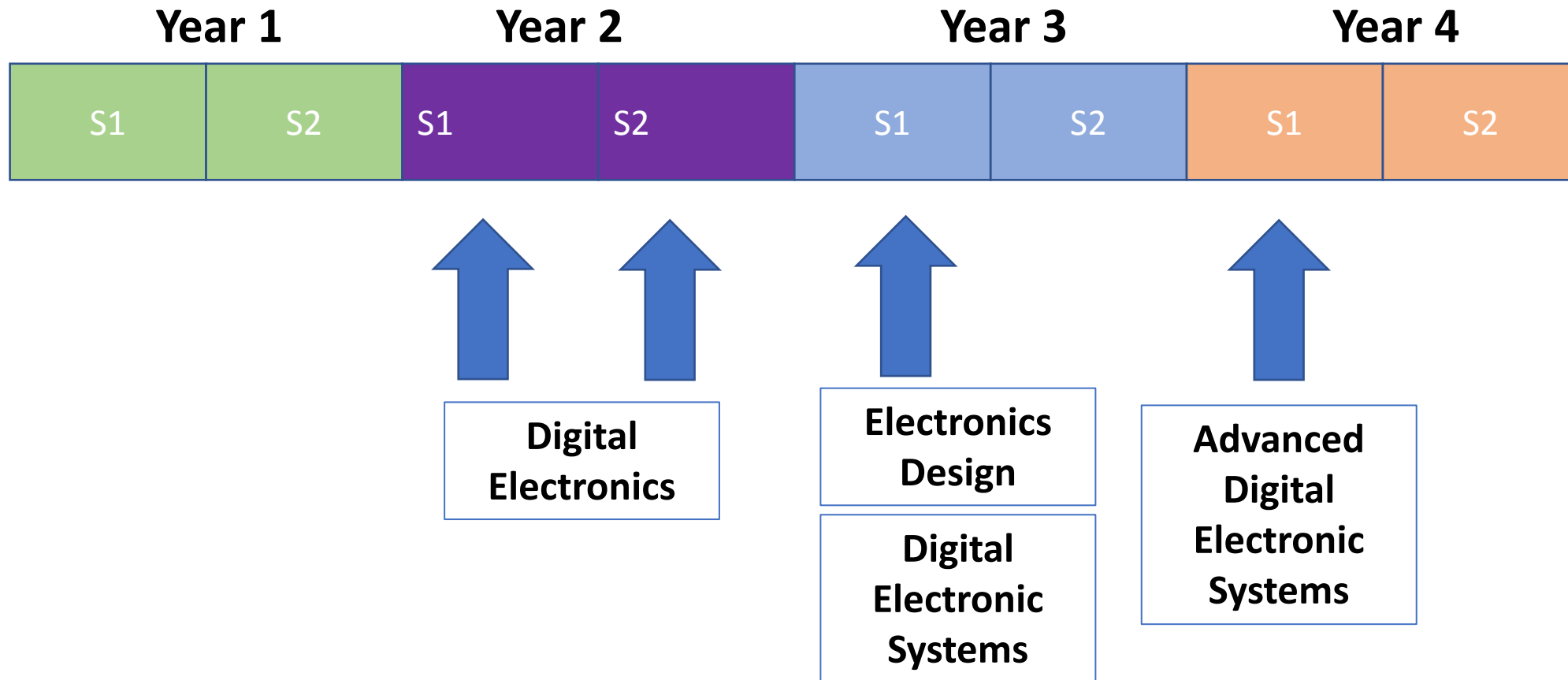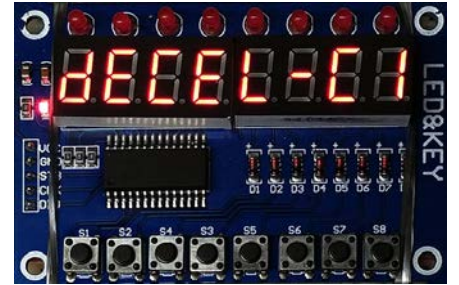- ≈ 6 MSc. Degrees

- ≈ 5 PhD. Programmes
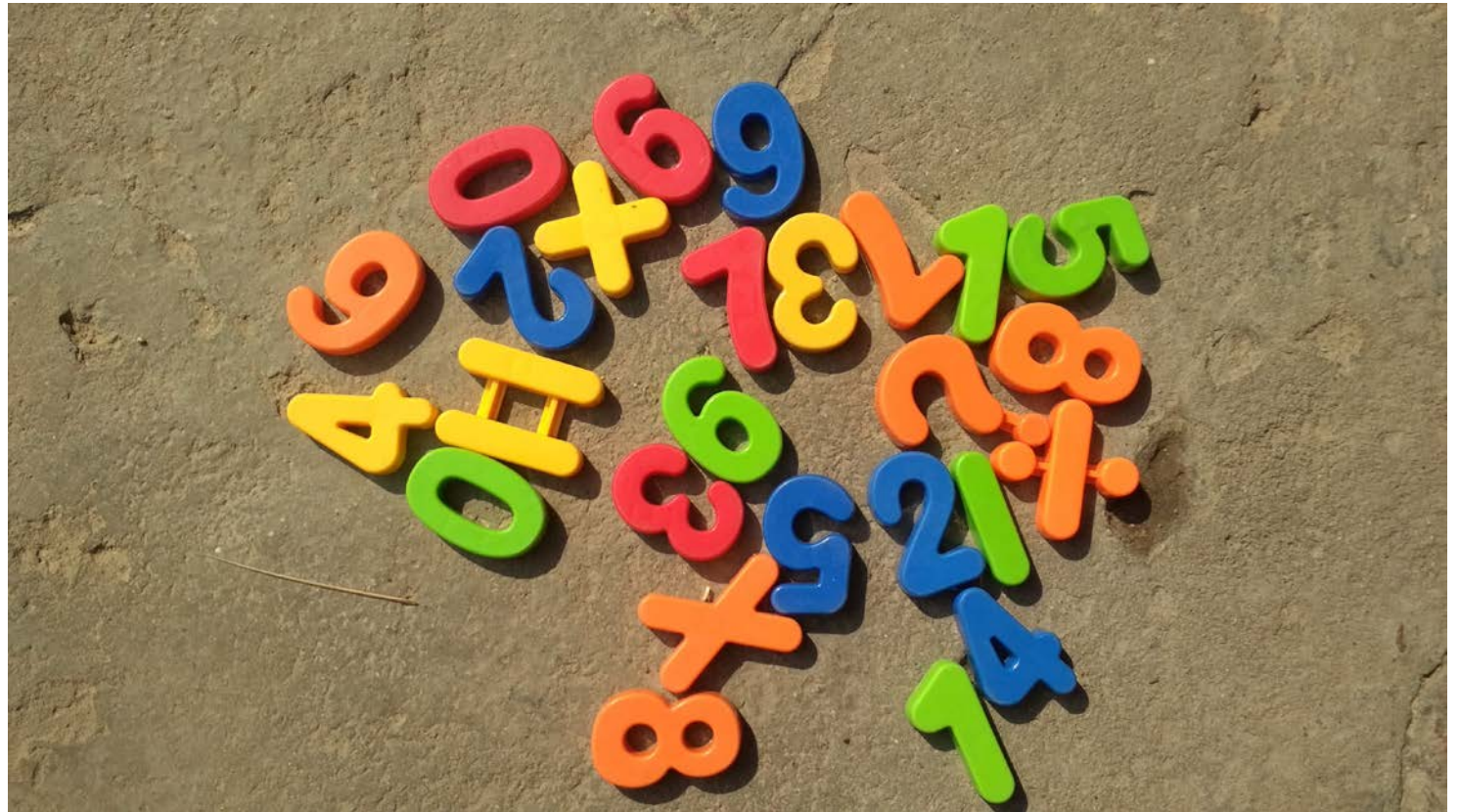
1.- Courses linked with DECEL BSc.

- We have mainly three courses in several degrees with topics related to DECEL:
  - **Digital Electronics** is general course based on the basic principles of Digital electronics
  - **Digital Electronics Systems** is another course based on microprocessor
  - **Digital Design** tackles topics related to FPGA and VHDL.

- The first two courses are mandatory for all Telecommunications degrees (4) and for Industrial Automation (1)

- Regarding Digital Design is also a compulsory course in several degrees of Telecommunications (2) and Computer Science (1). However, it is an elective one in Industrial Automation degree.

- All courses have 6 ECTS, it means 2h (Theory) +2h (Lab)/week

1.- Courses linked with DECEL BSc.

Year 1	Year 2	Year 3	Year 4
S1 S2	S1 S2	S1 S2	S1 S2

Digital Electronics

Electronics Design

Digital Electronic Systems

Advanced Digital Electronic Systems

Applying novel pedagogical methods and tools to the teaching activity for Digital Electronics Systems

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1.- Courses linked with DECEL BSc.

| Course	Degree	Number of Large Groups	Number of Lab Groups	English groups
Digital Electronics	Telecommunication, Industrial Automation, Computer Science	8	15	Yes
Digital Electronic Systems	Telecommunication, Industrial Automation	6	12	Yes
Digital Design	Telecommunication, Industrial Automation	3	5	No
Advanced Digital Electronic Systems	Telecommunication, Industrial Automation	3	6	No

1.- Courses linked with DECEL BSc.

Digital Electronics (6 ECTS)

- **Contents**: Gates, Boolean Logic, Basic combinational and sequential circuits, Finite State Machine, Binary Arithmetic.

- 2h/week theory. Groups around 50 students. 15 weeks.

- 2h/week problems. Groups around 25 students. 7 weeks.

- **Evaluation procedure**:
  - Intermediate tests (2): ≈ 35%
  - Final tests: ≈ 35%
  - Labs: ≈ 30%

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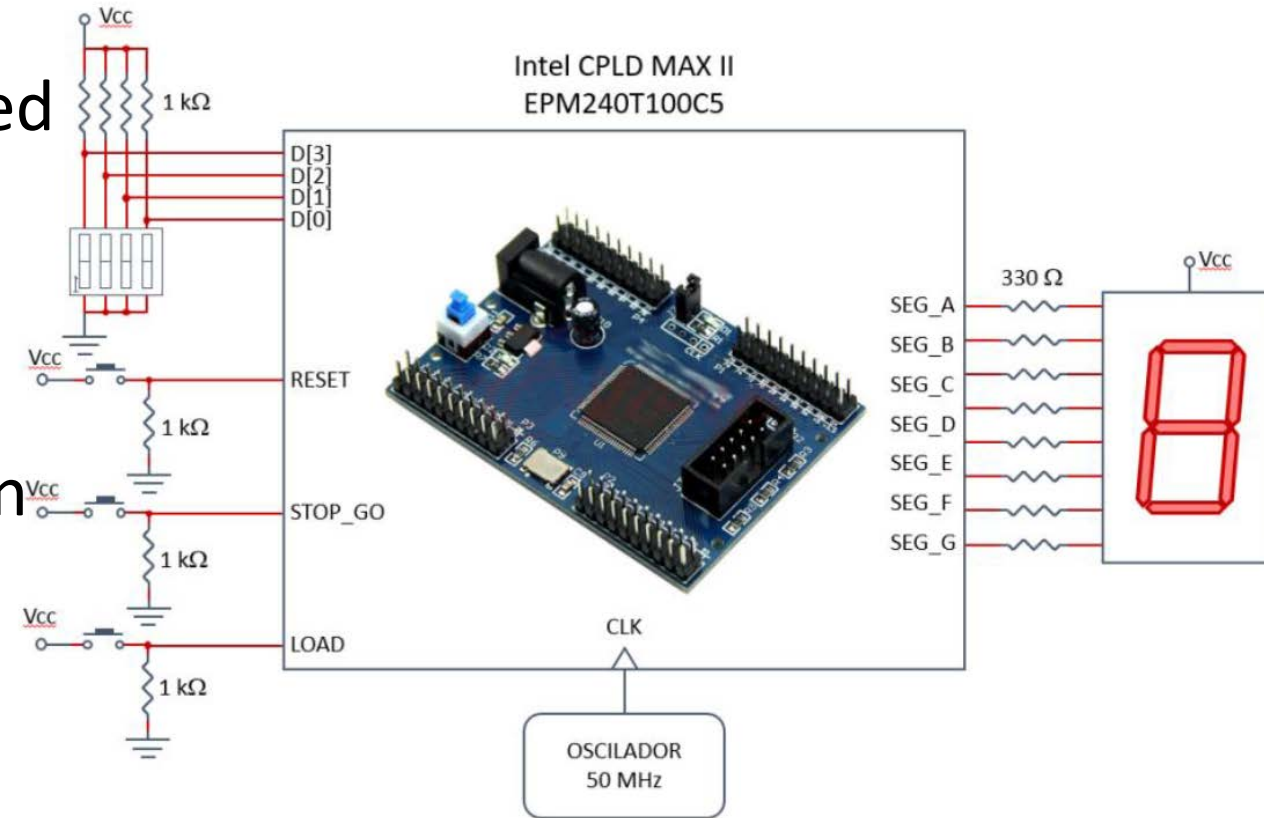# 1.- Courses linked with DECEL BSc.

Digital Electronics (6ECTS)

- Hardware
  - CPLD MAX II EPM240B (provided by UAH)
  - Displays, leds, resistor, capacitors, assembly board.

- Software
  - Intel Quartus

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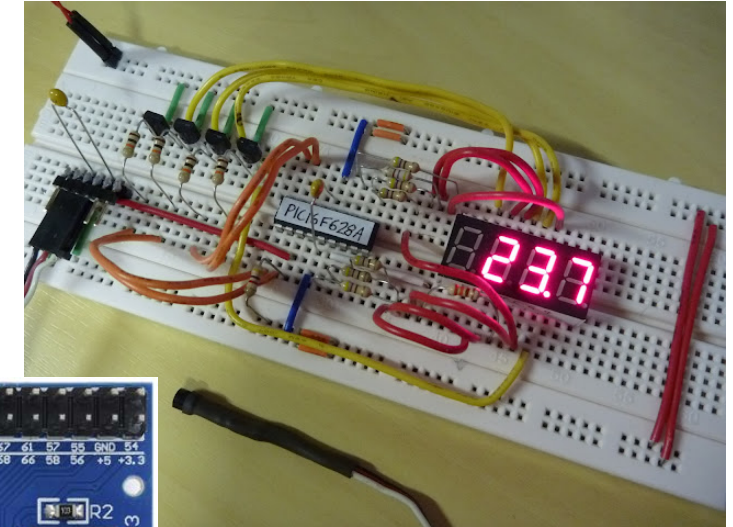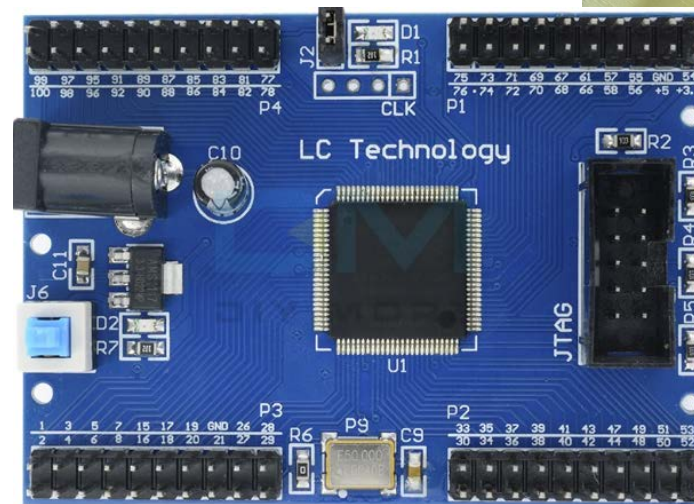
1.- Courses linked with DECEL BSc.

- Example of labs:
  - Lab1: Combinational circuits based on assembling board
  - Lab2: Combinational simulation and downloading to CPLD MAX II EPM240B
  - Lab3: Sequential circuits based on assembling board
  - Lab4: Sequential simulation and downloading to CPLD MAX II EPM240B

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1.- Courses linked with DECEL BSc.

Digital Electronics (6ECTS)

- Labs Methodology:

- The students know in advance the different labs and the schedule.

- All documentation is available in the LMS (Blackboard is the official tool for University of Alcala).

- Student reporting activity must be done through LMS.

- No remote labs are implemented.

- "Work at home and use the lab for testing" is the methodology for the lab weeks.

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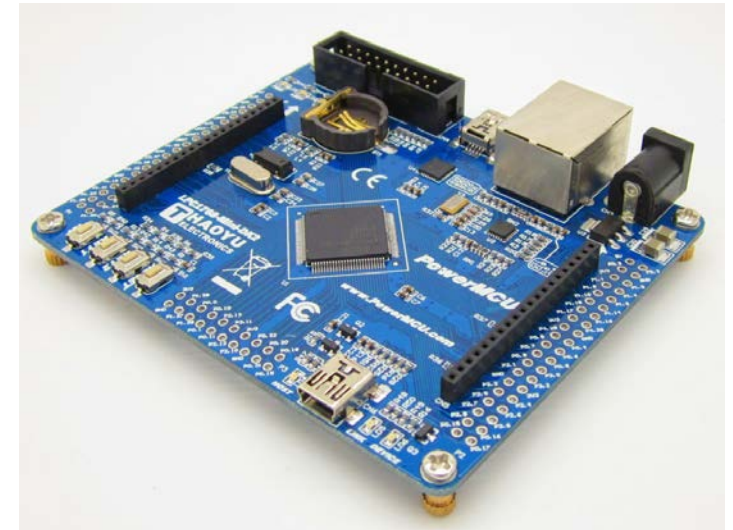
1.- Courses linked with DECEL BSc.

Digital Electronics Systems (6 ECTS)

- **Contents**: Introduction to digital systems based on microprocessors. Study of microprocessors

- 2h/week theory. Groups around 50 students. 15 weeks.

- 2h/week labs. Groups around 25 students. 15 weeks.

- **Evaluation procedure**:
  - Intermediate tests (2): ≈ 35%
  - Final tests: ≈ 35%
  - Labs: ≈ 30%

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1.- Courses linked with DECEL BSc.

Digital Design (6ECTS)

- Hardware
  - Mini-DK2 Card LPC1768-H (provided by UAH)
  - Displays, leds, resistor, capacitors, assembly board.
  - Rigid cables for connections, etc. LEDs and polarization resistors for digital outputs.
  - JLINK/ULINK2 Adapter (provided by UAH)

- Software
  - KEIL µVision® 5 development environment

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1.- Courses linked with DECEL BSc.

- Example of labs:
  - 2022-23: Design of a control system for a heating unit.
  - The project is divided in 4 parts
  - Different sensors are emulated with switches
  - Temperature selection is an input
  - Timers, interruptions, DACs configuration/reads are included in the lab.

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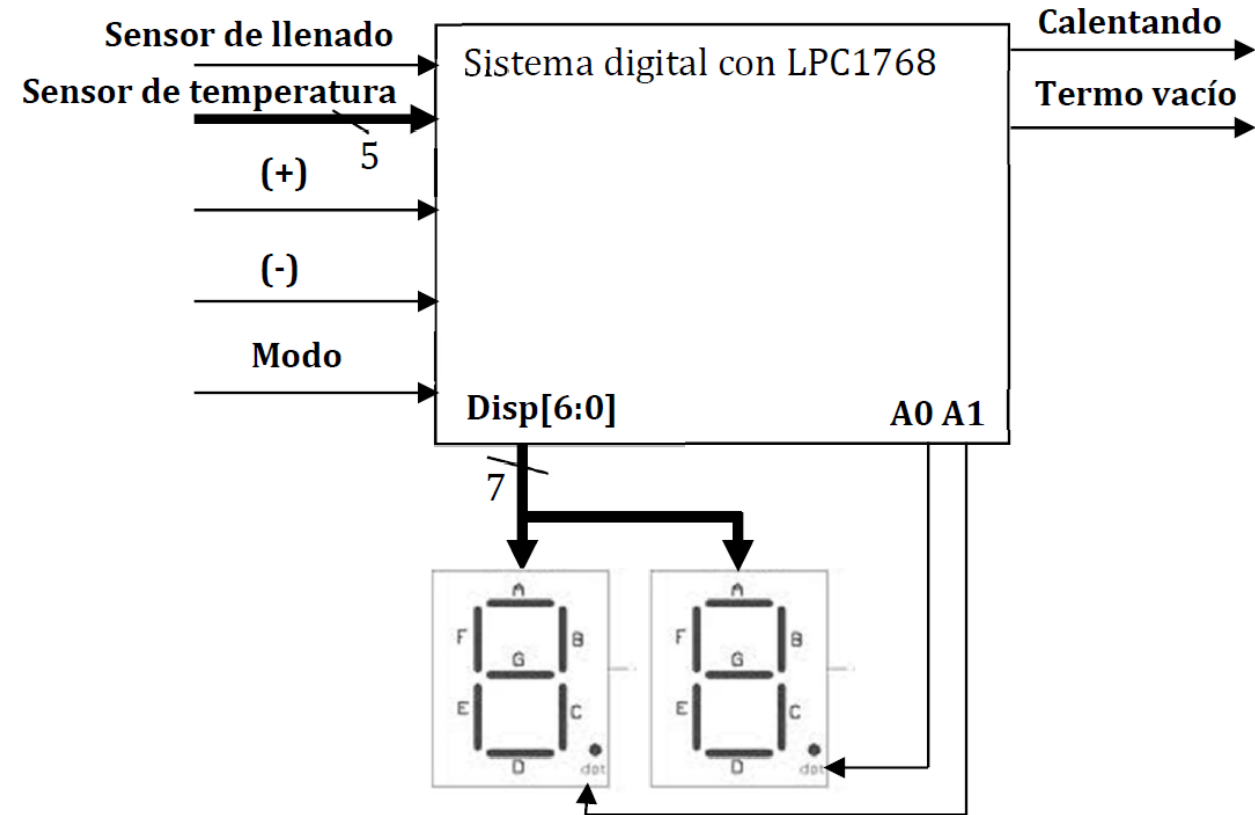
1.- Courses linked with DECEL BSc.

Digital Electronics Systems (6ECTS)

- Labs Methodology:

- The students know in advance the different labs and the schedule.

- Each week there is a task to be developed.

- Several restrictions regarding the code are fixed at the beginning (features of main, functions, interruptions, etc.)

- All documentation is available in the LMS (Blackboard is the official tool for University of Alcala).

- An individual evaluation is done at the end of lab period.

- No remote labs are implemented.

- "Work at home and use the lab for testing" is the methodology for the lab weeks.

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1.- Courses linked with DECEL BSc.

Digital Design (6 ECTS)

- **Contents**: Introduction to Hardware Reconfigurable devices and VHDL.

- 2h/week theory. Groups around 50 students. 15 weeks.

- 2h/week labs. Groups around 25 students. 15 weeks.

- **Evaluation procedure**:
  - Intermediate tests (2): ≈ 35%
  - Final tests: ≈ 35%
  - Labs: ≈ 30%

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1.- Courses linked with DECEL BSc.

Digital Design (6ECTS)

- Hardware
  - Nexys4 DDR (provided by UAH)
  - Motors, keyboards, DACs, ADCs, H-Bridge (provided by UAH)

- Software
  - Xilinx Vivado 2017.4

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1.- Courses linked with DECEL BSc.

- Example of labs:
  - 2022-23: Design of a driver for a DC Motor with parameters through a keyboard
  - The project is divided in 4 parts
  - Previous labs are oriented to this implementation (timers, FSMs, combinational & sequential blocks)
  - Working by pairs.
  - A final evaluation is done (individual)

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1.- Courses linked with DECEL BSc.

Digital Design(6ECTS)

- Labs Methodology:

- Synchronization between theory concepts and labs (two shifted weeks) .

- The labs hours are used to plan the development and solving doubts. Additionally, the teachers encourage the use of the evaluation boards instead of other issues which can be addressed at home.

- Modularity is the key of this lab.

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1.- Courses linked with DECEL BSc.

Advanced Digital Electronic Systems (6 ECTS)

- **Contents**: In this course students learn how to design microcontroller based embedded systems (specific applications microcontroller based electronic systems that incorporate the control of different peripherals).

- 2h/week theory. Groups around 50 students. 15 weeks.

- 2h/week labs. Groups around 25 students. 15 weeks.

- **Evaluation procedure**:
  - Intermediate tests (2): ≈ 35%
  - Final tests: ≈ 15%
  - Labs: ≈ 50%

1.- Courses linked with DECEL BSc.

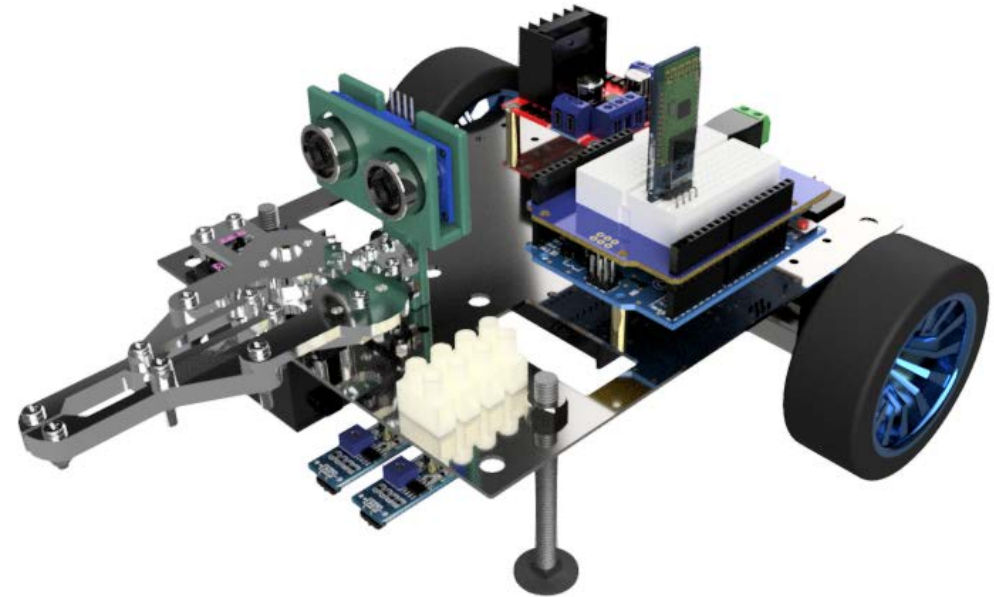**Advanced Digital Electronic Systems (6 ECTS)**

Hardware

- Mini-DK2 Card LPC1768-H (provided by UAH)
- Displays, leds, resistor, capacitors, assembly board.
- Sensors, actuators, Rigid cables for connections, etc. LEDs and polarization resistors for digital outputs.
- JLINK/ULINK2 Adapter (provided by UAH)

- Software
  - KEIL µVision® 5 development environment

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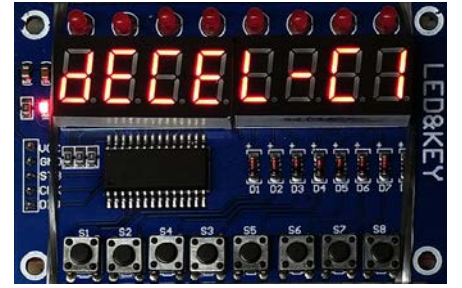
1.- Courses linked with DECEL BSc.

- Example of labs:
  - A whole robot controlled by a microcontroller. Different actions (pathfinding, collecting specific pieces, playing a game, etc.) must be implemented in the robot.
  - Software and Hardware tasks must be addressed in this lab.
  - The design must include concepts from different courses (IP communications, servers, analog issues, etc.)

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1.- Courses linked with DECEL BSc.
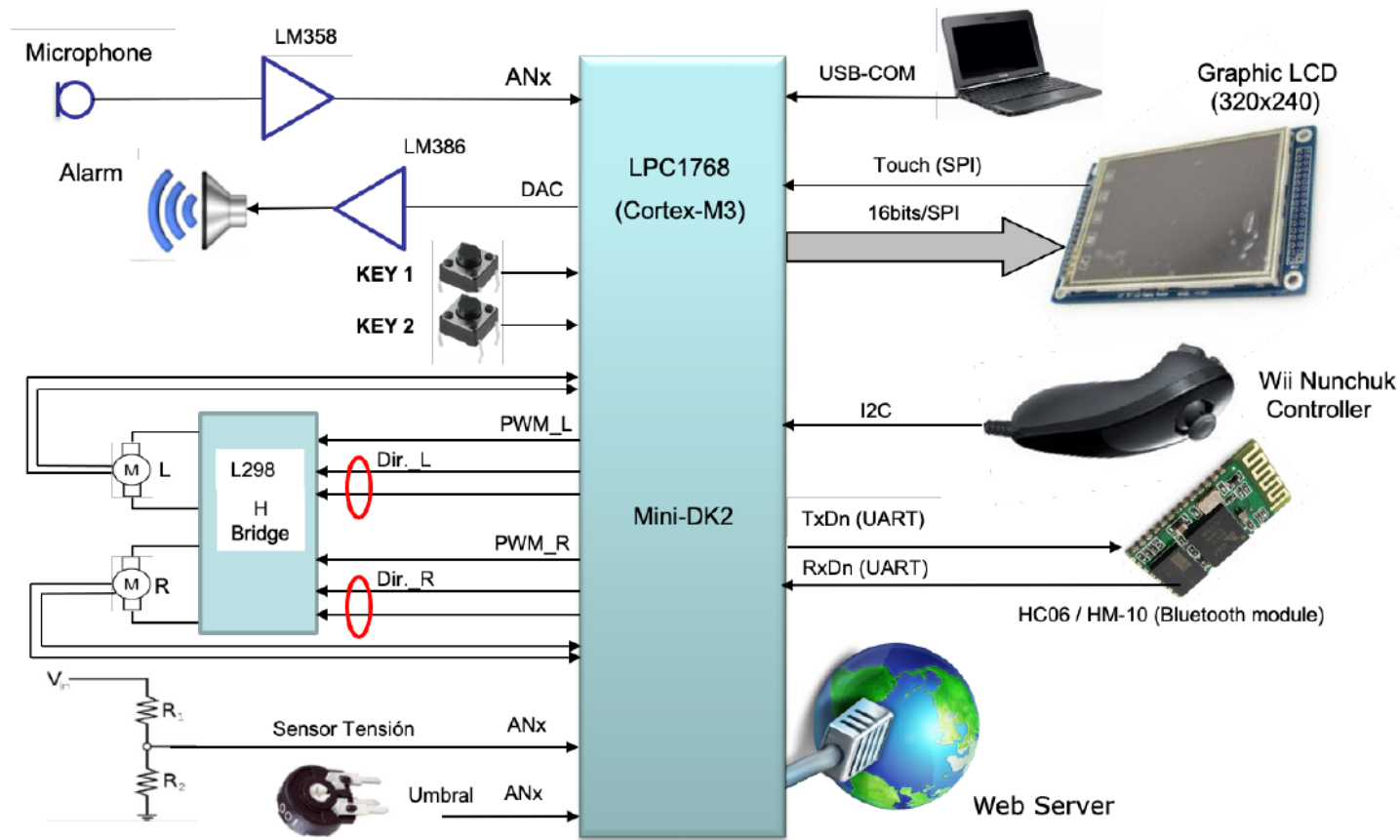
1.- Courses linked with DECEL BSc.

Advanced Digital Electronic Systems (6 ECTS)

Labs Methodology:

- A mix between PBL (Project Based Learning) and Flipped Learning is implemented since several years ago.

- Students dedicate a huge number of hours to the labs

- Problems with other courses at the same time

- An interested way to learn

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2.- Courses linked with DECEL MSc.

- Spanish regulation allows different type of Masters in terms of duration.

- Depending on the type of MSc several approaches are implemented.

- Then we can find Masters with 60, 90 or 120 ECTS.

- UAH has implemented several Masters with Digital Electronics courses.

- Most of them are related to Embedded Systems, Advanced Digital Design and System on Chips (SoCs).

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2.- Courses linked with DECEL MSc.

- Groups of students are small (not more than 20) and teaching activity is adapted to each student group.

- Different teaching methodologies are applied according to the course and the Master.

- PBL is proposed in courses related to Embedded Design. Others like Advanced Digital Design repeats the approach of modularity and with a huge charge of hours in the lab.

- Remote labs is used in some course for FPGAs.

- No easy integration with DECEL project is forecasted

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