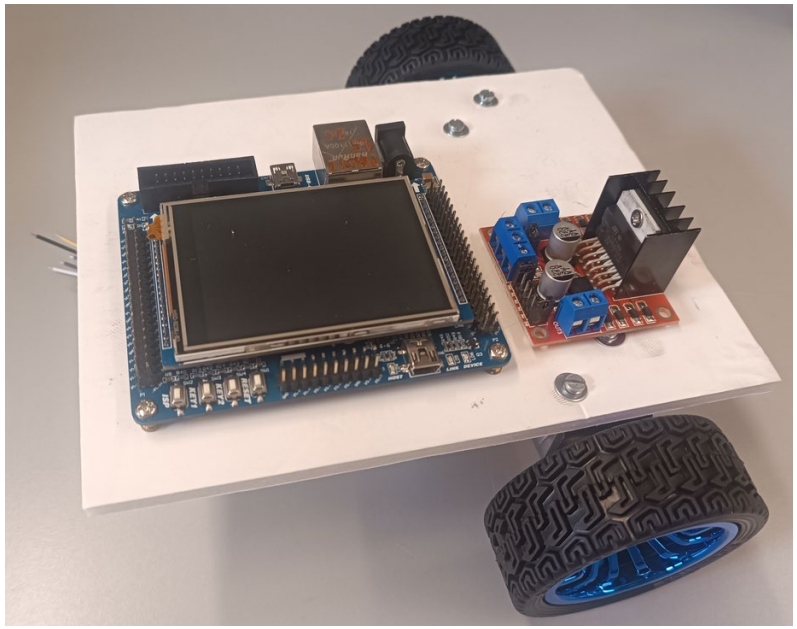
Laboratory Project 2025-26



Development of a remote-controlled rolling platform

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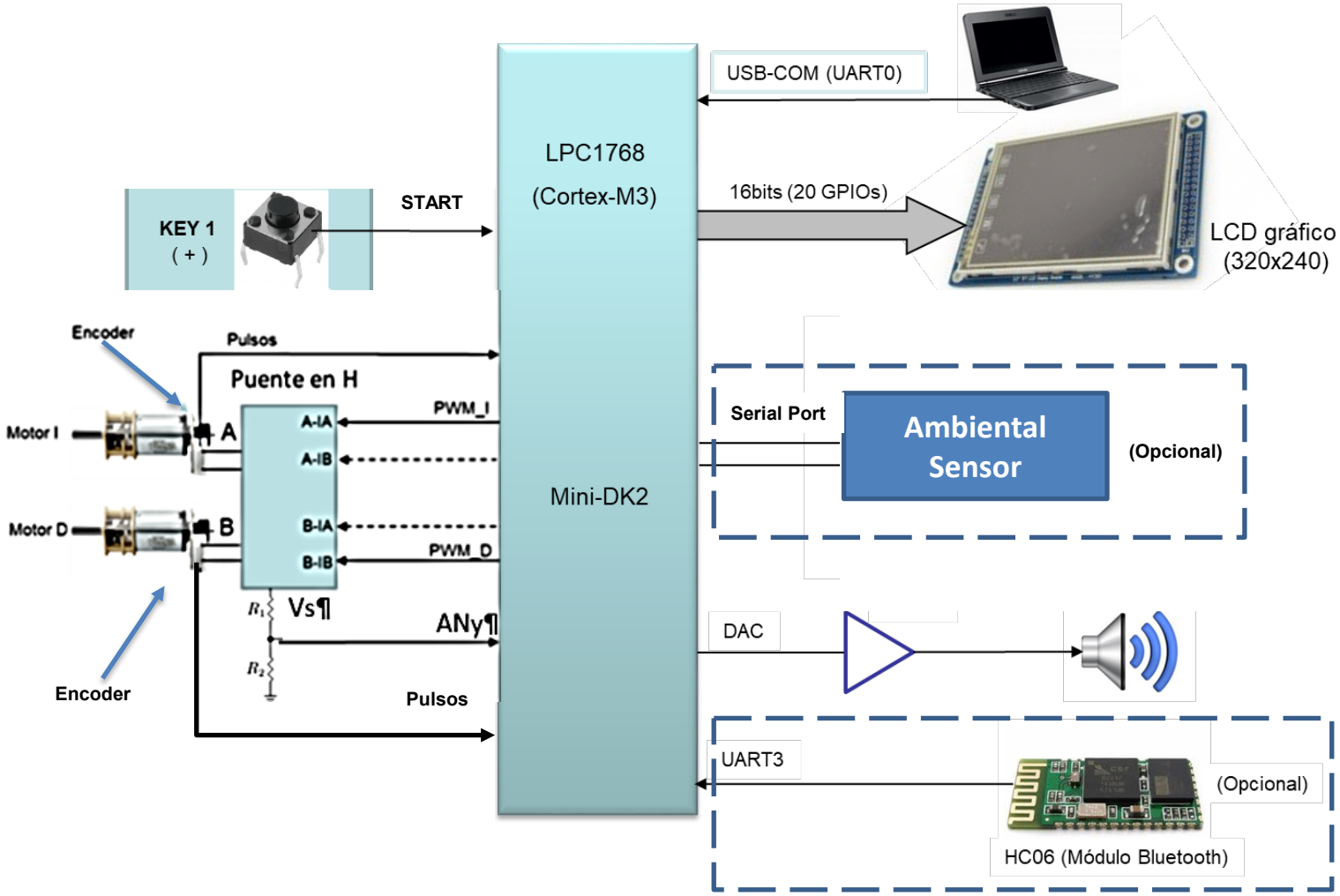
- Introduction
- Specs
- Material
- Planning
- Assessment

- **Design of a small mobile robot with differential traction**
  - **Robot with two independent DC motors** (one for each wheel)
  - Capable of making straight paths and 90º turns
    - **Optionally** make **non-holonomic movements, non-straight turns, reverse movement**
  - Able to measure route traveled
  - Battery charge status monitoring (power supply to motors)
  - Generation of audible signal with advancing movements
    - **Optionally generate variations** (time-intermitence and tone) in the acoustic signal
  - Controlled from a serial terminal
    - **Optionally** from **Bluetooth connection**
    - **Optionally** measuring **ambience variables** from a serial port **(SPI/I2C)**
  - Presentation of the status on a display

Specifications (I)

- Block diagram



Specifications (II)

a) Loading the sequence of movements via UART:

- A string of characters is sent from the terminal to the PC:

  Vxx**A**90**I**45**D**60[0x0D]

- Meaning of each field:

  V : Percentage of maximum speed desired (xx : %, with 2 digits)

  A : Move forward (xx : cm, with 2 digits)

  D : 90º turn to the right

  I : 90º turn to the left

b) Execution of movement:

- The robot waits for a push button to be pressed (Key 1 or Key 2 of the Mini-DK2) to execute a loaded sequence of movements, repeating it with each press
- If no sequence has been loaded: mobile stopped and display indication

- **Optional**: Make non-holonomic movements, non-straight turns, reverse movement
- **Optional:** The motion sequence can be sent via a Bluetooth port

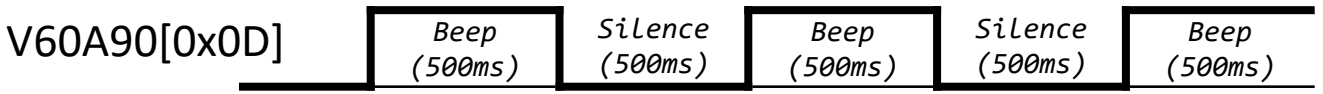
Specifications (III)

c) Analogue measurements:

- The supply voltage of the H-bridge that drives the motors is acquired

d) Analogue generation:

- Generation acoustic alarm indicating forward movement
- **Optional**: Variable intermitent acoustic signal



e) Mini-DK2 display monitoring:

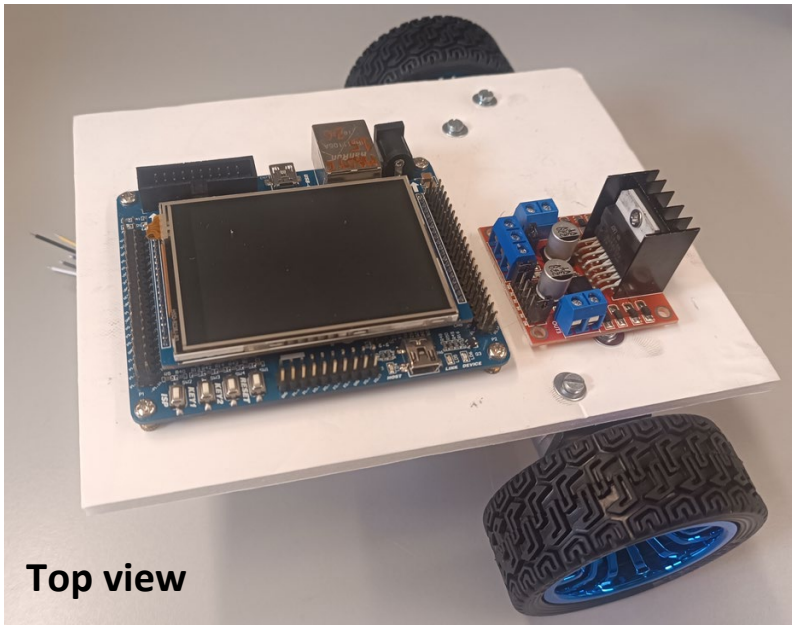
- Battery voltage
- If the mobile robot has no sequence loaded it will show “WAIT”
- Once the sequence is loaded, it will be displayed, as well as the message “PUSH BUTTON”
- Once the movement has started, the path advanced will be displayed
  (eg . “ xx cm”, “Turn R COMPLETED”, “40cm COMPLETED”…)

f) Optional: Ambience measurement

Using SPI/I2C communication module

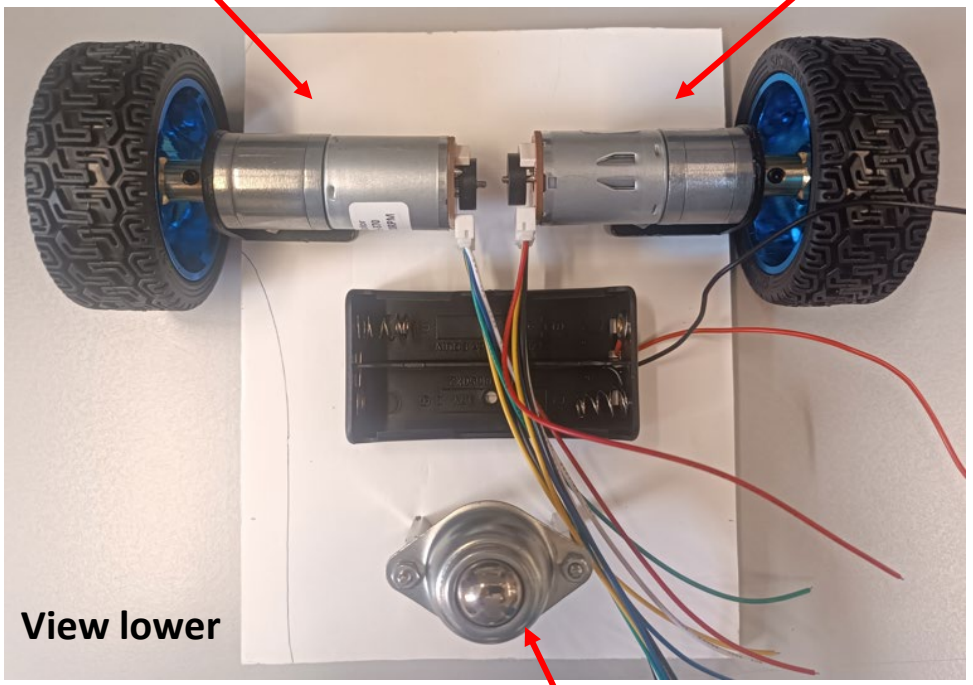
Specifications (IV)

- A mechanical chasis with 2 DC motors and a free wheel



Motor + Encoder
Left Wheel
(Motion)

Motor + Encoder
Right Wheel
(Motion)



Free Wheel
(Stability)

Angle brackets required for platform mounting

- **Necessary material**

Audio Amplifier + Speaker

18650 batteries (3.7 V)

https://es.aliexpress.com/item/1005005129286209.html

DC Motor Driver L298N

https://es.aliexpress.com/item/32686434452.html

https://es.aliexpress.com/item/32923423569.html

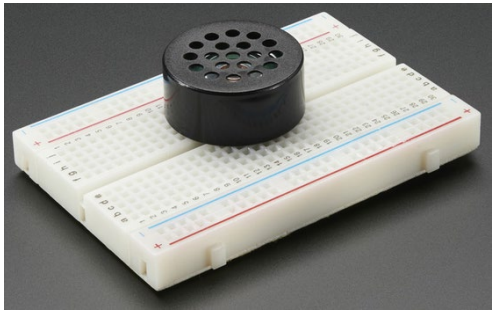
https://es.aliexpress.com/item/1005004177699678.html

https://es.aliexpress.com/item/1005001279982165.html

- **Auxiliary material**
  - **Connection cables**

http://es.aliexpress.com/item/Free-Shipping-40pcs-in-Row-Dupont-Cable-20cm-2-54mm-1pin-1p-1p-Female-to-Male/1864746390.html

- **Breadboard**



- **Pin strips**

http :// www . ebay .es/ itm /10x-40-Pin-Male-Header-0-1-2-54mm-Tin-Square-Breadboard-Headers-Strip-USA-/150838016410?pt=LH_DefaultDomain_0&hash=item231ea5799a&_uhb =1

Planning

HW/SW development	Weeks
Designing the system. Block diagram indicating optimal LPC1768 resources use in Mini-DK2. Keil environment for programming and debugging.	2
1st Millestone: Driving motors. Generation of PWM signals to move motors in different directions. **Non-holonomic movements, non-straight turns, reverse movement.**	3
2nd Millestone: Measuring robot movements. Distance and path monitoring based on the encoder reading with TIMERs and GPIOs.	2
3rd Millestone: Analog inputs/outputs. ADC configuration and reading for monitoring power supply from battery. Generation of acoustic alarm with DAC. **Variable acoustic signal.**	2
4th Millestone: Asynchronous Serial Communications. Programming and monitoring the sequence of movements through the UART0. **Movements sequence sent via Bluetooth. Measuring ambience variables from a serial port.**	2
Software integration.	2

Evaluation (I)

- The **evaluation of the practical part of the subject** (PL):
  - It will be carried out using a **continuous evaluation method** (with the exception of those **final evaluation requests accepted** according to the regulations)
  - It will have a weight of **40% of the total grade for the subject**
  - It will be based on the **development of a global practice (PBL)**

- The **continuous evaluation** until the beginning of the integration **will be graded through 4 MILESTONES (hitos)**

- **To pass the project evaluation, it is a necessary condition to have completed the functionality of the milestones**

Evaluation (II)

- **Tools:**
  1. **Continuous evaluation**
  2. **Final evaluation with oral presentation of the project**
  3. **Project report**

- **Qualification** taking into account the 3 tools**:**
  - Completion of the compulsory sections will provide a maximum score of 70% of the PL (assessment instrument of the subject in the Teaching Guide)
  - Optional functions will provide a maximum score of 30% of the PL (10% each):
    - Non-holonomic movements, non-straight turns, reverse movement
    - Variable acoustic signal
    - Movement sequence sent via Bluetooth
    - Measuring ambience variables from a serial port
    - Other improvements to be agreed with professors

  ❖ Obtaining the maximum score at each will depend on the **degree of achievement, correct functioning** , **quality of memory, clarity of exposition** , etc.

DOUBTS / QUESTIONS