Robot competition
Introduction meeting

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Goal of the competition

- Friendly competition: max. 6 teams of 3 students
- Earn a maximum of points by collecting toys (Duplo-like bricks) and depositing them at the collection point
- Arena with different terrain types: score depends on object positions
- New: bonus points for difficult objects
- Private competition (rehearsal, not evaluated)
- Public competition (robot **features** will be evaluated)

Educational goals of the competition

- Opportunity of creating a robot from A to Z
- Real-world challenges: real mechanics and electronics, system-wide integration, software & hardware debugging, choosing components and reading datasheets, supplier delays, unexpected costs, ...
- Functional and risk analysis
- Time, team, project & budget management

Main phases

- **First 3-4 weeks**: brainstorming, functional analysis, risk analysis, planning, possibly proof-of-concept testing
- **Milestone 2**: present your analysis to your coach
- **Weeks 4-7**: design phase. You get access to previous years' reports and files.
- **Week 7** (approx.): design review (graded)
- **Rest of the semester**: construction, integration, debugging
- **May 31st**: real arena becomes available

Functional analysis

- List all the functions that your robot is supposed to have (action verb, direct object), for example: move, detect toys, grab toys, localize in the arena…
- Define how important each function is (prioritize)
- Define what criteria to use to classify solutions for each function (*e.g.*, speed, reliability, etc.)
- Look for all possible solutions and classify them

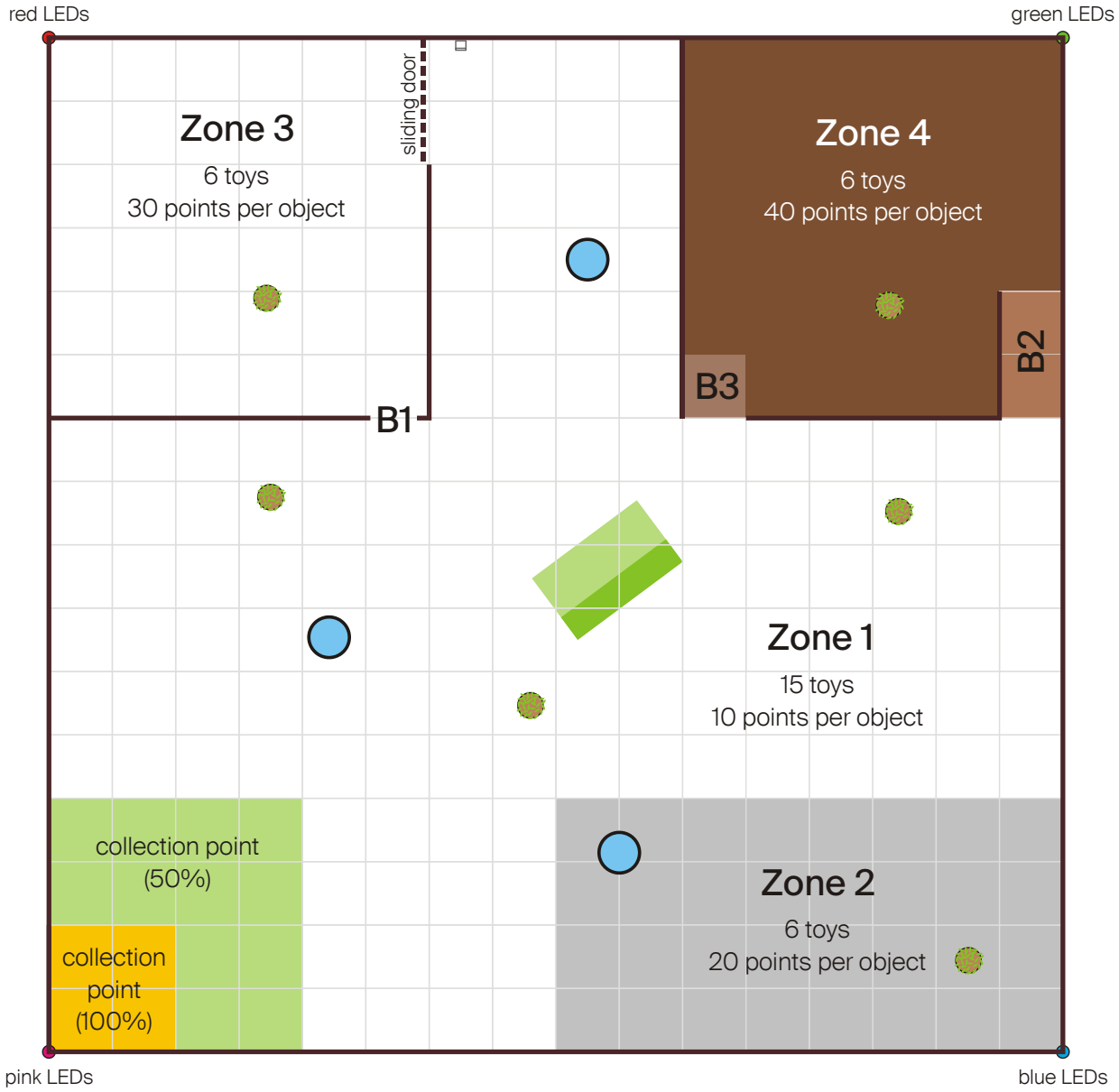
Risk analysis

- Done in parallel to functional analysis
- Identify any possible issue that might arise
- Classify risks in function of their likelihood (almost certain or quite impossible?) and impacts (catastrophic failure or minor misfunctioning?)
- Identify solutions or workarounds. This is especially important for high-impact risks

Time planning

- Identify tasks to be completed and their dependencies
- Estimate duration of tasks
- Assign task responsibilities to team members
- Useful tool: Gantt chart
- Allows for parallelization, task allocation, identification of critical paths (can the project be finished on time in the worst time scenario for each task?)

Arena example



Main rules

- Robots must be 100% autonomous:
  - Battery powered
  - No remote control
  - No remote computation
- Multi-robot solutions are allowed
  - Communication between robots is allowed (but not to offload computation)
  - Robots *must* have actuators with a competition-related goal
- Toys must remain intact
- Maximum size depends on arena constraints
- No flying solutions

Important dates

- Milestone 2: in around 3 weeks, private meeting with coaches
- Design review (“milestone 3”): around **week 7**
- Temporary report deadline: depends on your section’s requirements
- Final arena: **May 31st to June 12th** at Salle polyvalente
- Private competition: Thursday, **June 6th**, morning (TBC)
- Public competition: Wednesday, **June 12th**, 14:00
- Real report deadline: Sunday, **June 16th**, 23:59:59.999

Up-to-date calendar:
https://robot-competition.epfl.ch/calendar

Deliverables

- Report
- Videos

  A set of video files demonstrating all the capabilities of your robot. No fancy video effects or editing, simple cuts are ok.
- Archive with all source code, **CAD files**, etc.
  - Cloud-based CAD (e.g. Fusion 360) only ok when exporting files to a standalone CAD format (e.g. Inventor). **All files must be handed in**!
- The robot participating to the competition
  - Therefore: don't put anything in the robot if you want it back!
- All original packaging you received
- All virtual catalog parts (either in your robot or alone)

Grading

- **Design review** (milestone 3): 10%
- **Achievements**: 40%
- **Report**: 30%
- **Video**: 20% (scientific quality)

Achievements

Management (20%)

- Time management
- Budget management
- Team management
- Process management

Functionalities (40%)

- Localization & navigation
- Obstacle avoidance
- Being able to move toys
- Being able to drop toys at the collection point
- Robustness

Quality (40%)

- Mechanical design (drawings & design)
- Electronics design
- Software
- Integration (software & mechatronics)

https://robot-competition.epfl.ch/info

«List of achievements and grading»

Budget

- Real budget (750 CHF): buying parts
  - Coach must authorize the buying (except for small expenses)
  - Buy in local stores and keep receipts
  - Order from suppliers (*through us!*)

- Virtual budget (1’500 CHF)
  - Components already in stock
  - Access to DLL-PROT facilities
  - Access to mechanical & PCB workshop

A few hints

- Every year, people are late! Start working fast early!
- Keep it simple: a 4-DoF manipulator is *perhaps* overkill
- Don’t *assume* things you didn’t verify: *test* them!
- Discuss and ask questions if you have doubts
- Keep documentation of what you do
- Write drafts of report sections whenever possible
- Don’t underestimate the time it takes for integration and software development: one week is *not* enough
- Rather be ready too early than too late…

Points for your report

- The strategy you chose for the competition
- An overview of the architecture of your robot(s)
- A description of how every part of the robot(s) works
- Mechanical drawings, block schematics, electronics schematics if any
- A description of any algorithm you designed (navigation, image processing, etc.)
- The justifications behind all your choices
- The timeline (Gantt chart) as you have presented it at Milestone 3 (not one you updated to reflect the changes since that day)
- If you were late on that timeline, a detailed description of the various reasons (e.g., supplier delays, hardware failures, etc.). This is very important to help future participants anticipate the problems they will run into.
- Any specific problems you encountered during the semester, and how you solved them
- If the robot didn't perform as expected, an analysis of the exact reasons, and how the design of the robot should have been changed to prevent the problem from happening.
- Any hints you would like to transmit to the future students doing the competition

Project registration

- Project title: “Interdisciplinary robot competition”
- Professor: Auke Jan Ijspeert
- The PDF is usually generated on IS-Academia, and will be (digitally) signed by the professor

Miscellanea

- Please come on Mattermost if you didn't do yet. Answers to common questions will be posted/answered there.
- Practical electronics tutorial in 1-2 weeks (poll with dates will follow)
- Most robots will probably use WiFi:
  - Personal hotspots are not allowed on campus
  - Saving your EPFL password in a shared robot is bad practice
  - IoT network available at SPOT (only)
  - EPFL network (campus-wide) with special service account
- Virtual budget is virtual: no transfers to/from real budget. Broken objects are moved to real budget unless they can easily be repaired!

https://robot-competition.epfl.ch/