

# **FIRST® LEGO® League**

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## CADERNO DE ENGENHARIA

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TRADUZIDO POR EQUIPE SUNRISE

# O QUE É UM CADERNO DE ENGENHARIA?

- O caderno de engenharia é uma forma de documentar a jornada da equipe na temporada FIRST LEGO League.
  - Documenta o processo de design e construção
  - Documenta a pesquisa, viagens de campo, entrevistas e testes da solução
  - Documenta seus eventos de divulgação, o que fazem durante os treinos e até mesmo as ideias futuras

**Resumindo, se documenta TUDO!**

*FLL Tutorials mostra algumas páginas de Cadernos de Engenharia e também templates prontos para uso*

# O QUE PODE SER INCLUÍDO?

- Fotografias e desenhos
- Modelos LDD CAD do robô
- Planos para a temporada e tarefas para serem feitas
- Discussões e decisões durante os treinos
- Ideias e testes de anexos do robô
- Prints da programação e pseudo-códigos
- Problemas encontrados
- Melhorias feitas
- Ideias que vocês tiveram

# ALGUMAS PERGUNTAS IMPORTANTES

- Qual é o objetivo do treino de hoje?
- Que decisões tomamos hoje?
- Por que vocês tomaram esta decisão?
- O que vocês tentaram hoje?
- O que funcionou e o que não funcionou?
- Quando algo não funcionou, como vocês resolveram o problema?
- Que mudanças vocês estão planejando para a próxima vez?  
Quais são os próximos passos?

# EX I: CADERNO DE ENGENHARIA

- Documente como a equipe chegou a estratégia do desafio
- Documente quais missões serão feitas em cada saída
- Documente quem irá trabalhar com o que

**Student Name:**

**Date:**

**Goal:** Today we worked on developing a robot strategy. Each student on the team came up with their own strategy plan. They presented it to the team. We discussed each one and then we merged the ideas together, taking the best ideas.

This is our final plan: We plan to have 4 runs from base.

In run 1, we will do M01, M06, M09, M15. We feel this will work well since there are lines to follow and the missions are close together.

**Run 1 Pseudocode:** 1) The robot will leave base and head towards.....

In run 2, we will do M03, M25, M07

**Run 2 Pseudocode:** 1) The robot will leave base and head towards...

**Next Steps:**

John, Jessica and Ellie will work on run 1 attachments programming  
Fred, Eli, and Ananth will work on run 2 attachments and programming  
Eric and Samantha will work on creating the base robot.



# EX 2: CADERNO DE ENGENHARIA

Student Name:

Date:

Goal: Comparing different robot designs.

## Robot #1

### What works well

- It has a low center of gravity.
- It drives and turns accurately.
- It has 4 walls protecting it from external forces.
- Dual color sensors (Shielded) for line squaring
- Gyro sensor position in the middle and out of the way.
- Lots of areas to add attachments

Robot Image  
(top)

### What needs improvement

- Weight balance between front and back causing robot to jerk
- Robot is tilting back too much
- High walls seem to be making it heavy
- We only use 3 of the 4 available motors

Robot Image  
(bottom)

### Next Steps

- Position the Brick more backwards to balance out weight.
- Leave charging port more easily accessible.
- Add one more motor.
- Experiment with different wheels.

### Sample Comparison Table:

| Robot   | Size           | Wheels                                   | Motors           | Sensors         | Strength                 | Speed        |
|---------|----------------|--|------------------|-----------------|--------------------------|--------------|
| Robot 1 | 17X10X1<br>5cm | Edu wheels<br>2 ball bearing             | 4 Large          | 1 color         | Low center<br>of gravity | Medium speed |
| Robot 2 |                | Large Motor<br><del>Cycle</del><br>Skids | 2 Large<br>2 Med | 2 color<br>Gyro | Tall                     | Fast         |

Documente os testes  
baseados em  
diferentes

# EX 3: CADERNO DE ENGENHARIA

Student Name:

Date:

Wheels tested  
Image

## Goals: Compare different robot wheels

Today we tested different tires for our robot. The goal was to make a decision on which tire to use.

Documente outros testes, como rodas

| Category                        | Robot 1 with EV3 Edu Wheels | Robot 1 with Large Motorcycle wheels | Comments |
|---------------------------------|-----------------------------|--------------------------------------|----------|
| Move Straight 25 inches         | Worked well                 | Curved, jerks                        |          |
| Four 90 degree Right and Left t |                             |                                      |          |
|                                 |                             |                                      |          |
|                                 |                             |                                      |          |
|                                 |                             |                                      |          |
|                                 |                             |                                      |          |

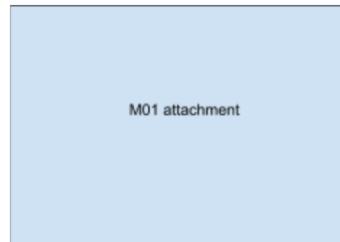
# EX 4: CADERNO DE ENGENHARIA

Documente  
diferentes ideias de  
anexos

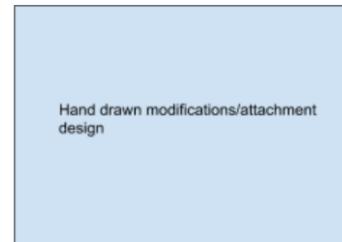
**Student:**

**Date:**

Goal: Work on Mission 01. The pictures show different designs for M01 that we created.



M01 attachment



Hand drawn modifications/attachment design

- Initial idea involved a flat box for M01. As we tested it out, we realized that we needed wall guide to make sure that the attachment will align on the mission model.
- We also realized, that a small ramp would help guide the delivery of the model to inside the circle.
- To retrieve the box back, we originally designed frames and beams and used an axle to grab it and bring it back to base.
- We improved the capture method by replacing the frames and beams with light tubes. This would not only make the box lighter but also would give more accuracy for capturing.

Documente  
entrevistas/viagens  
de campo

Goal: This week we also went on a field trip to the Space Museum and spoke with Astronaut X who volunteers there every weekend. We asked him questions about his experiences. He pointed us to a new resource on the NASA website which we plan to review before our next meeting.

# EX 5: CADERNO DE ENGENHARIA

**Student:**

**Date:**

Documente metas

Documente problemas encontrados

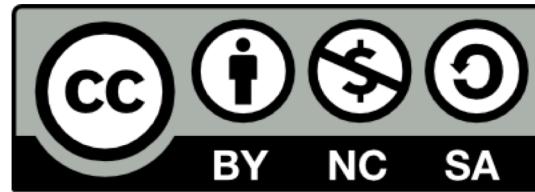
Documente o que funcionou nos treinos

This week we accomplished the following goals:

- Made a plan for what we want to get done by our qualifier. We all sat down and had a discussion on how we should organize our documents.
- We made some more progress on our third run. We made this run more consistent by using our color sensor to find the line. We also added M08 to this run so that we could increase our points.
- We had to test our color sensors this week. Last week we decided that if we wanted to go over the ramp we would have to move our light sensors up as they were hitting the ramp. When we were testing the mission where we go over the ramp, the light sensors would get in the way and our wheels would lift a little bit off the ground. Now, we lifted the light sensors up and tested that mission run and it worked, but we also had to recalibrate our light sensors so they can still sense lines.
- We also started working on our presentations this week. We started working on them before the meeting was over. It was good to do this at the meeting so that we could discuss with the team and make sure that everyone else was on track of all the presentations.

# CRÉDITOS

- Essa lição foi escrita por Sanjay e Arvind Seshan
- Mais lições de for FIRST LEGO League disponíveis em [www.flltutorials.com](http://www.flltutorials.com)
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