# Snoop Dog

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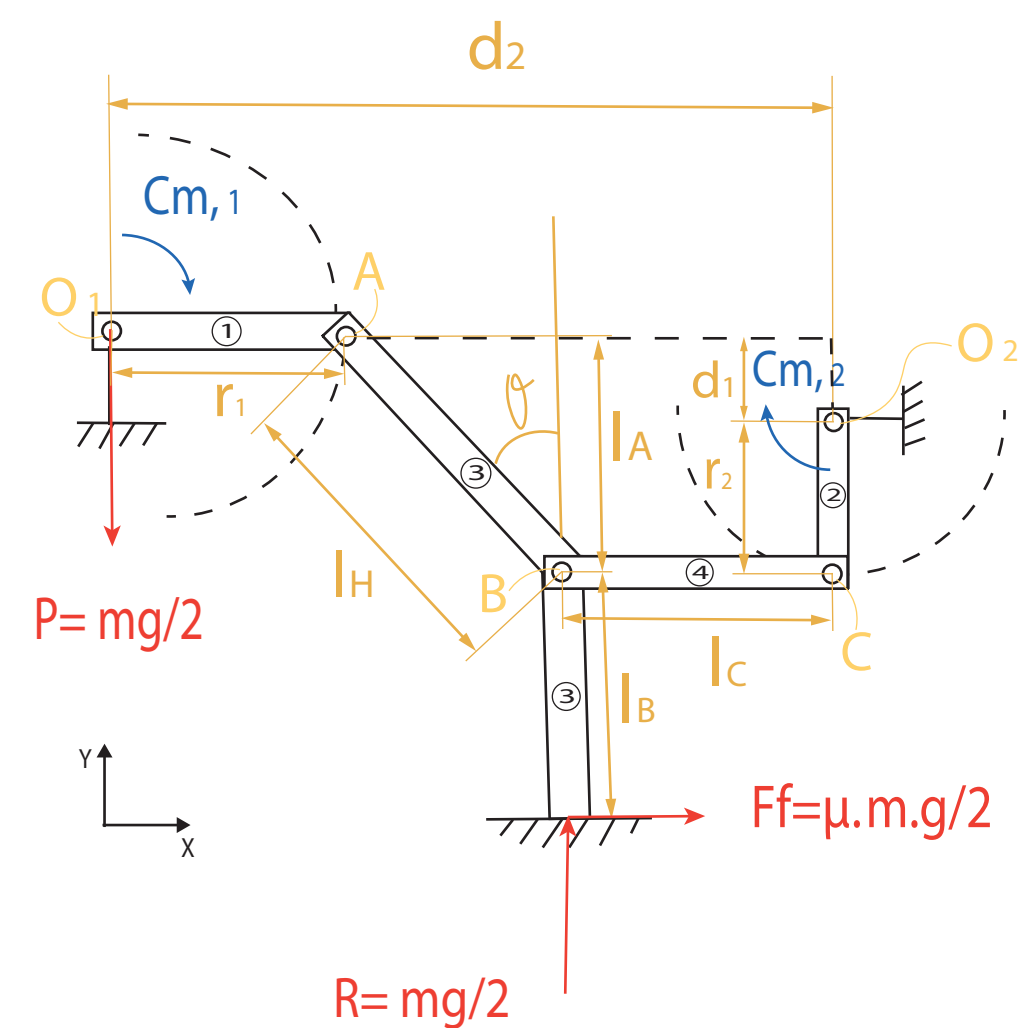
## Introduction:

The aim of this project is to provide a cheap, lightweight, easy to produce, battery powered and controlled quadruped robot. Contrary to his elder brother Cheetah-Cub, "Snoop Dog" is controlled in open loop. The main goal of the robot is to get it moving.

## Physical Calculation:



Momentum on motor required to lift half the weight:

$$M_1 = \frac{1}{2}mgr_1[\cos\theta_1(\frac{\mu}{\cos\theta} + \tan\theta) - \sin\theta_1]$$

$$M_2 = \frac{1}{2}mgr_2[(1 + \frac{l_B}{l_H\cos\theta})\mu + \tan\theta]$$

Maximum allowed Radii for given motor (SG92R):

$$r_1 = \frac{1}{2}\frac{C_{m1}}{R_1} = \frac{1}{2}\frac{C_{m1}}{0.125 \times 10 \times [\cos\theta_1(\frac{\mu}{\cos\theta} + \tan\theta) - \sin\theta_1]} = 96.2mm$$

$$r_2 = \frac{1}{2}\frac{C_{m2}}{R_2} = \frac{1}{2}\frac{C_{m2}}{0.5mg(1 + \frac{1}{\cos\theta})\mu + \tan\theta} = 69.5mm$$

## Leg Concept:

A new leg design was developped for Snoop Dog. Two connecting rods, each attached to one motor, in a planar configuration, allowing two degrees of freedom.
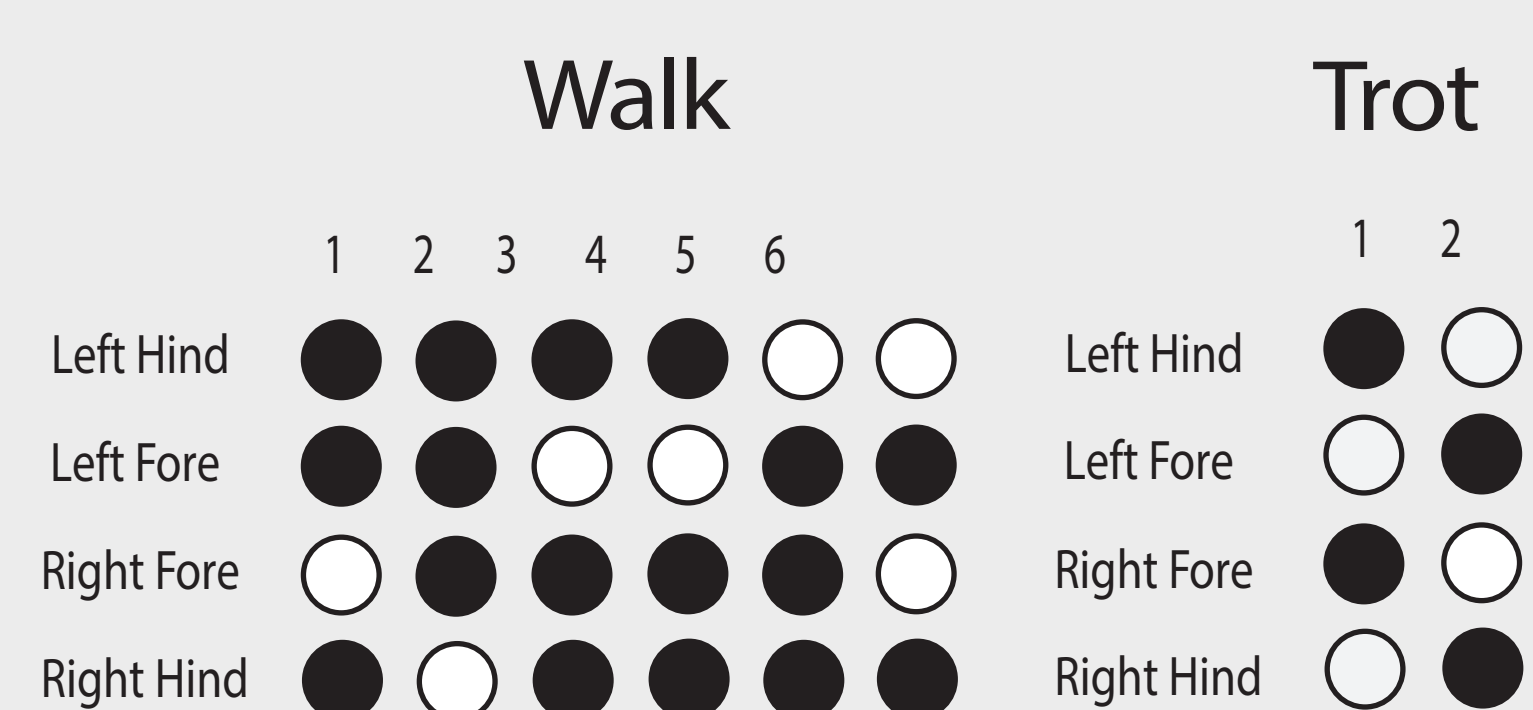This mecanism enables producing ellipses of diffe - rent shapes, imitating animal leg motions.

## Body Concept

A simple parallel structure allowing easy assembly and testing was designed.

## Gaits:

Locomotor cycle of implemented gaits:

| | Walk | | | | | | | Trot | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | 1 | 2 |
| Left Hind | ● | ● | ● | ● | ○ | ○ | Left Hind | ● | ○ |
| Left Fore | ● | ● | ○ | ○ | ● | ● | Left Fore | ○ | ● |
| Right Fore | ○ | ● | ● | ● | ● | ○ | Right Fore | ○ | ● |
| Right Hind | ● | ○ | ● | ● | ● | ● | Right Hind | ● | ○ |

## Implementation of the Gait:

- Programming laguage: C
- Compiler: Energia Release 0101E0014
- Motor control: PWM based
- Modifiable Parameters:
  - Leg motion speed
  - Individual leg control
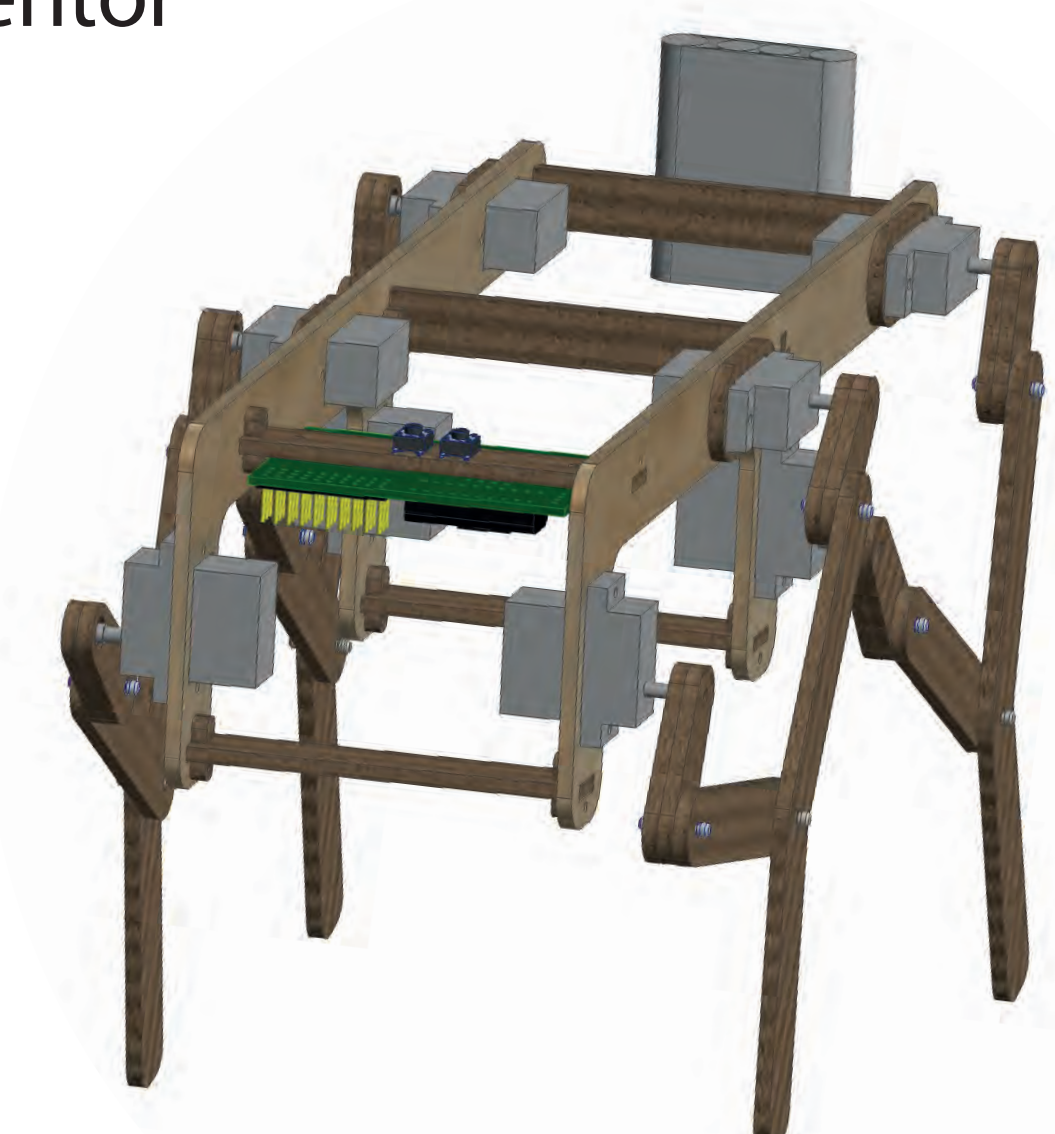
## Our Accomplishment:

Walking quadruped robot:
- 2 gaits implemented
- Cheap (67CHF)
- Autonomous,
- Assembly kit for easy production

## Cahier des Charges:

- Small, programmable, quadruped robot
- Cost under 60 CHF ideally
- Cost under 100 CHF required
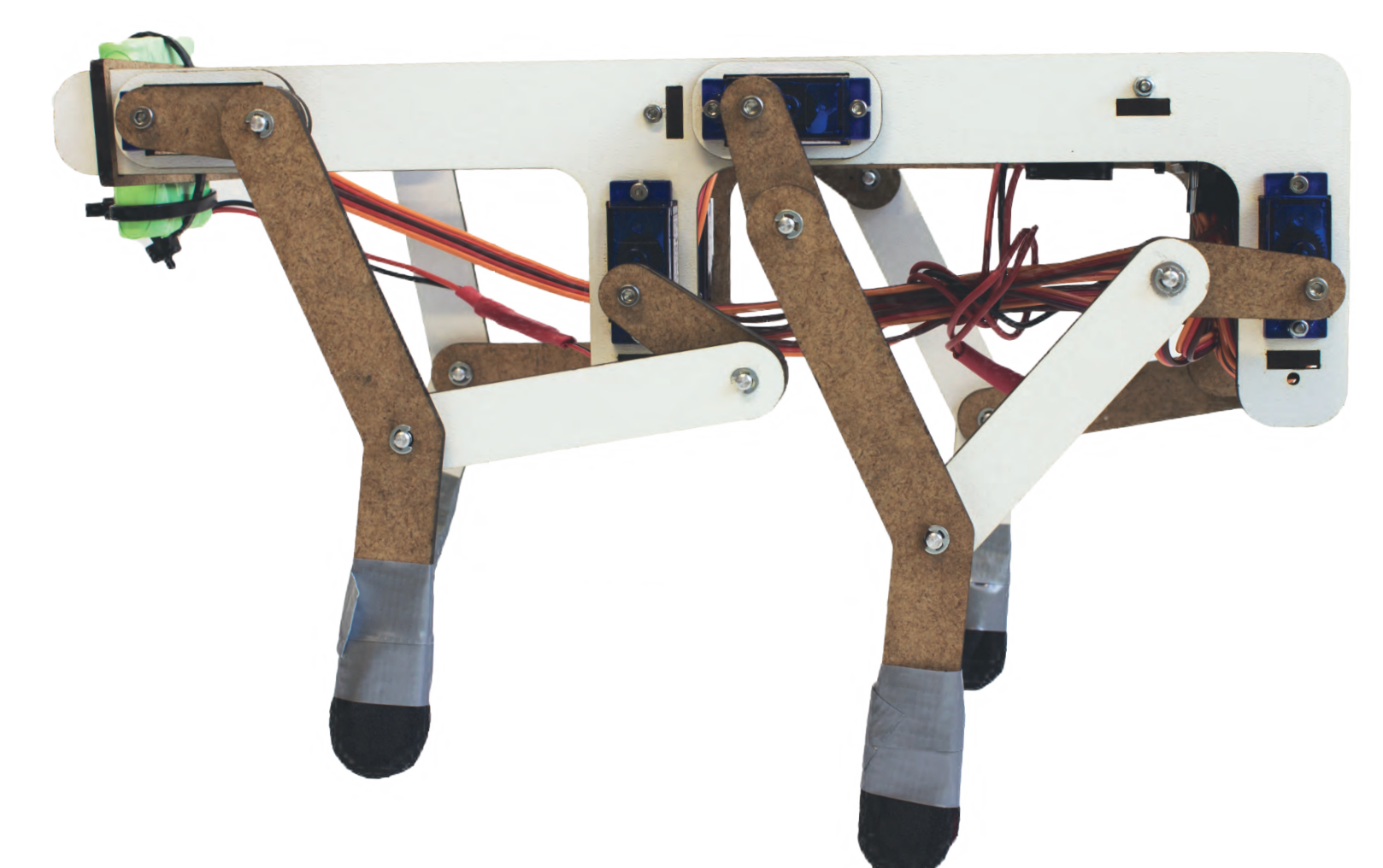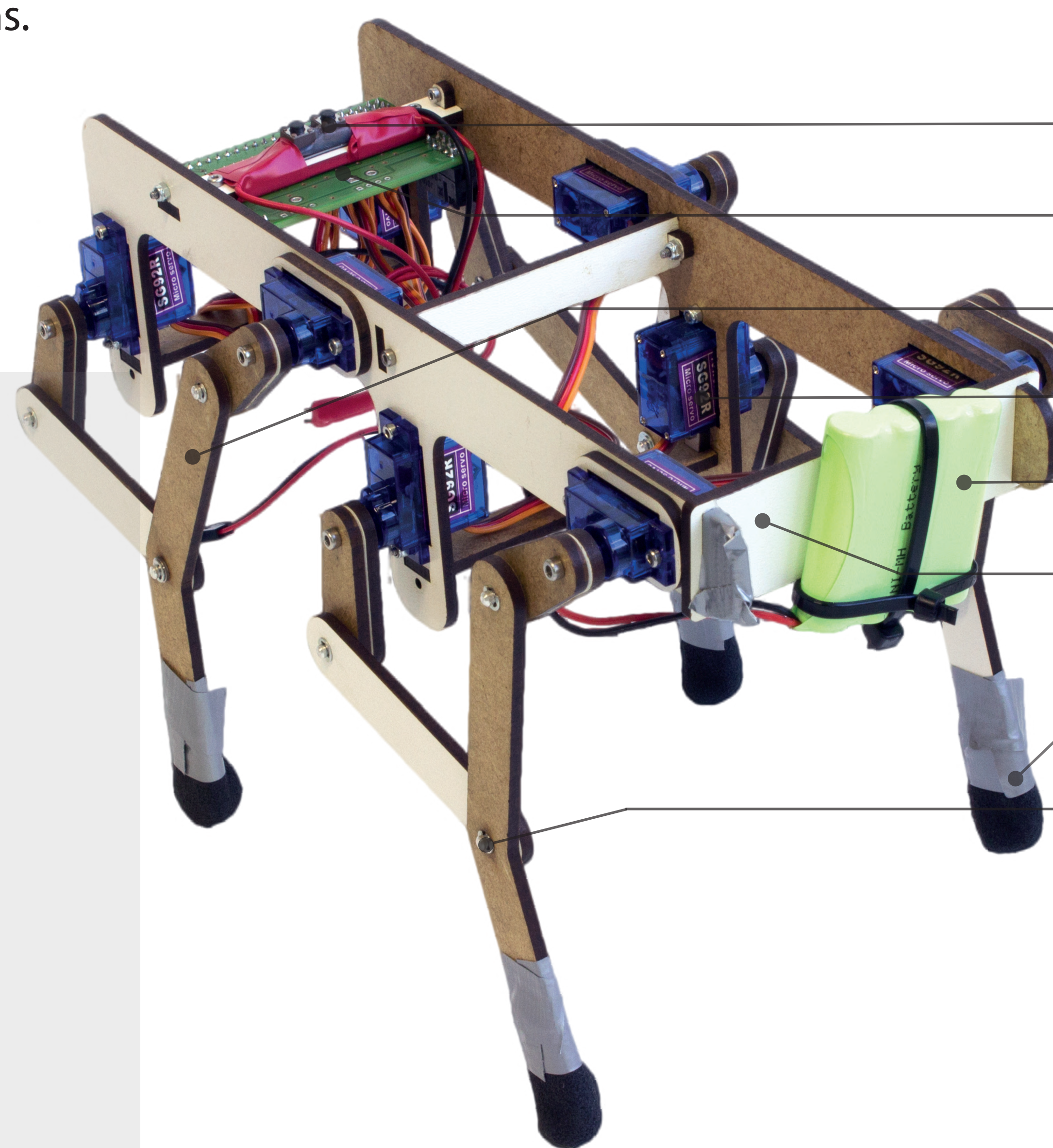- Easy production and assembly
- GUI (if possible)

## CAD Modeling:

The CAD modeling was done using Autodesk- Inventor



## Main constitutive parts:



Start/Stop Buttons

On-board Microcotroller MSP430

Wooden Leg Parts (3mm MDF)

SG92R Tower Pro Servomotors (8x)

4.8 V/700mAh Ni-MH Battery

Wooden Structual Parts (3mm MDF)

Rubber Pieces (4x)

Ball Bearings
&Aluminum Assembly Elements

## Production:

Laser Cutter: Trotec Speedy 400
Turning mill:  Alduro MDB-180V



## What this project brought us:

This project made us aware of the importance of good time/team management. Communication allows to be time efficient. However, ordering production and testing always take a lot of time. In the end, we are proud to present a functioning Snoop Dog.
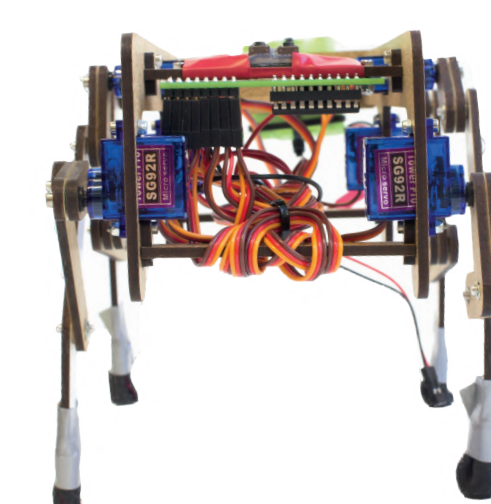


## Further Possibilities:

- Produce assembly kit
- Implement backwards/turning motions
- Optimize gaits
- Improve design
- Add Graphic User Interface
- Improve control