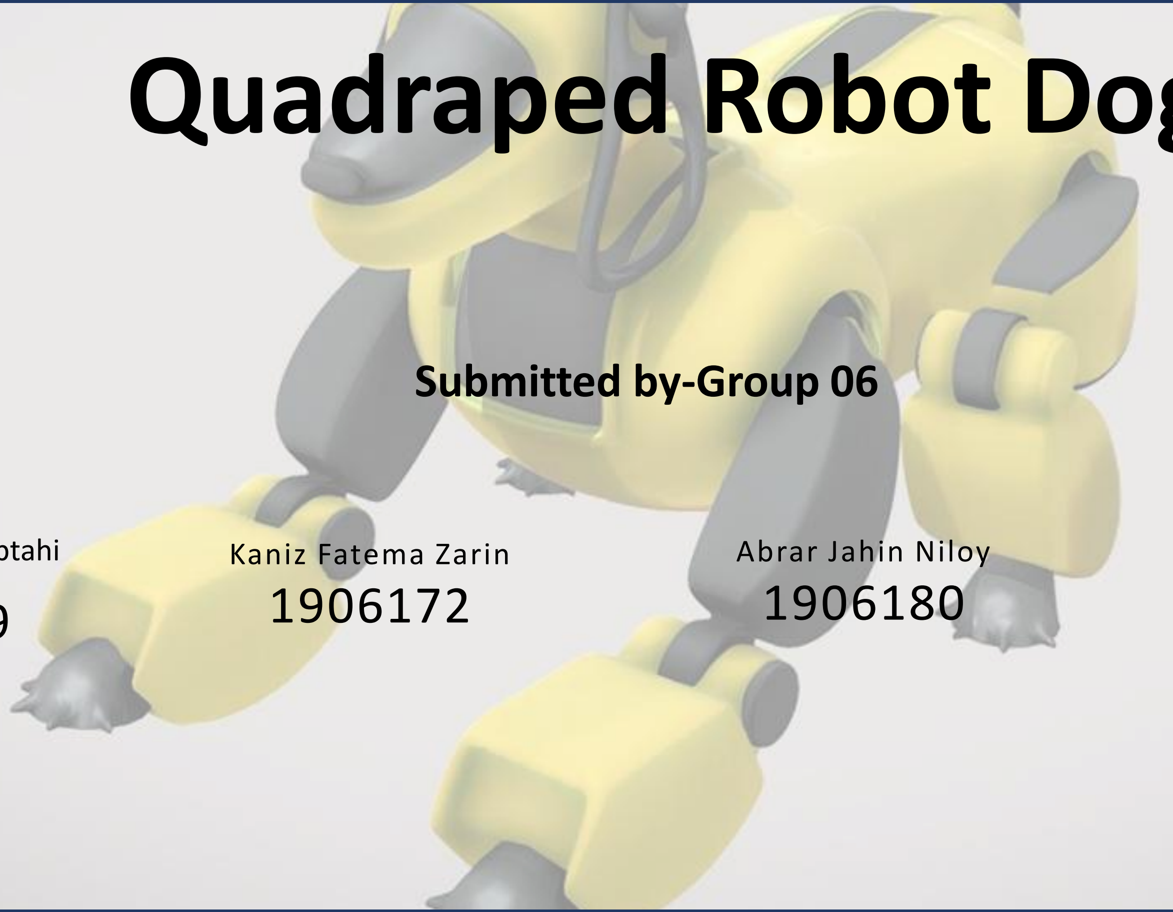
EEE 318-Control System I Laboratory
January2023,Level-3,term-2
Final Project Demonstration

Quadraped Robot Dog



Submitted by-Group 06

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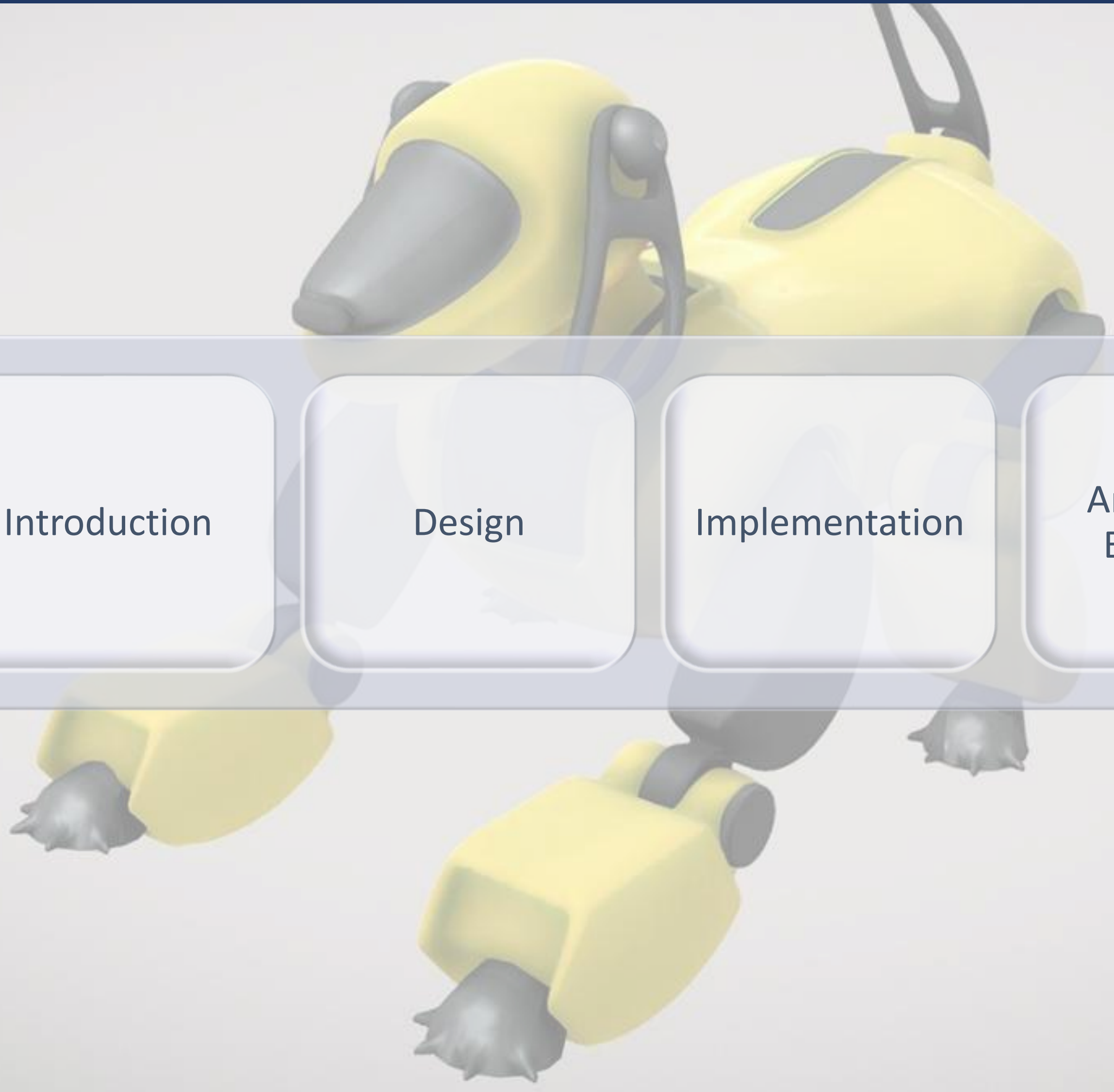
OUTLINE



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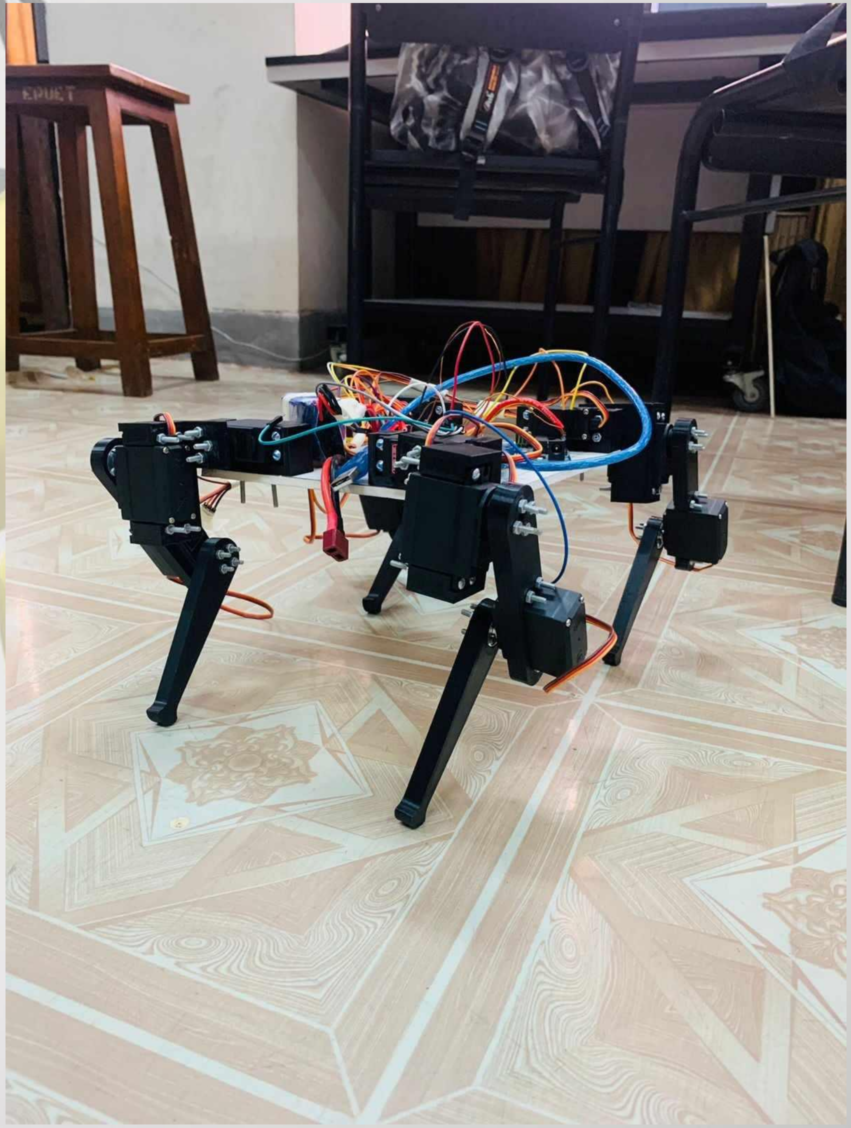
1. Summary / Abstract

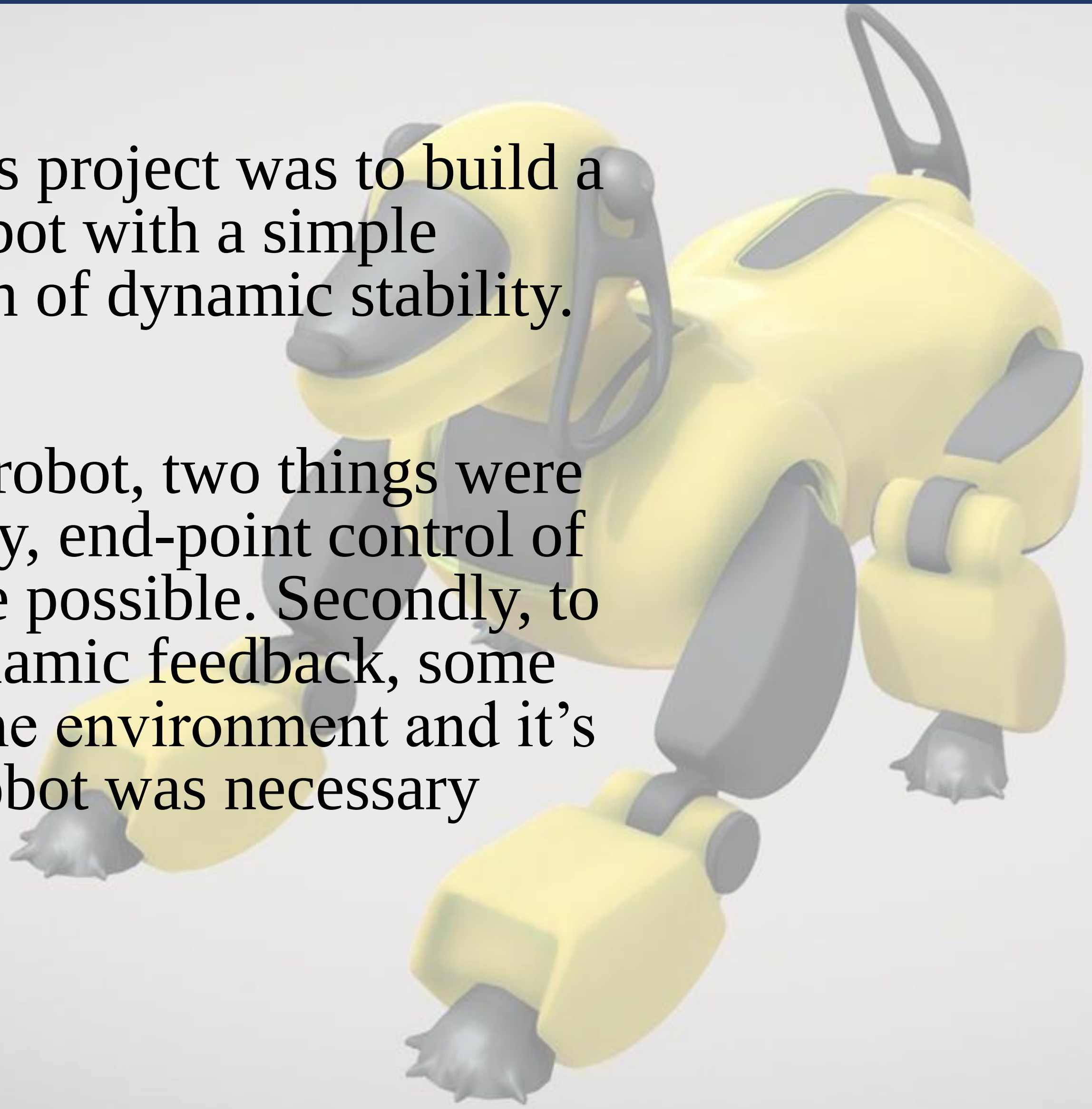
The developed robot is a dog style robot with reversed knee joints. The robot is controlled by an Arduino UNO microcontroller.



Introduction

The goal of this project was to build a four-legged robot with a simple implementation of dynamic stability.

To control the robot, two things were required. Firstly, end-point control of all feet must be possible. Secondly, to implement dynamic feedback, some way to sense the environment and it’s effect on the robot was necessary



Design Methods

Components

Servo

Servo motor

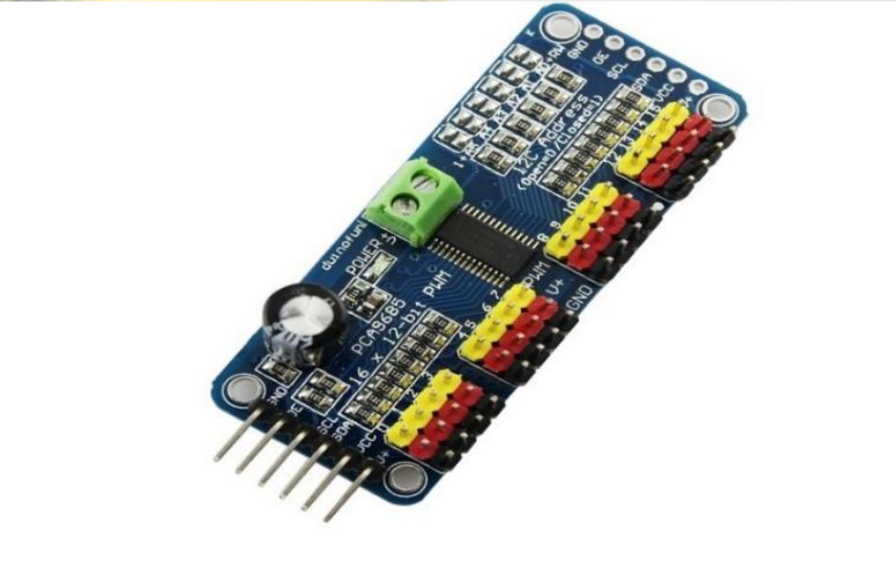


Figure 3: Servo Motor Driver

Design Methods

Components

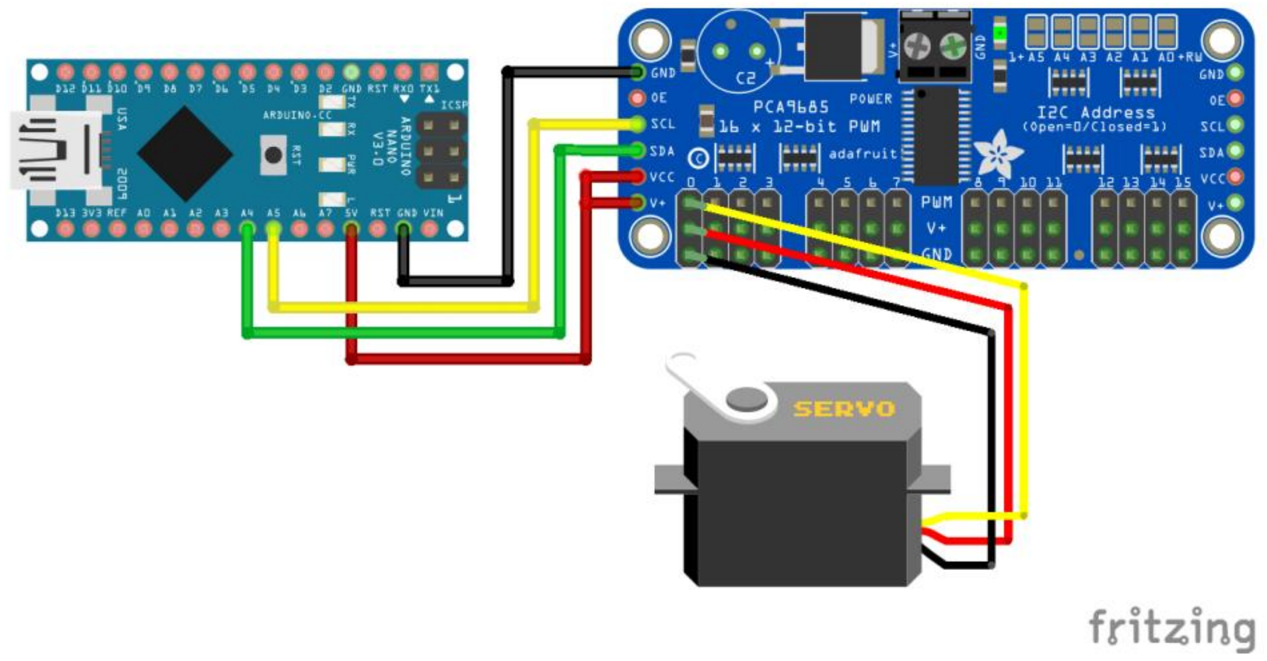


Figure 4: Servo Driver connection

Design Methods

Components

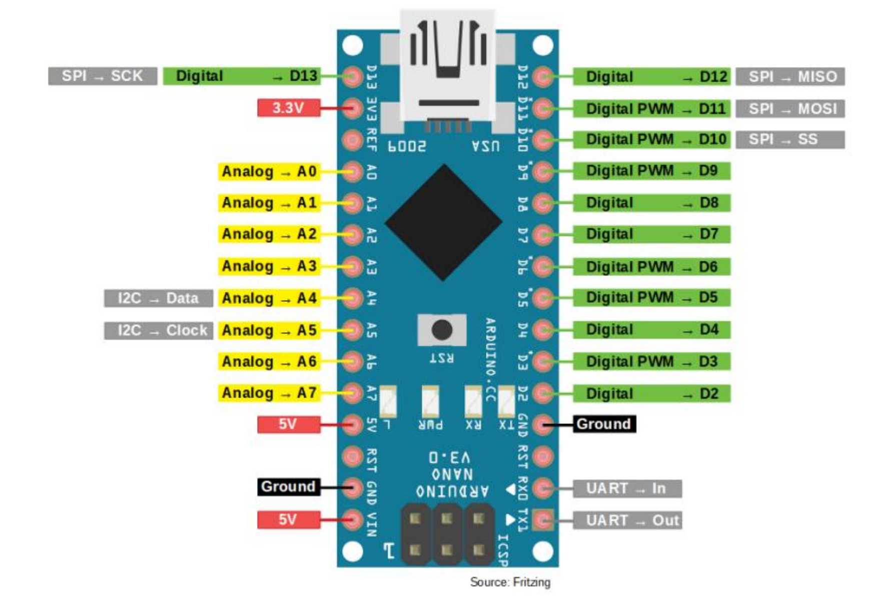


Figure 5: Arduino nano

Arduino

Nano shield

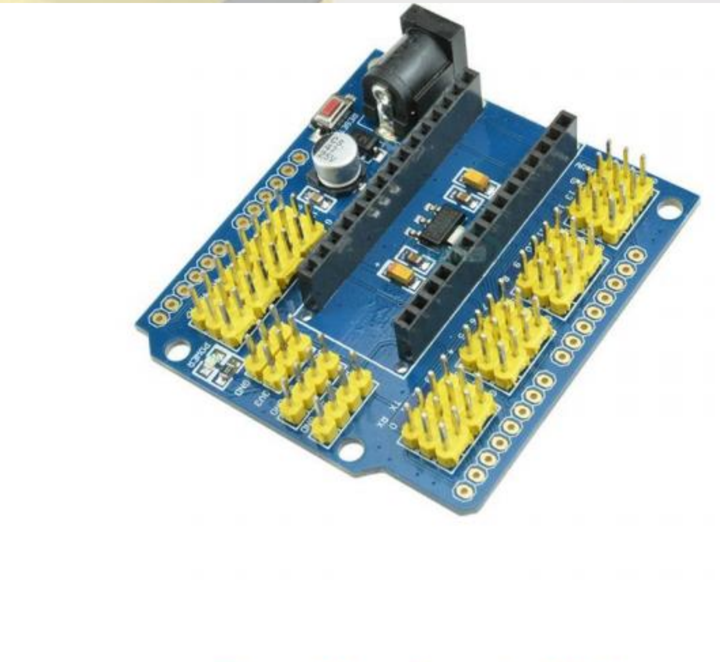


Figure 6 Nano Extension Shield

Design Methods

Components

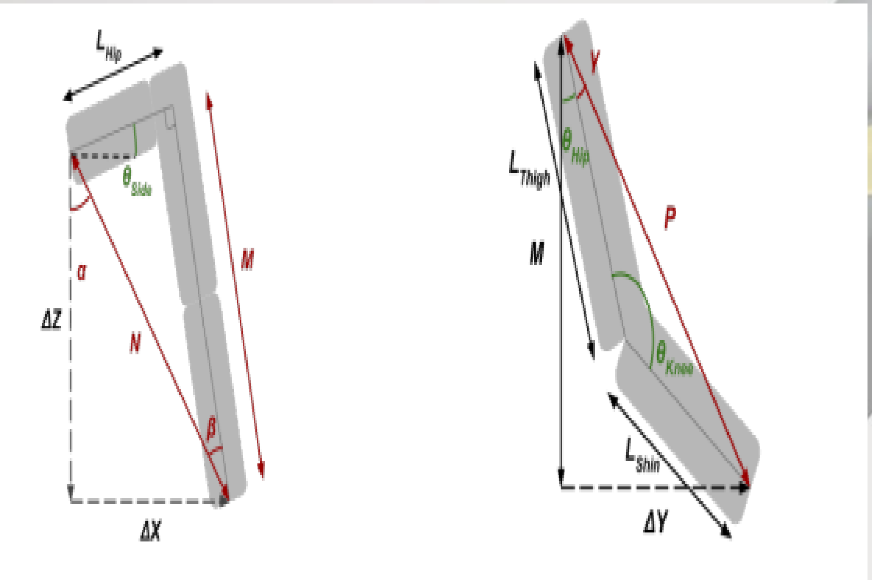
Figure 7: Lipo battery

Figure 8 Buck Converter

Design Methods

Algorithm

Inverse Kinematic



(a) Back view (b) Side view

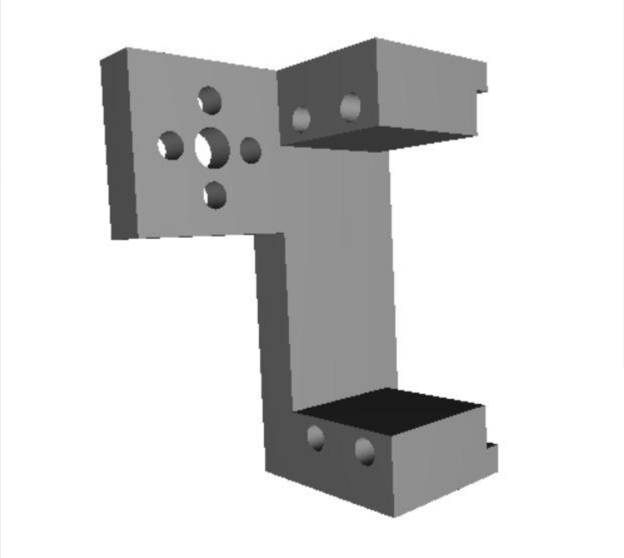
$$\theta_{side} = tan^{-1}\left(\frac{\Delta X}{\Delta Z}\right) - tan^{-1}\left(\frac{L_{hip}}{\sqrt{\Delta X^2 + \Delta Z^2 - L_{hip}^2}}\right) \tag{2.1}$$

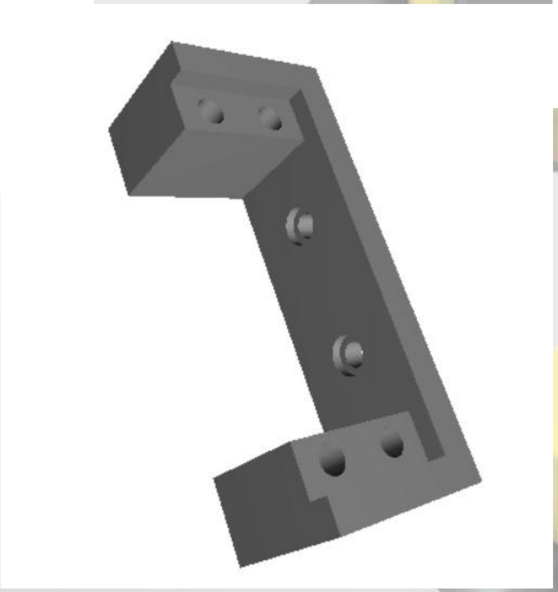
$$\theta_{knee} = cos^{-1}\left(\frac{\Delta Y^2 + \Delta X^2 + \Delta Z^2 - L_{hip}^2 - L_{thigh}^2 - L_{shin}^2}{-2L_{thigh}L_{shin}}\right) \tag{2.2}$$

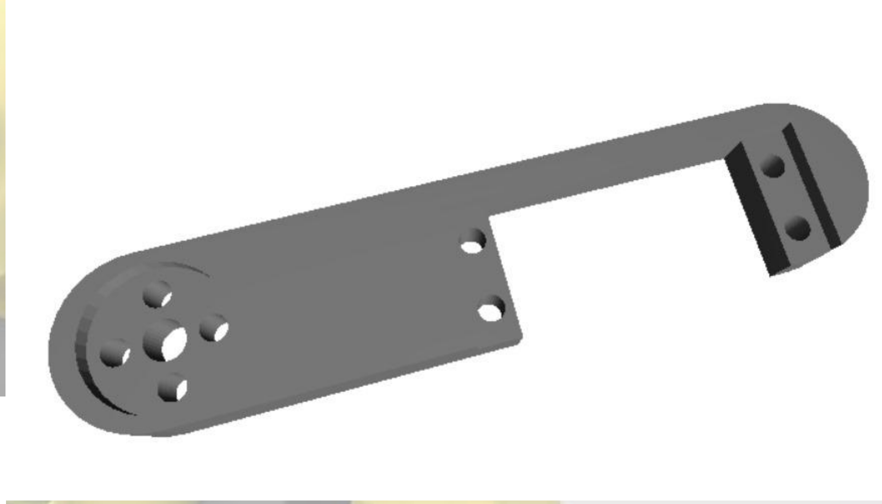
$$\theta_{hip} = tan^{-1}\left(\frac{\Delta Y}{\sqrt{\Delta X^2 + \Delta Z^2 - L_{hip}^2}}\right) - cos^{-1}\left(\frac{L_{shin}^2 - L_{thigh}^2 - \Delta Y^2 - \Delta X^2 - \Delta Z^2 + L_{hip}^2}{-2L_{thigh}\sqrt{\Delta Y^2 + \Delta X^2 + \Delta Z^2 - L_{hip}^2}}\right) \tag{2.3}$$

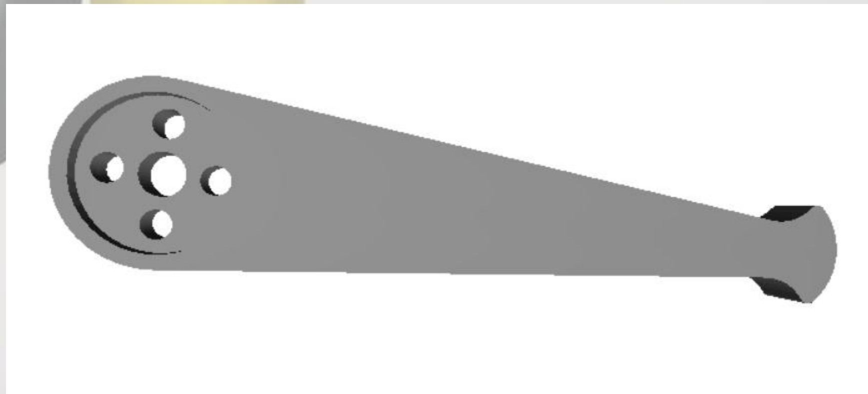
3D printed parts

3D printed limbs of the ROBOT DOG

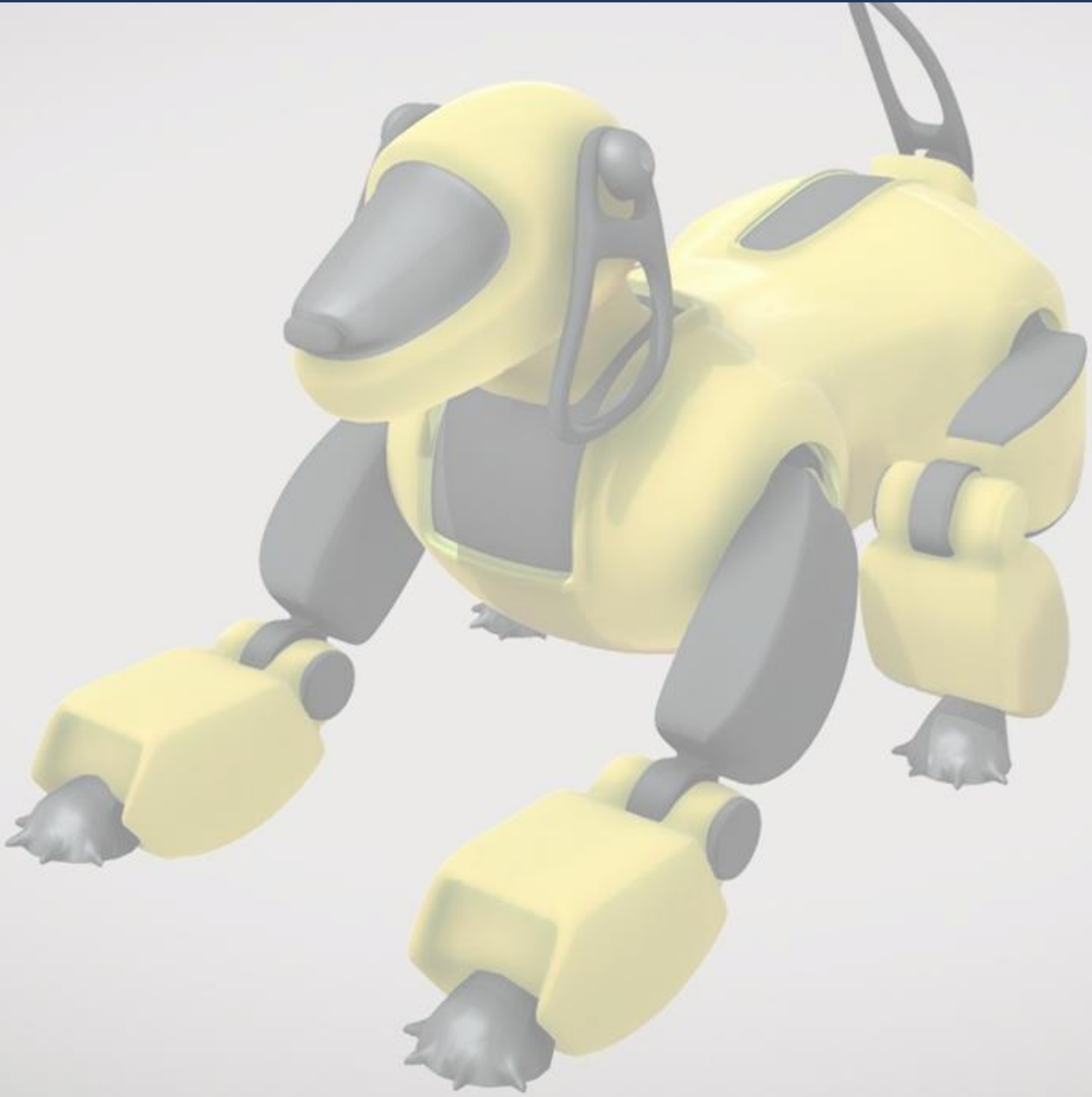




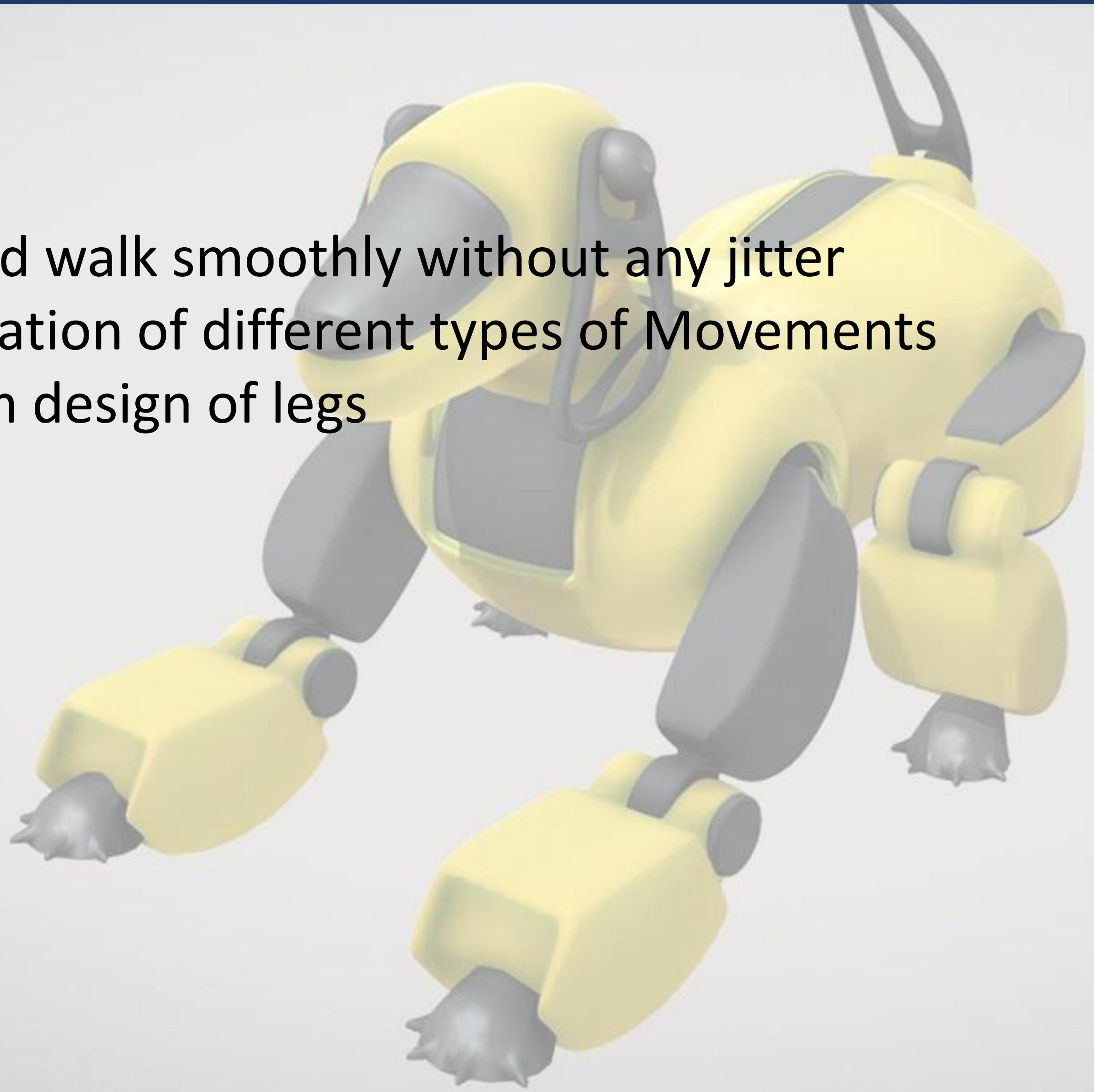




Assembled Hardware



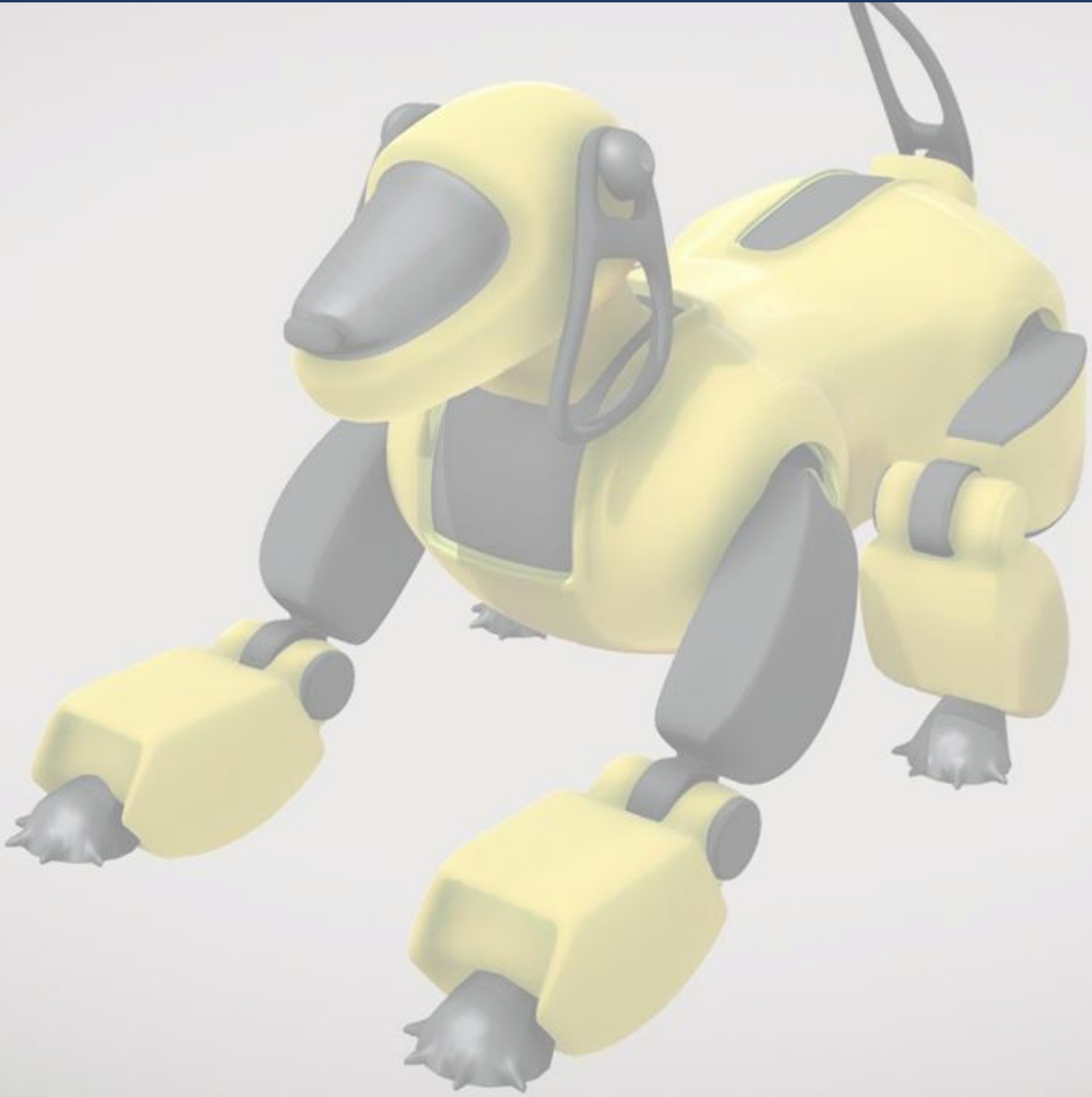
Analysis and Evaluation



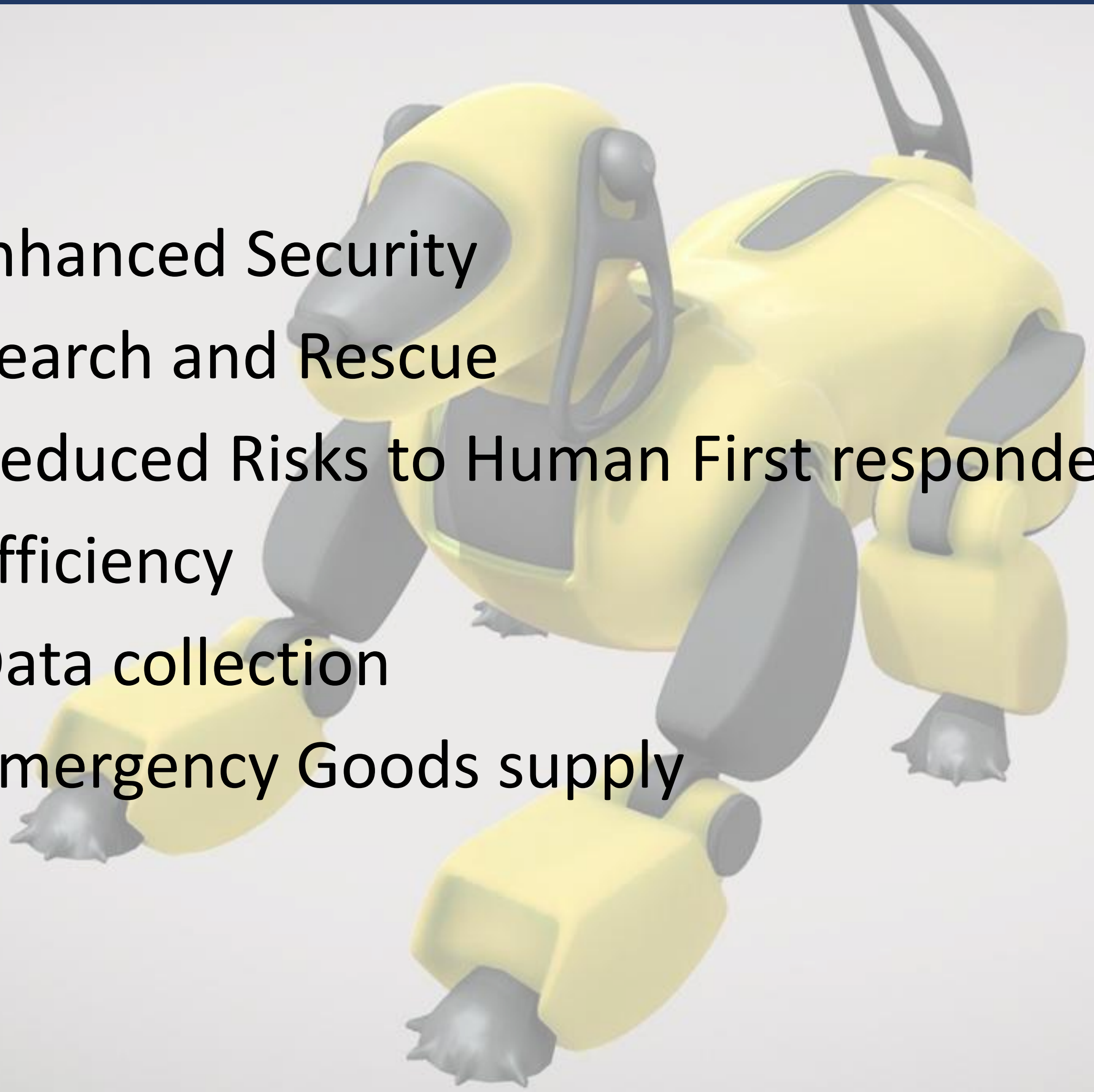
Novelty

- ❑Stand and walk smoothly without any jitter
- ❑Accumulation of different types of Movements
- ❑Optimum design of legs

Project Management and Cost Analysis



Practical Consideration



- ❑Enhanced Security
- ❑ Search and Rescue
- ❑ Reduced Risks to Human First responders
- ❑ Efficiency
- ❑ Data collection
- ❑ Emergency Goods supply

Environmental impact and sustainability

- ❑ Materials and Manufacturing
- ❑ Energy efficiency
- ❑ Repairability and upgradability
- ❑ Recycling and disposal
- ❑ Environmental Impact assessment
- ❑ User awareness

Teamwork and Contribution of Each Member

1906180,1906186- They mainly did the software part but also contributed in other areas

1906169,1906172- They mainly did the hardware part but also contributed in other areas

Reference

- https://kth.diva-portal.org/smash/get/diva2:1558600/FULLTEXT01.pdf?fbclid=IwAR2pWY-TMeTgTZohiWydAlXFkTV0kUJjY8yQgL23KipKR_il7uEqh2dE-5g

- https://www.instructables.com/Nova-Spot-Micro-a-Spot-Mini-Clone/