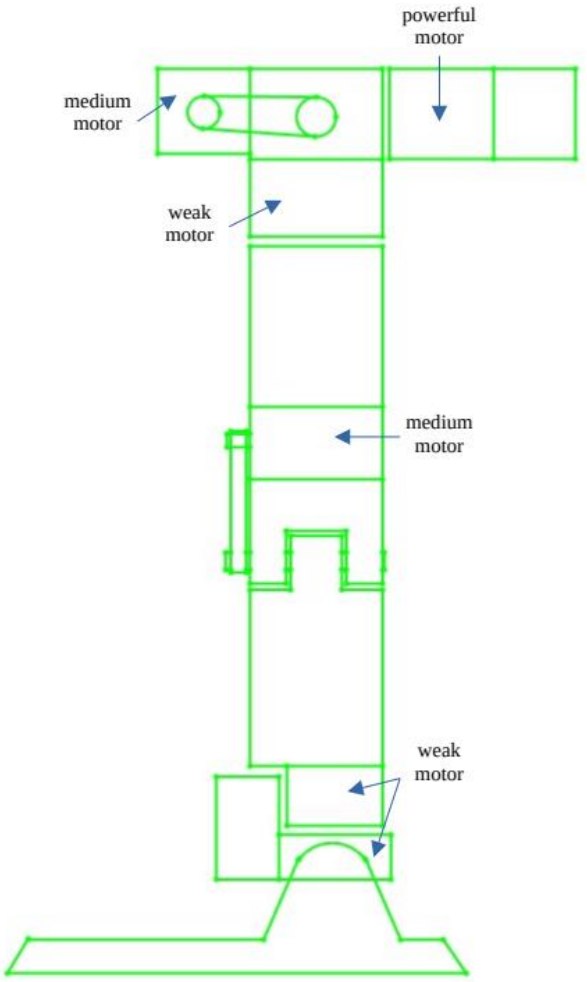
Project proposal

Overview:

This project aims to build a humanoid robot. Of course, because of time and cost constraints, the goal is to only build the lower part of the body with a piece of the trunk that will house the electronics, eventual batteries and so on. It must be able to walk smoothly while avoiding obvious obstacles and (reasonably) challenging terrains. A key inspiration for this project is the Atlas robot from Boston Dynamics. While we understand we will never achieve this level of refinement in the given delay, the goal is to get as close as possible to this kind of motion. A probably more realistic goal would look more like Poppy humanoid, an open source humanoid robot.

A base idea for the leg system is as following:



front view

The hip would have three axis of freedom, the foot two and the knee one. This would allow for a wide variety of motions, more stability and better handling of rough terrains like uneven ground, small rocks and small steps. In addition to the feedback from the motors, a few sensors are required to guarantee stability. Of course, a gyroscope in the body is mandatory, in addition to that an ultrasonic sensor placed on the upper part of the body would allow the robot to sense its environment and navigate without the need of a human input. Unfortunately, given the cost of batteries and the additional weight it adds, the robot will have to be plugged to a power source in order to operate.

Motivation

Humanoid robots have been in development for a long time now, and we are finally seing some decent achievements in this field. One of the benefits of this form factor is that the world we built was made principally for humans. This Is therefore the most suitable to wander around everyday spaces, buildings, stairs, or using our tools without any complicated and expensive adaptors or complete redesigns. Additionally, their human-like shape adds a sympathy factor which might help introduce more and more robots/automation in our everyday life.

Afterlife

This project is probably not the most suitable for a follow-up project for future students of cs-358. However it will probably not be at its finest once completed (again, given the time and resource constraints) but it might very well lead to a continuation either for us as students or for other people to take as a base and expand on. If done properly it might even be useful for a startup as an educational item or as a toy for small or older children, who hasn’t dreamed of a robot for its birthday present?

Costs

Most of the structural parts can be made using 3D-printing or laser-cutting. Some exceptions are metal rods for joints, rubber pads or a non-slippery material for the feet (note that this might be achieved with tpu on a 3d printer depending on the need). Regarding the more technichal part, there is 3 large stepper motors and 3 servos per legs, in addition to one servo for the body (in order to balance it from side to side). These will probably require some belts for easier placement on the robot. For the sensors, an accelerometer, an ultrasonic sensor and 2 to 4 load cells shhould be enough for the robot to have a decent perception of its environment. Depending on the workload this represents, adding a servo to move the ultrasonic sensor might add a better visualization of the environment.

Taking all this into account and some room for safety, the budget is around 240 CHF

Model	Type	Price	Amount
DMS515	Servo	5	8
17HS4401	Stepper	15	6
	Belt	6	1
	Metal rods	1	7
HC-SR04	Ultrasonic distance sensor	2	1
MPU-6050	6 DOF inertial measurement unit	5	1
HX711	Amplifier	4.90	2
	5Kg Load Cell	7.90	4
LilyGo TTGO T8 V1.8	ESP32	11.9	1
	PC power supply	30	1
	Shipment	9	1