

# Designing, assembling & programming a foosball goalkeeper robot

Jan Wilhelm, 6e    **Supervisor:** Clemens Pohle, **Advisor:** Dr. Hugo Leonel Cabrera Cifuentes

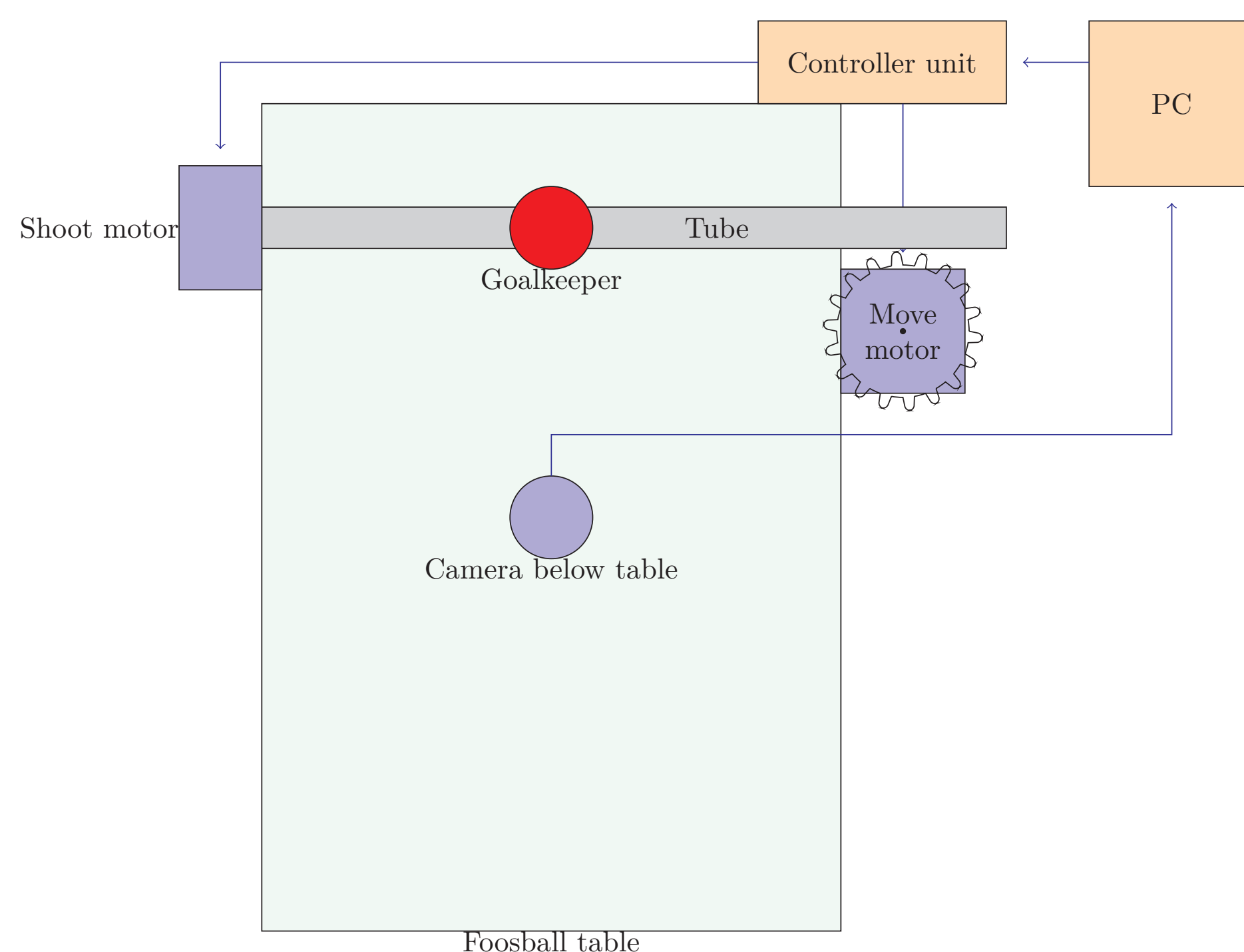
Kantonsschule Hohe Promenande Zürich, Schuljahr 2024/2025

## 1. Introduction

Foosball (table soccer) is fast-paced and unpredictable, requiring quick reflexes and real-time decision-making. This makes it a perfect challenge for testing the limits of AI and robotics. The **goal of this project** is to **build a foosball-playing machine that can play with a human**. The machine will rely on a camera to monitor the game from below and will be controlled by a computer using two motors per axis to move the players and shoot the ball. The goal is to build and test a foosball goalkeeper robot as a proof of concept, that a machine could compete with a human player.

## 2. Robot set-up

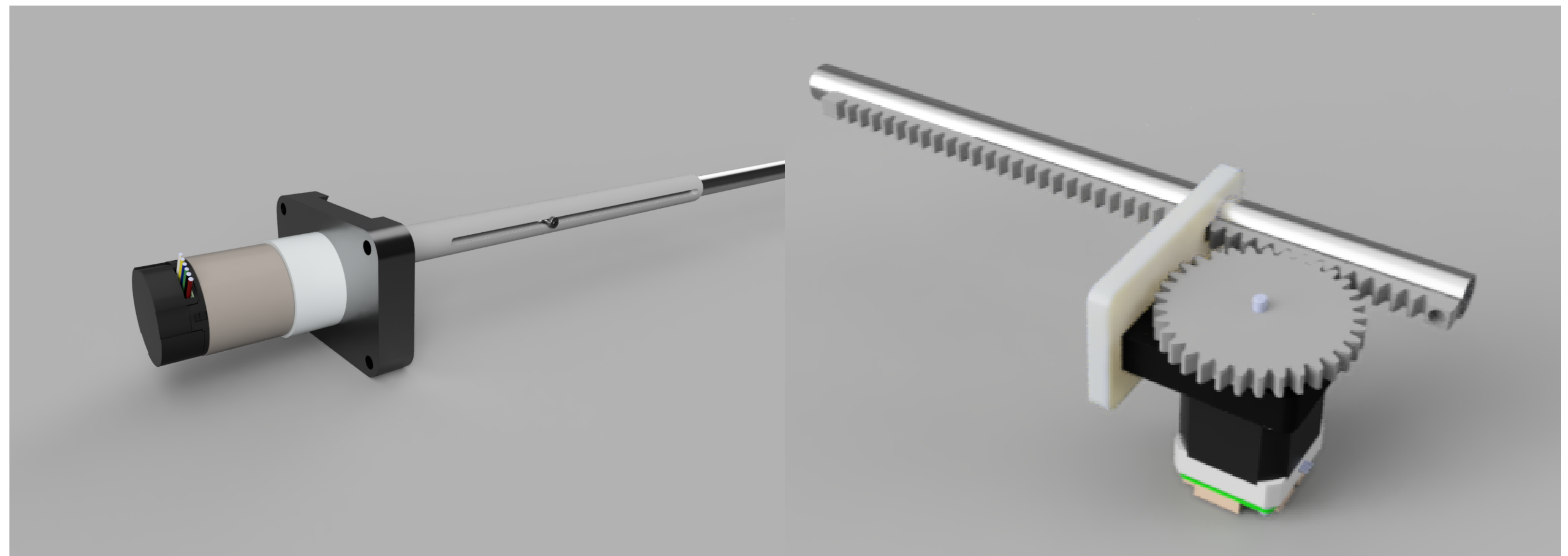
A simple diagram of the final system is shown below. The system consists of a camera below the table, to monitor the game. The camera is connected to a PC, which processes the images and sends the commands to the controller unit. The controller unit moves the motors to the desired position.



The foosball robot system

## 3. Construction

A DC motor (left) turns the goalkeeper in order to shoot the ball. A stepper motor (right) moves the goalkeeper to the correct position, using a gear to move the gearrack.

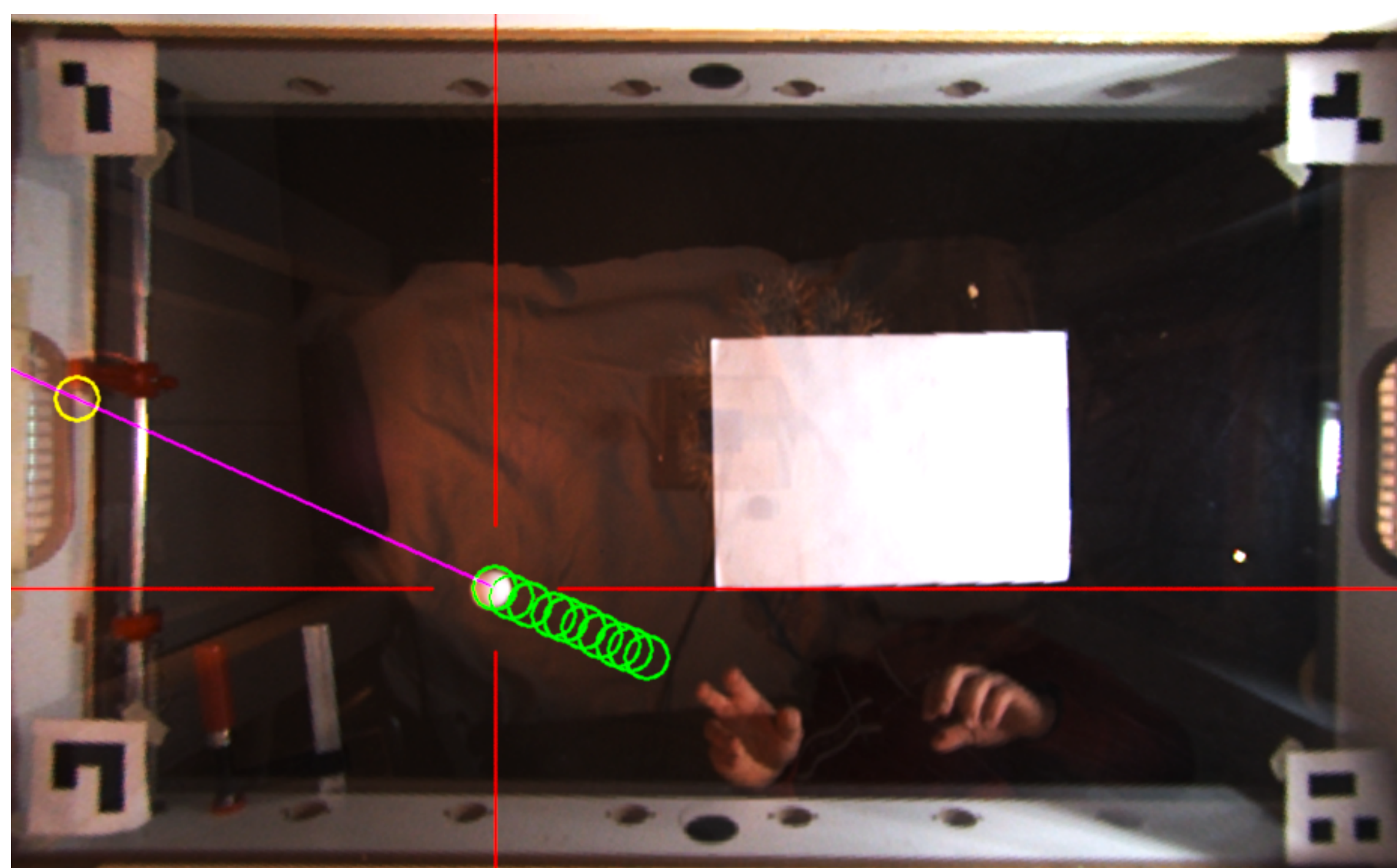


DC Motor

Stepper motor

## 4. Software & Electronics

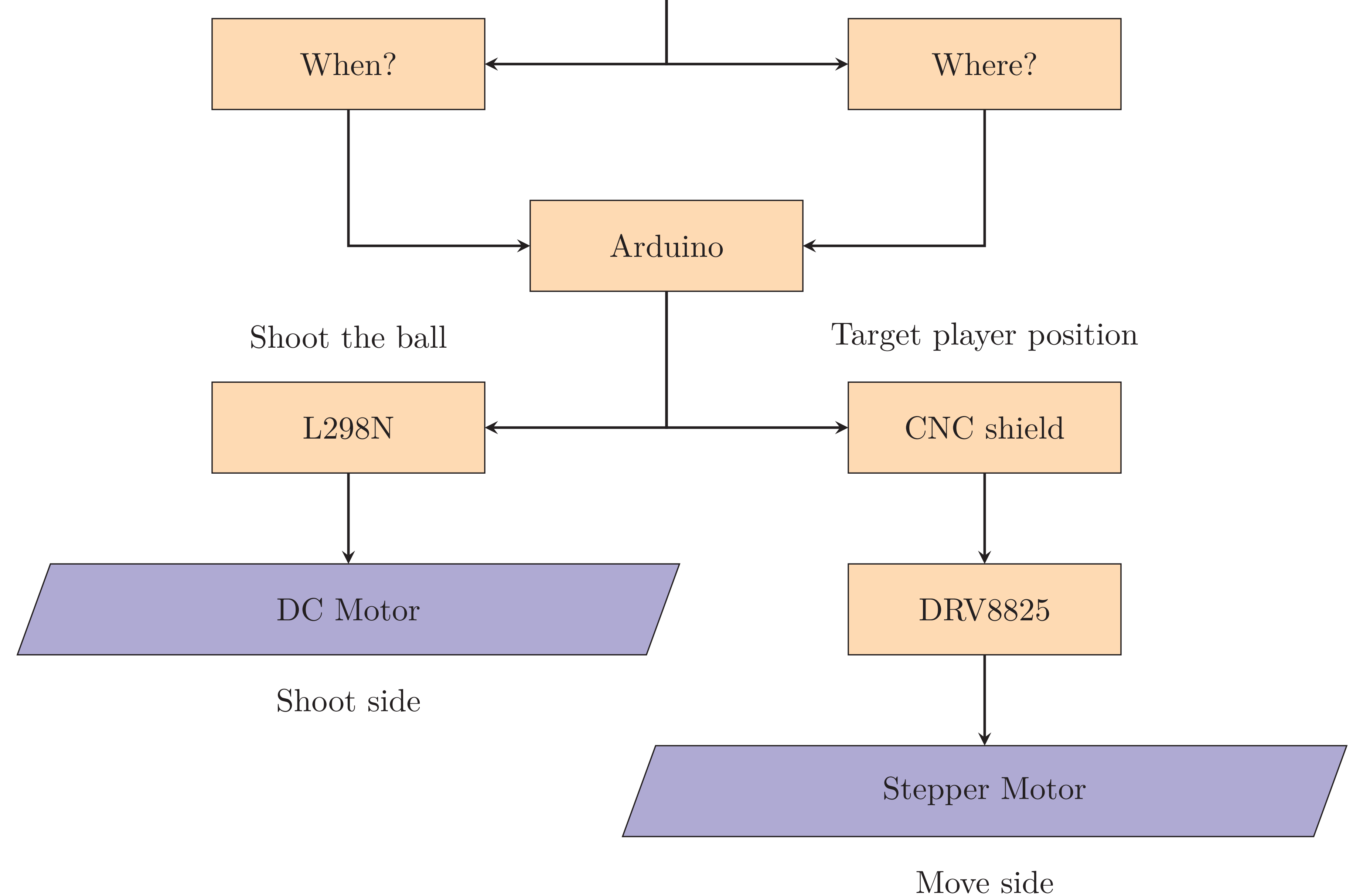
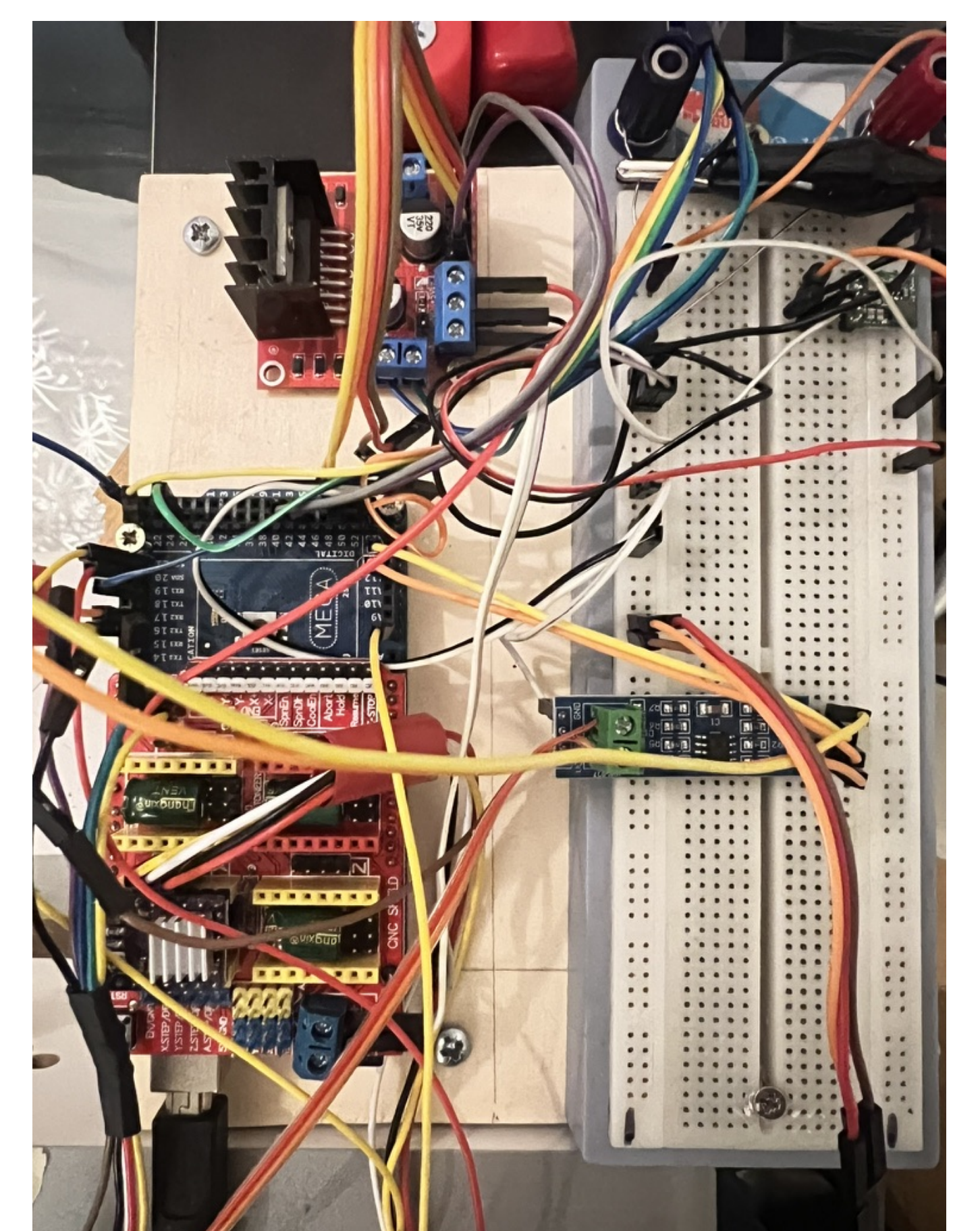
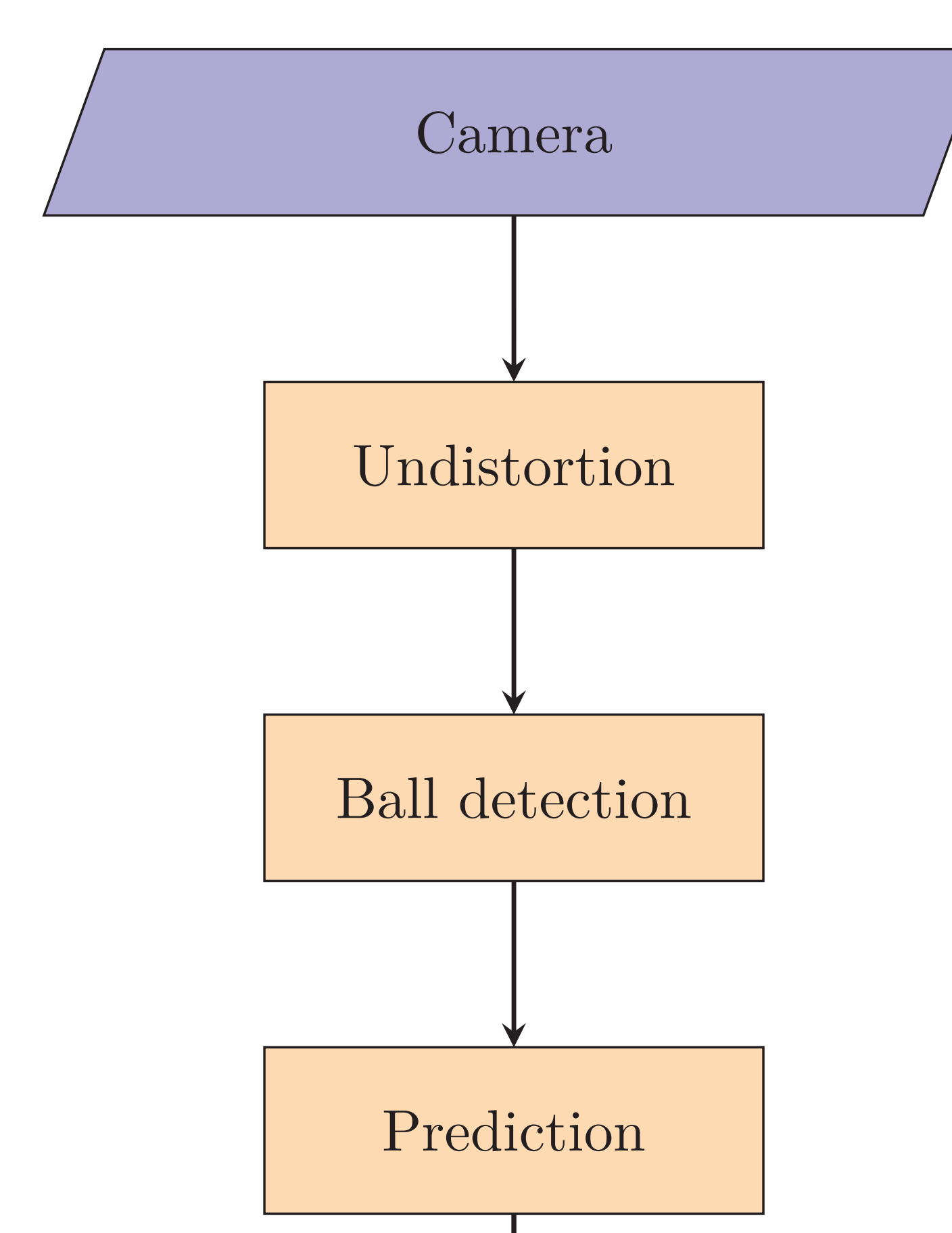
The software detects the ball on the table and predicts the future position and then the electronics give the correct commands to the motors.



Prediction of future ball position

## 5. Functioning of the robot goalkeeper

The flowchart below describes the whole process of the robot detecting detecting and catching a ball. First, the camera records a distorted image of the table. This image is undistorted by the respective algorithm. A prerecorded image is subtracted, in order to find the ball, using a sophisticated algorithm. The future position is predicted by a linear regression model. This position and the arrival time are sent to the arduino. The arduino moves the goalkeeper to the predicted ball position and shoots at the correct time.



Flowchart for the foosball robot

## 6. Results

This project successfully demonstrates the proof of concept for a foosball goalkeeper robot. Slow balls are stopped reliably. Fast balls sometimes still cause accuracy problems. Unfortunately, the goalkeeper is not capable of shooting the ball back everytime.

## 7. QR Code

Further Photos and videos can be found here:

