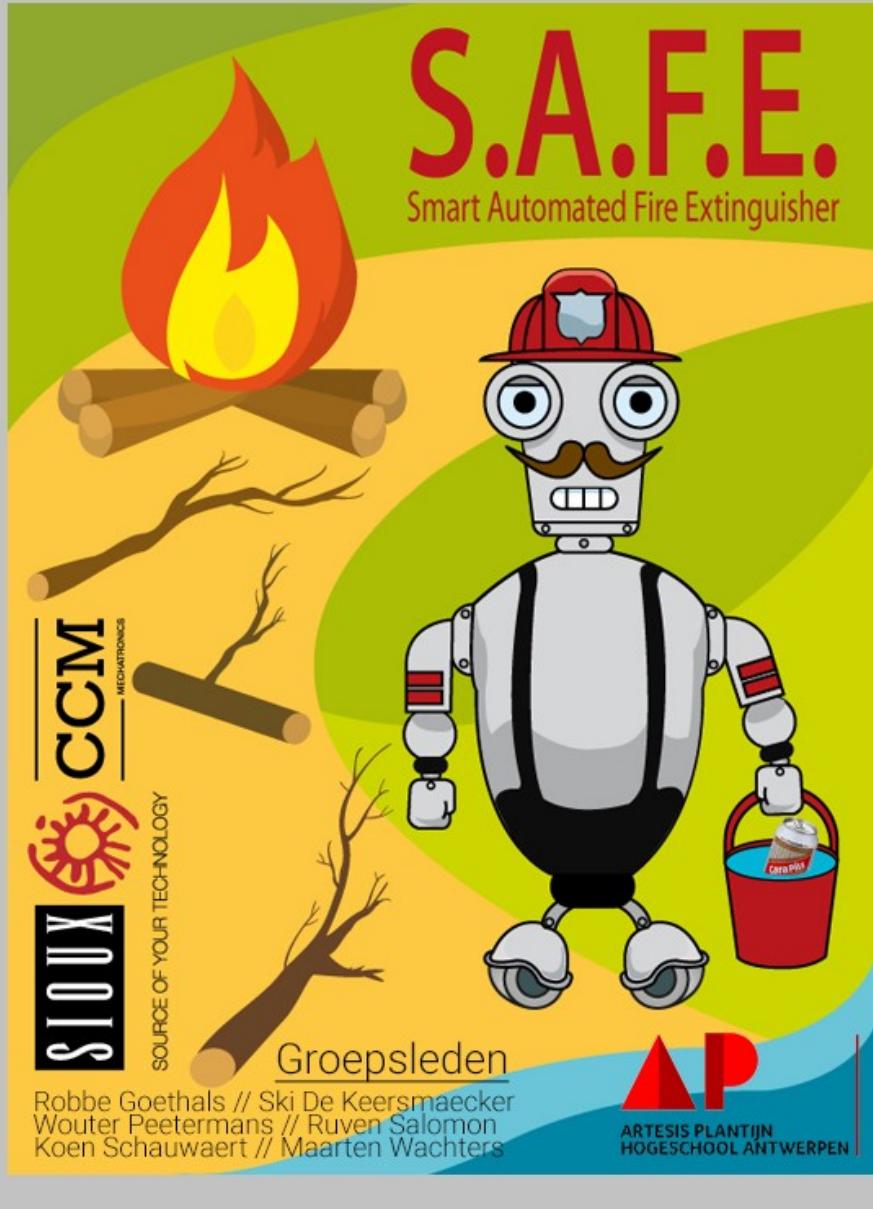


**Artesis Plantijn  
Poembak Delco**



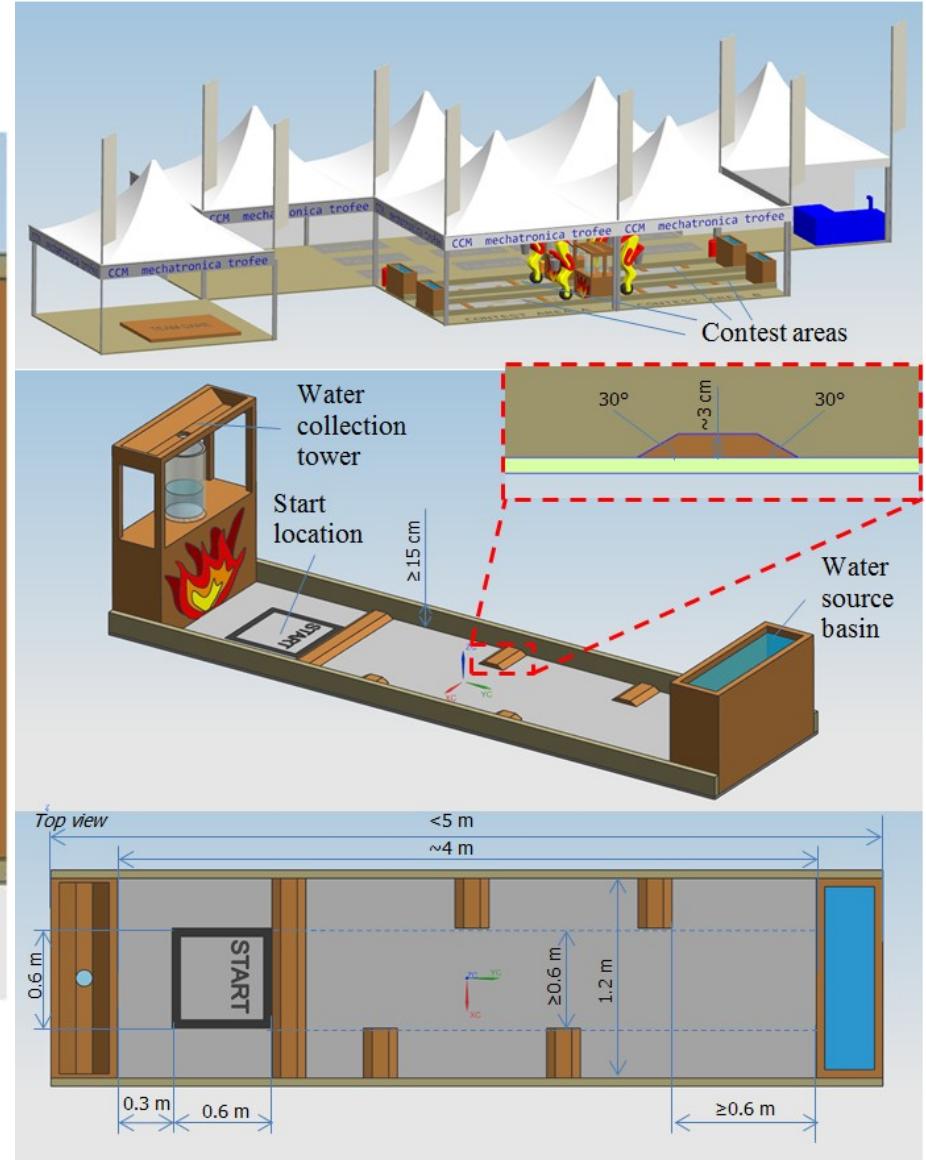
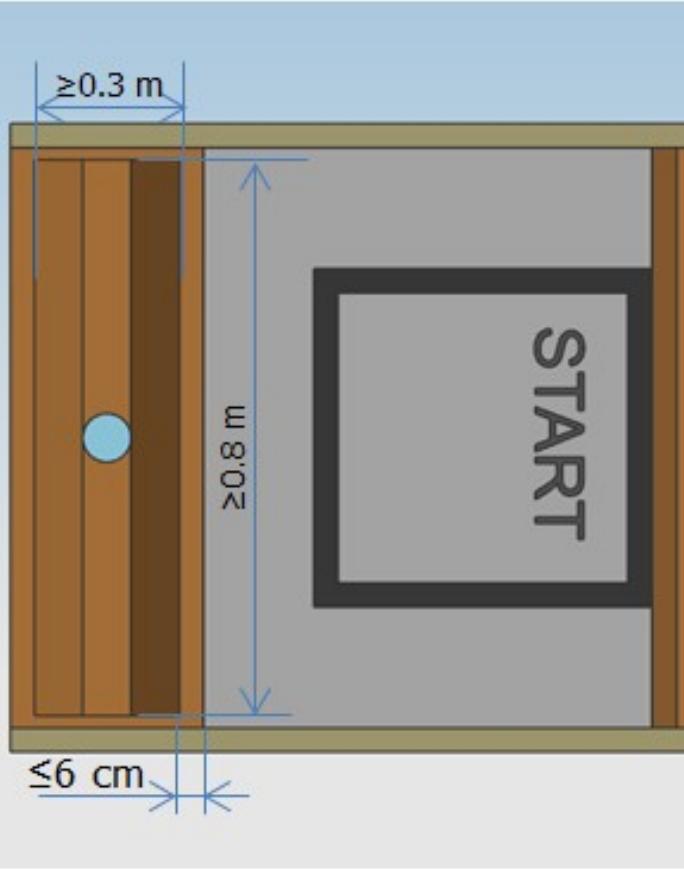
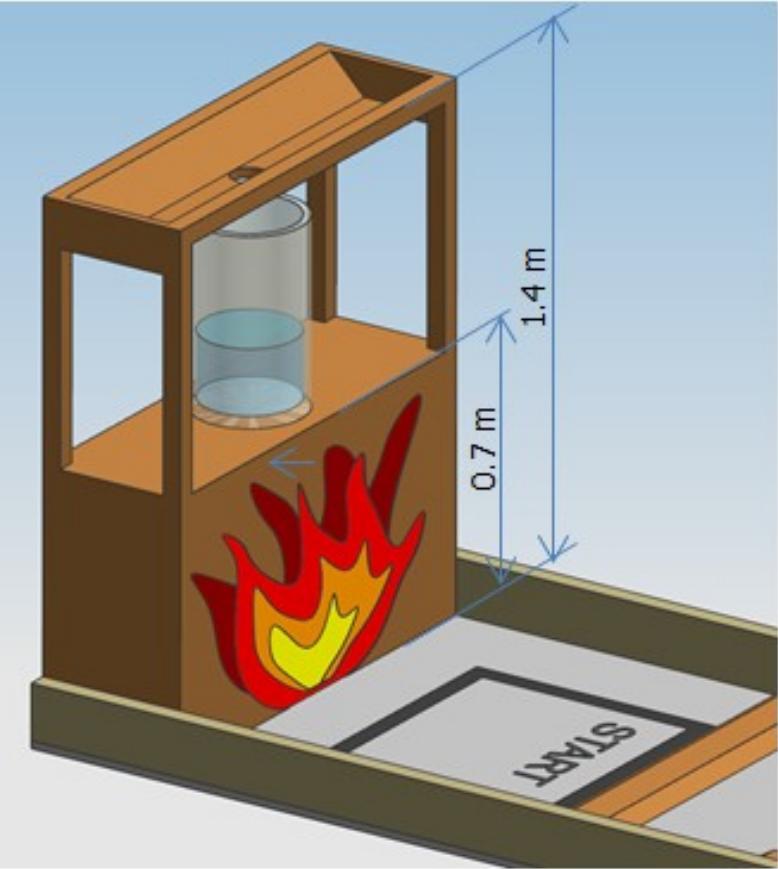
# Opdracht

# POEMBAK DELCO



- Overzetten van water
- Autonomous design
- Open bucket
- 10L in 5 minuten

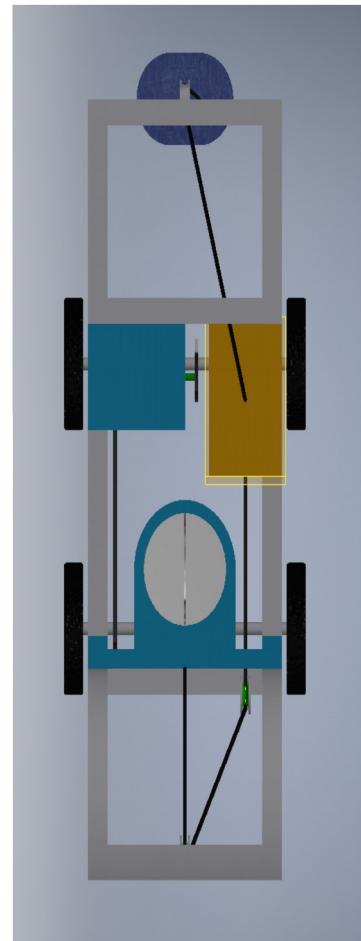
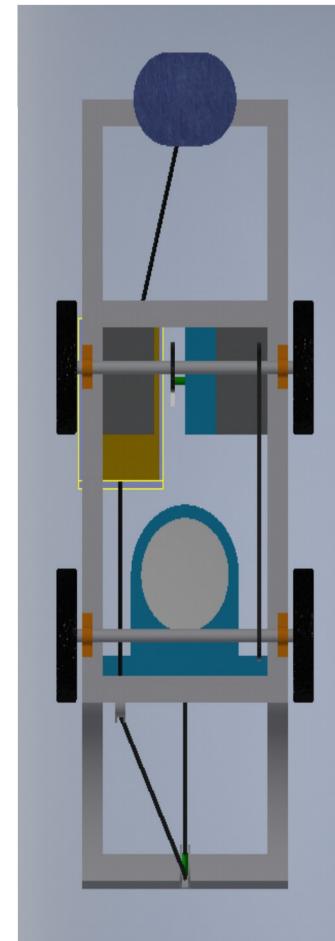
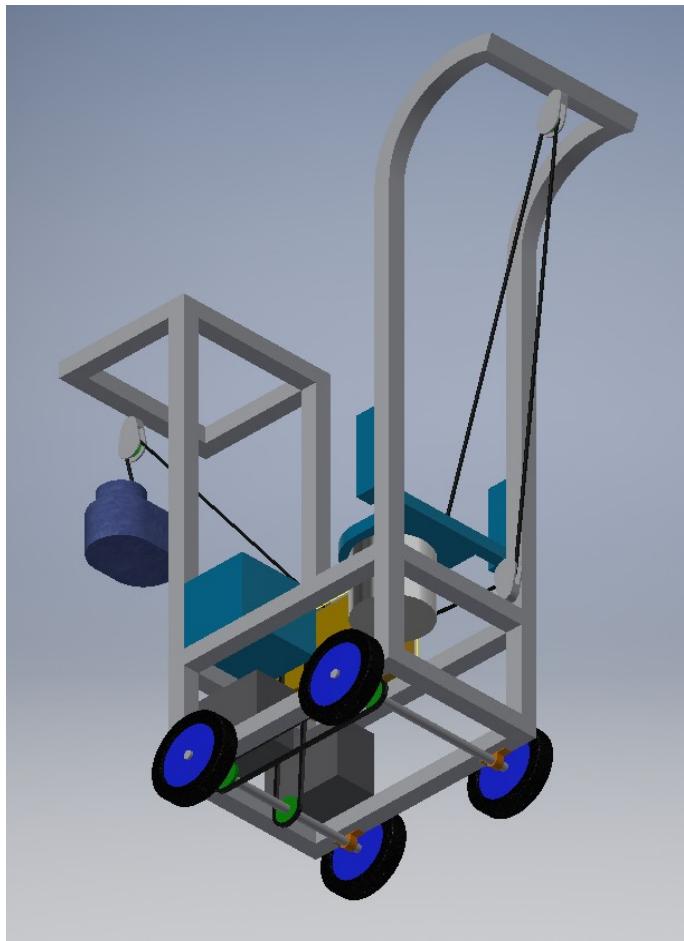
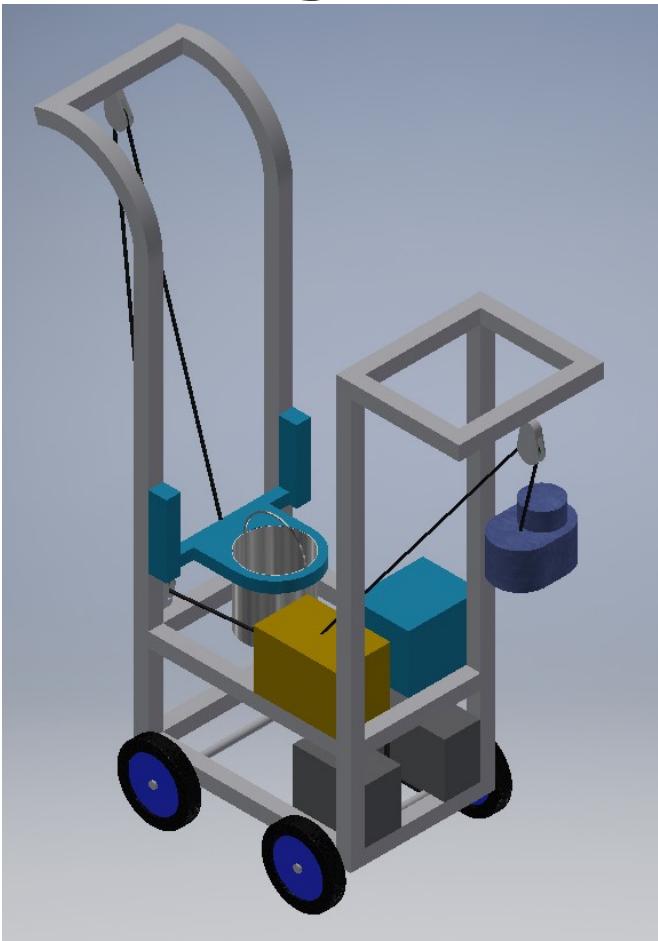
# Opdracht



# Eindresultaat



# Designs



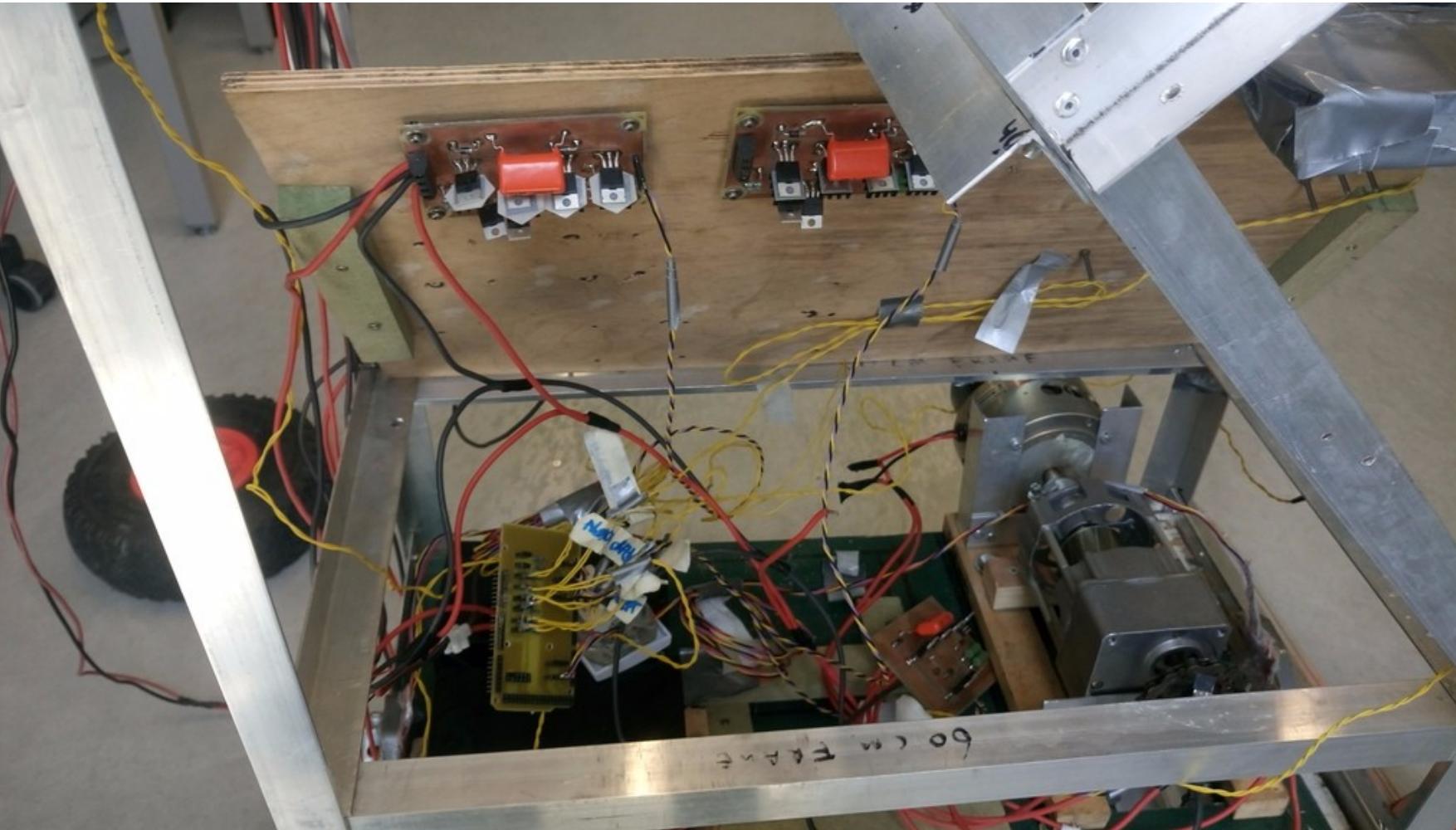
# Inhoud

- Elektronica
- Mechanica
- Programmatie
- Onderdelen
- Prijslijst
- Wedstrijdverloop
- Documentatie
- Analyse volgend jaar

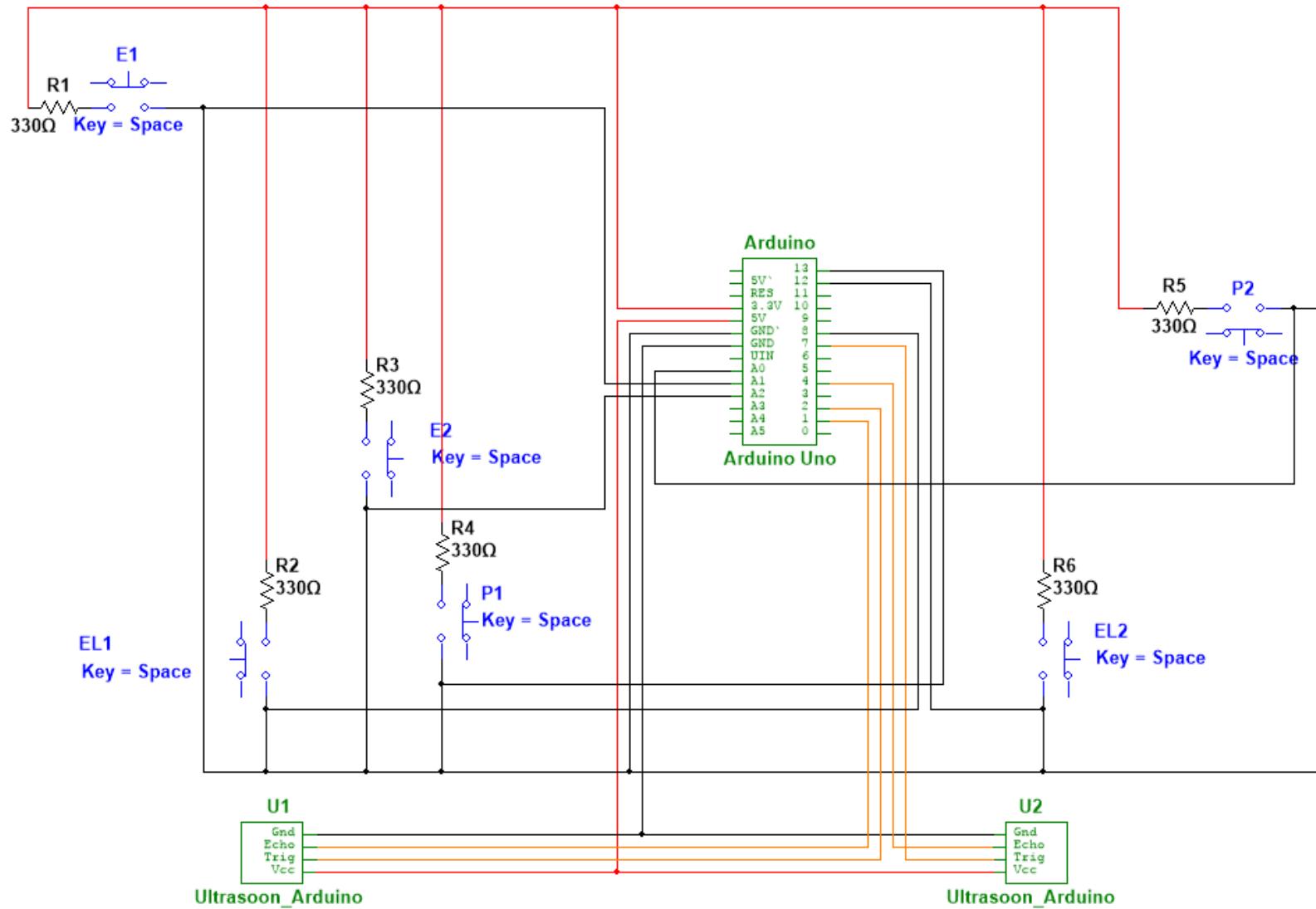
# Elektronica

- Elektrisch schema
- Motorcontroller
- Arduino Shield

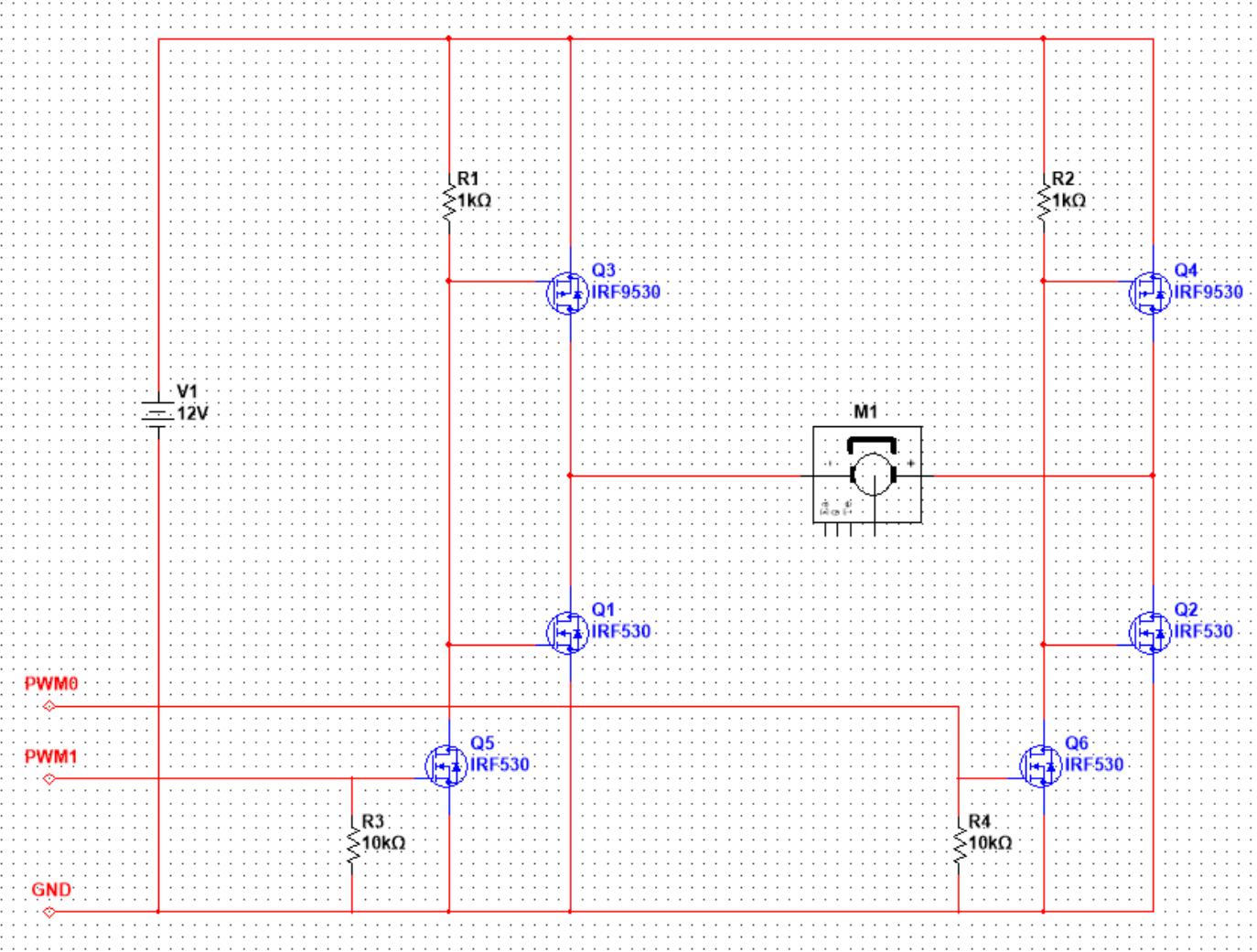
# Elektronica



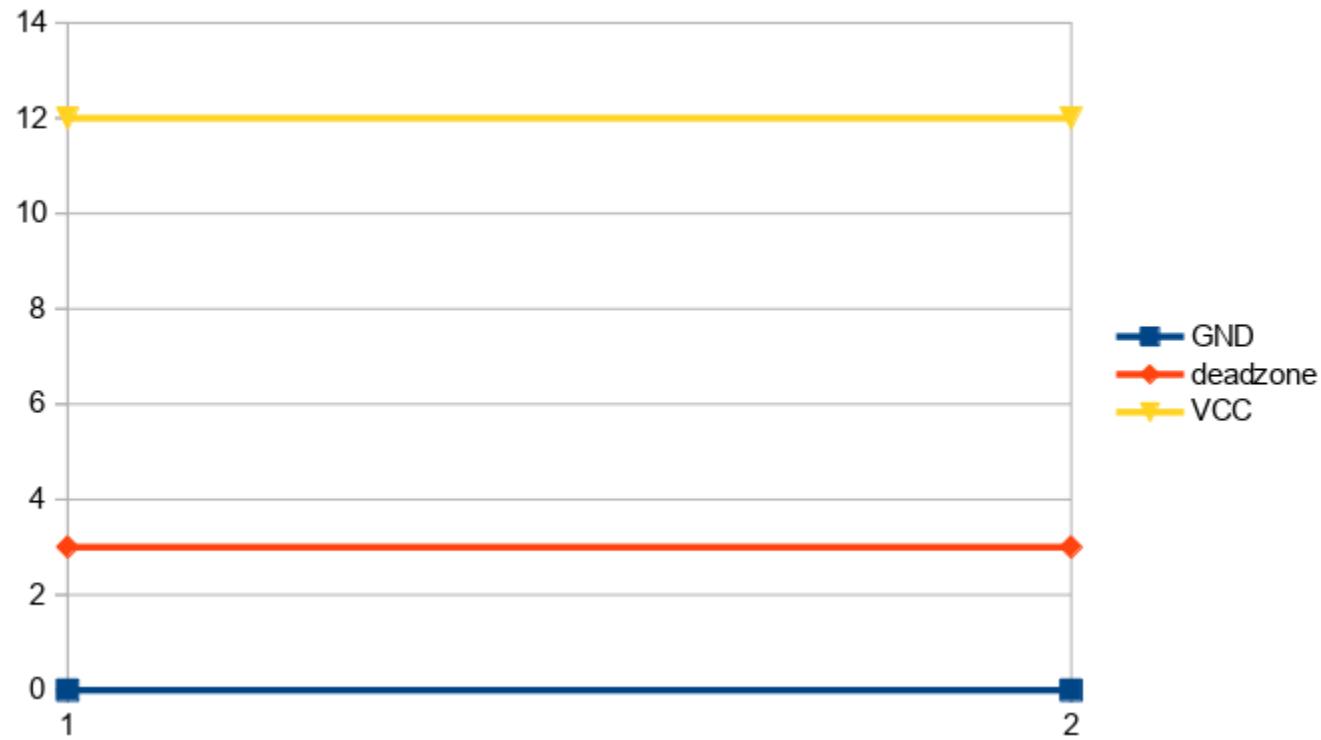
# Elektrisch schema



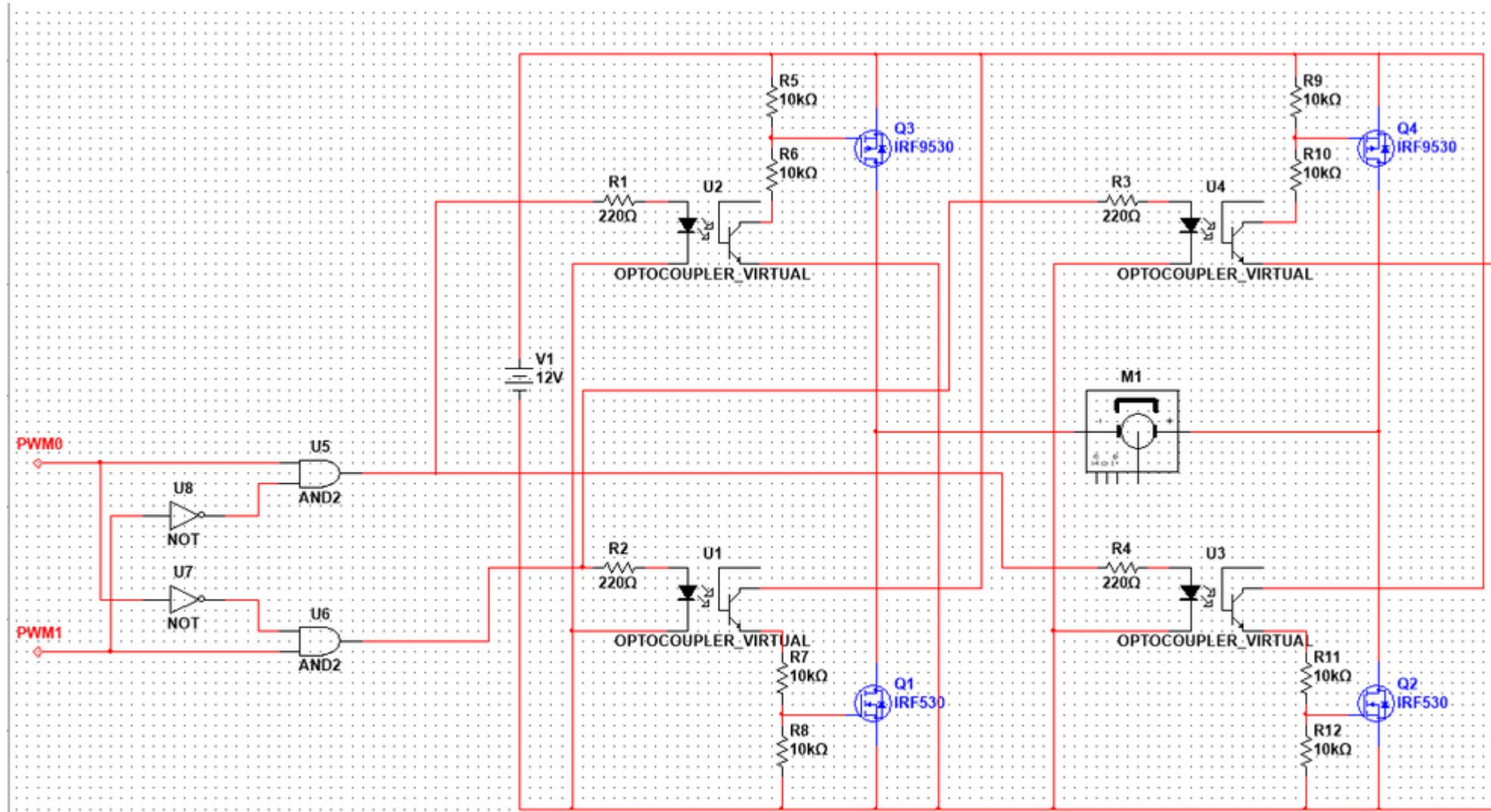
# Motorcontroller



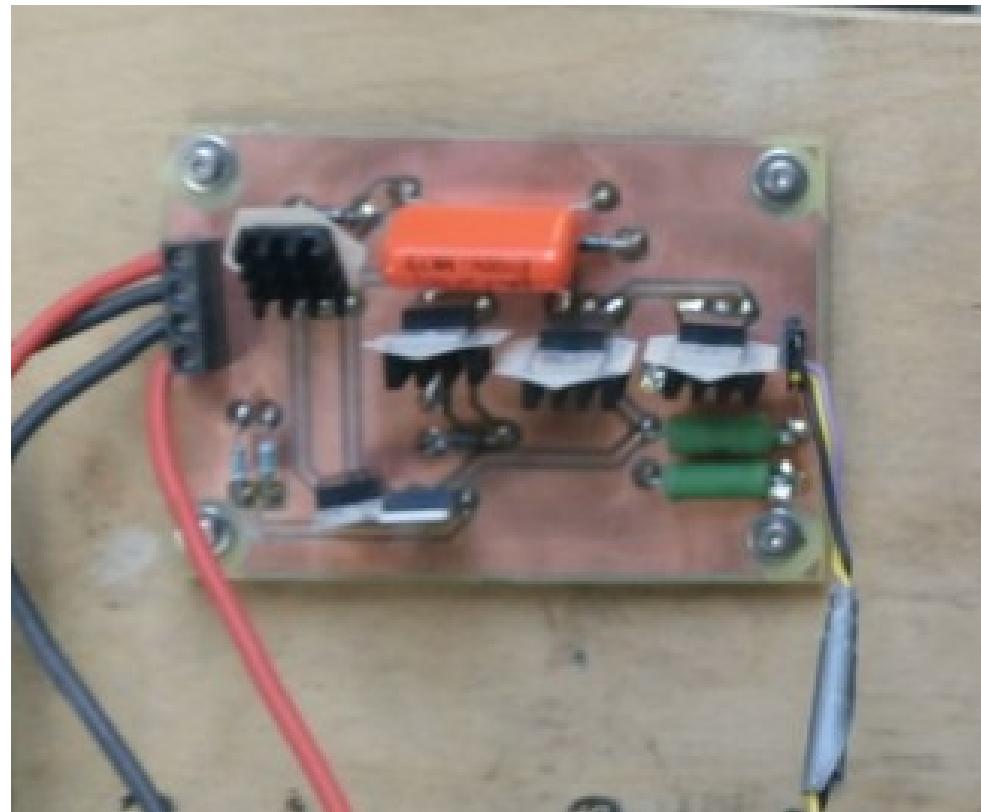
# Motorcontroller



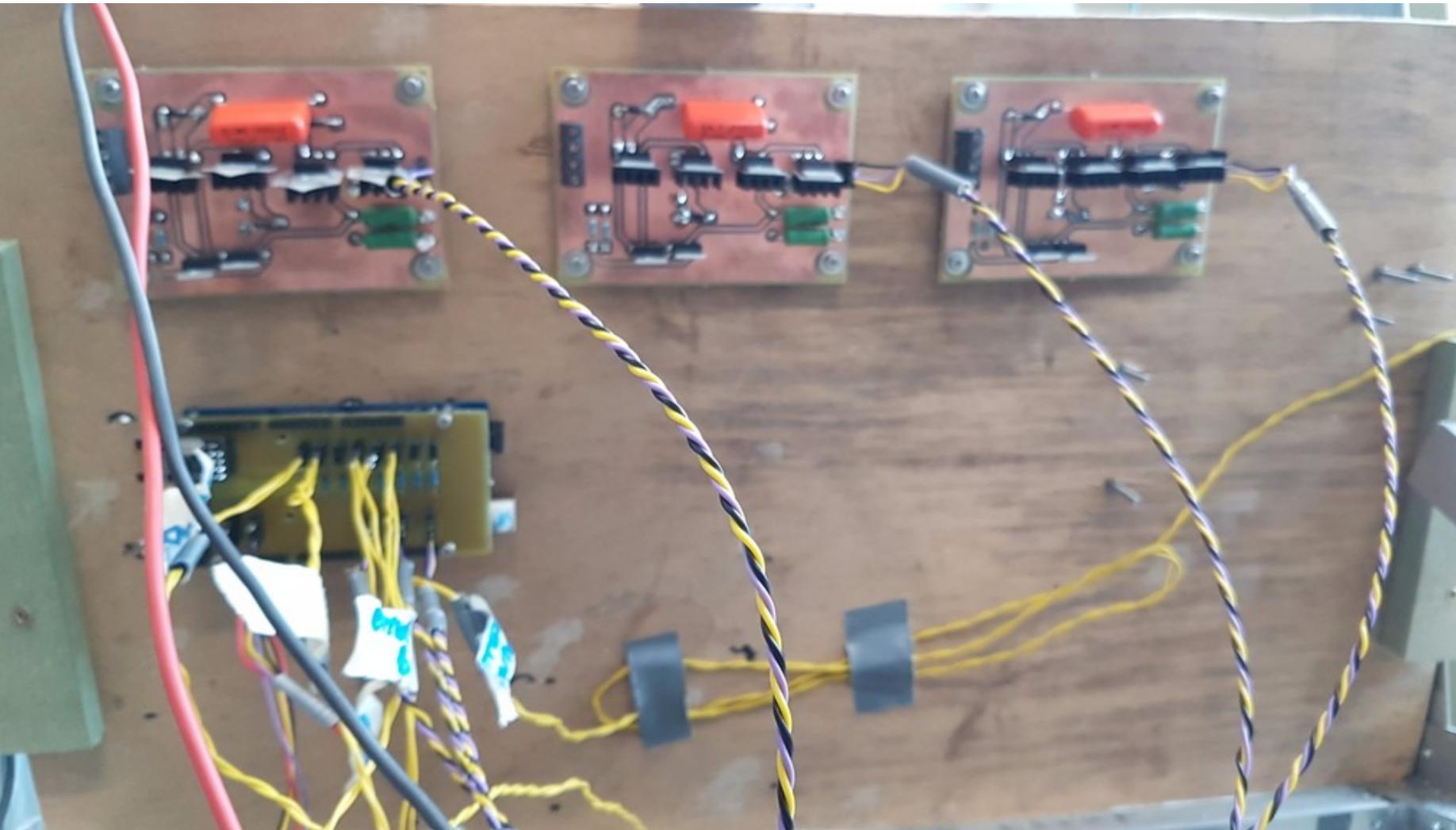
# Motorcontroller - verbeterd



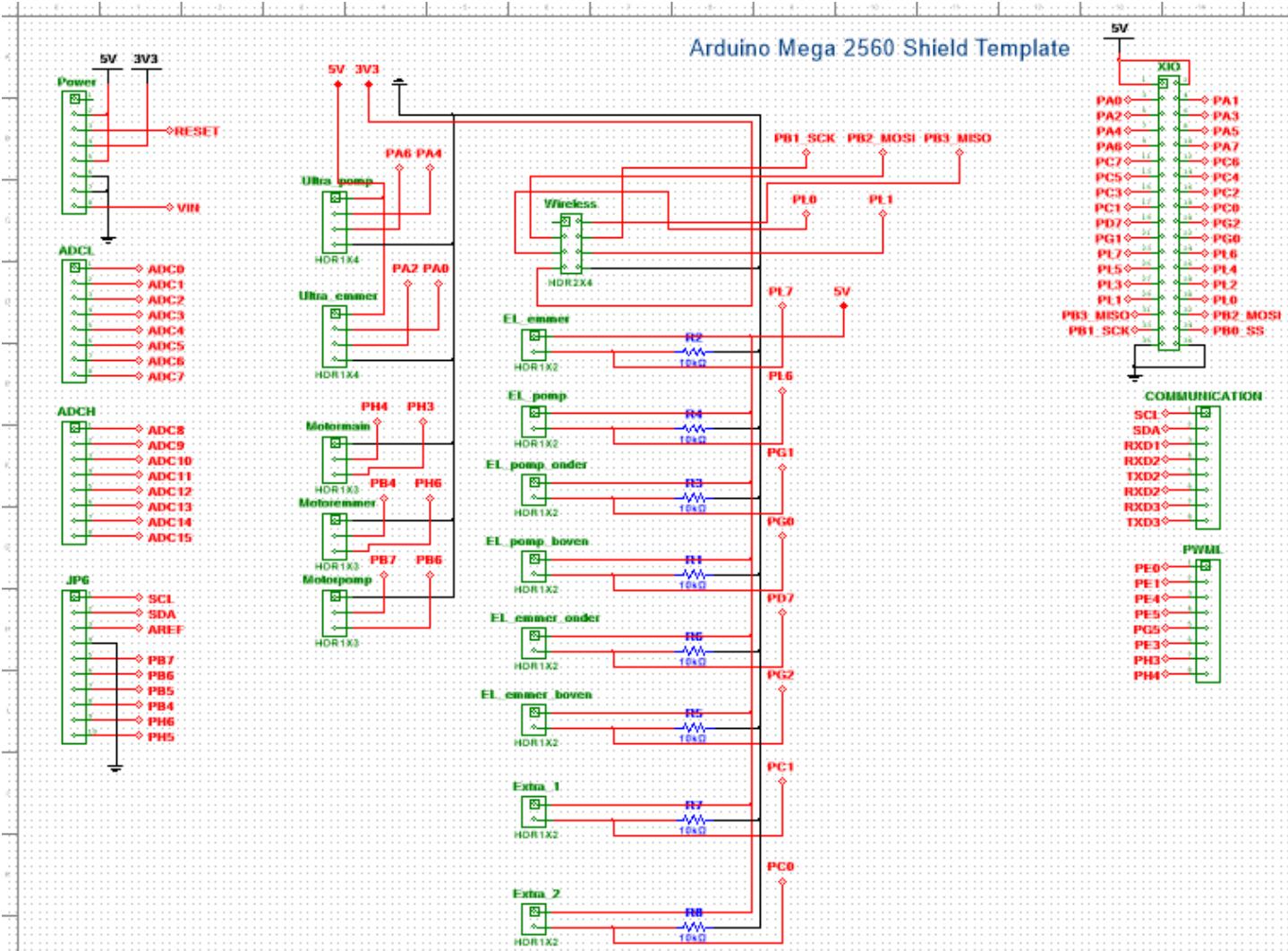
# Motorcontroller



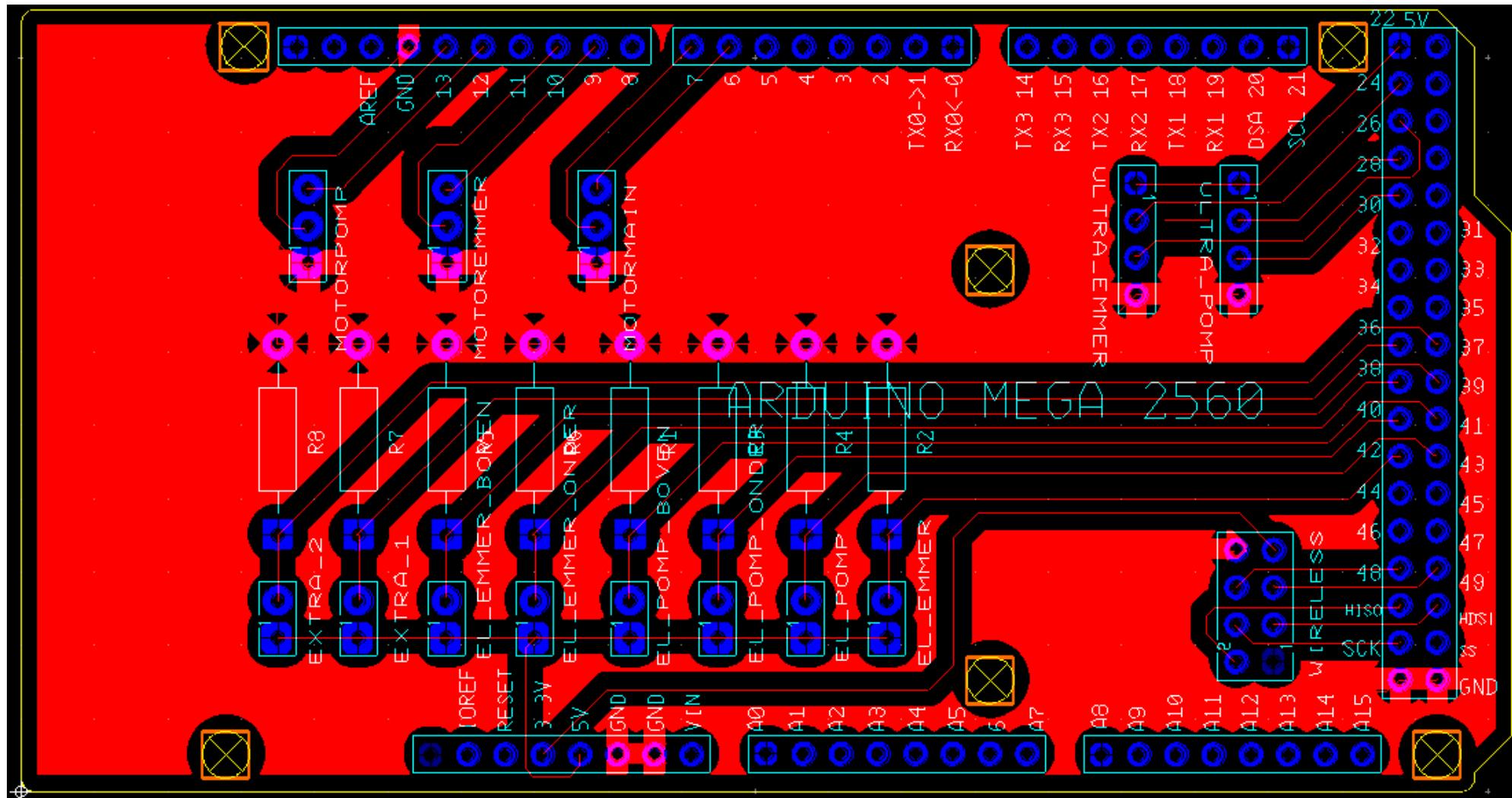
# Motorcontroller



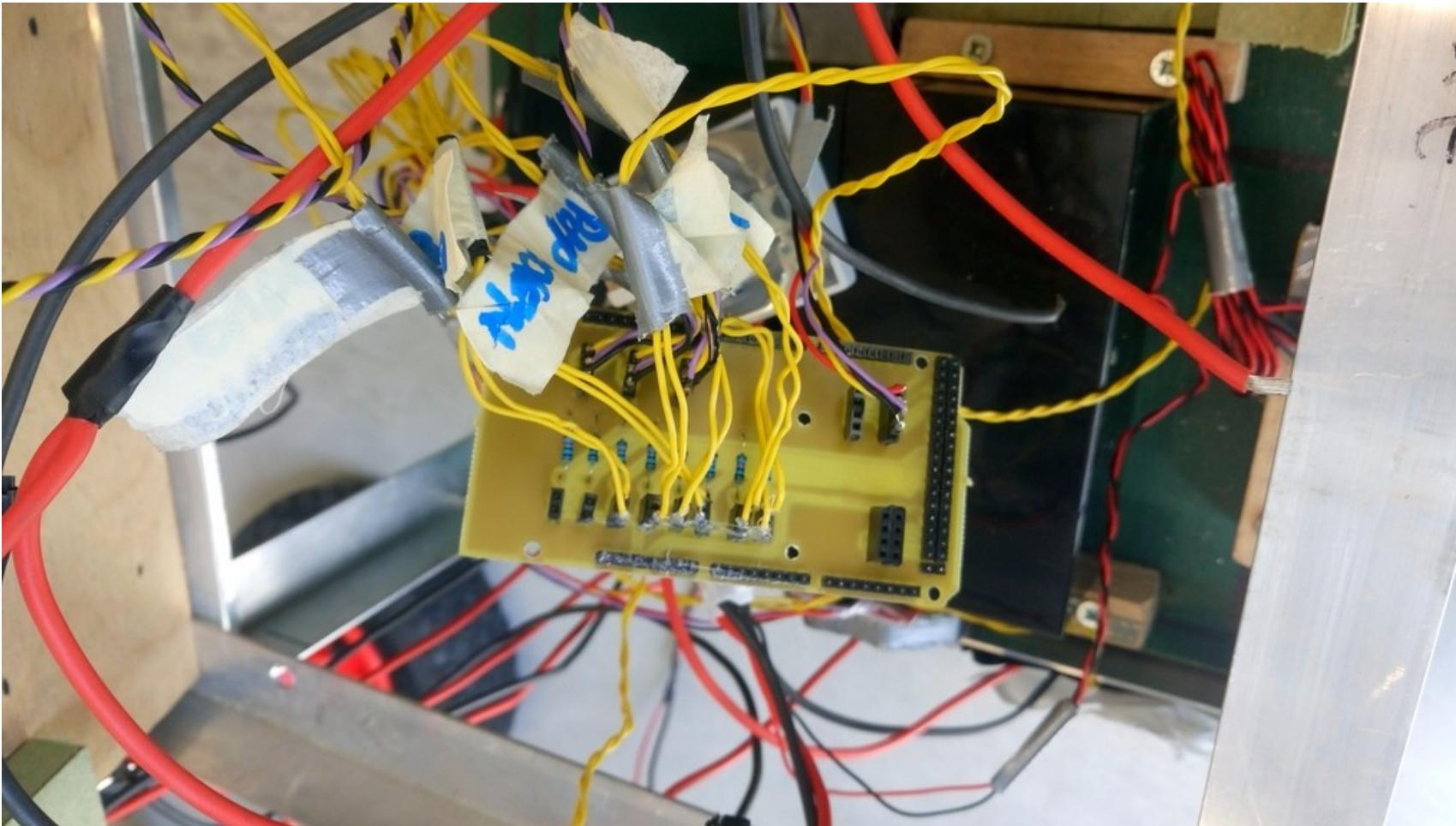
# Arduino Shield



# Arduino Shield



# Arduino Shield



# Mechanica

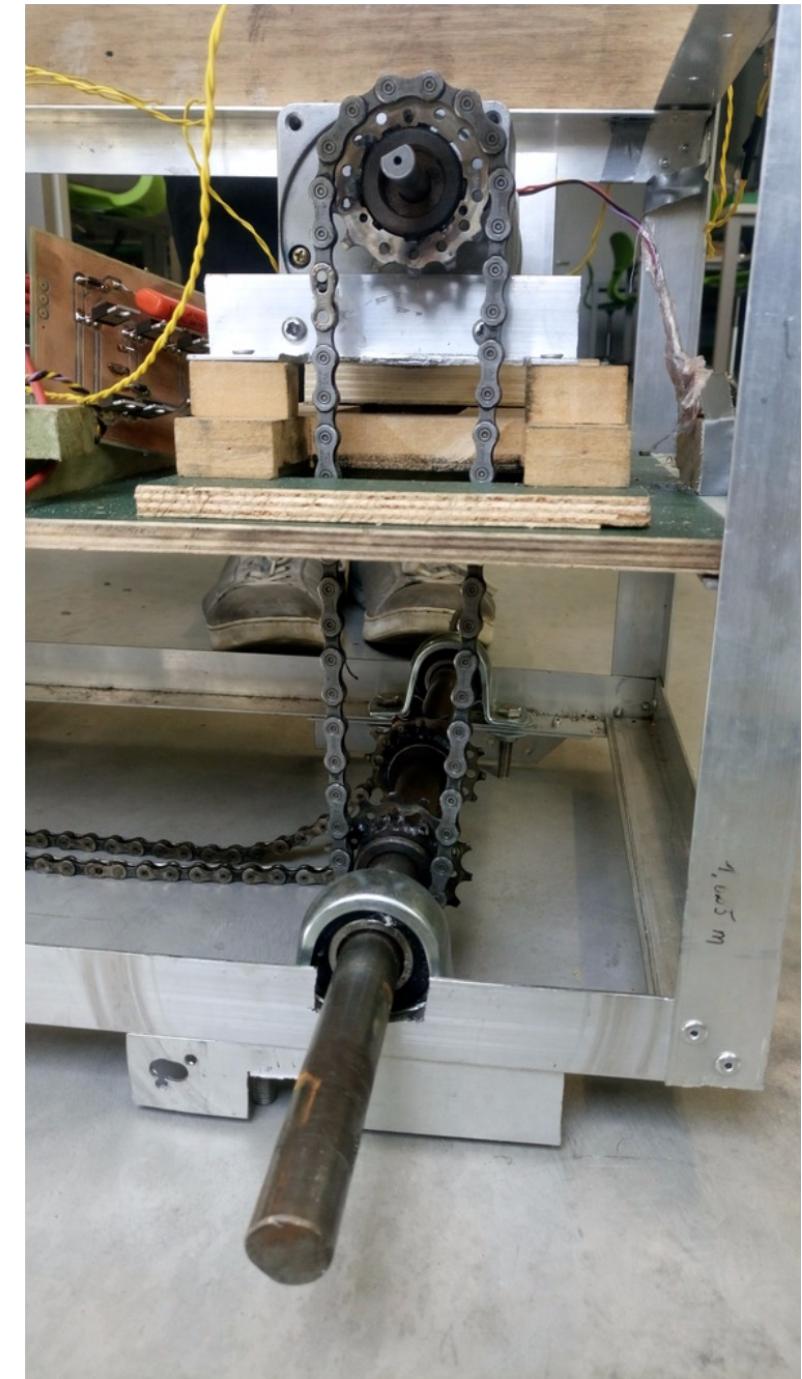
- Geheel
- Onderstel
- Pomp
- Emmer

# Geheel



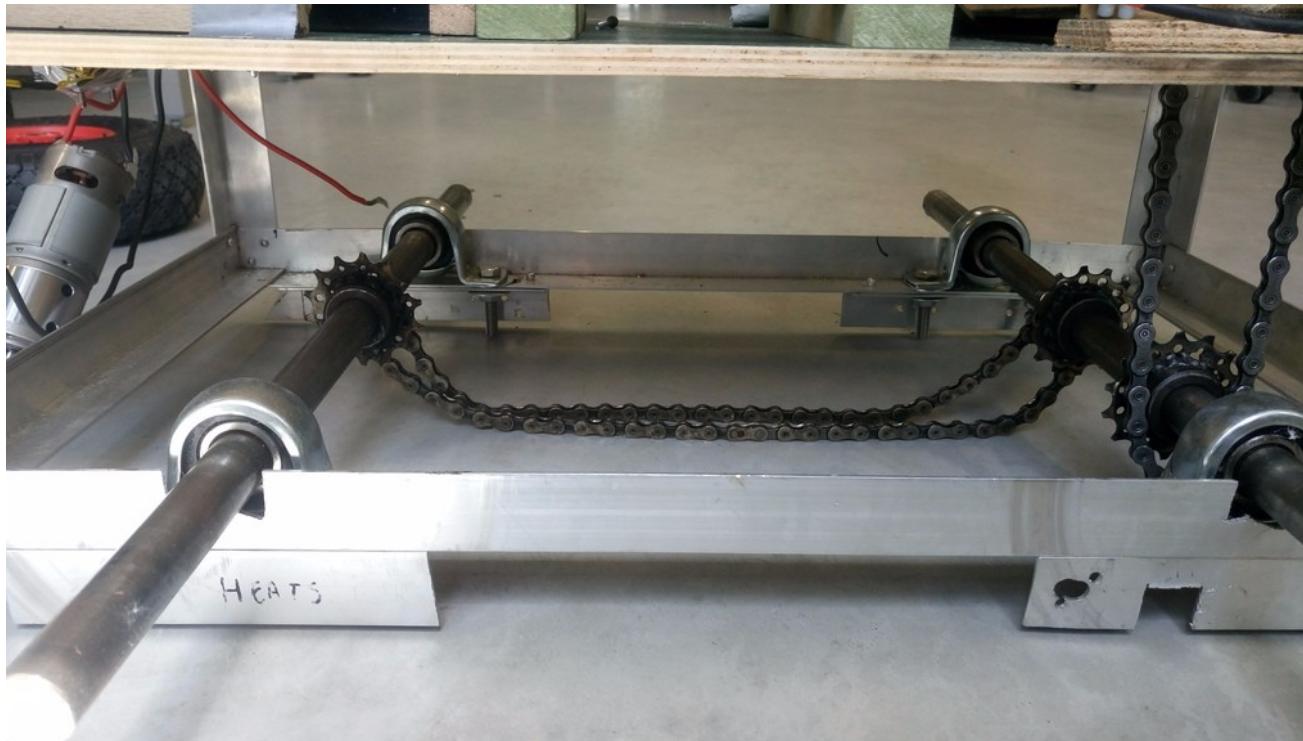
# Onderstel

- Aangedreven door motor



# Onderstel

- Aangedreven door motor
- 4x4



# Onderstel

- Aangedreven door motor
- 4x4
- Banden



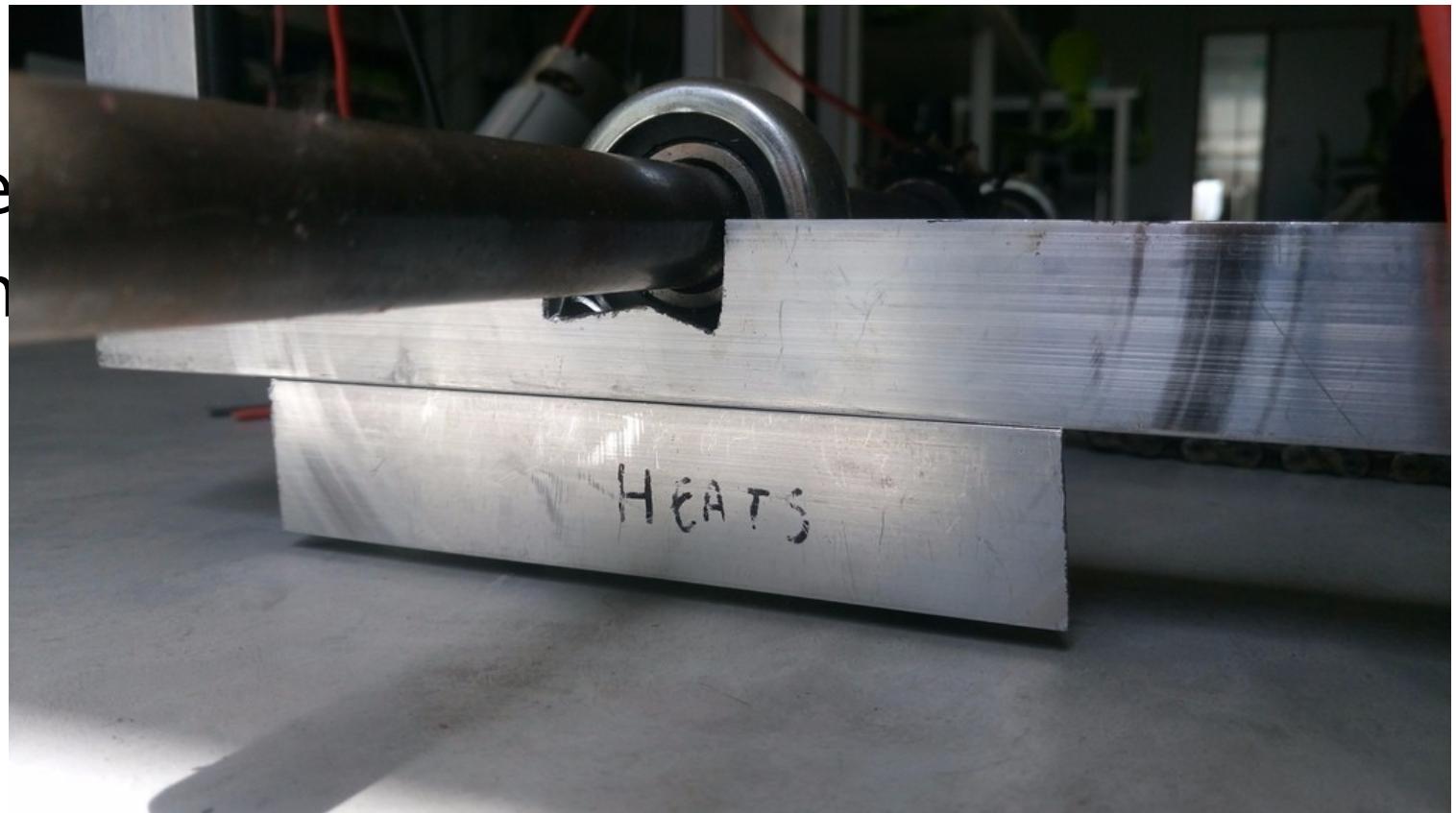
# Onderstel

- Aangedreven door motor
- 4x4
- Banden
- Bevestiging assen



# Onderstel

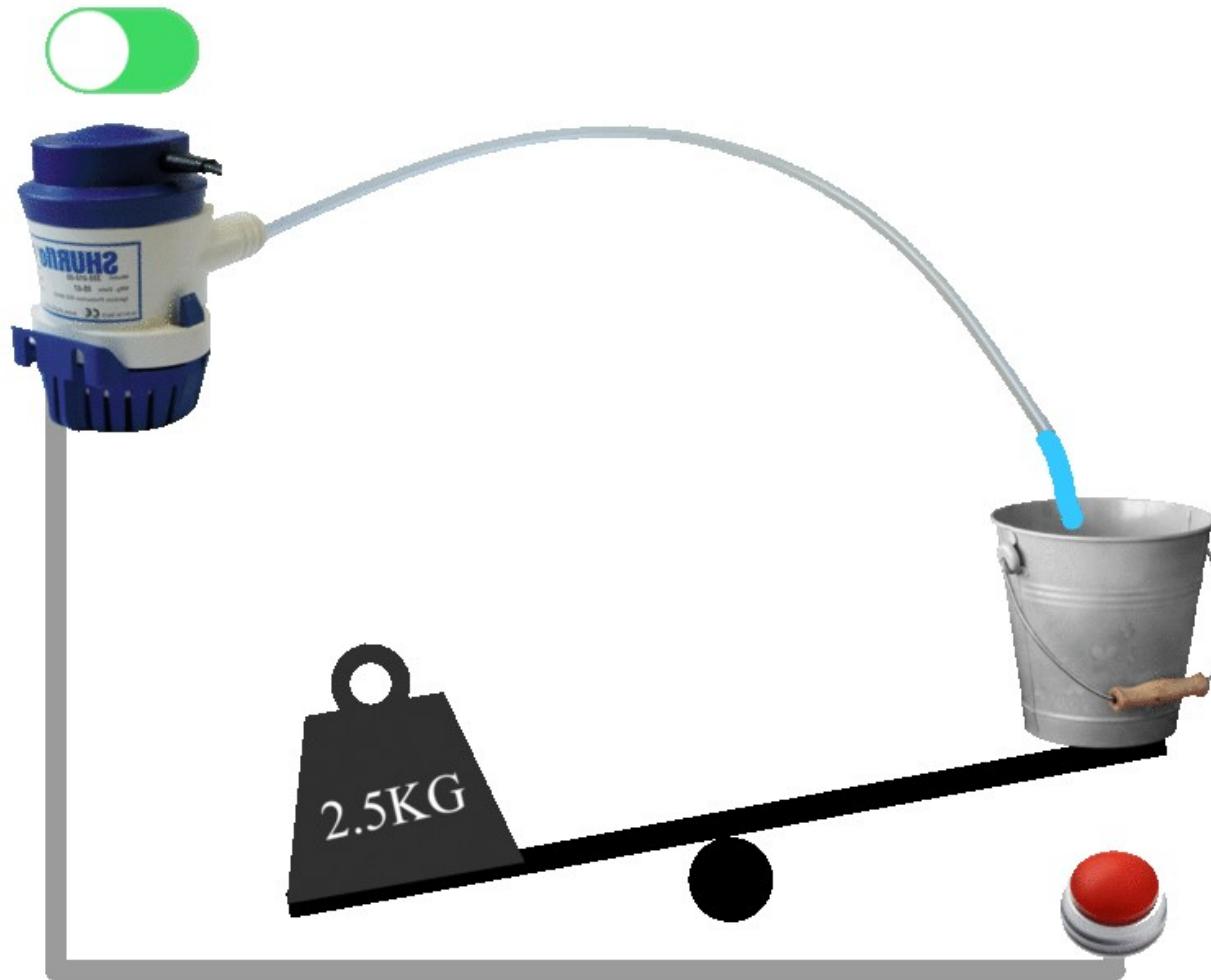
- Aangedreven door motor
- 4x4
- Banden
- Bevestiging assen
- Versteviging frame



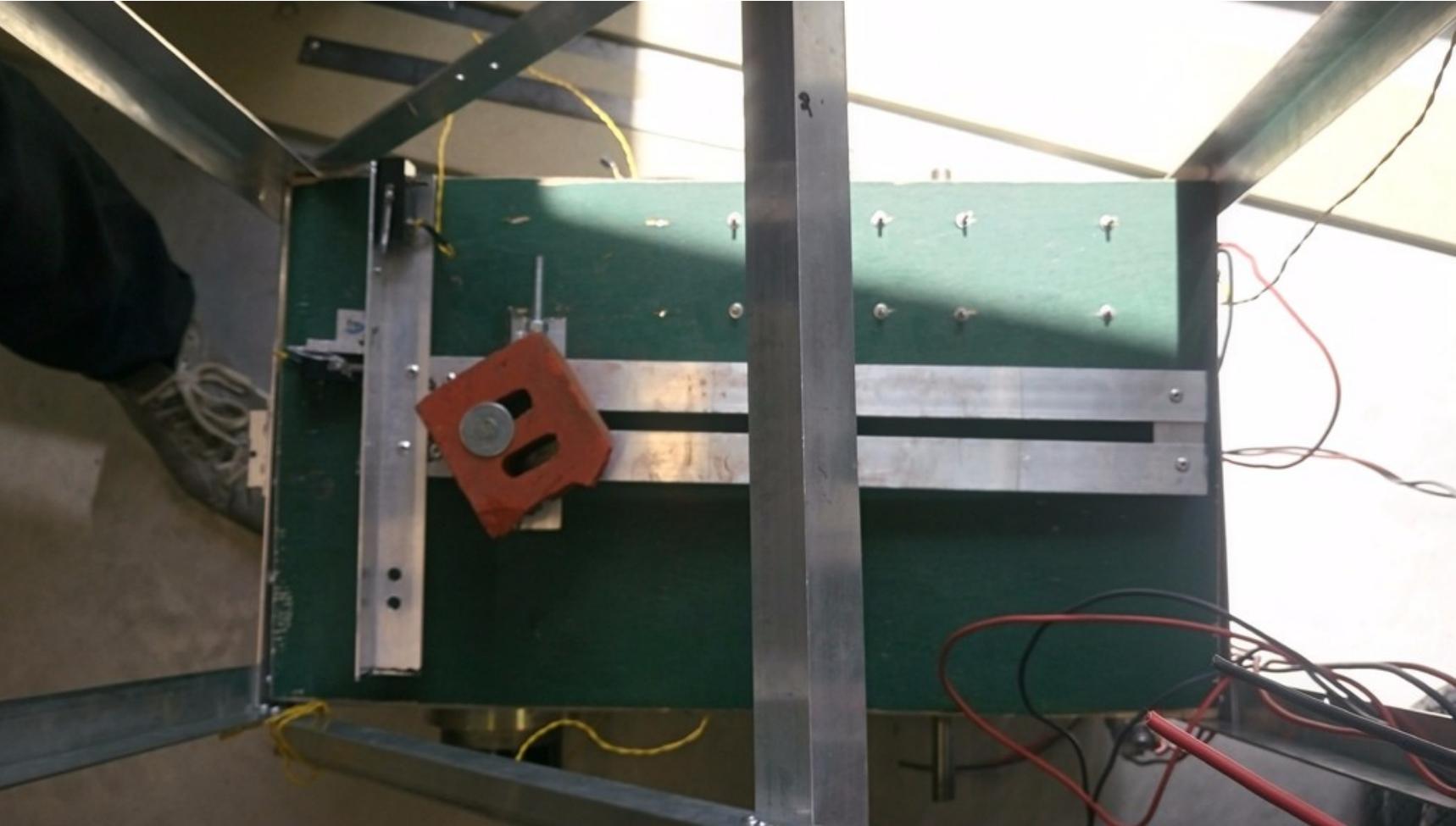
# Onderstel



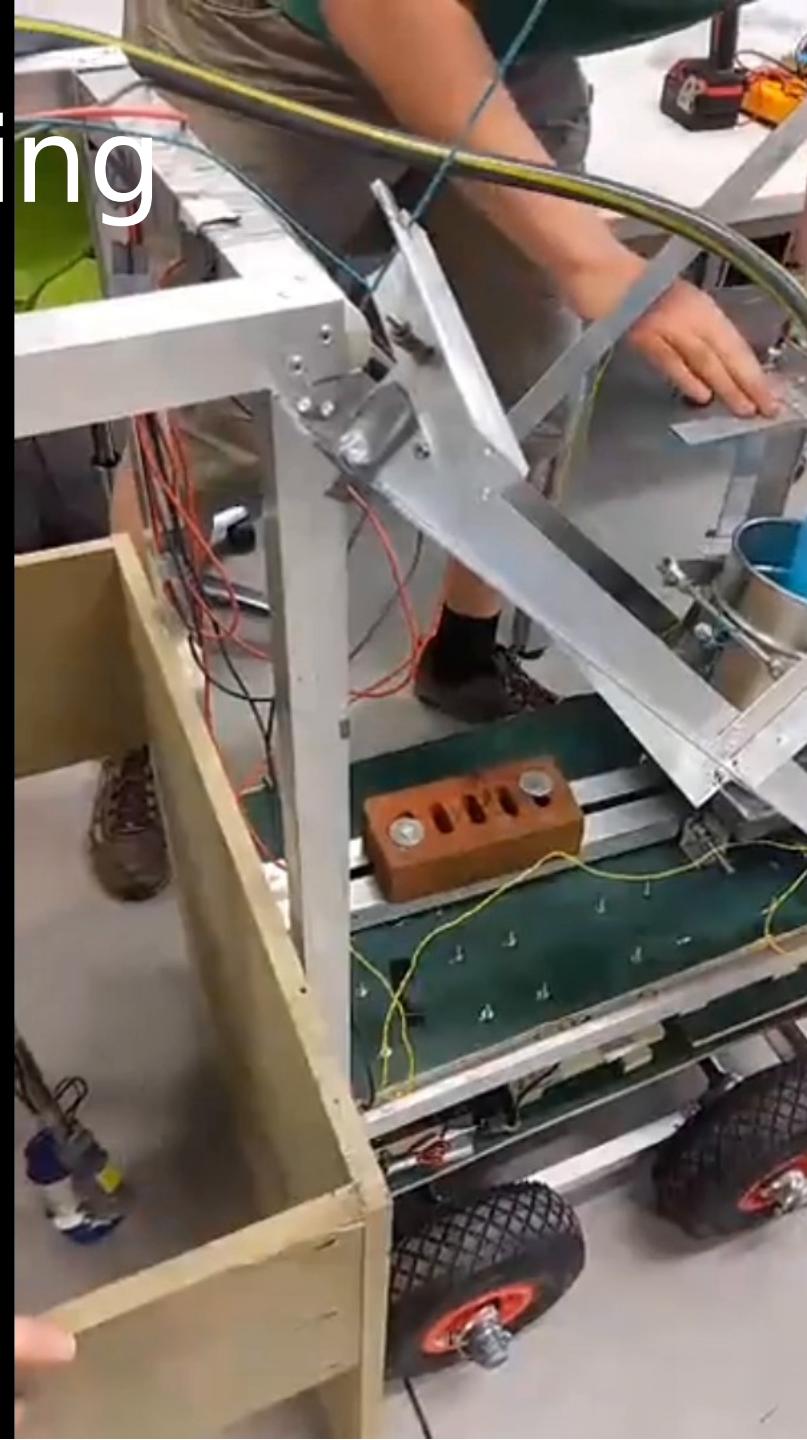
Pomi



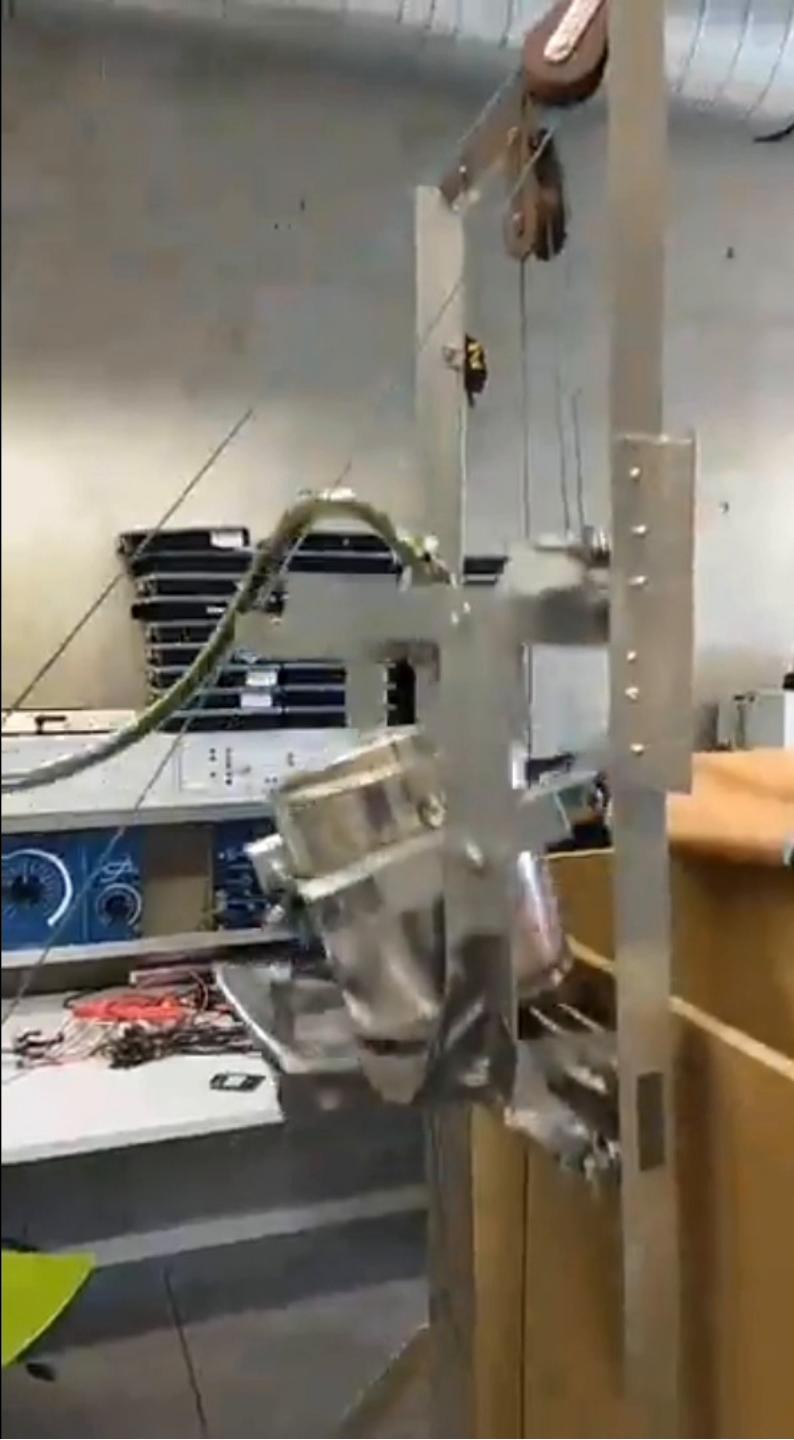
# Pomp - wipsysteem



# Pomp - werking



# Emmer



# Programmatie

## Project structuur van de code

```
main master > tree
.
├── comm.cpp
├── comm.h
├── debug.cpp
├── debug.h
├── expoavrg.cpp
├── expoavrg.h
├── main.h
├── main.ino
├── motor.cpp
├── motor.h
├── parser.cpp
├── parser.h
├── pin.h
├── sensors.cpp
├── sensors.h
└── src
    ├── driving.cpp
    ├── driving.h
    ├── loweringbucket.cpp
    ├── loweringbucket.h
    ├── loweringpump.cpp
    ├── loweringpump.h
    ├── raisingbucket.cpp
    ├── raisingbucket.h
    ├── raisingpump.cpp
    └── raisingpump.h
    └── states.h

1 directory, 26 files
```

# Programmatie

## Pinnen

```
1 #ifndef PINS_H
2 #define PINS_H
3
4 #define SCK_PIN 52
5 #define MOSI_PIN 51
6 #define MISO_PIN 50
7 #define CE_PIN 48
8 #define CSN_PIN 49
9
10 #define POMP_ULTRA_ECHO_PIN 28
11 #define POMP_ULTRA_TRIGGER_PIN 26
12 #define EMMER_ULTRA_ECHO_PIN 24
13 #define EMMER_ULTRA_TRIGGER_PIN 22
14
15 #define POMP_MOTOR_BACKWARDS_PIN 13
16 #define POMP_MOTOR_FORWARDS_PIN 12
17 #define EMMER_MOTOR_BACKWARDS_PIN 10
18 #define EMMER_MOTOR_FORWARDS_PIN 9
19 #define MAIN_MOTOR_BACKWARDS_PIN 7
20 #define MAIN_MOTOR_FORWARDS_PIN 6
21
22 #define EMMER_ONDER_PIN 38
23 #define EMMER_BOVEN_PIN 39
24 #define POMP_ONDER_PIN 40
25 #define POMP_BOVEN_PIN 41
26 #define EMMER_ZIJDE_PIN 42
27 #define POMP_ZIJDE_PIN 43
28
29#endif
```

# Programmatie

## Communicatie

✉ Gemakkelijk  
communicatie protocol

```
void startComm();
bool send(const void*, uint8_t);
bool read(void*, uint8_t);
```

```
//GETEST
bool send(const void *msg, uint8_t size){
    rf.stopListening();
    bool success = rf.write(msg, size);
    rf.startListening();

    return success;
}

//GETEST
bool read(void *buffer, uint8_t size) {
    if (rf.available()) {
        rf.read(buffer, size);
        return true;
    }

    return false;
}
```

# Programmatie

## Communicatie pakketten

```
#define DEBUG_MOTOR 0x01
#define DEBUG_DISTANCE 0x02
#define DEBUG_STATE 0x04
#define DEBUG_SENSORS 0x08
#define DEBUG_START 0x10
#define DEBUG_END 0x20

void setDebugMask(int);
void debug();

typedef struct {
    uint8_t id;
    int speed;
    unsigned int power;
} Motor_Info;

typedef struct {
    double emmerDistance;
    double pompDistance;
} Distance_Info;

typedef struct {
    State state;
} State_Info;

typedef struct {
    int sensorMask;
} Sensors_Info;

typedef union {
    Motor_Info motorInfo;
    Distance_Info distanceInfo;
    State_Info stateInfo;
    Sensors_Info sensorsInfo;
} Debug_Body;

typedef struct {
    uint8_t type;
    Debug_Body body;
} Debug_Message;
```

# Programmatie

## Debugging

```
//GETEST
void debug(){
    static long startTime = millis();
    static int pause = 500;
    static long currentTime = 0;

    currentTime = millis();

    if(currentTime - startTime <= pause){
        return;
    }

    startTime = currentTime;

    if(debugMask){
        sendStartMessage();
    }
}

if(debugMask & DEBUG_MOTOR){
    sendMotorInfo();
}

if(debugMask & DEBUG_DISTANCE){
    sendDistanceInfo();
}

if(debugMask & DEBUG_STATE){
    sendStateInfo();
}

if(debugMask & DEBUG_SENSORS){
    sendSensorsInfo();
}

if(debugMask){
    sendStopMessage();
}
```

# Programmatie

## Loop

```
void loop() {
    inputScan(); //update status of sensors.
    executeProgram(); //update state and perform action
    callHome(); //send debugging information.
    listenHome(); //see if we got instructions.
}

void listenHome() {
    uint8_t buffer[PAYLOAD_SIZE];

    if(read(buffer, PAYLOAD_SIZE)){
        Serial.print("Received: ");
        Serial.println((char*)buffer);
        parse(buffer);
    }
}

void callHome() {
    debug();
}

void inputScan() {
    sensorMask = getSensorMask();
    measureDistances();
}

void executeProgram() {
    updateState();
    stateAction();
}
```

# Programmatie

Sensormask:  
eindeloopschakelaar status  
inlezen

```
int getSensorMask(){
    int mask = 0;

    for(int i = 0; i < NUM_PINS; ++i){
        if(digitalRead(sensorPins[i])){
            mask |= 0x01 << i;
        }
    }

    return mask;
}
```

# Programmatie

Afstandsmetingen:  
exponential moving  
average

```
void measureDistances(){
    static NewPing ultraPSensor(POMP_ULTRA_TRIGGER_PIN, POMP_ULTRA_ECHO_PIN, MAXDISTANCE);
    static NewPing ultraESensor(EMMER_ULTRA_TRIGGER_PIN, EMMER_ULTRA_ECHO_PIN, MAXDISTANCE);

    unsigned int pompDistance = ultraPSensor.ping();
    unsigned int emmerDistance = ultraESensor.ping();

    ultraPAvrg.Update(((double) pompDistance) / 58.2);
    ultraEAvg.Update(((double) emmerDistance) / 58.2);
}
```

# Programmatie

- Functie van staat
- Vb:
  - Lowerpump
  - Timer

```
void lowerPump(){  
    unsigned long currentTime = millis();  
    static unsigned long startTime;  
    static unsigned long duration = 1000;  
  
    if(stopped){  
        startTime = currentTime;  
        stopped = false;  
    }  
  
    if(currentTime - startTime >= duration){  
        pompMotor.SetSpeed(0);  
    }  
    else {  
        pompMotor.SetSpeed(255);  
    }  
}  
  
void stopLowerPump(){  
    pompMotor.SetSpeed(0);  
    stopped = true;  
}
```

# Programmatie

## Drive

```
#include"../sensors.h"
#include"../motor.h"
#include"math.h"

double acceleration(double);

void drive(bool forward){
    static double thresholdDistance = 20; //afstand waarbinnen hij afremt en optrekt.
    double distancePump = ultraPAvrg.value;
    double distanceBucket = ultraEAvg.value;

    if(forward && distancePump <= thresholdDistance){
        mainMotor.SetSpeed(150);
    }
    else if(!forward && distanceBucket <= thresholdDistance) {
        mainMotor.SetSpeed(-150);
    }
    else if (forward){
        mainMotor.SetSpeed(255);
    }
    else {
        mainMotor.SetSpeed(-255);
    }
}

void stopDriving(){
    mainMotor.SetSpeed(0);
}
```

# Programmatie

Getest

```
//GETEST
]void stateAction() {
]    switch (currentState) {
```

# Onderdelen – lijst onderdelen

<b>Winkel</b>	<b>Prijs</b>	<b>Aantal</b>	<b>Totaal (incl. BTW)</b>	<b>Korte omschr.</b>	<b>Product</b>
<b>Conrad</b>					
888119 - 89	1,19	4 €	4,76	M4 zeskant moer 10st Eindeloop	Zeskantmoeren M4 DIN 934 RVS A2 10 stuks TOOLCRAFT 888119
130633 - 89	7,59	1 €	7,59	M4 zeskant schroef 100st 35mm Eindeloop	TOOLCRAFT Zeskantbouten M4 35 mm Buitenzeskant (inbus) DIN 933 Staal galvanisch verzinkt 100 stuks
481598 - 89	3,29	2 €	6,58	Inbusset 8 delig haaks	Brüder Mannesmann Haakse schroevendraaierset Inbus 8-delig
1008392 - 89	6,99	2 €	13,98	Slangklem set van 10	Sanifri 470010476 Slangklem Set van 10
188195 - 89	1,25	24 €	30,00	Heatsink Fischer 14x14x6mm	Koellichaam 29 K/W (l x b x h) 14 x 14 x 6 mm Fischer Elektronik ICK BGA 14 x 14
184061 - 89	10,97	2 €	21,94	Thermall Conductive Tape 25st	3M Thermally Conductive Adhesive Tape 8940 Warmtegeleidend pad Zelfklevend 0.19 mm 0.9 W/mK (l x b) 23 mm x 19.9 mm
816317 - 89	14,99	1 €	14,99	Popnageltang	Bralo BM-45 Popnageltang 250 mm
1202762 - 89	17,49	1 €	17,49	M8 zeskant schroef 40st 40mm	SWG Zeskantbouten M8 40 mm Buitenzeskant (inbus) DIN 933 RVS A2 40 stuks
1204389 - 89	7,49	1 €	7,49	M8 Sluitring buitenD: 30mm 100st	SWG Spatbordschijf Binnendiameter: 8.4 mm M8 Staal verzinkt 100 stuks
713472 - 89	9,29	4 €	37,16	Velgenspray mat zwart 500ml	Velgenspray zwart mat CRC PRO PAINT 10910-AB 500 ml
1068356 - 89	4,99	1 €	4,99	M3 schroef 30mm lang 100st PCB	TOOLCRAFT Cilinderschroeven M3 30 mm Binnenzeskant (inbus) DIN 7984 RVS A2 100 stuks
131880 - 89	0,89	1 €	0,89	M3 moeren 100st PCB	Zeskantmoeren M3 DIN 934 Staal 100 stuks TOOLCRAFT 131880
1067780 - 89	1,49	1 €	1,49	M3 Sluitring buitenD: 7mm 100st	TOOLCRAFT 1067780 Onderlegringen Binnendiameter: 3.2 mm DIN 7349 RVS A2 100 stuks
468899 - 89	1,79	2 €	3,58	4,1mm metaalboor 75mm	Wolfcraft 7537010 HSS Metaal-spiraalboor 4.1 mm Gezamenlijke lengte 75 mm geslepen DIN 338 Cilinderschacht 1 stuks
888166 - 89	2,79	1 €	2,79	Pattex Alleslijm 50gr	Pattex MULTI alleslijm 50 g
246573 - 89	6,79	1 €	6,79	Pattex Contactlijm 65gr (Metaal, hout / NIET PVC)	Pattex PFL1C Contactlijm 65 g
890258 - 89	5,99	1 €	5,99	Pattex Kunststoflijm 30gr (PVC)	Pattex Kunststof Speciale lijm PXSM2 30 g

# Prijslijst

<b>TOTAAL</b>		
<i>Incl. BTW</i>	€	188,50
<b>EINDTOTAAL</b>		
<i>Excl. BTW</i>	€	155,79
<i>Incl. BTW</i>	€	188,50
<b>RESTEREND BUDGET</b>		
<i>Excl. BTW</i>	€	155,49
<b>RESTEREND BUDGET (nieuw)</b>		
<i>Excl. BTW</i>	€	121,15

## Onderdelen - Winkels

- Conrad
- Farnell
- Brico

# Testrun



# Wedstrijdverloop

- Ontploft
- (foto mist)

# Wedstrijdverloop



# Wedstrijdverloop



# Documentatie - Repo

 .github

---

 3D\_MODELS

---

 DRIVING

---

 EMPTY\_BUCKET

---

 GIT\_MANUAL

---

 PUMPING\_WATER

---

 docs

---

 LICENCE.md

 README.md

# Documentatie - Github/Zenhub

Author ▾		Labels ▾	Projects ▾	Milestones ▾	Assignee ▾	Sort ▾
0 Open	35 Closed					
④ As a programmer I want my robot to have wireless communication so I can have real time debugging information.	general				1	
#35 by RuvenSalamon was closed 12 seconds ago						
④ As a team we want to imitate the build of the track, so we can practice on our own.	general				2	
#34 by koenschauwaert was closed 12 seconds ago	5 of 6					
④ As a customer I want my robot to have a professional appearance.	general				3	
#33 by RuvenSalamon was closed 12 seconds ago						
④ As a customer I want the team name to be visible on the robot.	general				4	
#32 by RuvenSalamon was closed 12 seconds ago	0 of 1					
④ As a team we want to program the software for Arduino to read-out sensors and start motors etc.	general				5	
#31 by koenschauwaert was closed 12 seconds ago	8 of 11					
④ As a team we want to program the software for Arduino to read-out sensors and start motors etc.	duplicate general				6	
#30 by koenschauwaert was closed on Apr 1	0 of 1					
④ As a team we want to program the software for Arduino to read-out sensors and start motors etc.	driving duplicate pump				7	
#29 by koenschauwaert was closed on Apr 1	0 of 1					
④ As a customer I want to receive a detailed presentation					8	
#28 by koenschauwaert was closed on Apr 1	3 of 3					
④ As a team we want "Green Light" from CCM to start our project				Sprint 1	9	
#27 by koenschauwaert was closed on Apr 1	0 of 1					
④ As a team we want to place our first order at Conrad/Antratek/Farnell					10	
#26 by koenschauwaert was closed on Apr 1	0 of 1					
④ As a team we want to find the best solution to pump water out of the basin	pump				11	
#25 by koenschauwaert was closed 12 seconds ago	0 of 1			Sprint 1		
④ [FPIC] As a customer I want a fully functioning robot					12	

## Documentatie - links

- Github: <https://github.com/ccmteamap/robot>
- Wiki: <https://github.com/ccmteamap/robot/wiki>
- Info CCM: <http://www.ccm.nl/nl/trofee/>
- Issues & sprints:  
<https://github.com/ccmteamap/robot/issues>
- Online scrum:  
<https://github.com/ccmteamap/robot/projects/1>

## Analyse volgend jaar

- Struikelblokken dit jaar
- Herbruikbaarheid
- Ter verbetering
- Te kopen materialen

# Analyse volgend jaar - Struikelblokken dit jaar

- Werkmateriaal
- Werkplaats
- Mechanische kennis
- Bestellingen

# Analyse volgend jaar - Herbruikbaarheid

- Materiaal
- Werkmateriaal
- Motorcontroller
  - Schema
  - PCB
- Arduino shield
  - Schema
  - PCB
- Programma
- Bestelling lijst

# Analyse volgend jaar - Ter verbetering

- Samenwerking Elektromechanica
- Betere werkplaats met werkmaterialen
- Inzage budget

## Analyse volgend jaar - Te kopen materialen

- Klinknageltang
- Boor + opzetstukken
- Zaag:
  - Metaal
  - Hout
- Dremel + kopstukken

# Happy End

