

Presidential Lyceum of Physics and Mathematics

Robotics Center

RoboCup 2019

RoboCup Junior Soccer Open

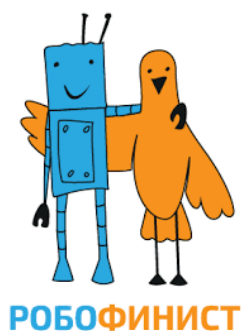


# MVK

## Engineering Journal

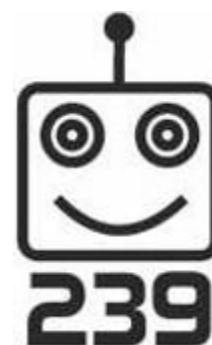
*Gorodov Michael*  
*Yarmolinsky Arseny*  
*Timofeev Maximilian*

***Supervisors:***  
*Filippov Sergey*  
*Korolev Dmitry*  
*Kitaev Nikolay*  
*Logachev Anatoly*  
*Nikolaeva Irina*



РОБОФИНИСТ

St. Petersburg  
2019





# RoboCup Junior Soccer Open League



**Special mirror allows 360-degree vision and navigation**

**Dribbler**  
Thanks to him, the robot can effectively perform defensive and attacking maneuvers

**Electromagnetic kickers**  
set at an angle to each other and allowing the robot to hit the ball in different directions

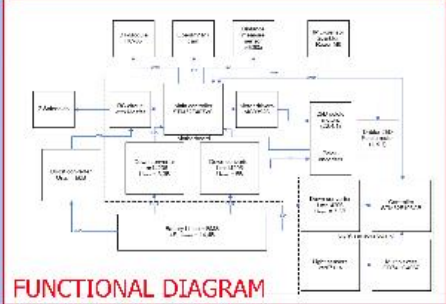
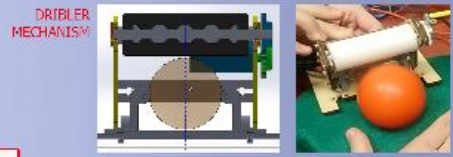
**Ball assistance sensor**  
Allows you to define right moment for hitting the ball

**OpenMV cam, ball detector, calculates the relative position of ball and robot**

**Self-developed Omnidirectional wheels**  
Allow the robot to move in any direction whatever from his orientation

**Bearing unit with gear gear for offset rotation axis**

**Quick release Li-Ion battery (14,48; 3Ah)**  
Provides uninterrupted operation of the robot systems



**FI CTRONIC COMPONENTS**

The main components of the electronic control system are the microcontroller and sensor board.

**ALGORITHM, PROGRAM ARCHITECTURE**

To describe motion or modes of recognized objects and ball's speed in a frame of camera module (FPS/frame) in the working board program. Similar to radar data for all available angles, compare between two color filter values based on color filter output principle of motion to determine since electronics control task is non-redundant (STREPTICS and STRESPIRE) and processed by our library manufacturer to work with the controller purposes. The software is written in C++.

**NAVIGATION**

The robot will determine the ball position in the field and will move to the ball position. The robot will determine the ball position in the field and will move to the ball position. The robot will determine the ball position in the field and will move to the ball position.

**DRIVE UNIT FEATURES**

The drive unit features include various components and specifications. It details the mechanical and electrical aspects of the robot's movement system.



**Coach:**  
Filipov Sergey,  
Korolyov Dmitriy,  
Kitaev Nikolay,  
Logachev Anatoliy,  
Nikolaeva Irina



**OUR TEAM MVK**



**Yarmolinsky Arseniy**  
age: 17

**Gorodov Michael**  
15

**Dmitriev Vladimir**  
17

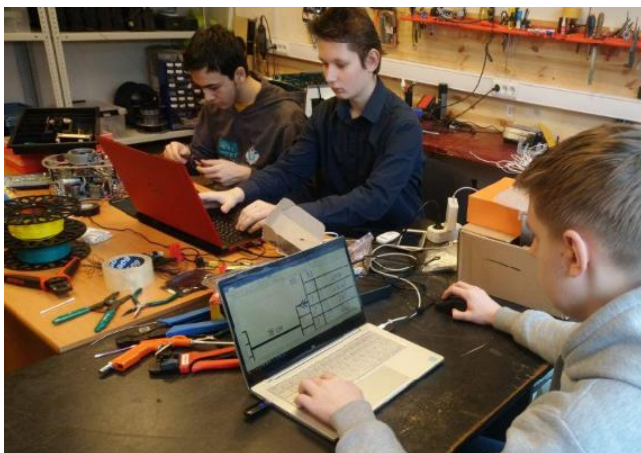
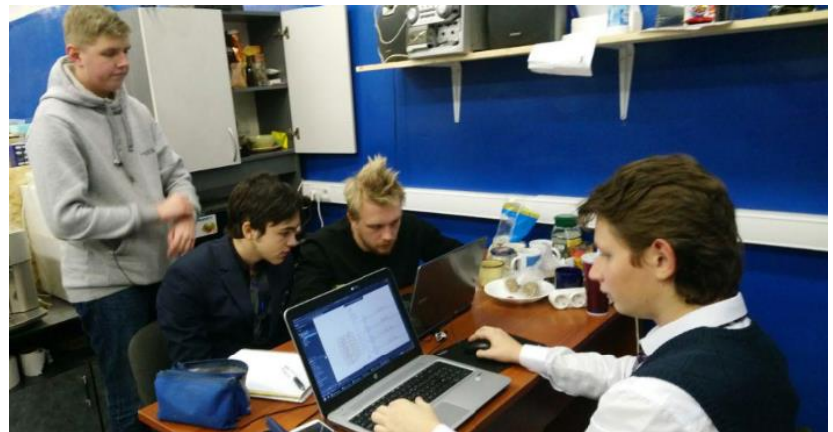


# Table of contents

Introduction.....	3
MVK team. ....	4
Functional diagram of the robot .....	5
Electronic part of the robot .....	6
Motherboard: .....	6
Photosensitive sensors board: .....	9
Self-design and PCB layout.....	11
Videocam OpenMV M7: .....	12
Inertial measurement module Sparkfun Razor M0:.....	12
Battery supply adapter: .....	12
Design part of the robot .....	13
Description of the mechanical part of the robot .....	14
General view of the robot in the assembly: .....	14
Omnidirectional wheels .....	15
Dribbler.....	16
Ball presence sensor .....	17
Mirror special shape. ....	17
Quick release Li-ion battery 4S (14,4 B; 3Ah).....	18
Software and hardware of the robot.....	19
Program architecture.....	19
Algorithm of searching for connected objects BFS (breadth-first search). ....	19
Used libraries. ....	21
Application protocols.....	22
Navigation and software logic part of the robot .....	23
Robot algorithm .....	23
Our event photo. ....	25
Manufacturing technology and software .....	60
Manufacturing technology .....	60
IDE, CAD and CAM software.....	60
Work with other teams.....	61
Acknowledgments .....	62

# Introduction

We - group of students, having experience of participation in Russian and international robotic competitions. The team applies knowledge in electronics, mechanics and programming, received in our past teams. We are a new team in RoboCup Junior Soccer Open, but each of us has already participated in various robotic competitions, including RoboCup.



## MVK team.



Gorodov Michael — team captain, software engineer, printed circuit board designer.

### Personal achievements:

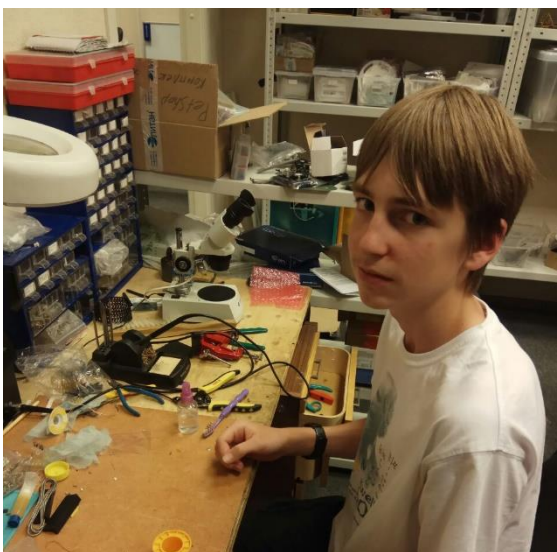
- 1 place in RoboCup 2018 (Montréal) Soccer Open in SuperTeam
- 1 place in WRO 2017 (San José) in the middle creative category
- 1 place in WRO 2016 (New Delhi) in the middle creative category
- 2 place in WRO 2015(Doha) in junior creative category



Yarmolinsky Arseny — design engineer, 3D designer, printed circuit board tracer.

### Personal achievements:

- 1 place in RoboCup Russia Open 2017 Junior Rescue Maze
- 1 place in internationally robotic festival Robofinist -2018, RTC Cup Extremal
- 1 place in internationally robotic festival Robofinist -2017, Robotic Airborne Racing
- 1 place in internationally robotic festival Robofinist -2015, RTC Cup Finder



Timofeev Maximilian— design engineer, 3D designer.

### Personal achievements:

- 2 place in RoboCup Russia Open 2017 OnStage
- 1 place in internationally robotic festival Robofinist -2017
- 1 place in internationally robotic festival Robofinist -2016

# Functional diagram of the robot

Based on the competition regulations, technical requirements and gained experience in last year's competitions we have made functional diagram of the robot.

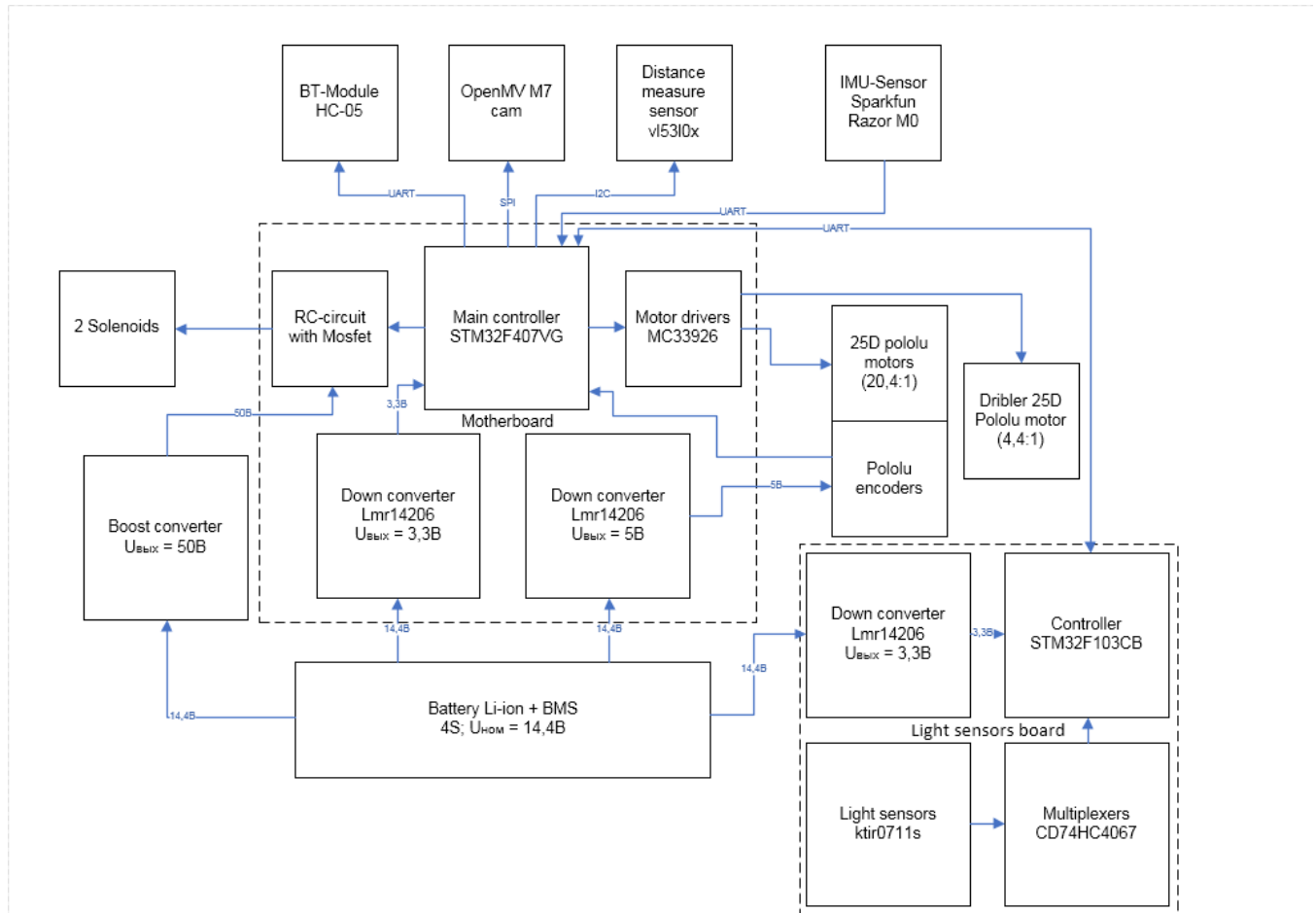


Fig. 1. Functional diagram of the robot

# Electronic part of the robot

Control block of robot-footballer include 3 printed circuit boards: motherboard, photosensitive sensors board and switching board - battery adapter.

The main components of the electronic control system of the soccer robot is motherboard and sensors board.

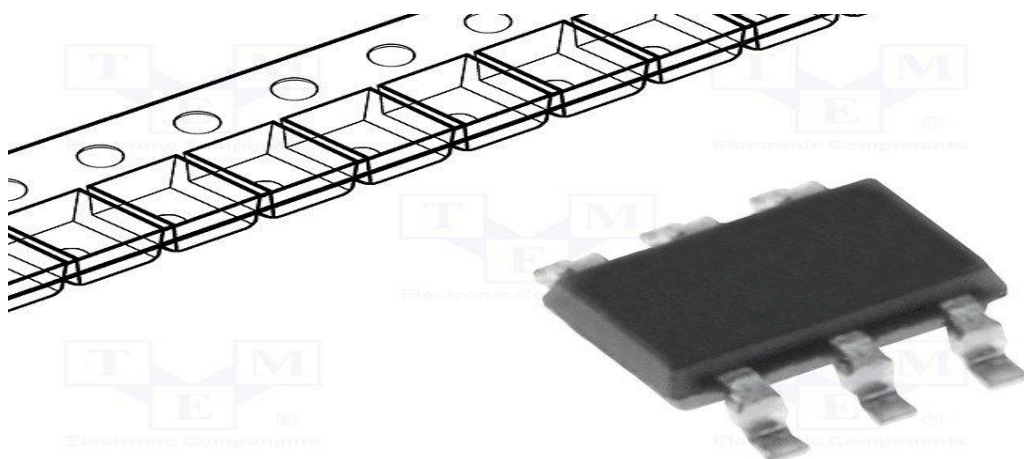
## **Motherboard:**

Is based on high-performance microcontroller STM32F407VGT6, STMicroelectronics, core ARM Cortex-M4.



On the motherboard is placed power sources, used chip Texas Instruments LMR14206 pulse down converter.

Other motherboard components: DC motors control electronics (H-bridge MC33926, NXP), solenoid impact mechanism control system, connectors for connecting peripheral devices (video camera OpenMV M7, BT-module HC-05, distance sensor vl5310x, IMU - sensor Sparkfun Razor M0, sensors board, 2 solenoids and other).



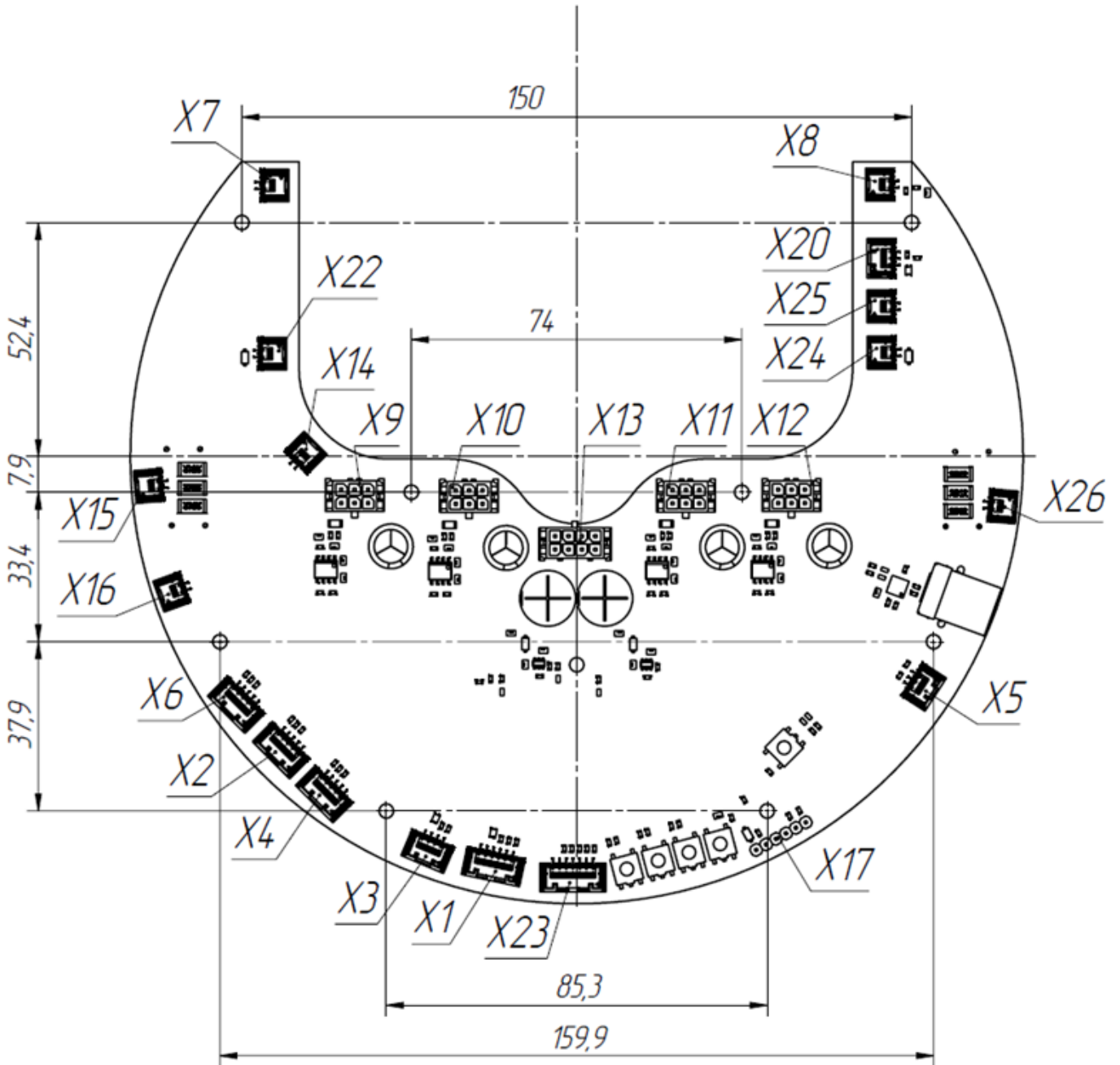


Fig. 2. Motherboard dimensional drawing. Component placement.

Motherboard dimensional drawing 200\*166 mm, outer contour radius 100 mm.

Connectors reference designation	Connectors name	Reply part name	Manufacturer	Function	Number of parts
X22, X24	5025840270 (Click-Mate 2)	5025780200 (Click-Mate 2F)	Molex	Solenoid impact mechanism connector	2

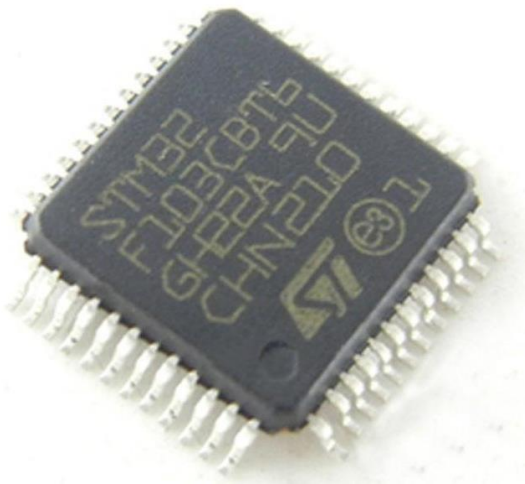


X15, X26	5025840270 (Click-Mate 2)	5025780200 (Click-Mate 2F)	Molex	Solenoid HV- supply connector (booster)	2
X7, X8	5025840270 (Click-Mate 2)	5025780200 (Click-Mate 2F)	Molex	Ball sensor connector in the capture zone (infrared LED and phototransistor)	2
X25	5025840270 (Click-Mate 2)	5025780200 (Click-Mate 2F)	Molex	Motor driver connector in ball capture device	1
X16	5025840270 (Click-Mate 2)	5025780200 (Click-Mate 2F)	Molex	ON/OFF button connector	1
X14	5025840270 (Click-Mate 2)	5025780200 (Click-Mate 2F)	Molex	Booster converter supply connector	1
X17	DS1021-1x6 (PLS 6)	DS1071-1x6 (BLS 6)	Ningbo connfly electronic	JTAG-SWD connector	1
X14	5025840470 (Click-Mate 4)	5025780400 (Click-Mate 4F)	Molex	Motherboard - sensors board connector	1
X2, X4, X6	5025840570 (Click-Mate 5)	5025780500 (Click-Mate 5F)	Molex	VL53L0X laser distance meter connector	3
X1	5025840670 (Click-Mate 6)	5025780600 (Click-Mate 6F)	Molex	OpenMV Cam M7 videocam connector	1
X23	5025840670 (Click-Mate 7)	5025780600 (Click-Mate 7F)	Molex	OLED display 0.96" 128x64 SSD1306 connector	1

X9, X10, X11, X12	430450612 (MicroFit-6)	5025780600 (MicroFit-6F)	Molex	Pololu High- power 25D 12V 20.4:1 DC motor connector	4
X13	430450827 (MicroFit-8)	430250800 (MicroFit-8F)	Molex	Battery supply connector	1

### Photosensitive sensors board:

Photosensitive sensors board is used to determine the marking of the polygon. The board contains microcontroller STM32F103CBT6, STMicroelectronics, core ARM-Cortex-M3.



Other components:

32 light sensors, open optical transistor optocouplers KTIR0711S, Kingbright; additional controlled illumination in the visible spectrum and 2 analog multiplexers.

Sensors board dimensions 183,25\*183,25 mm.

Connectors reference designation	Connectors name	Reply part name	Manufacturer	Function	Number of parts
X14	5025840470 (Click-Mate 4)	5025780400 (Click-Mate 4F)	Molex	Motherboard - sensors board connector	1
X17	DS1021-1x6 (PLS 6)	DS1071-1x6 (BLS 6)	Ningbo connfly electronic	JTAG-SWD connector	1

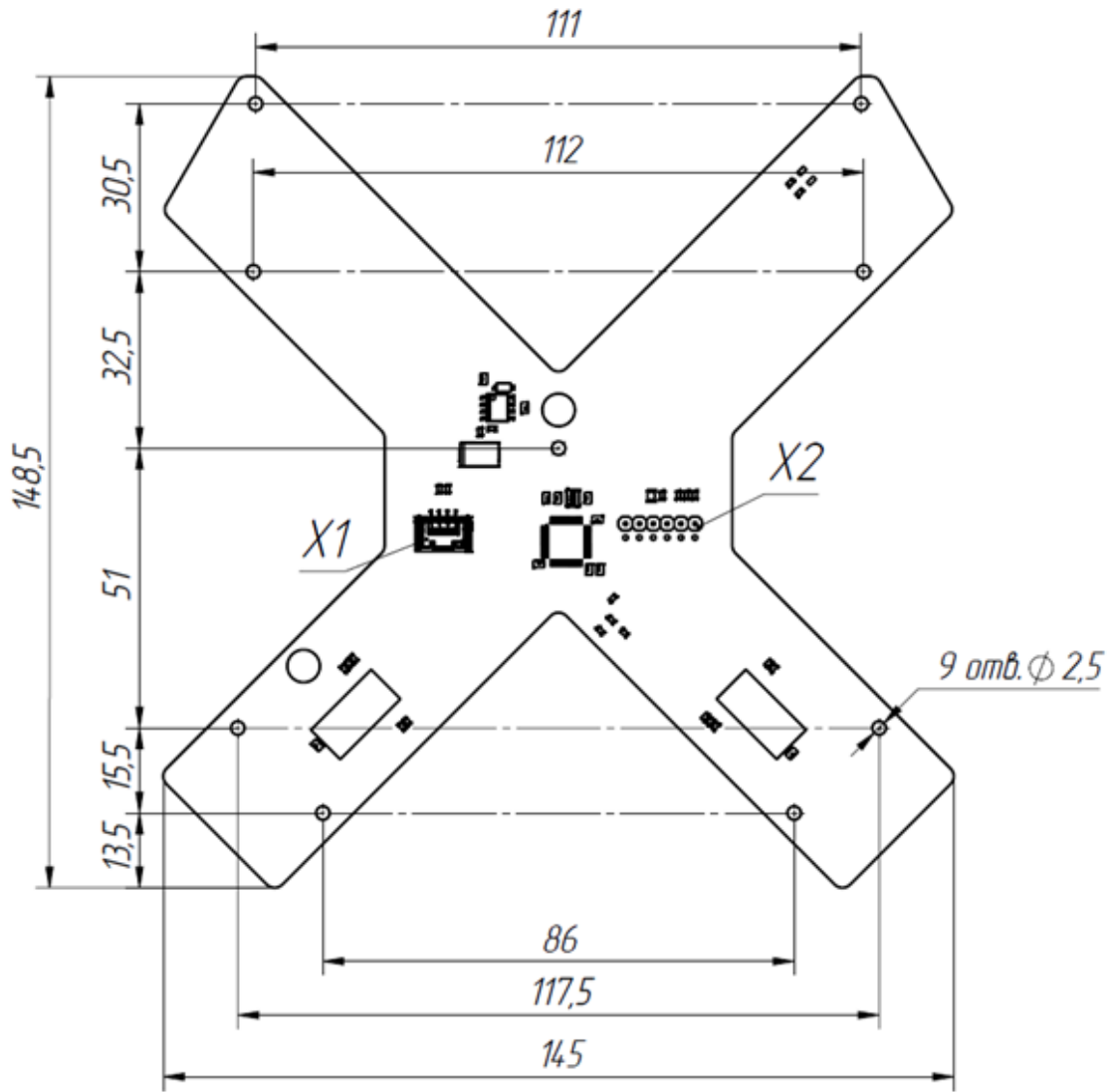


Fig. 3. Sensors board dimensional drawing

**Self-design and PCB layout.**

Altium Designer 18.7

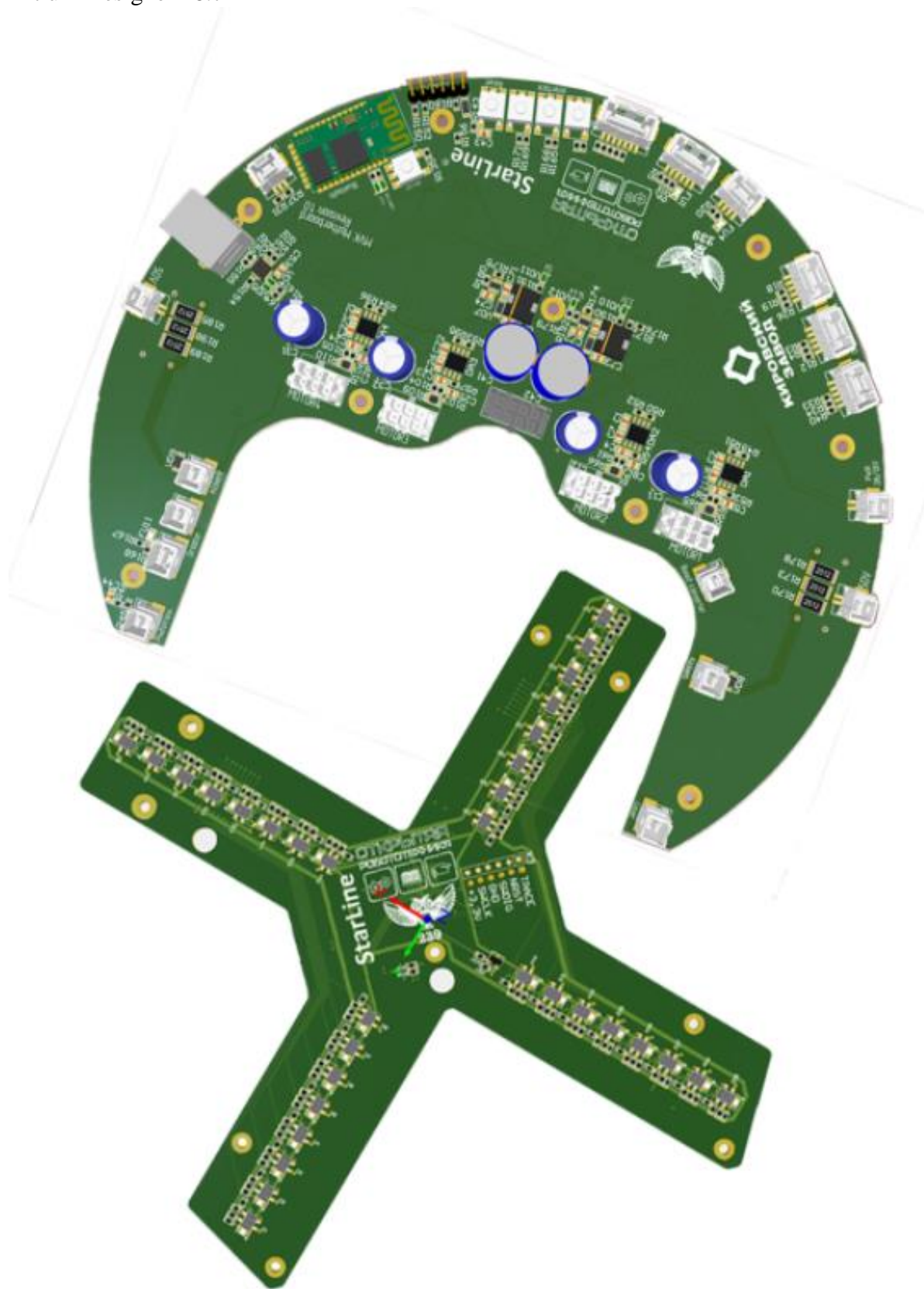
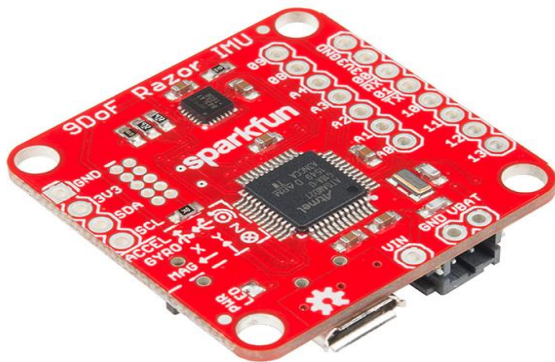


Fig. 4. Motherboard and sensors board appearances.



**Videocam OpenMV M7:**

Independent module, microcontroller STM32F7 series supported computer vision algorithms. Programming language Python.



**Inertial measurement module Sparkfun Razor M0:**

IMU-sensor, operates data from a gyroscope, accelerometer and magnetometer. Independent module with microcontroller onboard.

SAMD Arduino loader. Programming language C and C++ in Arduino IDE.

**Battery supply adapter:**

For ease of installation and assembly, a switchboard-adapter for battery connection was designed.

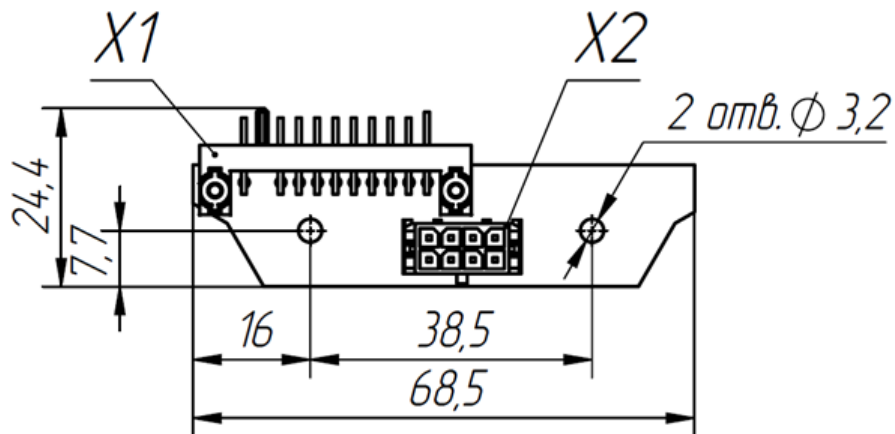
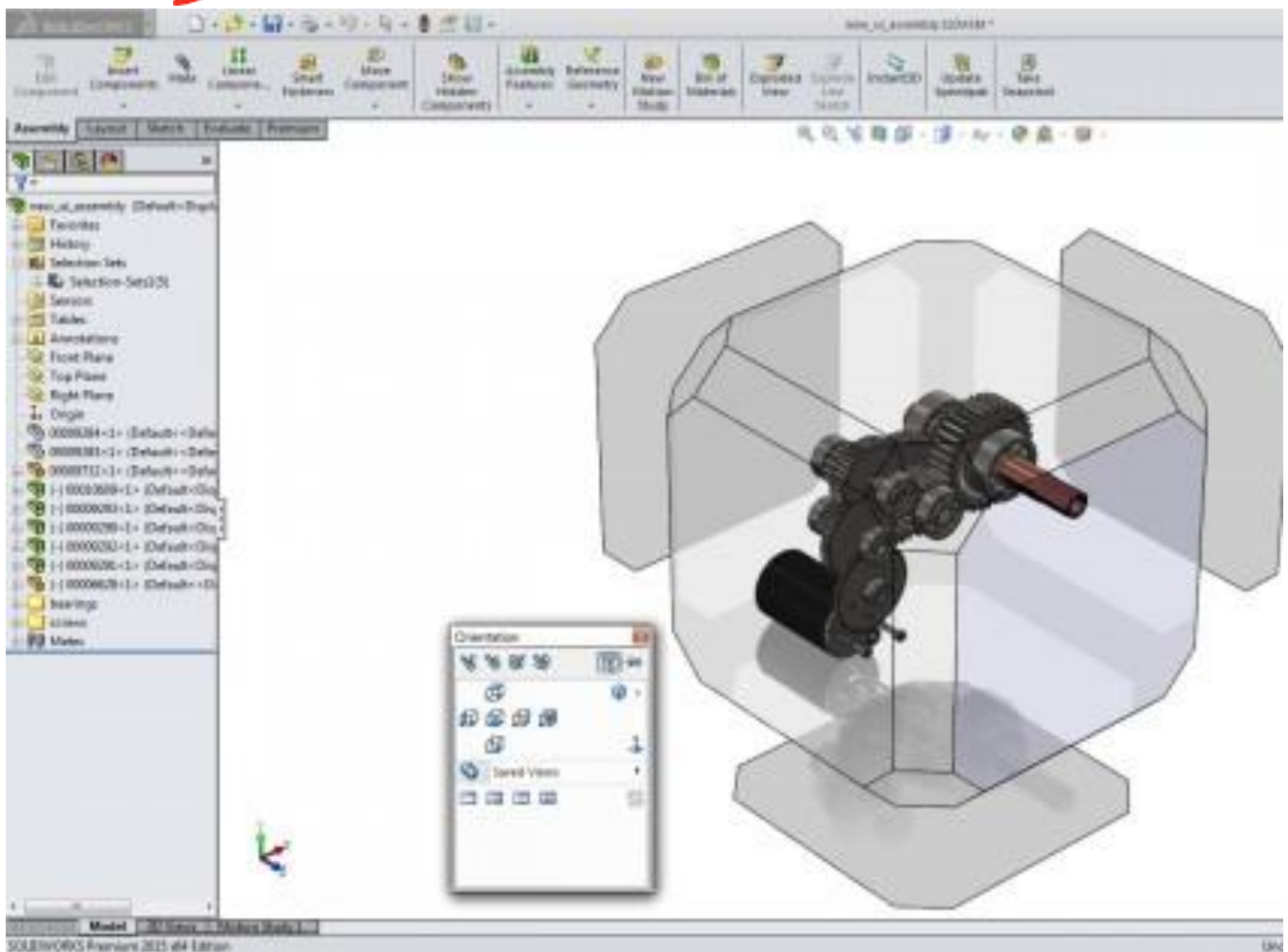


Fig. 5. Dimensional drawing of battery supply adapter.

# Design part of the robot

According to the experience of creating previous autonomous robotic systems, it was decided to create a detailed 3D model of the robot, in order to avoid docking errors when assembling and installing the robot. For this was chosen SolidWorks 2015 CAD.



## Description of the mechanical part of the robot

### General view of the robot in the assembly:

The robot is a 4-wheeled cart on omni-directional wheels.

There are 3 levels of component installation (numbering from bottom to top).

On the third level are located:

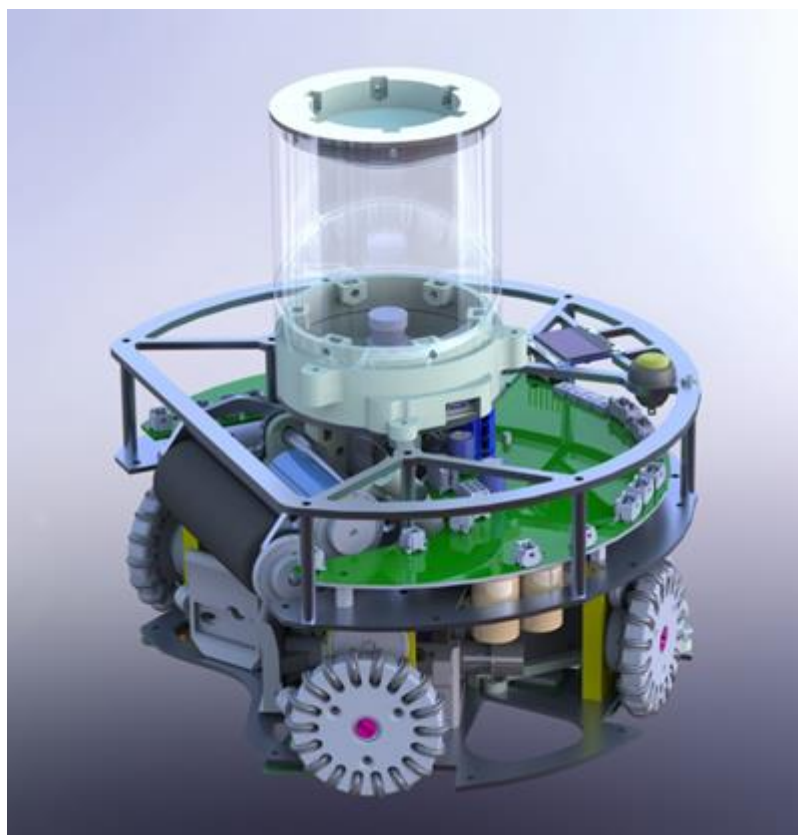
- 360-degree videocam
- IMU sensor
- Indicative screen
- ON/OFF switch button

On the second level are located:

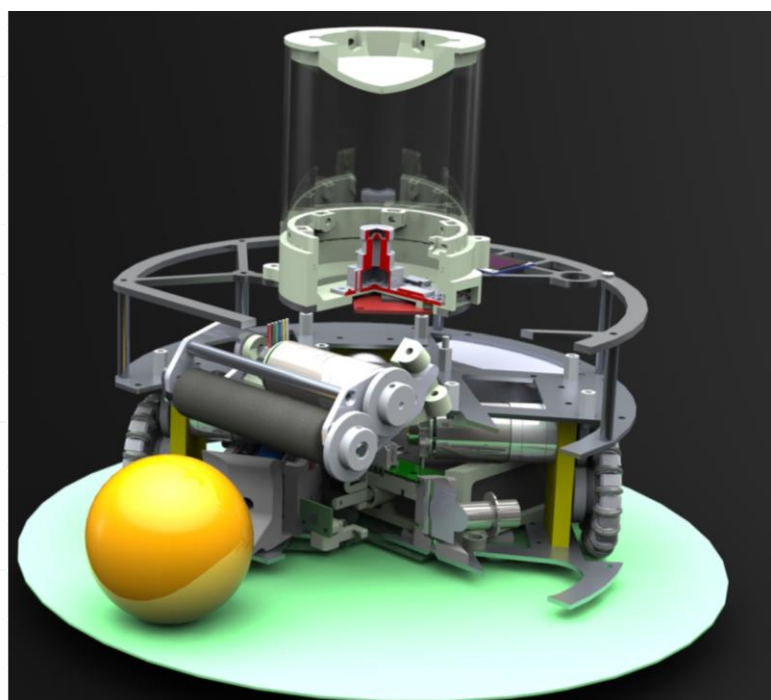
- Motherboard
- Dribbler

On the first level are located:

- DC motors
- Battery
- Solenoids
- Sensors board



### Quarter view



Chassis represented by four drives with bearing assemblies and gears to shift the axis of rotation of the wheel. Torque to the wheels drive DC motors Pololu 25D 12V High-Power 20.4:1 500 RPM 6.12 kgf\*cm with built-in encoder from two sensors of the hall and magnetic disk, mounted on the anchor of DC motor

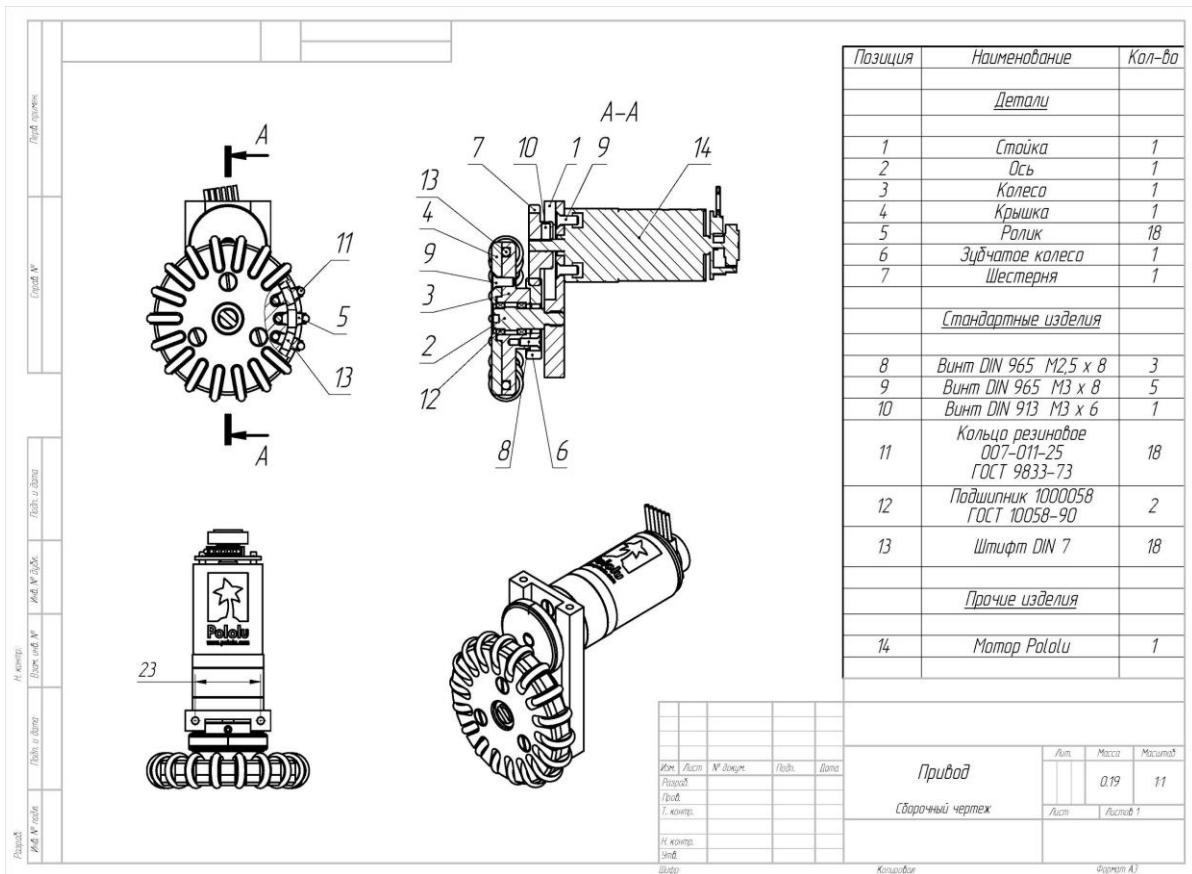
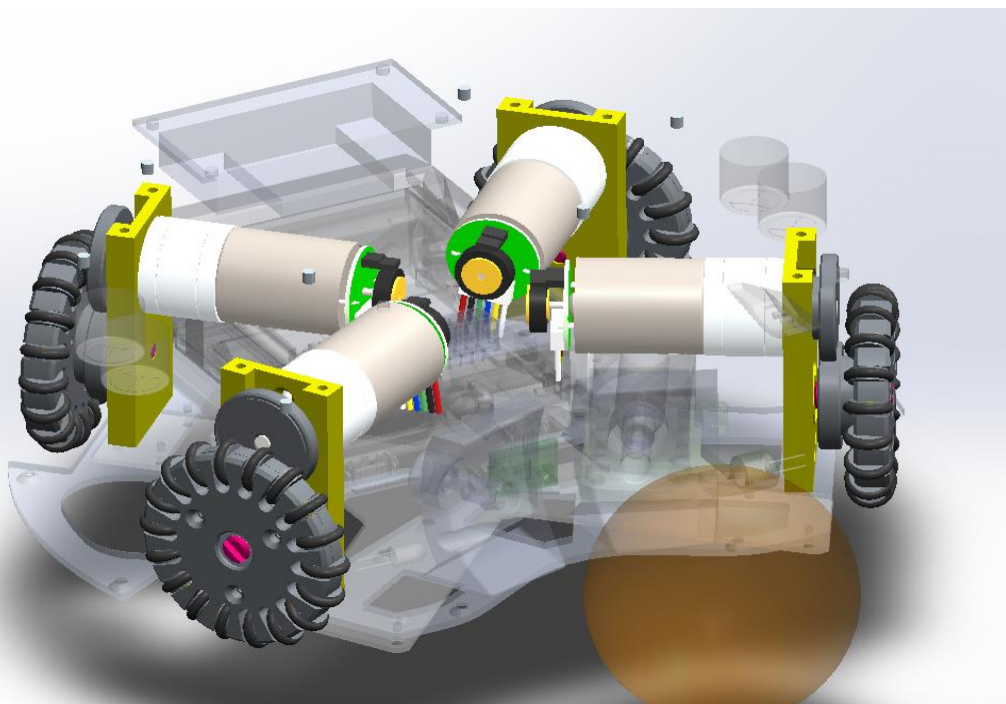


Fig. 6. Drive Assembly Drawing

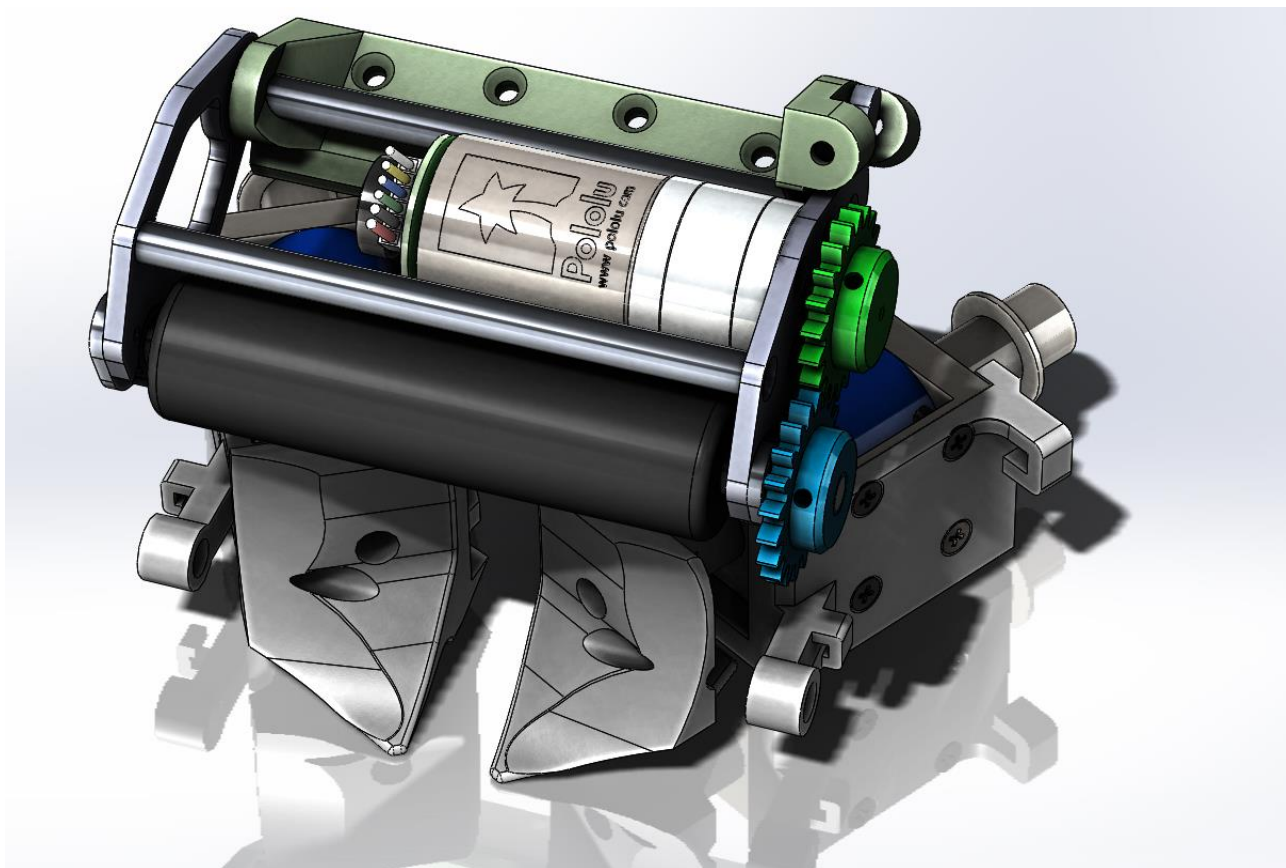
### Omnidirectional wheels

Self-developed omnidirectional wheels allow the robot to move in any direction regardless of its orientation.



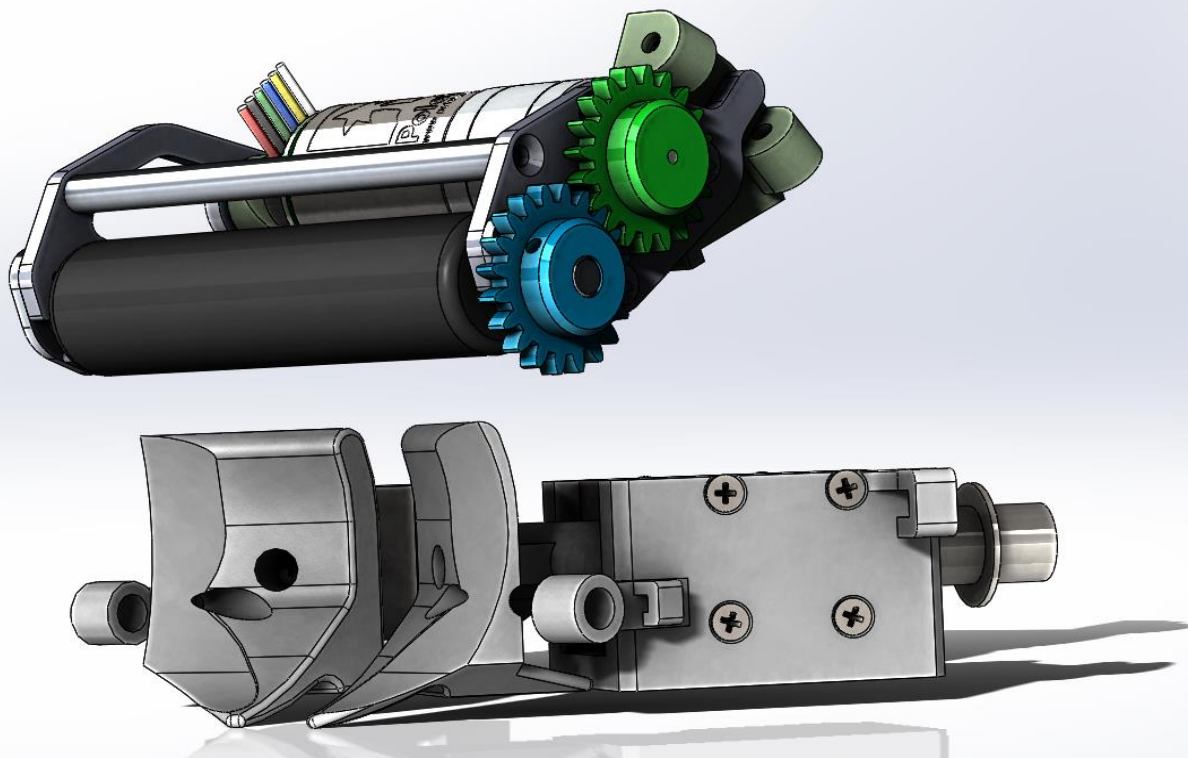


## Dribbler.



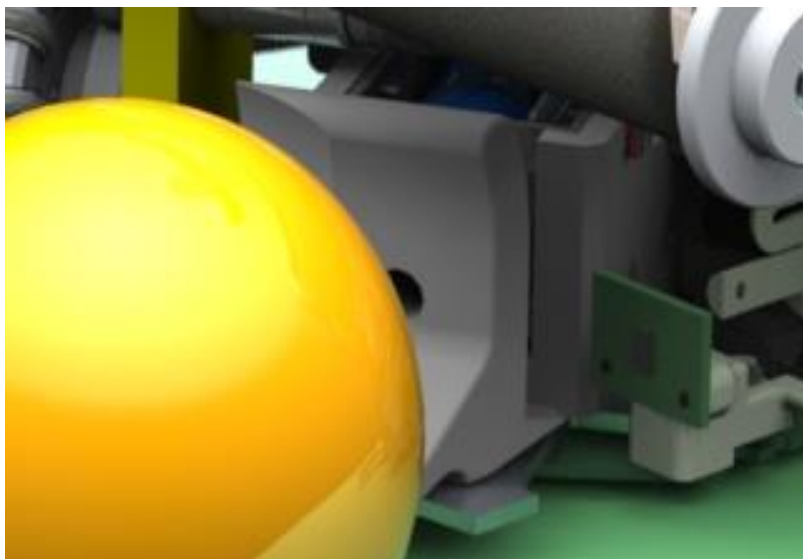
Dribbler - ball catching and dribbling mechanism. Thanks to him, the robot can effectively carry out attacking and defensive maneuvers.

Electromagnetic solenoid pushers mounted at an angle to each other and allowing to hit the ball in different directions.



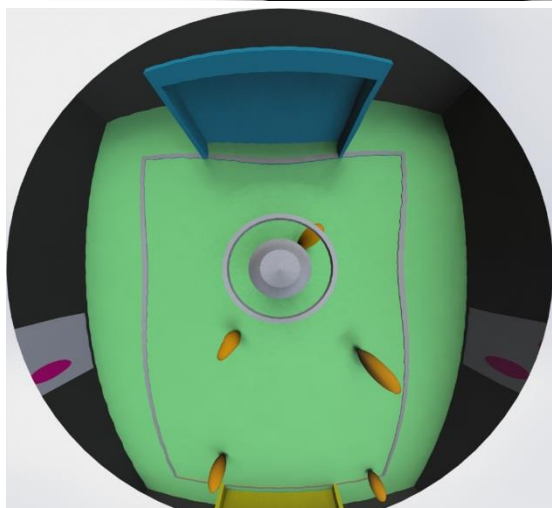
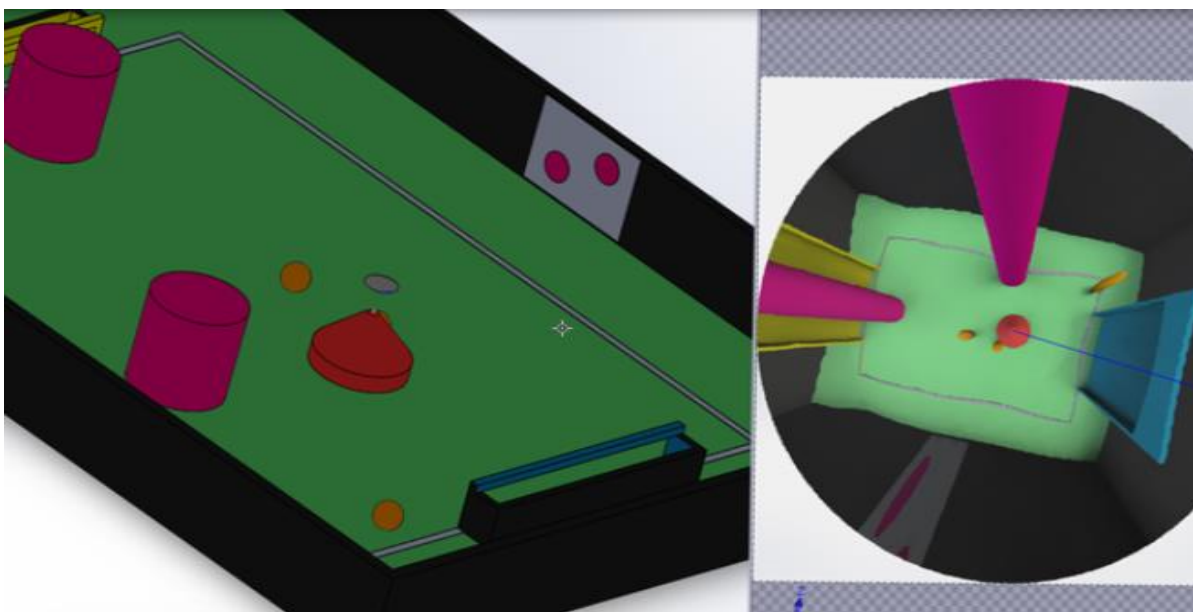
## Ball presence sensor

The presence of the ball sensor allows you to correctly determine the moment for hitting the ball. Works on a photo interrupter principle: consists of an infrared LED and a phototransistor. When the ball gets inside the robot, the flow of light is interrupted and the sensor is triggered.

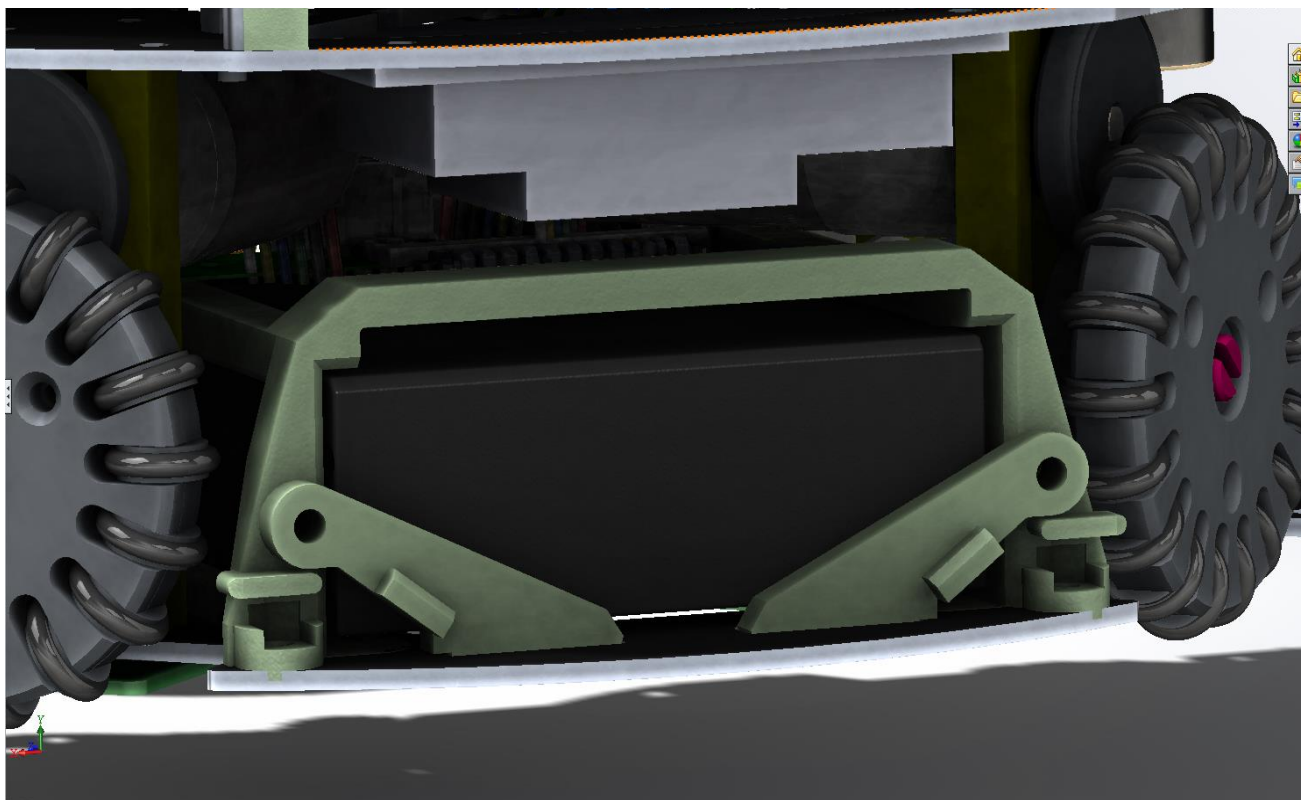


## Mirror special shape.

Allows the camera to see objects around the robot.



Quick release Li-ion battery 4S (14,4 B; 3Ah).



# Software and hardware of the robot

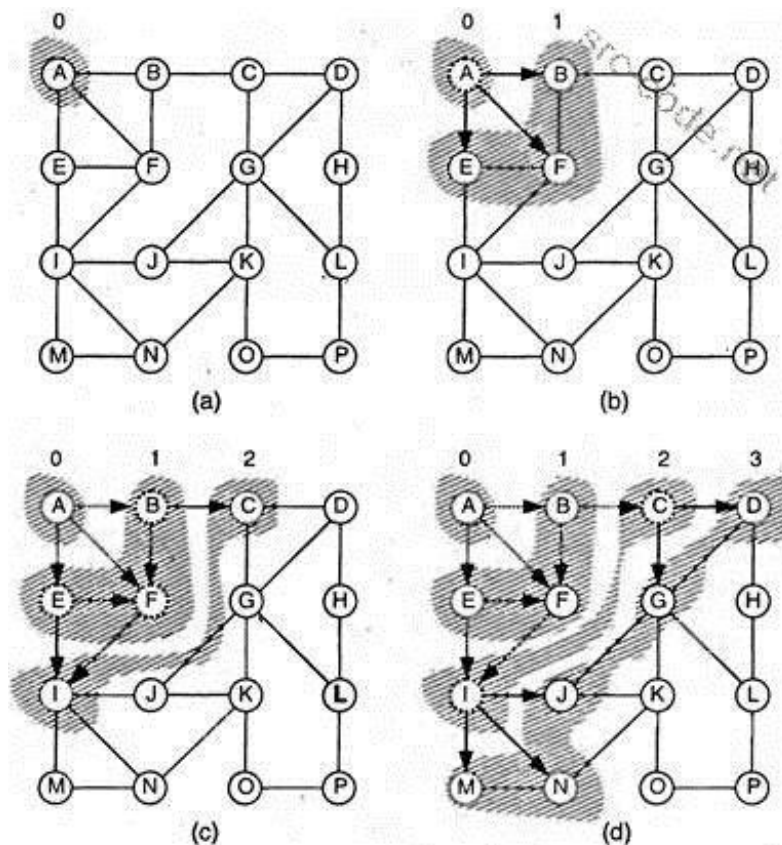
## Program architecture

We are programming OpenMV cam on MicroPython in OPENMV IDE. Main microcontroller STM32 programming in IDE Keil uVision 5 on C and C++ language. We use it because it provides us with an object-oriented programming paradigm: classes, structures, inheritance, interfaces, callbacks.

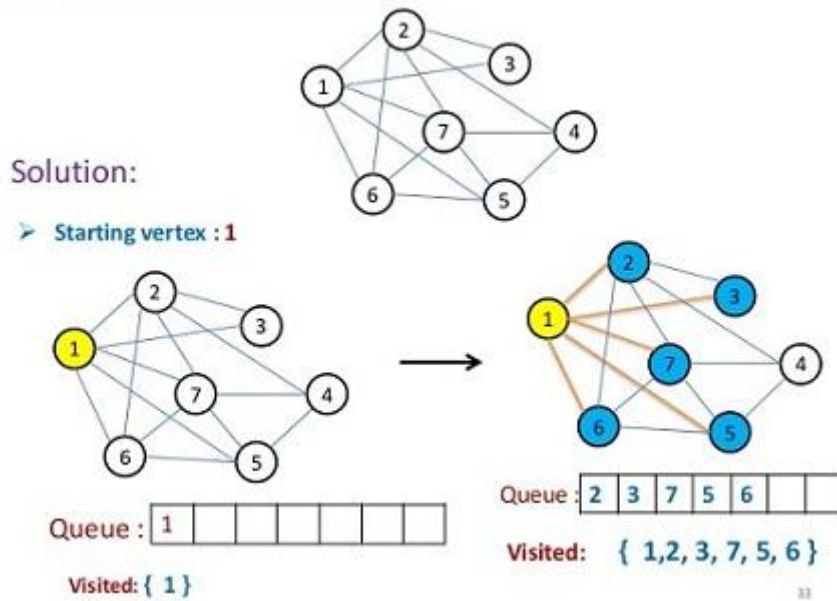
All peripherals supported by SPL lib for STM32, designed by STMicroelectronics. The architecture of the program is based on the principle of ultimate automation. Protocols UART and SPI between programmable controllers (OpenMV, motherboard, line sensors board, gyroscope) implemented with a hash-sum CRC-8. Processing IMU sensors values (accelerometer, gyroscope and compass) filter Mahoni&Madgwick based. The position preservation algorithm is based on PID-controller, where the mismatch is the difference between the angle from the sensor IMU and some angle of goal.

## Algorithm of searching for connected objects BFS (breadth-first search).

To describe mathematical models of recognizable color marks and a ball, the algorithm of searching for connected objects BFS (breadth-first search) built into the camera module is used.

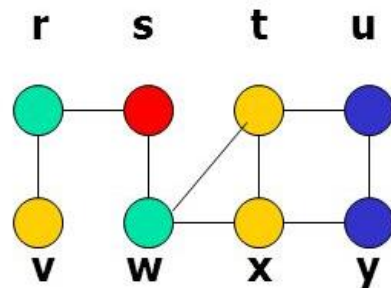


**Example: BFS Algorithm Tracing**

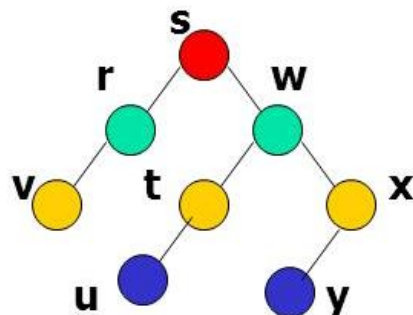


# Breadth-First-Search(BFS)

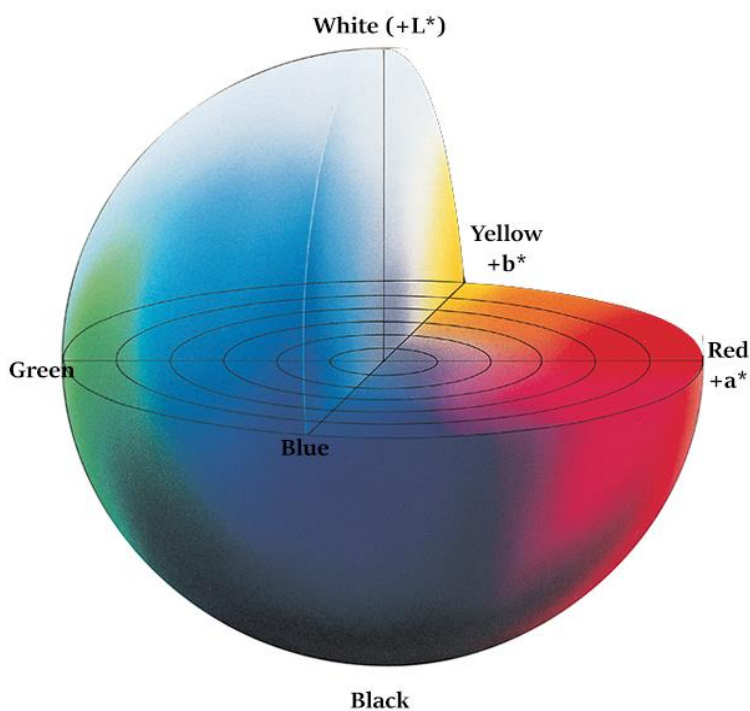
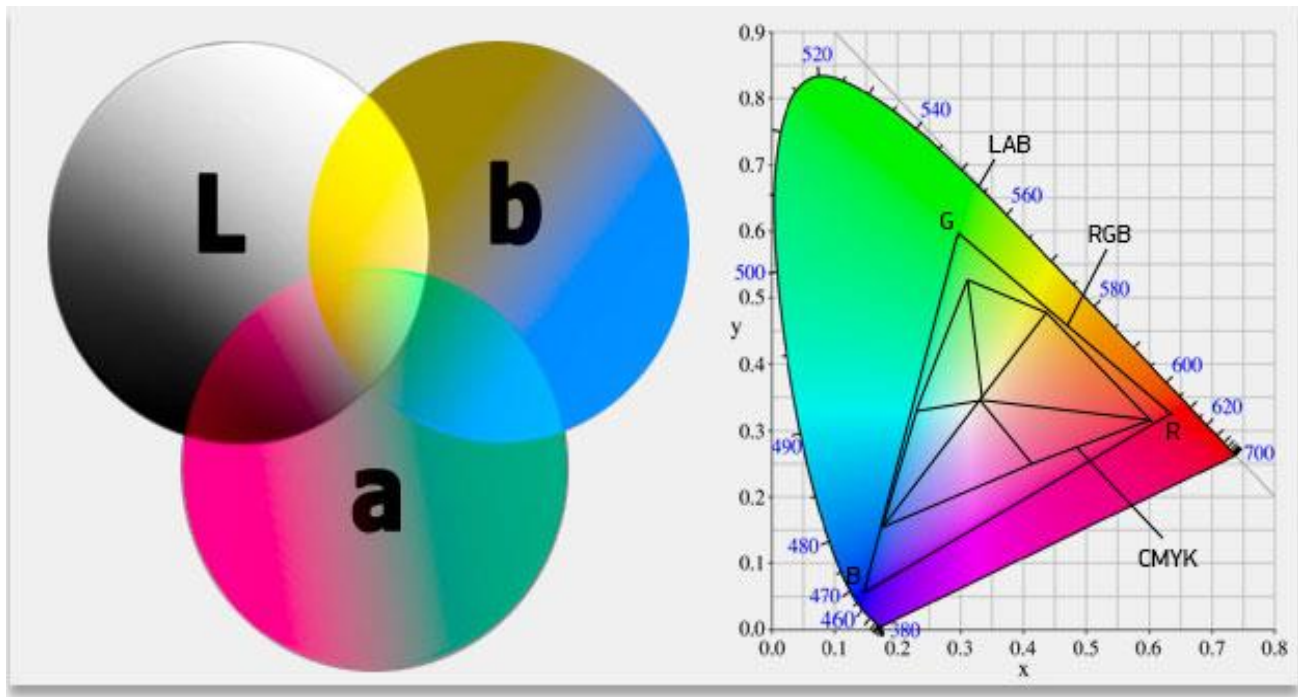
- For example BFS over that graph:



- We give the breadth tree:

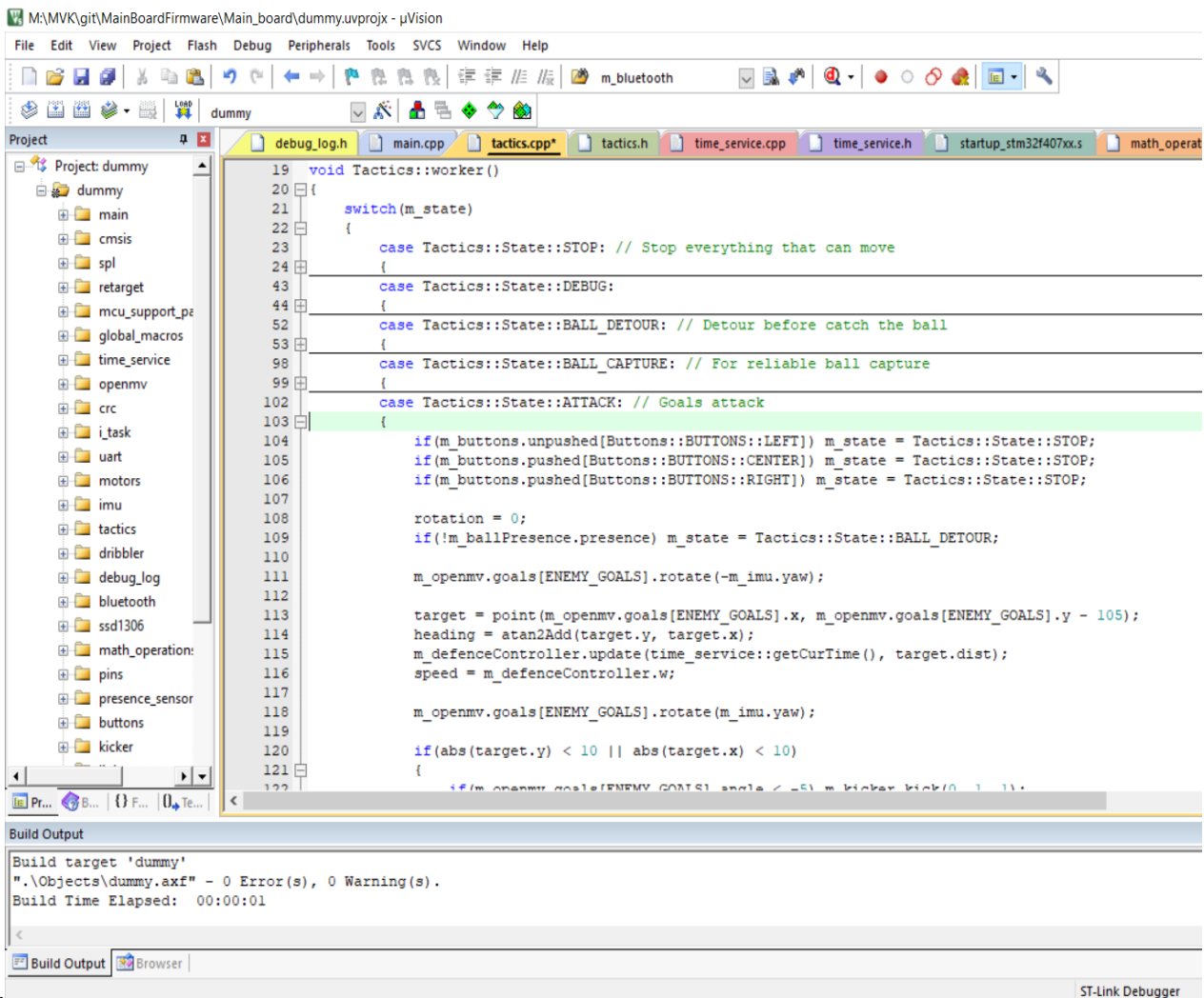


Similar in color dots are all that fall into the range between two calibration values - colors in 3D space. LAB.



### Used libraries.

Software architecture was based on the finite automaton principle according wiring diagrams of control unit. Hardware designed on microcontrollers STM32F1 and STM32F4 series. So software was based on libraries SPL and driver CMSIS for core ARM Cortex, provided by vendor. Software written in languages C and C++ in Keil uVision 5 IDE.



Software example.

## Application protocols.

For communication between programmable devices, application layer protocols have been developed..  
Three-state finite state machine:

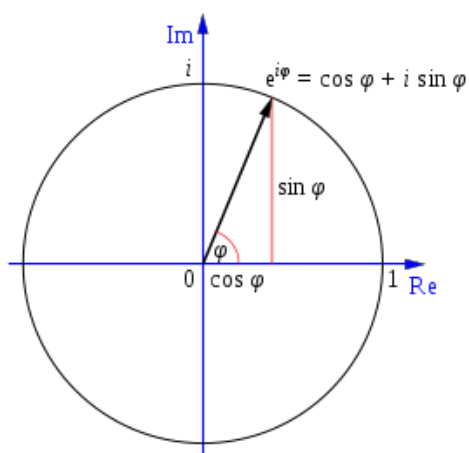
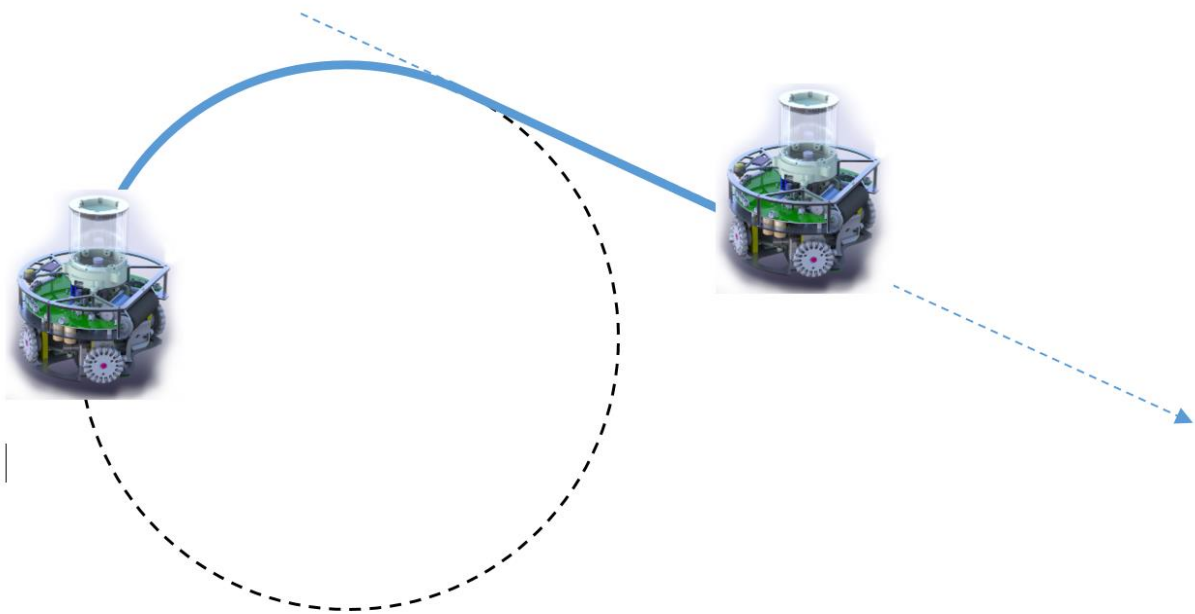
- Search header in the stream of incoming data
- Filling data
- Checking the hash-sum and logging information

# Navigation and software logic part of the robot

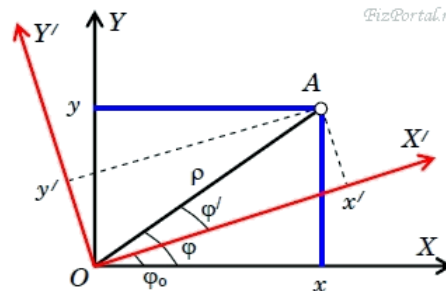
## Robot algorithm

Detour the ball is carried out on a circular trajectory with a variable radius, depending on the distance to the ball. Goals and colored tags - these are objects, which allow us to get the coordinates of our robot relative to the field. Robots are interchangeable, and goalkeeper can score.

Detour and follow the ball carried out on a bunch of elliptical trajectories and linear dependencies. In the algorithm of our robot - the union of a circle with a changing radius and a direct drive to the ball.

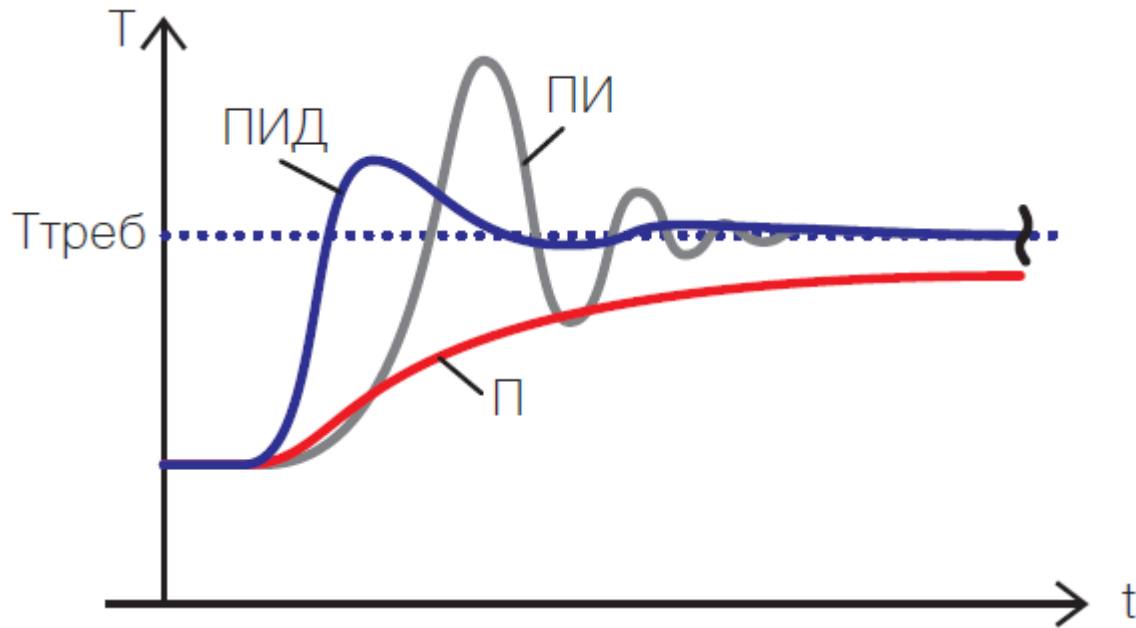


The use of a convex mirror allows you to use the polar coordinate system associated with the robot when solving the problem of its navigation in the coordinate system associated with the polygon. Orientation occurs in the created model of inertial and global navigation.





PID controllers are used to control the movement and maintain the specified system parameters, such as the speed of the motors and the direction of movement.



The DC motors have a high inductance. The DC motors drivers is regulated by the PWM signal.

For MC33926 H-bridge PWM signal frequency is equal 16 kHz.

A PID controller is used to stabilize the DC motors rotation speed. Feedback is provided by incremental bi-directional encoder Pololu.



[www.pololu.com](http://www.pololu.com)

# Our event photo.

9 September 2018

Application for participation in the competition 14.09 in National Committee.

24 September 2018

Began to keep an engineering book

11 October 2018

Selection and purchase of components.

Check DC motor with Arduino module. Find differences between technical requirements and real characteristics.

Mikhail tested the motor, works, will send the data tomorrow to Vladimir.

The mirror is offset by 0.1 mm in Solid Works.

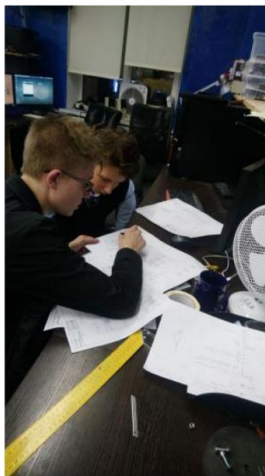
Calculate the mirror curve through the polynomial of the 8th degree

15 October 2018

Change team

Nikolay Kataev replaces Yarmolinsky Arseny

Started to check the motherboard and its correction.

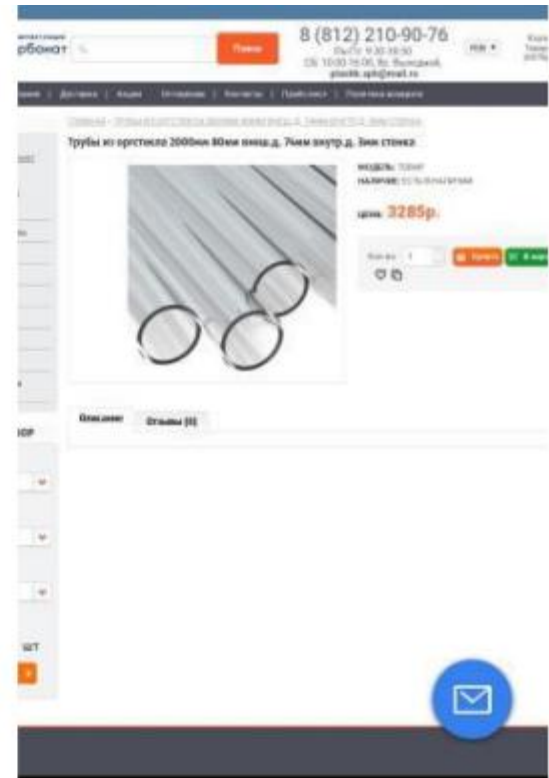
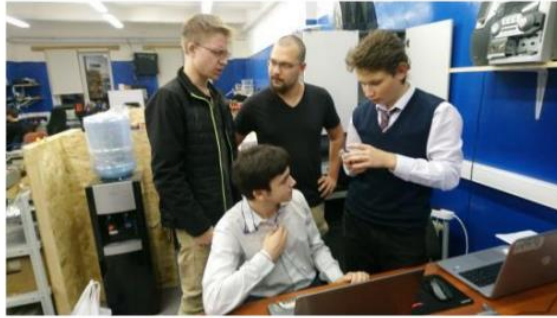


Model mirror sent to the development for the manufacture of metal on a CNC machine.

17 October 2018

Vladimir takes exams.

Arseny constructs the body. Mikhail layout the motherboard.



Found a tube for the manufacture of a transparent glass for the videocam.

[https://polikarbonatik.ru/index.php?route=product/product&product\\_id=505](https://polikarbonatik.ru/index.php?route=product/product&product_id=505)

Ordered material for the manufacture of parts of the robot

Steel 3 mm - 1 sq. m (including stock). Aluminum 3 mm - 0.5 sq. m (including stock)

We need to write our own simulator for the robot. Unlike kopters and other 3-dimensional objects, robot football player should be described as a two-dimensional object. It is necessary to calculate the inertia, acceleration and braking.

The final shape of the mirror is obtained. The set of points was interpolated by a curve using CAD tools; then it was exported to a sketch. Works acceptable (in the simulation). We make, metallize and try in real conditions.

Tactics: пока всё сводится к system with many previously described states, with the possibility of selective transition, training neural networks with reinforcements.

Navigation: discrete function of the distance to the object in pixel size + ball presence sensor + particle filter (multi-weight probabilistic) for combining data from a camera, gyro,

encoder. Access to the ball is carried out by the fragment function, a bunch of ellipses / parabolas / hyperbole and / or linear dependencies.

Maths: You will need to look at the algorithms of football players from ssl, msl and draw conclusions.

Yesterday received assignments for the PCB and design. Deadline - Wednesday. After order. Priorities are summarized in Google table.

Конструкция (Дмитриев Владимир)			
индекс	даты	план	результат
01	30.10.18	Начать оформлять тех журнал(рус + англ)	
02	31.10.18	Исправить звук в видео, добавить фрагмент с Арсением и фотками текущей конструкции и платы(не слишком раскрывая секреты)	
03	01.11.18	Исправить TDP, добавить Арсения, вставить актуальную инфу	
04	03.11.18	Взять контроль за закупкой:	
05	04.11.18	Рассортировать компоненты в копии сметы, что осталось купить, а что уже имеется или заказано	
06	05.11.18	Внимательно изучить принципиальную схему и текущую модель робота	
07	06.11.18	Распределить детали по материалам, способам и срокам изготовления	
08	07.11.18	Написать точные дни работы над роботом, количество часов и дней по неделям, конкретное время(необходимо встречаться у Королёва, у Миши дома и в 239	
09	08.11.18		

The design of the robot made the following changes:

- Relief fasteners for motor and wheels
- Increase the gap between the gear motor and the wheel
- Rebuilding holes for fasteners. It is not clear why the different diameter of the holes between the parts.
- Replacing the bearings on the wheel shaft.
- First level relief
- Second level relief
- Creating guides to install the battery
- Designing the top of the robot designing the top of the robot: rim for lifting the robot, mount for the camera and mirror
- Dribbling option used from the old robot. No dribble mount to the trolley. With Nicholas worked out a new version of dribbling commissioned by Mikhail – the robot lifts the ball and rides with it. The old version cannot guarantee the ball to hold.
- Creating an impact mechanism. An interesting idea to control the ball in the capture zone, but it is necessary to provide a mechanism to control the jamming of the impact mechanism. Currently there is no control.
- The model has no projects of the PCB on the assembly, please post.
- When striking forward (hit by both solenoids), the stroke of the impact mechanism is limited.
- No center of mass control. Unclear load distribution on each wheel.

- In the design there are mutual overlapping of parts into each other, it is necessary to fix it.

Michael develops circuit diagrams in Altium Designer. Programming currently he is not engaged. Arseny develops mechanical models in 3D, Solid Works. After completing the development of a 3D model, develops and layout printed circuit boards. The main metal components must be ordered today. Within two days, plastic parts should be made on 3D printers. Place of manufacture - Academy of Digital Technologies. Vladimir is preparing a BOM list.

Mirror grinding. Preparation of PCB. Check the order for the manufacture of metal products.

Несколько тезисов и рекомендаций команде для более эффективной работы.

1. Vladimir passed the exams and is ready to continue working.
2. Arseny added a 3D model with design changes.
3. Vladimir changes the design of the dribbling node. Changes in the design must agree with Nikolai.
4. Michael starts programming microcontrollers.

Journal of current work. Checkpoint December 10th readiness date.

<https://docs.google.com/spreadsheets/d/1qXN14V-KJkKux14Obw75WGMmY5oth1LZ9bK3ToelEzQ/edit>

Consultation log common to both teams (tables on different sheets):

[https://docs.google.com/spreadsheets/d/1gKal33aFAaZ9ydU\\_OatWX1hof7cYDoWeIJ4ftgNBnzQ/edit](https://docs.google.com/spreadsheets/d/1gKal33aFAaZ9ydU_OatWX1hof7cYDoWeIJ4ftgNBnzQ/edit)

Mikhail and Arseny second day at the Academy of Digital Technologies, work with the mirror, try the options. Varnished defective mirror. It went gray.



Cut the layout of the floors on the laser.

On 4 printers set the print parts. 3 mirrors yesterday passed for metallization. They took 3000 rubles. We are waiting for about a week. To finish gears and on Wednesday to try to send in the study for the order of metal. Contracts for batteries and chargers with Vladimir accounts, he will hand over tomorrow. Warranty included. On Wednesday, Mikhail and Arseny pass corrections

Planning the purchase of a set for plating. With sensors began to understand.



13 November 2018

We will go to Dmitry Korolev tomorrow, today we don't have time to finish it. Tomorrow in the morning I will agree on the meeting time, approximately 20:30

16 November 2018

Attention! Tonight on Skype we meet. Each team member assigns his working hours to the week: what item does a team member work on, how many hours will work on this part require?.



21 November 2018

The robot must have a handle to hold for the judges. Navigation this handle will not interfere.

Почему в Dot была убрана ручка? Что принципиально изменилось, что теперь не будет мешать? Камера другая We used to have the first version of the robot Raspberry board and WebCam. Rack 10 mm for WebCam installation.

22 November 2018

Vladimir found a pipe, Michael went and took the pipe. On Saturday, we can assemble and test the entire video surveillance node with a mirror. Tomorrow promise to give ready-made mirrors.

Mirrors are not ready. Production scheduled for Monday. Receipt of finished products is possible on Tuesday.

Increased PCB size required.

27 November 2018



28 November 2018

Mirrors do not provide the required field of view. We must look for the shape of a mirror. We need a mathematical model of the surface of the mirror in the form of a final formula.



Video lectures on work in Altium Designer

[https://www.youtube.com/playlist?list=PLUYH9oDZsrZ25Lv\\_HNp03AzZTBotullIBa](https://www.youtube.com/playlist?list=PLUYH9oDZsrZ25Lv_HNp03AzZTBotullIBa)

We must purchase a tool box.

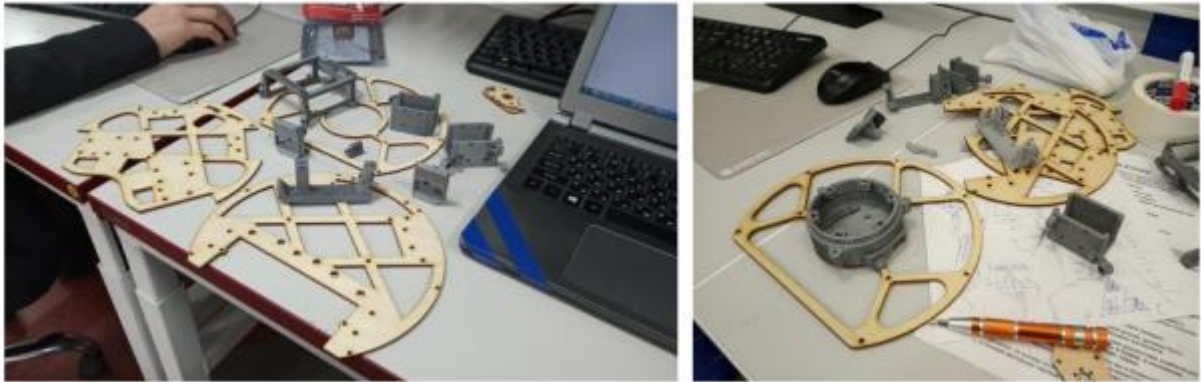
<https://spb.leroymerlin.ru/product/yashchik-dlya-instrumenta-systec-290h300h590-mm-12829203/>





Supply contract with three applications and 3 invoices is ready.

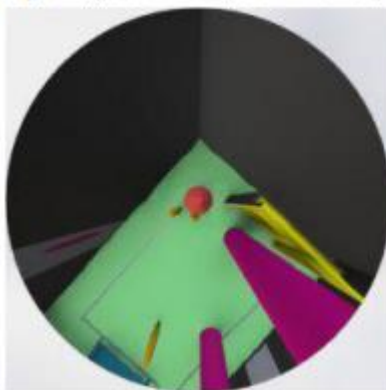
6 December 2018



Plywood levels are cut and almost all parts are printed on a 3d printer. Printing on the other parts printer is in progress. Quality is good.

All parts are ready.

Bought screws, washers, electrical tape.



Parts are metallized. Applying varnish on parts is postponed for two days. Mirrors of another form are transferred to the metallization company.

12 December 2018

Information was received on the readiness of 17.12.17 PCB in Rezonit.

<https://www.rezonit.ru/>

19 December 2018



Русподшипник

<https://www.ruspodshipnik.ru/>

Firm Marshal. Primer and metallization of 2 advanced mirrors. Price 2000 rubles for plating. Friday readiness.

21 December 2018

Fastener and bearings:

6x10x3 - 6 pieces;

7x11x3 - 24 pieces;

6x10x3 - 2 pieces;

4x7x2 - 2 pieces;

6 mm - inner diameter, 10 mm - outer diameter, 3 mm - thickness (mm).

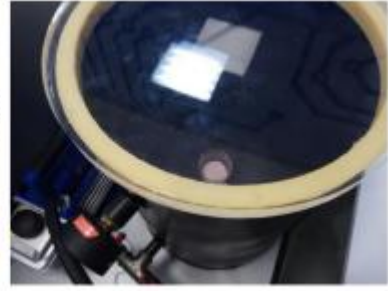
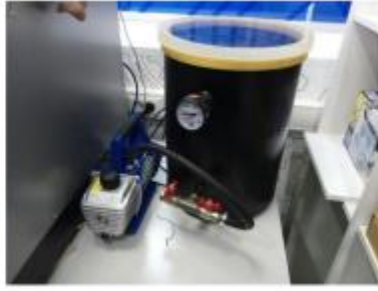
22 December 2018

Next week we will do two dribblers. Arseny repaired and set up his 3d printer. Now it will be possible to print molds for casting silicone parts on it. As well as mounting the drive for the model of the robot.



24 December 2018

Today we received the first batch of components from Elitan Trade LLC. Check components in the evening. Get power of attorney for the rest of the components.



25 December 2018

Plan adjusted.



Bearing list:

4x7x2.5; MR 74-2Z 6 pieces

6x10x3; MR 106-2Z 10 pieces

7x11x3; MR 117-2Z 30 pieces

Bearings should be ordered in Krasnoyarsk.

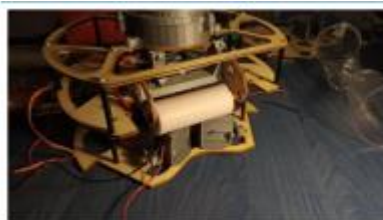
Bearing cost 2800 rubles.

Roller casting for dribbler.



28 December 2018

Today, team members from 13 hours working in the Academy of Digital Technologies. Additionally, 34 bearings are to be ordered. Filling the mold for a dribbler with two shafts designed by Vladimir.





31 December 2018

Mouser Electronics, a distributor of electronic components, has posted on its website a utility for generating elements for CAD programs.

<http://mouser.componentsearchengine.com/pcb-libraries.php>

A similar utility is available on the site <https://www.digikey.com/>

<https://www.digikey.com/en/product-highlight/a/accelerated-designs/ultra-librarian>

PCB test, sensors test (current test). Dribbler and bearings test.

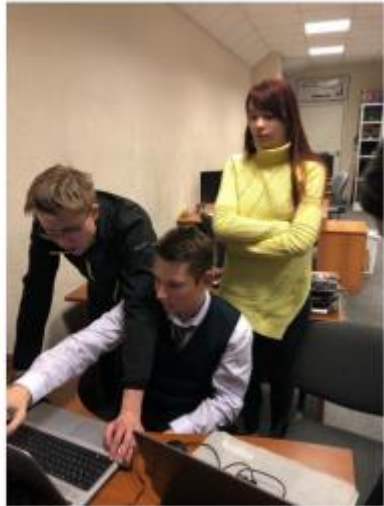
1 January 2019



13 January 2019

Altium Designer provides a library of electronic components from various manufacturers, recorded in 2010. After 2010, the library of components in the public domain is not available.

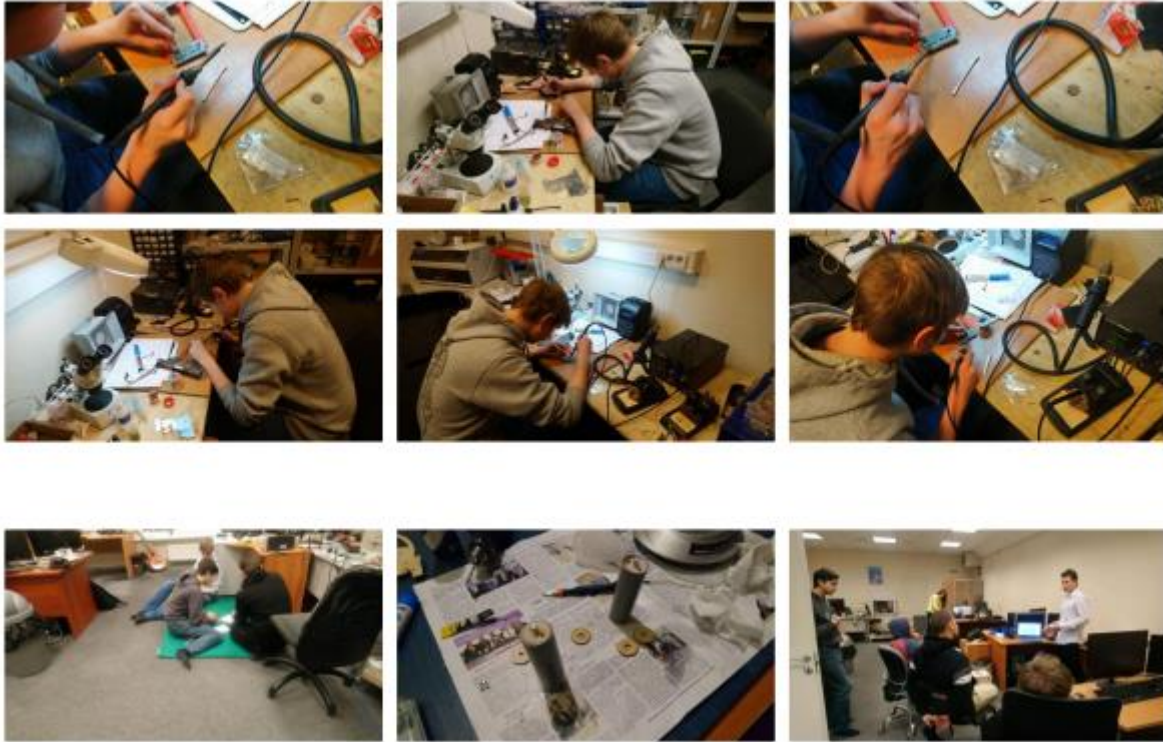
15 January 2019



28 January 2019



30 January 2019



Terms of Reference for English classes prepared (preparation for RoboCup).

3 team members, each must make up 10 sentences in English.

Sentences should not be repeated. Distribute between members of the team 15-20 questions in English. Answers to questions should be in the speeches of each team member of 10 sentences. Deadline - February 9. Learn 10 sentences in Russian and in English. Send videos before February 9 for evaluation.

Mirrors and mirror documents are ready. We can check mirrors. Demonstration of files ready PCB to Vladimir Korolev.



31 January 2019

Arseny completed the sensor PCB. Michael needs to finish the motherboard PCB. Vladimir is preparing a draft layout for mounting the dribbler shaft with bearings from below. The field of view of the mirror does not cover the entire field. Recalculation of the mirror shape is required.

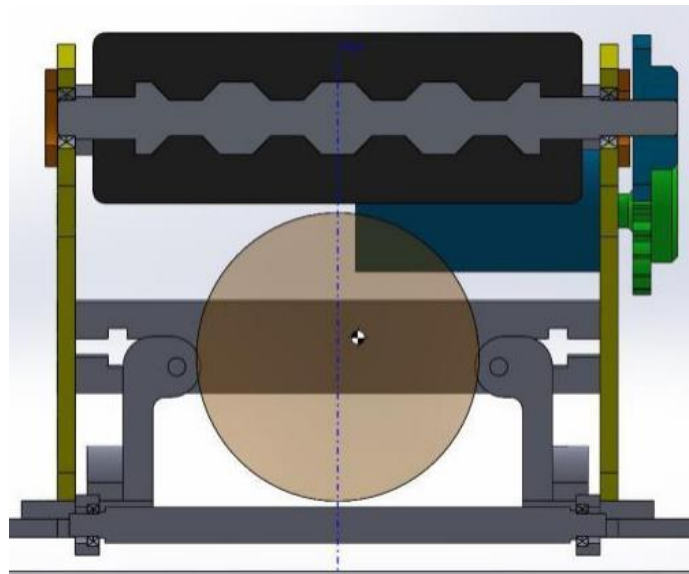
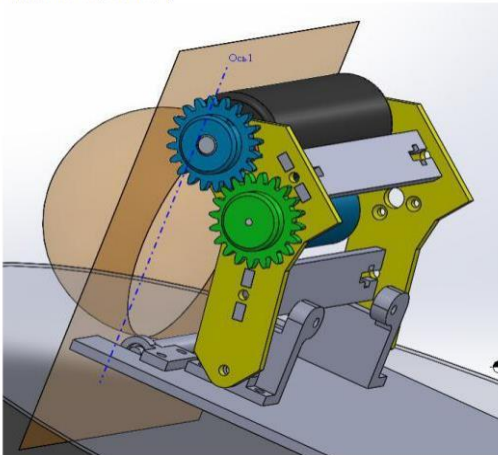
Check the weight of the robot. Order of metal products.





4 February 2019

image\_2019-02-08\_00-28-52.png  
Not included, change data exporting settings to download.  
image\_2019-02-08\_00-29-17.png  
image\_2019-02-08\_00-30-07.png  
image\_2019-02-08\_00-30-30.png



Parts made for two dribbling layouts. Michael continues PCB layout. Vladimir and Arseny check two options of dribbler. With two shafts with a diameter of 10 mm and 30 mm.

Silicone roller with a outer diameter of 10 mm. It is required to improve the quality of the test stand.

One faulty chip driver replaced in the store. Requires additional verification of the sensor board PCB.  
Fix silkscreen printing on the motherboard PCB.

Gerberfiles are stored for order in Rezonite PCB.

7 February 2019

Mikhail and Arseny must provide the files of printed circuit boards without errors for transfer to the manufacture.

9 February 2019

Final check of PCB files. Michael - a detailed plan for programming. Arseny completed work on the PCB. Tomorrow we order the manufacture of PCB.



[https://docs.google.com/spreadsheets/d/1mf9DS6HC3xr8FWCwjpGT\\_2dOxz7S1v\\_M2BqMpNJ\\_aWHM](https://docs.google.com/spreadsheets/d/1mf9DS6HC3xr8FWCwjpGT_2dOxz7S1v_M2BqMpNJ_aWHM) <https://drive.google.com/open?id=1nSeDZXVdRkvd--3WxEUdsur34CxaVRwf>

13 February 2019

The order of printed circuit boards in Rezonita is adjusted for accuracy.

14 February 2019

Добрый день!

Платы по Вашему заказу N 1097093 запущены в производство.

Статус оплаты: оплачено.

Срок изготовления: срочный

№	Наименование	Единица измерения	Количество	Объем заказа (шт.)	Срок изготовления (дней)
1	Матрица	шт.	1	1	10
2	Матрица	шт.	1	1	10
3	Матрица	шт.	1	1	10
4	Матрица	шт.	1	1	10

Список производителей многослойных печатных плат

1. Компания, производящая печатные платы

2. Компания, производящая печатные платы

3. Компания, производящая печатные платы

4. Компания, производящая печатные платы

5. Компания, производящая печатные платы

6. Компания, производящая печатные платы

7. Компания, производящая печатные платы

8. Компания, производящая печатные платы

9. Компания, производящая печатные платы

10. Компания, производящая печатные платы

С уважением, Резонит  
[www.rezonit.ru](http://www.rezonit.ru)  
+7 (495) 777-80-80

Accuracy class 4.

15 February 2019

Gum wheels are not delivered. Dribbler test.

17 February 2019

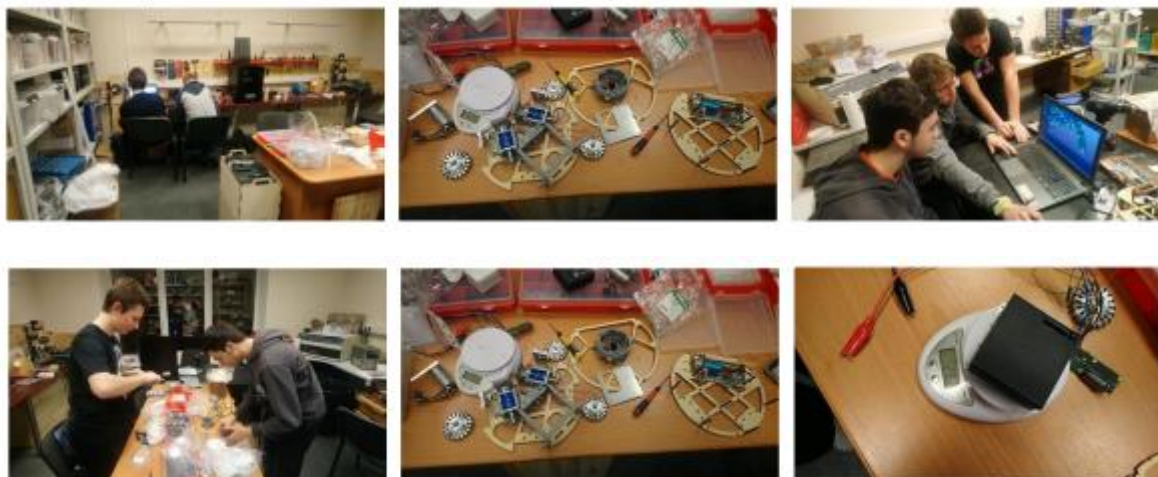
DC motor broke. With the other DC motor everything works.

The motor was disassembled, the cause of the malfunction is a poor-quality assembly. Poor workmanship - the cause of the anchor winding.

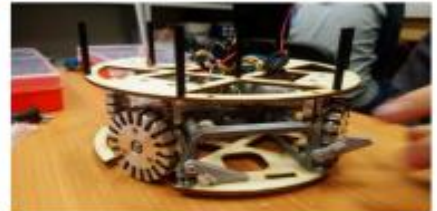
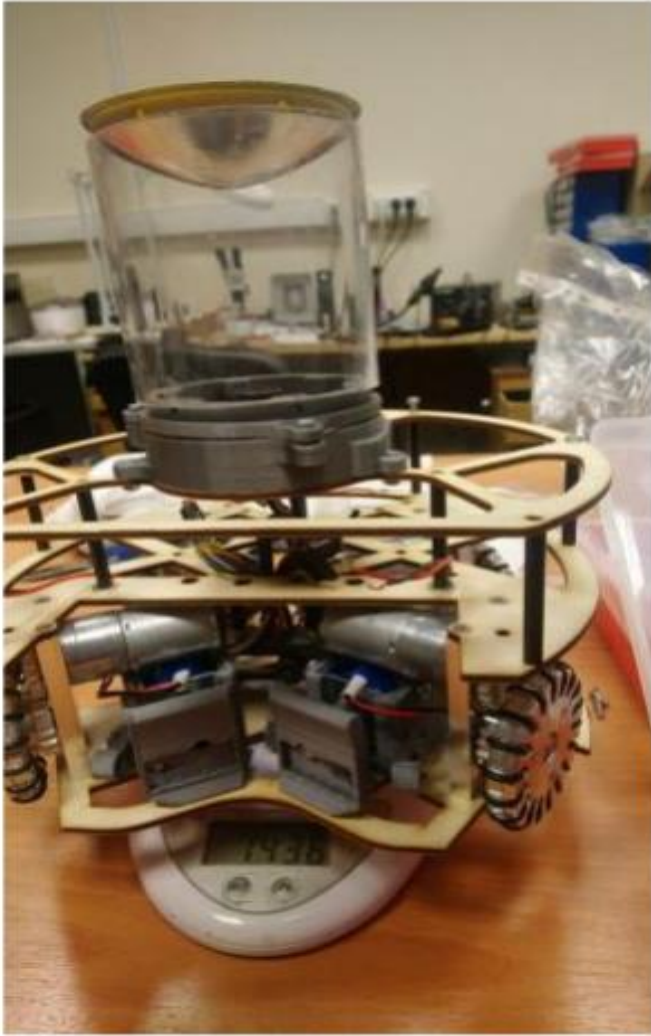
It is necessary to purchase motors with a reserve by quantity.



The ball jumps harder



There is no 14 volt voltage supply on the sensor board. Changes in the PCB design. Preparation of the correct edition of circuit diagram and PCB. Metal parts and a mirror should be ready by Friday.



23 February 2019

Today we sorting components

24 February 2019

Component delivery completed. Prepared for installation and assembly work. Mounting wires purchased. Begin to crimp cable lugs on the installation wires.



The lengths of the wiring are determined.

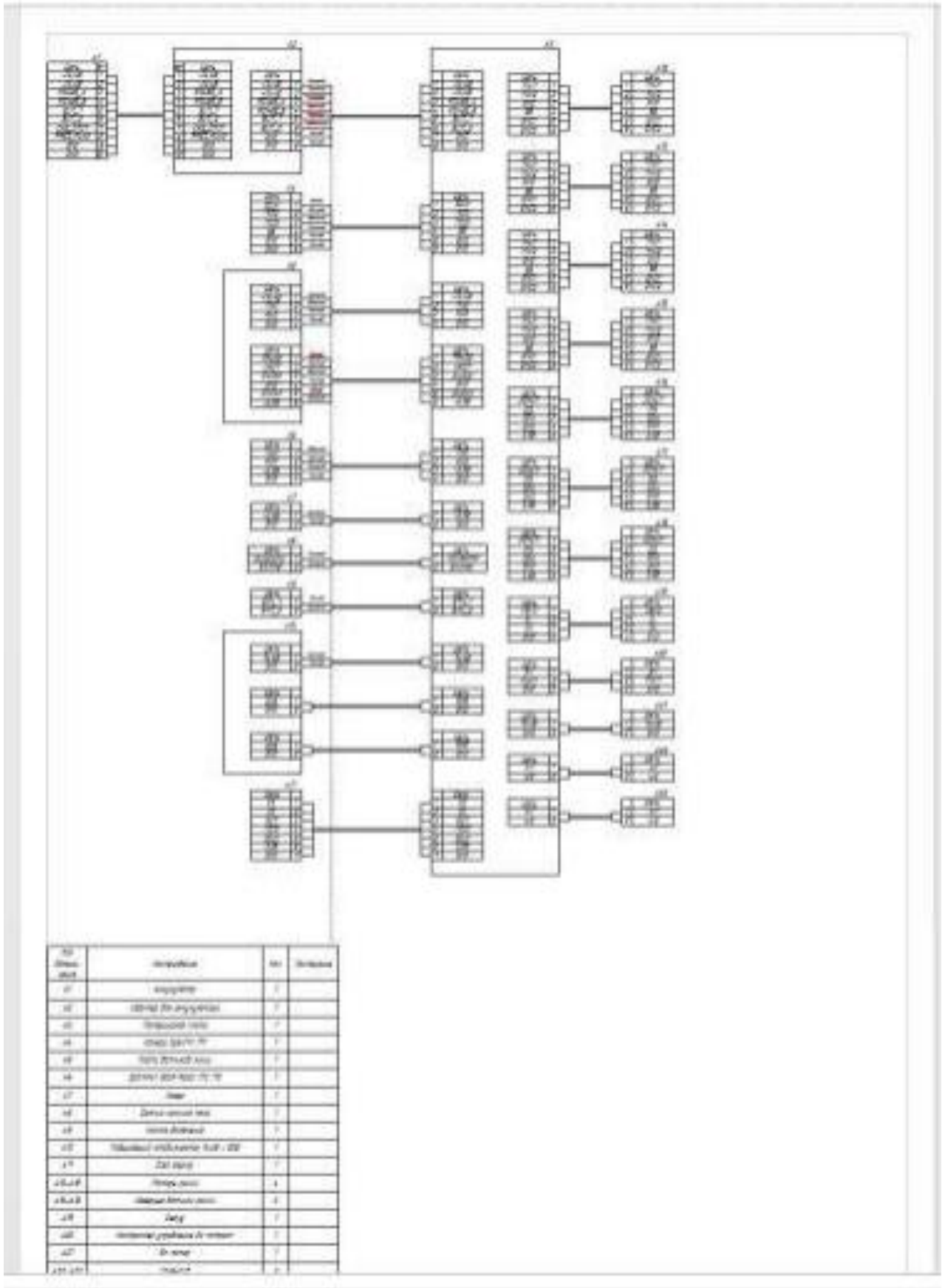


Fig. Wiring diagrams

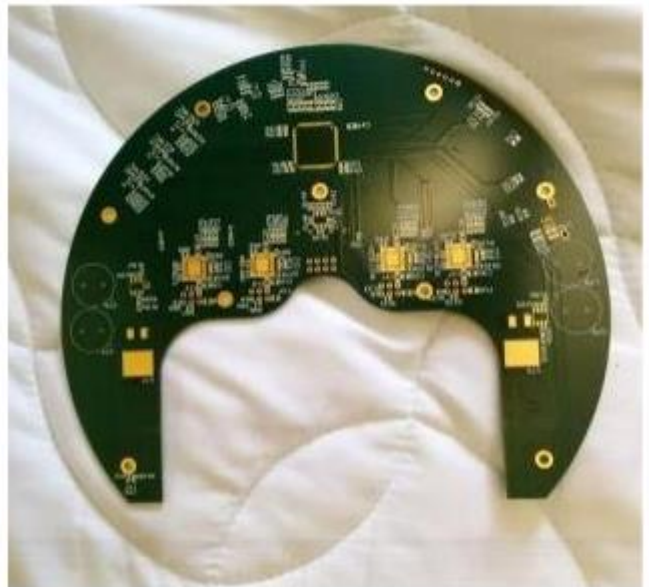
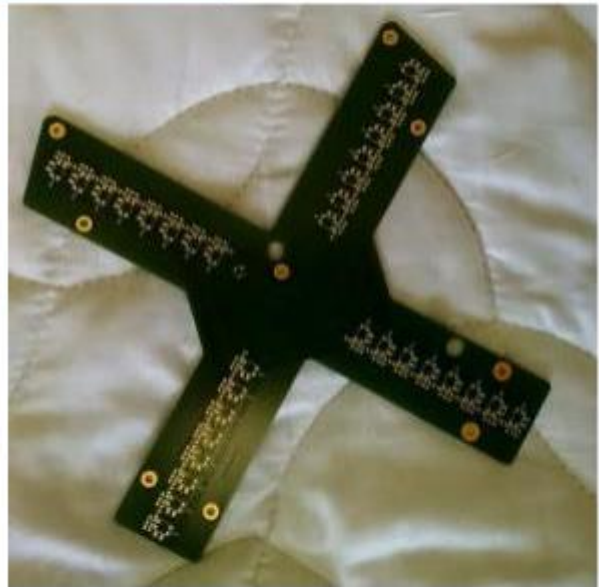
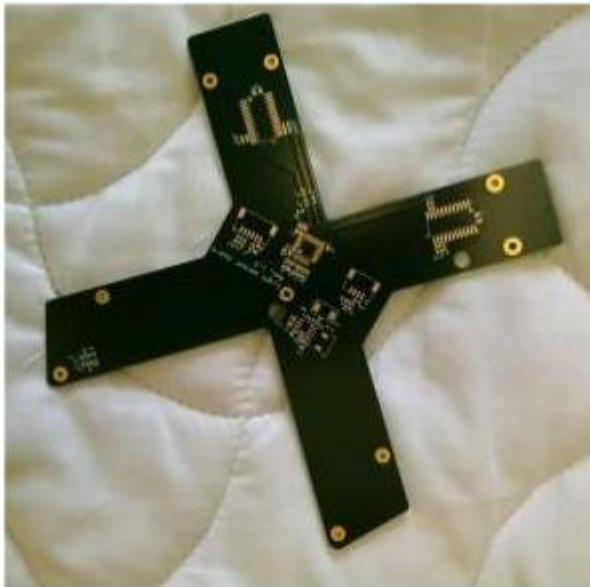
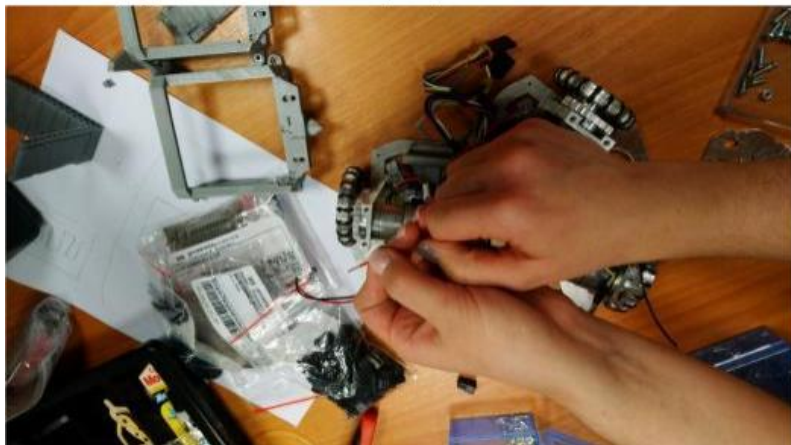


Fig. Printed circuit boards.



Heat treatment of printed circuit boards. Open, gently put in the oven, close, bake for 2.5 minutes.



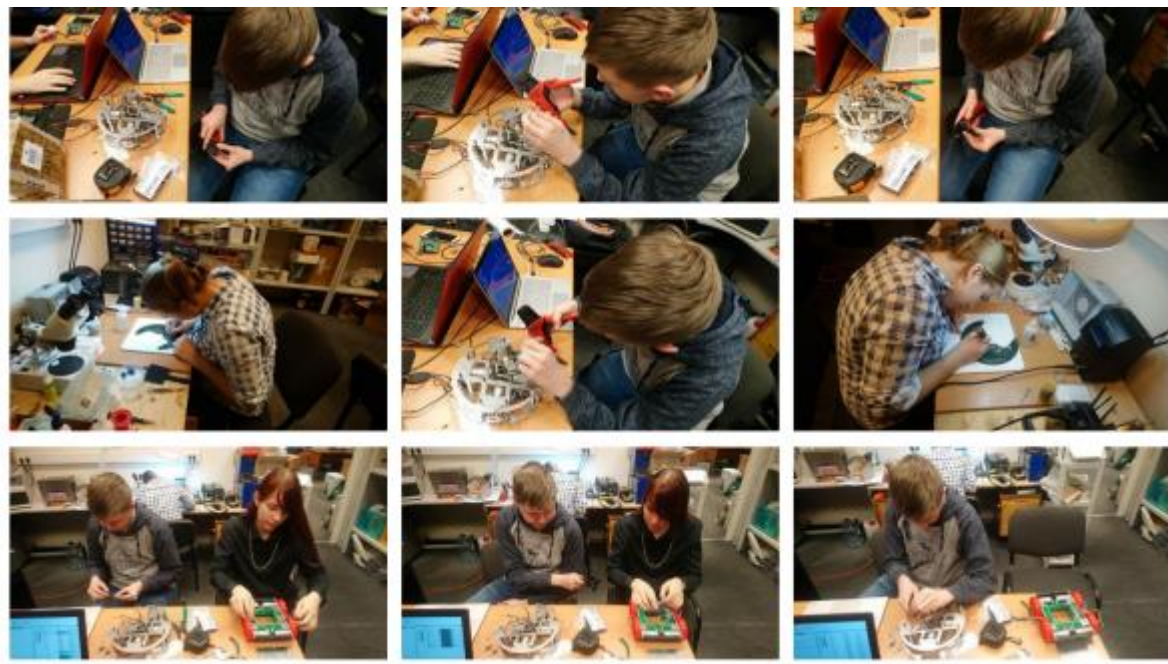
28 February 2019

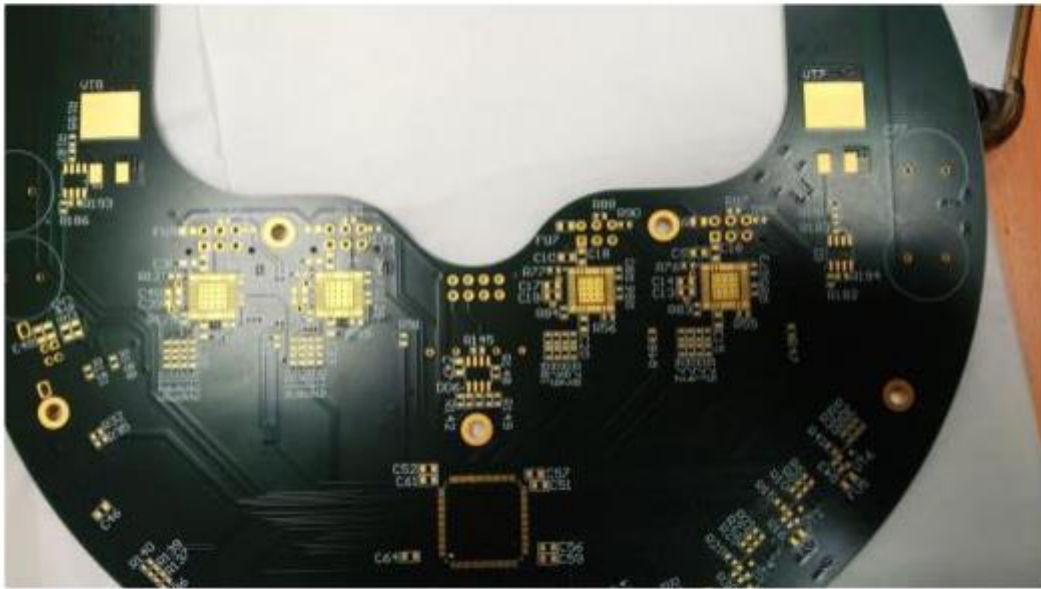






Washing of printed circuit boards is carried out in an ultrasonic wash bath.





1 марта 2019

On Saturday, we finish crimping the installation wires with cable lugs. Verification of drawings, wiring diagrams, materials and tools.



6 марта ждём последние компоненты из Элитана.



3 March 2019



4 DC motors reversal check.

tx



Wire marking. Black land, red food, white rx, yellow

Michael is debugging a gyroscope.

Vladimir solders and connects the videocam.



Arseny collects and puts dribbler.

4 March 2019

Dribbler: DC motor power is insufficient to create the desired torque. You should also change the gear ratio of the gearbox.

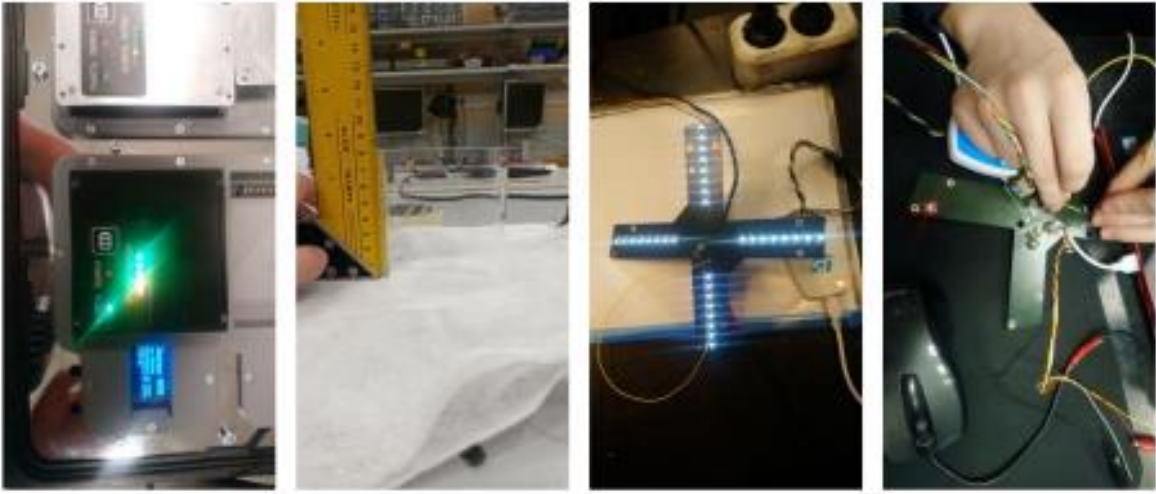


Sensor board not working yet: need to correct mistakes.

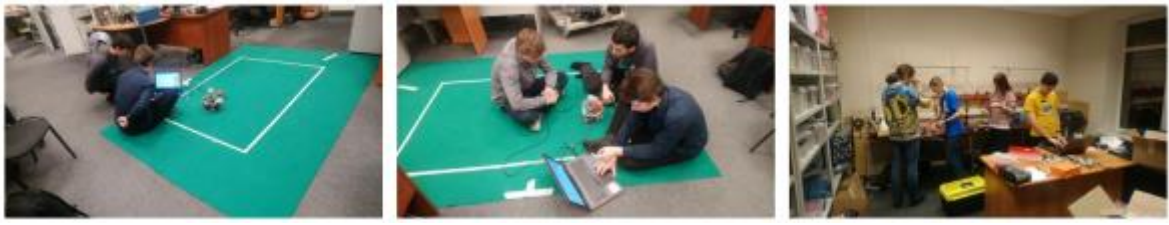
Выпаиваем, припаиваем.



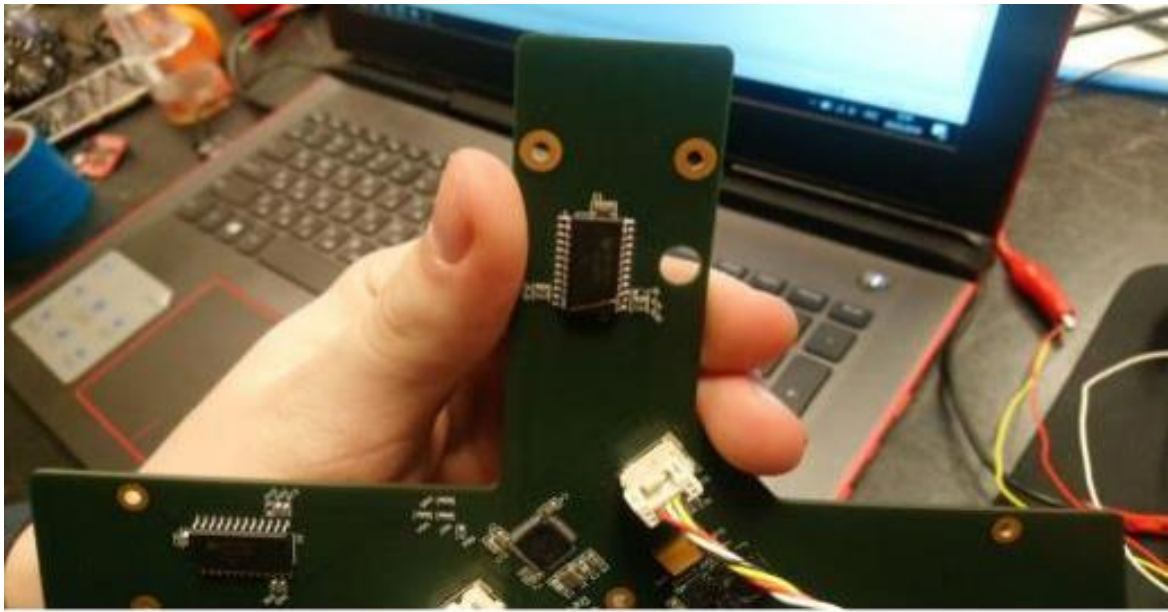
Motherboard: DC motor working. Need to test other nodes. Sensor board correction.



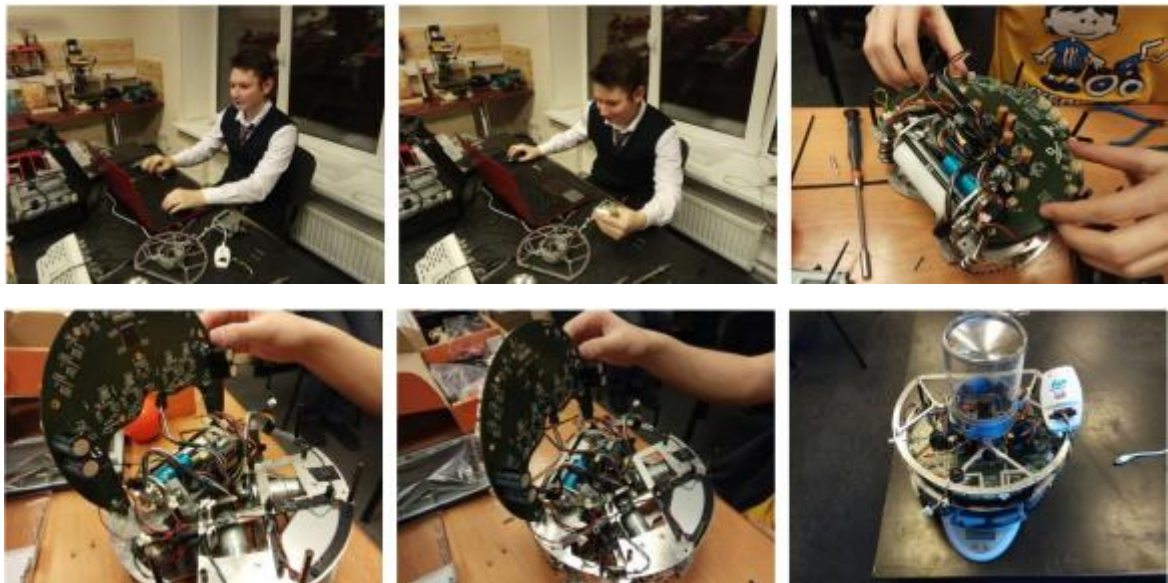
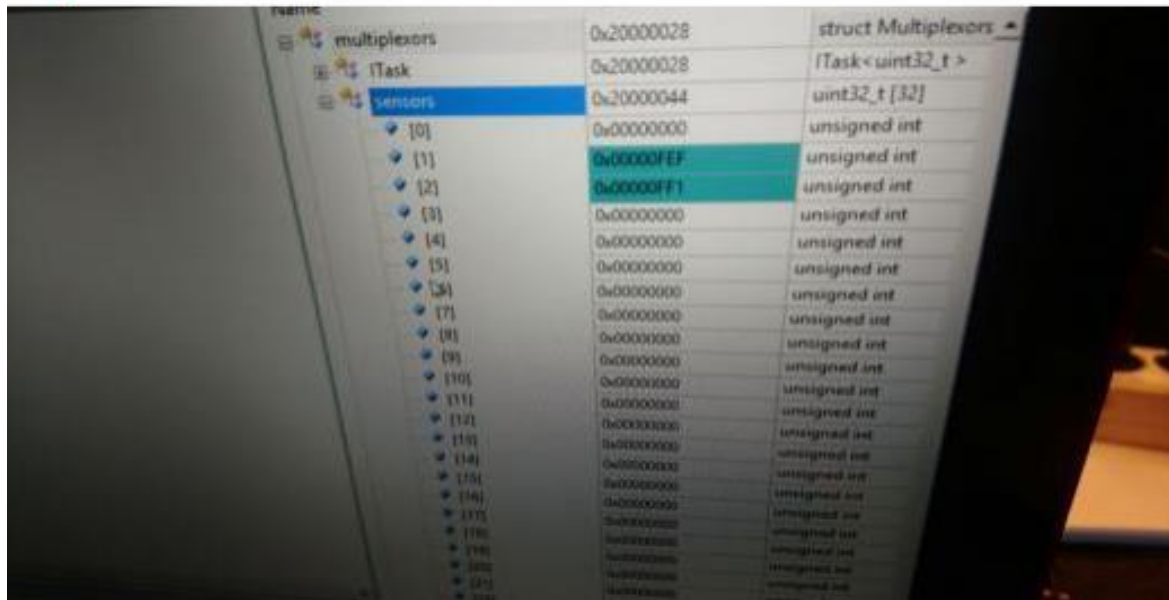
5 March 2019

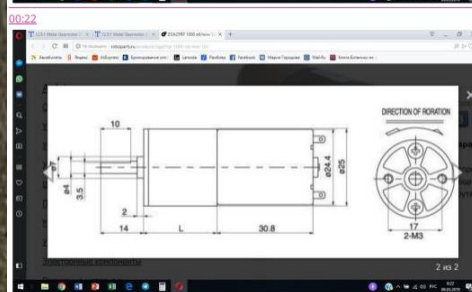
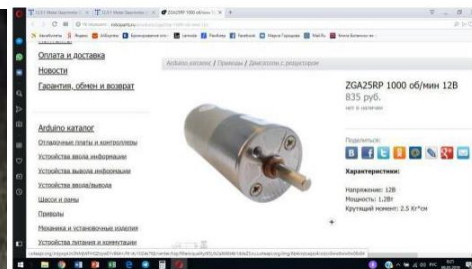


6 March 2019  
Multiplexer earned.



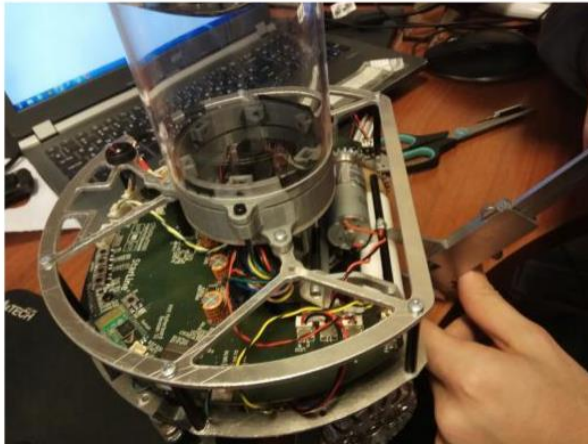
10:21





Selected suitable DC motors for driving the dribbler.





It is necessary to manufacture gears that will provide the required gear ratio of the gearbox.

10 March 2019

Salesorder 1J368574

Thank you for ordering from Pokol! You will receive an email confirmation when your order ships. Please print this page for your reference and contact us if you have any questions about the order.

<b>Order by:</b> Vina Ignorova Nikolovna Name: Aleya Potkarpova, 2 Flat 223 Saint Petersburg, Saint Petersburg 197341 Russian Federation +7(811)-237-94-78 vinaign@mail.ru	<b>Ship To:</b> Same as order	<b>Bill To:</b> customer Arsenii Markovich Iarmolinski Name: Aleya Potkarpova, 2 Flat 223 Saint Petersburg, Saint Petersburg 197341 Russian Federation +7(811)-237-94-78 vinaign@mail.ru						
<b>Order date:</b> 20 Mar 2018	<b>Customer Purchase Order:</b> 12240558	<b>Other Reference Numbers:</b> 7700101874979	<b>Customer Tax ID:</b> 1	<b>Payment Terms:</b> Statement ending in 2018				
<b>Ship Via:</b> USPS First-Class International		<b>Shipping Terms:</b> included in invoice		<b>Sales Rep:</b> NA, web order				
Order Line	Ordered	Canceled	Item Number	Item Description	Shipped	Back Order	Unit Price USD	Extended Price
1	4	0	3201	4.4:1 Metal Gearmotor 250mAh, rpm 187 52V	0	0	21.95	87.80
2	4	0	3202	8.7:1 Metal Gearmotor 250mAh, rpm 187 52V	0	0	21.95	87.80
<b>Subtotal:</b>								175.60
<b>S &amp; H:</b>								50.45
<b>Tax:</b>								0.00
<b>Total:</b>								\$206.05

DC motors ordered at rated speed 1000 rpm and 2000 rpm. (provide better ball retention).

It is necessary to maintain the number of spare parts DC motors.

Preparation of text documentation:

Arseny - Hardware (equipment, mechanical, electrical parts of the robot)

Michael - Software (robot software)

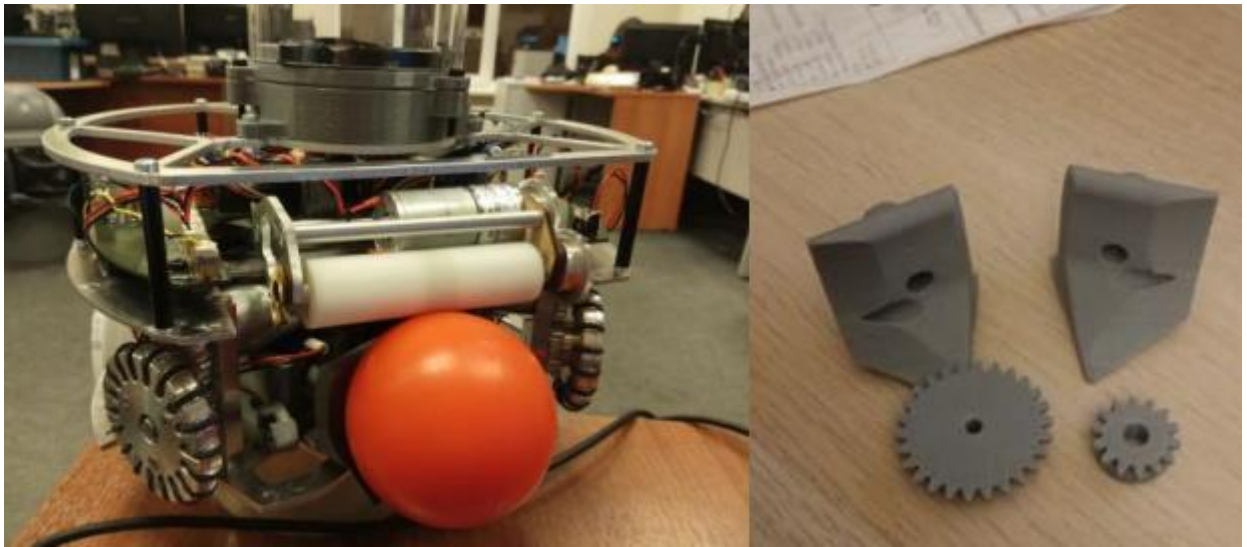
Vladimir - Strategy (how the robot solves the problem)

12 March 2019

The robot went! We make the order of the corrected boards and components. Demonstration performance at the Kirov factory tentatively on April 1-3. Must be a full game with 2 football players.

Transfer of draft design documentation.





17 March 2019

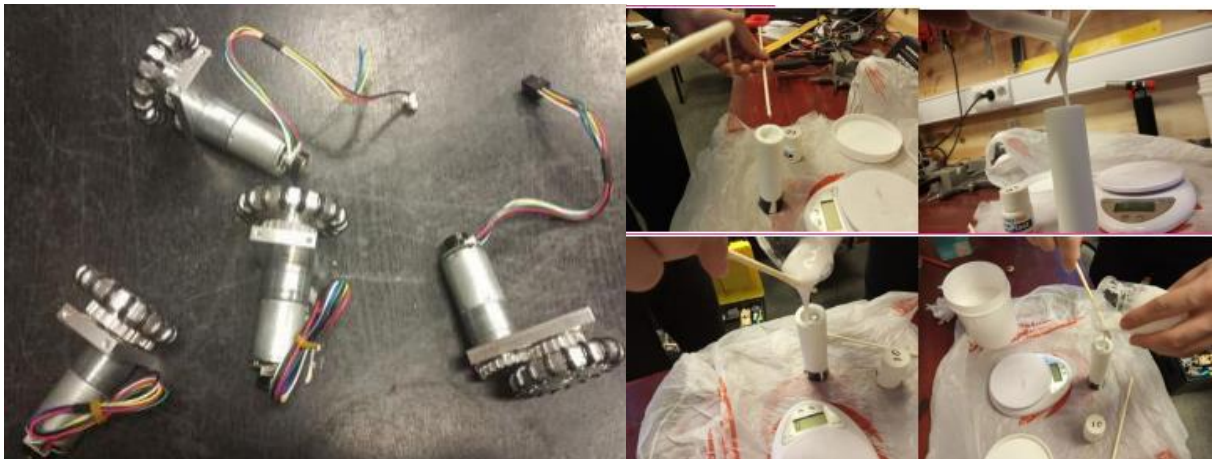
No ball grabbing. Dribbling bad.

20 March 2019

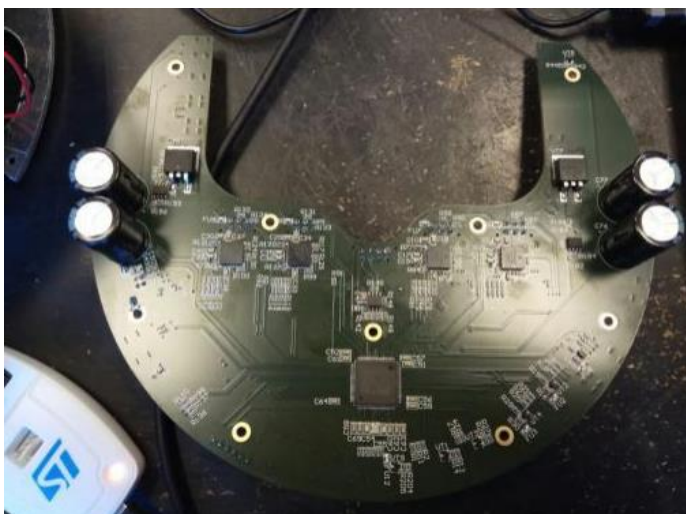


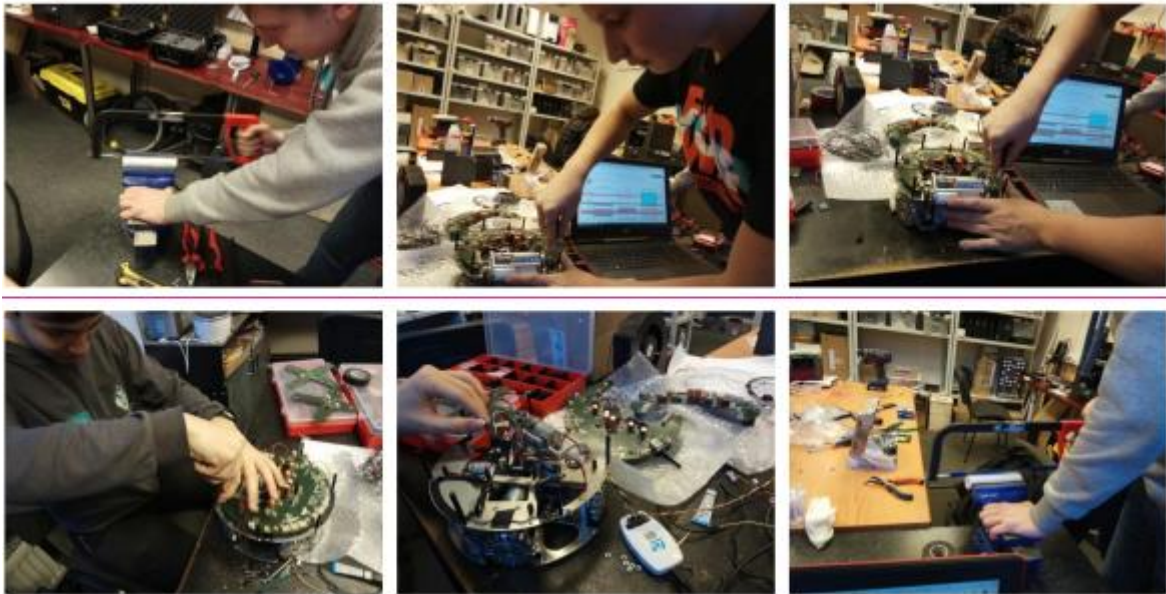
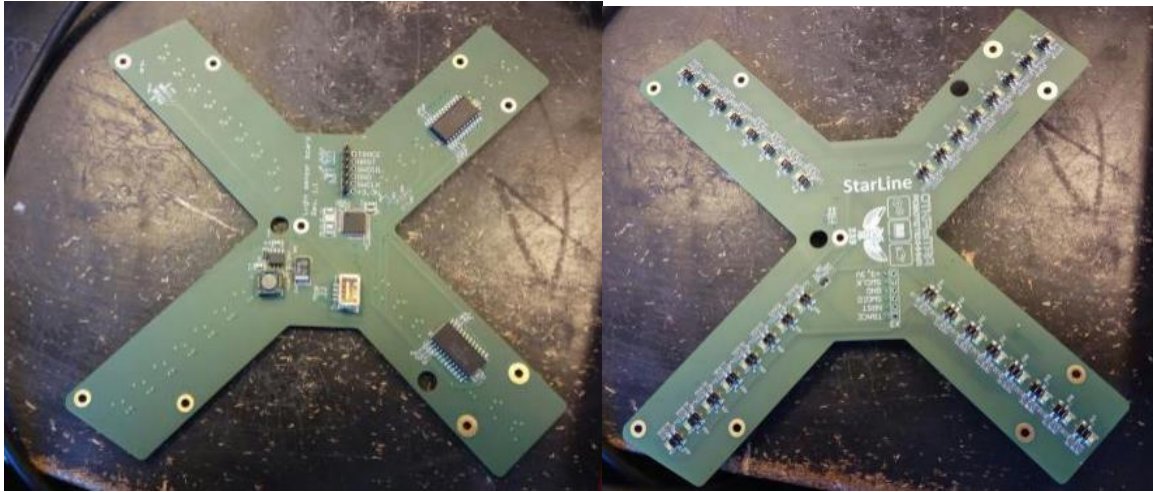
New edition of printed circuit boards ready.





Mikhail, Vladimir, Arseny - pick up all the components for soldering PCB boards.



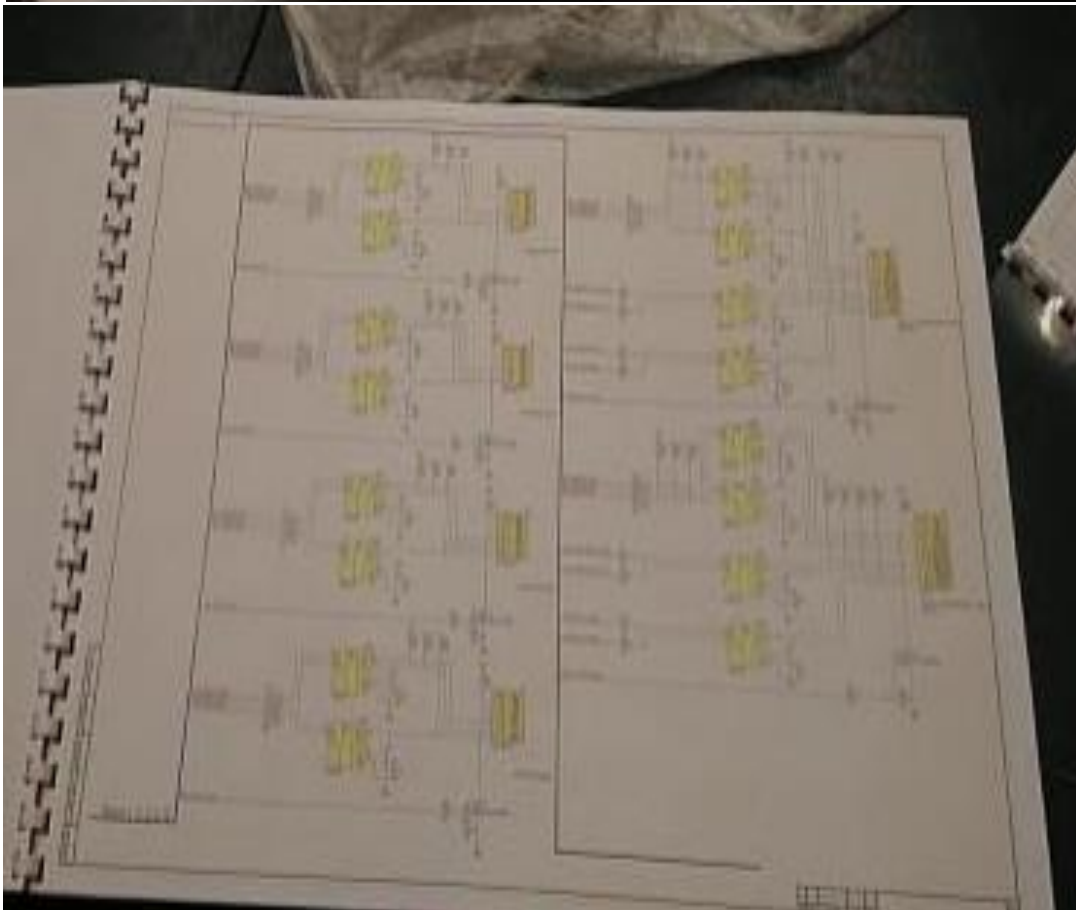
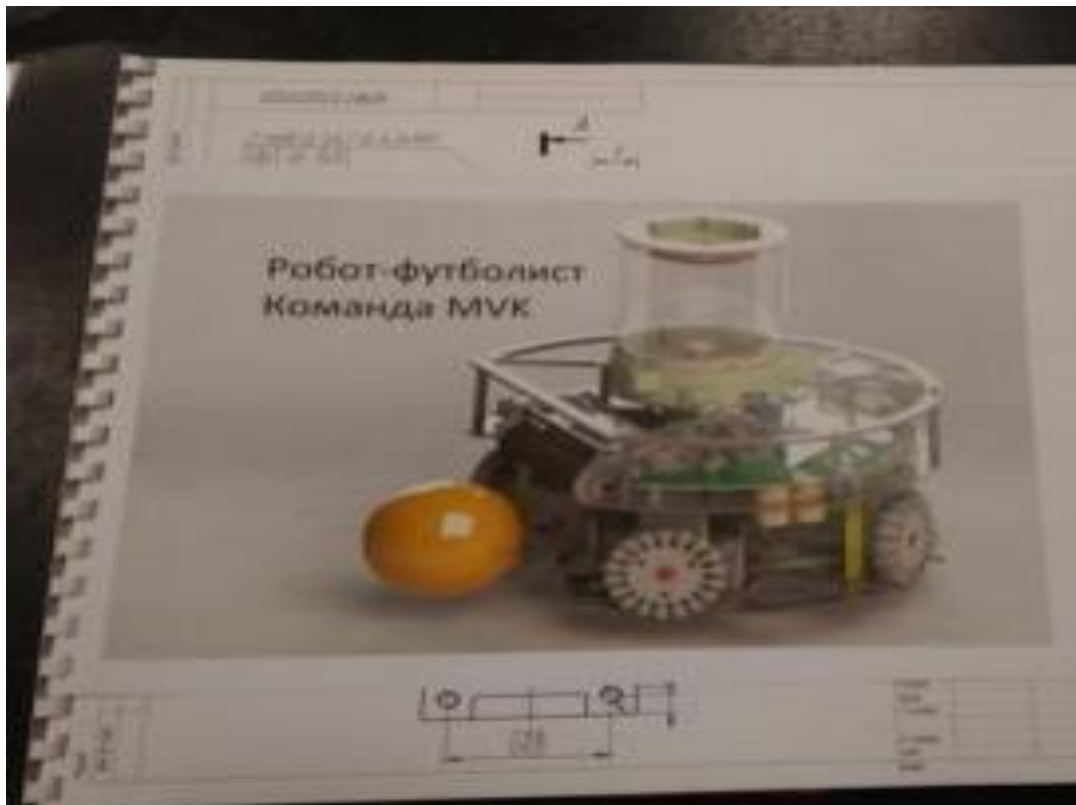


25 March 2019



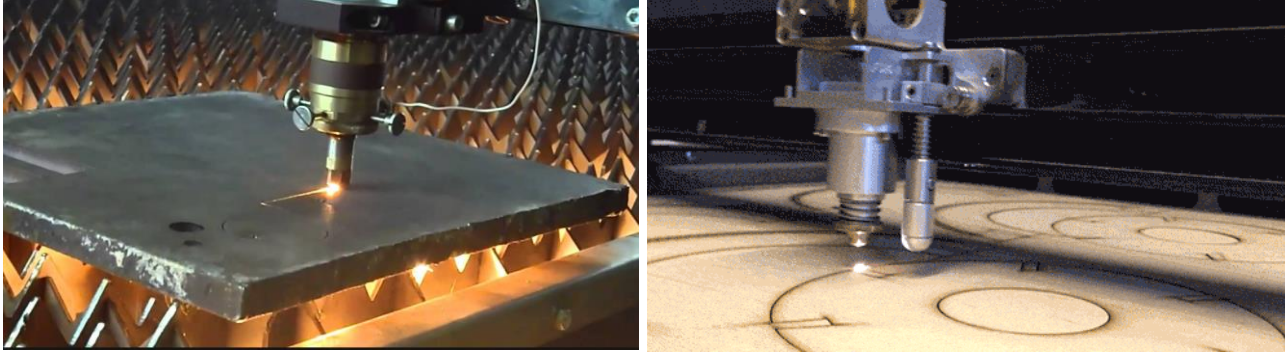
Trial wiring.

Wednesday 2nd robot must be assembled.



Created a technical description of the robot.

# Manufacturing technology and software



## Manufacturing technology, IDE, CAD and CAM software.

- Keil uVision 5 IDE - programming
- Solidworks - 3D modeling
- Altium Designer 18.7 – PCB layout
- ArtCam – software for milling products
- Cura – to prepare a 3D model for printing on a 3D printer
- RW Works – laser cutting software

# Work with other teams

We consulted several teams that helped resolve some issues with iron:

Kepler, the team won the first place in the younger age category in football at Robocup Russia Open 2017, participated in the world stage in 2017 in Japan;

Uran 239, team won first place in the older age category in football at Robocup Russia Open 2017, participated in the world stage in 2017 in Japan;

Samovar, team won first place in the RoboCup Junior Rescue Maze at Robocup Russia Open 2017, participated in the world stages of 2017 and 2018 in Japan and Canada, now it's the MK team;

«Sadrarobot6», Iran, which participated in world stages in Japan and Canada, now it's a VCC team.



# Acknowledgments

Our team would like to thank:

Director of the Presidential Physics and Mathematics Lyceum No. 239 Maxim Pratushevich and teachers, who helped us create our robots:

Sergey Filippov and Daniel Vedenin,

RTK experts:

Dmitry Korolev,

Anatoly Logachev,

Nikolay Kitayev.

We would also like to thank the sponsors: the Temur Aminjanov Charitable Foundation Finist, Kirovsky Zavod OJSC and the Anabasis Foundation for the Support of Classical Education.