Center for robotics
Physics-Mathematics Lyceum 30

Engineering book of
Competition First FTC

Team PML30 –*X*

PTC®

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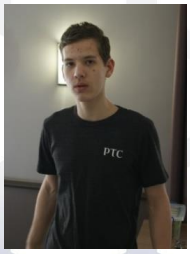
Saint-Petersburg, Russia
2015

Team PML30-phi

Physics and Mathematics Lyceum №30, Saint-Petersburg, Russia



Georgiy Krylov
Captain, responsible for efficiency of working in the team

Evgeniy Maksimyshev
Operator №1, engineer, responsible for programming

Nikita Safronov
Operator №2, engineer, responsible for technical documentation

Ivan Fokin
Engineer, responsible for purchasing materials

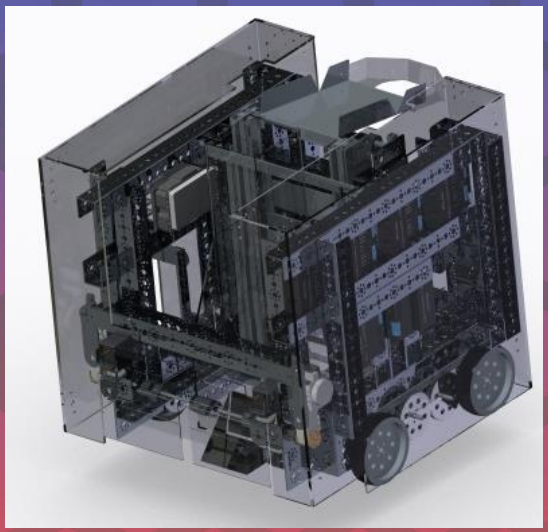
Maksim Radionov
Engineer, responsible for public relations

Strategy(number of scoring points is noted in brackets)**:**

1. Autonomus period (2 options):
   1.1. Riding out from the ramp, scoring autonomus balls into 60 and 90 cm rolling goals and delivering them to the parking zone. (**120**)
   1.2. Start from the parking zone, scoring autonomus balls into 30 and 90 cm rolling goals and delivering them to the parking zone. (**100**)
2. Driver control period: carrying 90 cm rolling goal and filling it with balls (**200 - 270**). During end game scoring 4 big balls into central goal(**180**) or delivering rolling goals to the ramp (**120**).

Construction features(numbers of following pages in engineering notebook is noted in brackets)**:**

1. Strength:
   1.1. Most of construction elements are made of metal (aluminum or steel).
   1.2. Elevator works stable, because it is made of furniture rails. (pages 27 and 41)
   1.3. Robot is heavy, so it's hard to turn it over.
   1.4. Robot is protected from collisions with Plexiglas.
2. Mobility:
   2.1. Robot has 6-wheel drive. Six motors and gear 2:1 for speed provide maximum power and maneuverability of moving. (page 198)
   2.2. With standard TETRIX omniwheels robot easily turns, and because of special construction it has no problems with riding up to the ramp. (pages 169 and 200)
3. Balls control:
   3.1. Gripper for balls consists of two fast rotating vanes. (pages 26, 122 and 176)
   3.2. The bucket for balls rises up with elevator and overturns backwards. (pages 103 and 178)
   3.3. Balls from the bucket move to the guide with hole at the end of it. Balls fall down from the hole vertically, so they always get into the goal.(pages 82 and 108)
   3.4. Robot captures the rolling goal with a special mechanism and carries it with itself. (pages 124, 202)



We thank our sponsors:

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1 Team PML 30 –X

Team PML 30 – X was assembled in September 2014 in the Russian city of St. Petersburg from 3 novices and 2 participants with experience. Tasks and roles were distributed among the participants, and we established safety rules. In the first place the team put spreading principles of gracious professionalism to others. All decisions were made collectively inside team with discussion to find the most optimal solutions. During the year we took part in many events and everywhere we have tried to attract attention to our team and encourage people to take part in FTC. Also we pursued and distributed the principles of honorable professionalism. Talking to the press, we hoped to attract more attention to our team and to the competition in general, as well as attracting sponsors. The latter was important because of the need for funds - purchasing materials and equipment costs a lot. The team took part in the three qualifying competitions and in the regional finals. In all of them we made new contacts, shared experience and provided mutual assistance to other teams. In the first qualifying rounds in Sochi we met Stuy Fission 310 from USA and maintain contact with them to this day. On regional finals, we met with a team from Romania, Auto Vortex, and keep in touch with them through Facebook. Also, there is an active group chat with a large number of Russian teams. You can find the team page in Facebook at the address https://www.facebook.com/pages/FTC-team-PML30-PHI. To increase the efficiency of our team work we used the version control system GitHub, which allows the entire team to work simultaneously on a single projects without losing files and providing easy way to resolve roblems. Also for writing technical books we been used professional typesetting system LaTeX.

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1.0.1 Instructors

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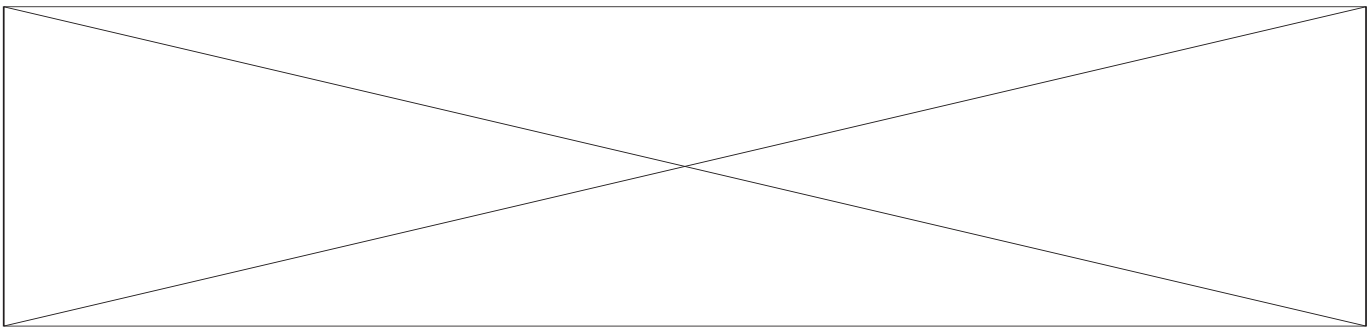
Luzin Dmitry
Head of Robotics Department in Phys-Math Lyceum 30, Saint-Peterburg, Russia. Main coach of FTC team.
Information: 25 years old, in robotics 5 years, in FTC 3 years.

Luzina Ekaterina
Professor of Robotics Department in Phys-Math Lyceum 30, Saint-Peterburg, Russia. Tutor of FTC team.
Information: 25 years old, in robotics 5 years, in FTC 3 years.

Fedotov Anton
Professor of Robotics Department in Phys-Math Lyceum 30, Saint-Peterburg, Russia. Tutor of FTC team.
Information: 22 years old, in robotics 4 years, in FTC 3 years.

Krylov Georgii
Professor of Robotics Department in Phys-Math Lyceum 30, Saint-Peterburg, Russia. Tutor of FTC team.
Information: 18 years old, in robotics 4 years, in FTC 4 years.



1.0.2 Team members

Ivan Afanasiev
Role in team: operator-1, decorating robot, Power Design, responsible for the debris collecting system.
Information: 16 years old, in robotics 2 years, in FTC 1 year.
Why I chose FTC:

Victoria Loseva
Role in team: communication with other teams and community, operator-2, responsible for the chassis.
Information: 17 years old, in robotics 2 years, in FTC 1 year.
Why I chose FTC:

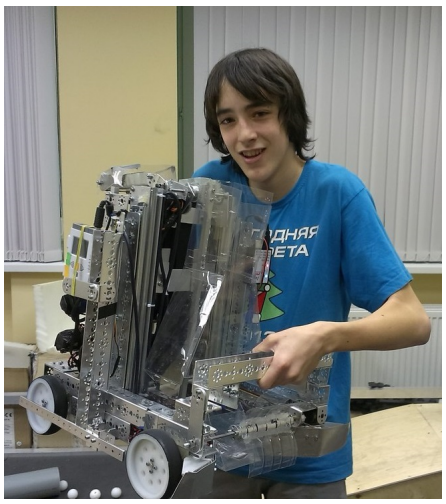
Nikita Safronov
Role in team: captain, reserve operator-2, responsible for the writing of technical book, responsible for mechanisms for scoring climbers.
Information: 17 years old, in robotics 4 years, in FTC 2 years.
Why I chose FTC: "I have chosen FIRST because I enjoy working with mechanisms and finding unusual technical decisions for solving problems. Also working on this project helps me to get new skills in a sphere of engineering. In this case I know, that I don't spend my time in vain."

Evgeniy Maksimychev

Role in team: reserve operator-1, responsible for the safety precaution, responsible for the writing of technical book, responsible for the elevator and bucket.

Information: 16 years old, in robotics 3 years, in FTC 2 years.

Why I chose FTC: "This is an interesting project that allows to implement some innovative solutions. In addition to the skills of designing robots, we also obtain the skills of the technical documentation and communication with colleagues which makes this competition as close to real engineering problems."



2 Thanks and prospects

We enjoyed working on a custom and non-standard project, which, besides its technical aspect, included working with new people who shared our values of friendship and mutual understanding.

Our team is planning to continue doing robotics, setting new goals for ourselves in order to improve. This is our first year taking part in FTC and we will participate next year as well. If we don't realize ourselves this year, we'll look at all our mistakes, correct them, and preform a lot better next year.

In any case, we are ready to learn new things, improve ourselves and expand our skills.

None of us know for sure what we want to do in the future, but we are certain that our experience will be very valuable to us.

Our thanks go to the company FIRST for organizing this competition, which we are very happy to be participating in. We appreciate this wonderful opportunity to test ourselves and learn something new and wish them success and growth in their future endeavors.

Also we thank our sponsors: company PTC and it's Russian representative "Irisoft"and charitable foundation "Finist"for their support. Also we thank Physics-Mathematics Lyceum 30 and it's director Alexey Tretyakov for providing comfortable conditions for preparation to competition.

Team PML 30 φ

3 How to read this book

4 Appendix

4.1 Program

4.2 Supplementary materials which were used in the robot's construction

1. Aluminium axis 1m x 8mm. 2 pieces.
2. Steel axis 3m x 8mm. 1 piece.
3. Aluminium strip 2m x 50mm x 2mm. 1 piece.
4. Aluminium strip 1m x 40mm x 3mm. 1 piece.
5. Aluminium profile 1m x 10mm x 10mm. 1 piece.
6. Furniture slats 30cm. 2 pieces.
7. Furniture slats 35cm. 4 pieces.
8. Belt 2,5m. 1 piece.
9. Plastic clamps.
10. Plastic bottle. 1 piece.
11. List of PET 1 m x 80 cm. 1 piece.
12. Hot melt adhesive.
13. Tape.
14. List of plexiglass 3m x 2m (cut). 1 piece.