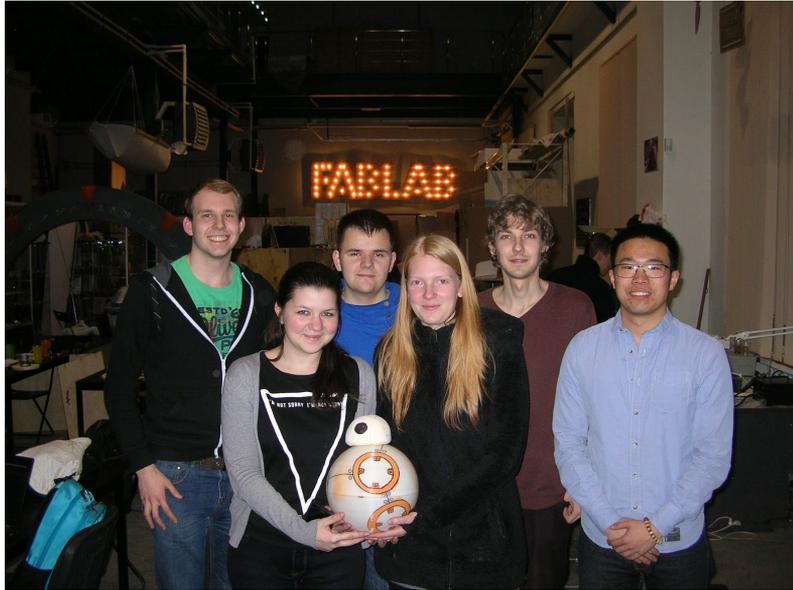


Report on the International Design Project - Team D - BB8

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Picture taken in FabLab

The purpose of this report is to give an overview of both official and unofficial parts of International Design Project 2016 and to make suggestions on its future improvement.

The main idea of International Design Project is to provide the students with an opportunity to create a real prototype out of their own idea which is something a lot of university projects lack. So we would like to go step by step in analysing our own experience of creating something with an international team.

The first meeting and the decision

The first official meeting of our full team was a skype conference at the 18 of March. Our team, as each team in this Project, consisted of three german and three russian students. Before that skype conference, team members from one country had met separately to get first information about the actual working process during this project, the making of the visas (for german students), and also to think about project ideas.

The reason why we all participated in this Project was that it was a real chance not only to think about our own ideas but also, and more importantly, create

something, build a prototype using appropriate tools. For the half of us this Project was the first experience of engineering creativity that ended up in a real prototype, not just scheming and calculating.

During the first meeting we had to decide altogether what we wanted to make and what our project was going to be like. We were allowed to create any kind of project we liked, but it had to fit in with several points. First, we had to remember that we only had three months in this project and the majority of that time we would spend in different countries. So we had to choose the project which we could finish in this time. Second, it was a very important thing not to run out of the budget that we had, which was a very difficult thing because we didn't even know that there were any restrictions about that. So our main aim was to make sure all of the needed components are reasonably priced. And third, we had to think about the project that could be produced by ourselves, meaning that every member of the group had the work to do and we didn't need special equipment (apart from that in FabLab) or extra members. So before the actual meeting every member of the team or the part of the team from one country put down couple of ideas and sketches so that we could choose altogether later.

. At the skype conference we first saw all participants. There were 4 teams with 6 students in each. After short introduction and a brief information about the whole Project we started conference within our own team. We made a short introduction of ourselves and a small summary of what we study and of skills we bring to this team. Then we exchanged the ideas and sketches. Everyone of us showed one project idea, so we had 6 ideas to choose the final one from. In the beginning it was a bit complicated to talk with three people on another side of the monitor because german students had only one pair of headphones, but that was figured out pretty quickly.

The decision of which idea to choose was made almost instantly. It probably looked like a long time making it because during explanation we had to change failing equipment of the PC and sometimes repeat our ideas as at first we had a bit of misunderstanding in languages. But we helped ourselves with gesture language and drawings. We had a lot of wonderful ideas, but we could only do one so we decided to build a little BB-8, the "Star Wars 7" robot. We were all very excited about that the second we heard this idea, so since that moment it seemed we didn't have any other choice but to build this little robot.

The rest of the time we discussed how we could make the robot move, what we needed to build it and how we could stay in contact the days before we meet each other in St. Petersburg.

It was one of the most wonderful things happened during the whole project work, the fact that within our team almost every decision was made very quickly but still through discussion. Since the day one we didn't spend much time on quarreling or arguing about anything. We thoroughly discussed everything to understand what each of us means and each of us dislikes about the idea so that there wouldn't be obstacles that we couldn't overcome.

Time between the meeting and arrival in St. Petersburg

We had a bit more than two weeks between the conference in skype and the arrival of the german students in St. Petersburg, so there were several tasks we had to accomplish.

The first thing to do was to lay down a list with all components and materials we needed to construct our robot. For example: Arduino for controlling, possible sensors for measurement of the movement or the material we wanted to make the body for the robot from. The cost sheet is available on the link: <https://docs.google.com/spreadsheets/d/1tkKIFXLkSuNyADffe74xY2TsrRB2mH5bSy7413XSSDg/edit?usp=sharing>

Also we had to write a kind of introduction to our project.

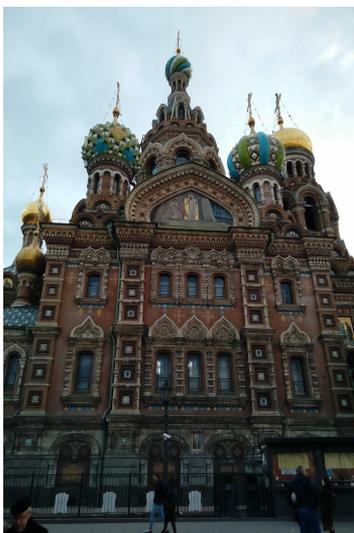
The second thing was to prepare as much as we could before the actual construction process so that we wouldn't need to waste our time on that. So we made a 3D model for the body and parts inside of it and gave the programming and the controlling of the robot a thought as well.

The third task for the german students was to make their visas for entering Russia as it turned out to be not that easy.

In that time we mostly contacted via Skype and WhatsApp to talk about some of appearing problems and new ideas how to solve them.

In St. Petersburg 03. - 11. 04.2016

The arrival of the german students in St. Petersburg, Russia was on Sunday, the third of April. They were taken from the airport to the students hostel near the Polytechnic University of Peter the Great. This was now the home for the german students for the next 11 days.





In the hostel it happened to be the first time for the german students to face the language barrier. The matron of the hostel could speak neither German nor English and obviously german students could not speak Russian. So with difficulties in understanding her and the staff everyone tried to follow all steps they had to do, to check in and to get the room key. After pretty complicated check-in everyone was introduced to the russian student who later helped translate everything the matron had to say. The rest of the day the german part of International Design Project walked through St. Petersburg and saw a bit of the city.

On Monday morning, the fourth of April, at 10 am we had the first meeting where we could finally see each other in person. The meeting was in FabLab Polytech, which is a fabrication laboratory that helps people bring their ideas to life. It is a very interesting place with atmosphere of co-working and co-creating in the air. It is placed in a old laboratory for fluid mechanics, with enough space to work for many students. As the main aim of this laboratory is to inspire and make people create something original and useful, inside it you will find a lot of tools for that, e.g., 3D printers, couple of laser cutters, drilling machines, a milling cutter, a sign-cutting machine, lots of hand-guided tools, examples of old projects, projects still in developing, lots of materials you could think about like plywood or plastic, etc.



International Design Project, at least, its first part, was held during the VIII International Fab Lab School, which is a special event held several times a year by Fablab Polytech and Peter the Great Polytechnic University. During this school that lasts usually for a week students from different countries make a team, choose a project to create and bring it to life using all of FabLab tools. There are usually workshops and lectures that would help in producing a project, for example, basics of CAD or programming. So besides four german-russian teams there were a lot of different groups which had not chosen the project to work on before the School and actually met there on the first day for the first time.

The first day of work started with official speeches from representatives of the University, the FabLab and the Project, then all project ideas got a short introduction.

It had never been mentioned before so it was a small surprise for us that we should explain our project to others. Polina and Svenja made a spontaneous presentation about our idea and our plans for the next days. While other students had to choose a project, we could finally start with ours.

The seven days in Russia had nearly all the same schedule. At 10 am we would start our project work with actual designing, cutting and printing needed parts. Then there would be some small workshops about CAD, CAM, working with special software and etc, everyone who was interested in could participate. Around 2 pm we used to have lunch. It was served in the university canteen for all of members, several buildings down the street. After that we would go back together and work until 5 pm. There would also be different workshops in that time. In between we could have tea or coffee with cookies or snacks. After the end of the working day there used to be a free time when we were allowed to do whatever we wanted.



Most days, except maybe the first one, we would do something together as one big international team. Couple of times we went in a bar and played games which included a lot of talking and explaining, also we watched football matches as

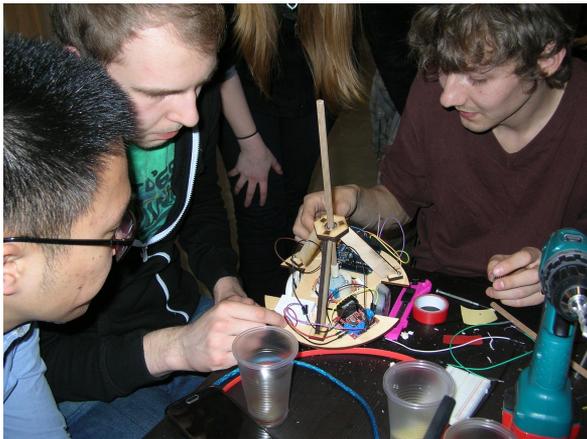
at that time there was the World Cup going on. It was all relaxed and calm, russian students tried to do their best to make german students feel welcomed and comfortable. Once our international company went around the city, got a chance to see St. Petersburg in the night and was told a lot of interesting information about historical places we were passing by. We even visited the Hermitage, one of the most famous arts museum of the



world. Once after a long working day we attended the Grand Maquette which is usually referred to as "Russia in miniature". There you could see the real maquette of the most important parts of Russia in a miniature version with cars, trains and a lot of eye-catching details in it.

The creative process

The first discussion we had in real life turned out to be a pretty difficult one as a part of students had difficulties in expressing themselves in another language. We had to struggle with that all the way through because we all had different level of English but there was an important point for us as a team that day. We understood who had the troubles with what and afterwards tried to help each other understand



something better, not to get annoyed at each other. It was a great thing to learn - how to deal with the problems of another member of the team to make a working process comfortable and productive.

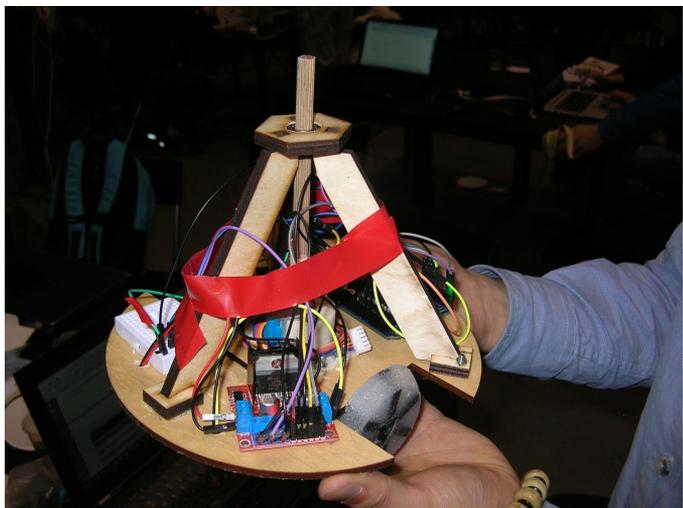
So after quite long and complicated discussion of where to start out project from and what to produce first we started with printing the body. For that we used a 3D printer, but our first attempt to print a

half of the body needed about 23 hours. It meant we could easily start with different parts.

The insides of the robot included a platform on which we planned to place all of the electronic parts, the holder for the metal balls so the platform could move smoothly inside the ball, the wheels and the head holder. So all of that had to be designed and produced. For the wheels a 3D printed form was made and then silicone was used to produce the wheels. The platform was cut out of plywood. On this platform we would place the electronic parts and the wheels.

Of course, we had some problems. The first one appeared in discussing the material of the body and the platform, we could not agree on that and finally were not sure how and where we were supposed to find those materials. However, as has already been mentioned, in the end we used plywood and plastic and there was a lot of that in FabLab volts.

Also, as we have already stated, there was a problem with languages. Sometimes it was complicated to discuss things but our



team was really quick to learn how to discuss things fast. When a problem appeared we tried to explain everything to all members and then tried to find solutions. We always took the time so all of us worked well together. When there were no words for explaining we would find another way to show the problem, like drawing or gesturing. Still trying to explain different stuff that we had never had to deal with before we all learned new vocabulary and trained to speak fluently and without being shy.



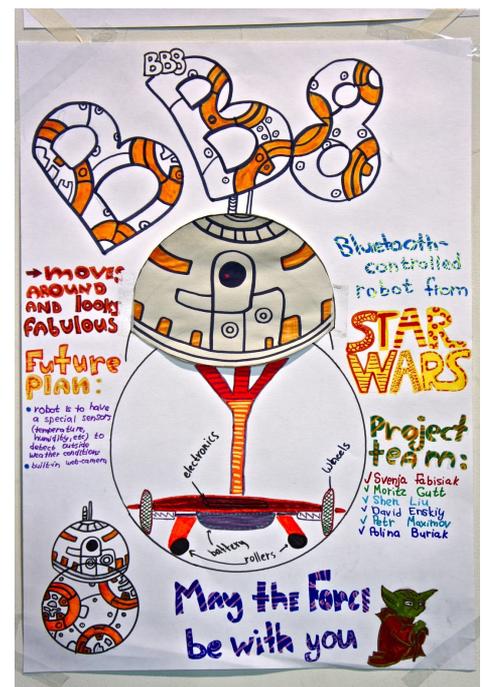
Surely not only problems with communication did we have. Joking among ourselves, we called our group “the destroyers” as during this week the six of us probably destroyed more things than you usually do in a month. It all started when we connected the battery with the board through cables and they just burnt.

Later we tried to implement the Bluetooth Module on the board and after a measurable amount of time understood it was broken, the second one broke down right in our hands so the actually working Bluetooth Module is the third one we had.

After we printed the two halves for the body (that took us two days) we saw that they wouldn't fit because the tolerance of the 3D printer was too cruel for our 3D model so we had to change it all. Basically we tried to fix this problem without reprinting the whole body, like cutting out the unnecessary part that prevented two parts from fitting, then printing the little ring and glueing it to one hemisphere but all of those were in vain as the parts didn't fit in the end. So we just reprinted the new version of our body.

While we were programming the Arduino, the laptop of our programmer Moritz crashed. The first day our leading engineer David crashed his tablet. There were a lot more accidents happened to our project. But we never stopped, always finding another way to deal with all the unpleasance, solutions to all problems and the way to finish this prototype.

On the last day we were happily able to work longer than normally. Nearly all other teams had left



but we were so close to make the body roll that we didn't want to stop working until we could see him roll. And we made him roll, that evening.

It was a moment when we all were very proud of our project. It worked not as well as we thought or hoped it would, but we were able to move the ball with our mobile phone via bluetooth forwards or backwards. It was sadly not possible to turn him right and left like we wanted, he had something on his mind that prevented him from listening to our commands. Also we didn't have enough time to construct the head, so that was the task left for the summer part of the Project.

For the next day we made a presentation of our project on a platform called "instructables", where you can find an instruction how to build anything in the world. There you can find a more detailed description of our project, the materials we used, pictures and step-by-step instruction how to do what we have done. Also we had to make a poster to show what steps we did.

This is the link to our project:

<http://www.instructables.com/id/Little-BB-8/?ALLSTEPS>

Time between St. Petersburg and Hannover

Even though we made our ball roll around at the last day of work, we were still far away from being finished with the project. There were a lot of things that had to be improved or even re-done. So we splitted the tasks we had to do before we meet again in Hannover, for that we had a bit more than 8 weeks. The russian team members constructed a new body because the old one was not completely round and the surface was rough. That were, as we thought, the reasons why the robot wouldn't obey every command it was sent. Also they produced other parts we would



need in Hannover, like special holders for head magnets and the model of these holders being installed onto our platform, because in Hannover we wouldn't

have so much tools like in Russia.

The german teammates were responsible for programming the arduino and the controlling app.

Together we thought about new problems and discussed if it would be possible and how to construct a functional head which would move when the robot moves.

Three weeks after the german students left St. Petersburg they were sent the project (actually the insides of the robot, the platform) so they could test the new programme before the meeting.

In Hannover 11. - 16.06.2016

The russian students arrived in the late evening at Saturday, the 11th of June. They stayed in a hotel near the university. The arrival of the russian team was very nervous because till the last minute it was unclear when they arrive and how long they were going to stay, all of that due to organisational problems. Thankfully everything turned out to be okay.

This time the first day for the project was the Sunday morning. We met at the international office and were given a little workshop about international team work, cultural differences and ways to deal with all that, had fun with answering some questions in a group work.

After quick lunch we came to work in the rooms of the ZDT, the place where we would work for this part of the Project. It was one big room with tables for working and a smaller room where all the tools and materials were stored.

The working time in Hannover was more limited than the time in St. Petersburg. We just had 3 days to make all the changes and to finish what we had begun in Russia. Each day we worked the entire day with a small breaks when we would check the food 4 german students brought each day. In the evenings we would go for a walk in smaller groups through Hannover, for example, sit down in a bar or just enjoy the city.



In the first place our team tried the new body with the new app. The app back in Russia was difficult to operate with as you had to write the actual commands to move the ball and, obviously, that wasn't very quick. This time it looked quite professional and was much easier to use as the interface was simple (you can see it on the photo above).

We had to face couple of problems with the new body and the old wheels so we had to make some changes into the inside design of the robot but in the end we could move the ball again. So we started dealing with the head. The russian members brought the printed head with them, we put four magnets inside of it and 3 balls to make its movements on the surface of the body easier. Unfortunately, after many attempts to make the body move with the head on, we had to admit that the head was heavier than the body could take. The wheels and the motors weren't strong enough to move the ball and the head together.



Sadly we didn't have enough time to make a new head or provide stronger movement for the ball. We tried a lot of different solutions from placing stones on the platform to make it heavier to reprogramming the speed of the wheels spinning, but nothing worked.

On the last day we painted the body and made a powerpoint presentation where we had to

describe the most important parts of our work and explain what we would change if we would have more time.

The presentation at the afternoon was in front of important members of our university and interested people. It started with



welcoming speeches and then we all had to present our projects, to show the development of it. The most important thing was to show how it works, in our case how the robot moves. It was nice to see what we all had created in such a short period of time while we all had our own studies and exams going on.

After the presentation in our last evening together we prepared a little surprise goodbye party for Igor, the director of the Fablab Polytech who was about to leave his position soon after the return to Russia. We stayed up all night, walking around the city, chatting a lot, having fun. It happened to be a very memorable night. Also it was a nice way to say goodbye to our team members.

What we loved about the project and what we would change for the next

What we usually miss in our university studies, is practice, actual creating of your ideas. So it was excellent to construct a whole project from the total beginning, just the idea, to the production of concrete and tangible parts of our mechanism. One of the most significant advantages of this is the fact that we could produce them on our own. It means we had to develop new skills like using a 3D printer, drilling, programming new software or even mixing chemical fluids in right proportion to create the wheels.

For all of us it was a great experience of international teamwork and of practicing our English in a more interesting and more successful way than in an usual English course. As we had to speak English all the time in our everyday life to communicate with people around who didn't speak our native language and also while working on our project, we needed a lot of vocabularies we may had never thought about but that could be necessary in the future.



Another important point for us is that we have found not only good teammates but new friends as well. We learned a lot about the cultural

differences of our countries and some things that are not so different. For example, people behaviour, the opening time of shops and etc. We had the chance to look through the stereotypes and find a lot of things people usually do not know about both of our countries and people in it.

The project was a fun and educational experience. However, there are several things we would like to change or improve.

First, it seemed that russian and german organisation committees lacked coordination in a lot of ways. It showed in late booking for the flights of russian students, not enough information for the day timetable both in Russia and Germany, not really organised part-time events. So we would suggest improving the organisation about those things for the next project.

Second, it would be nice to provide the students with some information about working process before they arrive at a place of work. That information, for example, could include the list of materials students could use in FabLab, the short list of the tools they would be able to operate with both in Russia and Germany, the budget that the project should be ran on and etc. All of that is essential in the time of discussing a project as the whole working process depends on that.

Third, we, especially the russian part of the project, would like to admit that the time for the visit to Hannover was difficult as everyone had their university exams going on. So we had to prepare for our exams during the project and even take the exams earlier than stated, it was nervous and uncomfortable, not really helpful for the project itself. We would suggest considering a change in dates for the project.

Fourth, the working time in Hannover was too short for finishing our project. It might be nice to prolong the stay in Germany.

To put it in the nutshell, it was a wonderful beneficial project and we would suggest that everyone try it and gain a fascinating experience. We hope everything we noticed would be improved and we are looking forward to continuing the international communication with our colleagues.