Photogrammetric Excursion – November 10-11, 2016

GeoEngine, 10th Generation

Introduction

On the days 10th and 11th of November 2016, the GeoEngine students from the 10th generation, had the opportunity to go on a two-days excursion to IGI, Leica Cameras and the city of Wetzlar; organized by Dr. Michael Cramer and fully sponsored by the company IGI.

The first day counted with several presentations and demonstrations at the headquarters of IGI, located in Kreuztal, nearby Siegen; IGI is one of world's leading geospatial companies, which specializes on system integration of several sensors into the positioning system, as well as on solutions for the kinematic and airborne surveying missions.

On the second day, a tour was made at the headquarters of Leica Camera, located in Wetzlar; where the famous "red dot" Leica cameras are manufactured. Leica company is well-known for its state of the art rangefinder cameras.

To finish the excursion, the group had the opportunity to enjoy a guided city tour in Wetzlar, small city with big history, well known for its relationship with Goethe and for being one of the German centers of optic companies, but also known as the photogrammetry's birth place.

The following report explains in detail all of these presentations, demonstrations and tours.

IGI Integrated Geospatial Innovations (IGI)

http://www.igi-systems.com/

Company presentation/overview

IGI is a small, engineering company which operates in each part of the World. Moreover, IGI was established almost 40 years ago, by professor Albrecht Grimm.

The group of students was welcomed by Dr. -Ing. Jens Kremer, who presented us an overview of IGI's products. It was a great opportunity to familiarize ourselves with topics such as: Mission Planning & Flight Guidance, Sensor Management, Mobile Mapping solutions, Aerial Sensor Systems and GNSS/IMU Navigation. One of the most interesting presented issues was the Clockwork-Ocean project (see http://www.clockwork-ocean.com/), which uses IGI's real-time software; the project was developed by people who wanted to measure small turbulences over the sea by using thermal sensors and GNSS/IMU systems.

After this introduction, the students participated in some other lectures and live demonstrations organized by the company.

RailMapper

In the afternoon, the demonstration of a new Mobile Mapping System for Rails, the *RailMapper* solution was presented to us. The main task of the demonstration was to show the rail mapping applications of the mechanism, however the *RailMapper* can be also used as a *StreetMapper*, so for both rail and street mapping purposes.

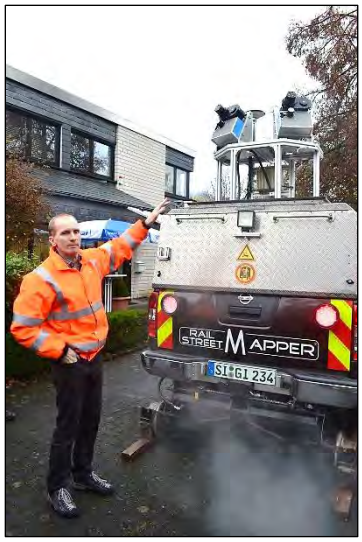
The *RailMapper* is basically a SUV car improved with devices allowing mapping of streets and rails. It is equipped with:

- Two precise laser scanners.
- Waterproof IMU.
- GNSS technology, consisting of two antennas mounted on the roof (one nearby laser scanners, one on the front of the car's roof).
- Optical odometer.
- Additional metal train wheels and equipment, for placing the whole system on the rails.
- Big lights, simulating train lights (front and back- respectively red for driving, white for driving backwards), for moving and signalizing around the train tracks.
- Extra hand break for a passenger, in case of emergency.
- Lights mounted over the front metal train wheels.
- Special horn, sounding like a train horn.
- Front metal car attachment, in case of need to install an extra equipment.
- Roof rail for attaching and moving a camera to the front of a car.
- Touch screen for operations inside the vehicle.

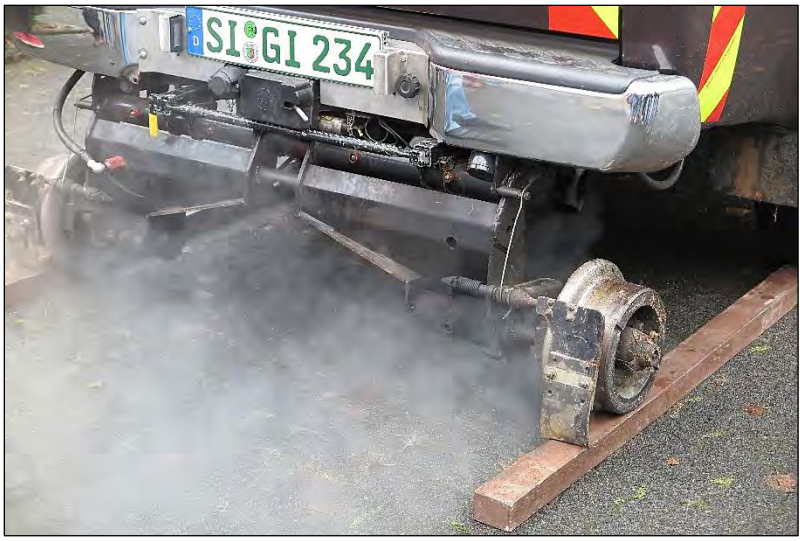
The vehicle can also be equipped with a photogrammetric camera, which can be mounted nearby laser scanners or on the roof rail. It improves the data quality, visualization and gives color to the scanned models.

The whole system is mounted on flexible lifting platform, allowing for hiding the whole system under a metal cover.

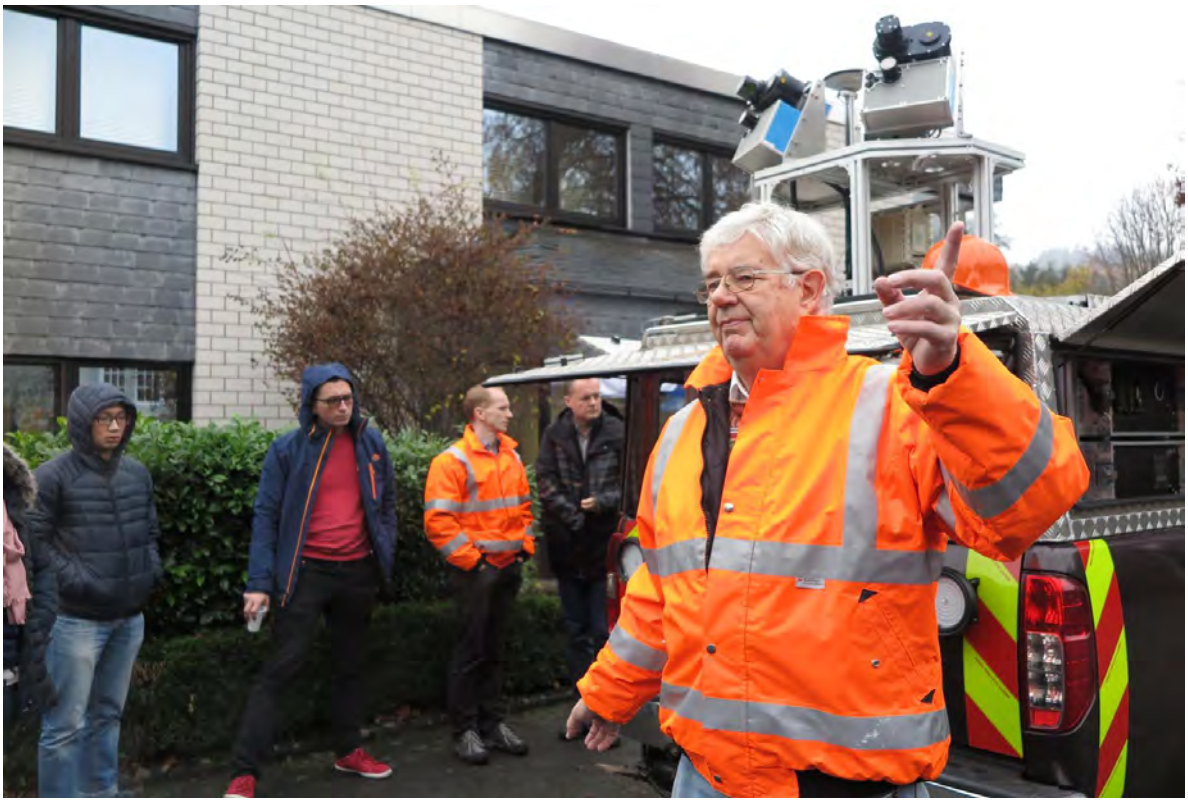
In order to use the *RailMapper* the people working with it need to wear special reflecting jackets and special shoes.



Dr. Kremer explaining the systems components.



The additional wheels, for putting the car onto rails.



Prof. Grimm, the founder of IGI, always active and always showing the future direction.

Photo 1. *RailMapper* live demonstrations.

Precise scanners allow a full 3D model of the terrain. The vehicle is used also for monitoring the rails. Highest accuracy of the data is achieved thanks to the *IGI TERRAcontrol*, an integrated GNSS and IMU navigation system, allowing the determination of the position of the sensors.

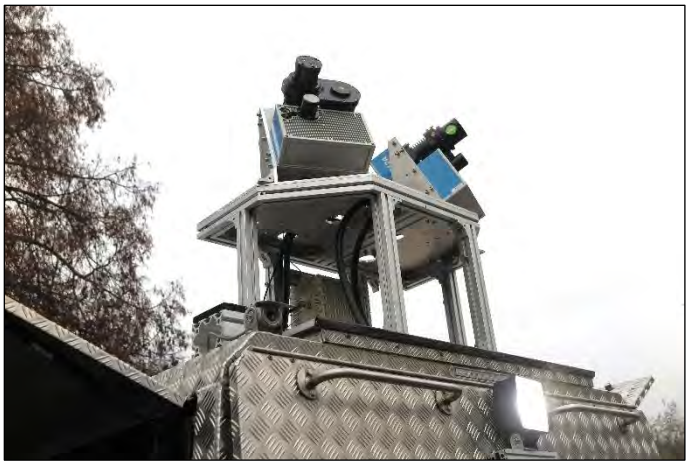


Photo 2. Laser scanners mounted on the *RailMapper*.

After acquisition the data must be processed. The processing includes:

▪ Reading in the GPS and IMU data and creation of the track (MM process, Aero Office) ▪ Graf Nav used for creation of base station	GPS+IMU (rough result)

▪ Reading in scanners data ▪ Matching two pointclouds from both scans based on their georeferencing, with reference to the coordinates and directions the coordinates and directions ▪ Calibration and creation of a pointcloud, based on georeferenced scans.	Laser scanners data (precise result)

The most impressive thing about the *RailMapper* was the quality of the data acquired. The point cloud seemed very dense due to a millimetre matching of both scans (based on GPS and IMU coordinates and directions data). It was a very interesting and complete demonstration on the RailMapper vehicle, its functioning, data acquisition methods and the post-processing.

Gyrocopter

In the last stop at the IGI Company, their Gyrocopter system was introduced. This does not classify as a helicopter, even though it looks like one, but rather as a small vehicle where powered up by the engine behind the seats, because of this reason the Gyrocopter cannot stay still during the flight and has to move on at slow or fast speed.

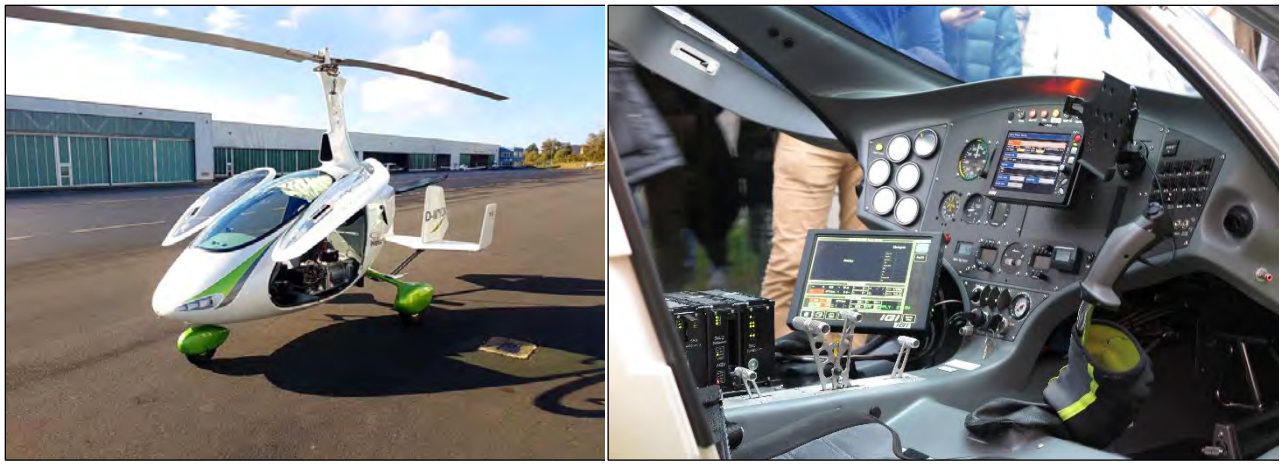
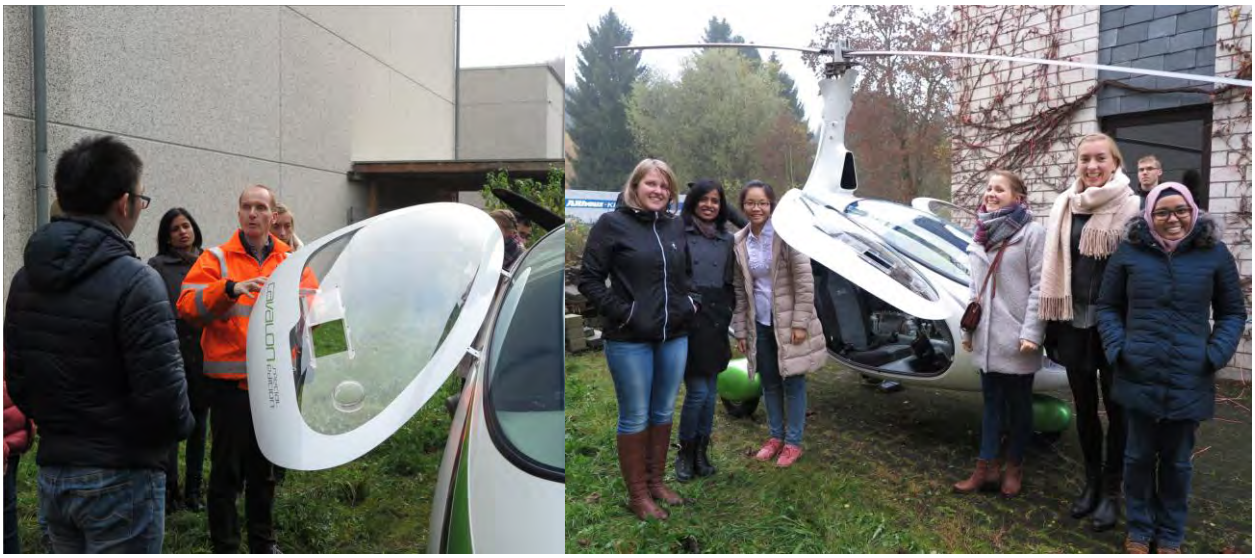


Photo 3. Gyrocopter (IGI Cavalon for Aerial survey) (left) [taken from IGI Systems] with inside overview (right).



Explaining the concept. Our girls like high-tech!

Photo 4. Gyrocopter demonstration

For the basic performance parameters of this survey platform, we know that this Gyrocopter uses 115hp, 4cyl-boxer engine and the maximum velocity is 185 km/h, the flying time can be up to 4 h, which is long enough to cover a certain area, its batteries are an enhanced to provide more flying energy. This platform is pretty cheap comparing with other aero photogrammetric solutions, with a price nearly to 90 000 euros.

The Gyrocopter is equipped with AERO control IMU, AERO control & Digi Control, CCNS-5, DigiCAM and LiteMapper, all of these digital imaging sensors are fixed besides the seat of the pilot. With the help of other sensors and computers, the Gyrocopter can capture the data almost automatically only need a few operations from the side of the pilot, so it is a one-man operating system. Another advantage of such platform is that the requirements of the pilot are much lower than the requirements for an

airplane pilot, which means it only requires a relatively simple training before operation. The application of this platform has three main parts: photogrammetry, airborne laser-scanning and 3D city modelling.

The data processing demo was also presented to us, and is really impressive how simple it is.

Meydenbauer and the early Photogrammetry

The late lecture about the history of photogrammetry and the life of the photogrammetry's pioneer Albrecht Meydenbauer was held after dinner in the youth hostel and was given by Prof. Albrecht Grimm.

The session started with the display of old lens and a few books with photographs that were captured using the concept of photogrammetry by Albrecht Meydenbauer. The details on illumination and working with old cameras using these lenses were explained in detail.

Later, the presentation continued with the history of Albrecht Meydenbauer, starting with his beginning, his life as a student in Berlin, the invention of photogrammetry and his late life.

Along the lecture, we were told by professor Grimm how Meydenbauer came up with the idea of measuring through images, when he almost fell down from the tower of the St. Mary's Cathedral in Wetzlar back in 1858; later on, the term *Photogrammetry* was coined and first published by him in an architecture magazine in 1867. Most of the documentation that Meydenbauer made through his photos were presented as well, being able to have a better glance to what his worked was.

The presentation ended with a lot of friendly discussions related to the history of photogrammetry, seeing our presenter's energy and fascination about the theme gave us motivation to know more about his great knowledge.

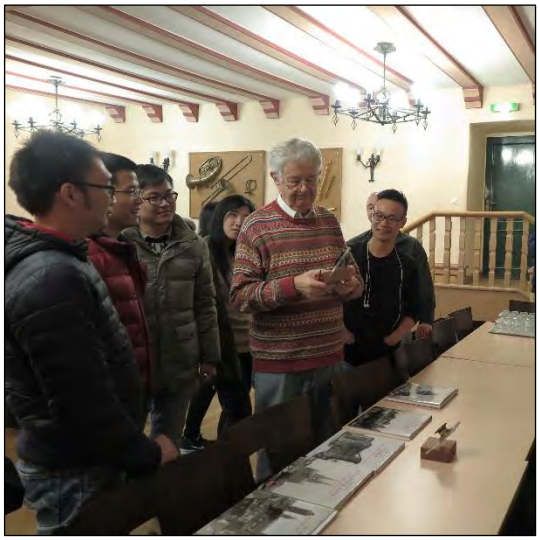
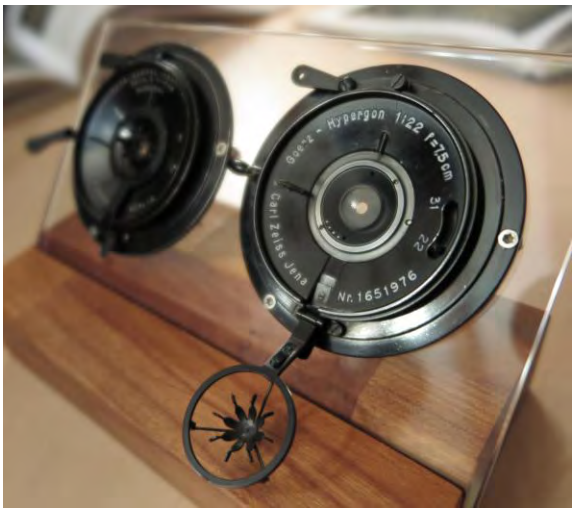
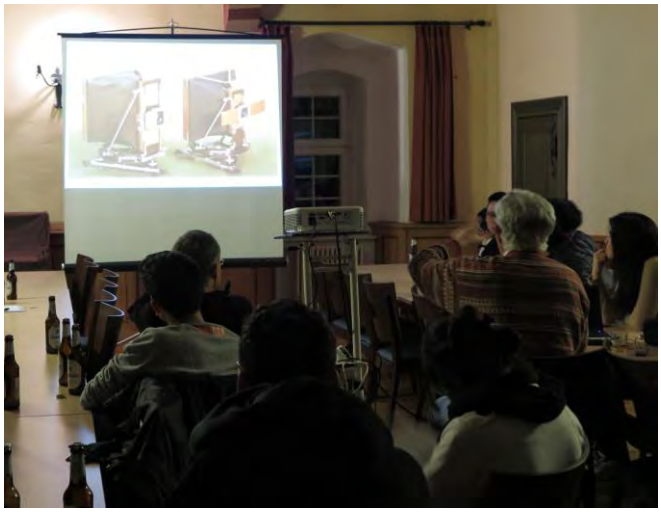


Photo 5. Professor Grimm explaining old optic instruments and an old Maydenbauer's photo of Berlin's French cathedral



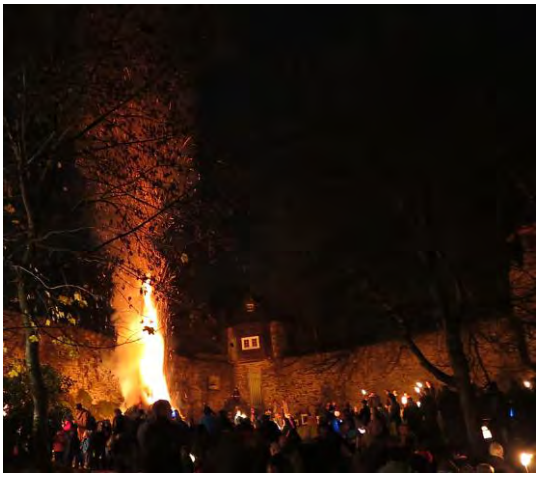
Historic lenses as used by Meydenbauer.

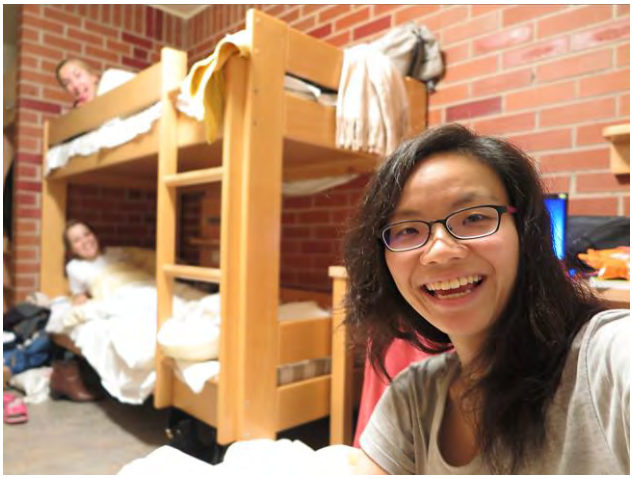


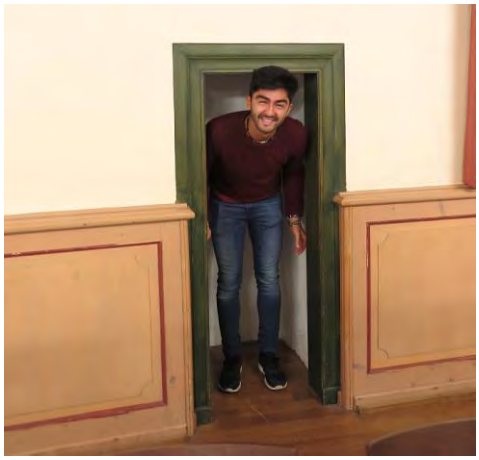
Students listening Prof. Grimm, maybe this lecture is one of the rare ones, where there is beer on the table?!

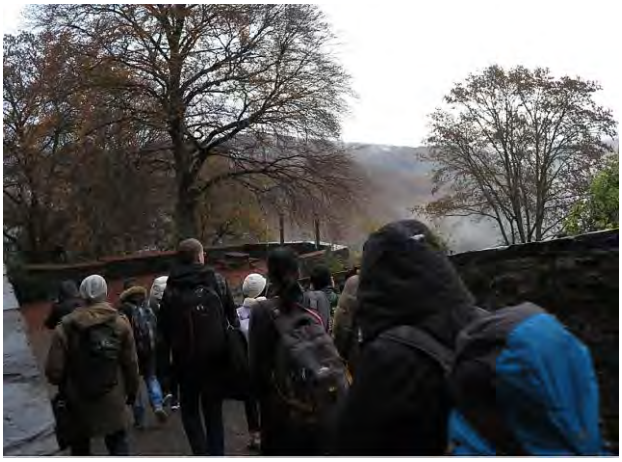
Photo 6. Meydenbauer and the early photogrammetry, Presentation given by Prof. Grimm

And for sure, spending the night in such historic Youth castle, located in the old fortress Freusburg, was another experience. There is nothing to add …









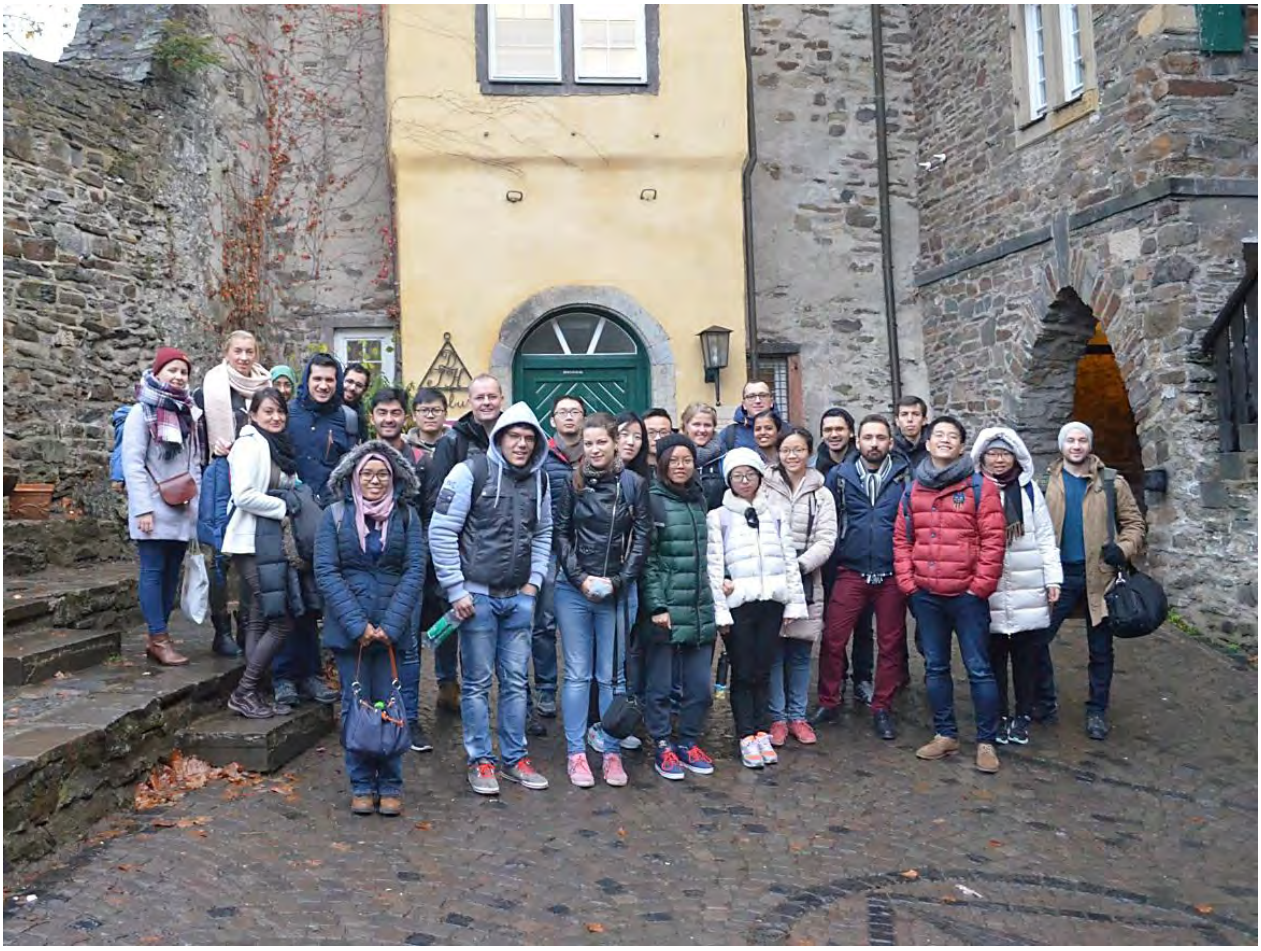


Photo 7. Freusburg impressions …

Leica Camera, Wetzlar

http://us.leica-camera.com/

Guided Tour

In the morning of the second day of our excursion we headed to Leica Camera's new constructed building complex in which around 60 million euros were invested by the company. It is noticeable that the buildings have special shapes e.g. round, binocular and square representing one of the products of the company and back side of a camera, for manufacturing purposes.

It was truly impressive the inside of the building where the group was greeted by Leica's staff and our personal guide. Inside the building is possible to feel the combination of a modern design approached with illustrations, not just photos but influential moments of humanity's history: from the initial dynamic photo (before when it was not possible to capture a photo if the object was not stable) to eventual futuristic images. In the middle of the foyer stand Leica Camera evolution, manufactured cameras between 1916 and 2014, without a doubt a unique exhibition.

Photo 8. Official photo of the visit to Leica Camera.

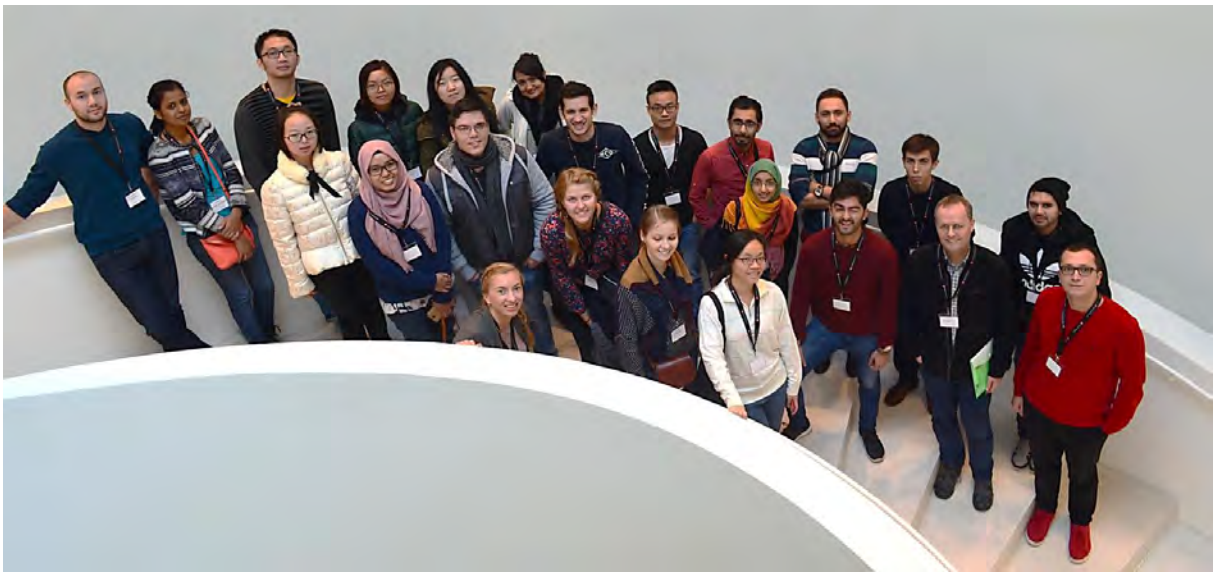
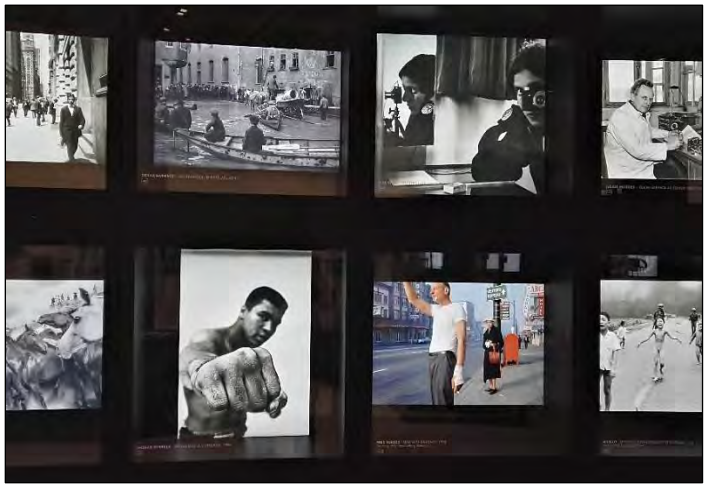


Photo 9. The group within impressive architecture.

Photo 10. Leica Cameras' main gallery.

During the tour, it was sometimes difficult to concentrate on the guide's speech when you are in front of the '*36 out of 100'* gallery, which transmits some emotions. By the way, it has to be mentioned that 36 is the number squares in a camera roll which almost everybody forgets nowadays. Having obtained the first impressions, we were guided to the manufacturing area: thorough analysis (considering molecular properties of 50 top sorts of glasses and special glues with 1-micron thickness), an experienced team and high standards show why the results are from the best quality(!). After the factory tour, it is possible to agree that the price of the product fully deserves its value.

The next part of our tour was the *History Wall of Leica Cameras* which tells how the company established, developed and successfully survived as the last German camera company standing despite a tough competition. A hi-tech display tells you about Ernst Leitz and Oskar Barnack, followed by sensors, objectives and the whole Leica camera family. Customers can purchase a camera with a stunning image performance or another product of Leica Camera in the last section of the building, not just a shop but a showroom with an exhibition area where many of us posed for a photo for the memory.



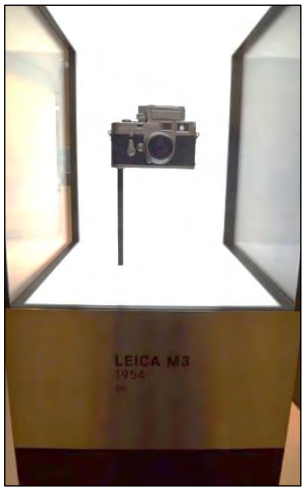


Photo 11. *"36 aus 100"* gallery (left) and one of the emblematic Leica cameras (M3) from exhibition (right).

Technical Presentation

After the guided tour, due to some emergency reasons our technical presentation had to be replaced by another presentation about the company and its products. This took place in a nice and modern seminar room which reflected the quality and the luxury of the brand.

The pride of the workers for their brand can be easily seen as they showed how Steve Jobs once introduced one his products and exclaimed that it was *'as beautiful as a Leica camera'*.

Leica Camera was the pioneer in capturing movement and turning it into a photograph as they reduced the shutter exposure, they also changed the direction of the lens to horizontal direction creating a full frame picture from a small camera, idea which at the time was not well received but it started to make the brand known among journalists, who appreciated the value of not having to stand for a few minutes with a big camera to capture a moment.

In the last part of the presentation products were shown in two general types: Cameras and Sport Optics. Camera models go from model C, passing through models X, Q, T, M, SL and S. The price range varies from the 600 up to 20 000 euros; being the model M the most popular and known among the customers. Sport Optics are specially designed and manufactured for sports, hunting and bird watching the range of products and prices is also large.

To finish, Leica as other companies has studied the customers and their needs in order to offer a better service and product. For this reason, they have recently built a Leica boutique in Los Angeles, including not only their large cameras selection but also a warm atmosphere for photographers to discuss and enjoy.

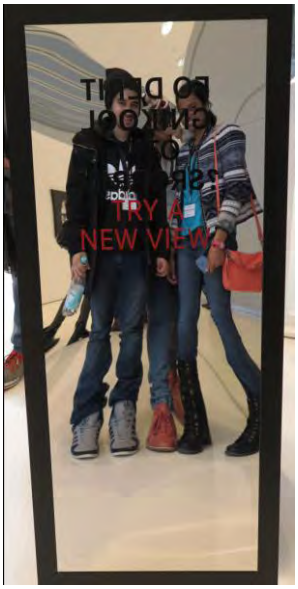


Photo 12. Try a new view & and try a new camera?! ☺

Wetzlar – City Guided Tour

The last part of this excursion was a guided tour in the city of Wetzlar. The city is well known as the place where Photogrammetry was born, but also for the innovation they have in the field of optics and someone can realize that from the significant amount of optic park stations that are spread all over the city. From this point, we were toured around the old city of Wetzlar.

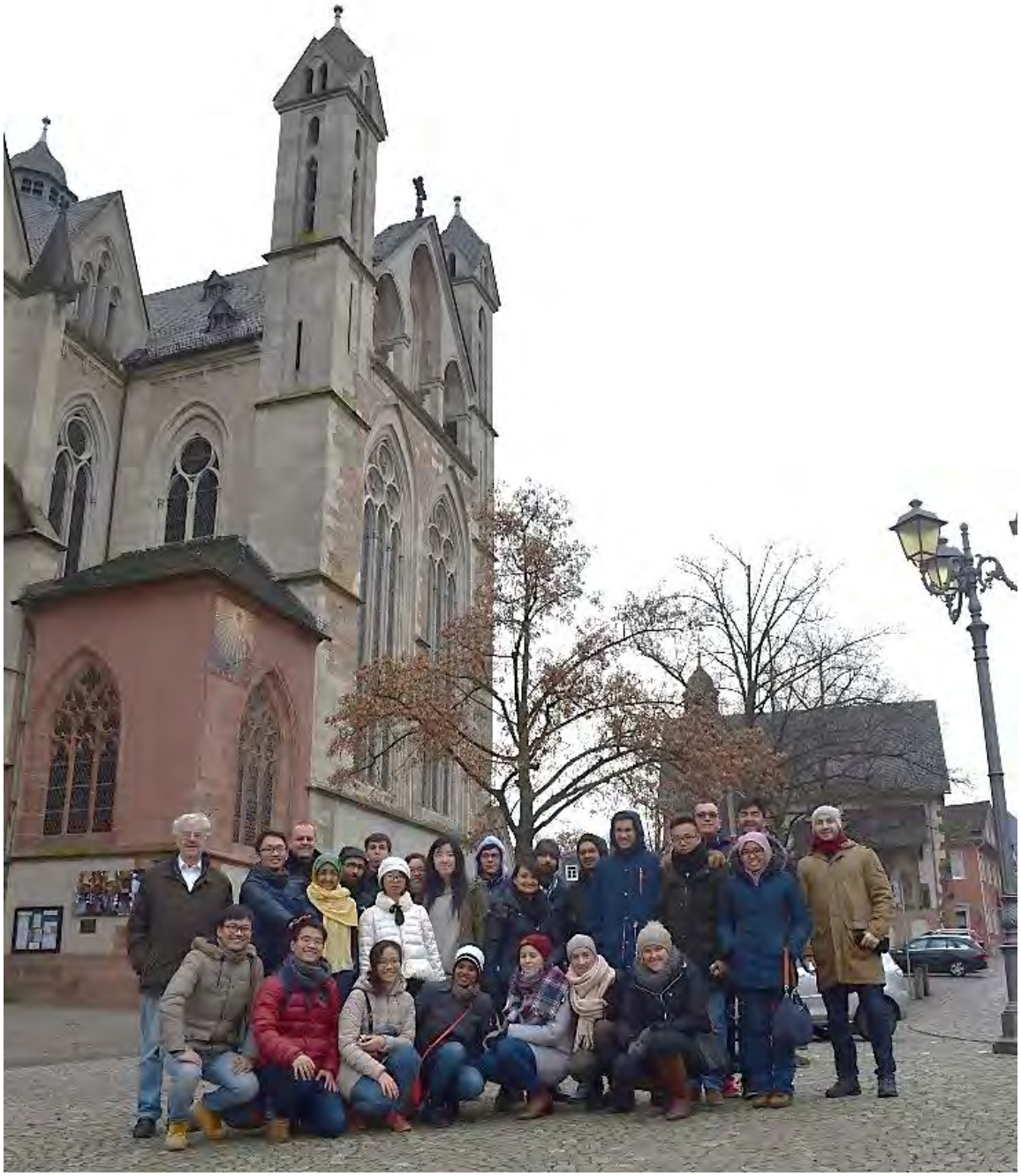


Photo 13. Wetzlar cathedral, the place where Photogrammetry was born.

The tour started by telling us about the history of the old town which developed by being a Free Imperial City and the seat of the Imperial Supreme Court of the Holy Roman Empire. Then, we had the chance to enter to its Cathedral, which keeps a lot of history within its several walls, including Photogrammetry's history, there the guide gave us a lot of details about the creation and the different stages through which the church went along these centuries.

After the Cathedral, we wondered around the city and we had the opportunity to stop by and ''play'' at the optic stations. As mentioned above, Wetzlar is well known for the optics development and is the home of many world-famous optical companies like Leitz (Leica), Hensoldt (Zeiss) and Minox. We also got the chance to discover a little bit about the times when Goethe lived in the city, which was the theme for one his novels. To finish the tour, the group was guided to see the old Lahnbridge which crosses the Lahn river and headed back to the bus to return to Stuttgart.

Photo 14. The exact point where the first Leica photo was taken.