

Leon Santen

B.S. Engineering: Robotics (+ Sustainability)

Education

Olin College of Engineering, B.S. Engineering: Robotics

May 2021

#1 or #2 most innovative engineering institution worldwide (MIT-study)
Recipient of 4-year, 50% Olin Merit Scholarship, GPA: 3.76

Lessing-Gymnasium, Frankfurt am Main, German High School Diploma

May 2016

German Physics Society Award for outstanding students
Among five best students out of 100, Final Exams: 15/15 Points in AP Physics and Mathematics

Experience



click me

Fish-friendly water turbine design and turbine injury research - internship July 2021 - June 2022

As part of Natel Energy's engineering team, I am helping to design the first water turbines that do not kill fish and impact their surrounding eco-systems as little as possible. My work ranges from cavitation test design to conducting scientific studies to investigate the impact of turbine passage on fish. We are in the midst of publishing a fish-passage study that suggests that Natel's turbine allows for safe downstream passage of eels. I helped to run large parts of the study, improved the high-speed video system, analyzed our data, and helped to write the paper.



Land-based, communal engineering at an off-grid farm

Aug. 2020 - May 2021

I organized a micro-campus with 15 students at an off-grid permaculture farm during the first COVID semesters. This time was enabled through two rounds of fundraising, during which we collected \$ 13,000 in total. During our time in nature and community we...

- started to build three dwellings with natural materials (wood, straw, clay, old glass bottles)
- learned about living in community with humans, animals, and plants and held weekly meetings
- cooked for ourselves and organized our chores more or less successfully
- harvested vegetables in the summer and took care of the chickens, goats, dogs, cats, turkeys etc.
- maintained a micro-hydro system, upgraded the solar panel system, and automatized the fridge's energy usage
- reflected a lot on our privilege and how much we actually needed to thrive as humans

If you're curious, you will find more on olinatwoodlandharvest.com or on page 27 of my bachelor's thesis ([link](#)).

As my main projects, I designed and started to build a vertical-axis Savonius wind turbine and constructed and designed a sun tracker (pan-tilt mechanism) for five solar panels. During this time of immersion into community and nature, I wrote my bachelor's thesis on "holistic engineering and a science of holism for a thriving world". This transformative time sparked my excitement for an engineering practice inspired by nature, the social sciences, spirituality, action-based research, intentional communities, and many other (indigenous) wisdoms.



Duodenoscope valve redesign at Boston Scientific - Senior Capstone

Aug. 2020 - May 2021

During this two semester long project, we redesigned the internal valve system of a medical device used for endoscopy procedures. We started our process with an extensive overview of all valve types. Then, we prototyped many different valves with 3D resin printing and iterated on our designs many times. Flow performance, haptic feedback, intuitive use, and manufacturability were in the center of our design process. I came up with a hybrid mechanism that is now in the process of being patented.

Ground Robotic Autonomous Vehicle Lab - Autonomous Tractor

Aug. 2019 - May 2020

I developed a ROS-integrated, ultrasonic sensor system that senses the amount of accumulated dirt in the tractor's box blade. When the tractor accumulated too much dirt in its box blade, it lifted the bucket to prevent stalling. This system allowed an uninterrupted flow of its autonomous task to even out hills.



Sustainable design - research assistant of Ph.D. Benjamin Linder

Feb. 2018 - Jul. 2020

Poster publication in June 2020 - "*The Effects of Behavior Prompts on Laundry Habits*"

We conducted an IRB-approved study with 90 participants to investigate the effect of social engagement around one's environmental impact regarding the frequency of laundering. Prior to the actual study, we investigated many high-frequency and high-impact cases such as razors, car washing, and clothing. The impact of washing machine usage was particularly high as most people only wear their shirts once or twice before washing them.

Most students did not want to compromise on their shirt habits. However, for the group that used abacus-like wear counters on their jeans, self-reported wearings of denim jeans and similar pants increased from 5.6 to 8.2 wearings per wash cycle on average.

Personal Info

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Portfolio • Website
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LinkedIn
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Skills

Massage Therapy

Python, C++, R

SolidWorks, CATIA

Cello, DJing

Community work

**MATLAB, Simulink,
Mathematica, ROS**

**CNC Mill, CNC Lathe,
MIG Welding, 3D-Printing**

Scientific study design

Illustrator, Photoshop

Languages

English, German, Latin



leonsanten.info



Interactive audio-visual art installation

Dec. 2019

Displayed at the Olin College exposition in 2019, this project aimed to create an immersive, magical experience by integrating a self-built and sewed environment with distance sensors, UV-lights, and interactive painting. A big jellyfish floated in the middle of the room, and a human sized fish could be entered. Wave-sounds were playing in the dark room. When someone entered the fish, the jellyfish turned on its UV-light and the fish changed its "uvula light" to a glowing orange. The UV-light made patterns on the jellyfish visible that were drawn by visitors. As the fish was entered, soothing piano sounds were added to the soundscape. Small groups of children and adult visitors lay down, played in the cozy fish, and enjoyed the light and sound. If this is hard to imagine, you can see more photos by clicking on the purple button.

Water counter sustainable design self-study

July 2019

I prototyped an electrical water counter that displayed the time of water used. I lived with two other people and installed the water counter on our bathroom faucet. Even though it was not sensitive to the flow of the water, all of us noticed a change in behavior. I tracked the time of water used. After two weeks of adjustment time, our collective water usage went down from 3-4 minutes per day to 1-2 minutes per day.



Environmental and structural comparison of Styrofoam and paper cups

Feb 2019

This material science projects aimed to answer the question "Should I choose styrofoam or paper cups?" Surprisingly, styrofoam cups scored lower in eco-toxicity and human health ReCiPe eco indicator points as their weight is significantly lower than paper cups. The bad recycling infrastructure for paper cups added to their environmental weight. Click on the button to the left to see our project poster. We further analyzed their physical structure under an electron microscope, stress tested their materials, and investigated their heat flow under high temperatures.



Research publication - Technical University of Munich - Prof. Dr. Lienkamp

Aug. 2018

Publication in June 2019 - *"Should We Allow Him to Pass?" Increasing Cooperation Between Truck Drivers Using Anthropomorphism*

This study investigated the potential to increase the willingness of truck drivers to cooperate during overtaking scenarios using anthropomorphized interfaces. Drivers were in favor of the human-like agent while the result did not indicate an increase in willingness to cooperate. I helped to design technical systems, and planned/conducted the study. I further built a modular dynamic driving simulator for future studies.

Off-road vehicle suspension design - BAJA

May 2018

As a member of a 25 person team, I designed the upper and lower suspension A-arms of an off-road vehicle. My FEA-based design worked perfectly during two off-road vehicle competitions. I further designed and fabricated the driver's seat with composite molding.

Fabrication internship - SCHÜTZ GmbH, Germany

May 2017

As an engineering intern, I went through all manufacturing processes for IBC-containers. In four months, I learned about injection molding, CNC milling/lathing, machine construction, CAD, blow-stretch molding, and welding. Lesson learned: Engineers must be in touch with and take the manufacturing workers seriously.

