Global Innovation Capstone Projects

Fresh minds to push industrial innovation?

Tobias Larsson
Professor & Director

Department of
Mechanical Engineering

OASIS & NOMAD

from our *ECV Support Solution*

VOLVO

CONSTRUCTION EQUIPMENT

BLEKINGE TEKNISKA HÖGSKOLA · BTH ·

LELAND STANFORD JUNIOR UNIVERSITY

Typical documentation

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Product Development Research Lab

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GLOBAL ENGINEERING INNOVATION: SUGAR & STANFORD ME310

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Our global capstone project programmes

We particpate in Stanford ME310 Global Design Innovation and SUGAR Network. Find more on these two capstone project programmes on this page

SUGAR Global Engineering Innovation

SUGAR Global Engineering Innovation is a dynamic network uniting students, universities, and companies to advance innovation through hands-on learning. We emphasize human-centered design to help young minds create impactful solutions.

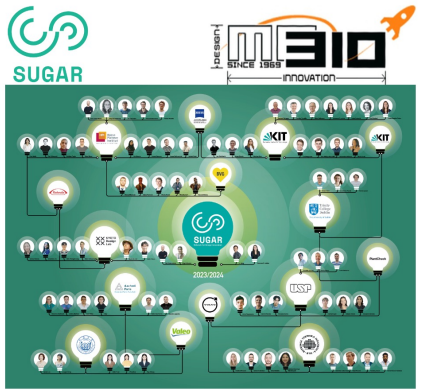
Since 2008, the BTH Product Development Research Lab has partnered with SUGAR.

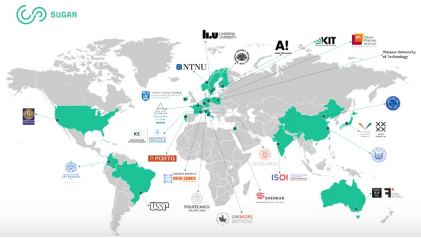
Comprising 24 top universities globally, SUGAR forms multicultural, multidisciplinary teams to tackle design challenges from corporate partners. SUGAR has grown steadily since its 2008 launch, supported by this strong community.

SUGAR's mission is to connect universities and industries worldwide, promoting student-led innovation and learning. Our platform empowers students to solve real-world problems with human-centered, responsible design.

What SUGAR is made of...

1. **Real People**
   - **Human-Centered Design:** Student teams develop solutions with real users in mind, keeping close contact to ensure their designs are practical and user-friendly.
   - **Support System:** Teaching teams, coaches, and corporate sponsors are there to support students every step of the way.
2. **Real Companies**
   - **Innovation Challenges:** Companies bring their project briefs to the table and get fresh insights and ideas from students, tackling their innovation challenges head-on.
   - **Corporate Engagement:** Businesses benefit from the fresh perspectives and innovative solutions generated by student teams.
3. **Real Projects**
   - **Hands-On Experience:** Student teams dive into real-world problems, giving them valuable, hands-on learning opportunities.

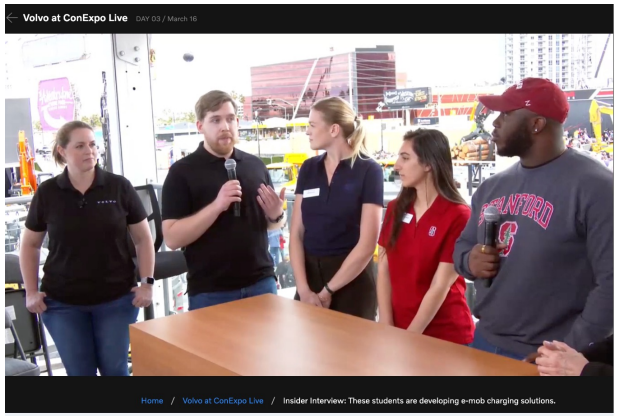




Elektriska entreprenadmaskiner utanför elnätet?

14th March 2023 No Comment

Karl-Henrik, Hedvig, Stefan och Ludwig skapade tillsammans med Stanfordstudenter Nomad och Oasis – två enheter som tillsammans kan generera och distribuera energi till eldrivna maskiner utanför elnätet, till exempel vid katastrofarbeten. Projektet är en del av kursen ME310, en årlig kurs och ett globalt samarbete med Stanford University där bland annat Volvo Construction Equipment utmanar [...]



ME310 21-22 at ConExpo in Las Vegas

16th March 2023 No Comment

Oasis/Nomad renewable energy solution presented at Stanford EXPE

9th June 2022 1 Comment

Oasis/Nomad renewable energy solution presented at Stanford EXPE

Maskinteknikstudenter tog hem stipendier i Sparbanksstiftelsen Kronans årliga utdelning

18th November 2022 No Comment

ME310 Convergence week på Stanford

7th April 2022 2 Comments

BTHs team i Stanfordprojektet ME310 är precis hemkomna från "Convergence Week" på Stanford University, där man tillsammans har jobbat med projektet och bestämt sitt slutkoncept som man ska konstruera till slutpresentationen i juni. Årets projekt går ut på att utforska behov och möjligheter att ta alternativa energikällor till platser där man inte har lättillgänglig infrastruktur [...]

Why?

Basic idea; mimic challenges globalisation puts on global companies. Approach challenges with global student teams, supported by coaches. Real problems, real solutions!

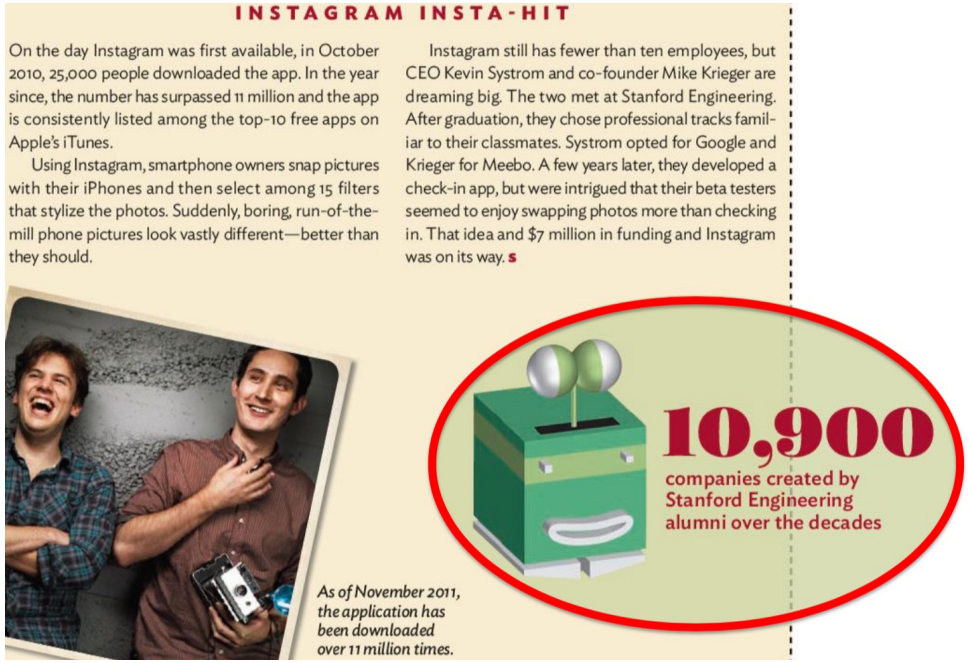
Can our students match SU?

Strive for WOW results!

Why Stanford?

(25 years of collaboration with) **#1 engineering school** in the world.

"Stanford alumni have founded a large number of companies, which combined produce more than $2.7 trillion in annual revenue and have created 5.4 million jobs, as of 2011"



INSTAGRAM INSTA-HIT

On the day Instagram was first available, in October 2010, 25,000 people downloaded the app. In the year since, the number has surpassed 11 million and the app is consistently listed among the top-10 free apps on Apple's iTunes.

Using Instagram, smartphone owners snap pictures with their iPhones and then select among 15 filters that stylize the photos. Suddenly, boring, run-of-the-mill phone pictures look vastly different—better than they should.

Instagram still has fewer than ten employees, but CEO Kevin Systrom and co-founder Mike Krieger are dreaming big. The two met at Stanford Engineering. After graduation, they chose professional tracks familiar to their classmates. Systrom opted for Google and Krieger for Meebo. A few years later, they developed a check-in app, but were intrigued that their beta testers seemed to enjoy swapping photos more than checking in. That idea and $7 million in funding and Instagram was on its way. s

As of November 2011, the application has been downloaded over 11 million times.

10,900
companies created by Stanford Engineering alumni over the decades

50+ years of ME310

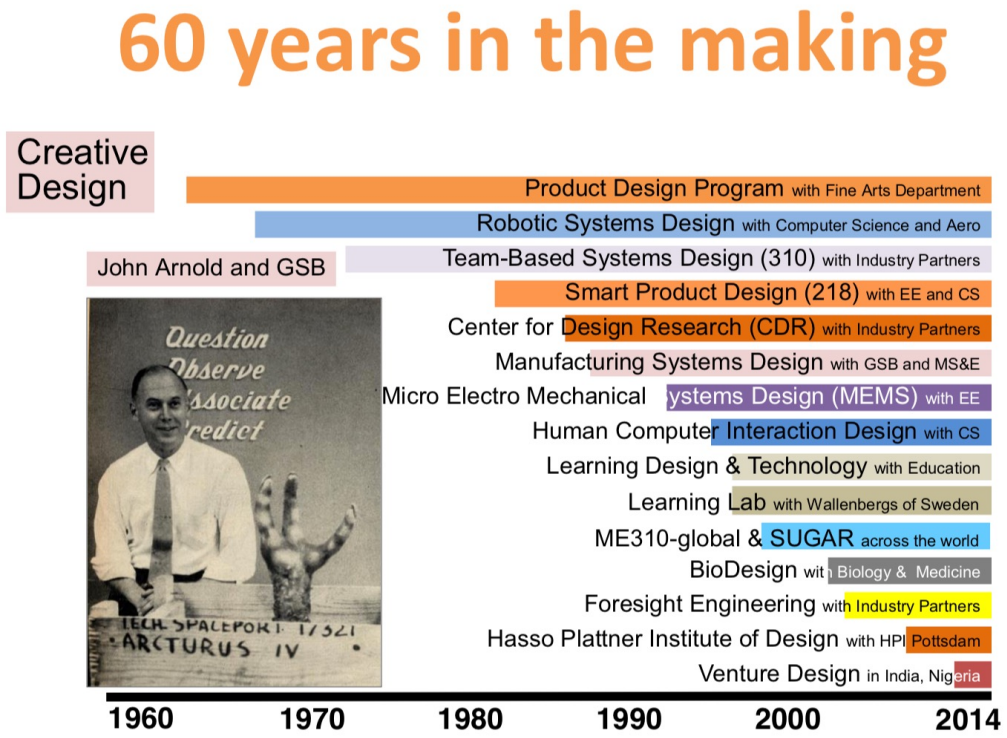
Product design program at Stanford (John Arnold)

- Human-centered design and Needfinding

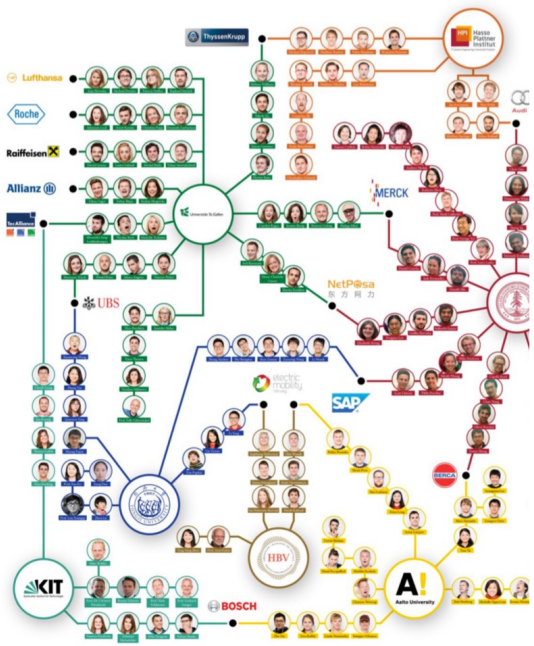
Web: http://our310.stanford.edu

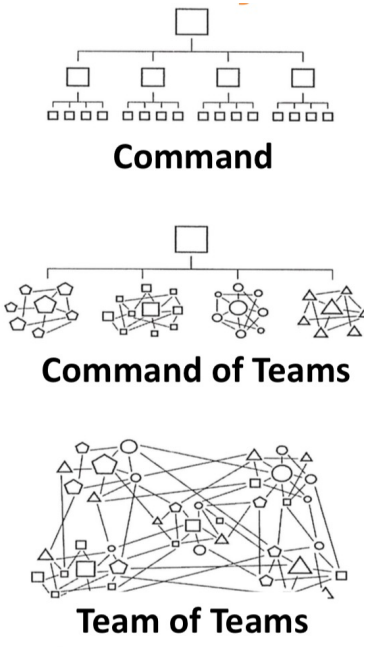
The BTH-legacy:
https://www.productdevelopment.se/?page_id=1092

Carleton, T: 50 years of redesign
https://www.goodreads.com/book/show/51850292-me310-at-stanford-university



Corporate projects – cohorts of students





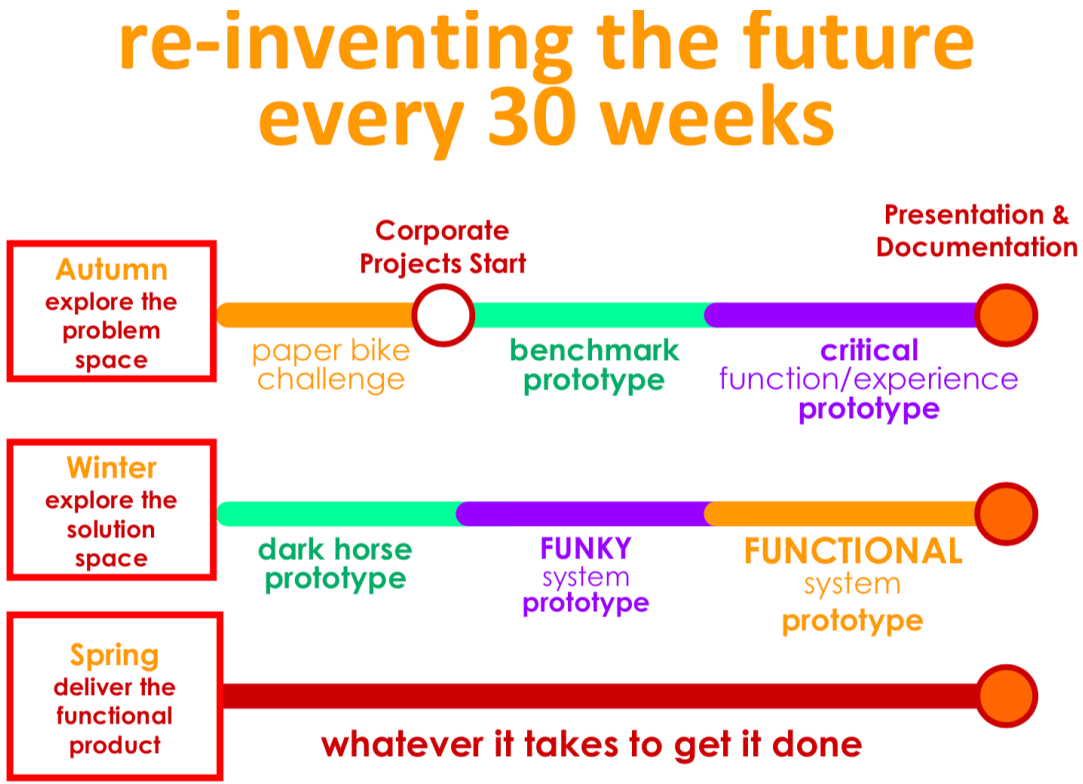
Some **45 msek** of project investments for BTH/LTU from external partners

Over the span of a year

Full year (3-quarter) course.

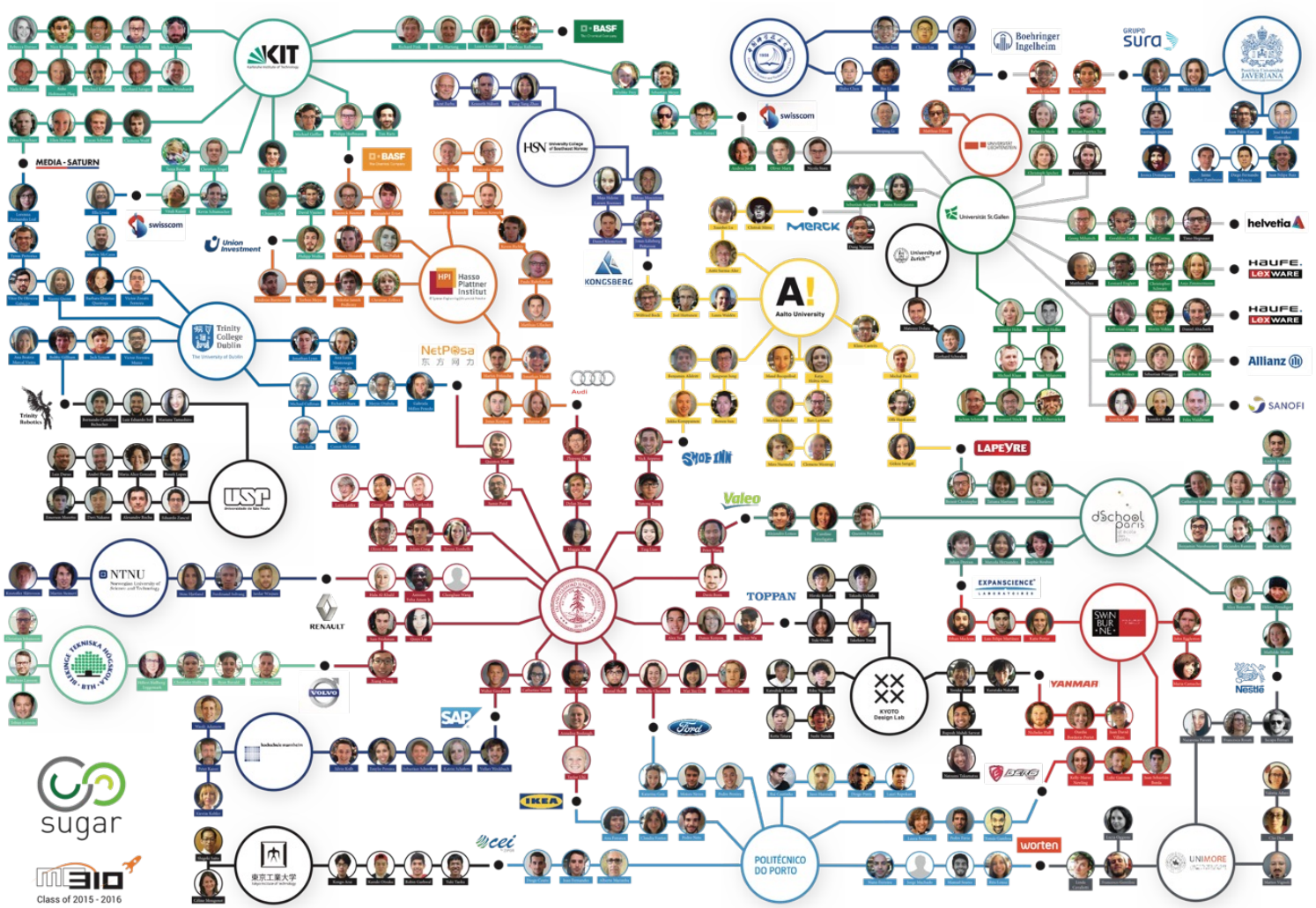
Go from a Wicked problem definition to a full functioning prototype between October and June

- Autumn: explore needs and problem space
- Winter: prototyping / exploring solution space
- Spring: bring it home, whatever way works
- (Summer: bring it in the company and define next year's challenge)



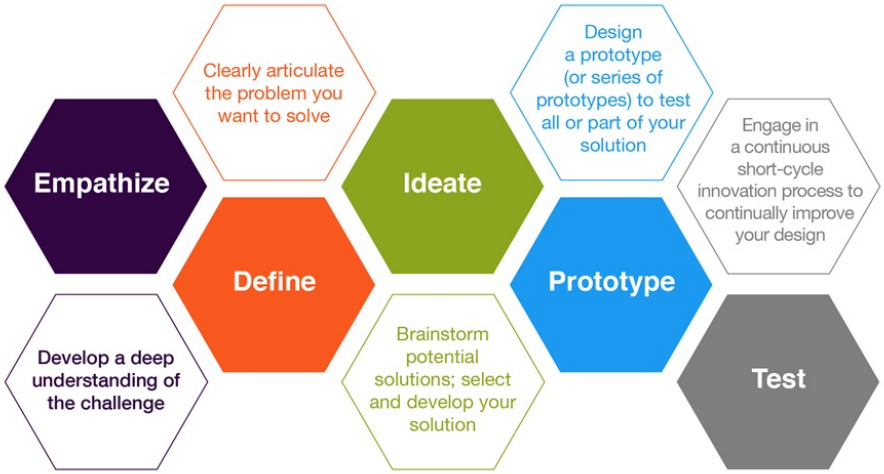
Team of Teams

Team of

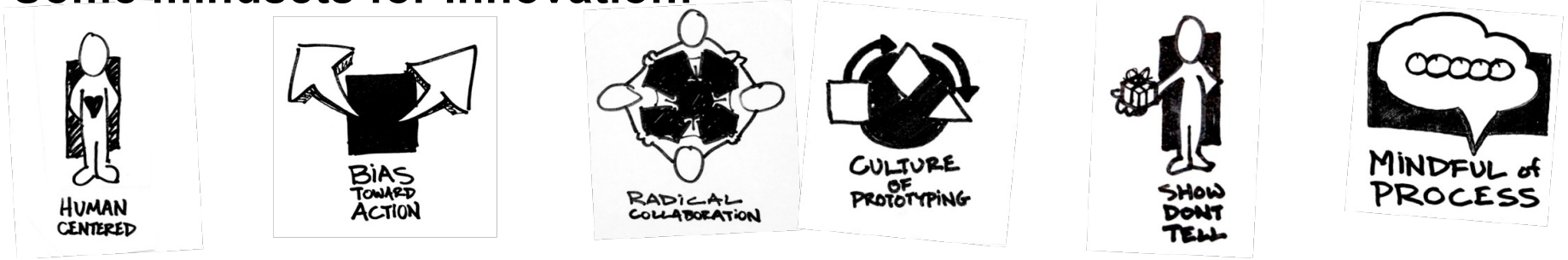


Design thinking approach

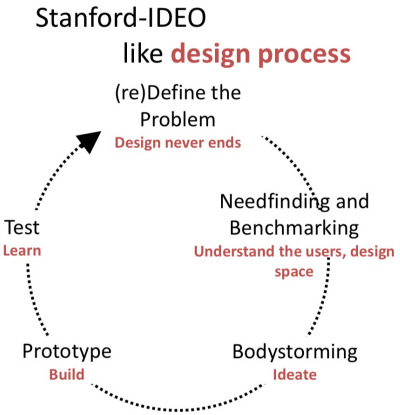
Design Thinking invented by Stanford Design Division and IDEO

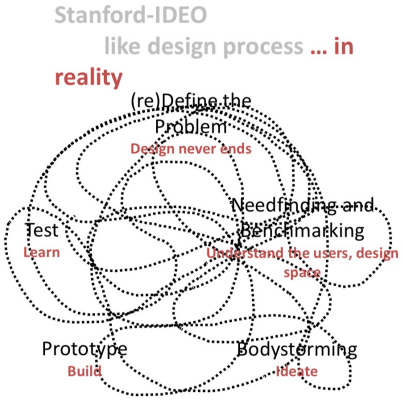


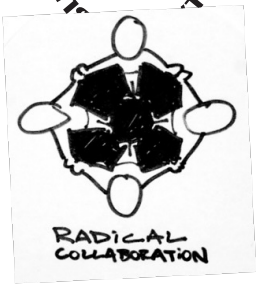
Some mindsets for innovation:

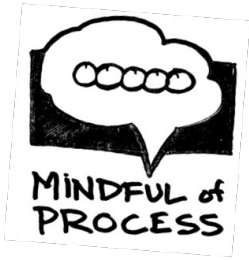


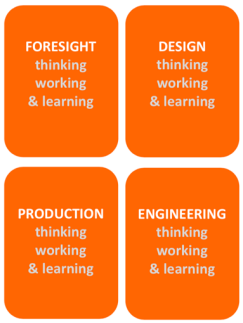
Ethos of Design thinking







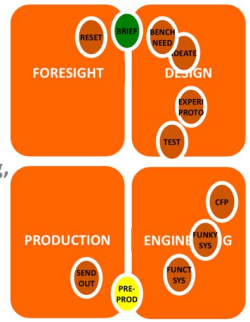




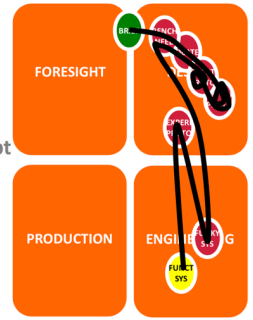
people

have different ways of thinking, working, and learning

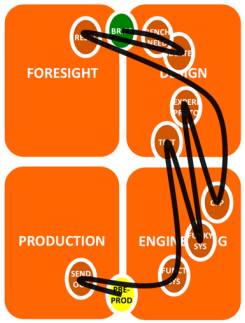
Lande PhD 2009



way points along the passage from a concept to functional proof-of-concept hardware, software, and experience ...



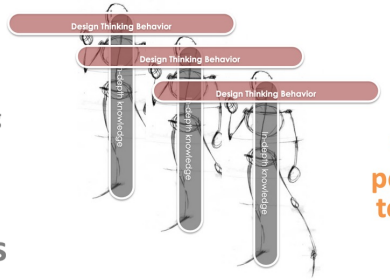
team-B's 8 month passage through the thinking and doing space



team-A's 8 month passage through the thinking and doing space

A earned a **WOW**

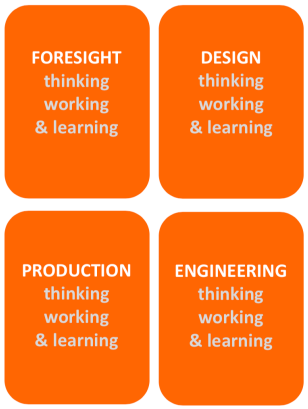
B earned a **thanks**



"T"
people
teams

Some pillars of the ME310 course

The lifecycle of an project



people

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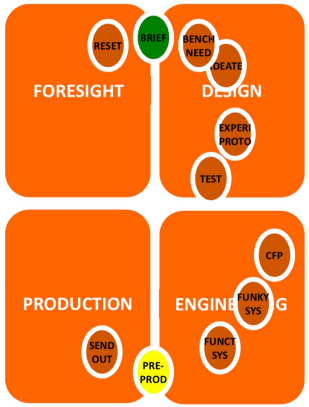

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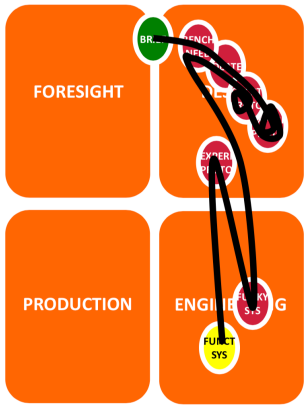
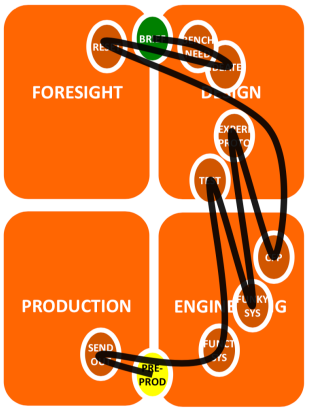


team-B's 8 month passage through the thinking and doing space



team-A's 8 month passage through the thinking and doing space

A earned a **WOW**

B earned a **thanks**

BTH Legacy

Tobias, Christian *(student -04)*, Andreas, Ryan *(student -16)*, Martin, Jenny, …

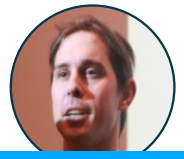
- Luleå University of Technology 1996 - 2011
- Blekinge Institute of Technology 2011 - …

Research

- Distance-spanning technologies
- Team based global innovation
- Knowledge Based Engineering


TOBIAS LARSSON


CHRISTIAN JOHANSSON ASKLING


RYAN RUVALD


MARTIN FRANK


JENNY ELFSBERG


ANDREAS LARSSON

INTEL iCare

Abbott Diabetes Care

Mimir

Nösphere

IDEUM

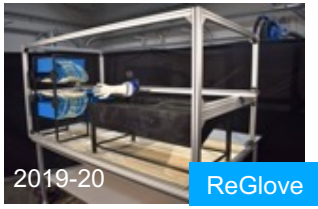
Volvo CE NIX

Volvo DNES

Volvo CE CX.Link

Volvo CE Advance

Volvo Oasis & Nomad



ReGlove

A RESEARCH VEHICLE…

Where we collaborate in research with our partner companies

Tang PhD 1989

re-search
re-design
re-innovate

a few things we have learned from instrumenting design teams in the

design-flight simulator

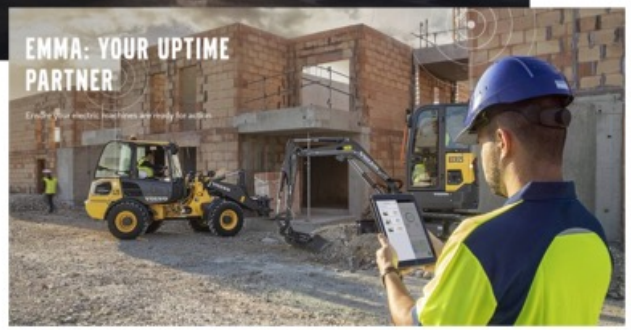
Students are our test subjects.. ;-)
We use the student projects to develop new engineering design methods.
Similarly, Volvo have learned from the ME310 Design Thinking / Innovation Engineering approaches for their innovation initiatives …

Volvo Group

STAKEHOLDERS:

- Volvo Construction Equipment
- Volvo Connected Solutions
- Volvo Innovation Labs
  - Hub 335 @ Mountain View, CA (PhD thesis!)
- MACK Trucks / Volvo Trucks

(often in collaboration on
highly interesting prompts 5-10 years out)



Key takeaways

- Teams spending time with each other outside the schedule during the week when they are gathered at Stanford are better at staying in touch throughout the year and are therefore able to utilize the full team's insights and capabilities better. The years when team members only show up occasionally for the hang out time, and seemingly want to be elsewhere, reflected that lack of connectedness by more frustration and conflict, or disconnect later in the year.
- Teams that do not get the "one global team" feeling will not reach as far as the ones collaborating throughout the journey. Some teams ended up with one Stanford delivery and one BTH delivery and connected these through storytelling
- Teams seem to reach further with their solution when the final convergence does not happen until the Stanford students visit in Sweden during spring break, therefore any attempt to converge prior to the spring break are challenged.
- Mutual interest for each other's work and respect for each other's competences within the local teams, and in the global team significantly increases the quality of the final EXPE delivery, why the supporting cohort made sure the teams set up lightweight knowledge sharing technologies (Bertoni & Larsson, 2011) and conduct joint meetings from the get-go.
- The quality of the EXPE delivery is higher when the full team engages in intense, co-located collaboration to get the showcase prototype and the auditorium presentation ready for EXPE. This meant that the BTH students arrived at Stanford 3-4 weeks prior to the EXPE. An intense and memorable experience for the team, and a significant time and money investment for all involved.
- Teams with a few individuals being appointed, or self-appointed, as leaders tend to lose a few individuals in the teamwork, so the team breaks up in subgroups. Teams where all feel equally responsible tend to stay cohesive and involved throughout the project.
- Teams that take on an ownership role, and act as this is their project, their shared accomplishment and do not just accept what the teaching teams are telling them become more cohesive and end up prouder and more satisfied with their experience.

A model to deeply engage with students in their early career, and get deeper collaboration with the industries that need them, and cut across disciplines in education.

Can we make it a BTH model across all disciplines? (in real life)

VOLVO VOICES ABOUT ME310

"What I think is beneficial with students is that they are new to these areas; with beginner's mind and new perspectives."

Also, the methodology that is used, starting from a Needfinding perspective, means that you go in with open eyes and not really have a solution in mind. You are not clouded by your surroundings."

TOMMY HANSSON,
VICE PRESIDENT INNOVATION LAB AT VOLVO GROUP CONNECTED SOLUTIONS

"The Volvo team this year have done an absolutely fantastic job. I can't remember that I have seen this good balance between the two sides before, definitely not with all team members so equally involved and motivated. You would all have been proud if you had heard how well the students could explain every step of the journey, and every decision they made."

"And what I loved the most, with my colleagues as audience, was how they emphasized the importance of an iterative process, the importance of low fidelity prototyping and the value of asking questions."

JENNY ELFSBERG,
DIRECTOR, VOLVO INNOVATION HUB 335 SILICON VALLEY

"We use this collaboration to explore! It is very nice to also use the results of the collaboration to show what a group of engineering students accomplished during a course on 9 month. Especially the insights gained and the overall research conducted in the early stage is invaluable for our organization."

"The big advantage for us as company is, that we can use the collaboration to take a glance at areas which might be of higher interest in the near future, without the bias of the big organization. The students bring in some new skills and another type of experiences."

MARTIN FRANK,
COMPANT SPECIALIST, VOLVO CONSTRUCTION EQUIPMENT

"This is a great way for Volvo to attract talent because the way you attract talent is getting people excited to work for you, and by tapping into these ideas and interacting with these students you're learning first-hand what future candidates and future generations want to work with and what motivates them."

"If you can implement that when they're ready to join the workforce – they feel invested already before they start working for you and your ideas. They know they were creating the ideas of the future; 'I want to be a part of that future'."

CHRISTOPHER KONNICK,
HR BUSINESS PARTNER, VOLVO NORTH AMERICA

PROJECT PORTFOLIO

OASIS & NOMAD

from our *ECV Support Solution*

VOLVO

CONSTRUCTION EQUIPMENT

BLEKINGE TEKNISKA HÖGSKOLA · BTH ·

LELAND STANFORD JUNIOR UNIVERSITY

DNES is the solution for SENDing materials and...

- Sensing Characteristics
- Recording Ownership
- Sharing Location
- Tracking transport
- Connecting stakeholders

2019/20: REGLOVE

VOLVO reglove

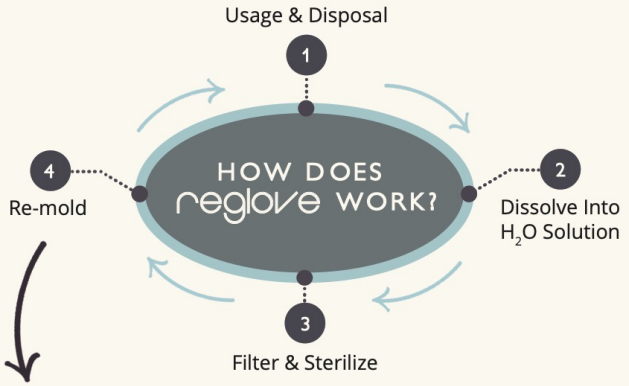
A recyclable glove in an increasingly wasteful world.

Each year, 300 billion disposable gloves are used. A large majority of these gloves are sent to landfills.

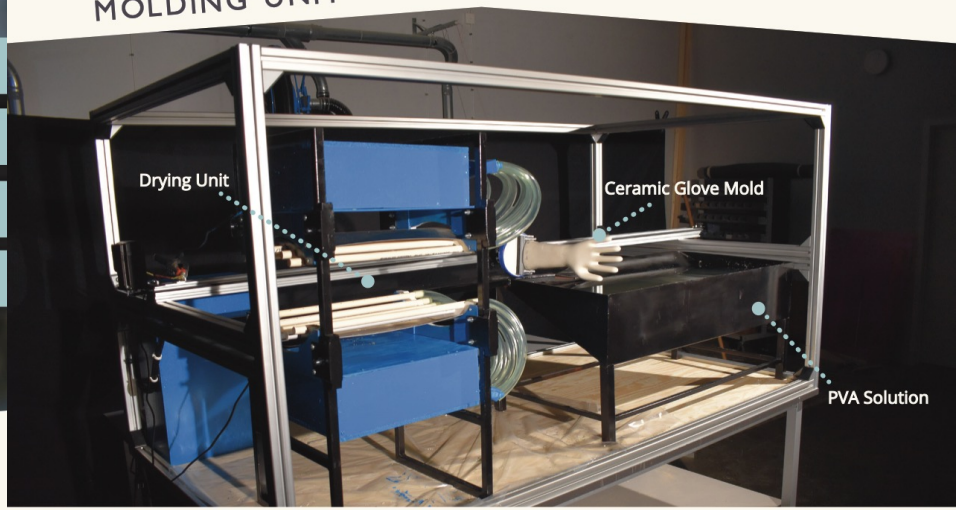
- DURABLE
- FLEXIBLE
- BREATHABLE
- GRIPPABLE

BENEFITS

- Circular system reduces the amount of landfill caused by PPE
- In-house glove manufacturing decreases dependence on external supply chains, especially in shortage situations
- Mobile system allows gloves to be made anywhere



MOLDING UNIT



Waste Management workers currently go through 3-5 pairs of gloves per 8 hour shift. Using water-soluble Polyvinyl Alcohol (PVA), Reglove gives facilities the ability to reproduce fresh gloves after they've been contaminated. Unlike current single-use gloves, Reglove is environmentally friendly and biodegradable.

VOLVO GROUP

Jenny Elfsberg
Martin Frank
Govi Kannan
Julie Wright
Lenny Levin

VOLVO CONNECTED SOLUTIONS/ MACK/VCE/WASTE MANAGEMENT

2018/19: V-COM

VOLVO CONNECTED SOLUTIONS

v-com

Harmony between humans and trucks

THE PROBLEM

30-35% of total truck accidents result in fatalities or severe injuries for vulnerable road users like pedestrians and bicyclists

Foremost accident types between road users and trucks:
30% crossing accidents
20% involve a Heavy Goods Vehicle making a turn

- Volvo Trucks Safety Report 2017

USERS

Pedestrians, Cyclists, and Truck Drivers

Key information sought by road users for decision-making in traffic:
- Eye contact with driver
- Safe areas to occupy
- Determining intentions of oncoming vehicle (velocity, direction)

Current state of road communication:
- Light information is binary and therefore unclear and indirect
- Heavy Vehicle Operators feel blamed for accidents
- Lack of active safety systems that communicate directly to road users

"You are never sure what the truck driver's intentions are. Sometimes you think they have seen you, but they have not."
- Pedestrian

"People are so stuck on their phones that they forget where they are walking."
- Truck driver

FEATURES

SENSING SYSTEM

Road User **Attentiveness Detection** using **Machine Vision** built with Deep Learning Network

COMMUNICATION CONSOLE

▲ Driver **eyesight projection** via Headtracking

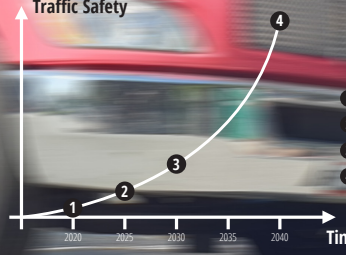
Confirmation signal to spotted Road Users ▶

Speedometer projection **showing intention** of oncoming vehicle ▶

▲ Indicates safe spots around truck

▲ Visualize vehicle manuevers

BENEFITS



Precautionary safety system that assists road users in navigating safely around trucks

1. v-com
2. Extended communication capabilities
3. Central communication console for autonomous vehicles
4. Seamless flow of traffic through connectivity between humans, vehicles, and the smart city

Jenny Elfsberg
Erik Lindström
Dastan Gomi
Charvi Aggarwal
Bhargav Reddy
Gaurav Gude
Catie Cuan

2017/18: ADVANCE

"The Pains of Today, The Concerns of Tomorrow"

Future construction sites will be autonomous and electric. Current infrastructure is not flexible enough to manage the transition towards this future. We introduce **Advance**, a versatile system that is designed to attend to the various needs of the future construction site. Distributing modules that enable on demand energy, dynamic communication networks, and more, Advance establishes the first stepping stone in this transition. Enabling autonomy through modularity, with Advance the possibilities are endless.

Pains of Today

Today's construction workers struggle with the following issues:

- Inflexible Power Infrastructure
- Static Network, Signal Losses
- Repetitive Manual Labor
- Safety & Health Risks

Concerns of Tomorrow

As construction evolves, the user evolves to be the autonomous construction vehicles. They need:

- Energy
- Connectivity
- Constant Uptime

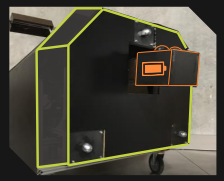
Transporter

An autonomous and intelligent robot. It receives information from site elements and determines the best time to act on the site using different modules.

Modules

Transporter attachments that perform tasks satisfying needs in the construction site

Mobile Access Point (MAP)
Couples with and redistributes MAPs to optimize network coverage.



XChange
Automated PowerPack (Energy Storage Device) exchanging machine. Replaces depleted packs with charged ones.

VOLVO
Exploration initiative in collaboration with Volvo Construction Equipment

Corporate Liaisons:
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Martin Frank

Coaches:
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Ryan Ruvald

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Christopher Perez
Salvador Perez

Simon Knutsson
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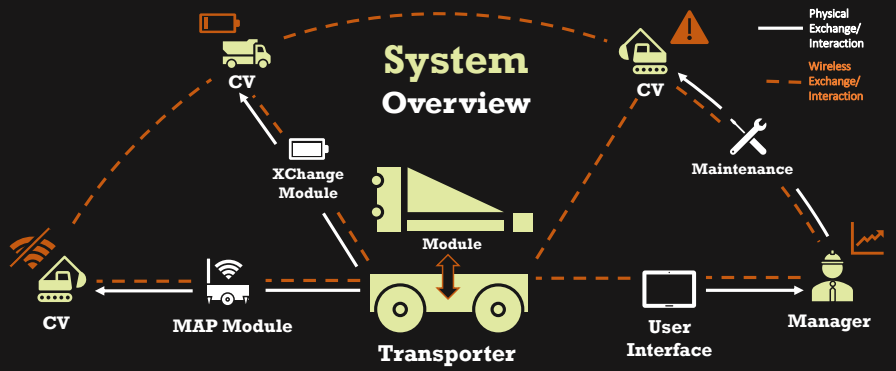
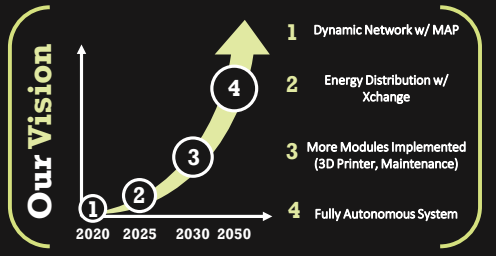
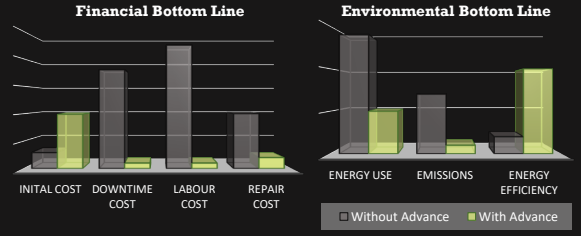
Daniel Larmark
Natalia Baraslievska

Enabling the Future of Construction



Autonomous, Electric Construction Vehicles · CV Needs · The Human Stakeholder Interacting w/ the System · Stakeholder Needs





VOLVO CONSTRUCTION EQUIPMENT

2016/17: TRACE

WHY

The team was challenged to look to the future of construction. With autonomous machinery on the horizon, a major obstacle in the implementation of autonomous worksites is the unpredictable nature of construction, especially in material identification and handling. Huge amounts of material are brought onto a site multiple times a day, and need to be located and accessed at specific times. To add to this problem, ground space on a site is typically very limited. This regularly affects workers on construction sites, causing delays and miscommunication between the many subcontractors. To tackle this, the team designed a system to track all material entering a site, and organize it both spatially and temporally. By discretizing a worksite by area and time of day, subcontractors can effectively claim areas to work and move both equipment and material without unintentionally coinciding at critical times.

HOW

SETUP
- Delivery arrives
- Tag scanned
- Info uploaded

PLACE
- Attach tag
- Tag uploads coords

TRACK
- Reserve space
- Plan route

WHAT

Velcro + strap attaches to material

Low power mode until movement sensed

Battery last months on one charge

Button press displays info

Rugged mobile case

Delivery database pushes info to tags

Barcode scanner insures quick and accurate input

Device charged in dock

VISION

Today — Future

Used by workers · Identifiable by machines · Optimized by machines · Fully autonomous site

Noor · Hassan · Louise · Kristian · Chen · Naser · Alex · Shenli

VOLVO CONSTRUCTION EQUIPMENT

2015/16: CX.LINK

Autonomous Construction Vehicles

Autonomous construction vehicles will operatate alongside human workers on construction sites within the next twenty years. As a leader in the construction industry, Volvo Construction Equipment (Volvo CE) aims to create a system that will enable efficient communication between human workers and automated machines. Such a system will increase safety and foster trust between the human workers and machines.

Command Center

The command center monitors the site for potential collisions. An alert is sent to the affected worker if a dangerious scenerio is detected. The alert changes the color status workers hard hat as well as the beacon light of the machine.

Smart Hard-Hat

The hard-hat system is made up of an integrated bone conduction headset and light indicator. This provides workers with reliable audio and visual communication.

Machine Pod

The machine pod integrates today's machines into a connected system, by transmitting location and position data. The beacon light conveys the curent status of the machine

Wrist Mounted Display

The display provides workers with machine trajactories and intentions in real time. The display serves as a platform that enables workers to interact with machines, and provides workers with insight into the autonomous systems knowledge.

Ryan Ruvald
David Winqvist
Hillevi Hallberg L.

Martin Frank
Jenny Elfsberg

Qinye Liu
Xiang Zhang
Samuel Frishman

VOLVO CONSTRUCTION EQUIPMENT

2014/15: NIX

URBAN MINING

The construction and demolition (C&D) industry in the US generates 350 million tons of waste every year. However, this material has the potential to be reused or recycled. In the future, mining new material will become more costly, and with new environmental sustainability regulations, it will become imperative to reuse material onsite. This will eliminate the need to quarry new material and reduce carbon emissions from trucking. Volvo Construction Equipment values environmental sustainability and aims to be at the forefront of urban mining.

1

Collapsible design enables for transport of 100 units.

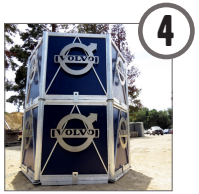
2

The robust RotoSlide Hinges enable fast onsite setup with two workers.

3

The NIX can be filled and moved with equipment already on the jobsite.

4



The NestRight base allows for safe stacking of up to 10 NIXs for months of storage.

5

The FlexFold bottom provides controllable material release.

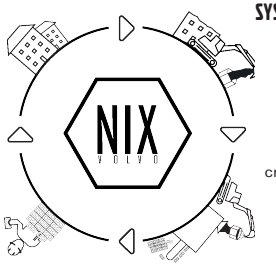
THE NIX

Currently there is no way to effectively store large volumes of aggregate material on a jobsite. The NIX decreases material footprint area enabling onsite reuse. This reduces trucking, which decreases carbon emissions and mitigates traffic disruption. Using the NIX to make C&D projects less disruptive, a contractor can reduce the risk of community push back and litigation. The NIX system leads to environmental, social, and monetary benefits.

MODULAR DESIGN

The modular design of the NIX allows it be assembled into a hexagon or square. The hexagon holds 4 cu yds of material and costs $650. The square hold 1.6 cu.yds and costs $450.

SYSTEM OVERVIEW



The NIX can be used in conjunction with onsite sorters, crushers, and batch plants creating a circular economy on the jobsite.

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Kristine Bunker
Teresa Tombelli
Tom Owlett

Gustav Kågesson
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Niklas Nilsson
Zainalabidin Tahir
Oskar Erlingsson
Simon Ha
Victor Söderberg

Volvo Liasons:
Jenny Elfsberg
Martin Frank
Coach: Michael Balsamo

VOLVO CONSTRUCTION EQUIPMENT

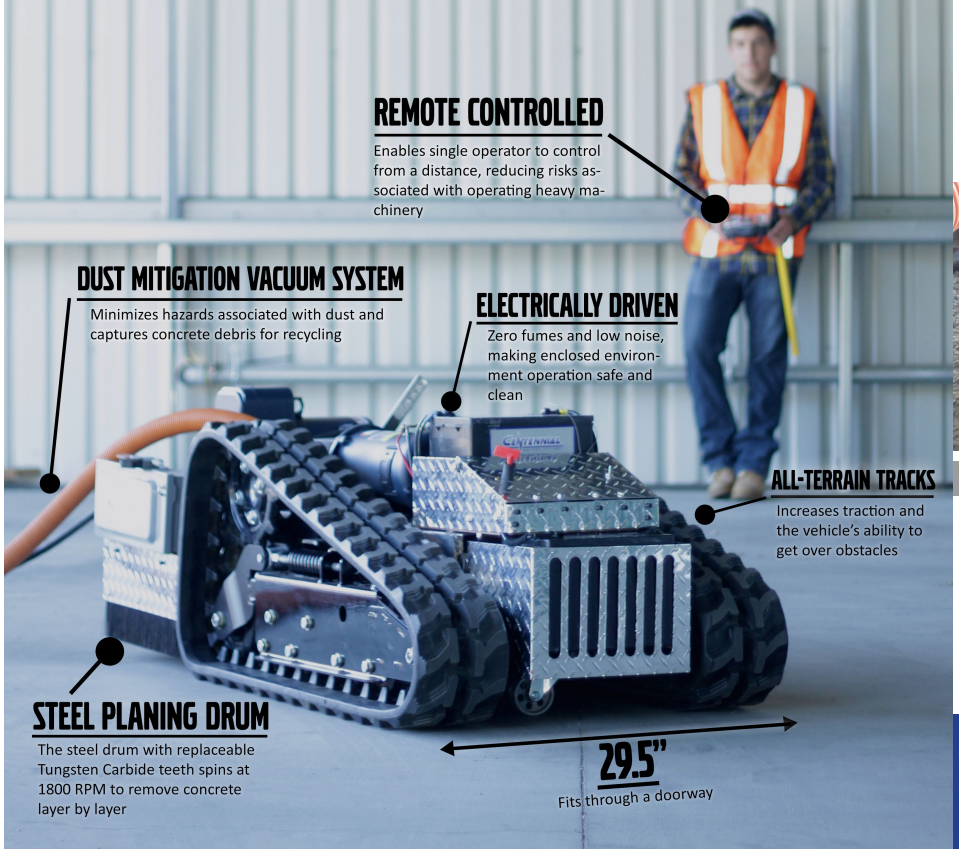
2013/14: 310X

310X

COMPACT CONCRETE PLANER

A CONCRETE VISION FOR THE FUTURE.

THE VOLVO 310X IS A GROUNDBREAKING SOLUTION FOR CONCRETE REMOVAL IN CONFINED SPACES. THE REMOTE CONTROLLED CONCRETE PLANING VEHICLE REMOVES JACKHAMMER OPERATORS FROM HAZARDOUS AND TEDIOUS WORKING CONDITIONS. THIS FACILITATES EFFICIENT USE OF HUMAN RESOURCES AND EFFECTIVE RECOVERY OF RAW MATERIALS IN URBAN DECONSTRUCTION.



REMOTE CONTROLLED

Enables single operator to control from a distance, reducing risks associated with operating heavy machinery

DUST MITIGATION VACUUM SYSTEM

Minimizes hazards associated with dust and captures concrete debris for recycling

ELECTRICALLY DRIVEN

Zero fumes and low noise, making enclosed environment operation safe and clean

ALL-TERRAIN TRACKS

Increases traction and the vehicle's ability to get over obstacles

STEEL PLANING DRUM

The steel drum with replaceable Tungsten Carbide teeth spins at 1800 RPM to remove concrete layer by layer

29.5"

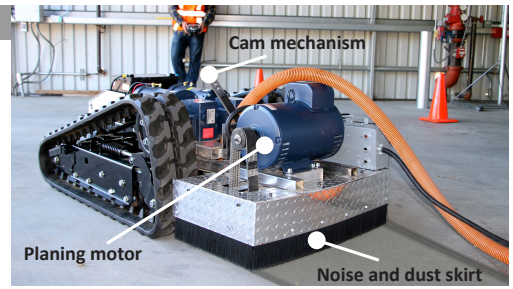
Fits through a doorway

BACKGROUND

As natural resources become increasingly scarce, there is a growing demand to recover materials from existing structures. The confined spaces associated with urban deconstruction necessitate compact equipment. Today the only option on jobsites are jackhammers, which are labor intensive and hazardous to use. In order to more effectively remove material from the urban landscape, the development of new machinery is imperative. This equipment must be able to access and work within confined spaces and around people, safely, quietly, and efficiently.

SOLUTION

The Volvo 310x is electrically driven by two 1 HP DC motors and 40:1 gearboxes. The drive motors are controlled by the Roboteq MDC2460 speed controller allowing for battery power and safe-distance remote control operation as well as potential future automation. The steel planing drum at the rear is turned at 1800 RPM by a 7.5 HP AC motor. A manual locking cam mechanism lowers the planer to a fixed engagement height allowing the operator to remove concrete layer by layer (0.25").



BENEFITS

High torque makes for smooth planing and easy travel over obstacles. Differential steering allows the vehicle to maneuver in tight spaces. Zero emission battery power allows the vehicle to travel without being restricted by cords. At 29.5" wide the 310x can fit through standard doorways, granting it greater access to confined rooms. The manual locking cam mechanism allows the operator to control the rate of engagement and move away during operation. The diamond plate skirt and vacuum system contains dust and debris.

KEY SPECS

- 1000 ft indoor remote control range
- 1 foot/second max planing speed
- 62 cubic feet/hour removal rate (equivalent to two jackhammer operators)
- 90 dB from 15 ft (vs. jackhammer at 115 dB)
- 29.5" x 60" footprint
- 950 lbs

TEAM: KEZIA ALFRED // TIM MARTIN // CALDER HUGHES // JACK BRODY // DAVID ANDERSSON // ZHENQING GAO // YI CHAI

LIASIONS: ANDREAS NORDSTRAND // JENNY ELFSBERG

COACH: MICHAEL BALSAMO

VOLVO CONSTRUCTION EQUIPMENT

2012/13: IDÉUM

TANGIBLE CONNECTIONS

Organize your ideas on **hexagonal tiles that magnetically snap together** with a satisfying *click*. Building on others' ideas becomes intuitive, gratifying, and fun. Tangible ideas can be easily clustered and reconfigured, **inspiring new structures and connections.**

ILLUMINATED IDEAS

A soft glow highlights ideas as they are added to the surface, reinforcing the value of each contribution. Spotlights follow tiles as they are slid around, **injecting kinetic energy** into the discussion. They glow brighter and bigger as ideas are gathered together, echoing the mounting excitement.

SCULPTED INTERACTION

The dynamic hexagonal shape makes **teammates face each other** while keeping the work area within arm's reach, **ensuring equal and active engagement**. The horizontal work surface and standing configuration **encourages physical movement and energy**.

THE NEED

Corporate teams tasked with delivering innovation on a short time frame face a stressful task. This is compounded by the fact that these **teams often do not *view* themselves as creative**. We set out to bring energy - and a touch of fun - back into the brainstorming process, creating an inspiring and playful experience that **builds creative confidence.**

OUR PRODUCT

The IDÉUM experience is **designed to encourage behaviors that result in better idea generation**. Inspired by the d.school's *Rules of Brainstorming*, it incorporates some of these mantras into its physical form. For example, the magnetic tiles encourage literal building on ideas.

This focus on tangibility - on physical movement and sensory stimulus - creates a sense of play. Evoking memories of toy blocks and imaginary worlds, it encourages users to lose some of the inhibition of the corporate meeting room.

THE CREATIVE ENVIRONMENT

IDÉUM is designed to be part of a new innovation center in Karlskrona, Sweden. The site of the center is Kungshall, a storied naval warehouse constructed in the 17th century. Kungshall's goal is to support users at all stages of the design process - from needfinding through to implementation - and then connect them to the resources they need to make their ideas real. IDÉUM enhances idea generation and organization, functioning as a nexus that teams return to throughout the design process.

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BLEKINGE INSTITUTE OF TECHNOLOGY:
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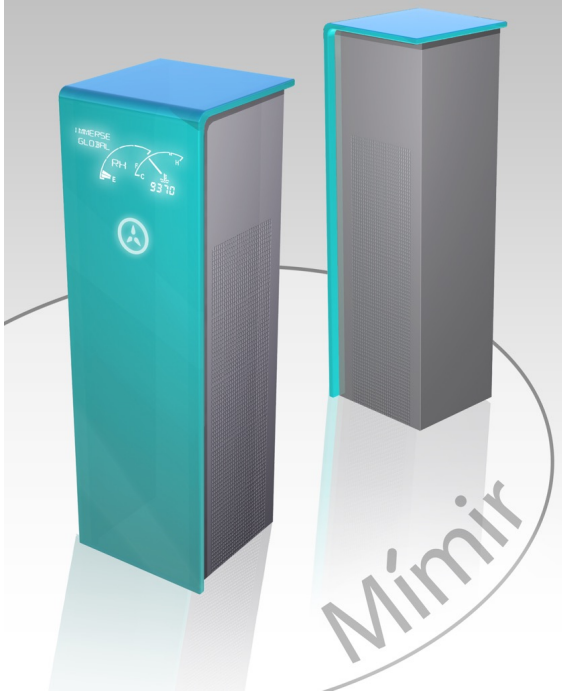
VOLVO Construction Equipment
Michano

VOLVO CONSTRUCTION EQUIPMENT/MICHANO

IMMERSE GLOBAL

immerse global®

Mímir - *Atmospheric Water Generator*



ME310 2007-2008

Background

Scarcity of pure drinking water is a big problem in the world today. According to several surveys, one out of every three persons on the planet lacks accessibility to fresh water. This has necessitated the need to come up with alternative sources of drinking water as the conventional sources such as ground water and rivers are neither universally available nor very pure at times. Air water generators have been addressing the need to generate pure drinking water from atmosphere for the past two decades. However, the design presently in vogue has a limited applicability. The present technology is not a reliable option in adverse climatic conditions, like low relative humidity and extreme temperatures.

The Vision

Team Immerse aims to design and develop an Atmospheric Water Generator that produces clean, affordable drinking water even in adverse climatic conditions. The task includes development of a new, radical technology that is energy efficient and works reliably under a wide humidity range. In addition, the look and feel of the new device would create a new user interaction and provide added comfort and portability for home and office use.

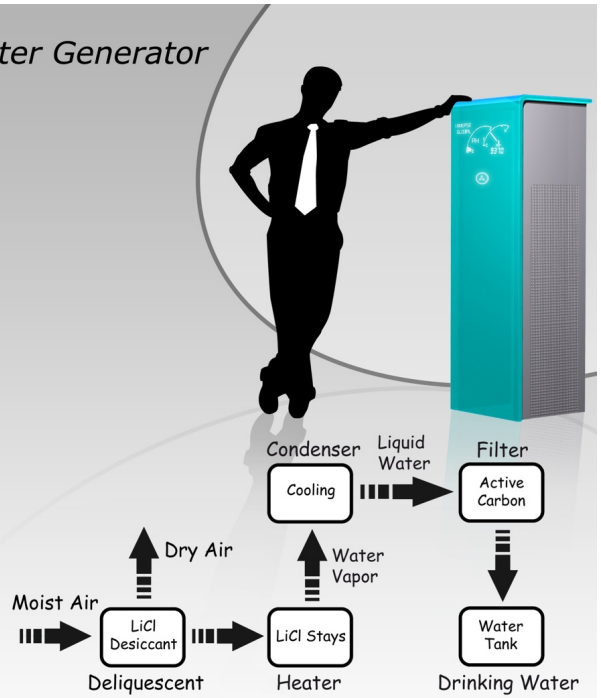
Mímir - *Atmospheric Water Generator*

Present Design

Team Immerse design uses an aqueous solution of the desiccant – lithium chloride – to absorb moisture from air. Desiccants are chemical substances that have a natural tendency to absorb moisture from the environment. The key advantage of a desiccant over conventional refrigeration cycle is that its performance does not deteoriate appreciably at low humidity levels. Also, the liquid solution enables easier handling of the substance. The CUBE can manage two very important things - an effective water collecting system and a high airflow. The air flow needs to be high because of the small amount of water at low RH levels. Another aspect is that the prototype uses a true distillation process to extract the drinking water. This process naturally kills any microbes and fungi that may be present in the solution, thus producing clean, pure drinking water.

Features

Produces enough water for one family even under dry conditions (7-10 liters of water per day at 25ºC, 35% relative humidity). The technology is energy efficient and is environment friendly (no refrigerants involved). Produces clean and healthy drinking water.



immerseglobal

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Henrik Bruce

2007/08: MÍMIR (with PIEp & LTU)

2005/06: NÖSPHERE

Nösphere
ME310 2005-2006

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Coach
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Project Sponsor
City of Luleå, Sweden

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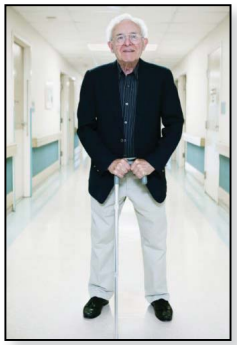
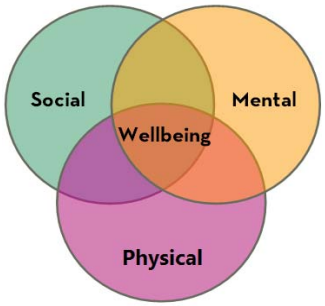
Web
http://wikibox.stanford.edu/05-06/index.php/Projects/SiriusWellBeing

Background



The aging of the world's population is a growing concern for all generations. Over the next few decades, the coming retirement of the Baby Boomers and the lengthening life expectancy of individuals will create a demand for elderly care services that will outstrip current resources. Even today, the quality of life in nursing homes is far from ideal, leaving a large potential for a novel product or service.

To explore this potential, a new elderly care facility is being constructed in Luleå, Sweden in collaboration with the EU-project "Our Life as Elderly." This new facility is intended to serve as a world-leading model for modern elderly care, providing a complete sense of wellbeing for its inhabitants. Team Sirius was tasked with creating a product or service that enhances the wellbeing of elderly persons in the latter stages of life.

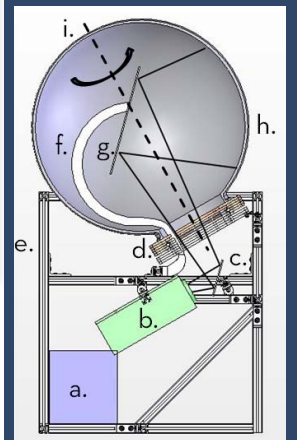


Vision

With the goal of enhancing physical, emotional, and social wellbeing, Team Sirius focused on a method to encourage activity through multi-sensory stimulation. In early stages of prototyping, this concept took the form of a hallway through which residents would be motivated to walk, using the appearance of personalized pictures on the walls with pleasurable lights, sounds and scents. The team later moved from the concept of a multi-sensory environment to a tangible product that can provide similar stimulation.

Nösphere
ME310 2005-2006

How it Works



Internal Projection

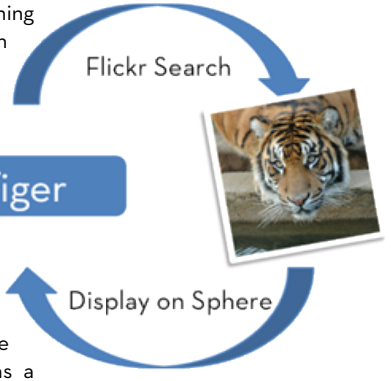
The Nösphere is free to rotate about a single axis. The image is created using internal projection, the also has the ability to provide a click function, similar to a typical scroll wheel.

Components

a. Computer
b. Projector
c. Primary Mirror
d. Large inner diameter bearing
e. Aluminum frame
f. Secondary mirror holder
h. 22 in polycarbonate sphere
i. Axis of rotation

Design Development

Team Sirius developed the Nösphere, a 22 inch diameter ball, which is used to interact with media in an unconventional fashion. The sphere stands approximately two feet off the ground (ideal wheelchair height) and rotates around a vertical axis at an angle of 30°. Using Flickr, an online photo album, residents or caretakers input a key phrase into a hidden computer using a keyboard, and a set of matching pictures appear on the ball (e.g. animals, sunsets, pictures of their family and friends). The image is projected on the surface of the ball, and as the elderly user rotates the sphere, one image rotates off the ball as a new one rolls into view. When testing the original concept of the Nösphere in a nursing home, Team Sirius observed obvious excitement in elders as they physically manipulated the ball and in return saw images



DESIGN FOR WELLBEING: NEEDINN (with LTU/SIRIUS)

2005/06: FUTURE BLOOD GLUCOSE METERS

Abbott Diabetes Care

STANFORD UNIVERSITY

LULEÅ TEKNISKA UNIVERSITET

ME310 - 2005-2006

TEAM ABBOTT

Future Blood Glucose Meters

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Luleå Members:
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RESEARCH IN USER INTERFACES FOR FUTURE BLOOD GLUCOMETERS

Project Background and Goals

Diabetes, a disorder affecting millions of people across all age groups, is forcing those afflicted to grapple with sudden changes in lifestyle, diet, exercise and healthcare costs. A critical component in this new lifestyle is the blood glucose meter – a device that measures a patient's blood glucose concentrations in milligrams per deci-Liter. Through interactions with users, Team Abbott learned that many existing meters do not fully harmonize all the needs of a complete diabetes management program and that the meters that attempt to do so are complex and awkward.

Team Abbott's solution to the problem focuses on **juvenile Diabetes**, and consists of a meter that **encourages better self-management** of diabetes by providing **behavior-improving feedback**.

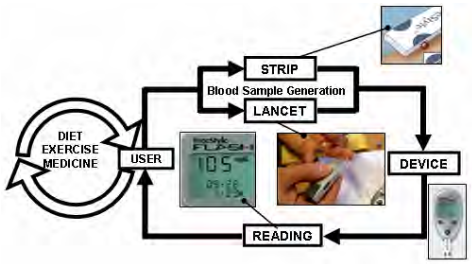


Fig 1. The blood glucose testing procedure with the user in the center, utilizing the results of each test to enact lifestyle changes in diet, exercise and medicine.

A Collaborative Design Effort

The Stanford University team is partnered in this endeavor with a team at Luleå Technical University, Sweden. The teams developed a close relation through brainstorming and collaborative design sessions that helped generate a multitude of concepts and allowed for distributed development at latter stages of the project.

Abbott Diabetes Care

Informative Feedback for Kids

- Set up a diabetes management plan, follow it and watch it in action.
- Detect correlations and compute smart averages for the user's blood glucose and other lifestyle information.
- Make medication intake suggestions based on the user's body, current performance and specified targets.
- Suggest automatic reminders and alarms to complete the entire self management cycle.
- Implement Operant Conditioning to educate the user and help correlate symptoms with results through positive behavior reinforcement.

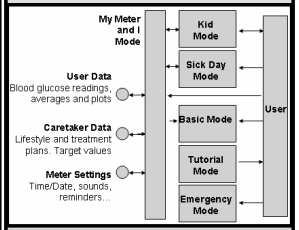


Fig 3. Software Interface of Informative Feedback for Kids: 6 user modes that implement smart information management and positive behavior reinforcement.

Team Vision and Development Strategy

Team Abbott's research and prototyping efforts led the design process through two joint paths, continuously refined by expert opinion and user feedback:

- Design an **innovative**, **playful** and **highly portable** meter that appeals to children.
- Turn the **Informative Feedback for Kids** concept into reality.

Fig 2. Feature diagram of the modular Twist meter.

Final Design: The Twist

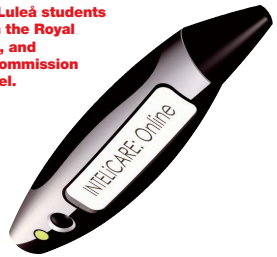
Team Abbott's design efforts culminated in the production of **Twist**, a modular glucose meter that complements and interacts with a software simulation of the various user modes of **Informative Feedback for Kids**. An ultimate validation campaign at the Lucille Packard Children's Hospital confirmed many of the design features and provided valuable opportunities for future work.

ABBOTT DIABETES CARE (with LTU/SIRIUS)

INTEL/DESIGN FOR WELLBEING

INTELiCARE

INTELiCARE is a project where Luleå students collaborated with students from the Royal Institute of Technology, Sweden, and Stanford University, USA, on a commission from technology corporation Intel.



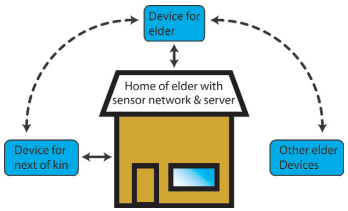
The Luleå INTELiCARE team.

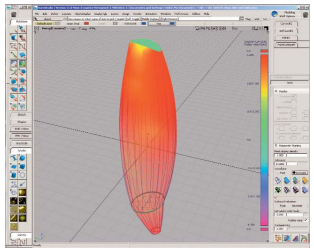
The project aim was to prolong elders' independence and enhance their quality of life. It was also intended to encourage elders to maintain and expand their social networks. The solution was to use intelligent systems at home that control the user's physical and social activity level. By using this system, a relative or caregiver gets a better insight into the elder's life. The system also encourages physical and social activities by creating active networks among elderly people, facilitating lines of communication that encourage them to socialize with other elders.

A feasible scenario is a widow in her early seventies living on her own. She has a son who is in the middle of a stressful career and family life. He does not have the time to check in on his mother as often as he would like to. Thanks to the INTELiCARE system, he can get a glimpse of his mother's social and physical activities. He can see her routines and her social and physical activities as well as being able to send a signal, to which she can respond to indicate that everything is okay.

His mother can see her friends' keenness to contact her and she can signal her social availability to them. She can also send a signal to her son to say that everything is okay. Another possibility with this unit is that she can counteract cognitive decline by viewing images and explanatory text of relatives and friends by projecting these images and texts with the unit on, for instance, a table or a wall.

The Social Health Monitoring System.





3D model in AliasiWavefront Studio Tools.

The system consists of three main components:
1. Communication device for next of kin
2. Communication device for the elders
3. Communication system

Communication device for next of kin

This device enables relatives to monitor how the elder person's routines and social and physical activities are going. By receiving different vibration patterns from the unit the different activities can be interpreted. There is also a possibility to send a "ping" signal to the elder, a signal that can mean whatever the customer wants.

Communication device for the elders

This unit gives the elders the possibility to see what their friends' availability is at the moment. If they browse through the names of their friends they can see if they want to socialize or not.

Communication system

The communication system is a computer system that connects the two devices and it consists of a number of sensors in the home of the elder. The sensors sense a range of activities that thereafter are interpretered and translated into the three main activities that can be seen on the communication device for the relative.

The project was carried out using a product development methodology that aims to give students a solid foundation for carrying out any product development project in the future. The methodology aids the development work by giving a structured way of carrying out the project and seeing to it that the needs of the user are satisfied with the new product or service.

Result

The result presented in May was the system with the two included devices that has been successfully given the properties that the project group aimed for. A few new creative functions have emerged that aim to fulfil and further exceed the user's expectations.

Looking back on this project, having used this product development methodology in a distributed collaboration with Stanford University and the Royal Institute of Technology, the INTELiCARE members feel they have been successful in creating new solutions that promote the wellbeing of elderly people.

2003/04: INTELiCARE (with LTU/SIRIUS)

2003/04: INTELiCARE

intel iCare

Stanford University
ME 310 2003 – 2004

Team Based Design with Corporate Partners

Project:
Proactive Health Technology

Innovations:
- Development of a new concept in preventative care
- Unobtrusive sensing of elder's wellbeing
- Discreet update to caregiver(s) on elder's status
- Promote social interaction and slow cognitive decline
- Prolong independence

Team INTELiCare:

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Proactive Health Technology

Prolonged independent living through an innovative communication media driven by ubiquitous computing

Background

Intel's Proactive Health group enlisted students from Stanford, KTH Royal Institute of Technology (Stockholm, Sweden) and Luleå Technical University (Luleå, Sweden) to explore potential applications of ubiquitous computing and to develop technologies that prolong elders' independence and enhance their quality of life. The student design group, Team INTELiCare, is focused on solutions that are non-medical in nature and target two primary user groups: part time caregivers and elders with mild to no cognitive decline.

User Inspiration

Meet Mary and Jeff. Mary is an 88-year old widow who lives independently in her own home. She is in good physical health, but is becoming more forgetful. Mary's son Jeff is her primary caregiver and becomes increasingly concerned as he notices a decline in her activity levels and mental sharpness. As a caregiver constantly on the go, Jeff struggles with juggling his career, family life and providing care for Mary. Jeff is wondering how long it will be before he is forced to place his mother in a care facility and wishes there were a system that would help alleviate the burden of caring for his mother while also improving her quality of life.

Project Vision

Needfinding and ethnographic research from Intel revealed the above scenario is common in families caring for an elder and identified the following two potential product development areas to assist part time caregivers and elders:

- ***Caregiver on the go -*** Caregivers are often active and busy members of the workforce with the added burden of watching over a loved one. The caregiver is concerned with the wellbeing of the elder and needs to check up on the elder throughout the day to ensure he/she is doing well. A device that could ease the burden of a busy individual by discretely conveying vital information sensed about an elder would make it easier to keep the caregiver and elder connected and could prolong the independence of the elder by reducing the need to place the elder into a nursing home.
- ***Social connectedness -*** Current society makes it difficult for elders living alone to maintain an active social life. Yet, research indicates that elders that stay active tend to be less prone to further cognitive decline. A product that facilitates the ability of independently-living elders to have an active social life could also reduce the effects of cognative decline and prolong their independence.

Figure 2: Mote-equipped INTELiShoes track and transmit physical activity information

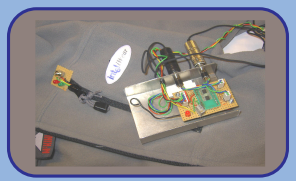


Figure 3: Smart Mics in this INTELiWear garment sense and infer data to determine a user's social activity level

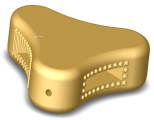


Figure 4: Ambient caregiver's portal – deflection model

Figure 5: Ambient caregiver's portal – vibration model

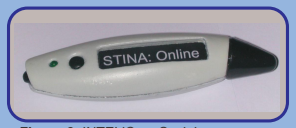


Figure 6: INTELiCare Social Connectedness Tool (for elder)

INTELiCare System Functionality

The iCare system is designed to unobtrusively sense the wellbeing of an elder, convey the status to a caregiver and promote social interaction. This is realized through a series of components listed in figure 1 and described below.

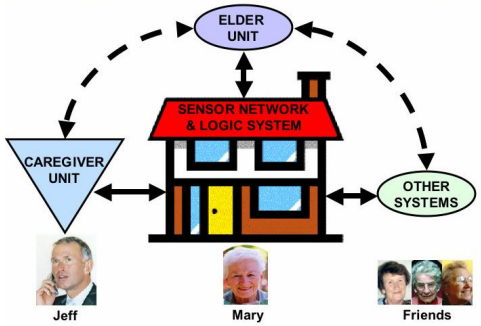


Figure 1: Diagram of System Functionality

Sensor Network
- In home system senses and infers elder's wellbeing
- Physical sensor – custom pedometer measures walking frequency to determine physical activity level
- Social sensor – a dual-microphone sensor monitors the user's voice and filters background noise to infer level of social activity
- Routine sensors – various contact switches monitor typical household objects such as doors, cabinets, windows, chairs, and beds

Central Computer Logic System
- Gathers and analyzes data from mote sensor network
- Relays information to / from elder and caregiver devices

Caregiver Device
- Acts as a caregiver's ambient portal to important information regarding an elder caretaker
- Conveys high, average, and low activity level in three categories; social activity, physical activity and daily routines
- Desirable methods of conveying information resulted in two devices – deflection and vibration models

Elder Device
- Keeps elder users connected to loved ones via an IM reminiscent contact list
- Notifies elder when caregiver checks in on him/her
- "Portable Projector" functionality allows elders to browse and display a memorable photo album

INTEL/DESIGN FOR WELLBEING (with LTU/SIRIUS)

DESIGN FOR WELLBEING

CRE[ATIVO]^2 – mobility devices for an active lifestyle

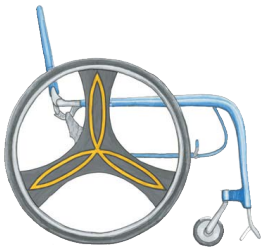
In this international project students worked on expanding today's concept of mobility devices for active users. The primary goal was to address the challenges that people with disabilities face due to winter conditions.

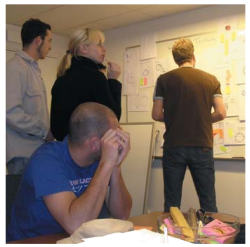
Imagine yourself going up a steep grade in the dead of winter. There is a light dusting of snow and a thin layer of ice on the ground because it was warm the day before. You can barely keep yourself from falling let alone walk up the hill. That wing-flapping motion with your arms isn't helping. Now imagine that same scenario but this time in a wheelchair that is meant for traversing linoleum floors. If you thought you were getting nowhere walking, try spinning around for a while!

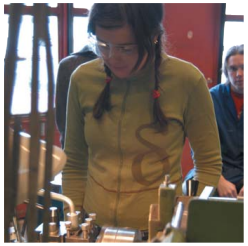
The Task

CRE[ATIVO]^2 is part of the Design for Wellbeing initiative, and its main goal is to enhance the wellbeing of persons with disabilities by using their description of needs as a starting point for product development.

The team started out with only one set of keywords to frame the scope of the project: *active, winter, leisure time.*







From these words the team started to focus on mobility devices. Through rigorous needs analysis and benchmarking of current solutions the group discovered the need for winter-adaptable manual wheelchairs. Thus, the mission statement for the CRE[ATIVO]^2 project was formulated:

To develop a safe mobility device that is easy to maneuver on varied terrains and in multiple weather conditions. The device should also improve user access to facilities and transportation, while being easily transportable.

International Cooperation

The work has been conducted in an iterative development process on a global scale. Eight students from Luleå University of Technology and four students from Stanford University, USA, have worked together as a single team, where each geographically separated group has contributed its own skills and viewpoints, both culturally and professionally, to solve the task.

This, together with the fact that the two universities have different theories of approaching product development, has allowed the team to apply the best of both worlds during their work. All participants were also exposed to technologies supporting collaborative design, providing crucial experiences in multinational teamwork.

Results

Through numerous concept generations and evaluations, a light-weight composite wheelchair and a tire cleaning system was developed. By using composites instead of metal, the weight of the wheelchair was reduced, thus allowing for the addition of extra features while still keeping the chair lighter than the most popular chairs on the market today. A center of gravity adjustment feature was added, whereby the user can adjust the center of gravity position while in the chair. This allowed for the backrest to be adjustable in different positions, giving the user added comfort. Traction in winter was improved by the addition of clip-ons with a unique tread pattern.

Finally, a wheel cleaning device was created to help the user to clean the chair before entering the house during late winter and early spring, when pavements are wet and dirty.

2003/04: CREATIVO (with LTU/SIRIUS)

2003/04: CREATIVO

Side-Winder

Manual Wheelchair
Tire Cleaning System

Stanford Team Members: Karlin Bark, Jeremy Melul, James Parle, and Brett Swope

Background:

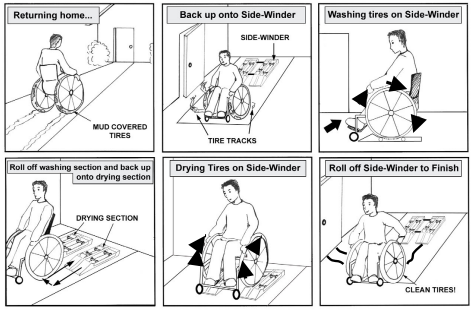
The goal of the project is to improve the wellbeing of those who use assistive mobility devices, keeping in mind the terms *active*, *winter*, and *leisure*. Through extensive research, benchmarking and needfinding TeaMate discovered a need for a device that prevented active manual wheelchair users from tracking dirt and water into their homes. It was discovered that wheelchair users tend to be less active due to the hassle of having to clean their tires each time they enter their home.

Designing a Better Rag:

There is currently no product on the market that is capable of quickly, effectively, and cheaply cleaning a manual wheelchair user's tire and most wheelchair users are relegated to using a rag. The Side-Winder, named after the sideways path that occurs during the cleaning process, is designed to address the need for a low cost tire cleaning system for active manual wheelchair users that is intuitive to operate and reliable. The design was developed using user feedback as the primary driving force. Extensive prototyping and testing insured that the Side-Winder fulfilled the design requirements.

How the Side-Winder Slithers:

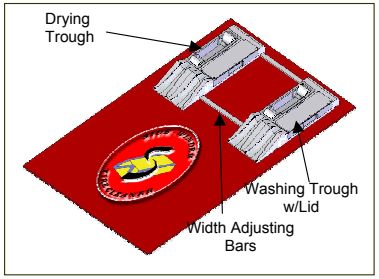
The Side-Winder is designed to both wash and dry the user's tires making it suitable to remove dirt, snow, mud, water, gravel and other debris from the wheelchair's tires year round. The Side-Winder tire cleaning system for manual wheelchair users can easily be placed just inside the entrance of a home or any other suitable location around the house. The device accommodates nearly all wheelchair geometries that are currently on the market and custom wheelchairs. The tires are cleaned by rotating them in a washing trough, which contains brushes immersed in water. The brushes and water combine to remove the dirt from the tire tread. A drying trough, next to the washing area, is equipped with highly absorbent material to dry the water off the tires. After these two main stages, the cleaning process is complete. The Side-Winder uses a six step process to clean the user's wheelchair tire. These intuitive steps are summarized and are visually represented in the storyboard below.

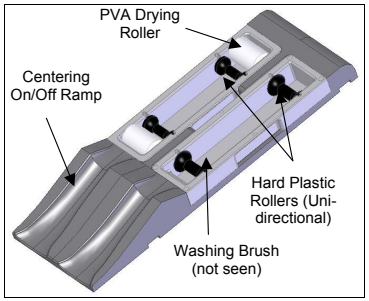


Design Specifications:

System Specifications

Overall Height:	1.75 in
Overall Width:	3 ft (with carpet)
Overall Length:	5 ft (with carpet)
Volume:	0.6 ft^3
Weight:	20 lbs
Maximum capacity:	350 lbs
Instruction time required:	3 minutes





The Side-Winder body and troughs are constructed out of rugged ABS plastic and the washing support rollers are constructed of Delrin plastic. The support bars and drying rollers are constructed of Aluminum and Polyvinyl alcohol (PVA) respectively. The main subsystems of the cleaner are the two Washing Troughs, the two Drying Troughs, and the Body. The Washing Troughs each contain two Delrin rollers, a washing brush, a fling prevention brush and a sealing lid. The two drying troughs each contain two Delrin rollers and two ultra-absorbent PVA rollers. All four troughs slide into the body to form the cleaning system and the Aluminum bars allow the user to adjust the system width to accommodate various wheelchair sizes.

System Features:

- Easy to grasp handles on both the washing and drying troughs
- Removable plastic rollers for cleaning
- Customized brush pattern to clean the entire tire tread
- Curved on/off ramps to align wheels into the device
- Adjustable bars to adjust the width of the device to accommodate various wheelchairs
- Anti-fling brush to stop water from spilling out of the device
- Lid to easily transport washing trough without spilling water
- Cleans tire completely in less than 2 revolutions
- Highly absorbent PVA drying rollers to dry the tires

DESIGN FOR WELLBEING (with LTU/SIRIUS)