

“New product **design**”  
Capstone **projects** course in ME

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# Topics to be addressed

1. What is a Project?
2. Engineering design and methodology
3. Project based learning (PBL) and Design-build-test (DBT) projects
4. Teaching “21<sup>st</sup> century skills” in mechanical design projects
5. “New project design” course examples

# “Project”

The word **project** comes from the **Latin** word **projectum**.

The word "project" originally meant "something that comes before anything else happens".

# What is a Project?

- Any assignment which will end when a goal is reached
- A project is a job that is done once
- A project is a problem scheduled for solution -  
J.M Juran

# Formal definition of a Project?

## **PMI definition:**

**Any undertaking with a defined starting point and defined objectives by which completion is identified. In practice, most projects depend on finite or limited resources by which the objectives are to be accomplished**

# Project management – (A profession)

Project management includes three main phases: Planning, executing and controlling.

## PMI definition

**Project Management is the art of directing and coordinating human and material resources throughout the life of a project by using modern techniques to achieve predetermined objectives of scope and quality, time and cost**

Engineering project management includes in addition Methodology of project development.

# Confusing terminology (Hebrew - English)

Design – תכן Mechanical design

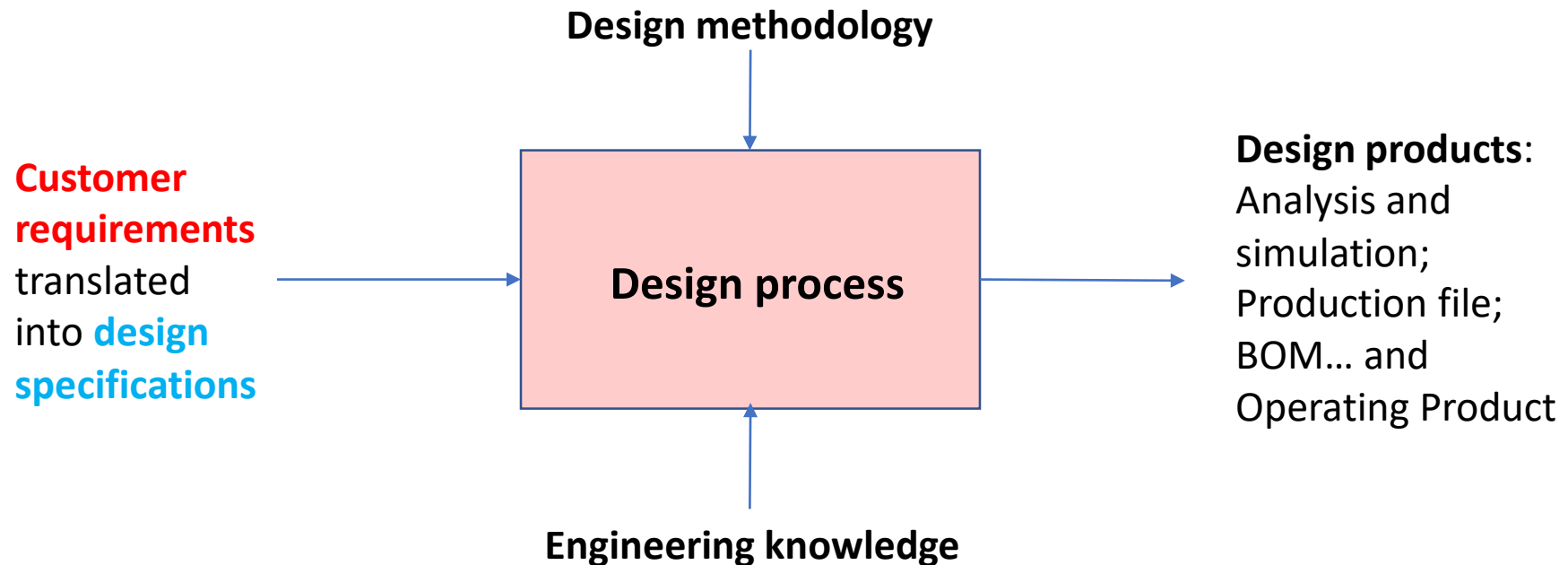
Design - עיצוב Fashion (Art) design

Planning - תכנון Project planning

Design - תכן Machine (Product) design

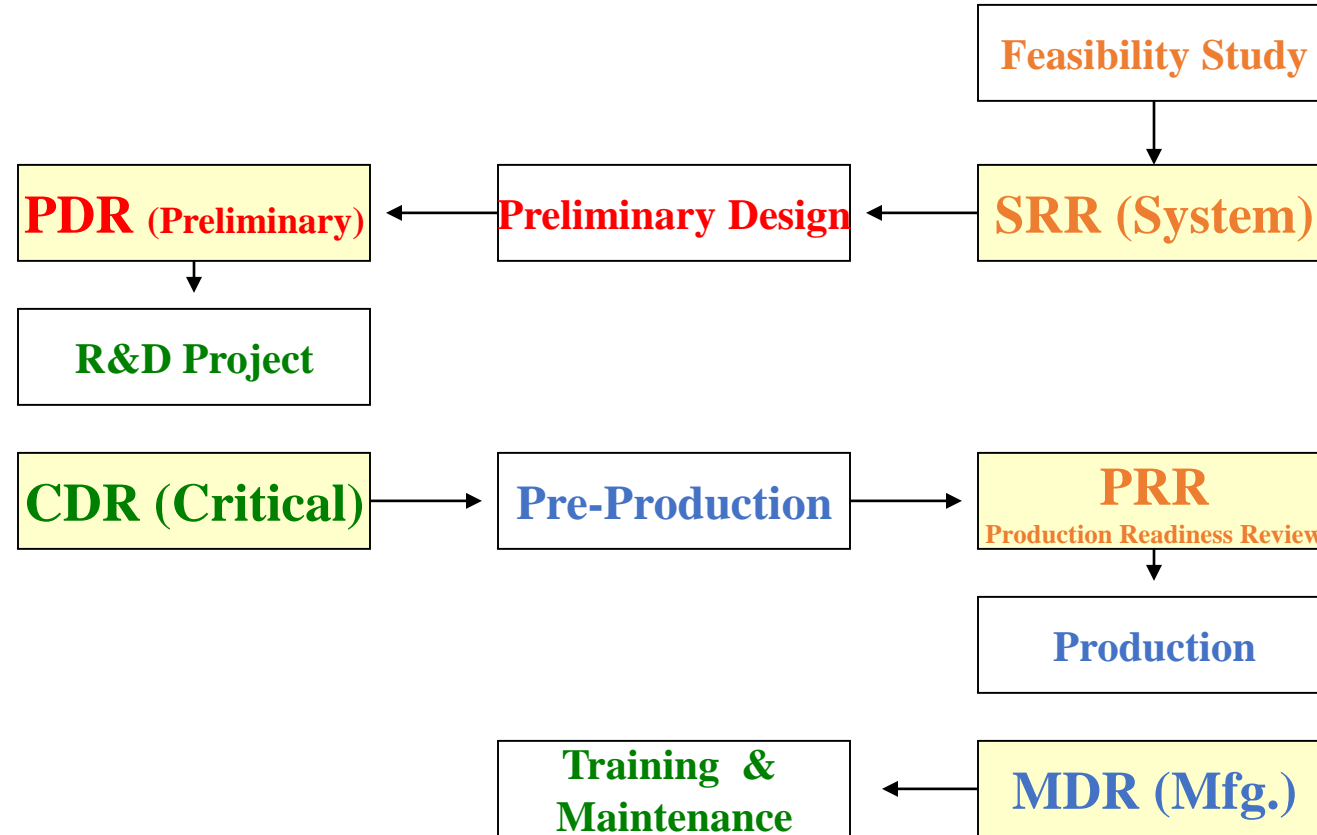
# Engineering design process

Engineering design is a decision-making process with a goal of finding an optimal solution for a product that will meet customer's needs.





# Development Methodology - Design Reviews



# Project based learning and Design-built-test projects

1. PBL is a style of **active learning** and **inquiry-based learning**.

There are numerous benefits to the implementation of PBL's strategies in the classroom – including a greater depth of understanding of concepts, broader knowledge base, improved communication and interpersonal/social skills, enhanced leadership skills, increased creativity, and improved writing skills.

R. Katz, Integrated Thinking in Mechanical Engineering Education, *International Journal of Engineering Education* Vol. 31, No. 6(A), pp. 1613–1621, 2015

2. The design, build and test (DBT) project was created with the idea that the best way to learn **engineering** is by **doing** engineering. The primary goal of a DBT project is to provide students with an experience that is fun, motivating and educational.

(PDF) *Using design, build, and test projects to teach engineering*. Available from:

[https://www.researchgate.net/publication/3883130\\_Using\\_design\\_build\\_and\\_test\\_projects\\_to\\_teach\\_engineering](https://www.researchgate.net/publication/3883130_Using_design_build_and_test_projects_to_teach_engineering)

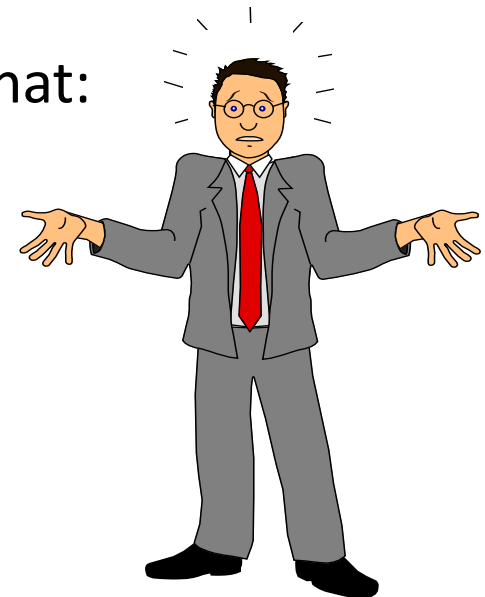
# Teaching engineering design by DBT projects

**The ONLY way to learn how to DESIGN is by performing design in practice, building a product and testing it! (and by learning from correcting mistakes and from hands-on experience)**

We want to show to the students that the design process includes obstacles and failures and a lot of joy and satisfaction at the end of the project.

They look for practical experience, but we know that:

**Experience is the term we use to describe our failures.**



# Teaching 21<sup>st</sup> century skills in DBT projects

Working on DBT projects students learn “soft skills” that are required to complete an operating system:

Communication skills

Teamwork

Oral and writing skills

Professionalism

Critical thinking

Adaptability and more

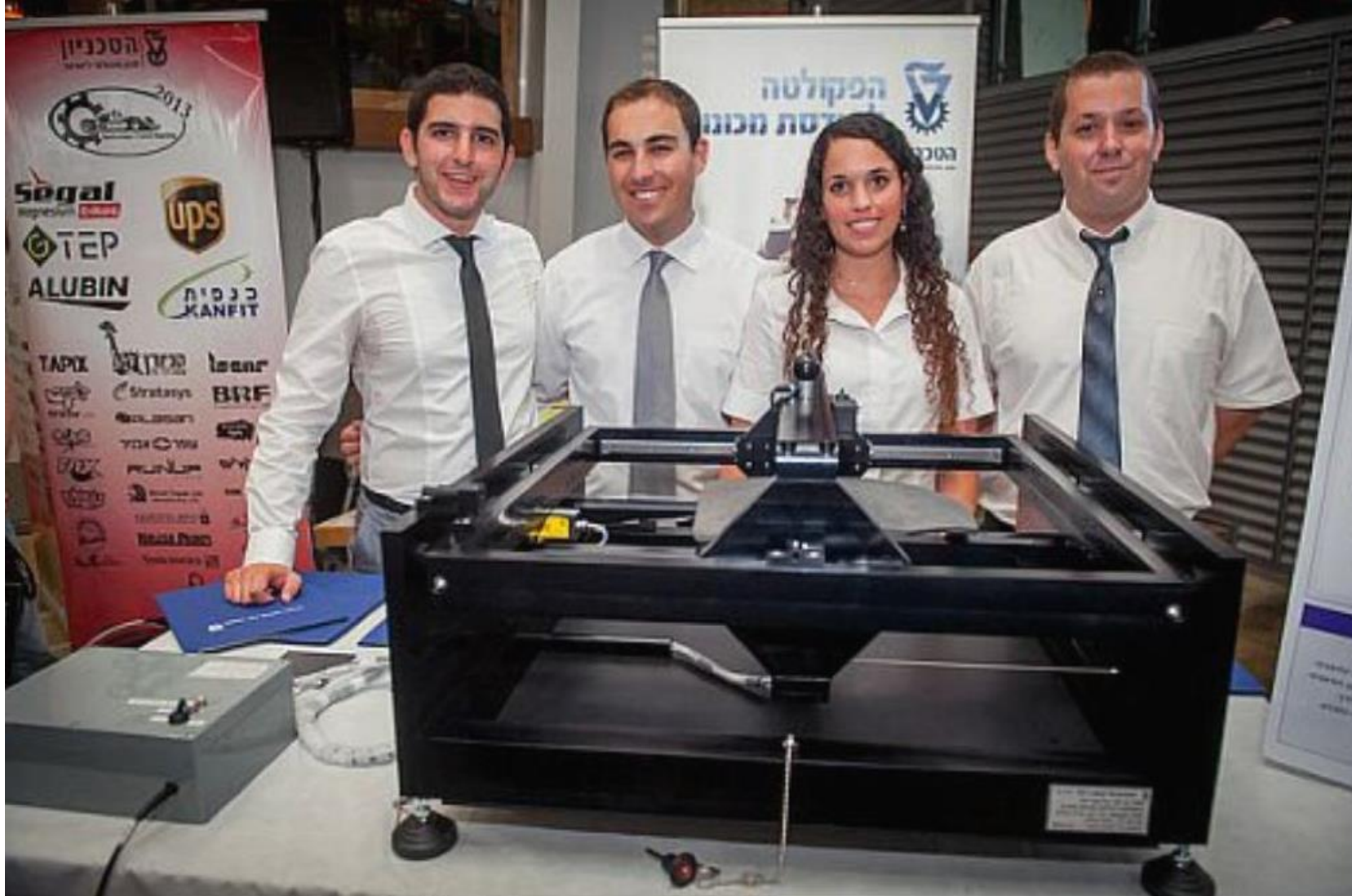
Talmi, I., Hazzan, O., and Katz, R., Intrinsic motivation and 21st century skills in an undergraduate engineering project: The Case of the Technion Formula Student Project, Higher Education Studies; Vol. 8, No. 4; 2018. <https://doi.org/10.5539/hes.v8n4p46>

# “New product design Course”

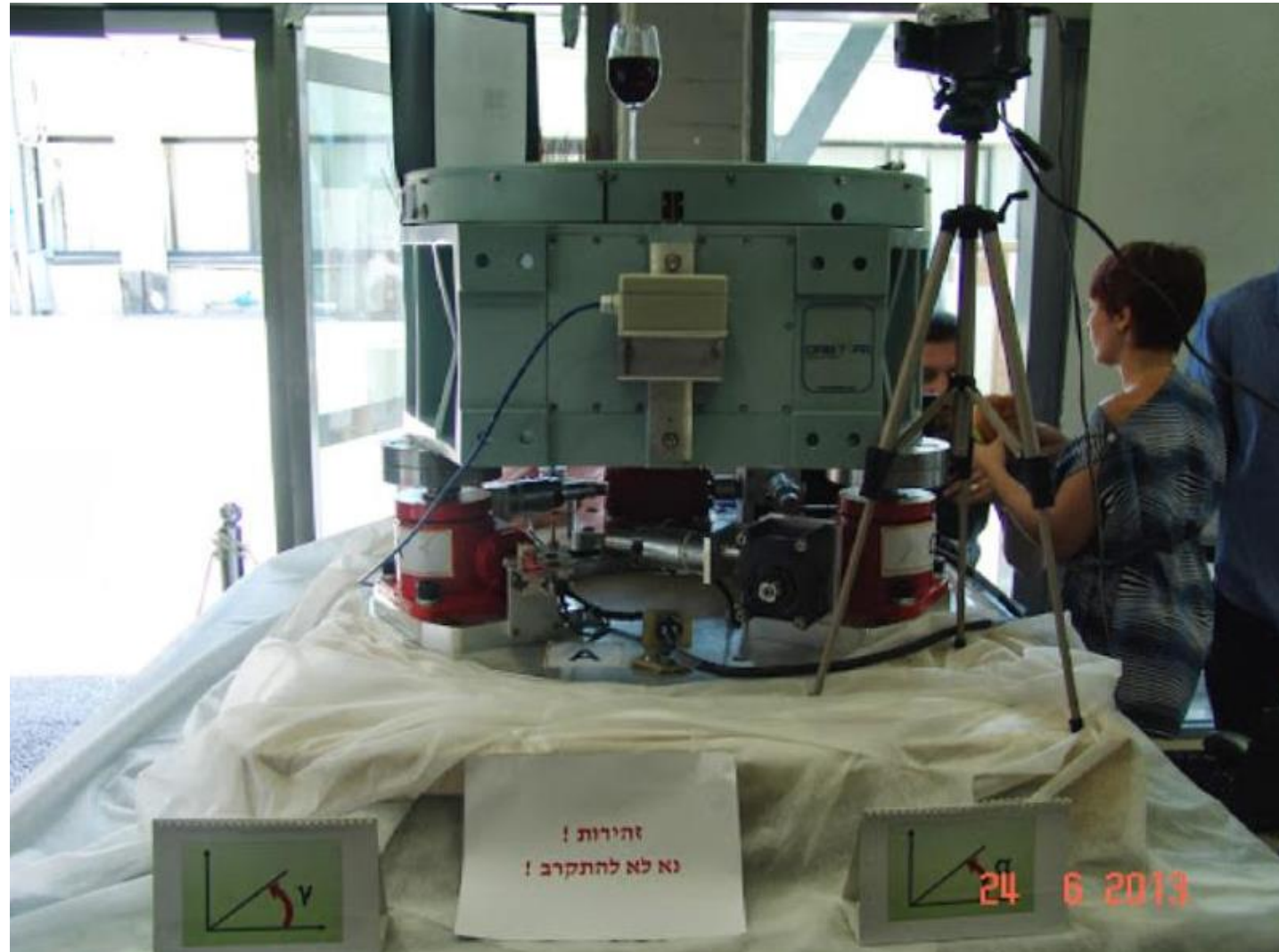
## Course goals:

- To provide our students required *tools* that will enable them to design with a thorough understanding of the *design process and applying their analytical skills*.
- Students are expected to produce a *creative* design that meets customer’s specifications and that will be well manufactured, assembled and tested.
- It is an annual course for seniors with “local” and industrial customers.
- It is one of three obligatory project courses in the design, manufacturing and CAD track.
- Each year in June there is a design Expo.

# Non-contact inspection machine for measuring ceramic plates (Rafael) (1<sup>st</sup> place)



# 3D antenna stabilization system (Orbit) (2<sup>nd</sup> place)

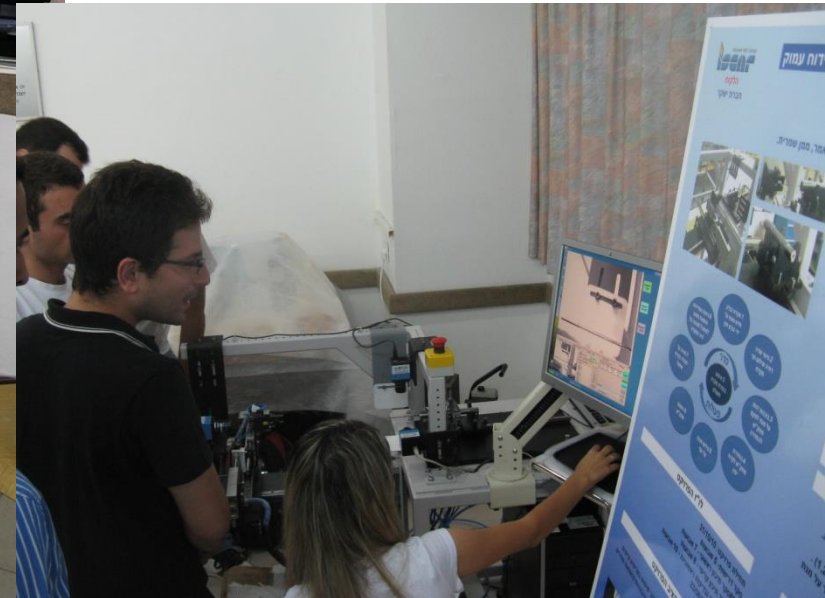
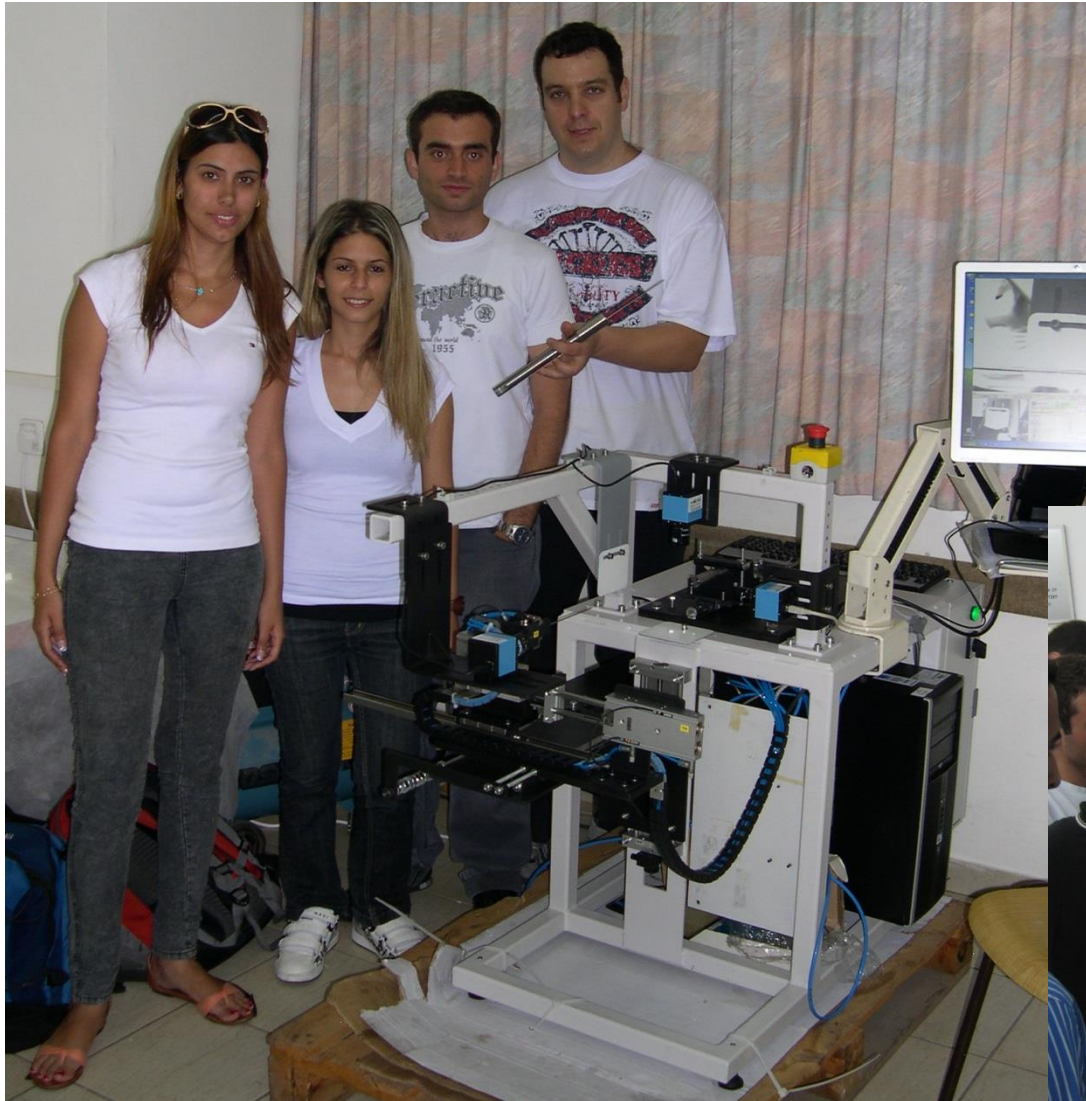


Personal protection device for psychiatric patients  
(Technion/Shaar Menashe) (3<sup>rd</sup> place)





# Non-contact inspection of deep cooling holes inside a drill (Iscar)



# Anti roll-back brake (Technion) 2012



# Students' Formula Race Car



# Annual Design Expo



## President's visit - 2013 expo



Q&A