

Integrated manufacturing technologies laboratory

Sigal Berman and Lior Fink
Ben Gurion University, Israel

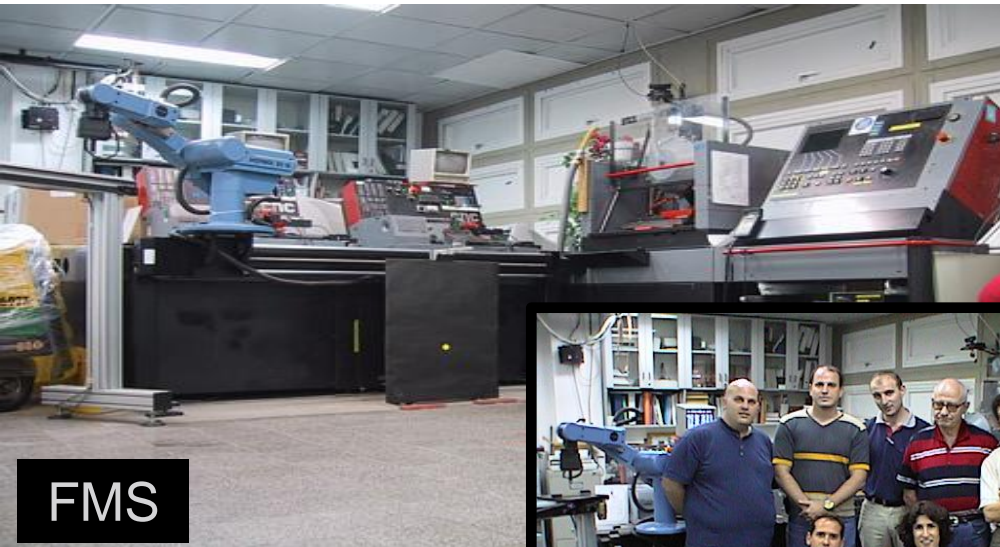
ICPR-21, Stuttgart, Germany, August 2011

Motivation

- Fundamental transformations are emerging in production management and organization. Work at all levels is being re-shaped by e-work. (Nof, 2007; Bracht & Masurat, 2005; Zuehlke, 2010).
- The digital future factory is becoming a reality for which future engineers must be prepared.
- *Agenda today:*
 - *IMT fundamentals*
 - *Courses in IMT*



History – CIM-NEGEV



FMS



ASRS



Assembly



QC

Collaboration and team work

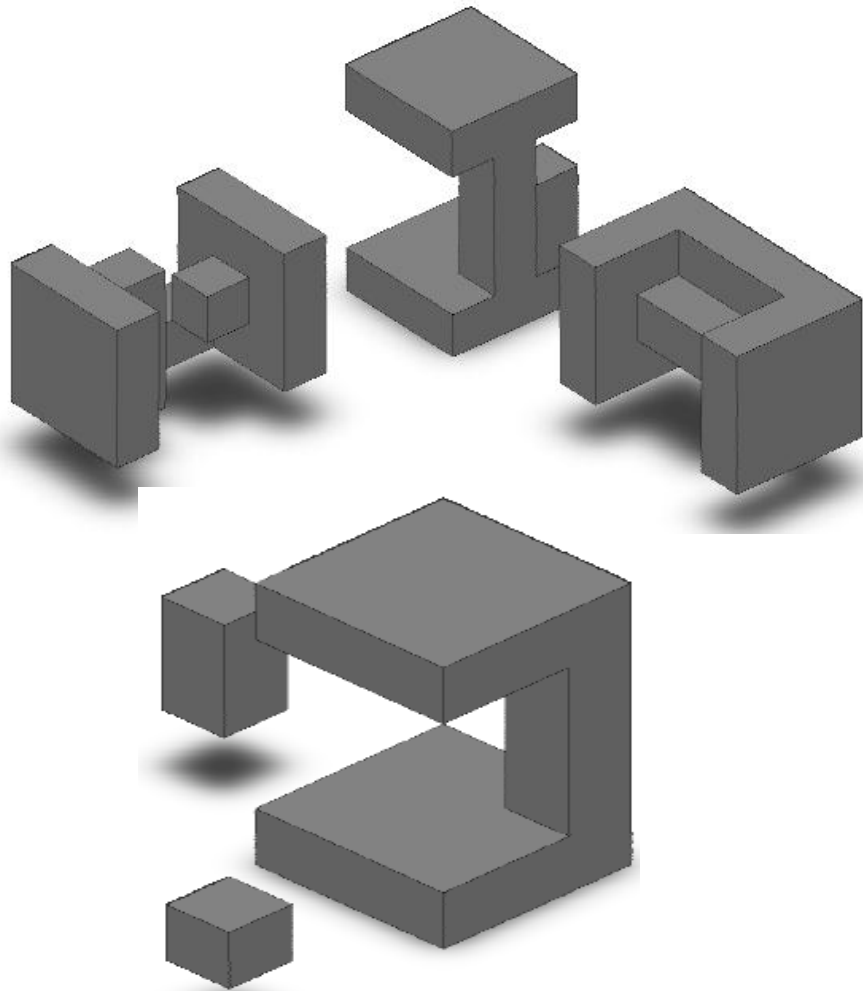
- Management support + seed funds
- Survey
 - Other facilities
 - Academia
 - Industry
- IMT team
 - Academia (Intelligent systems and production, HF, IS)
 - Technical support
 - Students
- Advisory committee
 - Dr. Jochen Rode, SAP AG
 - Dipl.-Ing. Eckhard Hohwieler, Fraunhofer-Institute for Production Systems and Design Technology (IPK)
 - Prof. Shimon Nof, Purdue University

IMT MOTTO

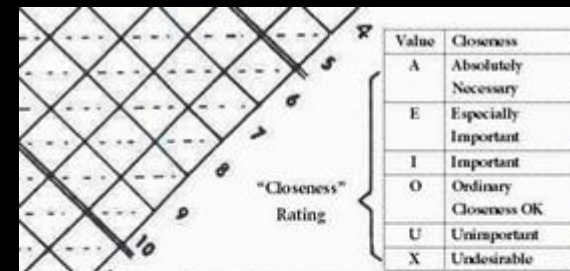
- Future factory facility producing real life products
- **Integration** of
 - Shop floor activities and information systems
 - Human factors and human modeling and shop floor control
 - Autonomous and semi autonomous processes
- Implementation of concepts from
 - Intelligent system control
 - Information systems
 - Human factors
 - Green manufacturing



Product line (3D toys)

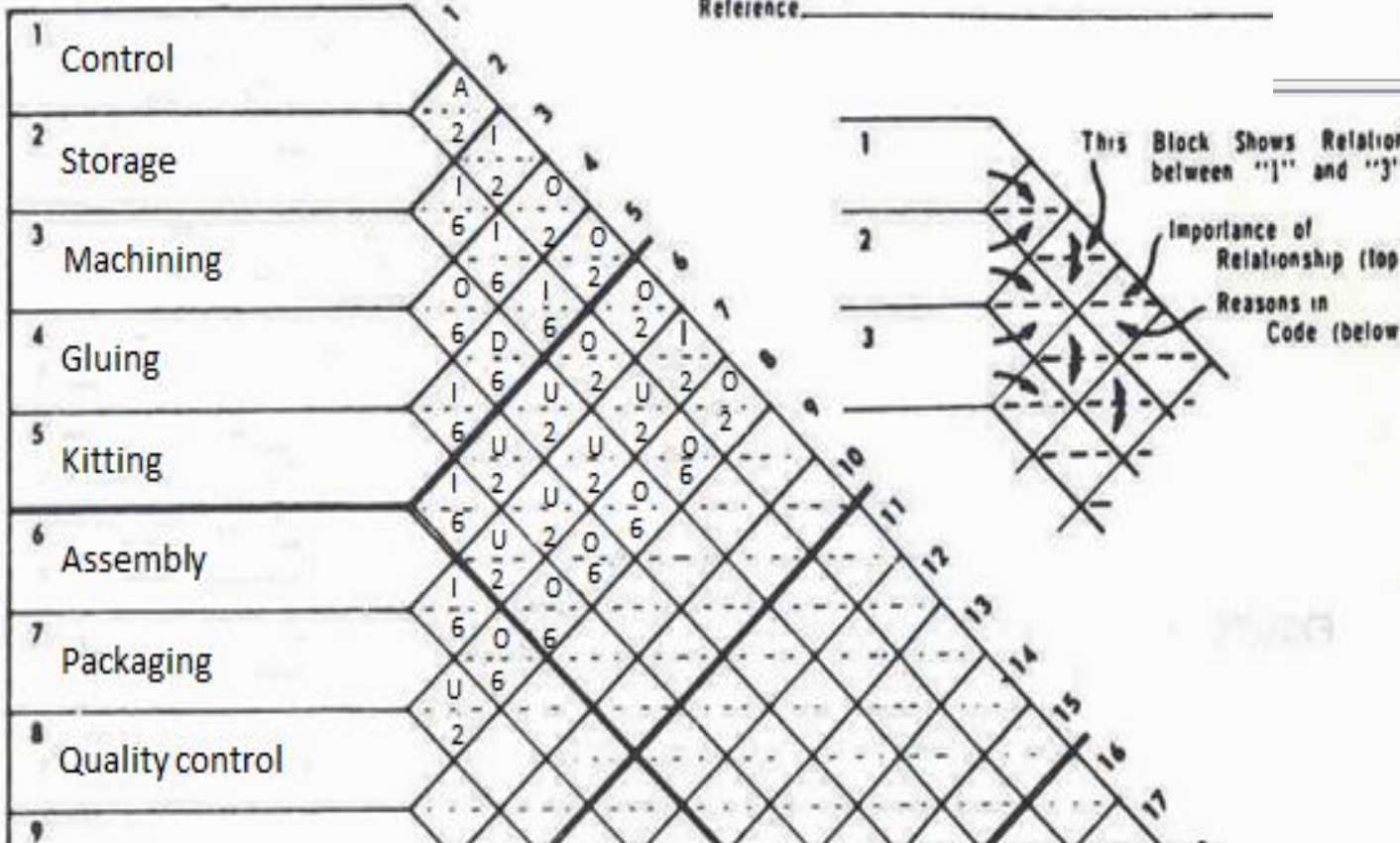


Facility planning



ACTIVITY RELATIONSHIP CHART

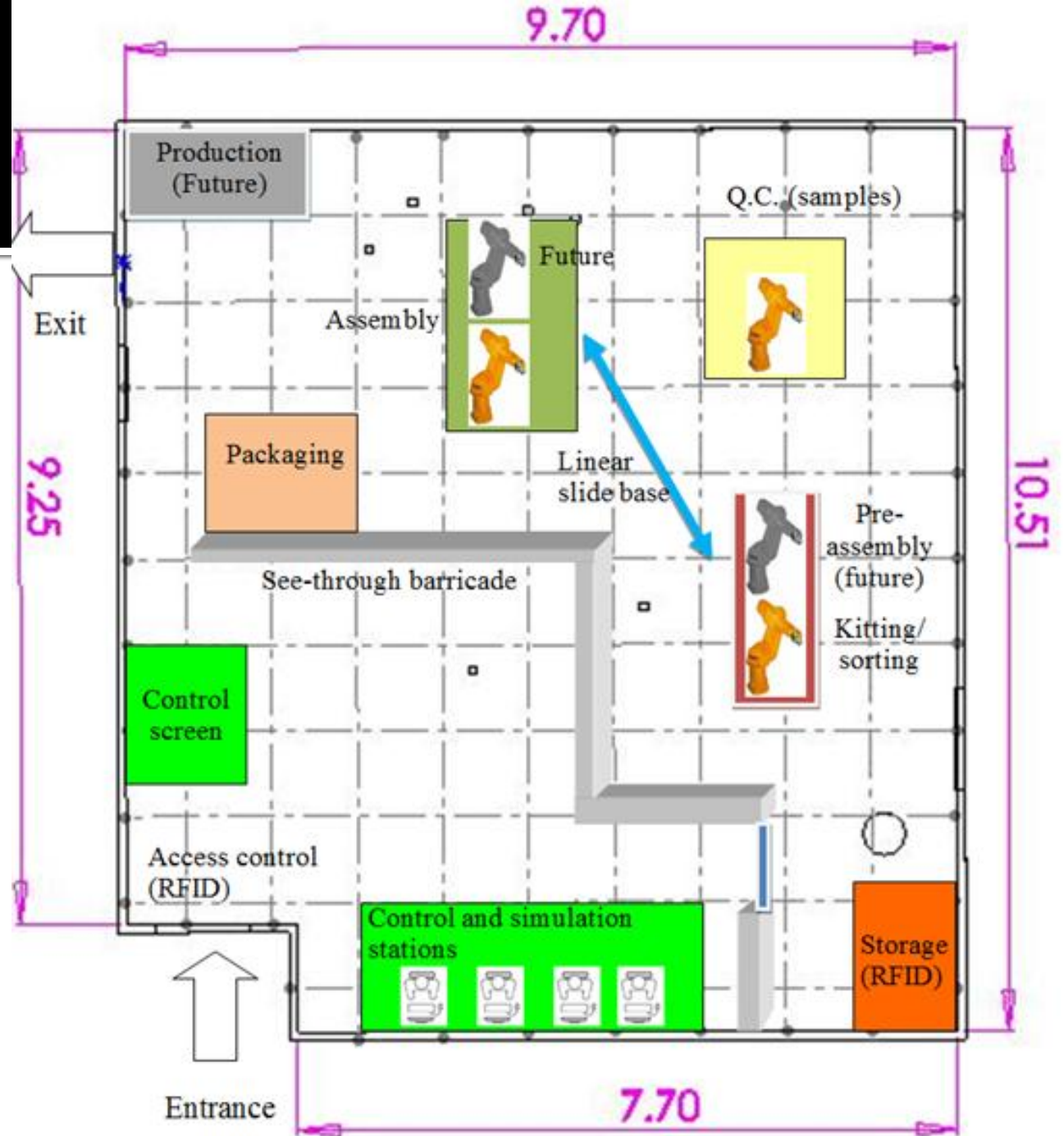
Plant IMT Project Toy3D
 Charted by Sigal Berman With Yossi Zahavi
 Date 31/3/2011 Sheet 1 of 1
 Reference _____



Reasons behind the "Closeness" Value

Code	Reason
1	Use Common Records
2	Share Same Personnel
3	Share Same Space
4	Degree of Personal Contact
5	Degree of Paperwork Contact
6	Sequence of Work Flow
7	Perform Similar Work
8	Use Same Equipment
9	Possible Unpleasant Odors

Layout



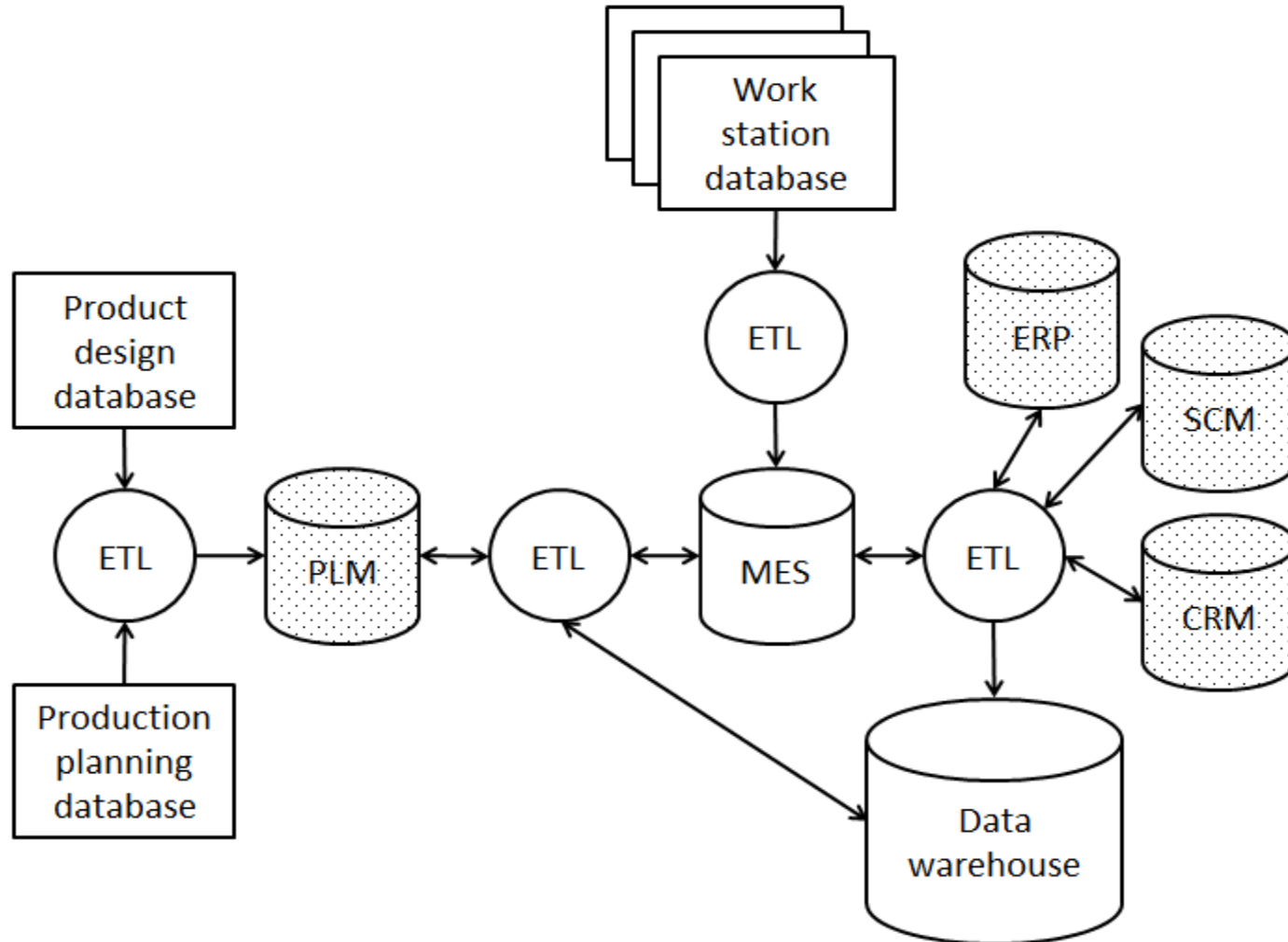
Integrated manufacturing technologies



IMT

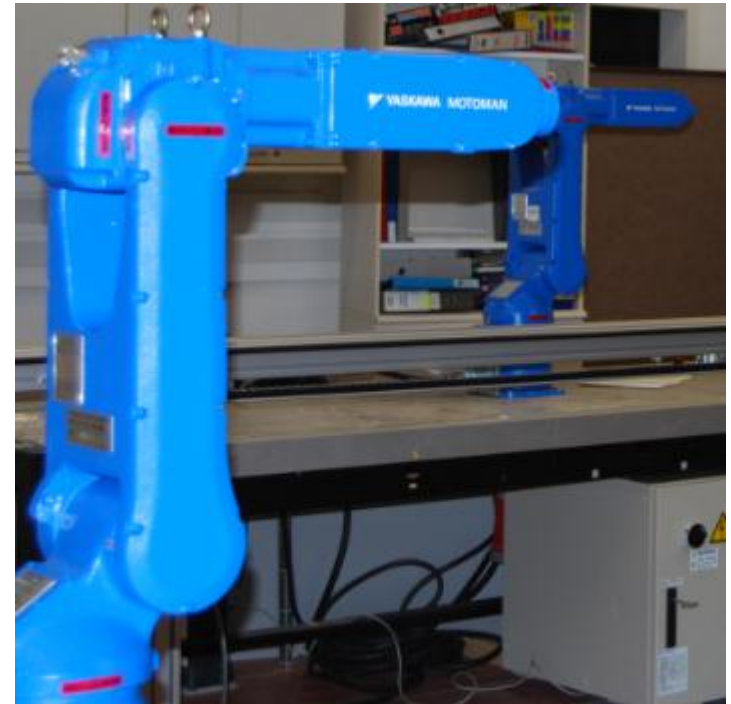


Information infrastructure



Robotic and intelligent automation

- Two MH5 Motoman robots
- Advanced sensing
 - Image processing
 - 3D vision
 - Active sensing
 - Force and tactile sensing
- Process simulation and optimization



Human Machine Interfaces (HMI)

- Ecological interfaces
- Gesture recognition
- Devices
 - Video wall
 - Touch screens
 - Hand held devices
 - Lights and sounds



RFID

- Supplier entrance door
 - Fitted rack storage station
 - Work stations
 - Floor tags
- Studies regarding the value of RFID in the retail sector have already shown it can facilitate considerable savings (Hardgrave et al., 2008)



Courses

2011

2012

Course	Semester	Level	Activity
HMI	B	Graduate	Laboratory meeting Mini project
Computer integrated manufacturing systems	B	Graduate	Laboratory meeting Hands-on homework assignment
*Foundations of robotics in production systems	A	Graduate	Laboratory meeting
Advanced topics in data processing	A	Undergraduate (elective)	Laboratory meeting System based homework assignment
Automation	A & B	Undergraduate (mandatory)	Laboratory tour
Introduction to information systems	A & B	Undergraduate (mandatory)	Laboratory tour System based class example

- Part of INTRO EU international education project.
- More courses in 2nd stage

HMI (Dr. Tal Oron-Gilad)

- The course deals with human factors issues in human machine system design.
 - Graduate elective
 - 30 students
- The aim of the collaboration with the laboratory is to give a physical grounding to the course project.
- *Laboratory experience*
 - *Mini project* - Design an interface for a station
 - Laboratory meeting (3 hour)
 - A short lecture about the laboratory.
 - Hands on work
 - Tour
 - Documentation
 - Technician interview

Advanced topics in data processing (Dr. Adir Even)

- This course deals with the implementation of data warehouses and their use for BI and other decision support applications.
 - Graduate elective
 - 30 students
- The aim of the collaboration with the laboratory is to demonstrate the implementation of BI solutions in industrial environments
- *Laboratory experience*
 - Homework exercise - based on simulated data
 - Laboratory meeting (3 hour)
 - A short lecture about the laboratory.
 - Hands on work
 - Tour
 - Documentation



Additional functionalities

- Platform for graduate and undergraduate projects
 - 4th year undergraduate projects (~5 per year)
 - M.Sc. and Ph.D. theses
- Major attractor for guests to Ben-Gurion University
- Demonstrations for Engineering faculty courses
- Demonstrations for community/youth education programs

Quantifying laboratory activity

- Courses - The IMT lab has started partial operation in the last spring semester (2011).

Activity	Type	# participants
Automation	Undergraduate – mandatory course (demo)	137
Man-machine interfaces	Graduate course (Lab meeting and mini project)	14
4 th year projects	Undergraduate	7 (4 projects)

- Extra curricular activity - Delegations currently hear a short explanation of the lab future plans.
- Publications - Two abstracts related to the IMT lab were accepted to the 21st International Conference on Production Research (ICPR).

Acknowledgments

- This research has been partially supported by the Paul Ivanier Center for Robotics Research and Production Management. The IMT laboratory is supported in part by Intel (Israel); (Intel mentor: Dr. Adar Kalir).
- The authors wish to thank
 - IMT advisory committee members Prof. Shimon Nof, Dr. Jochen Rode, and Dr. Eckhard Hohwieler.
 - IMT team members Dr. Tal Oron-Gilad, Dr. Adir Even, Dr. Raziel Riemer, Dr. Roie Zivan, Prof. Yael Edan, Jonathan Korpel, Noam Peles, Gil Baron, Nissim Abu-Hazera, Jossi Zahavi, and Anat Polachek.
- Thank you!

