MISSION IN THE PALESTINIAN TERRITORIES (WEST BANK)
September 21st – September 28th, 2013
Jean DEPREZ

1- Missionary, finances

Jean DEPREZ, retired professor of Paris-Sud 11 University, president of the association MedLink.
The mission was supported by MedLink.

2- Context

- In the frame of the training workshops organized by MedLink in Palestine, Jean DEPREZ animated in January 2012, as instructor, a workshop "Introduction to PLC" in the Schneider Training Centre in Bethlehem.
Following this workshop, he was contacted by the representative of Schneider in Palestine (Rifat SHARAWI at that time) and the Schneider Foundation (Patricia BENCHENNA) to make a proposal for a project dedicated to support Palestinian universities. The proposal "Supporting professional curricula in Palestine universities" was submitted by MedLink in May 2012. The issue was the improvement of laboratories in PPU, PTU and in the Schneider Training Centre.
After some delays and modifications of the proposal, the project "Supporting professional curricula in Palestine Polytechnic University" was approved by the Schneider Foundation, PPU and MedLink. It consists in 3 phases of equipment and training of trainers in the fields of Industrial Automation and Electric Energy Distribution. The agreement of the phase 1 of the project is now almost signed by all partners. After complete signature, a grant up to 46 000 € would be received by MedLink from the Schneider Foundation, to support the equipment and the training sessions of phase 1.
As soon the grant is received, MedLink will order all the equipment to ANDVANtech, Palestinian Schneider partner integrator. ANVANtech will ensure the integration and installation of the equipment in PPU.
In order to reduce the delay, we have proposed a working session in PPU between Schneider, PPU academics, ADVANtech and MedLink.

- 3D Design Software and Mechatronic Systems were two of the subjects pointed out when visiting in November 2011 Palestinian Universities and Companies. In this context, MedLink, in association with the French Company DOOD (Digital Object On Demand), proposes a workshop "Rapid prototyping" witch introduces 3D software and 3D printing. The 3D printer is a perfect example of mechatronic system.

3- Objectives of the mission.

- Preparation of the implementation of the phase 1 of the Schneider project in PPU:
  - General presentation of the project supported by the Schneider Foundation
  - Presentation of the equipment to the professors and technicians who will use it in PPU. Review of their wishes about the didactic exploitation of the equipment.
  - Technical aspect of the project
    - integration of the local and remote units,
    - wiring of the I/O taken into account the wishes of the PPU staff and the constrains of the CANOpen area network and of the local and remote operational parts
    - electrical AC supplies to be installed,
      electrical and mechanical protections, security
    - pneumatic supply if necessary
  - Ordering and delivering the equipment
  - Expected schedule for installation and test in PPU

- Training of trainers aspect of the project (definition of the contents of the 2 training sessions in Phase 1)
- Future use of the equipment by non qualified students (the main target group in table 1 of the Memorandum of Understanding)

- Presentation of the Mechatronic training workshop "Rapid Prototyping: 3D Design and Printing" in PPU, Al Quds University (Abu Diss), Bir Zeit University and PTU
  - Introduction to rapid prototyping
  - Provisional program of the workshop
  - Request to universities for hosting the workshop.

4- Calendar of the mission

- Saturday September 21st:
  Flight Paris - Tel-Aviv AF1620
  Transfer (taxi) Ben-Gourion – Hébron.
- Sunday September 22nd:
  8:30 – 9:00: Meeting with Raed AMRO, Dean of the Faculty of Engineering in PPU
  9:00 – 16:00: Working meeting in PPU on the Schneider project
  Diner with Duaa ABUZAINAH, teacher of French in PPU
- Monday September 23rd:
  9:00 – 11:30: Lecture on SFC and Unity pro SFC programming
  11:30 – 12:30: Presentation of the workshop "3D design and printing"
  Transfer (taxi) Hebron - Jerusalem
- Tuesday September 24th:
  9:00 – 10:00: Meeting with Ibrahim SHAHWAN (Schneider)
  Transfer to Al Quds University - Abu Diss (Bus)
  11:00 – 13:00: Presentation of the workshop "3D design and printing" in the faculty of Engineering
  Lunch in Abu-Diss and transfer to Jerusalem (with Labib ARAFEH)
  16:30: Meeting in the SCAC, French Consulate, with Philippe CAPELLAERE
- Wednesday September 25th:
  Transfer to Ramallah
  10:00 – 10:30: Visit to the Melkite Pastoral Center
  11:00 – 12:30: Meeting with Wasel GHANEM (Bir Zeit University) in the Center for Continuous Education in Ramallah. Presentation of the workshop "3D design and printing".
  13:00 – 16:00: Visit to Sultan YASEEN in the "Crisis Management Initiative" office in Ramallah
  Transfer to Tulkarm with Sultan YASEEN
- Thursday September 26th:
  8:30 – 9:00: Meeting with Adnan ISLHAI, former director of Palestine Technical College Khadoorie.
  9:00 – 10:00: Meeting with Basim ALSAYID, former dean of the Faculty of Engineering in Palestine Technical University Khadoorie (PTU-K). Presentation of the workshop "3D design and printing",
  10:00 – 10:30: Short meeting with Mutamed KHATIB, new dean of the Faculty of Engineering, short meeting with Marwan AWARTANI, new president of PTU-K
  10:30 – 11:30: Meeting with Basim ALSAYID. Discussion on cooperation projects. Discussion on the following of the Al Maqdisi program "Design and Control of photovoltaic systems".
- Friday September 27th:
  Open day in Tulkarm.
- Saturday September 28th:
  Transfer Tulkarm- Ben Gourion Airport (taxi). Flight Tel-Aviv Paris AF 1621.

5- Meetings about the Schneider project

On Sunday, 11 participants attended the work session in PPU:
From PPU: Ola ANTARI, Hareth SHALALDA, Muder SWEITY, Kareem ALJUNEIDI, Saleh ALTAKROURI, Abdelkarim MOHTASIB, Makawi HRAIZ, Hasem ISSA
From Schneider: Ibrahim SHAHWAN
From ADVANtech : Rifat SHARAWI
From MedLink: Jean DEPREZ
The continuous learning department has no independent teaching staff. It depends in its training activities on the faculties' staff, mainly the staff of faculty of engineering (CET) and faculty of applied professions (CAP).
Muder, Hareth (both from CAP) and Kareem (from CET) are usually the engineers who are involved in the training courses related to PLC, and automatic control in general, organized by the continuous learning department

Most of the points mentioned in the above objective section have been developed.

5.1- General presentation of the project supported by the Schneider Foundation

The person who had participated to the writing of the proposal (Aref HERBAWI) was unfortunately not present. Most of the participants from PPU were not informed of the objectives of the project, including its impact on unemployed people and unqualified youths.

5.2- Presentation of the equipment to the professors and technicians who will use it in PPU. Review of their wishes about the didactic exploitation of the equipment.

After presentation focusing on equipment of phase 1 (Automation Lab, **see annex 1**), the discussion didn't allow to extract specific wishes.

5.3- Technical aspect:

- The main point was the specification for the **interface between the local control units and the operative parts. Some constrains:**
    - The discrete I/O have to be connected to switches and LEDs in order to allow the user to simulate one operative part, OR to a standard connector allowing the control of a Schneider operative part OR a customized operative part developed by teachers or students for their projects.
      Remark: the operative part of Schneider are delivered with SUB D Connectors (see technical doc)
    - The Analog I/O have to be connected to BNC coaxial adapters OR to the connectors mentioned above.
      Remark: the Schneider operative parts don't use analog I/O but they may be modified by teachers in order to use it.
    - Security and safety (for user and equipment) have to be taken into account for the design of the interface, especially in order to be used by unqualified students.
    - One emergency stop is suitable on the interface (zero active). It should be in parallel with other eventual emergency stops (operative parts).
    - Specification have to be given to ADVANtech for the assignation of the I/O

  We have certainly missed some constrains. All participants were encouraged to think about this critical point.
  It was decided that Rifat will make a technical draft proposal for the interface, and send it for discussion to PPU and MedLink. Somme suggestions (to be discussed) are given in **Annexe2**
- The specifications for the interface between the remote control units and the remote operational parts will be defined later (we missed technical information for the conveyor belt and the AC motor)
- Installation of the equipment: 2 rooms seem possible to install the equipment. The most suitable one is used at this time by the students for their graduation project. The other one is a part of the current PLC lab. **It has to be taken into account that to this equipment will be added, in the same room (phase 3 of the project) 2 industrial systems that will need place…**
- Electric AC and pneumatic supplies are available

5.4- Ordering and delivering the equipment. Expected schedule for installation and tests in PPU.

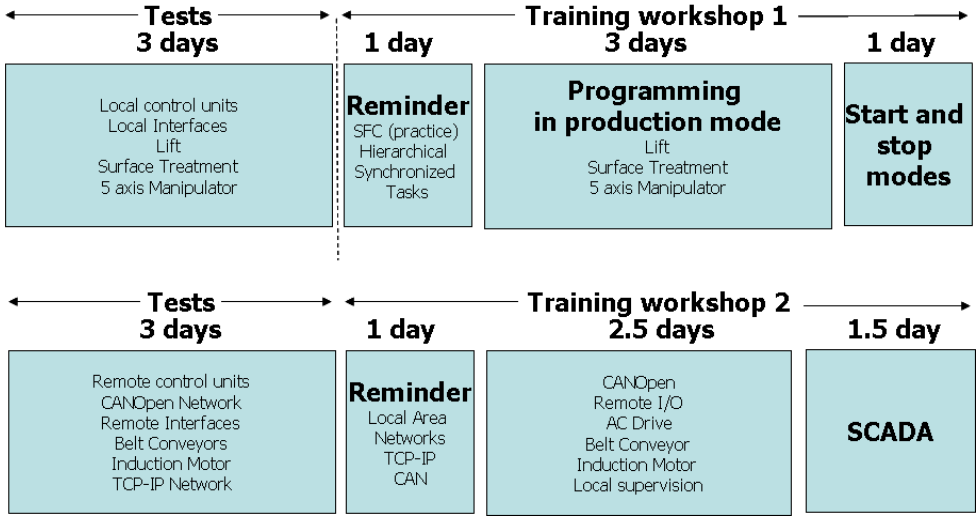
Assuming that the money will be received by MedLink during the first week of October and taken into account

that a part of the equipment (control parts) is already reserved for the project, Ibrahim and Rifat estimate that the equipment can be ready for tests at PPU between December 15th and January 15th. The critical point is the time for delivery in Palestine of the operative parts built in France.

5.5- Training of trainers aspect of the project (definition of the contents of the 2 training sessions in Phase 1)

Before each training workshop, 3 days will be necessary to MedLink for testing and calibration of the systems. The training workshop itself consists on 5 days (about 35 hours) of practical work on the equipment. Du to the heterogeneity of knowledge of the trainees, we will start each workshop by a session (1 day) of reminders of the main techniques used during the training.

The provisional contents are the following:



On the demand of the PPU team, in order to save time during the first workshop, a short training (2.5 hours) was done on Monday September 23rd to introduce SFC to the participants who where not familiar with this concept:

1. **SFC Sequential Function Chart**
2. **Definitions**
3. **The 5 Main Rules**
4. **Exclusive Sequences**
5. **Parallele Sequences**
   Exercise: Machine tool
6. **MacroStep**
7. **Hierarchical Graphs**
8. **Unity Pro SFC Editor**
9. ***Demo: Programming a SFC with unity Pro***

A printed document and the .ppt presentation have been left to the participants

5.6 - Future use of the equipment by non qualified students (the main target group in table 1 of the Memorandum of Understanding)

Because most of the participants discovered this point, it was not treated. The participants involved in Continuous Education teach non qualified students. They have to prepare a document explaining how they will use the equipment to improve the curricula in Industrial Automation. This will allow opening the discussion during the next workshop.

6- Introducing the training workshop in Mechatronics: "Rapid Prototyping: 3D design and printing"

The workshop (see description in **Annex 3**) has been presented at PPU, Al-Quds Abu Diss, BZU and PTU. All universities are ready to welcome the workshop in January 2014 and to buy the printer used during the workshop. In any cases, if the workshop is in another university, BZU would like to buy a printer and to employ Julien for 2 days after the workshop to mount and test it: BZU has already planed the use of such machine for graduation projects.

It is now in our hand to choose one university and to establish a convention.

Since 2004, MedLink organized 11 workshops in West Bank, (PTU, PPU, BZU and BMIP), but none in Al-Quds. Because of Al Quds wishes to welcome this workshop, we will start the process with this

University and send a proposal for mutual agreement to Dr. Labib ARAFEH, Dean of Faculty of Engineering.
The French Consulate should support the flight tickets for the 2 instructors. We have to obtain the permission to carry the printers (in spare parts) trough the Diplomatic Case. The size and weight for each kit are: 60x50x50cm, 12kg.

7- Conclusion

- The Schneider project is now on the track. The participants at PPU have been sensibilized to the objectives of this project. The improvement of curricula for all levels of education would be defined gradually when discovering and using the equipment.
- The integration and installation of the equipment by ADVANtech, including the design of the interface between the control units and the operative parts, have to be carefully followed by the PPU team, the final user, with students of various educational levels.
- The content of the 2 training workshops of phase 1 was defined to give to the participants the knowledge allowing them to practice by themselves, in order to prepare the teaching material for the students, with the help of MedLink if necessary. It would be efficient if Schneider could provide them with evaluation versions of Unity Pro allowing them to practice and became familiar with the software.
- The Schneider Foundation has confirmed during this mission that the grant will be received by MedLink during the first days of October. The official order for equipment will be sent by MedLink to ADVANtech the following day. Schneider and ADVANtech have to confirm as soon as possible the date of delivery and installation of the equipment at PPU in order to allow MedLink to check the availability of instructors after this date and to plane the mission, avoiding conflict with other missions (see below).
- Some documents have to be sent to the Palestinian Ministry of Finance in order to allow ANDVANtech to trade at “zero VAT” conditions. Ibrahim (Schneider) is going to solve this issue.
- Rather than one official “opening session” at the beginning of workshop 1, we suggest one official “closing session” at the end of workshop 2. We should be able (we hope!) in that case to show to the participants of this official meeting the lab in order of working, with demonstrations.

- It is now sure that the Mechatronic training workshop “Rapid prototyping: 3D design and printing” will be held in Palestine in January 2014. A mutual agreement with the Faculty of Sciences and Technology of Al Quds University (Labib ARAFEH) will be proposed by MedLink. Another agreement will be proposed to Bir Zeit (Wasel GHANEM) University for equipment with a 3D printer.

- Dr. Marwan AWARTANI, new president of PTU, deeply encouraged MedLink to continue organizing training workshops welcomed by the University. He asked to Basim ALSAYID to explore new ways of cooperation.

- A technical mission will be organized around May 2014 to implement at PTU the system developed at IUT Cachan to control a photovoltaic system. This mission will be supported by the remaining found of Al Maqdisi program.

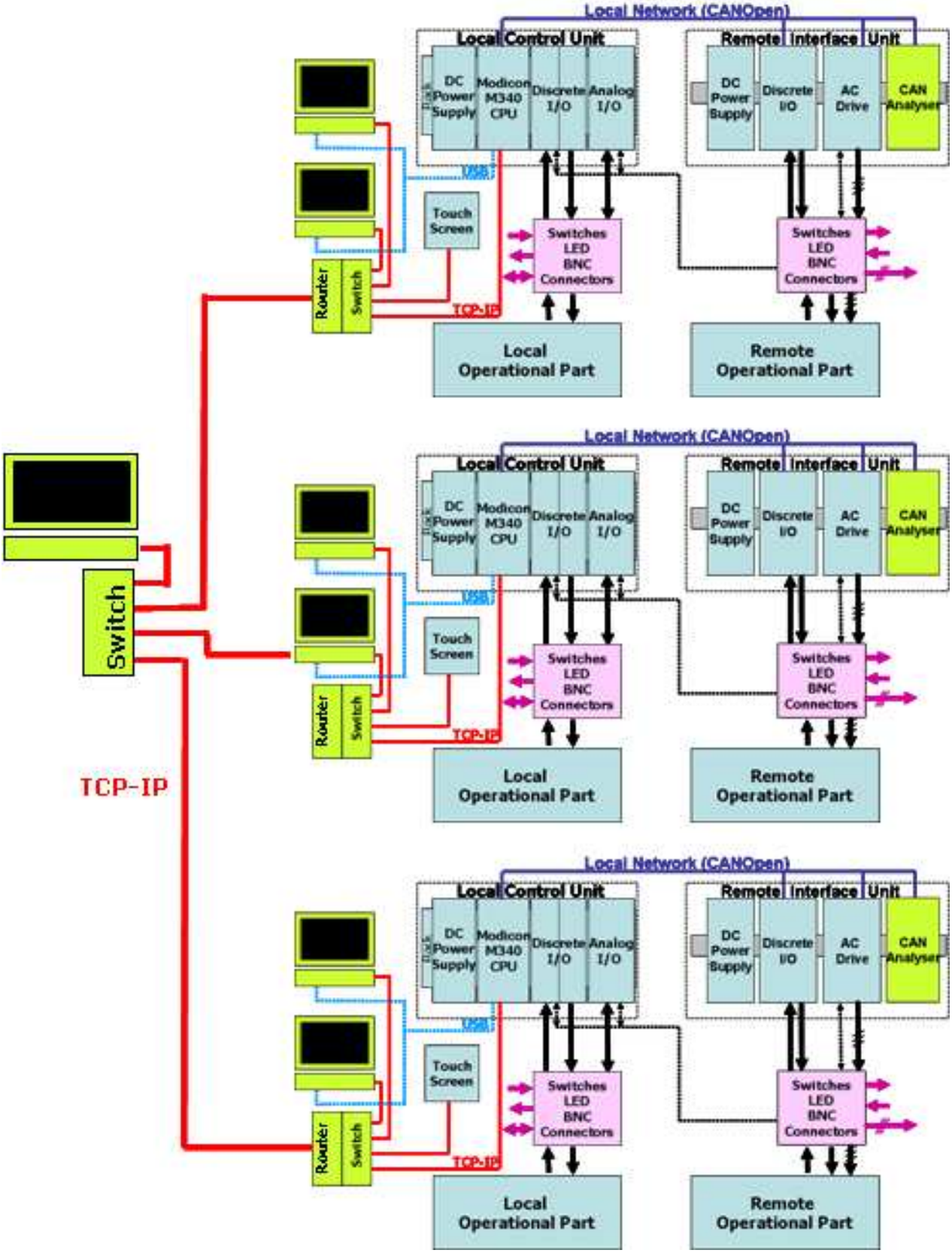
- Thanks to my Palestinian colleagues for their warm welcome in all places. Special thanks to Sultan Yaseen’s Family for welcoming me at the end of the mission in Tulkarm.

Paris, September 29th 2013

Jean DEPREZ

Annex 1

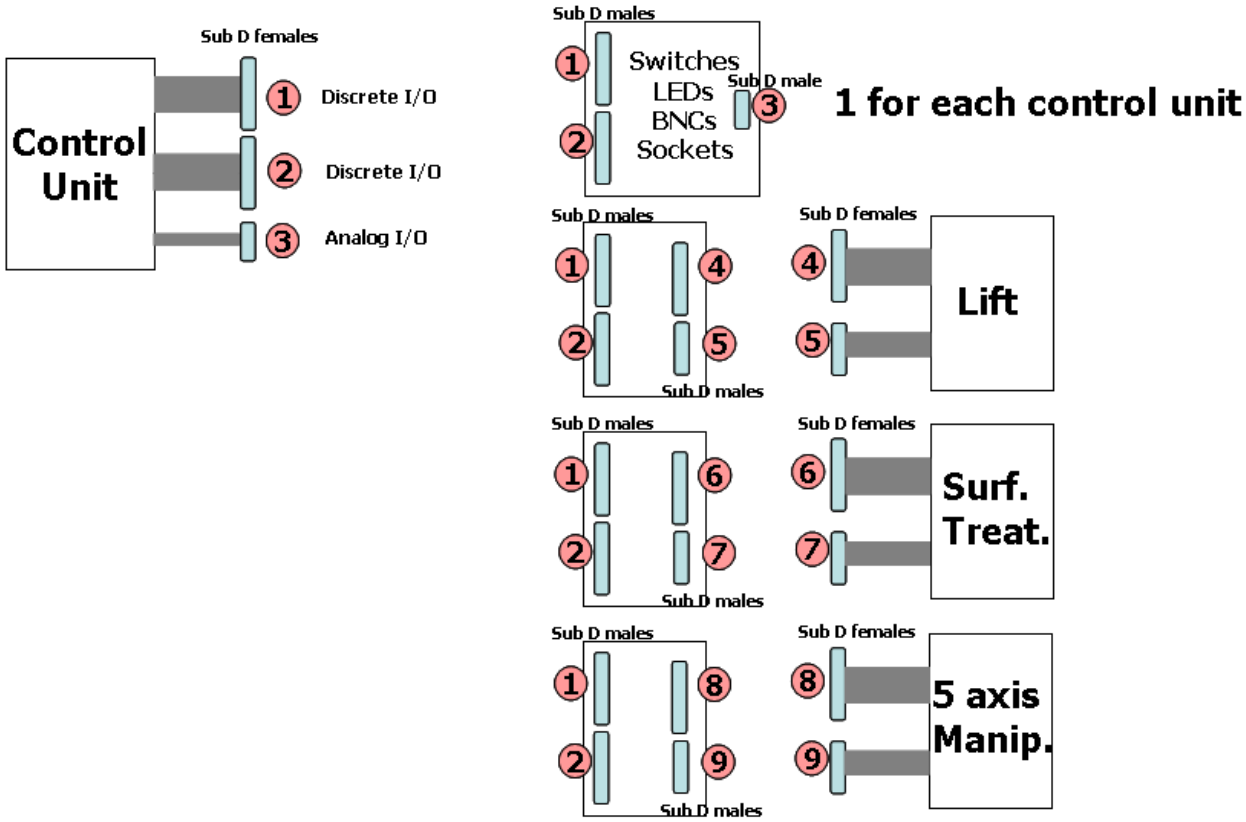
Equipment for the automation lab (phase 1)



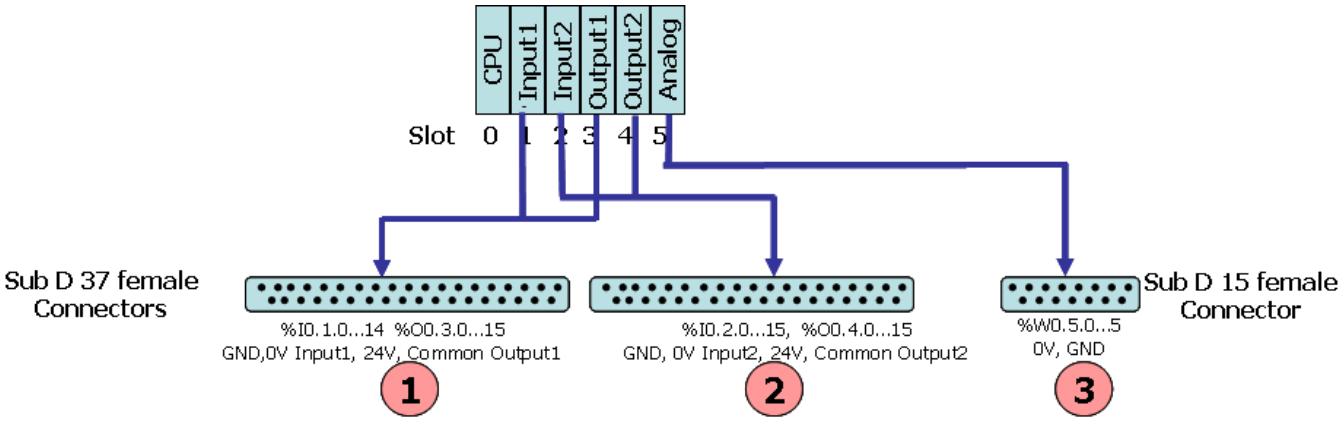
Annex 2

Proposal for the interfaces between the local control units and the operative parts.

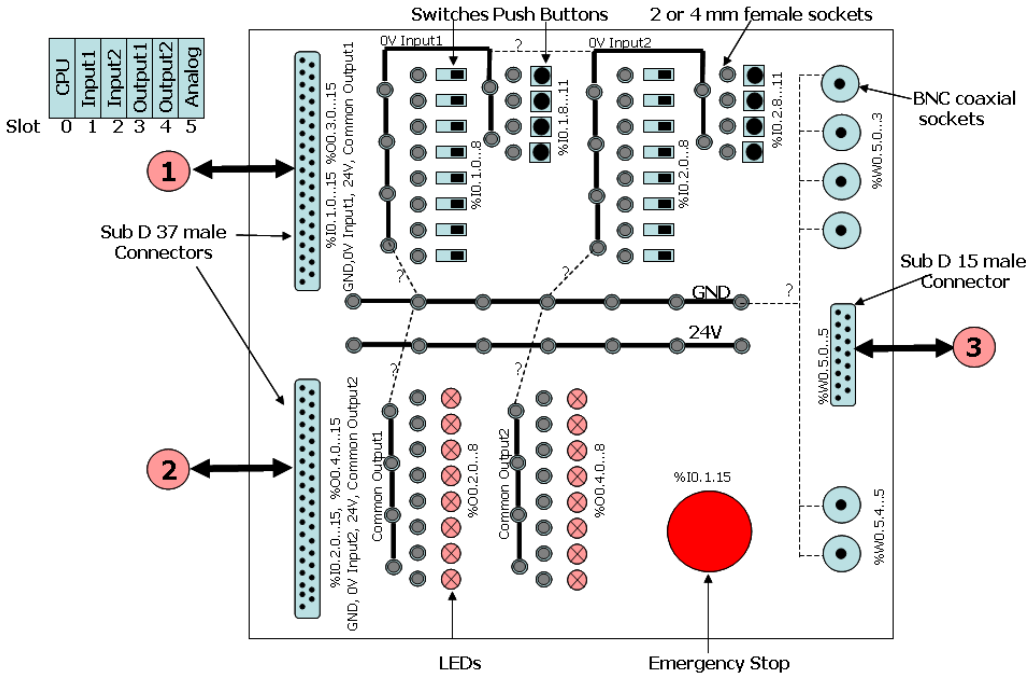
Suggestions:
It seems difficult and not useful, to implement on the same interface the capability to connect either the operative parts (lift or surface treatment or 5 axis manipulator) or switches, leds, push button and sockets.
We suggest the following architecture:



- the I/O of each control unit are connected to 3 SUB D female connectors (2 for discrete I/O and 1 for analog I/O).



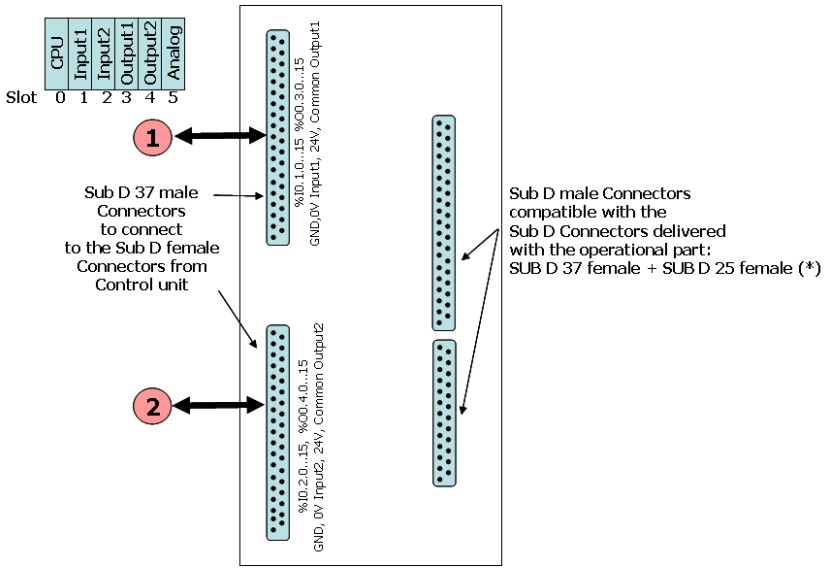
- If the user wants to use a simulated system with switches, leds or connecting sensors and actuators trough sockets, the connectors from the control unit are plugged in 3 SUB D male connectors connected to these switches, leds, sockets and coaxial BNC.



Suggestions:
- Input %I0.1.15 is reserved for the emergency stop.
- 24 inputs are connected to 4mm (or 2mm) female sockets and switches or push button. This is enough to solve most educational exercises.
- 16 outputs are connected to LEDs
- The 0V for inputs, Common for outputs are connected to 4mm (or 2mm) female sockets (I suggest to connect them to the DC GND … to be discussed…)

The 4 analog inputs and the 2 analog outputs are connected to BNC coaxial sockets. (I suggest connecting the channels grounds to the DC GND… to be discussed…)

- If the user wants to use one of the 3 operative charges, the discrete I/O connectors from the control unit are plugged in 2 SUB D male connectors wired themselves to 2 SUB D male connectors compatible with the SUB D female connectors delivered with each operational part (see technical doc for mechanical and electrical characteristics and pins assignation).



(*): to be checked on technical documentation of operational parts

Annex 3

Training Workshop in Mechatronics:

"Rapid Prototyping, 3D design and printing"

http://AssociationMedLink.com

http://dood-studio.com/

1- The fab lab concept

(See http://vimeo.com/7819076)
A fab lab (fabrication laboratory) is a small-scale workshop offering (personal) digital fabrication. It is generally equipped with an array of flexible computer controlled tools that cover several different length scales and various materials, with the aim to make "almost everything". This generally includes:
- Sheet material cutting: laser or water jet cutter,
- Computer-aided manufacturing: subtractive milling or turning CNC machines,
- Rapid prototyping: typically a "3D printer",
- Printed circuit board milling: 2D high precision milling for pre-clad copper boards,
- Microcontroller and digital electronic design, assembly and test stations.

They are open to different kind of users (engineers, designers, artists, DIY, students…), who want to rapidly shift from the conception phase to the prototyping phase of a product.

The fab lab concept grow out of a popular class in MIT "How to Make (Almost) Anything?". Since 2001, over than 125 official fab labs (respecting the MIT charter: http://fab.cba.mit.edu/about/charter) grow up in 34 countries. But many other non-registered fab lab are displayed all over the word. Many of them (often called FacLab) are hosted in universities.

The key of the fab lab word is the sharing of knowledge, hardware and software tools, design and products inside a given fab lab and externally with the worldwide fab labs.

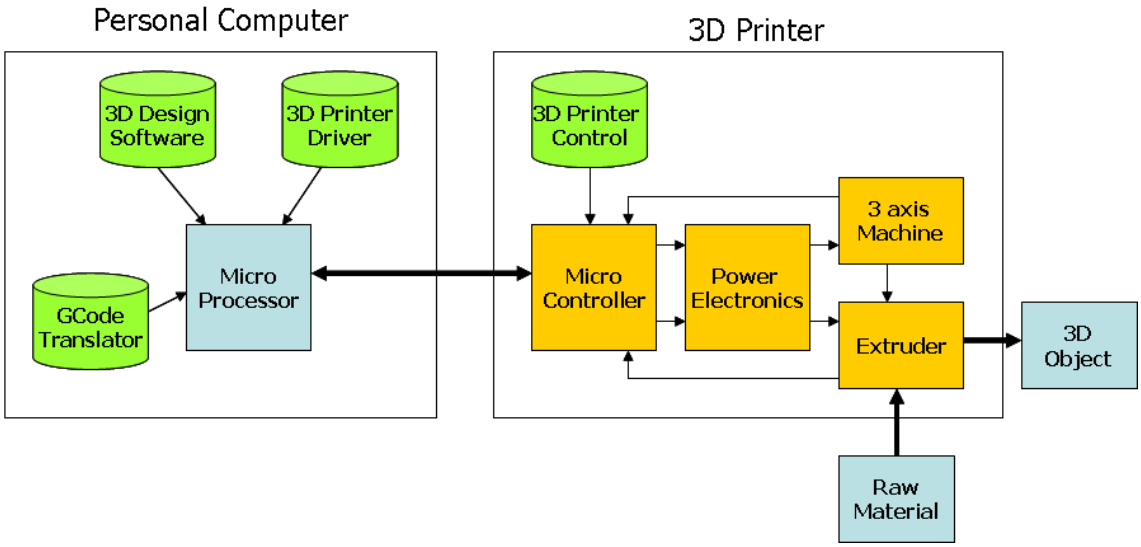
The objective of this training workshop is to introduce Rapid Prototyping, using 3D design software and 3D printing.

2- 3D printing

(See http://www.youtube.com/watch?feature=player_detailpage&v=ewtUAMNda5U)
3D printing is a process of making a three-dimensional solid object of virtually any shape from a digital model. 3D printing is achieved using an additive process, where successive layers of material are laid down in different shapes. 3D printing is also considered distinct from traditional machining techniques, which mostly rely on the removal of material by methods such as cutting or drilling (subtractive processes).
A materials printer usually performs 3D printing processes using digital technology.
The 3D printing technology is used for both prototyping and distributed manufacturing with applications in architecture, construction, industrial design, automotive, aerospace, military, engineering, civil engineering, dental and medical industries, biotech (human tissue replacement), fashion, footwear, jewellery, eyewear, education, geographic information systems, food, and many other fields. It has been speculated that 3D printing may become a mass market item because open source 3D printing can easily offset their capital costs by enabling consumers to avoid costs associated with purchasing common household objects.

The **RepRap** concept (Replication Rapid prototyper) has resulted in the proliferation of structures of printers developed in Open Sources communities.

3- Rapid Prototyping



A 3D Rapid Prototyping station usually consists on
- a personal computer running
  - a 3D CAD parametric feature solid modelling software. This software allows a 3 dimensional drawing of the object to be printed
  - a compiler (slicer) that translate the drawing into code (GCode) to be sent to the printer.
  - a driver able to control the printer from the PC (sending the GCode and supervising the printing process)
- a 3D printer mainly composed of
  - an extruder to fetch, to melt and to deposit the layers of material (plastic)
  - a 3 axis mechanical system to move the extruder
  - a microcontroller running a control software to drive, thru a power electronic interface the mechanic and thermal processes

4- Training workshop "Rapid Prototyping: 3D design and printing"

All the specific software used during the workshop are "open-source" or "free download".
- 3D design capture software: **SketchUp** (Google-Trimble)
- 3D Gcode translator: **Slic3r**
- 3D printer driver: **Pronterface** (Kliment)
- Microcontroller hardware platform and development software suite: **Arduino** based on ATMEL microcontroller
- 3D printer control software: **Marlin**

The 3D printer is the printer (DOM: **Digital Object Maker**) developed by the company DooD in cooperation with the FabLab of Cergy-Pontoise University.
A video of the printer is available in
http://www.dailymotion.com/video/x15acua_digital-object-maker-process_tech

The hosting university has to purchase the 3D printer that will be used during the workshop. The price is 800 €, including 5kg of raw plastic material, to be paid to MedLink before the end of the workshop.

Before the workshop, 1.5 days are dedicated to the mounting and tests of the 3D printer. It is suitable that the future users of the printer in the hosting university would participate to this work, in order to be able to perform the maintenance of the printer. Guest, as student under graduate project in Mechatronics, can be invited to assist to these sessions.

The training workshop itself is a 3.5 days seminar (about 24 hours).
Provisional program:

1- Introduction: Presentation of the concept and review of the different industrial and Open Source 3D printers
2- The DOM (Digital Object Maker) 3D printer: 3 axis machine, extruder, power electronics for heating and stepper motors drive, ARDUINO microcontroller board, software (Marlin, Pronterface, Slic3r)
3- Tutorial: introduction to SketchUp 3D design software
   Basic tools. Design of a mechanical piece from schematic specifications
4- Mechanical and firmware calibration, Slic3r and Ponterface parameterization, printing of the design.
5- Advanced: Printing of the piece with different parameters (Thickness of layers, speed of printing, bridges, support…)

Who ?

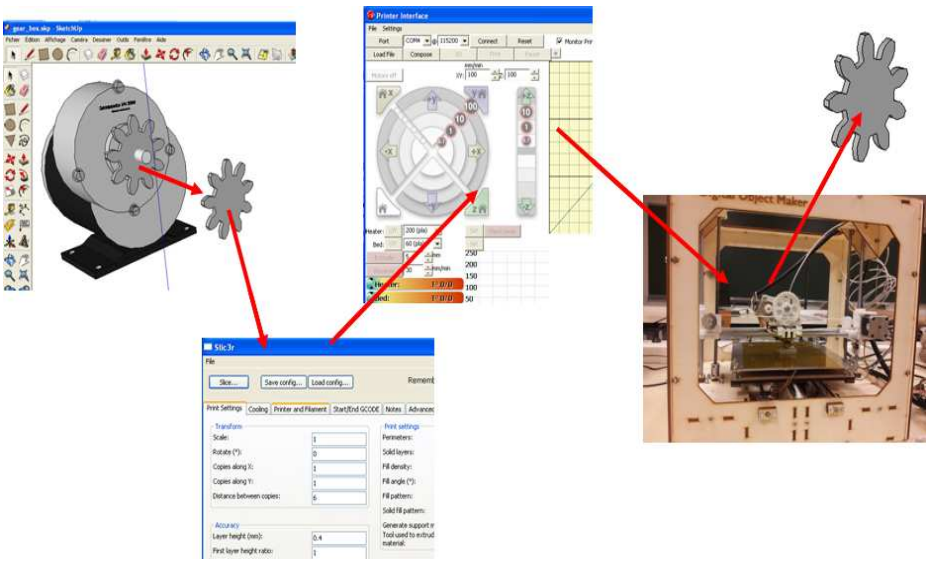
Instructors (2): Julien DEPREZ (DooD), Jean DEPREZ (MedLink)
Participants (~20): teachers, technicians, engineers in Mechanics, Mechatronics, Electrical Engineering, Design, Applied Ar (Universities or Industries)

Where ?

PPU, Al Quds, Bir Zeit, PTU ?
Constrains: the hosting university has
- to buy a 3D printer(800 € including 5kg of raw material)
- to provide food and accommodation during the workshop

When ?

January 2014 ?



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