ENEE4304 "Instrumentation and Measurement"
Design Project (2016)

Objectives:

Each group must design, build, test and demonstrate an instrumentation and measurement device controlled by a **Microcontroller (a PIC or Arduino Board containing a microcontroller)**. The device should have functioning elements in all six categories listed below (exceptions can exist depending on project complexity and with prior approval from the instructor). The device will be rated (graded) on the level of functionality achieved in each category. There will also be grading adjustments for qualitative attributes and how well the project is documented. Projects will be ranked in comparison to each other.

Project Deliverables:

D1. Student list and main topic (group due   W 2-3-2016)

D2. A project proposal written in a word document with functional block diagram and a summary of each functional element (group due W 16-3-2016)

   Note that projects will not be accepted if the proposal was not approved by the instructor.

D3. A study of latest state of the art sensing techniques and latest existing specific sensor types for the quantity(s) to be sensed in the project (individual due S 26-3-2016) document needs to be checked using Turnitin program.

D4. Final choice of sensor, acquiring the sensor, simulation/testing and characterization of the sensor, Signal conditioning circuit design , Microcontroller programming   to be shown in the Project Progress

meeting (group due M 25-4-2016)

D5. Finished Project due M 16-5-2016 which includes:

   D5.1) Final project report which includes: complete schematics, parts list, simulation and test results.

   D5.2) Functional Hardware

   D5.3) Power point slides for 10 minute in-class group presentation (date will be specified later 20 &22-5-2016)

Project Details

Each group (consisting of 3 students) must come up with a unique idea for a device that performs some useful function related to instrumentation and measurement except a temperature measurement device, water level indication, line following robot and any project that was submitted as a requirement for any other course (in particular Electronics and Control systems) by the group or anybody else, if this happens this will be considered cheating and will be dealt with according to university academic rules.

Required Functional Element Categories (see general block diagram below)

   A. **Data Input Element: Switch; Potentiometer; keypad; keyboard..etc**
   B. **At least one Sensor/Transducers which is used to measure the different levels of input quantity and   (avoid using the sensor to just detect the presence or absence of the measurand)**
   C. **Signal Conditioning (Amplification, Linearization, bias removal, filtering, isolation, etc) according to particular project needs)**
   D. **Digital Control Unit (Microcontroller) to perform functions such as: Calculation, Counting, Integration, Logic, Decision Making and Control Function.**
   E. **Output Device/ Actuator (at least one actuator): for example**
      -DC motor (controlled on/off, forward and reverse, PWM speed control)
      -Stepper motor (unipolar/bipolar)
      -Closed loop feedback servo motor

-Relay(s) – Valves - Solenoids

F. An Output LCD Display that shows the quantity being measured
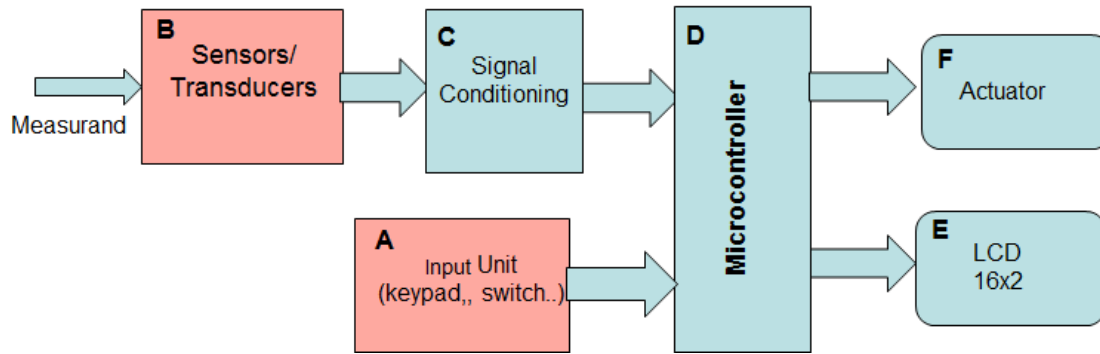
General Project Block Diagram

D3. Sensing Techniques Study

General Guidelines:

1. Each student must write and submit a study / term-paper on a the latest sensing techniques **and latest existing** specific sensor types for the quantity(s) to be sensed in the project after approval of proposal by the course instructor.

2. When preparing and writing the term paper each student must use printed material from books and periodicals (magazines, journals, transactions and conference proceedings) found in the library (at least two resources) in addition to some electronic materials such as electronic books and internet resources .

3. Students must read on the given topic and summarize the main ideas while keeping the proper referencing and keeping copies of the material used in the term paper preparation in case asked to submit them.

4. The term paper should be written in English while using 12 Size Times New Roman font in Microsoft Word.

5. The term paper should start with a cover page having the Birzeit logo, and must contain four main sections: Abstract , Introduction, Main Study results and Conclusions

6. Total number of pages except the front and back cover must be between 4-10 pages

7. Term paper might include figures and drawings in a reasonable amount

8. *Cut and paste from the Internet and e-books is not allowed and will result in a zero grade. The finished paper needs to be checked using Turnitin program (less than 30% copy).*

9. Each student must present his own work and use his own language with help of word processing software spell checking tools

10. Refer to the technical writing document provided at the following site:

http://web.mit.edu/me-ugoffice/communication/technical-writing.pdf

11. Finished Term paper due date is 26-3-2016

Project deliverables and Due dates

	Task/Deliverable	Responsible	Due date
D1	Group Members and main topic	Group	2-3-2016
D2	Detailed proposal with Block Diagram	Group	16-3-2016
D3	Project Sensing Technique Study	Individual	26-3-2016
D4	Sensor, SC and microcontroller finished design and build	Group	25-4-2016
D5.1 D5.2	Finished project (report + Hardware)	Group	16-5-2016
D5.3	Finished project (presentation)	Group	20/22-5-2016

Instructor: Nasser Ismail