Personal Mechatronics Laboratory

www.PML4all.org

An Affordable, Comprehensive and Transparent Kit for Mechatronic Systems Design and Development

Towards Student-centred Engineering Education

Every Student/Engineer Must Own PML.

LAB-ON-THE-GO

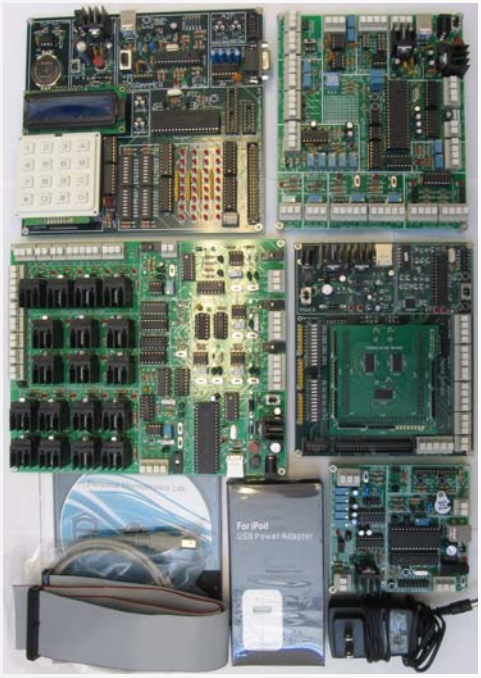
PC-based oscilloscope, function generator, battery charger, IR detector, transistor and continuity tester and more, all on one board.

SENSE, PROCESS, ACTUATE

Computer on the board with dual MCU and many peripherals (LCD, keypad, debugging module, real-time clock, etc.), motor driver board (DC, stepper, servo), sensor board, FPGA-MCU interface and data processing, and open-source software applications.

LEARN, OWN, MODIFY

All boards are modular, versatile, and easy to modify or repair. All circuits are fully explained, and they are traceable on the boards.



- A set of 5 electronic boards, with accessories, software applications, and lab manuals and course materials, suitable for carrying out mechatronics projects, including microcontroller- and FPGA-based real-time programming, motor controls, sensor data processing and analysis, etc.
- Ideal for college and university students to experience concepts of mechatronics, and for engineers to prototype and verify multidisciplinary design ideas.

NEED

In the current engineering world, design of complex systems involves multiple disciplines and hence engineers who are capable of handling a wide spectrum of systems design and synthesis, from mechanisms and electromechanical systems, to circuits and sensory devices, to microcontrollers and FPGA's. In response, the newly-revised engineering curricula have begun to recognize the need for the diversity of scope and expertise, and emphasis on hands-on, student-centred teaching approaches. Consequently, there is a growing need, in both academia and industry, for learning and development tools that help students and engineers gain hands-on knowledge of multidisciplinary mechatronic systems.

SOLUTION

An affordable, comprehensive and transparent collection of utilities, in the form of electronic boards and their accessories, accompanying software applications, and laboratory manuals and course materials, is offered to engineering schools and R&D departments for the design and development of mechatronic systems. It is a "lab-on-the-go," containing basic laboratory equipment, as well as other instrumentation required for running mechatronics experiments. The PML toolkit, with its unique pedagogical features, is a must-have for every college and university course or industrial workshop that involves students/engineers in hands-on multidisciplinary training.

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Why use PML for Teaching?

The PML toolkit has been designed and developed by a university teacher incrementally over a decade of teaching mechatronics courses. Its profound impact on learning outcome is attested by more than 1000 students who have used the kit in their courses.

Why use PML for Professional Development?

The PML toolkit is an affordable, versatile, and modular solution for studying the feasibility of a design idea and rapid proof-of-concept prototyping.

KEY BENEFITS

- Affordable to own for individual students and engineers
- Open, modular, and simple design for learning
- Comprehensive set for a wide range of multidisciplinary engineering projects
- Extensive instruction manuals, lab manuals, and course materials

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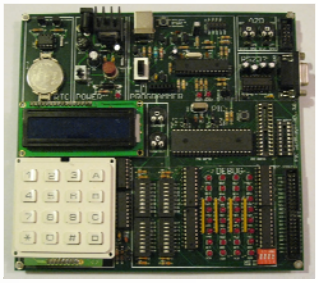
Toolkit Components and Features

Utility Module: A Lab on Board

- Function generator (square, triangular, sinusoidal, ±10V, 1Hz-100KHz, and adjustable offset and duty cycle)
- PC-based dual-channel oscilloscope (USB connection, sampling rate up to 30KHz)
- Battery charger for NiMH and NiCd rechargeable batteries (1 to 8 cells)
- Continuity checker and Transistor tester for NPN and PNP BJT transistors
- Infra-red detector for testing IR emitters
- PIC microcontroller driver with 17 I/O pins

Microcontroller Module: A Dual-core Computer on Board



- Dual-PIC processing and I/O and memory extension
- In-circuit USB programmer (compatible with MPLAB®)
- On-board (removable) 4×4 keypad and 16×2 LCD
- Debugging Module with 32 indicator LEDs and signal-emulation switches
- Dual USB-adaptor power supply (7.5-24VDC)
- Real-time clock with 32.768KHz crystal and battery

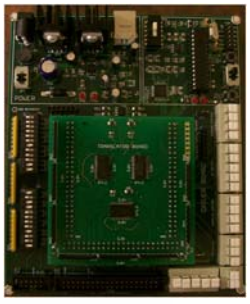
Driver Module: A Multiple Motor Controller on Board

- For driving multiple stepper, DC brushed and brushless, and servo motors simultaneously
- Can be operated independently or in conjunction with Microcontroller Module or a PC
- On-board speed and directional control

Sensor Module: A Multiple Sensor Data Processor on Board

- Various photodetectors, microswitches, resistive, temperature, and PIR sensors
- Signal conditioners: comparator, amplifier, debouncer, active filter, and A/D
- Signal operators: sum, difference, differentiation, integration, peak detection, and sample & hold
- On-board programmable PIC microcontroller and PC USB interface

Interface Module: An FPGA-PIC Signal Switching Board



- Changes I/O configuration between modules without a need for rewiring
- Can be operated as an independent FPGA, PIC, or FPGA-PIC driver
- Can be operated as an independent data acquisition board (analog and digital I/O)
- FPGA configuration programmable via both FTDI and PIC
- Dual USB-adaptor power supply (7.5-24VDC)

Accessories

- CD loaded with
  - Lab manual containing various multidisciplinary experiments
  - Instruction manual for each module
  - Software for Utility, Microcontroller, Driver, Sensor, and Interface Modules
- 5V AC-DC adaptor and 15V USB adapter
- 2 USB cables and 2 40-wire ribbon cables with connector headers
- 4x4 Keypad and 16x2 LCD

Textbook (ISBN: 9781259090356)

M.R. Emami, *Multidisciplinary Engineering Design: from Theory to Practice*, McGraw-Hill Ryerson, New York, 2013