SUMMER TRAINING CAMP-08

ROBOTICS

Microcontroller & Embedded Systems

ROBOTICS @ LAKSHYA

In science fiction, the Three Laws of Robotics are a set of three rules written by Isaac Asimov, which all robots must obey.

The Laws state the following:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

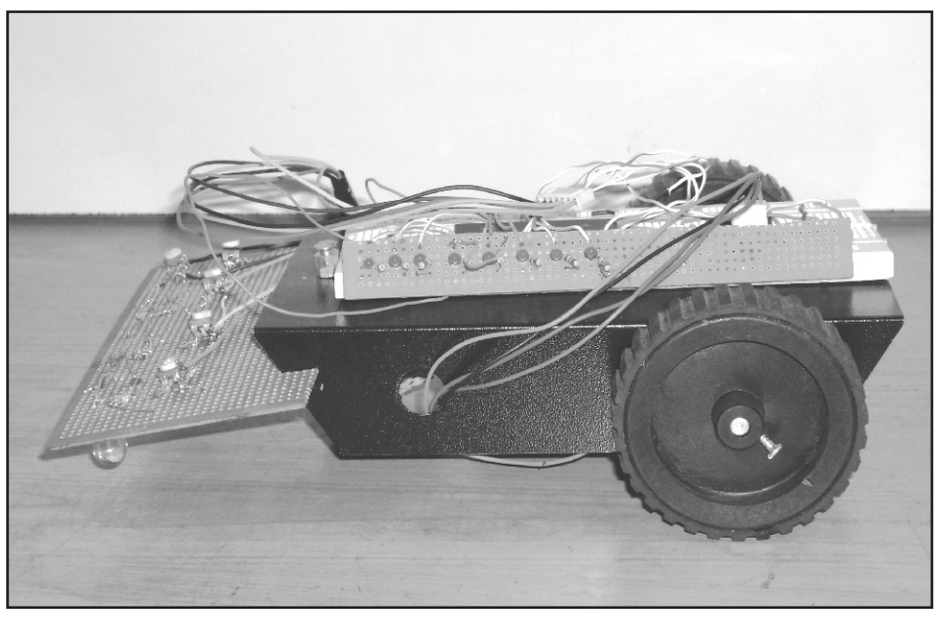
Every now and then do you not ask yourself ? Could that task be automated ? Could I not have a robot do that work for me ? Although humanoid robots have been made there is a lot an engineer and a scientist can do to make them resemble a real human being more and more.

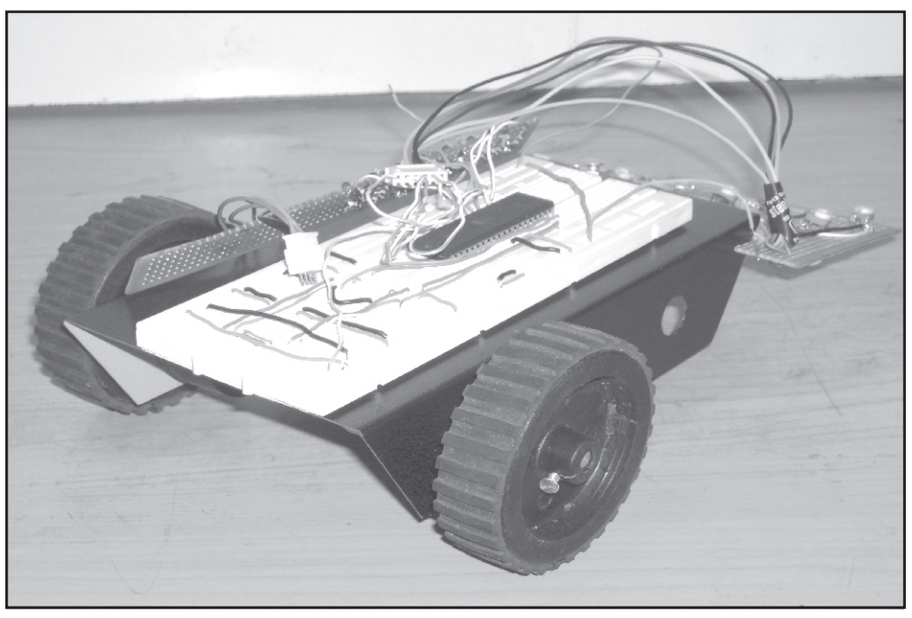
It all starts from a humble beginning, cutting down wires , soldering wierd multi -pinned pieces called Integrated Circuits onto a board, supplying power, assembling the mechanical design, not to forget the softwares, if you are designing an autonomous robot.

Robotics brings together several very different engineering areas. First there is wood/metal/plastic working for the body. Then there is mechanics for mounting the wheels on the axles, connecting them to the motors and keeping the body in balance. Next you have electronics to power the motors and connect the sensors to the controllers. At last you have the software to understand the sensors and drive the robot around.

We at LAKSHYA provide you with an oppurtunity to learn and implement all that your books at school and college might not teach - to design, innovate and recreate the excitement that hundreds and thousand of robotics enginners around the world feel while breathing life into what they call a "ROBOT" .With a perfectly designed lab for such a course, this training is one of its kind in Orissa.

So, be there and go happy 'Robot-ing".





Project Development

An autonomous obstacle avoidance Robot -Construction Project I
Construction of a line following Robot -Construction Project II
Hardware control using Parallel Port of computer -Construction project III

Lakshya™ ... The Missing Link.

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ROBOTICS
Microcontroller & Embedded Systems

Syllabus

Basic Electronics Components and Equipment Study

- Registers, Capacitors, Inductors-An overview
- Diodes & Transistors
- Construction and Types
- Modes of operation
- Use of diode and transistors as switches.
- Voltage regulators
- Integrated circuits
- Opamps
- Breadboard, Multimeter and power supply Usage

Sensors

- LDR
- Infrared Sensor(photo detector)
- Temperature sensors
- Sonar …

Motors

- DC Motors
- Stepper motors
- Servo motors

Display Modules

- 7 Segment LED, LCD

Digital Electronics

1 Binary Systems
Signed Binary Numbers
Octal and Hexadecimal Numbers
Binary Logic
Binary Codes

2 Boolean Algebra and Logic Gates
Basic theorems and properties of Boolean Algebra
Boolean Functions
SOP & POS form
Digital logic gates

3 Gate level minimization
The map method
NAND and NOR implementation
XOR function

4 Combinational Logic
Combinational circuits
Binary adder and Subtractor
Encoder / Decoder
Multiplexer / Demultiplexer

5 Synchronous sequential logic
Sequential circuits
Latches
Flip Flops – SR, JK, D, Master Slave

6 Registers and Counters
Shift register – SIPO, SISO, PIPO, PISO
Ripple counter
synchronous counter

7 Memory and Programmable logic
RAM
Memory decoding
ROM
UVROM , EEROM, Flash memory Their concept and use.

8 Digital Integrated Circuits
TTL Logic
MOS
CMOS
Propagation Delay
Fan in , Fan out

9 555 timer application

10 Digital to Analog converter

11 Analog to digital converter

MICROCONTROLLER &

Embedded systems - An overview

Microcontrollers

- Features
- Common Microcontrollers

The 8051 Microcontrollers

1. Inside 8051
2. Introduction to 8051 assembly programming
3. I/O programming in 8051
4. And many more…

AVR Microcontrollers (ATMEGA

1. Architectural Overview of the AVR
- Features of an AVR Atmega 16 microcontroller
- Pinouts of Atmega 16

2. Development Hardware
3. Development Software
4. Types of memory-a brief insight
5. Memory layout in ATMEGA 16
- Program Memory-FLASH
- Data Memory-SRAM

6. The AVR System Clock
- Oscillator options
- FUSE settings

7. I/O- Ports
- Ports as General Digital I/O
- Alternate PORT functions

8. Analog Comparator in AVR
- Analogue Comparator Interrupts
- Multiplexed inputs

9. Analog to Digital Conversion
- General ADC concepts
- Multiple Voltage reference selections
- Prescaling
- Noise Cancelling in AVR
- 10th /8th bit Conversion
- Multiple channel selections

10. Interrupts and ISR's
- External Interrupts
- ISR's
- Other Interrupts sources

11. Power management in microcontroller
- Need of power management
- Different Sleep Modes

Idle mode, ADC noise reduction mode, power down mode, power save mode, standby mode, extended standby mode.

12. Timer/Counter and Pulse Width modulation in AVR
- 8 bit Timer/counter0
- 8 bit Timer/counter2
- 16 bit Timer/Counter1
- Prescaling
- Modes of Operation
- Mode setting for PWM generation and pulse train generation

13. Serial communication in AVR

Image processing Basics with MATLAB

1. What is a digital Image
2. Image Sampling and Quantization
3. Representation of Image in matrix format
4. Basic relationship between Pixels
   a. Neighborhoods
   b. Adjacency, connectivity, Regions, Boundaries
   c. Distance Measure
5. Image Histogram, Image Negative
6. Histogram Processing
7. Image Enhancement
8. Image Restoration
9. RGB Image and its format
10. Color Image Processing
11. Morphological Image processing
12. Image Segmentation
13. Camera Interfacing using MATLAB.
14. Robot Control Through Computer After Image Analysis

Hardware Interfacing (Experience Theoretical Data in Reality)

1. Knowing Components
2. Controlling relays Using transistors
3. Inductive Load Driver IC's Interfacing (ULN2003/2803)
4. Light Dependent Resistors, temperature sensors
5. Infrared Sensors – Obstacle Detection

(i) UnModulated
(ii) Modulated

6. DC Motor speed controlling using PWM
7. H-Bridge driver IC (L293d)
8. Study of regenerative Breaking
9. Stepper motors
10. Servo motor controlling
11. LCD Interfacing using microcontroller
12. Controlling parallel port of computer
13. Serial Port Interfacing
14. Analog signal to Digital conversion with light and temperature sensors

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Hardware control using Parallel Port of computer -