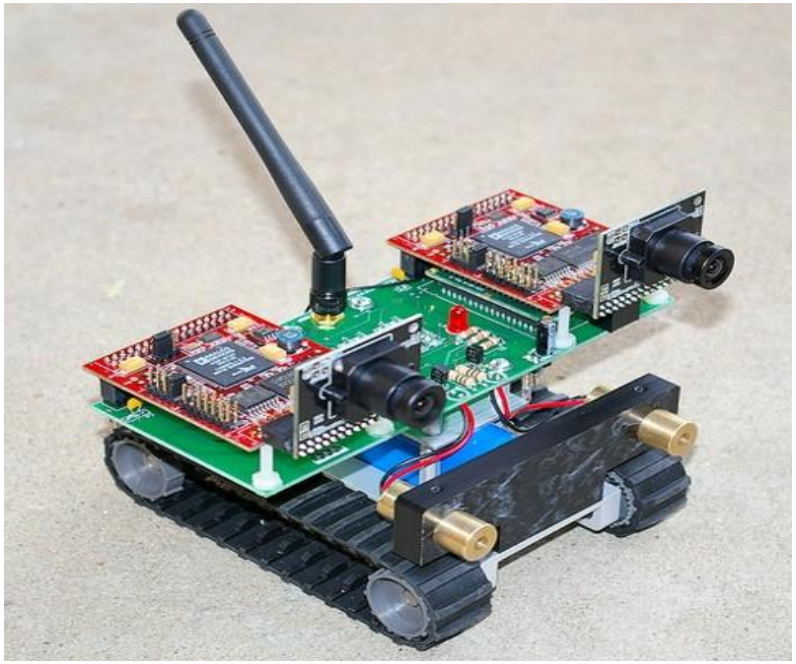
ROBOTICS LECTURE SERIES

(LECTURE 2 –INTRODUCTION TO ELECTRONICS)



Jairaj Phase 2nd Year

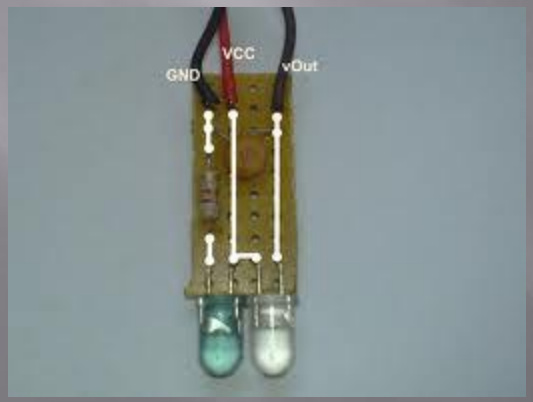
Nikhil Jain 2nd Year

Deepak Shinde 2nd Year

Functioning Of Robot

- Steps:

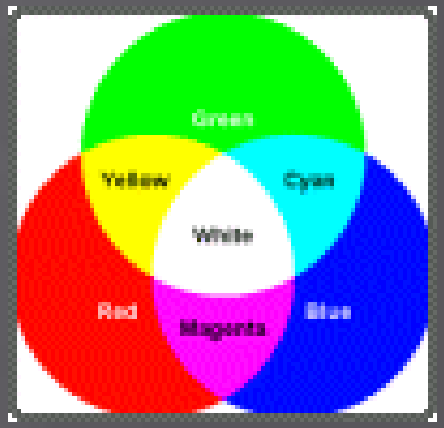
1. Sensing(Input: Manual or Sensors)
2. Processing(MCU)
3. Acting(Output to Actuators)



Sensors

- In order for a bot to do any task on its own, it requires sensors.
- What to sense?

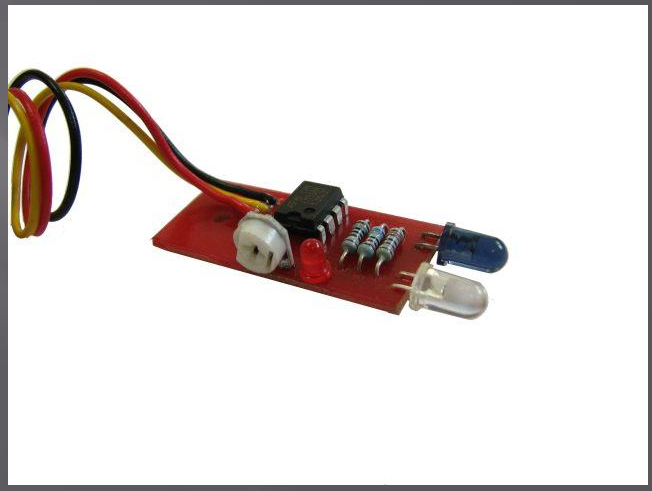
1. **Color** of the lines it is moving on.
2. **It's distance** from an object.
3. **Physical contact** with anything.
4. **Motor rotation**



Color Sensing

IR sensor

- IR LED emits light.
- Reflected light received by photo-transistor.
- Voltage across it depends on the light of the object from which it was reflected.



LED light sensor

- Same principle.
- But uses colored LEDs.
- Picture shows an array of 7 such sensor, hence the name 7-channel line sensor.

Distance sensing

Sharp sensor

- IR used.
- Pair of receiver and transistor.
- But here, the output depends on the distance of the object which reflects the light.
- Uses triangulation method.

Ultrasonic sensor

- Sends high frequency sound waves.
- Echo from an object is received by the receiver.
- Time interval between sending the signal and receiving echo tells the distance !

Physical Contact

BUMP sensor

- Like a switch
- On contact, it is pressed and the circuit is completed, hence we get a signal.

Rotatory Motion

Encoder doubt?

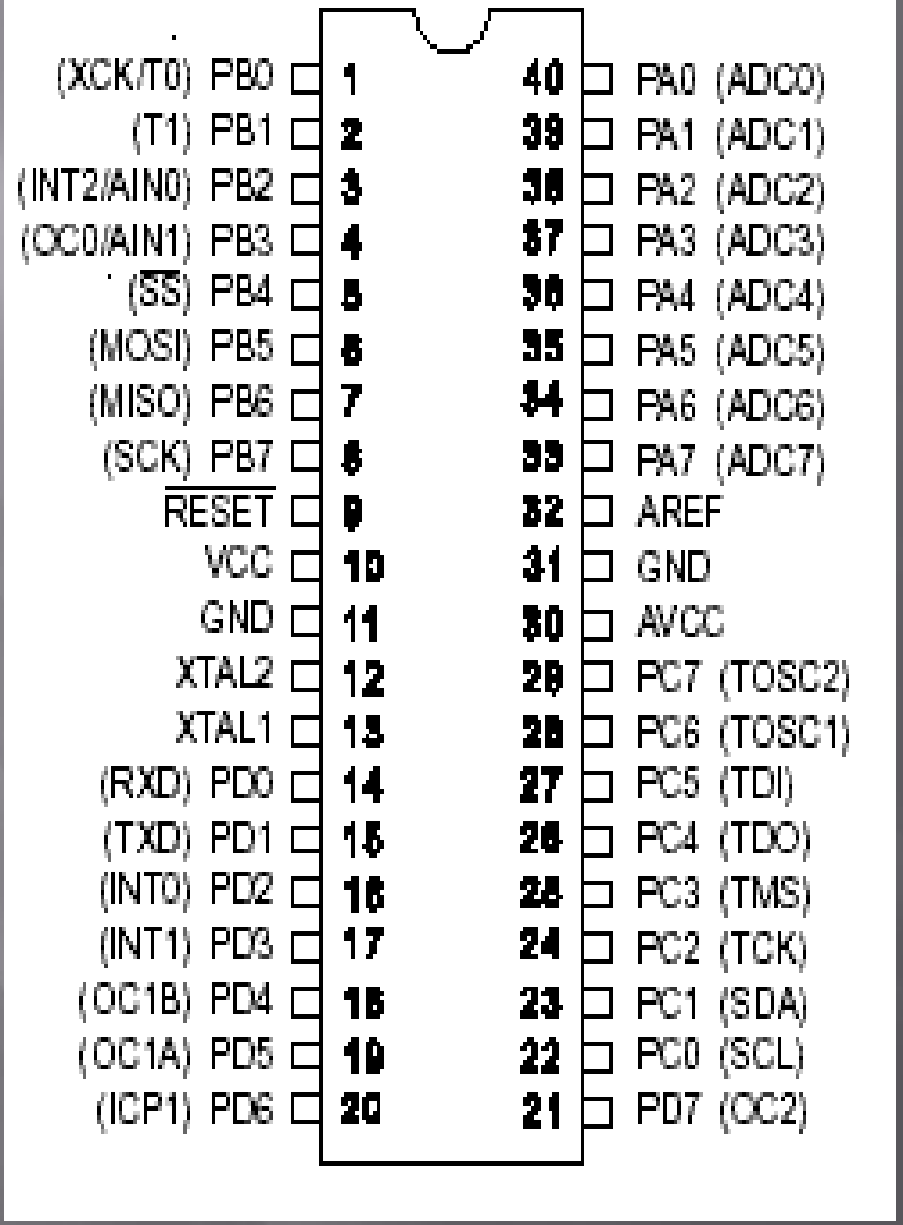
1) Determine displacement, velocity,
   acceleration, or the angle of a
   rotating sensor
2) Problem of skidding of tires

Processing

- The output of the sensors needs to be processed (**Microcontroller**).
- Abbreviated as **MCU**.
- Nothing, but an IC (Integrated circuit)
- In general, we can say that it's like a **mini-computer.**

Concept Of MCU

- MCU consists of several ports.
- Ports are pins on the MCU which can be turned ON and OFF using a program.
- This behavior is called Output mode.
- In input mode, these pins can read digital values(1 or 0).
- Value more than threshold value is read as 1 and less than that is read as 0.


(XCK/T0) PB0 1
(T1) PB1 2
(INT2/AIN0) PB2 3
(OC0/AIN1) PB3 4
(SS) PB4 5
(MOSI) PB5 6
(MISO) PB6 7
(SCK) PB7 8
RESET 9
VCC 10
GND 11
XTAL2 12
XTAL1 13
(RXD) PD0 14
(TXD) PD1 15
(INT0) PD2 16
(INT1) PD3 17
(OC1B) PD4 18
(OC1A) PD5 19
(ICP1) PD6 20
40 PA0 (ADC0)
39 PA1 (ADC1)
38 PA2 (ADC2)
37 PA3 (ADC3)
36 PA4 (ADC4)
35 PA5 (ADC5)
34 PA6 (ADC6)
33 PA7 (ADC7)
32 AREF
31 GND
30 AVCC
29 PC7 (TOSC2)
28 PC6 (TOSC1)
27 PC5 (TDI)
26 PC4 (TDO)
25 PC3 (TMS)
24 PC2 (TCK)
23 PC1 (SDA)
22 PC0 (SCL)
21 PD7 (OC2)

Functions in MCU

- Timer: MCU has an internal clock which generates clock pulses. (Used to determine time)
- ADC: Analog signal is converted
- USART: The MCU can be connected to laptop or computer using this function. We can give input from the laptop.
- Serial Peripheral Interface: Two MCU's can be connected with each other using this function.

Lcd

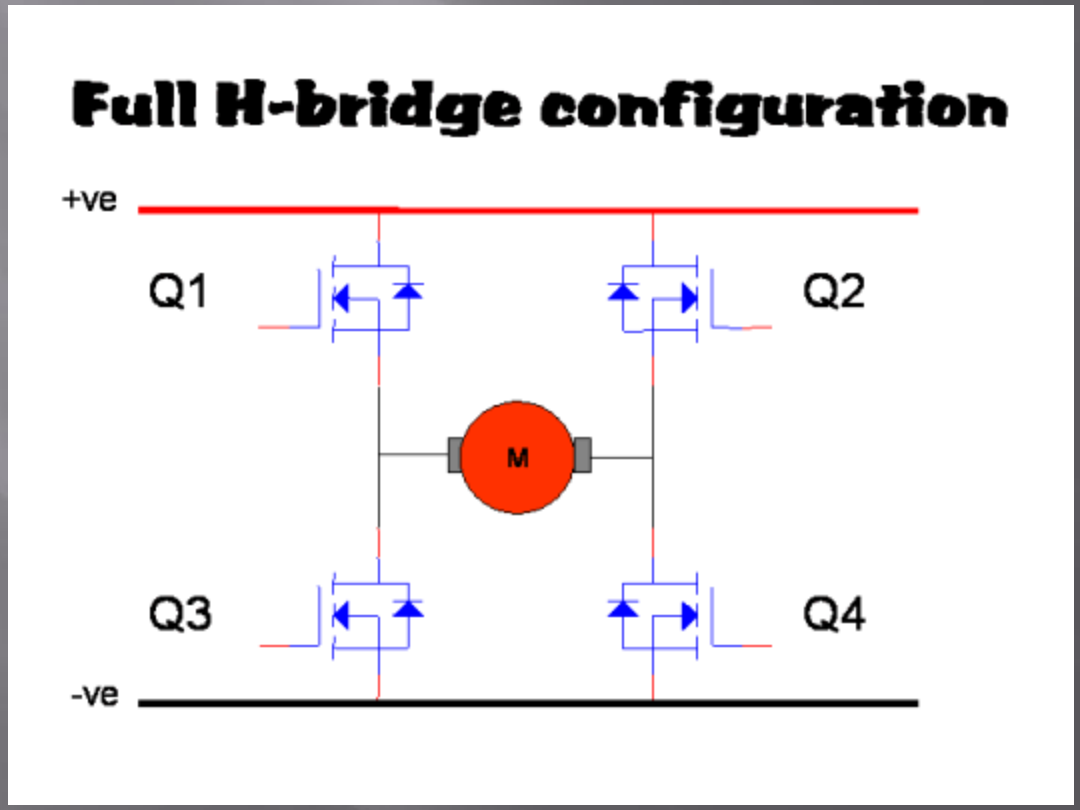
- We need to interface an LCD to our microcontroller so that we can display messages, outputs, etc.
- Sometimes using an LCD becomes almost inevitable for debugging and calibrating the sensors

Motor Drivers

- The current from MCU output pins is not enough to run a motor.
- Therefore, we need an external driver circuit to connect the motor to external power when the output pin is high.
- We can make a circuit or there are IC available for same purpose. Eg. L293,L293D,etc.

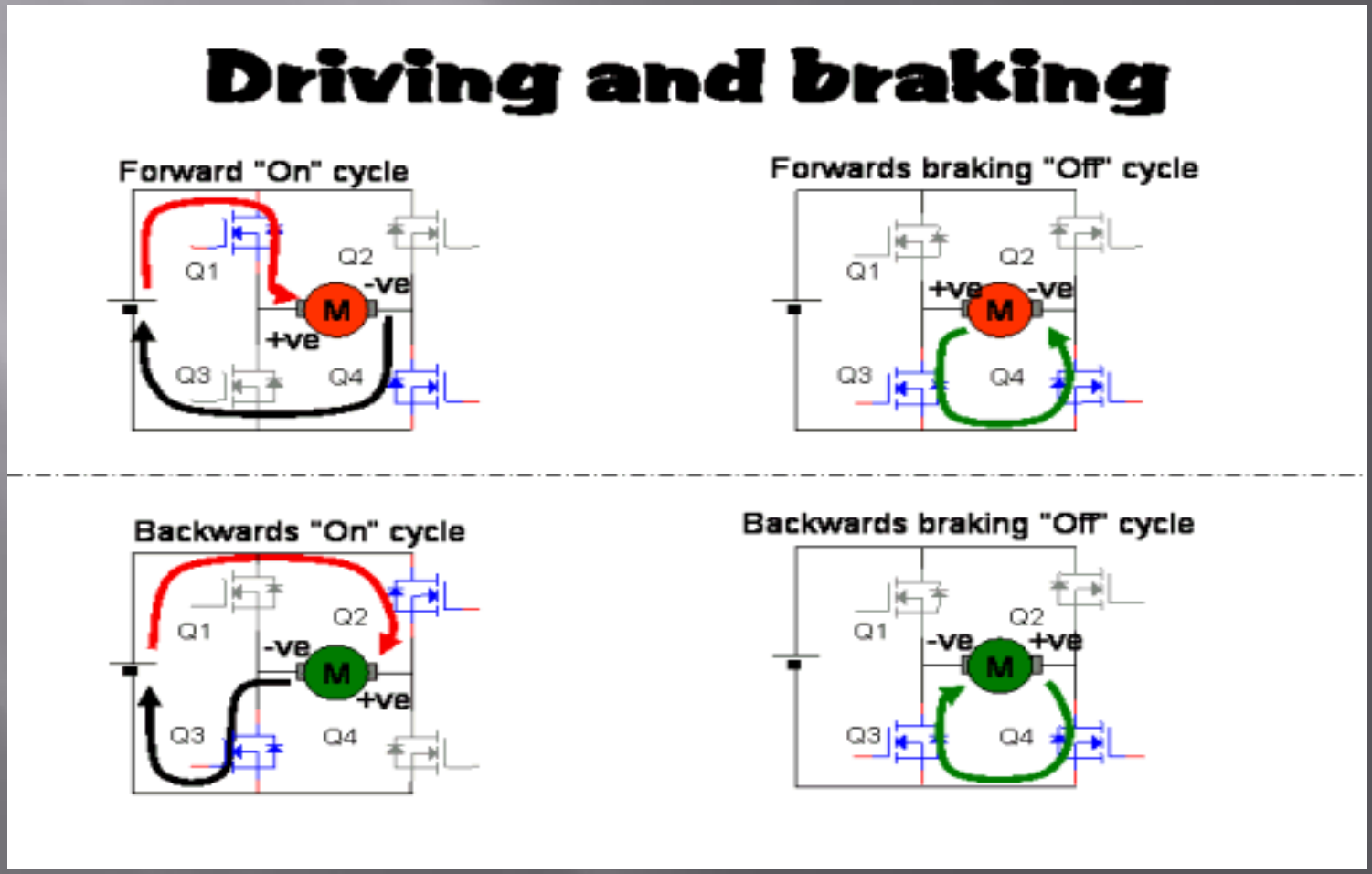
H Bridge

It's a circuit to allow the rotation of motor in both direction



Working of DC motor

Driving and Braking using H Bridge



Working of DC motor

H-Bridge in short

S1	S2	S3	S4	Current Direction	Effect
1	0	0	1	1 to 2	Motor spins forward
0	1	1	0	2 to 1	Motor spins backward
1	1	0	0	-	Braking Occurs
0	0	0	0	-	Free running

H bridge using L293D