Motion Control Of Firebird-V Robot

e-Yantra Team
Embedded Real-Time Systems Lab
Indian Institute of Technology-Bombay

IIT Bombay
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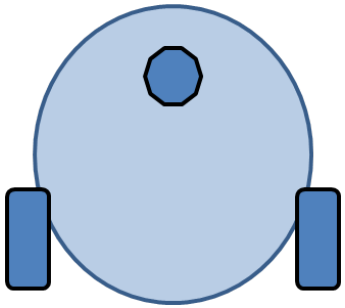
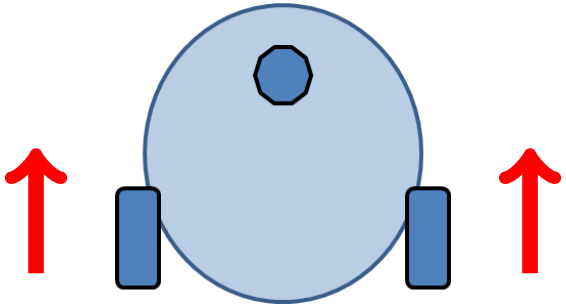
Agenda for Discussion

1. Basic Movements of Robot
   - Motion of Robot
   - Understanding L293D IC
2. Motor Interfacing on Firebird
   - Pin connections
   - Logic Table
   - Writing C-Code

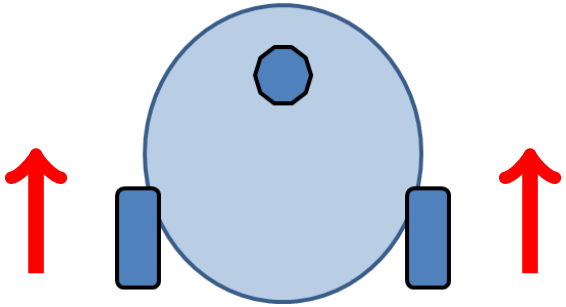
Various Motion



Various Motion



Various Motion



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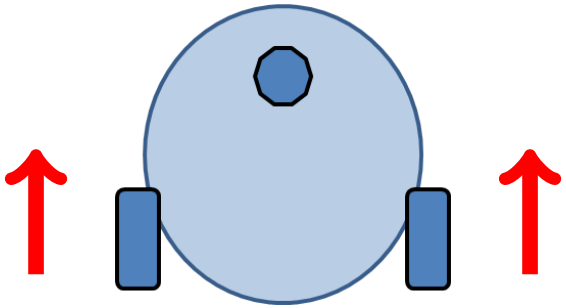

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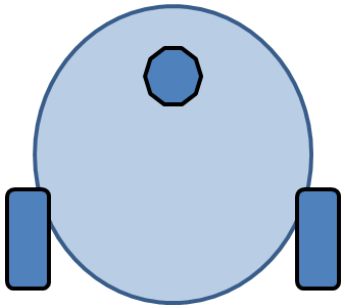

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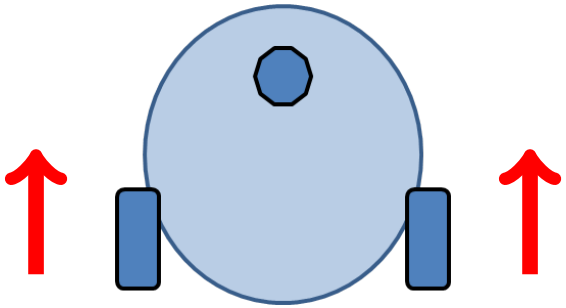

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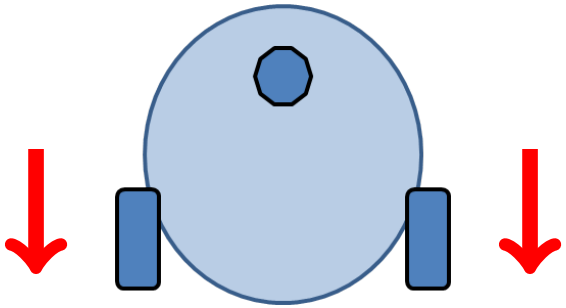

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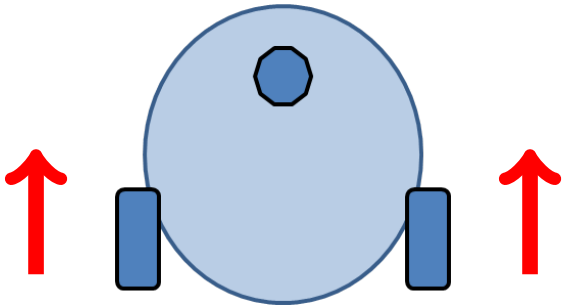
Various Motion



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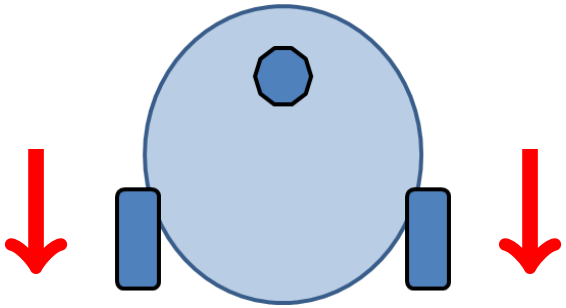

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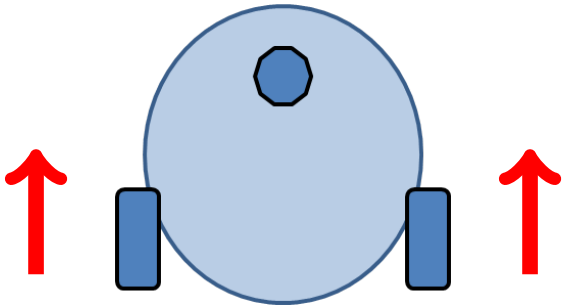
Various Motion



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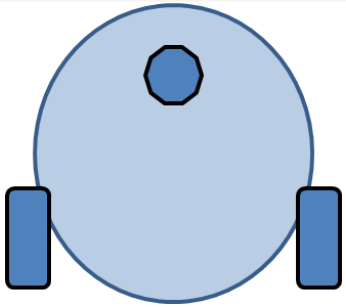

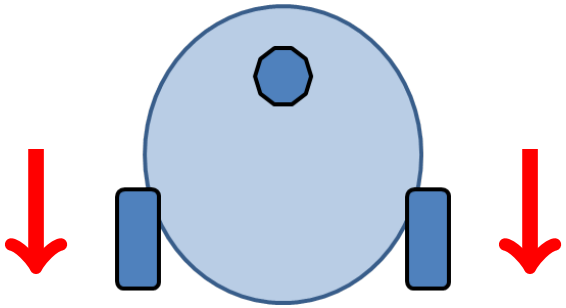

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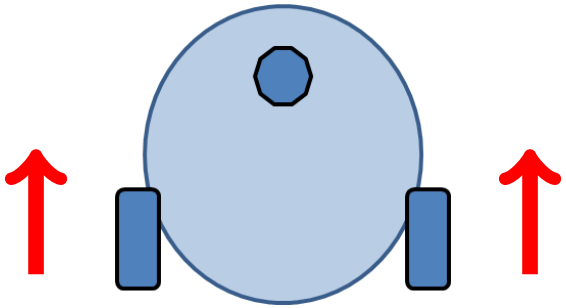

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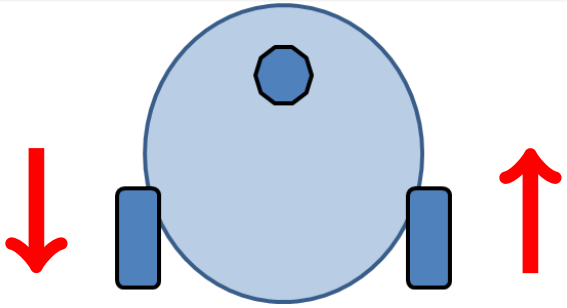

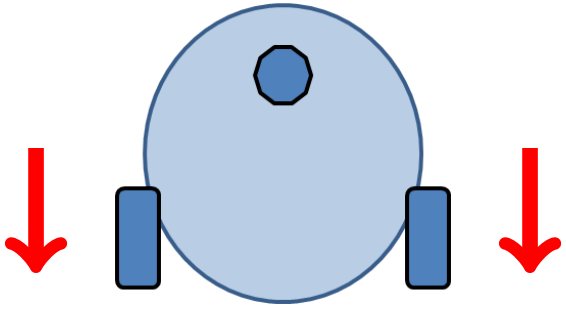

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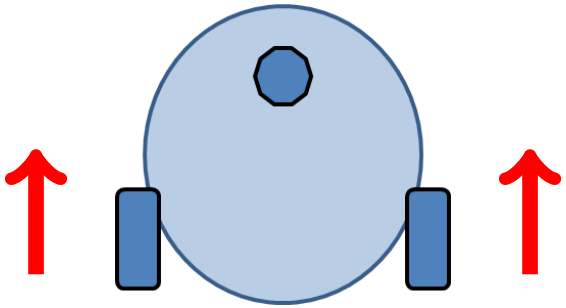

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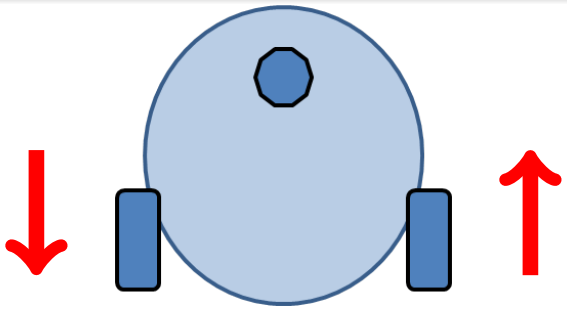

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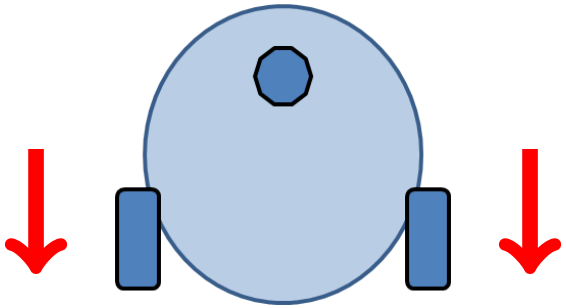

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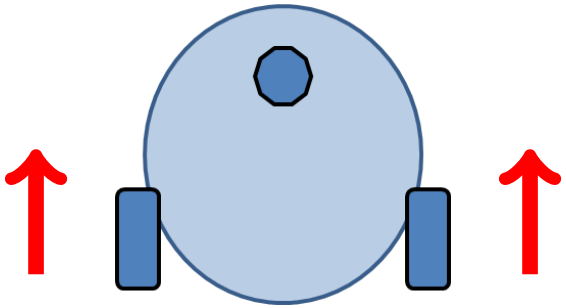

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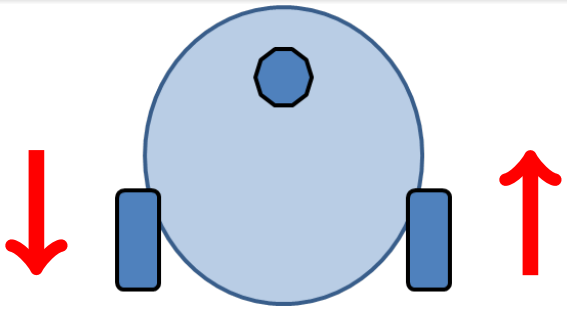

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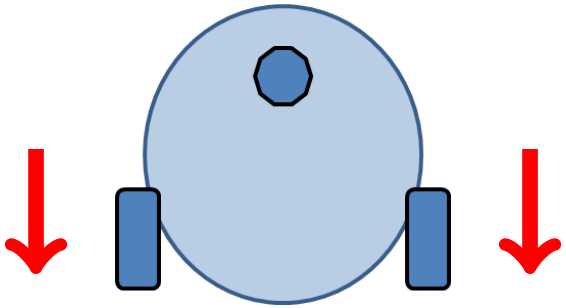

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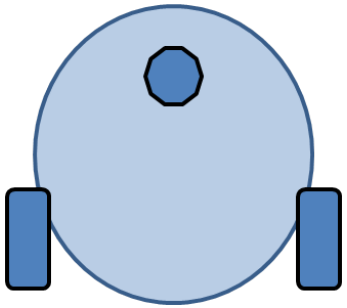

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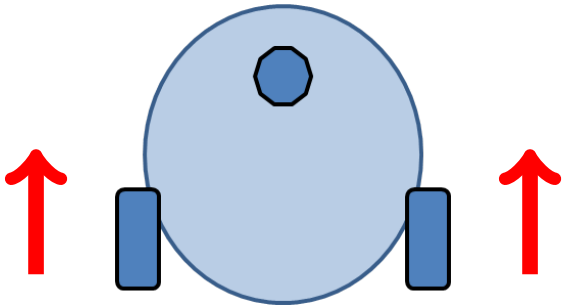

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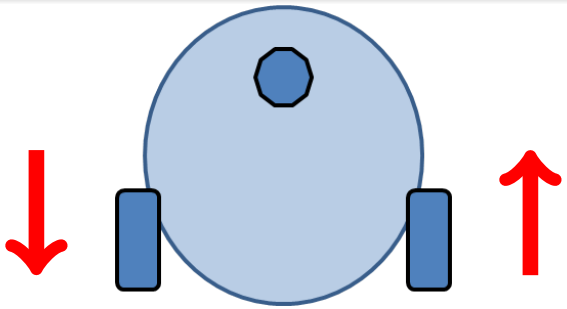

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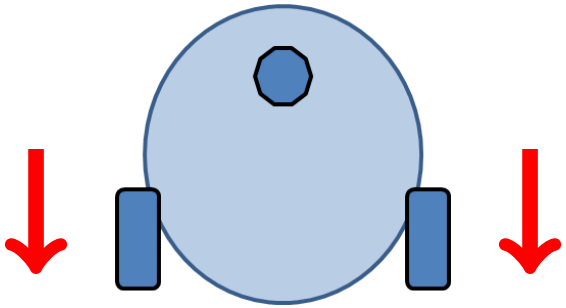

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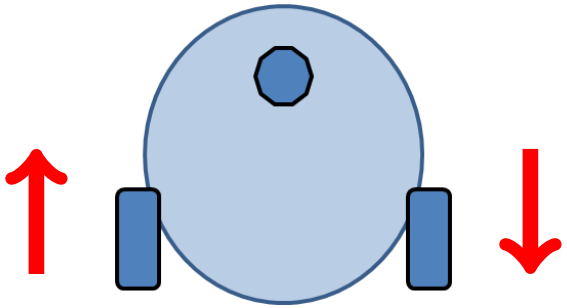

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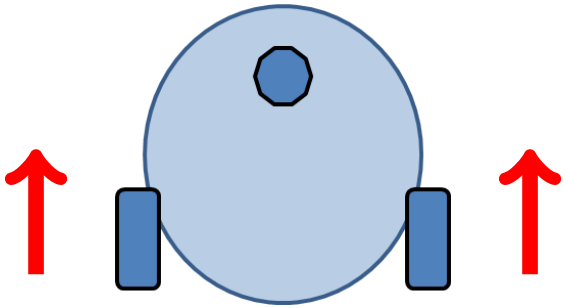
Various Motion



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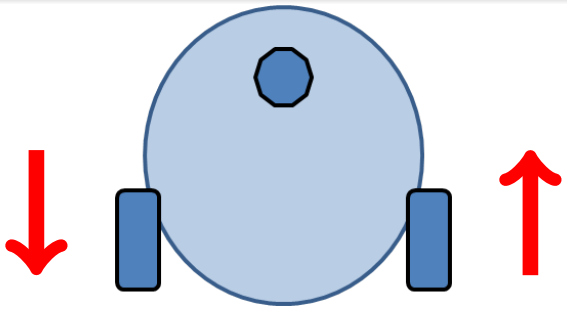

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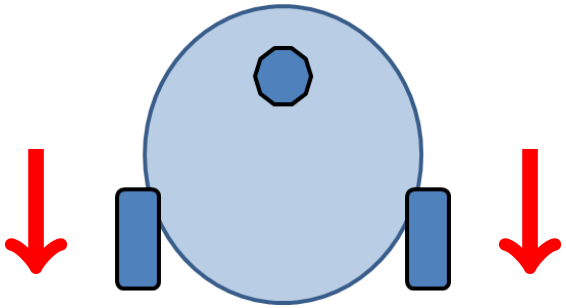

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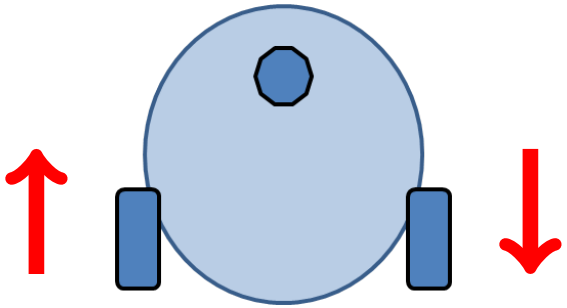
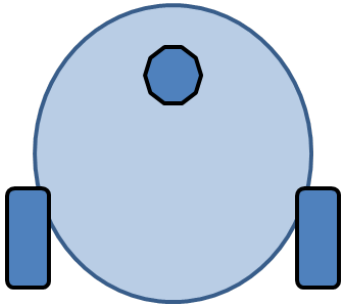
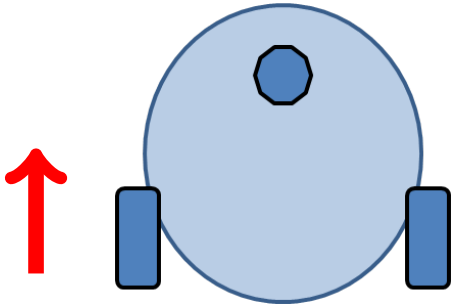


Right

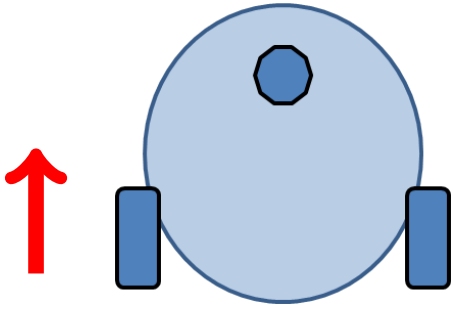
Various Motion (Contd..)



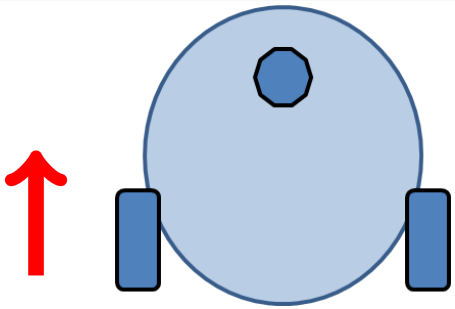
Various Motion (Contd..)



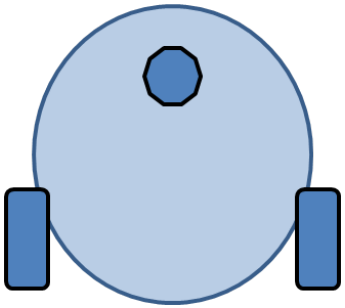
Various Motion (Contd..)



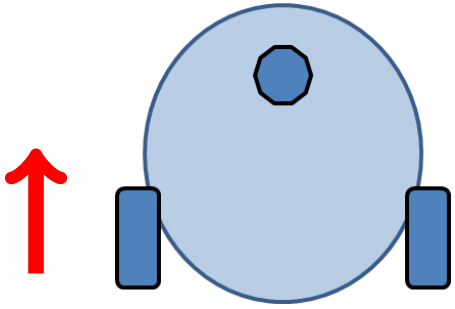
Various Motion (Contd..)



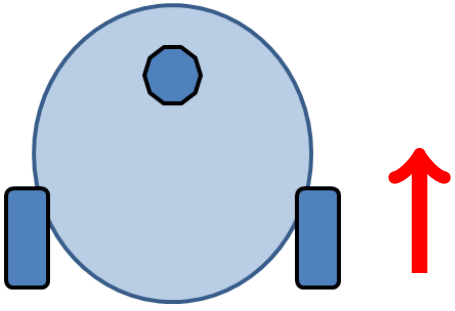
Soft-Right



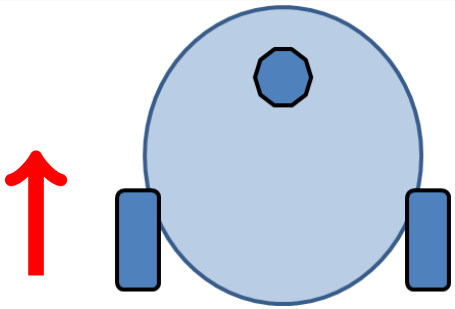
Various Motion (Contd..)



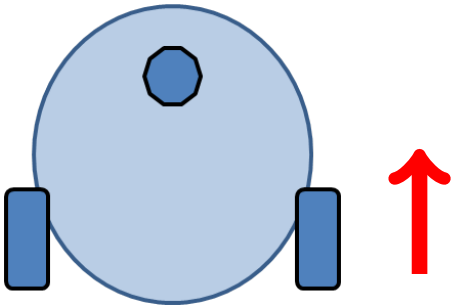
Soft-Right



Various Motion (Contd..)

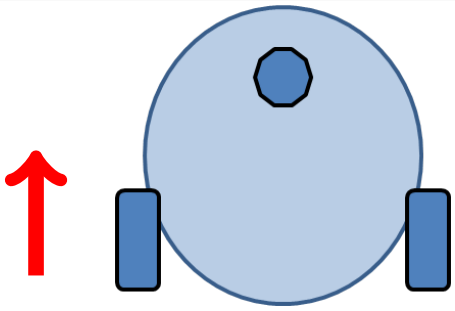


Soft-Right

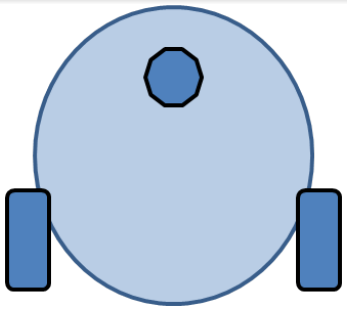


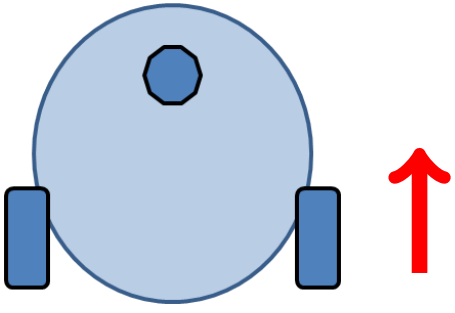
Soft-Left

Various Motion (Contd..)



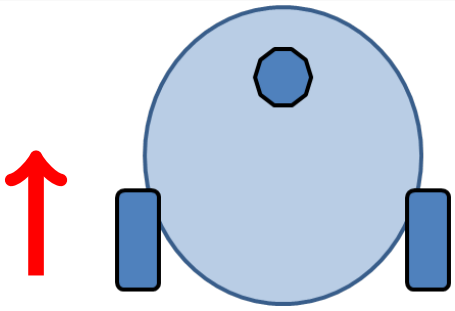
Soft-Right

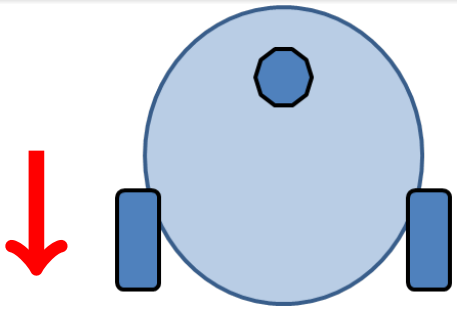




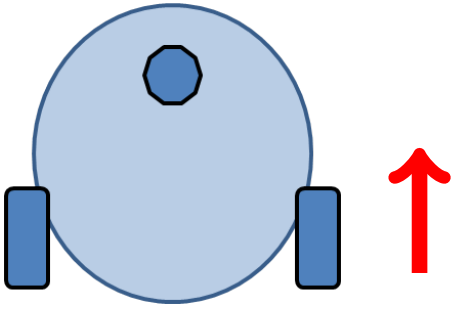
Soft-Left

Various Motion (Contd..)



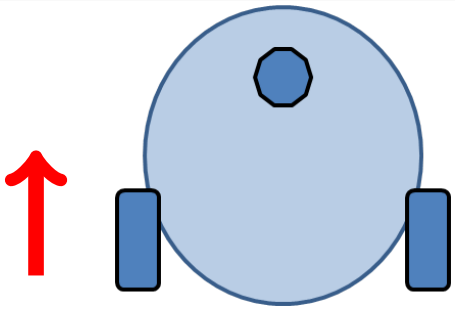


Soft-Right

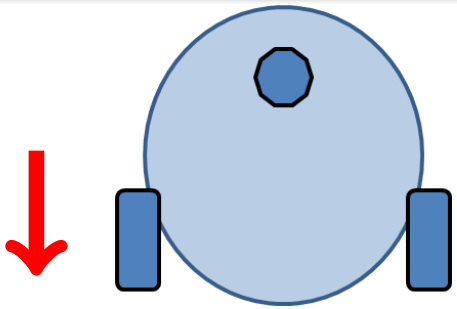


Soft-Left

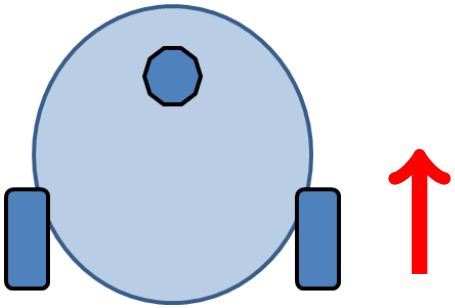
Various Motion (Contd..)



Soft-Right

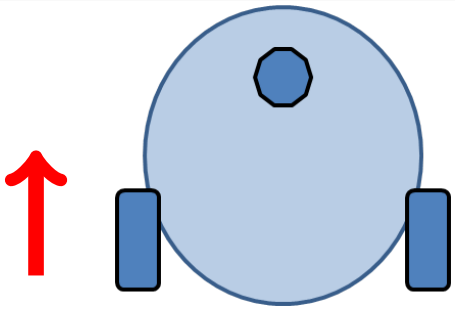


Backward Left



Soft-Left

Various Motion (Contd..)



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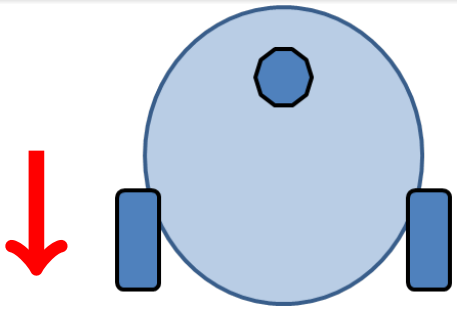
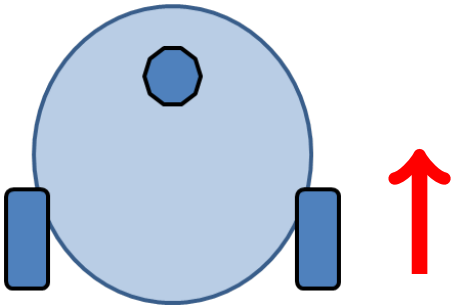
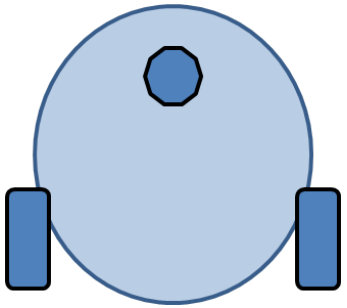


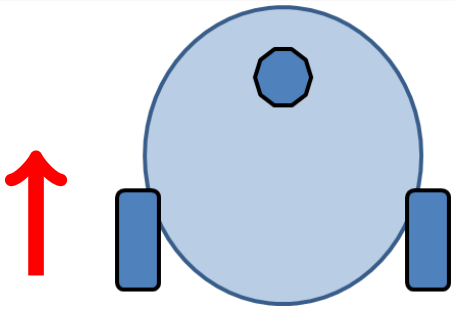
Backward Left



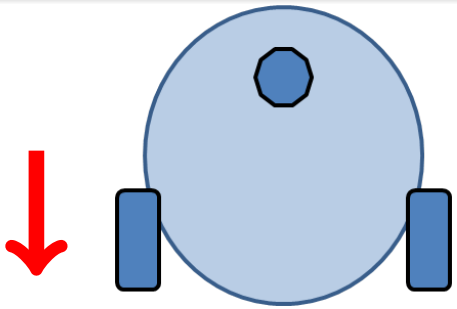
Soft-Left



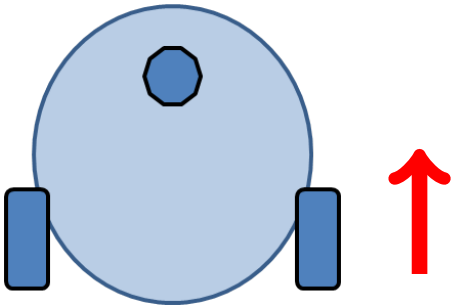
Various Motion (Contd..)



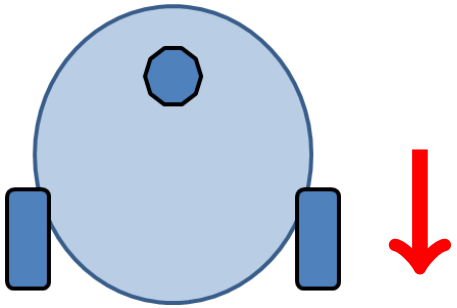
Soft-Right



Backward Left

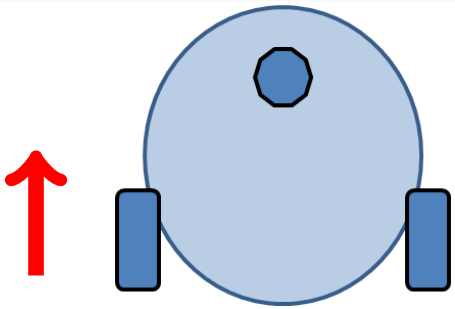


Soft-Left

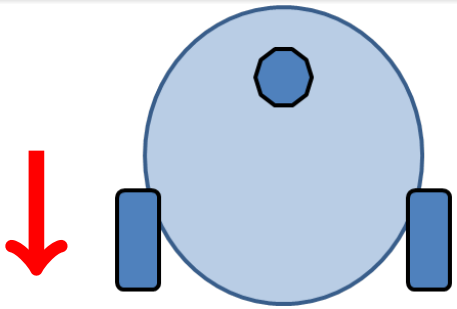


Backward Right

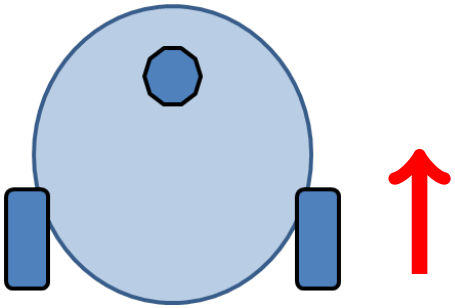
Various Motion (Contd..)



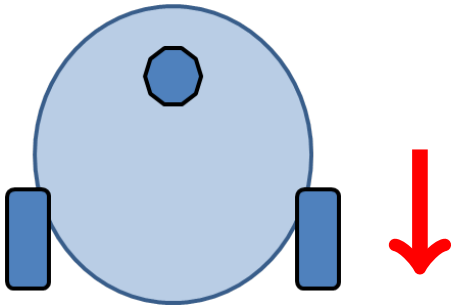
Soft-Right



Backward Left



Soft-Left

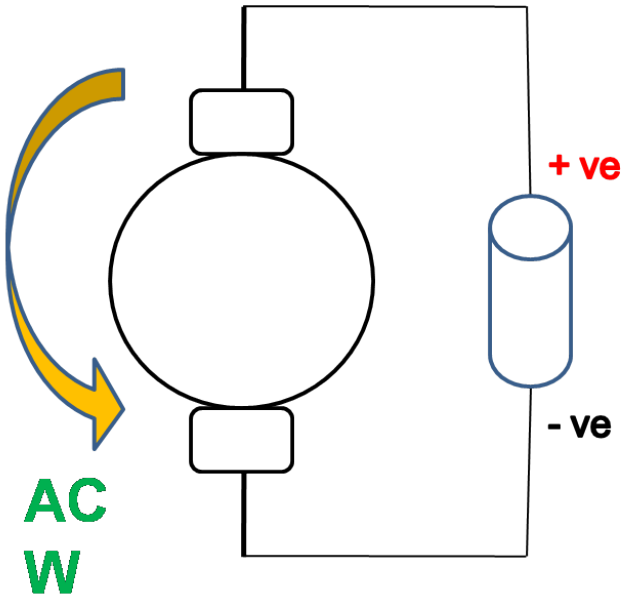


Backward Right

Direction Control of DC Motor

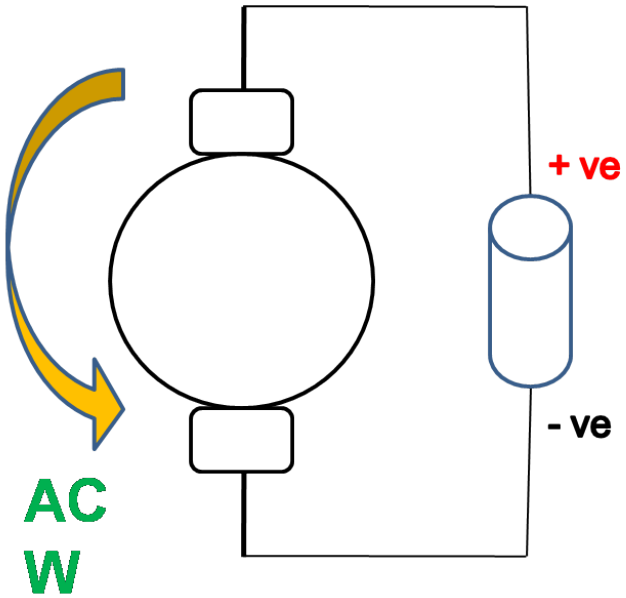
Direction Control of DC Motor

Anti-Clockwise Motion



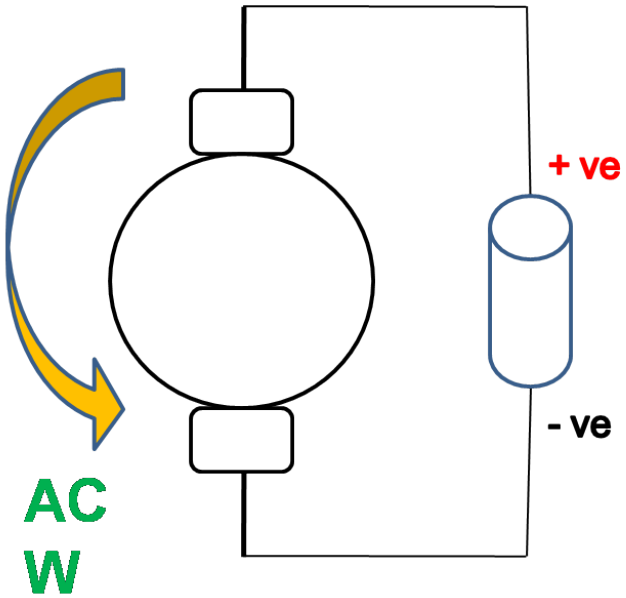
Direction Control of DC Motor

Anti-Clockwise Motion

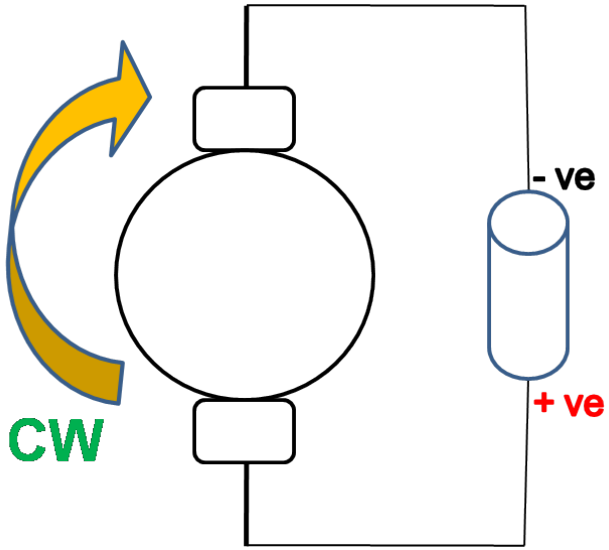


Direction Control of DC Motor

Anti-Clockwise Motion

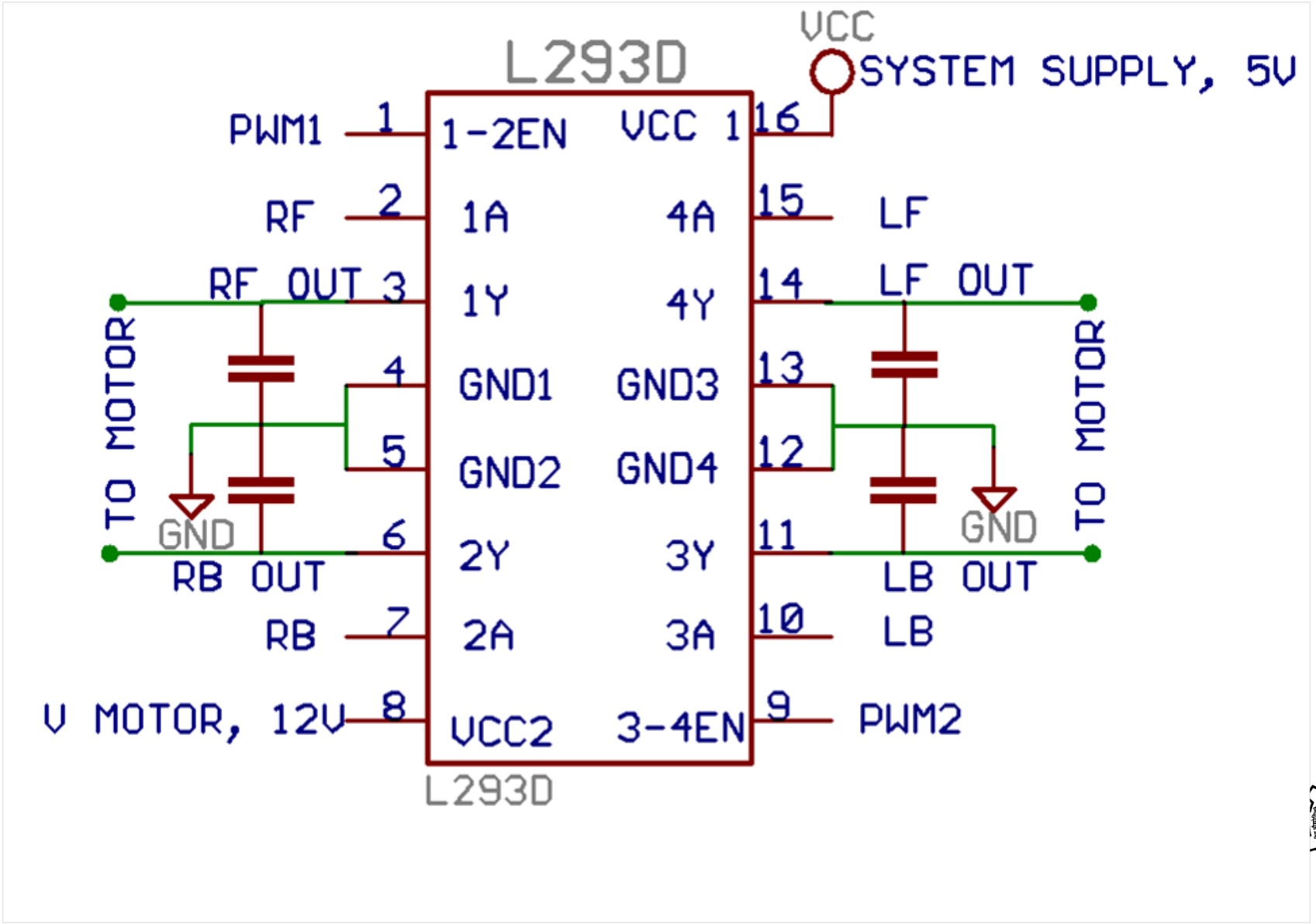


Clockwise Motion



L293D IC

L293D IC


L293D
VCC
SYSTEM SUPPLY, 5V
PWM1
1
1-2EN
VCC 1
16
RF
2
1A
4A
15
LF
RF OUT
3
1Y
4Y
14
LF OUT
TO MOTOR
4
GND1
GND3
13
5
GND2
GND4
12
TO MOTOR
GND
6
2Y
3Y
11
GND
RB OUT
LB OUT
RB
7
2A
3A
10
LB
V MOTOR, 12V
8
VCC2
3-4EN
9
PWM2
L293D

Motor Pin Connection

Motor Pin Connection

1. Three out of four pins for Direction control is connected at PORT0 and one pin is connected at PORT1

Motor Pin Connection

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Motor Pin Connection

1. Three out of four pins for Direction control is connected at PORT0 and one pin is connected at PORT1

   a. P0.22 - Left Motor Control

   b. P1.21 - Left Motor Control

   c. P0.10 - Right Motor Control

   d. P0.11 - Right Motor Control

Motor Pin Connection

1. Three out of four pins for Direction control is connected at PORT0 and one pin is connected at PORT1
   a. P0.22 - Left Motor Control
   b. P1.21 - Left Motor Control
   c. P0.10 - Right Motor Control
   d. P0.11 - Right Motor Control
2. Two Pins for Enabling Motor Driver IC is connected at PORT0

Motor Pin Connection

1. Three out of four pins for Direction control is connected at PORT0 and one pin is connected at PORT1
   a. P0.22 - Left Motor Control
   b. P1.21 - Left Motor Control
   c. P0.10 - Right Motor Control
   d. P0.11 - Right Motor Control
2. Two Pins for Enabling Motor Driver IC is connected at PORT0

Motor Pin Connection

1. Three out of four pins for Direction control is connected at PORT0 and one pin is connected at PORT1
   a. P0.22 - Left Motor Control
   b. P1.21 - Left Motor Control
   c. P0.10 - Right Motor Control
   d. P0.11 - Right Motor Control
2. Two Pins for Enabling Motor Driver IC is connected at PORT0
   a. P0.7 (PWM2)- Left Channel Enable
   b. P0.21 (PWM5)- Right Channel Enable

Logic Table

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward				

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward				

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left				

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left	1	0	1	0

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left	1	0	1	0
Right				

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left	1	0	1	0
Right	0	1	0	1

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left	1	0	1	0
Right	0	1	0	1
Soft Left				

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left	1	0	1	0
Right	0	1	0	1
Soft Left	0	0	1	0

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left	1	0	1	0
Right	0	1	0	1
Soft Left	0	0	1	0
Soft Right				

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left	1	0	1	0
Right	0	1	0	1
Soft Left	0	0	1	0
Soft Right	0	1	0	0

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left	1	0	1	0
Right	0	1	0	1
Soft Left	0	0	1	0
Soft Right	0	1	0	0
Stop				

Logic Table

Direction	P0.22 LB	P1.21 LF	P0.10 RF	P0.11 RB
Forward	0	1	1	0
Backward	1	0	0	1
Left	1	0	1	0
Right	0	1	0	1
Soft Left	0	0	1	0
Soft Right	0	1	0	0
Stop	0	0	0	0

Syntax for C-Program

Syntax for C-Program

#include

Syntax for C-Program

#include

```
#include <lpc214x.h>
```

Syntax for C-Program

#include

```
#include <lpc214x.h>
```

Pin Configuration

Syntax for C-Program

#include

```
#include <lpc214x.h>
```

Pin Configuration

```
void Init_motion_pin (void)
{
     PINSEL0 = 0X00002000; // Set direction pins as GPIOs
     PINSEL1 = 0x00000400;
     PINSEL2 = 0x00000000;
     IO0DIR  = 0x00600C80;  // Output Port0
     IO1DIR  = 0x00200000;  // Output Port1
     IO0SET  = 0x00200080;  // Set PWM Pins
     IO0CLR  = 0x00400C00; // Initially stop
     IO1CLR  = 0x00200000;
  }
```

Syntax for C-Program (Contd..)

Syntax for C-Program (Contd..)

Main-Program

Syntax for C-Program (Contd..)

Main-Program

```
int main (void)
{
   Init_motion_pin ();
   while(1)
    {
      forward();
      delay_ms();
      stop();
      delay_ms();
    }
}
```

Syntax for C-Program (Contd..)

Main-Program

```
int main (void)
{
   Init_motion_pin ();
   while(1)
    {
      forward();
      delay_ms();
      stop();
      delay_ms();
    }
}
```

Functions

Syntax for C-Program (Contd..)

Main-Program

```
int main (void)
{
   Init_motion_pin ();
   while(1)
    {
      forward();
      delay_ms();
      stop();
      delay_ms();
    }
}
```

Functions

```
void forward (void)
{
     IO0SET= (1<<10);
     IO1SET=(1<<21);
     IO0CLR=(1<<22)|(1<<11);
}
```

Syntax for C-Program (Contd..)

Main-Program

```
int main (void)
{
   Init_motion_pin ();
   while(1)
    {
      forward();
      delay_ms();
      stop();
      delay_ms();
    }
}
```

Functions

```
void forward (void)
{
     IO0SET= (1<<10);
     IO1SET=(1<<21);
     IO0CLR=(1<<22)|(1<<11);
}
```

```
void stop (void)
{
     IO0CLR=(1<<10)|(1<<11)|(1<<22);
     IO1CLR=(1<<21);
}
```

Syntax for C-Program (Contd..)

Syntax for C-Program (Contd..)

Define All related motion functions and include in main function

Syntax for C-Program (Contd..)

Define All related motion functions and include in main function

1. Backward();

Syntax for C-Program (Contd..)

Define All related motion functions and include in main function

1. Backward();
2. Right();

Syntax for C-Program (Contd..)

Define All related motion functions and include in main function

1. Backward();
2. Right();
3. Left();

Syntax for C-Program (Contd..)

Define All related motion functions and include in main function

1. Backward();
2. Right();
3. Left();
4. Soft Right();

Syntax for C-Program (Contd..)

Define All related motion functions and include in main function

1. Backward();
2. Right();
3. Left();
4. Soft Right();
5. Soft Left();

Thank You!

Post your queries on: http://qa.e-yantra.org/