Experiment 2

Group No. : Date :

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AIM: To control DC Motor Position via Arduino Mega.

Block Diagram:

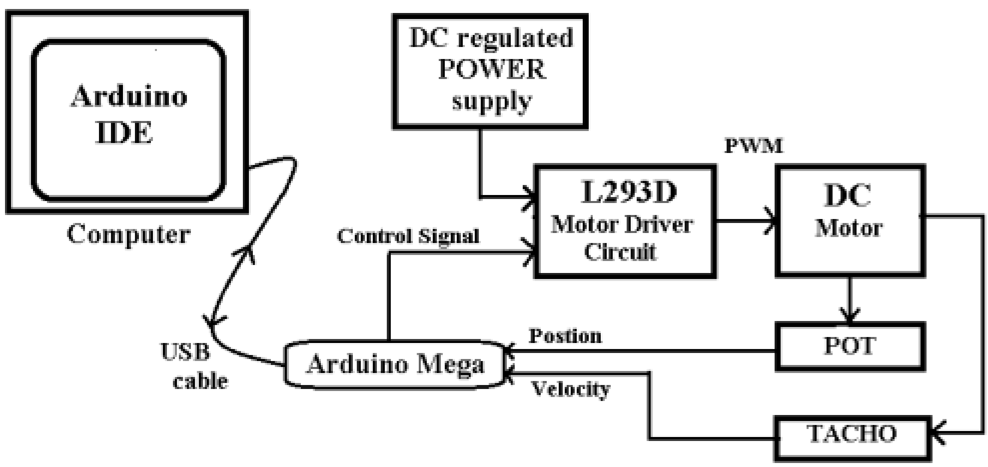
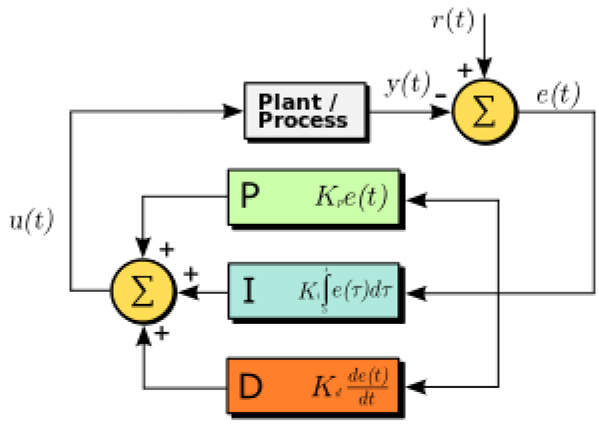


Figure 1

These are the following considerations for this experiment :-

1. PID Algorithm
2. PWM Implementation
3. Dead Band Implementation
4. Achievement of Specifications (tr = 0.4s to 0.5s, ts < 1s, OS <10%)

1. PID Algorithm:- A PID controller is a control loop feedback mechanism commonly used in the control systems. It continuously calculates an error value as the difference between a measured process variable and a desired setpoint.



Effect of each term
Proportional (**P**) - It acts on the present values of the error
Integrator (**I**) - It acts on the average of past errors since it sums up all the previous error.
Derivative (**D**) - It acts as a predictor for the future error based on the present error value i.e. if present rate of change of signal is high it is likely there may be error in future because of this deviation.

Here are the few snapshot from the code we implemented :-

```
feedback = analogRead(motorout);
error = setpoint - feedback * 5.0 / 1024;
perr = kp * error;
derr = kd * (error - lasterr);
ierr += ki * error;
lasterr=error;
out = perr + derr + ierr;
```

2. PWM Implementation: The output u(t) from the PID Algorithm is encoded into the PWM. Here we generated two signals (s1 and s2) to represent the differential output.

If u(t) >0 then ON time of s1 =T*u(t)/alpha and s2 =0;

and

if u(t) <0 then ON time of s2 =-T*u(t)/alpha and s1 =0;

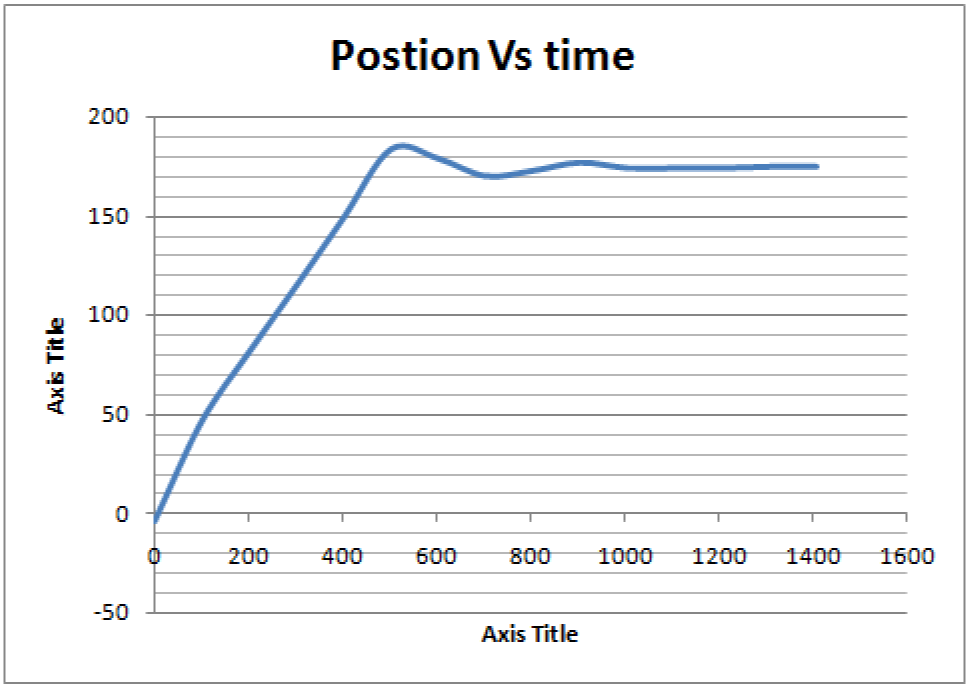
where T is the time period of the pulse,

alpha is taken through rough estimate of max(u(t)).

These differential output is given to the motor driver circuit to rotate the motor in either direction.

3. Dead band: The dead band represents the range over which the primary controller will allow the process variable (PV) to deviate without exerting any correction. It implies that the system will oscillate over small value. We have **shown this part to TA.**

4. Achievement of Specifications (tr = 0.4s to 0.5s, ts < 1s, OS <10%)



Time in ms	Position in angle
0	-4.52
100	45.8
202	81.16
302	114.48
402	148.48
503	183.16
604	178.4
705	169.56
805	172.28
905	176.36

1007	173.64
1107	173.64
1207	173.64
1308	174.32
1409	174.32

tr(rise time) = 0.5s

ts(settling time)= 0.9s

os= 6.67%