

PID Controller with DC Motor



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Contributions

Aditya	Report + Slides + Theory
Lokesh	Hardware + Microprocessor
Nitin	Camera + Data Validation
Saurav	Dashboard

Motivation

- PID Controllers used in robotics and industries.
- Demonstrate the principles of feedback control laws and illustrates the PID mechanism.
- Remote control, access, and observation using IoT devices

PID Controller

- Control loop mechanism that can be used to read sensor output and recalibrate voltage input to reach the desired output on an actuator.
- Setpoint: desired output
- Program variable: current output
- $\text{Error} = \text{SP} - \text{PV}$

Methodology

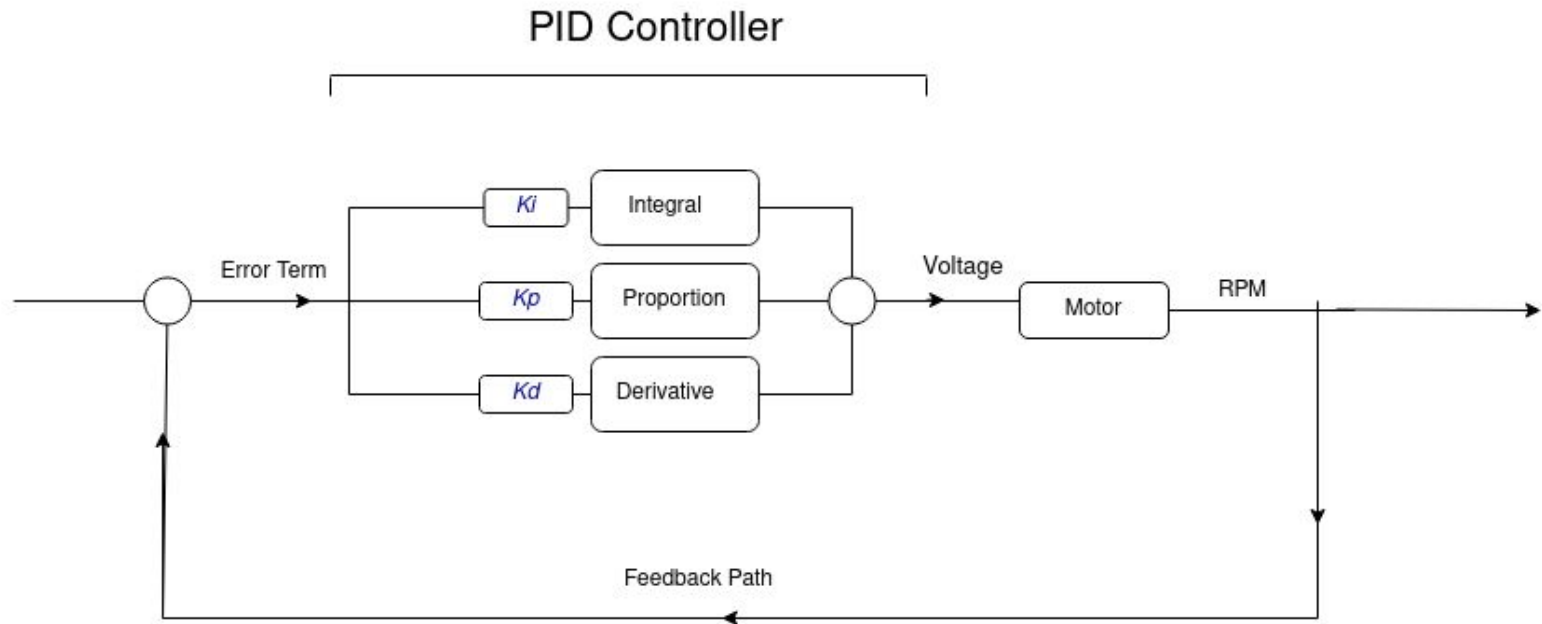
- Proportional Tuning
- Integral Tuning: Past error
- Derivative Tuning: Future trend of error

$$u(t) = K_p e(t) + K_i \int_0^t e(t) dt + K_d \frac{de(t)}{dt}$$

Hardware Components

- ESP-32 CAM (with FTDI programmer)
- ESP32
- 12V Battery / power source
- PCB
- DC Motor with angle sensor
- Motor driver
- Acrylic sheets
- Wires

PID Controller



Overall Workflow

- User registers, logs in.
- User enters angle, K_p , K_i , K_d . Pushed to ThingSpeak.
- ESP32 uses PID controller and pushes data to ThingSpeak.
- Graphs & video feed pulled from ThingSpeak in the dashboard.

Home Page - Logged Out

↔ ESW Project - PID Controller

Control motor from here remotely

The following site displays a dashboard upon login, along with slot booking and user controlled input

REGISTER

LOG IN

Register

↔ ESW Project - PID Controller

← BACK TO HOME

Register below

Already have an account? [Log in](#)

Name

Email

Password

Confirm Password

SIGN UP

Login

↔ ESW Project - PID Controller

← BACK TO HOME

Login below

Don't have an account? [Register](#)

Email

Password

LOGIN

Home Page - Logged In

↔ ESW Project - PID Controller

Hey there, Saurav

DASHBOARD

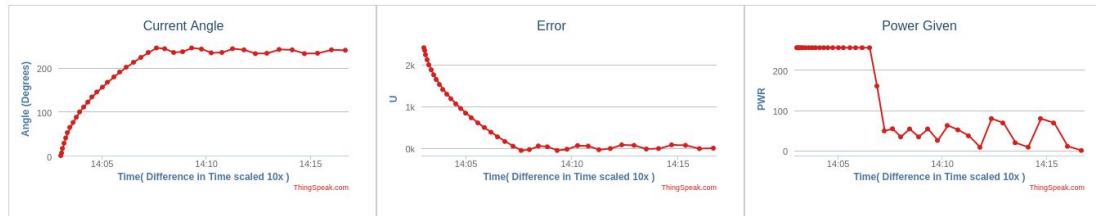
CAMERA

LOGOUT

Data Visualisation

↔ ESW Project - PID Controller

Angle (°):	K_p (default : 10):	K_i (default : 5):	K_d (default : 0.025):	SUBMIT
	10	5	0.025	



Data Visualisation

User enters:

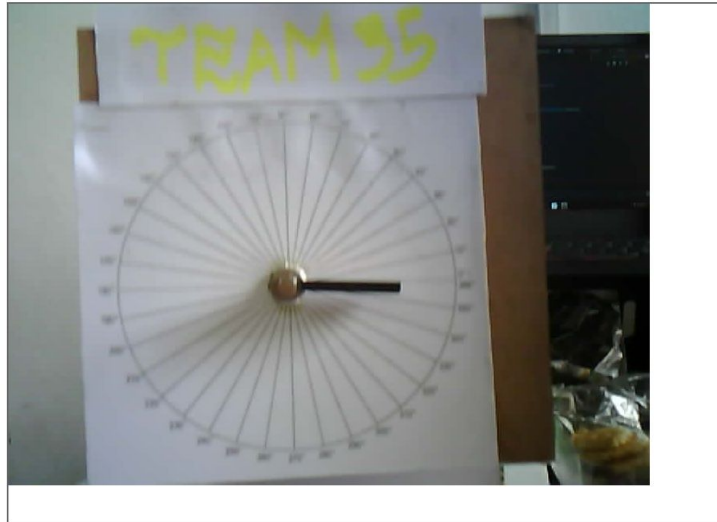
- Setpoint
- K_p
- K_i
- K_d

User sees:

- Program variable
- Error
- Output power

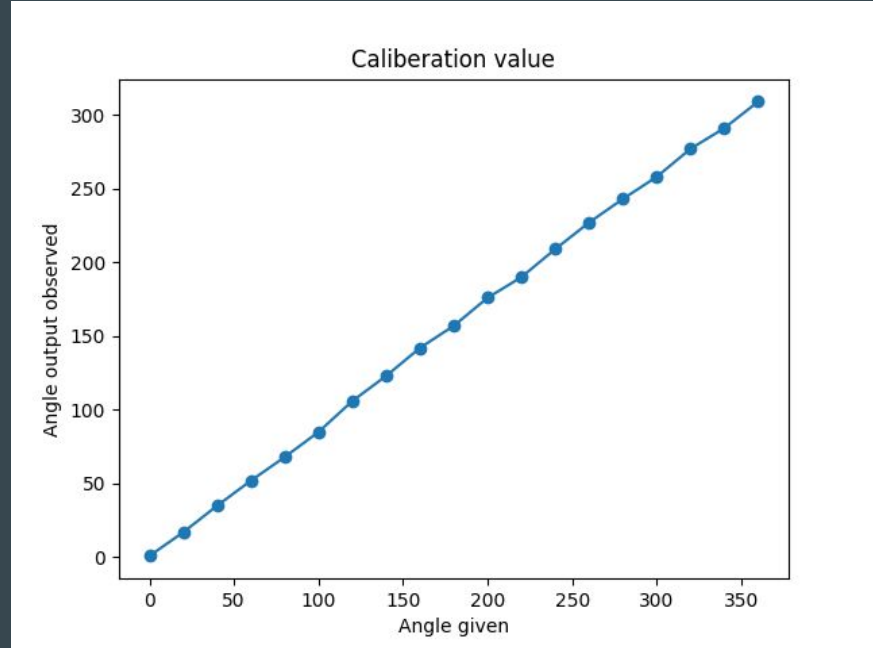
Live Video Feed

» ESW Project - PID Controller



Data Calibration

- Multiply the encoder value by $360^\circ / 420$.
- Run the motor through various inputs.
- Error: $\pm 5^\circ$



References

- https://en.wikipedia.org/wiki/PID_controller
- <https://www.ni.com/en-in/innovations/white-papers/06/pid-theory-explained.html>
- <https://www.electrical4u.com/pid-control/>
- <https://ctms.engin.umich.edu/CTMS/index.php?example=Introduction§ion=ControlPID>

Thank You