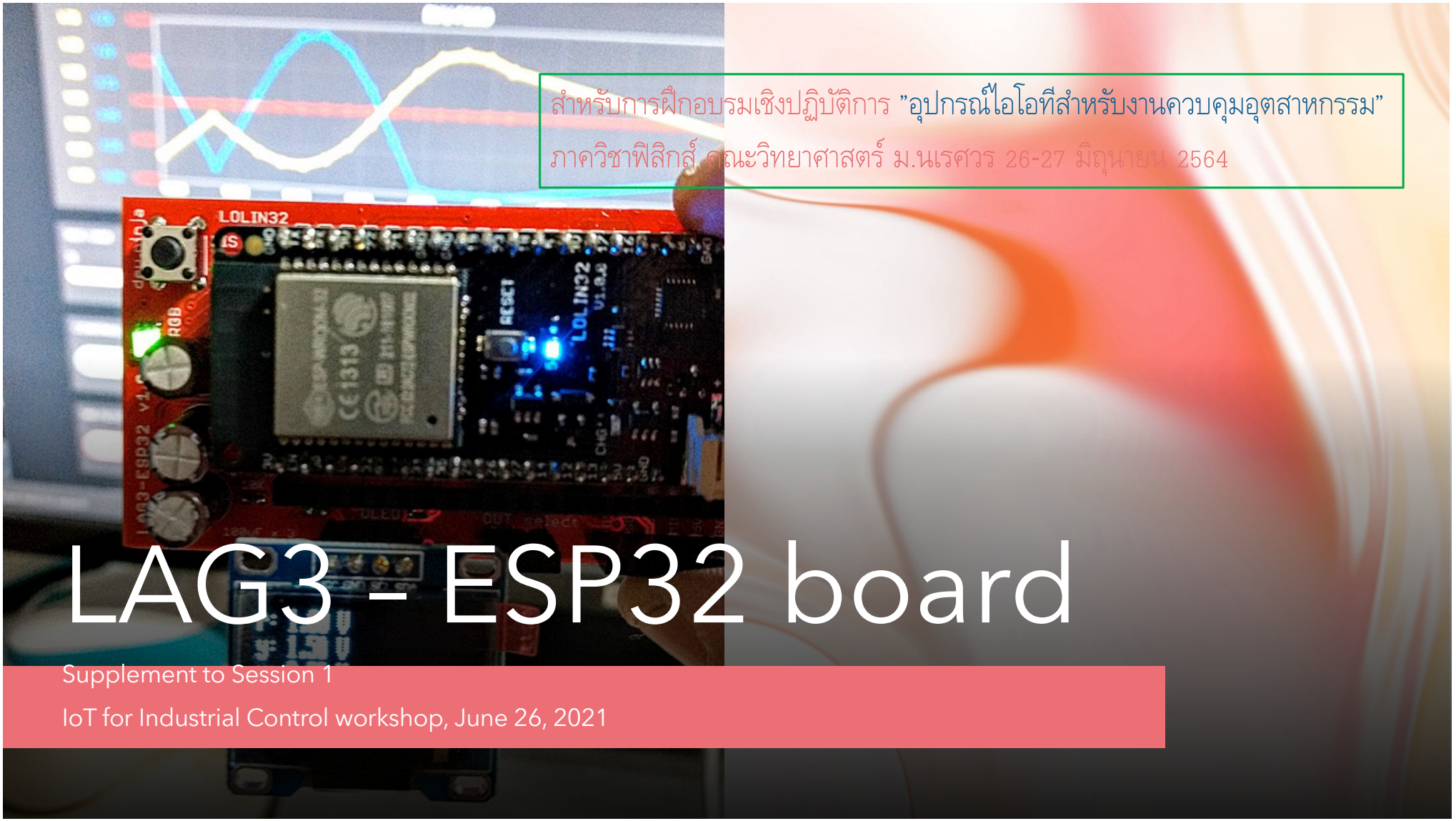


สำหรับการฝึกอบรมเชิงปฏิบัติการ "อุปกรณ์ไอโอทีสำหรับงานควบคุมอุตสาหกรรม"
ภาควิชาฟิสิกส์ คณะวิทยาศาสตร์ ม.นเรศวร 26-27 มิถุนายน 2564

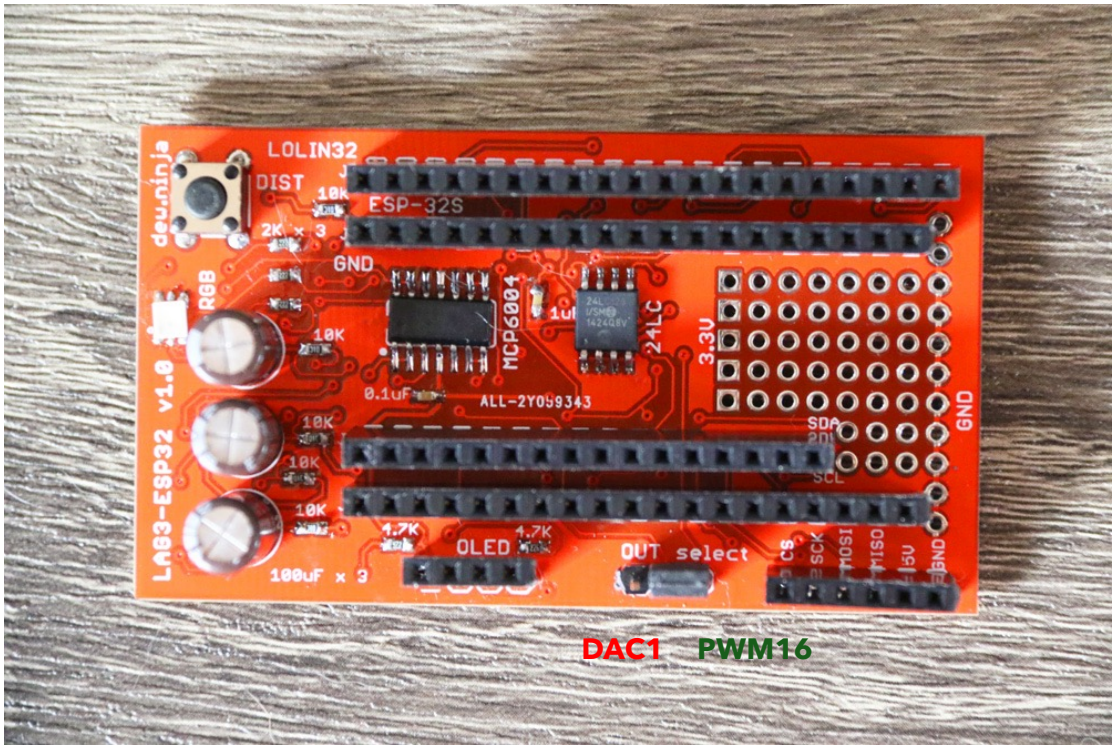
LAG3 – ESP32 board

Supplement to Session 1

IoT for Industrial Control workshop, June 26, 2021

LAG3 – ESP32 board

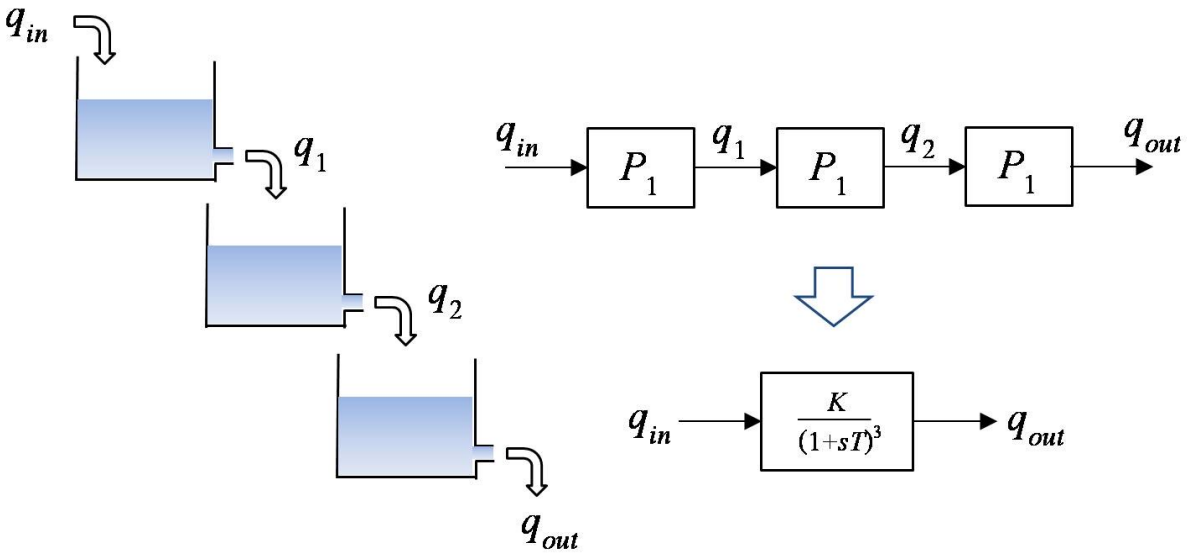
- 3-level cascade tank using RC circuit and op-amp
- Connector for OLED display
- RGB LED and EEPROM (optional)
- Can be used with WEMOS LOLIN32 or NODEMCU-32S (commercial ESP32 modules)
- DAC1/PWM16 outputs (selectable via jumper)



ESP32 pins used

GPIO	Name	Type	Function
39	ADC3	Analog IN	Plant output (Y)
32	ADC4	Analog IN	State variable (X2)
33	ADC5	Analog IN	State variable (X1)
25	DAC1	Analog OUT	Controller output (Analog)
16	PWM	OUT	Controller output (PWM)
22	SCL	OUT	I2C
21	SDA	OUT	I2C
19	PWMR	OUT	PWM for red LED
18	PWMG	OUT	PWM for green LED
17	PWMB	OUT	PWM for blue LED
5	LED	Digital OUT	On-board LED

Model of 3 cascaded tank



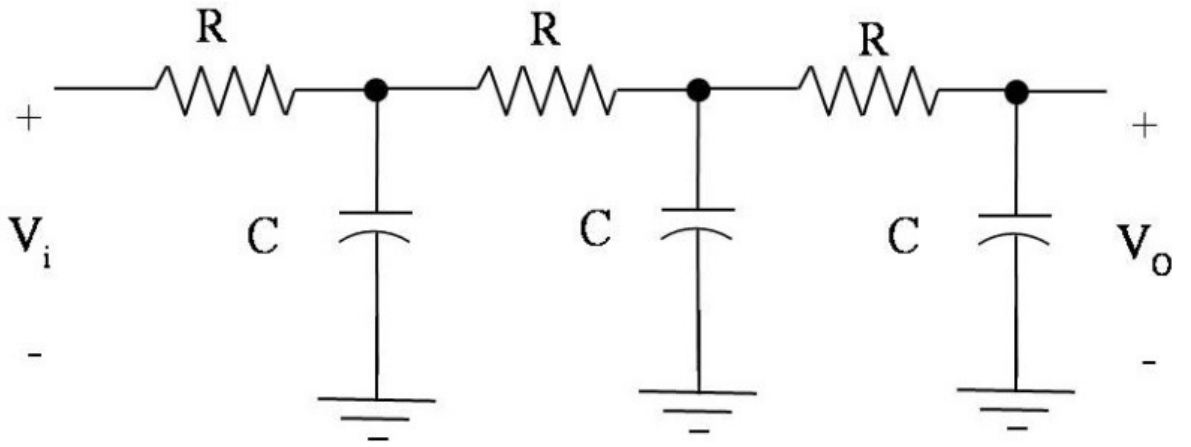
normalized transfer function

$$\frac{1}{(s+1)^3}$$

called "third-order lag"

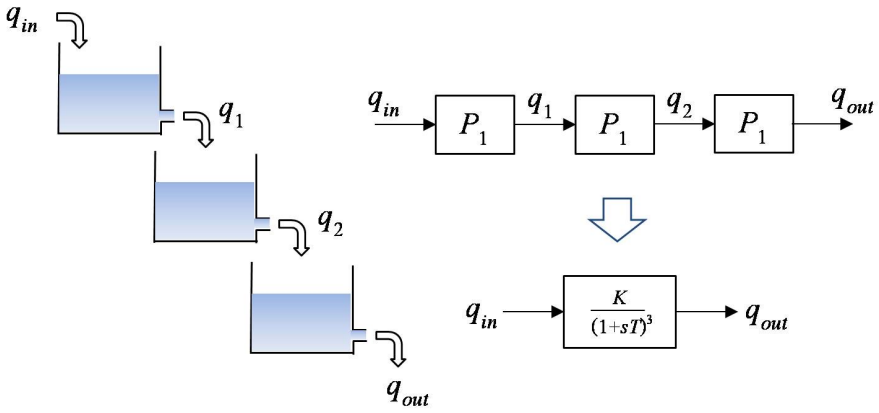
Want to simulate using electric circuit

First attempt



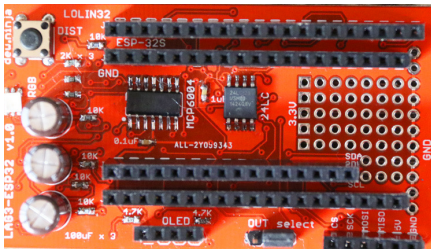
$$P(s) = \frac{1}{(RC)^3 s^3 + 5(RC)^2 s^2 + 6RCs + 1}$$

Model of 3 cascaded tank

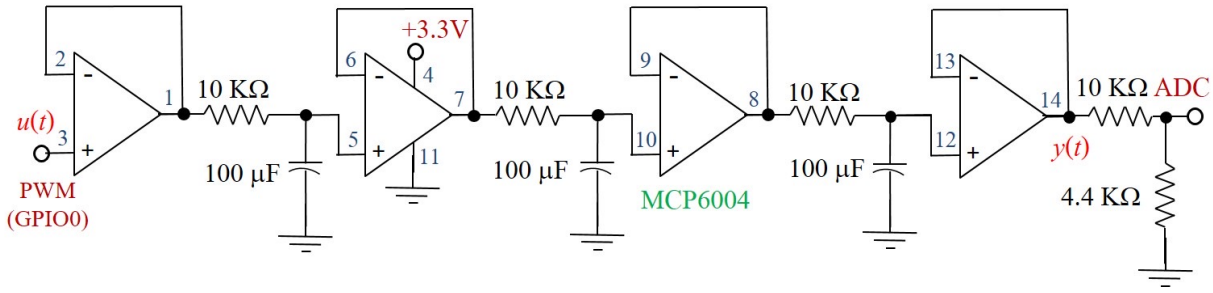


normalized
transfer function

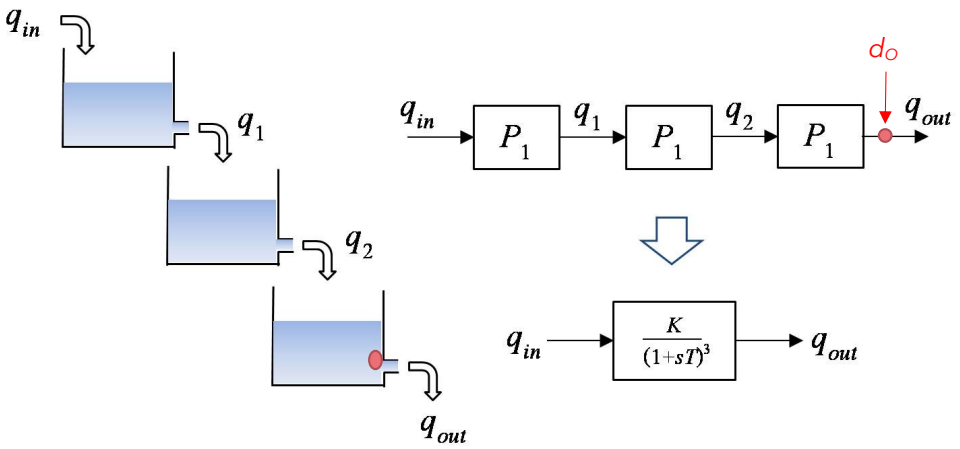
$$\frac{1}{(s+1)^3}$$

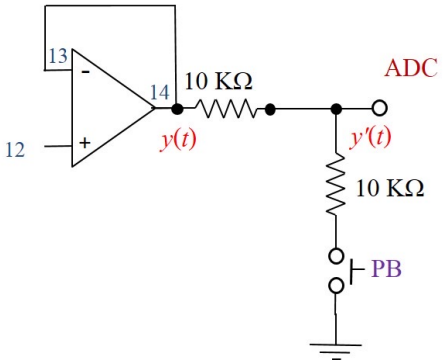


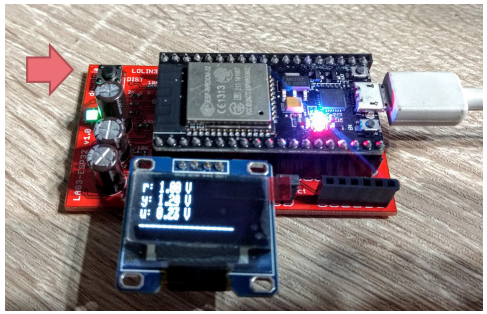
Simulated by RC and op-amp circuit



Output disturbance switch







When disturbance switch is pressed