

Microcontroller Application on Sewage Treatment Plant

Wu Pan^a, Zhong Qing Feng^b, Wang Chang Qing^c

a)3rd engineer in Motor Vessel, China

b)3rd engineer in Motor Vessel, China

c)3rd engineer in Steam Vessel, China

ACSU41B: Malaysia Maritime Academy

Melaka, Malaysia

*Corresponding: alam012376@alam.edu.my, alam011551@alam.edu.my, alam000856@alam.edu.my

ABSTRACT

Prevention of pollution by Sewage from ship is under Marpol Annex IV, here we will not talk about the regulation and the principle of sewage treatment plant onboard ship. This project is a simple design which used the microcontrollers unit (MCU) as a control circuit instead of Electrical wiring control circuit. This design was programmed using C++ programmer software into the microcontroller unit, and simulated using the Protenus software. This micro control system similar with tank level control by monitor the level of chlorination tank, PIC also used in this system, it is included in the program. Easy installed and monitoring, less wiring will be the advantages compare to electrical control circuit. This system can be monitored using simulator software through Data presentation such as display. The maintenance on electrical control circuit also reduced due to micro control circuit.

KEY WORDS: Microcontroller, tank level control, PIC, MCU, control circuit, Data presentation.

NOMENCLATURE

CPU	Central Processing Unit
HH	High High Level
H	High Level
N	Normal Level
PIC	Peripheral Interface Control
MCU	Micro Control Unit
LED	Light Emitting Diode

1.0 INTRODUCTION

The micro control system has five basic components. These are the processor unit, memory, the power supply unit, input/output interface section and the programming device.

1. The processor unit or central processing unit (CPU) is the unit containing the microprocessor and this interprets the input signals and carries out the control actions, according to the program stored in its memory, communicating the decisions as action

signals to the output.

2. The power supply unit is needed to convert the mains a.c. voltage to the low d.c. voltage (5V) necessary for the processor and the circuits in the input and output interface modules.
3. The programming device is used to enter the required program into the memory of the processor.
4. The memory unit is where the program is stored that is to be used for the control actions to be excised by the microprocessor.
5. The input and output sections are where the processor receives information from external devices and communicates information to external devices. [1]

2.0 METHODOLOGY

The Microcontroller will continuously monitor the chlorination tank level; There are three sensors attached to the chlorination tank which are HH, H, N. When the HH sensor triggered will give a warning alarm through a buzzer and LED; when H sensor triggered motor will start and pump the liquid out of the tank; when N sensor triggered motor will stopped. The motor controlled by the MCU through a relay. The mechanism applications in this system were reduced, the low price MCU also can offer great performances.

2.1 Component

The components of the system consist of:

- 1) PIC16F84A [2], this Microcontroller only have 16-pins, it considers as the brain of the system.
- 2) Three sensors installed to the chlorination tank to control motor start, stop and warning alarm.
- 3) Buzzer give sound alarms.
- 4) LED give visual response.
- 5) Motor will be activated when sensor triggered.
- 6) Relay control the motor and buzzer.

Figure 1 shows the schematic diagram of system design.

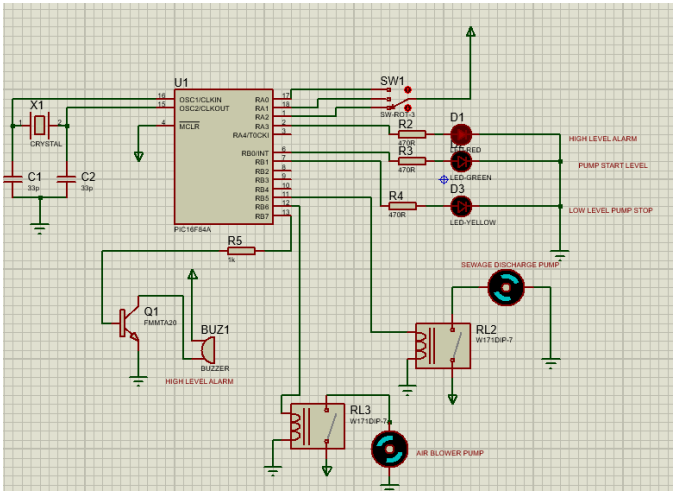


Figure1: Schematic diagram

2.2 Operations

The operations of the system described below:

- ✓ SW1 act as three sensors, when top sensor active it means that the chlorination tank at Normal level, LED yellow will light up, the sewage discharge pump auto stopped.
- ✓ When the middle sensor active that means the chlorination tank at High level, LED green will light up, the sewage discharge pump auto started and pump the liquid out of the tank.
- ✓ when bottom sensor active it means that the chlorination tank level at HH level, both LED red and LED green will light up, the Buzzer will give a sound alarm and the sewage discharge pump continuous running.
- ✓ The air blower will not influence by the sensor, it will always keep running and continuous supply air to the system.

Table 1 shows the logic of this operation:

SW position	LED Red	LED Green	LED Yellow	Disc Pump	Air Blower	Buzzer
1 (Top)	0	0	1	0	1	0
2 (Mid)	0	1	0	1	1	0
3 (Bot)	0	1	0	1	1	1

Table 1

2.3 Circuit

The control system circuit consist of five main circuits:

1. Power source circuit for micro controller.

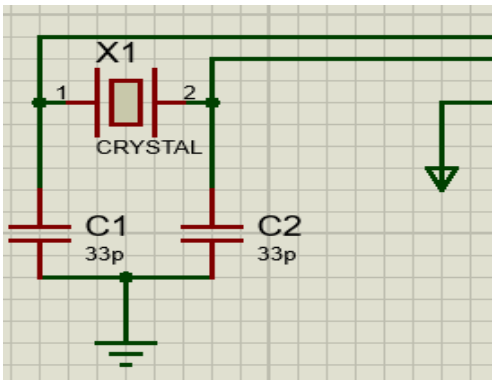


Figure 2: Power source circuit

Power supply to the MCU is 24V, compare to 220V control circuit it is lowest and also can offer great performance. The function of the crystal is provide more stable and accuracy single phase oscillator frequency.

2. Input and Output circuit.

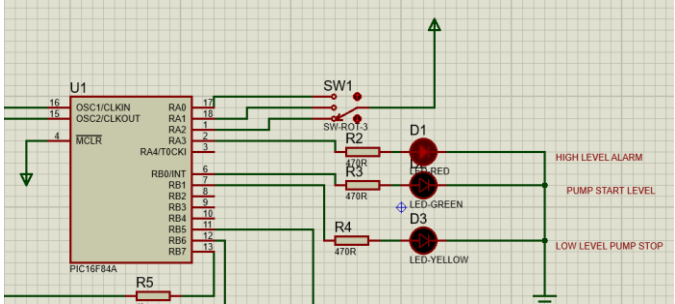


Figure 3: Input & Output circuit

The three input sensors are connected to Port A and all the output of the system are connected to Port B, including LEDs.

3. Discharge Pump Circuit.

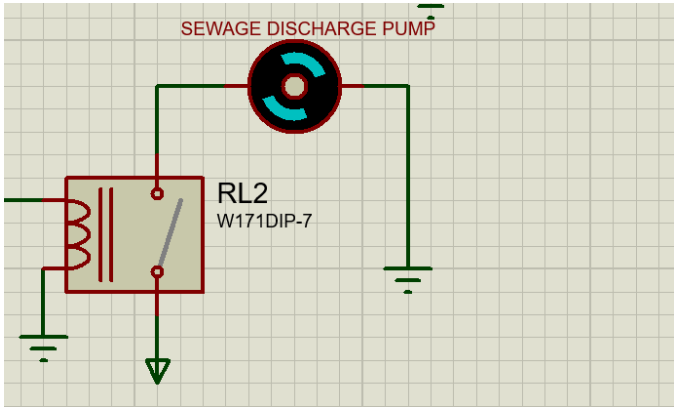


Figure 4: Discharge Pump circuit

When tank level reach Mid sensor the pump will automatically start to reduce the tank level, and when tank level reach Bottom sensor the pump will automatically stop, this action achieved by the relay. The relay act as a contactor switch, when received signal from MCU, the relay will close and 440V current flow to the motor.

4. Air Blower circuit

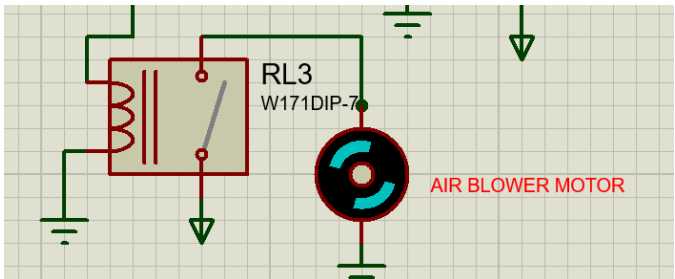


Figure 5: Air Blower circuit

The air blower circuit similar with pump circuit, also used relay as the control element. The motor will not influence by the tank level.

5. Buzzer circuit

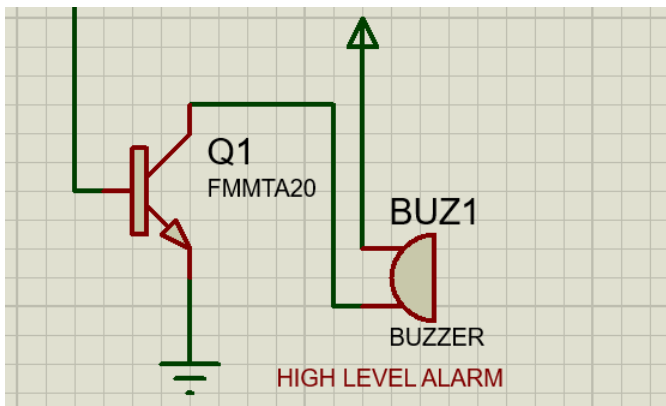


Figure 6: Buzzer circuit

When tank level reach HH level, the buzzer will be sounded and LED red will light up. The NPN transistor in used, when get the signal from MCU the circuit completed, the buzzer will be sounded.

3.0 CONCLUSIONS

Thus, this proposed system will reduce the mechanism applications, maintenance on electrical circuit onboard, easy install and low cost will be the advantages.

This system could further be improved and used in future, allowing the crew easy observe the level of the liquid.

The program of the system can be edited and changed.

References

- [1] W.Bolton, Instrumentation and Control Systems, vol. 7, Bucking Chilterns University College, High Wycombe,UK: Newnes, Dec.2005, p. 161.
- [2] P. Datasheet, "Microcontroller Chip Technology," 05 March 2020. [Online]. Available: <http://www.microship.com/wwwproducts/en/PIC16F84A>. [Accessed 05 March 2020].