INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Microprocessor Based Water Level Controller

Dr. D. K. Kaushik
Dean, Faculty of Science, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India

Abstract:
It is a wonderful project presented in this paper. It avoids the unnecessary overflow of the overhead tank when the motor is running to fill the water to the tank from the underground water. The overhead tank is generally used to supply the water to different parts of the building. This controller is designed using the Microprocessor 8085A and some electronic circuitry. The level of water will be displayed on the seven segment LED display units and accordingly the motor starts running automatically if the level is below desired level and stops the motor if the overhead is filled full.

1. Introduction

The author in the present paper designed and developed a water level controller using the most popular and widely used Microprocessor 8085A. The controller automatically switched ON the electric motor to pump out the water from the underground water to lift to overhead tank placed on the top of the building for the distribution of water to the other parts of the building; when level of the water on the Overhead tank is empty or the level goes below to a certain level. Further, when the tank gets filled up to a certain level / top level, the motor is switched OFF. The level of the water inside the upper water tank is displayed on the seven segment units connected separately with the microprocessor through Programmable Peripheral Interface (PPI) IC 8255A and an electronic circuit. The software for the controller was prepared in the assembly language of the Microprocessor 8085 which was checked on the M/S SCIEN TECH kit (M85-01) and found to work satisfactorily. The simple logic of assembly language programming is very easy to understand rather it is self explanatory. The assembly language program gives the level of water on the overhead tank as the input to the Microprocessor to switch ON the motor to pump out the water from the underground water or OFF the motor if water is filled in the overhead tank to the desired level. The input of the level is taken through the input port A of 8255A IC while the port C of 8255A gives the signal to the motor. Such project may be useful to the students of B. Tech./M. Tech. of the Electrical or Electronics Engineering.

2. Set-Up

For the controller 8 thick metallic probes connected to +5 V d.c. supply through resistance are immersed in the upper tank. The difference in heights between the probes is equal to 10 cm(say) or desired. Besides the probes, another metallic strip is also immersed in the tank, which is grounded. The total height of the overhead tank is divided in to 8 equal regions and all these metallic strips are kept in the overhead tank with the help of a non-conducting cover as shown in figure 1. The eight probes are also connected to the inputs of 8 inverters (two Hex inverters). The outputs of the inverters are connected to 8 bits of port A of 8255-I, used as input port. When the water level is below the probe, the output of the corresponding inverter will provide a logic 0 to its bit of port A. However, if the water level touches the probe or above the probe and less than the next probe, then it provides logic 1 to the corresponding bit of port A. The status of water level in the upper tank can directly be read by the microprocessor through the input statement. For example, if only one probe is immersed in the water, then port A of 8255-I will read it 01H, similarly for the others. Table 1shows the data to be read out by 8255-I, when different probes are immersed in the water. When the water level of the tank is below 10 cm, the pump is automatically switched ON; however, when its level reaches to 80 cm, the pump will be switched off.

Sr.No.	Probes immersed in water	Data to be read out by the microprocessor		Level in Cms.
		in Binary	in Hexadecimal	
1.	1	0000 0001	01 H	10
2.	1 and 2	0000 0011	03 H	20
3.	1 to 3	0000 0111	07 H	30
4.	1 to 4	0000 1111	0F H	40
5.	1 to 5	0001 1111	1F H	50
6.	1 to 6	0011 1111	3F H	60
7.	1 to 7	0111 1111	7F H	70
8.	1 to 8	1111 1111	FF H	80

Table 1

The connections to the two segment display units connected to the port B of 8255-I for displaying the level of water in the upper tank in centimeters are shown in figure 2. If the water level is between 1 and 2 probe, then the display unit will display 10, similarly for the other levels (ref. table 1). The outputs from 8 probes are connected to two Hex inverters, whose outputs gives signal to Port A (8 bits) which is used as input port of microprocessor. The port B of 8255A being used as the output port gives the BCD signals to two ICs 7447 (active low). These two ICs 7447 (BCD to seven segment decoder drivers) provides outputs for two Common anode FNDs as shown in figure 2.

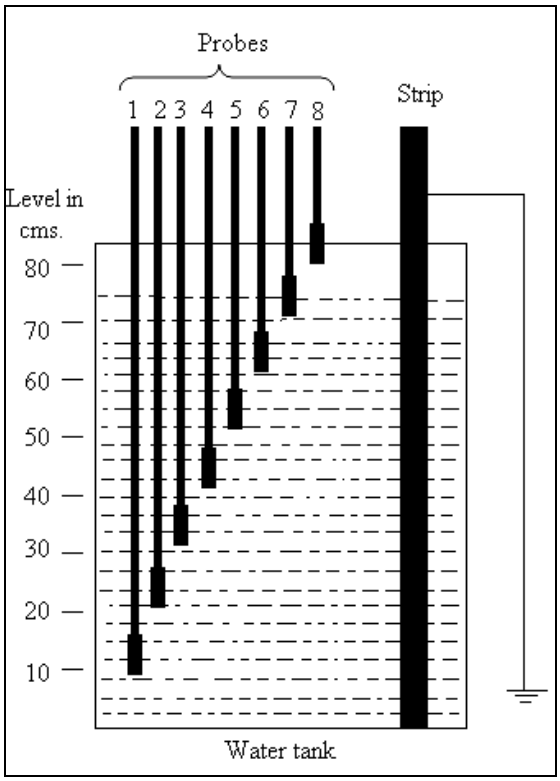

Figure 1

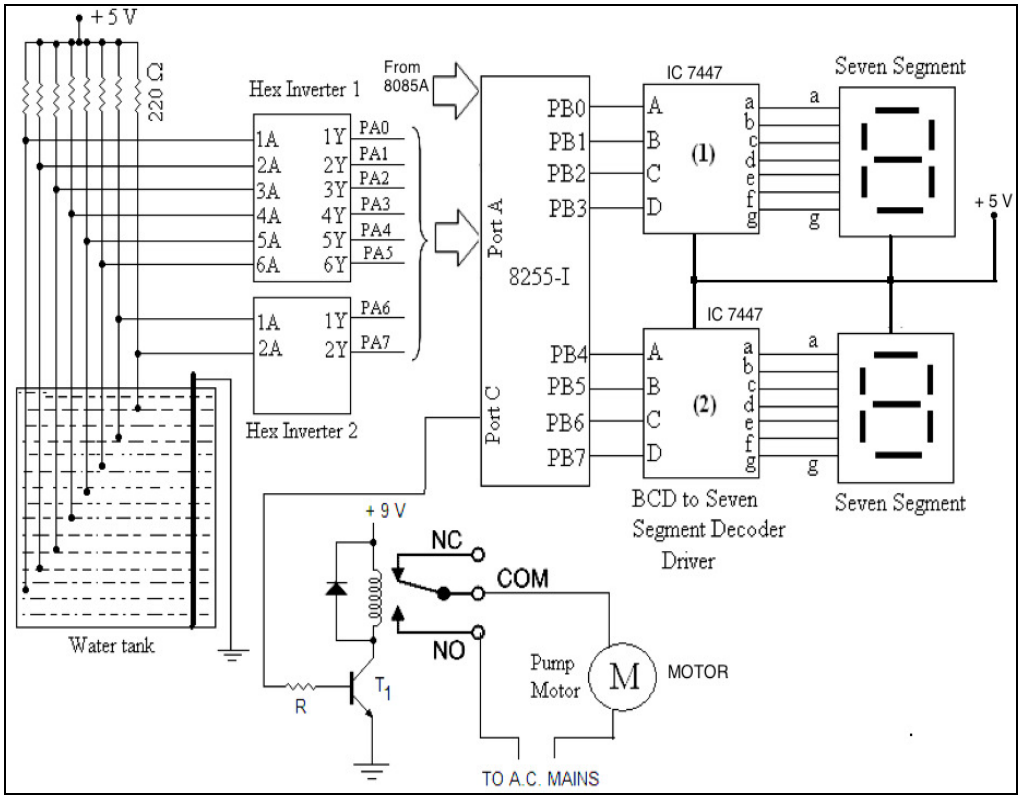

Figure 2

3. Assembly Language Program

The assembly language program for the design of water level controller with the above mentioned conditions is given below, which is self explanatory.

Label	Mnemonics	Operand	Comments
	LXI SP,	XXXX H	;Initialize the stack pointer.
	MVI A,	90H	;Control word for 8255-I.
	OUT	03H	;Works port A of 8255-I as input port and other ports B & C as output ports.
START	IN	00 H	; Read the water level through input port A.
	LXI H,	25FF H	; Intilise the H-L register pair (starting address of the look up table).
	MOV C,	M	; Data is moved to C-register which is used as counter.
AGAIN	INX	H	; Increment the H-L register pair.
	CMP	M	; Compare the two levels.
	JZ	PT1	; If two levels are equal, then jump to PT1.
	DCR	C	; Decrement the counts.
	JNZ	AGAIN	; If counts are not zero then jump to AGAIN.
PT1	INR	H	; Increment the content of H-register.
	MOV A,	M	; Get the water level in Accumulator.
	OUT	01 H	; Move it to Port B of 8255-I for the display.
	CPI	10 H	; Compare this data with 10 cm.
	JNC	NXT	; If the water is more than 10 cm, then move it to NXT.
	PUSH	PSW	; Else save the Acc contents in the stack.
	MVI A,	01 H	; 01 H is loaded to the accumulator.
	OUT	02 H	; PC0 is high (Switch on the motor for lifting the water).
	POP	PSW	; Get back the accumulator contents from the stack.
NXT	CPI	80 H	; Compared the data with 80 cm.
	JC	START	; If the data is less than 60, then jump to START.
	MVI A,	00 H	; 00 H is loaded to the accumulator.
	OUT	02 H	; PC0 is low (Switch off the motor).
	LXI D	FA00 H	
AGAIN	DCX	D	
	MOV A,	D	; Half Sec time delay program
	ORA	E	
	JNZ	AGAIN	
	JMP	START	; Jump to start.

LOOK UP TABLE

25FF H	09 H (Counts)		**Water level in Cms.**	
2600 H	00 H	2700 H	00 H	(00 Cm.)
2601 H	01 H	2701 H	10 H	(10 Cm.)
2602 H	03 H	2702 H	20 H	(20 Cm.)
2603 H	07 H	2703 H	30 H	(30 Cm.)
2604 H	0F H	2704 H	40 H	(40 Cm.)
2605 H	1F H	2705 H	50 H	(50 Cm.)
2606 H	3F H	2706 H	60 H	(60 Cm.)
2607 H	7F H	2707 H	70 H	(70 Cm.)
2608 H	FF H	2708 H	80 H	(80 Cm.)

4. Working

This program written in assembly language is self-explanatory. The assembly language program written above may be stored in some memory locations and the look up table data too is stored in the specified locations. Hardware discussed above after preparation may be connected to the Microprocessor kit as shown in figure 2. When the program is executed, the display units will display the water level in the overhead tank and according the motor starts running if the water level is below the 10 cm (Say) and the motor is switched OFF if the overhead tank is filled up to the desired level. It was found to work very accurate.

5. Acknowledgement

Thanks are due to the authorities of SVS University, Meerut for providing the necessary facilities for the research.

6. References

i. R. S. Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th ed., Prentice Hall, 2002.
ii. B. Ram, "Fundamentals of Microprocessor and Microcomputers" DhanpatRai Publications, New Delhi.
iii. D. K. Kaushik, "An Introduction to Microprocessor 8085", DhanpatRai publishing Co., New Delhi.