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Water Level Indicator with Alarms Using PIC Microcontroller

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ABSTRACT : *This paper shows a design of a water level indicator with PIC microcontroller. This design is applicable for both reservoir and main tank in home or industries.PIC 18F452 used in this design. There is also buzzer and LCD in this design. LCD used to show the level of water in both reservoir and main tank. Buzzer used to create a siren to stop the pump or water coming channel. There are 10 DIP switches used in this design. These switches indicate water level of both tanks. PIC microcontrollers also controls the motor which pumps the water in the tank from the reservoir. In the auto mode, motor is automatically turned on when water level reaches 20% in the tank and it is turned off when water level reaches 100%. Choose PIC microcontroller for programming flexibility, faster speed of execution since microcontrollers are fully integrated inside the processor*

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Keywords - *Pic Microcontroller, Sensor, Crystal, LS2 Buzzer, Protues.*

I. INTRODUCTION

Now a day's water crisis is no one global risk. One drop of water waste can be vary for us. 750 million people around the world lack access to safe water [1]. Today in world when people try to solve these problem one unseen problem stand up now. Water wasted by full tank is now a comparatively risk problem.

This design is to solve that problem. This design not only indicates the amount of water present in the overhead tank but also gives an indication when the tank is full. This design uses widely PIC microcontroller 18F452, bilateral switches to indicate the water level through LCD display. When the water is empty the wires in the tank are open circuited and resistor pulls the switch low hence and open the switch. As the water fill in the first reservoir tank its fill-up percentage shown in the LCD display. Today in the world most of the developing countries using this in their home and also industries. All probes used to implement should be made by aluminum.

Need of a water level indicator are shown below:

- Overflow problems.
- To prevent wastage of energy.
- To prevent wastage of water.
- Attention.
- Observation.
- Automatic switch off.

II. PIC MICROCONTROLLER 18F452

PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology. PIC stands for Peripheral Interface Controller. There are lots of Microcontroller chips 18F452 is one of them. This chip is suitable for large operation.

The PIC 18F452 is a 28/40 pin high performance flash based microcontrollers with 32 Kbytes of program memory and 1.5Kbytes of RAM. Also 256 bytes of EEPROM data memory is provided to store data. The 18F452 microcontroller operates from DC to 40 MHz clock/oscillator input with 16 bit instructions and two priority levels for interrupts [2]. One of the main additional feature of this microcontroller is its 8 * 8 single cycle hardware multiplier. This will make multiplication easier and faster than the software routines used in previous controllers like 16 F series. The total number of interrupt sources in 18F452 microcontroller is 18, with an instruction set having 75 instructions unlike 35 instructions in 16 F series. The I/O ports in the microcontroller is divided into 5 ports like 16 F series :- PORTA(6 pins), PORTB(8 pins), PORTC(8 pins),PORTD(8 pins) and PORTE(3 pins).
Peripheral Features:

1. PSP (Parallel Slave Port) Module
2. USART module - Supports both RS-232 and RS-485 communication
3. MSSP (Master Synchronous Serial Port) Module – Supporting both I2C and SPI
4. Three external interrupt pins
5. Timer0 Module with 8/16 bits timer/counter with programmable pre-scalar.
6. Timer1 Module is a 16 bit timer/counter
7. Timer2 Module is a 8 bits timer/counter with 8 bit period register
8. Timer 3 Module is a 16 bit timer/counter
9. The values of sinking current and sourcing current is very high and is rated at 25mA
10. Two CCP (Capture Compare PWM) modules with 16 bits Capture Input and maximum of bits PWM resolution
11. Ten bit ADC (Analog to Digital Conversion) with high sampling rate
12. Supports in Circuit Debugging (ICD) via two pins – PGD and PGC

III. EQUIPMENT'S

Pic Microcontroller is main equipment but there are lot of equipment's to design this. Here is a list of equipment's with short description in below:
Input Voltage: 1 2volt power supply is required. Adopter polarity is shown in the picture.

Capacitors: Capacitor has ability to store charge and release them at a later time. Capacitance is the measure of the amount of charge that a capacitor can store for a given applied voltage. The unit of capacitance is the farad (F) or microfarad. The capacitors used in the circuit is an electrolytic capacitor. The value and voltage rating of the electrolytic capacitor can be directly read from the capacitor itself. The electrolytic capacitor should be used with proper polarity. In the circuit the electrolytic capacitor is used as a bypass capacitor. Any noise variation in the circuit is removed by the capacitor [3].

Water Sensors: Simple wires can be placed in the water tank. As the current required to pass through the wire is in nano amps. But if need then place carbon rods at the end of wires which can be extracted from the 1.5v AA cell. These carbon rods should be thoroughly washed.

Transistor: Any npn transistor will work here.
LM7805: This is the 5v regulator used to power up the whole circuit.
Seven Segments: These are used to display water level. Common cathode seven segments are used.
LCD: Common 16x2 LCD can be used in this circuit.
LED Bar: J7 is the 10 LEDs bar.
Crystal: 10 MHz crystal needs to be attached with the PIC18F452.
PIC18F452: This microcontroller is used to generate all the required logic for this circuit.
D2, D4 Diodes: Any diode 1N4007 or 1N4148 or any other general purpose diode will work here.
LS2 Buzzer: Any 5v buzzer will work here.

IV. WORKING PRINCIPLE

The operation of this project is very simple. In this project "water level indicator" there are 3 main conditions:

1. There is no water available in the source tank.
2. Intermediate level i.e. either of 3rd to 7th level.
3. There is ample amount of water available in the source tank.

Condition 1: Water not available

When the tank is empty there is no conductive path between any of the 8 indicating probes and the common probe (which is connected to 5v+ supply) so the sensor region will not have sufficient biasing voltage hence it remains in cut off region and the output across its collector will be Vc approximately 4.2v. As in this case the microcontroller is used in the active low region (which means it considers 0-2 volts for HIGH and 3-5 volts for LOW) now the output of transistor which is 4.2v approximately will be considered as LOW by the microcontroller and hence the default value given by microcontroller to the seven segment display is 0 which indicates as the tank is empty.

Condition 2: Intermediate levels

Now as the water starts filling in the tank a conductive path is established between the sensing probes and the common probe and the corresponding transistors get sufficient biasing at their base, they starts conducting and now the outputs will be Vce (i.e. 1.2v-1.8v) approximately which is given to microcontroller [4]. Here the microcontroller is programmed as a priority encoder which detects the highest priority input and displays corresponding water level in the seven segment display. In this project while the water level reaches the 7th level i.e. last but one level along with display in seven segment a discontinuous buzzer is activated which warns user that tank is going to be full soon.

Condition 3: Water full

When the tank becomes full, the top level probe gets the conductive path through water and the corresponding transistor gets into conduction whose output given to microcontroller with this input microcontroller not only displays the level in seven segment display but also activates the continuous buzzer by which user can understand that tank is full and can switch off the motor and save water [5].

V. SOFTWARE SIMULATION

The Software which have used for this project is "Proteus" version 7.8. Proteus is one of the user friendly software in simulation world. For both electrical and electronics based circuit simulation and implementation can be done very easily with this software. Before starting the implementation and the simulation of the project circuit it is necessary to make an algorithm. Because a fruitful algorithm can makes the path easier to implement a circuit both virtually and practically.

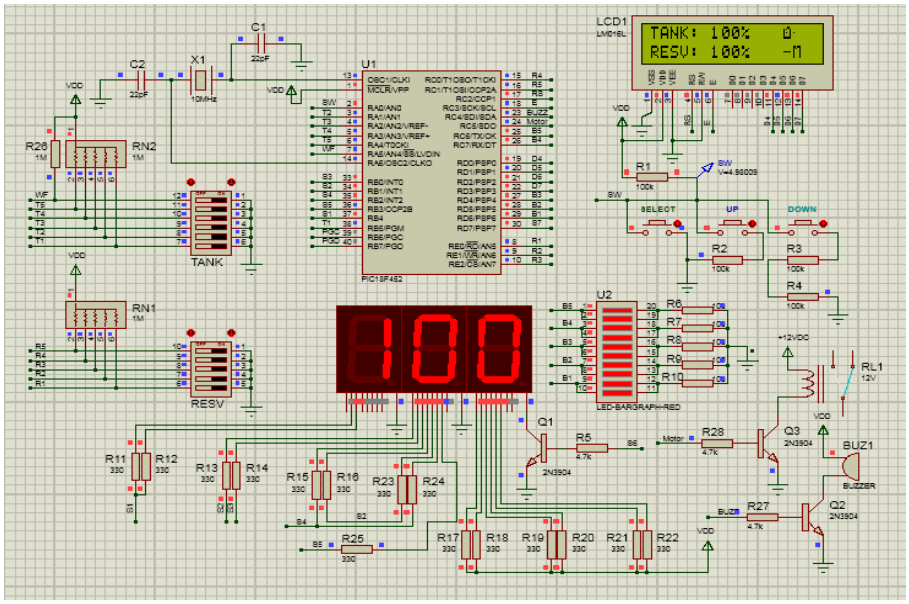

Figure 1: .Main window of software simulation when both tanks have 100 are full And buzzer speakers are on.

This is the main simulation of this design. It's clearly shown that all tanks are full all DIP switches are in the right side LED bar graphs are all red that means buzzer is on. Buzzer sign is active when tanks water reaches up to 80 percent. When siren hearing have to stop the down switch. Then LCD display options like start motor or enable motor again.
There are two sensor using both of them used for sensing the level of water in tank.

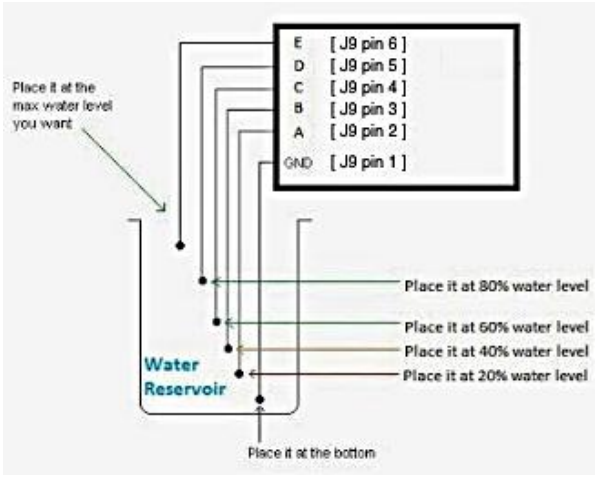

Fig. 2: Procedure of Water Reservoir.

In fig 2 it shows the working procedure of sensor in water reservoir. Six J9 pins used for to build a sensor in the water reservoir J9 pin 1 is used for grounding. This grounding pin place in bottom of the tank one thing is careful that it doesn't touch ground of the tank. Pin 2 to 5 used in different water levels of 20 to 80 percent. Then last Pin 6 place it at the maximum level we want.

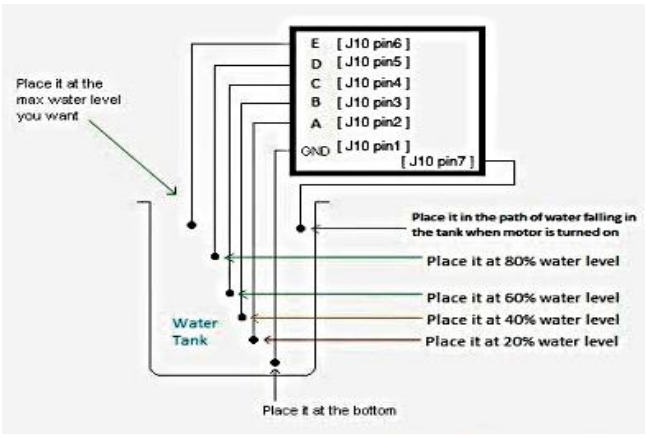

Fig. 3**:** Procedure of Water Reservoir

In fig 3 it shows the working procedure of sensor in water tank. Seven J10 pins used for to build a sensor in the water tank J10 pin 1 is used for grounding. This grounding pin place in bottom of the tank one thing is careful that it doesn't touch ground of the tank. Pin 2 to 5 used in different water levels of 20 to 80 percent. Then last Pin 6 place it at the maximum level we want. There is one extra pin 7 it place in the path of water falling in the tank when motor is turned on.

VI. Projects Applications

Water Level Indicator Project Applications:

- Automatic Water level Controller can be used in Hotels, Factories, Homes Apartments, Commercial Complexes, Drainage, etc., it can be fixed for single phase motor, Single Phase Submersibles, Three Phase motors. (For 3 phase and Single Phase Submersible Starter is necessary) and open well, Bore well and Sump [6]. We can control two motor and two sumps and two overhead tanks by single unit.
- Automatic water level controller will automatically START the pump set as soon as the water level falls below the predetermined level (usually 1/2 tank) and shall SWITCH OFF the pump set as soon as tank is full [7].

- Fuel level indicator in vehicles.
- Liquid level indicator in the huge containers in the companies.
- Low costs.
- Easily operate because of microcontroller.
- Low power consumer.
- It can be used to predict flood.

VII. Acknowledgements

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VIII. Conclusion

This paper was intended to design a simple and low cost water level indicator. This is not only for water tank but also used for oil level and chemical lab. To design this system, we used microcontroller as a platform and local materials for low cost. Our target was to design a system in such a way that its components will be able to prevent the wastage of water. Microcontroller code was deployed here. The whole system operates automatically. So it does not need any expert person to operate it. It is not so expensive. This design has much more scope for future research and development. Though it is a project, we hope some modification in this project will lead to a reasonable diversity of usage. Obviously there are some limitations in our design some of them in the below:

- Heating problems due to stray capacitances.
- Neck strain.

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