

## DESIGN AND IMPLEMENTATION OF AUTOMATED WATER LEVEL INDICATOR AND MOTOR CONTROLLING USING MICROCONTROLLER

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### ABSTRACT

In this writing we are going to show the notion of water level monitoring and maintaining using electrical conductivity of water. Here we observe the water level sensing and controlling using microcontroller in both wired and wireless system. This approach may

help to reduce the home power consumption and as well as overflow of water which causes wastage. Furthermore, for remote water monitoring system like data loggers, satellite data transmission systems which can indicate amount of water in the tank. Moreover, now a days cellular phones are available with high quality graphical and computation power system. Ultimately, we have given proposal to determine and sense water level universally through an web and cellular based monitoring service protocol.

**KEYWORDS:** Indicator, microcontroller, wireless indicator, conductivity, nozzle and water level sensor.

### I. INTRODUCTION

In present world sustainability of easily obtainable water resource is dominant issue in many aspects. So many problems have been arisen due to inefficient use, poor water allocation, inadequate and integrated water management. Water is such thing which is used in industry, farmland, plantation and household consumption. Therefore, proper usage and water monitoring are potential constraints for both internal and external water management system. In last few eras different monitoring system were introduced to detect water level around the

world. To utilize water resource it is very important to measure water level for both government, private sectors and residential usages. Through this way, it would be possible to find the actual execution of such steps with integration of various controlling activities.

So, automated water controlling system execution makes potential importance in home applications. The present automated method of water level detection is depicted here and used the device to make ON and OFF. Generally, in home appliance the very common way of controlling water level is to start the feed pump at a low level and assume it to reach at higher level of water inside the tank. It is examined that, this is not rightly supported for adequate controlling system. Besides this, for monitoring of fluid levels, silos, reservoirs, and dams etc. are being vastly used by liquid level control system. Usually, this sort of system have various characteristics like visual multi level of tank, continuous level indication. Automatic control of pumps and visual & audio alarms at desired levels as user requires can be added in this prevailing system. Monitoring is very crucial side to have water sustainability at a desired goal in an automation system. This paper is presented in following ways. i.e. basic concepts of the system design is discussed in the chapter two. In the next chapter the concept of PIC16F84A is depicted. This type programmatic approach through microcontroller must result of an automated water level detecting and controlling system. In the fourth chapter Design and Implementation part is described. Chapter five is on proposal of monitoring and controlling the network. The last chapter is involved with the future works and conclusion.

## **II. BASIC CONCEPTS**

### ***A. Water Level Indicator***

The water level monitoring and controlling system is contained by some basic parts which are softly aggregated together in our proposed method like LED is used for indication of different water levels. LED will be lighted with the aggregation of water level sensors. LED is ON if the sensor senses water and OFF for not sensing water. This is the basic technique to monitor and control water level.

### ***B. Water Level Sensor***

We would like to introduce an water level sensor with some handy materials like resistance, rubber, iron rod and nozzles etc. Iron and steel are the main elements of a connecting rod which should be connected with ground. There are at least four nozzles which needed to connect with +5v via 1k $\Omega$  resistors. After that we have to tie them together and keep a tuber

at the joint position will act as an insulator. Through the properties of conductivity water, nozzles and connecting rod get electric connection with the attachment sensors and water.<sup>[13]</sup>

### ***C. Water Pump Controlling System***

To control water pump automatically there is an output pin of microcontroller via a motor driver circuit. Generally, microcontroller sends two types of signal i.e. positive (+5v) and ground (0v) signals to the motor driver circuit which causes ON and OFF respectively of the water pump. Besides a manual switch is used on the motor driver circuit for controlling it manually which makes the total system more user friendly. Thus we can say that this system is combination of both manual and automation processes.

### ***D. Microcontroller***

A microcontroller is a compact integrated circuit designed to run a specific operation in a system. A typical microcontroller includes a processor, memory and both input/output peripherals in a single chip. It is largely used to monitor and display the functions. It costs low that is why all the time it becomes the first priority to choose among the designers. This device can be designed for any specific task. As it is a compact IC so hassle to manage so many external components are not needed for its applications. Using this device we can achieve TVC (Time, cost, visit) reduction idea and it takes low space to work in the system.<sup>[3]</sup>

### ***E. Others***

It is essential to set interface devices between the high power devices and the microcontroller pins to control these the high power devices like heaters, lights, motor and solenoids. To switch electricity from miliampere to several thousands of amperes some mechanical relays sometimes called contactors are used. in this system to adjust high voltage AC current we should connect a relay circuit must be connected with negative side of the cable of motor. On the other hand the positive part of the cable should be joined with 220v ac current. So that electromagnetic relay is used as an electrical amplifier.

## **III. PIC 16F84A MICROCONTROLLER**

PIC is a sequence of microcontrollers of Microchip Technology family. In fact this is the sequel of PIC1650 which was developed by General Instrument's Microelectronics Division. It is controlled by software and programmed in the manner to perform tasks. This microcontroller is almost cost effective, functional and simple to discover. This device is

used to control peripheral devices and soothing the load from the main CPU. This is the reason to choose 8-bit PIC 16F84A microcontroller as a main controller of the system.<sup>[3]</sup>

#### **A. PIC 16F84A Features**

- It carries 1000 words of program memory which is capable to translate 1024 instructions
- The data memory (RAM) contains 68 bytes.<sup>[3]</sup>
- Data EEPROM is 64 bytes
- 13 I/O pins that are individual direction control
- Indirect, direct and relative addressing modes.

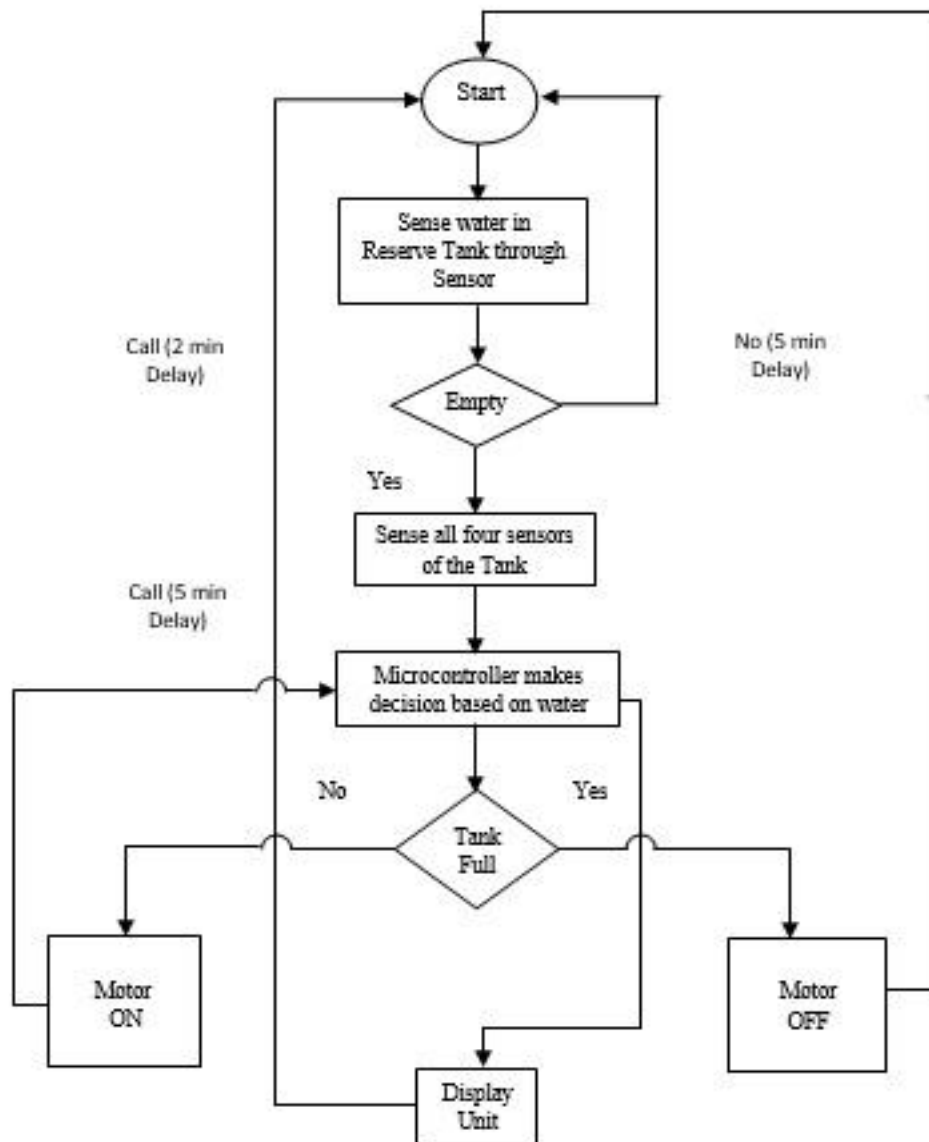
#### **B. Memory Organization**

Two memory blocks are found in PIC 16F84A. They are 1. program memory and 2. data memory.<sup>[3]</sup> To store program generally flash memory is used in PIC 16F84A because this type of memory has rewriting mode in a large scale which helps to update information. The another significant thing is the presence of EEPROM for which it does not matter whether the switch is On or OFF. This causes not to lose flash memory even being switched off. Data memory has two parts i.e. general purpose registers and special purpose registers where general purpose registers are used to store data such as integer and floating-point values and special purpose registers are for holding programs state.

### **IV. DESIGN AND IMPLEMENTATION**

To examine this experiment we have used some devices and machines like water pump and which is controlled by an water level sensor and these sensors are used to indicate the water level by sensing. Two tanks have been kept where one is for reserving water, another is for general purpose. An eight bit microcontroller for automation and most important thing is the use of MPLAB programming software to write into PIC 16F84A memory,<sup>[3]</sup> and finally an inverter.

### A. System Architecture



To make the system more easier microcontroller is been used hence the complexity of circuit has been reduced and the design has been simple. Here the water level is sensed by an inverter and input from the sensor unit is taken by a microcontroller. Water pump's action (either ON or OFF) is depended on water status of water tank which is related to input variables. Through a flow chart of whole design is given blow in Fig. 01.

### B. Sensor Unit

Water level sensor part is consisted by two portions. One is the sensor in reserve tank and the other four sensors are attached inside the water tank. It is referred before that nozzles, rod and rubber etc. are used to have these sensors. Iron and steel are the elements of rod which is connected with the ground and nozzle connects +5v. These both nozzles and iron rod are

bounded together with a rubber which causes to make electrical connection of nozzles and rod individually. 22 k $\Omega$  resistance is been used due to water conductivity. The principal operation of the system is nozzle of the sensor is contacted with water and for water conductivity, rod and nozzle becomes connected. Input of the inverter connects nozzle which carries the ground signal (0v). On the other hand the input of microcontroller connects the output of inverter which causes the LEDs ON or OFF.

### ***C. Control Unit***

A specific program controls the microcontroller which is related with water pump. A transistor is used here also. Emitter of the transistor is grounded and collector is joined with the relay circuit. Relay circuit contains one inductor and one diode for opposing the change of current flow and sending signal in one direction respectively. Between two cables of motor pump one is connected with AC 220V as positive voltage and the other one is joined with relay circuit as negative point.

Different phase of Control unit are as follows:

#### ***1) OFF operation***

For OFF operation, transistor plays a vital role and it becomes OFF based on the emitter and collector openness. In this time microcontroller provides 0V to the base of transistor. After that no ground signal (0V) is passed in the relay circuit. So positive Signal (+5V) is found in the negative side of motor pump's cable. For having 220v ac at the one end and positive signal (+5v) at other side cause the motor pump keeps OFF.

#### ***2) ON operation***

To make transistor ON two things are related for the operation. First one is collector and emitter have to be short and the another is to send positive signal (+5v) through microcontroller. Both motor pump and relay circuit get ground signal (0V) and that is why the motor pump will be ON where 220v ac at the one end and ground at negative side.

In addition, the current is changed up-to ground to positive signal (+5V) and it's vice versa then inductor can endure some resistance. This the reason to use a diode. To control the motor driver circuit manually there is an ON/OFF switch is also been used.

**Table Experimental Result.**

Output (where -- = No Operation, 1= ON & 0= OFF)							
Reserved Tank	Water Tank	LED 1 <sup>st</sup>	LED 2 <sup>nd</sup>	LED 3 <sup>rd</sup>	LED 4 <sup>th</sup>	Pump	Tank
0	0000	0	0	0	0	0	Vacant
1	0000	1	0	0	0	1	Vacant
1	1000	1	1	0	0	--	1/4
1	1100	1	1	1	0	--	2/4
1	1110	1	1	1	1	--	3/4
1	1111	1	1	1	1	1	Full

#### ***D. Operation Description and Diagram***

To execute the whole system we use some important parts like Crystal Oscillator, PIC 16F84A microcontroller, two capacitors having capacitance 22 pF and 27 pF, water tank, water level sensor, LED, inverter, transistor, capacitor, inductor, wire and power. Fig. 02 shows the total circuit where all these parts are seen. LEDs are used to monitor water level from the house (see **Table II or 1 or A**) and to detect the water in the reserve tank RA4 pin of the microcontroller is been used also. For no water in the tank the microcontroller provides a signal which controls the circuit and keeps switch in OFF mode for while. It starts to sense the reserve tank again if the timer is kept on. For having the inverted output from the water source RA0, RA1, RA2 and RA3 pins are used. One side of a crystal oscillator is connected with two pins of microcontroller and they are Pin 15 and 16. The another end of crystal oscillator joined with ground through two capacitors 22 pF and 27 pF respectively.

No water in the water tank means four pins RA0, RA1, RA2 and RA3 gets ground signal (0v) and the resultant is all LEDs are OFF. To indicate the water tank is full RA0 pin senses positive signal (+5v) and for vacancy pin RA3 senses ground signal. If RA0 senses positive signal (+5v) then it is indicated that water tank is fully filled with water. On the other hand if the water tank is vacant then pump becomes ON and the LEDs become OFF. Ground signal for pins RA0, RA1, RA2 and positive signal (+5v) for pin RA3 means 1/4th of the tank is filled with water. On the other hand for all pins RA0, RA1, RA2 and RA3 positive signal (+5v) the LEDs remain ON and means the tank is full of water including the pump should be OFF.

#### ***E. Programming Description***

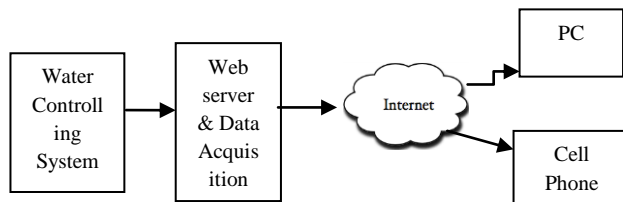
PIC16F84A microcontroller's assembly language is been used to control the whole process and **MPLAB software provided by MICROCHIP [3] has been used for the simulation and**

**test.** Crystal Oscillator (XTAL) of 4MHZ has worked as external timer. After having the power connection, microcontroller takes input through inverter. Register loads inverted inputs from pins RA0, RA1, RA2 and RA3 of microcontroller and combination is been checked. The following ways are found for combination checking.

1. After getting the signal to the first pin of microcontroller then it is loaded to the register. Next all the pins are checked one after one and the registers are loaded by the signal. Following the signal combinations an output is been decided and the signal is sent to the output pin.
2. The total operation is done following a cycle and repeated itself with respect to the input signals.

## V. PROPOSED WATER LEVEL MONITORING NETWORK

Our proposal assures to save a good amount of usable water everyday and control the wastage a huge amount of water. Besides to make it convenient for monitoring from a remote place we add an useful wireless automated controlling system. Both monitoring and controlling through wireless communication processes are described below.



### A. Data communication

- 1) Step 01: Data collection from sensors (WLS<sub>i</sub>) where (i = 1..3.4.5) and WLS is connected with USB cable or wireless.
- 2) Step2: Time duration is fixed to take data. External port is been used to send serialized data to the controlling server.
- 3) Step3: Data is sent following bit order and every bit represents sensor activities.
- 4) Step4: Microcontroller provides data datagram packet and communication can be TCP and UDP where data is formed following a definite time instance.

### B. Data acquisition and representation

Step 01: Data procurement server should tie the particular port that is relegated from data correspondence protocol.



Step 02: Received Data store in support and process stored information in online application.

Step 03: Data is been changed into XML format. Information could be sending from server by means of SOAP information passing protocol.

Step 04: Data portrayal ought to be in graphical client interface for clients to monitor and in this way they ought to have verified access to control microcontroller. If there should be an occurrence of water level sign, warning message could be incorporated into XML record.

Step5: Data sending technique ought to look after Interface serializability. Additionally, PC server should bolster multi customer and store obtained information in support that client can get to database and control microcontroller. What's more, client approval ought to be incorporated into this area for security viewpoint.

### **C. Remote communication**

Step 01: Design intelligent application programming for remote PC or portable should show information in table arrangement or in the graphical interface for reconciliation of the remote water level observing.

Step2: Display the accessible neighborhood associations and the put away remote associations through the web. Besides, Display distinctive information of remote robotized controlling framework by various sort (sensors/actuators in one hub, all gadgets in a room, all gadgets in an loft/production line).

Step3: Display the entire system structure for the support client.

## **VI. CONCLUSION**

Water is a standout amongst the most imperative essential requirements for all living creatures. In any case, shockingly an enormous measure of water is being squandered by uncontrolled use. Some other robotized water level observing framework is additionally offered so far yet the vast majority of the technique has some shortness practically speaking. We attempted to survive these issues and executed an effective mechanized water level observing and controlling framework. Our intension of this look into work was to build up an adaptable, conservative and simple configurable framework which can settle our water losing issue. We have been utilized an ease PIC 16F84A microcontroller in this framework which is the key point to decrease cost. We have effectively try the framework in lab and in this manner proposed an online water level checking and controlling system which adaptability would offer us to control this framework from wherever by means of web even with various

sort of gadgets. This could have a generous profit by this investigate work for effective administration of water.

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