International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Special Issue 7, April 2014)
International Conference on Industrial Engineering Science and Application (IESA 2014)

Automatic Electronic Water Level Management System using PIC Microcontroller

Tanmoy Chakraborty[1], Khairul Alam[2], Satadal Mal[3], Utpal Biswas[4]
[1]*Department of Computer Science and Engineering, Saroj Mohan Institute of Technology, Guptipara, Hooghly, West Bengal, India*
[2]*Research and Development Wing,Advance Integrated Tech. Lab, Kolkata, West Bengal, India*
[3]*Department of Electrical Engineering, Kalyani Government Engineering College, Kalyani, Nadia, West Bengal, India*
[4]*Department of Computer Science and Engineering, University of Kalyani, Kalyani, Nadia, West Bengal, India*

***Abstract* — Automatic Electronic Water Level Management System (AEWLMS) of a multistoried residential building is very useful in urban area. It is realized using PIC microcontroller based electronic design and tested in laboratory. This will save energy and eliminate human personnel making it cost effective and low priced as well. This paper deals with two reservoirs, one is in the roof top and another one is underground. One pump is coupled with a motor. Depending upon the water level of both the tanks, the motor will be in ON or OFF state to maintain the water level of roof top tank minimum level to maximum level through constant monitoring.**

***Keywords*— PIC Microcontroller, Water Level Management, Energy Efficient, Automation, MOSFET, Operational Amplifier, Digital Latch.**

I. Introduction

This sort of water level management appears to be very simple but very useful. This design will save energy due to mal operation of water level management manually. A person if assigned for the purpose has to be very sincere in operating the pump/motor switching on or off. Otherwise, the pump/motor will run for the excess period during which the water will be wasted due to overflow and the energy will be consumed simultaneously. On the other hand, it is very difficult for a person to be very active and sincere for all the time during discharge and loading of upper roof top tank. So, to save energy and to eliminate the pump operator, this design will be very effective for the society as a whole. The proposed system basically consists of one underground reservoir, receives water from the local municipal corporation and another tank placed on the roof top of the same multistoried building. These two tanks are connected by a pump operated by a single phase/three phase induction motor.

Water will be pumped to the roof top tank and up to the limiting level. Then the motor will be automatically in stop condition. The water will be consumed by the residents of that building. When that water level reaches to a minimum level, the motor will automatically started for pumping water, subject to the minimum maintenance of water level in the underground reservoir.

The exact related work is almost not available, however, paper [1] deals with water level sensing and controlling for agriculture, industry and domestic consumption. Another one is on microcontroller based drip irrigation system; safety analysis of drinking water; waste water handling system etc. In this paper the proposed system is designed by comparator, amplifiers, digital latch etc.

II. Proposed Work

It has been assumed that there is an underground reservoir in the ground floor and a tank at the top of a multistoried building. Water will be automatically store in the reservoir as per the service provided by the local municipal authority. Our object is to pump water to the roof top tank under the following conditions.

The motor and the pump will be started when the water level in the underground reservoir will maintain certain minimum level.

The water level in the roof top tank when falls below certain level, the motor will be started to pump water to the upper tank and the motor will be automatically stopped when the water level will reach up to the desired level.

The condition 2 is applicable when condition 1 is satisfied. The object is to develop a microcontroller based high performance dedicated system to take care the pumping of water following the above conditions.

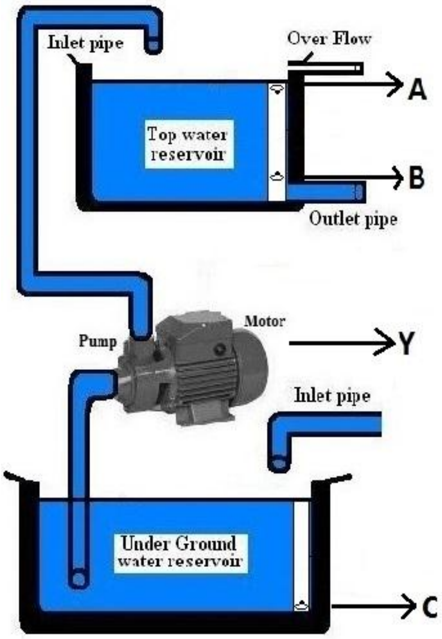

Fig. 1 Actual System Flow

The fig.1 shows the two tanks, one placed at the upper roof top and another is underground one. The pump is connected in between two reservoirs. A single phase induction motor is coupled with the pump. There are three mechanical floats; float A fitted to the top level of the upper tank, float B fitted to the bottom level of the upper tank and float C fitted to the minimum level to be maintained of the lower tank.

When the water level of the lower tank reaches in the minimum level, float C generates logic 0 and when the water level of that tank is higher than the minimum level, the float C will generate logic 1.

When the water level of the upper tank reaches in the minimum level, float B generates logic 0, else logic 1.

When the water level of upper tank reaches the top level, float A generates logic 1, else logic 0, when the water level is in the intermediate level.

The motor is connected to lift water from lower tank to upper tank, subject to the condition; when float C=1 and float B=0. The motor will be stopped, either float C=0 or float A=1. In fig.2, shows the system overview of AEWLMS.

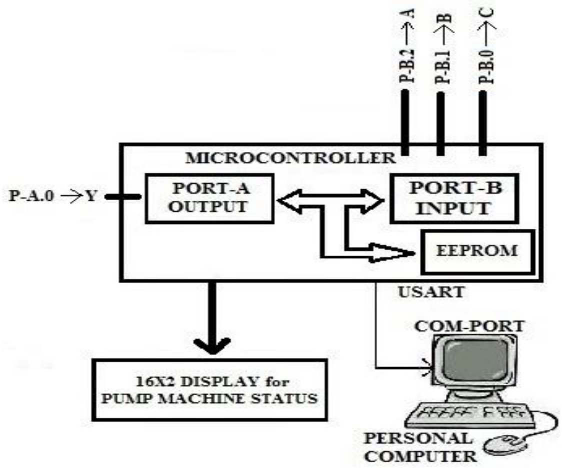

Fig. 2 System Overview

In order to realize the control circuit using microcontroller, the need of previous state to be preserved in the EEPROM contained in the microcontroller.

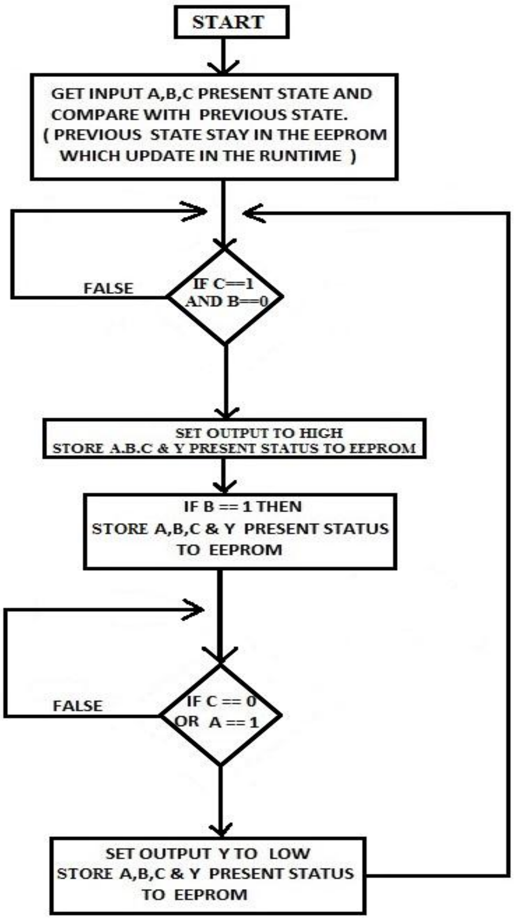

Fig. 3 Data Flow Diagram

Step 1: The state of float A, float B and float C is read by the microcontroller through the input port and stored in the EEPROM during the runtime.

Step 2: If float C=1 and float B=0, it will move to the next step 3, else Step 2.

Step 3: Then start the motor and store the present state of float A, float B, float C and motor (Y=1).

Step 4: Input the present state of float A, float B and float C. If float B=1, store float A, float B and float C to EEPROM.

Step 5: Float B will be logic 1 after receiving some water into the upper tank. Again store the state of float A, float B, float C and motor Y.

Step 6: Check the state of float A and float C now. If float C=0 or float A=1, then the motor will be stopped, i.e. Y=0 else continuously monitor the state.

State 7: Reset the output Y=0, meaning the motor will be stopped. Again the present status of float A, float B, float C and motor Y will be stored in the EEPROM.

State 8: Again go to Step 2.

The total algorithm is also shown in the Fig. 3 Flow chart.

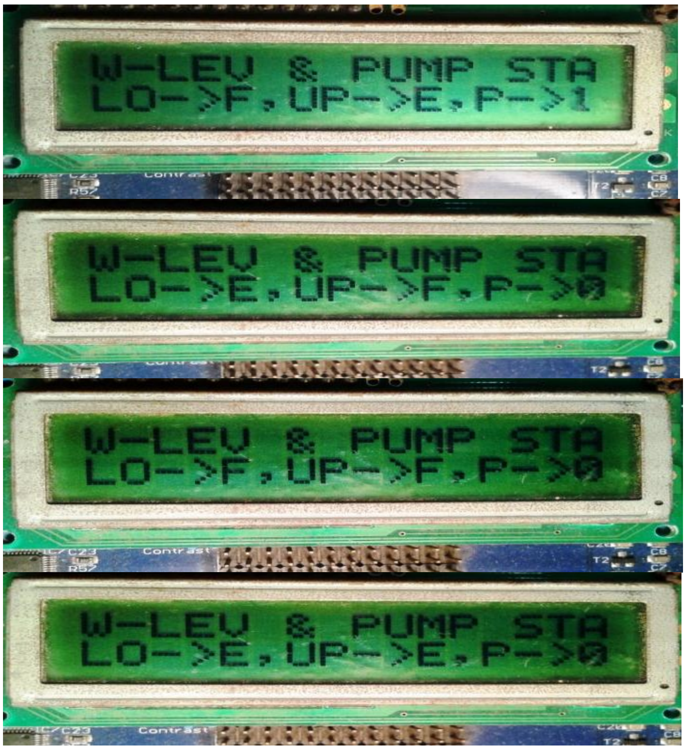

Fig. 4 Snapshots of 16X2 LCD Display

III. Conclusion

The microcontroller based automated system will take care of water level at the ground level reservoir and that of roof top tank; pump water from reservoir to the roof top tank relieving the residents to deploy person for running the pump as and when necessary. Moreover, the person deployed could not estimate the minimum level of water of the ground level reservoir. There is a chance of damage to the motor; it is started when the level of water falls below the minimum level. This possibility is eliminated with the installation of this automated system and rather protecting the motor from damage. This kind of water level controller is available at Rs. 1400 approx. but that of our present system costs Rs. 300 approx. Hence it is cost effective and efficient.

Acknowledgment

The authors are really thankful to the Department of Electrical Engineering, Kalyani Government Engineering College, Kalyani, Nadia and the Department of Computer Science and Engineering, University of Kalyani, Kalyani, Nadia for extending the infrastructural facilities without which it was difficult to implement the system.

REFERENCES

[1] M.F. WAGDY, M.S.P. LUCAS "A PHASE-MEASUREMENT ERROR COMPENSATION TECHNIQUE SUITABLE FOR AUTOMATION" IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, IM-35 VOL.1, MARCH 1986.

[2] W.V. SUBBARAO, V.ORDAX "DIGITAL MEASUREMENT OF PHASE ANGLES FOR FAULT TOLERANT SYSTEM" SOUTHEASTCON '93, PROCEEDINGS, IEEE, ISBN 0-7803-1257-0, 4-7 APR 1993.

[3] A.K. AI-AIi, M.T. Abuelma'atti, I.Hussain "MICROCONTROLLER-BASED PHASE-ANGLE MEASUREMENT AND CORRECTION TECHNIQUE" Industrial Automation and Control: Emerging Technologies, 1995., International IEEE/IAS Conference, 22-27 May 1995.

[4] W.Que, E.P.Casale, S.A.Sebo "Voltage-current phase angle measurements during aging tests of polymer insulators" 2002 Annual Report IEEE Conference on Electrical Insulation and Dielectric Phenomena.

[5] I. Adam, A. Mohamed, H. Sanusi "Simple Phase Angle Measurement of Two Periodic Signals", Proceedings of 2009 IEEE Students Conference on Research and Development (SCOReD 2009), 16-18 Nov. 2009, UPM Serdang, Malaysia.

[6] T. Xia, Y. Liu "Single-Phase Phase Angle Measurements in Electric Power Systems", IEEE Transactions Power Systems, Vol.25, No.2, MAY 2010.

[7] Hewlett Packard, Inc., "Gain-phase meter 3575A," Operating and Service Manual, June 1976.

[8] Vicente Ordax Jr., "Prediction of component or system failure with multi-phase power simulation" Florida International University MS thesis dissertation, August, 1990.

[9] B. Djokic, and E. So,''Phase Measment of Distorted Periodic Signals Based on Nonsynchronous Digital Filtering", IEEE Tram. Inrmmmfotion and Meanrremenls, Vol. 50, No. 4, pp.864-867, August, 2001.

[10] Al-Ali, A.K. Abuelma'atti, M.T.Hussain, I. "Microcontroller based phase angle measurement and correction technique", International IEEE/IAS Conference on Industrial Automation and Control: Emerging Technologies, 1995, pp. 569-571, May 1995.

[11] R. Michelliti, "Phase Angle Measurement Between Two Sinusoidal Signals", IEEE Transactions on Instrument and Measurement, Vol.30, No. 1, pp.40-42, February 1991.

[12] P. Bonanomi, "Phase angle measurements with synchronized clocks—Principle and applications," IEEE Trans. Power App. Syst., vol. PAS-100, no. 12, pp. 5036–5043, Dec. 1981.

[13] J. Chen, "Accurate frequency estimation with phasor angles," M.Sc. thesis, Bradley Dept. Elect. Comput. Eng., Virginia Polytechnic Inst. State Univ., Blacksburg, VA, 1994.

[14] A. G. Phadke, "Synchronized phasor measurements in power systems," IEEE Comput. Appl. Power, vol. 6, no. 2, pp. 10–15, Apr. 1993.

[15] Z. Zhong, C. Xu, B. J. Billian, L. Zhang, S. S. Tsai, R. W. Conners, V.A. Centeno, A. G. Phadke, and Y. Liu, "Power system Frequency Monitoring Network (FNET) implementation," IEEE Trans. Power Syst., vol. 20, no. 4, pp. 1914–1921, Nov. 2005.