Reservoir Water Level Indicator using UM66 Microcontroller

K. Govinda[1] Sreekar .ch [2] Sandilya .k[3]
[1]SCSE, University, Vellore, India [2, 3] SENSE, VIT University Vellore, India.

Abstract---In this paper we introduce the notion of water level monitoring and management. More specifically, we investigate the microcontroller based water level sensing and controlling through wired or wireless environment. Water level management would be very useful in reducing the man power and it can be remotely monitored. This will even decrease the overflow of water in the reservoir. Microcontrollers are used in the automation of any job. This work is mainly based on setting a water level monitoring indicators for different levels. Finally here we are proposing a method to monitor the water level by providing an indicator system.

I. INTRODUCTION

Sustainability of available water resource in many reason is a predominant issue now-a-days. This problem is quietly related to poor water allocation etc. Therefore, efficient use and water monitoring are potential constraint for home. The monitoring water level in a river or reservoir is very much important in the applications related to agriculture and flood prevention etc. Moreover, the common method of water level control for home appliance is simply to start feed pump at a low level and allow it to run until higher water level is reached in the water tank. This is not properly supported for adequate controlling system. Besides this, water level control systems are widely used for monitoring of liquid levels in reservoirs and dams etc. Usually, this kind of system provides visual multilevel as well as continuous level indication. Audio visual alarms at desired levels and automatic control of pumps based on user's requirement can be included in this management system.

II. LITERATURE REVIEW

Many earlier works dealt with various techniques of monitoring and controlling of water levels in Industrial and domestic applications. Broadly this automatic control problem can be achieved under electrical methods. Float ball type water level control is a popular method of control still used in practice for normal applications such as overhead tank Overflow restrictors etc. The electrical methods of control include a microcontroller-based circuits which automatically predict the water levels and accordingly active the circuit to operate motors. In spite of several such available methods, still there are new techniques in this application so as avoid dangerous operating conditions in industrial boilers.

Tan [1] proposed a water level control system for nuclear steam generator. The control system consisted of a feedback and a feed forward controller. The robustness (the characteristic to be very strong) and performance of both the controllers are analyzed and tuning of the 2 parameter of the controllers. It is shown that the proposed gain scheduled controller can achieve good performance at high and low power levels.

Safarzadeh et al. [2] presented a water level control system for horizontal steam generators using the quantitative feedback theory.

Mirada et al. [3] proposed a control strategy to achieve desired tracking of drum water level. Sliding mode & H-∞ control policies are employed. Transfer function between drum water level (Output) and feed water vs. steam mass rate were considered.

Maffezoni [4] highlighted the principal dynamic phenomena which determine the structuring of boiler-turbine control systems, clarifying the essential connections of such phenomena with the physical nature of the process. Zhang and Hu [5] proposed the water level control system using PI controllers. Zhang et al. [6] analyzed the water level control of pressurized water reactor nuclear power station using PID and fuzzy controllers. Ansari far et al. [7] proposed an adaptive estimator based dynamic sliding mode control method for water level control. Liu et al. [8] presented a Proportional controller with partial feed forward compensation and decoupling control for the steam generator water level.

In 1965, the concept of Fuzzy Logic was conceived by Prof. Lofty Zaiden at the University of California at Berkley. He presented fuzzy set theory not as a control methodology, but as a way of processing data by allowing partial set membership rather than crisp set membership or non-membership. This approach to set theory was not applied to control systems until the 70's due to insufficient small-computer capability prior to that time. Professor Zaiden reasoned that people do not require precise, numerical information input, and yet they are capable of highly adaptive control. If feedback controllers could be programmed to accept noisy, imprecise input, they would be much more effective and perhaps easier to implement [9]. Likewise, neural networks are also capable of representing the precise information from existing data sets. These intelligent control techniques like neural networks, fuzzy logic and genetic algorithms have been used in liquid level control for the last two decades.

In 1997, Park and Song [10] investigated self-organizing fuzzy logic controller for water level control of steam generators. Wu et al. [11] built a prototype of water level control system implementing both fuzzy logic and neural network control algorithm and embedded the control algorithms into a standalone DSP-based micro controller and compared their performances. Surgeon model was used for fuzzy logic control system and Model Reference Adaptive neural Network control based on back propagation algorithm was applied in neural network. Galina et al. [12] Presented applied fuzzy logic for water level control in boiler drum and combustion quality control. Fuzzy control rules were extracted from operator knowledge based on relative ruling criteria for existing boiler room. Tafoya et al. [13] proposed a novel interval type-2 fuzzy control system by extending the membership functions to interval type-2 membership function without increasing the design

complexity. The control system can efficiently reduce the uncertain disturbances from real environment.

III. PROPOSED METHOD

The technique of water level monitoring and controlling system concentrated with some basic parts which are softly aggregated together in our proposed method. Basic descriptions of some parts are described below.

Water level indicator- For the indication of water level we use the LED light which will indicate water level. By touching different water levels through the water level sensors, LED will turn on/off (i.e. on-sensor senses water).

Water Level Sensor -To make the specified water level sensor we would like to introduce some convenient materials such as Buzzer, resistance, etc. Connecting wires are used to complete the basic circuit by connecting it to a battery. When the probe touches water, a current flows through the sensor and then the LED indicates on. For a wireless monitor system the sensor circuit is connected to a UM66 microcontroller which would send a signal through a FM transmitter which can be received by a receiver tuned to that specific frequency.

Others- To control some high power devices such as lights, heaters, solenoids and motor with a microcontroller we need interface devices between the microcontroller pins and the high power devices. Mechanical relays sometimes called contactors are available to switch currents from mill ampere to several thousands of amperes. In this system we should use a relay circuit with the water pump to adapt with high voltage ac current. The output of relays circuit should be connected with motor's negative side of the cable. The positive side of the cable should be connected with 220v ac current. So, we can use electromagnetic relay as an electrical amplifier.

A. *Design And Implementation*

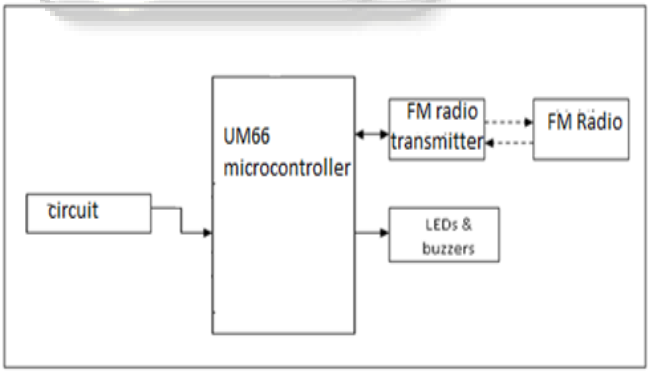

Fig. 1: System Architecture

System Architecture- As we can see from the experiment figure: the basic wire in the circuit is connected to the positive terminal of the battery. And coming to each and every successive levels we can see that there is a resistor in the first two levels, from which they are connected to a sensor and then to an LED. Coming to the third level the wire is directly connected to a sensor and then to a buzzer which would indicate that the level of water is full in the reservoir. Here sensors are used to sense the level of water accurately.

Sensor unit-Water level sensor unit consist two parts, one sensor is used in reserve tank and wires are placed inside water tank at various levels. Moreover, sensors are composed with rod, nozzles, inducting rubber etc. Rod is made by iron and steel, that is grounded.

IV. RESULTS AND DISCUSSION

We have implemented this sensor system successfully at a mini reservoir near Vellore. The results were surprising as the sensor system worked without any major glitches. The system was considerably low cost compared to existing systems in the market. The sensors were deployed in the reservoir at various depths and the signals sent by them were uninterrupted

V. CONCLUSION

Water is one of the most important basic needs for all living beings. But unfortunately a huge amount of water is being wasted by uncontrolled use. Some other automated water level monitoring system is also offered so far but most of the method has some shortness in practice. We tried to overcome these problems and implemented an efficient automated water level monitoring and controlling system. Our intension of this research work was to establish a flexible, economical and easy configurable system which can solve our water losing problem. As a future work this automation can be integrated through web to monitor remotely.

REFERENCES

[1] W. Tan, 'Water level control for a nuclear steam generator', Nuclear Engineering and Design, vol.241, pp.1873-1880, 2011.
[2] Safarzadeh, A. KahkiSedigh and A.S.Shirani, 'Identification and robust water level control of horizontal steam generators using quantitative feedback theory', Energy conversion and Management, vol.52, pp.3103-3111, 2011.
[3] H. Moradi, M.S. Avval and F.B. Nejad, 'Sliding mode control of drum water level in an industrial boiler unit with time-varying parameters: A comparison with H-∞ robust control approach', Journal of Process Control, vol. 22, pp. 1844-1855, 2012.
[4] Maffezoni, 'Boiler-Turbine dynamics in power-plant control', Control Eng. Practice, vol. 5, pp. 301-312, 1997
[5] Z. Zhang & L.S. Hu, ' Performance assessment for the water level control system in steam generator of the nuclear power plant', Annals of Nuclear Energy, vol.45, pp. 94-105, 2012
[6] G.D. Zhang, X.H. Yang, X.L. Ye, H. Xu, D.Q. Lu & W. Chen, 'Research on pressurized water level control of PWR nuclear power station', Energy Procedia, vol. 16, pp. 849-855, 2012.
[7] G.R. Ansarifar, H.A. Talebi & H. Davilu, 'Adaptive estimator-based dynamic sliding mode control for the water level of nuclear steam generators', Progress in Nuclear Energy, vol.56, pp. 61-70, 2012.
[8] C. Liu, F.Y. Zhao, P. Hu, S. Hou & C. Li, 'P-controller with partial feed forward compensation and decoupling-control for the steam generator water level', Nuclear Engg. & Design, vol. 240, pp. 181-190, 2010.

[9] V.Novák, I.Perfilieva and J.Močkoř, Mathematical principles of fuzzy logic Dodrecht: Kluwer Academic. 1999, ISBN 0-7923-8595-0.
[10] G.K.Park and P.H.Seong, 'Application of a self-organizing fuzzy logic controller to nuclear steam generator level control', Nuclear Engg., Design, vol.167, pp.345-356, 1997.
[11] D. Wu, F. Karray, I. Song, 'Water level control by Fuzzy Logic and Neural Networks', IEEE Conference on Control Applications, pp.3134-39, 2005.
[12] V. Galzina, T. Saric, R. Lujic,'Application of Fuzzy Logic in Boiler Control', Technical Gazette, vol. 15, pp. 15-21, 2008.
[13] Z. Tafoya, L. Ping, C. Jiangtao, 'Study of Interval Type-2 Fuzzy Controller for Twin-tank Water level system', vol. 20, pp. 1102-1106, 2012 .

