Microcontroller Based Automated Water Level Sensing

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Abstract: The need to conserve natural resources and energy has always been at their hike. With the growing population and their growing needs, the demand for these resources has increased which has eventually increased need to conserve them. With the growing technologies under the various engineering disciplines, regular practice for the development of these technologies is taking place. This project is such an example of the development, which will contribute to the conservation of water and energy and prove to be effective for the future generations. This instrument is designed to sense the water level in a tank using a potentiometric level sensor, measure, display and hence, control the water level, which contributes to the conservation of water and energy respectively.
Keywords: Potentiometric level sensor; level measurement; arduino.

1 INTRODUCTION

Water is one of the most essential natural resource, required for each and every purpose. However, sustainability of available water resource in many regions of the world is now an important issue. This problem is very much related to poor water allocation, inefficient use and lack of adequate and integrated water management. Water is commonly used for agriculture, industry and domestic consumption. Therefore, efficient use and monitoring of water are potential constraints for home or office water management. Measuring water level is an essential task for government and residence perspective. In this way, it would be possible to track the actual implementation of such initiatives with integration of various controlling activities. The existing automated method of level detection is described and that can be used to make a device on/off. Moreover, the common method of level control for home appliance is simply to start the feed pump at a low level and allow it to run until a higher water level is reached in the water tank. This is not properly supported for adequate controlling system. Besides this, liquid level control systems are widely used for monitoring of liquid levels, reservoirs and dams etc. Usually, this kind of systems provides visual multilevel as well as continuous level indication. Audio visual alarms at desired levels and automatic control of pumps based on user's requirements can be included in this management system. Proper monitoring is needed to ensure water sustainability is actually being reached, with disbursement linked to sensing and automation. Such programmatic approach entails microcontroller based automated water level sensing and controlling.

2 PROBLEM STATEMENT

Measurements have been on the world since the beginning of humans. Every creation since the beginning starts with measurements. The world today has developed complex and un-imaginable

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technologies to fulfill the ever demanding of necessities and needs thus creating at almost possible control of a system. Measurements have become crucial part now.

Accurate liquid level is vital in the process industries where inventories, batching and process efficiency are critical measurements. Human supervision is limited for several hours and the accuracy is almost not perfect. Hazardous contents of a vessel must be watched carefully every day without break and human are not capable of it. Extra workers thus to higher cost are results of these. Continuous monitoring and adjustments are necessary and important in this type of situation. Plants have become bigger or smaller and higher or shorter for lower cost and these developments are above humans' capabilities. Monitoring and measurements of these modern processes are almost impossible done by humans.

In this project, the micro-controller is proposed and built into actual plant with model of water level to be monitored. It introduces a better solution in accurate level measurements and automatic process in bringing water to the specific given level point (set-point). Not only that, the other crucial figure of smooth transition of level control can be controlled by micro-controller.

3 DESIGN OF THE SYSTEM

The design that is being developed is only an initial stage of the whole mechanism. The block diagram in figure 1 only gives an overview of how there will be the flow in the controls. Mainly there are four stages, but there are few intermediate processes.

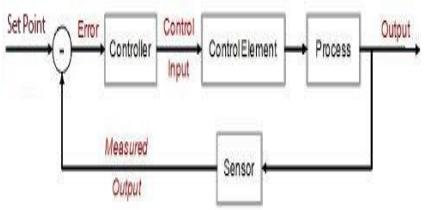


Fig. 1. Block diagram of the system.

Here are the descriptions of the blocks and the intermediate process that is taking place.

3.1 Controller

The main part of this project is controller. The controller compares the desired level with the actual level and set the level of water accordingly .Here controller used is ARDUINO UNO AT-MEGA 365 PPU.It controls the actual level of water by turning ON-OFF pump according to the pre-determined level through relay module. If it exceeds the desired level, then pump gets OFF to stop the overflow.

3.2 Control Element

The overflow and underflow conditions are overcome by relay level module. The relay module acts as a control element. Controller (Arduino UNO AT-MEGA 365 PPU) controls the level of water by turning ON /OFF the pump through relay module.

3.3 Process

The process through which whole controlling mechanism is being carried on is the water level of the tank

3.4 Sensor

The sensor used in this mechanism is potentiometric level sensor. The float and gear mechanism is used to sense the amount of water level in the tank, through a potentiometric level sensor senses the actual level of water is noted and is fed to PC via Arduino UNO board. The visual output using LCD display is displayed which lights up the LEDs respectively to indicate each level. (LOW, MEDIUM, HIGH).

3.5 CONNECTION DIAGRAM-

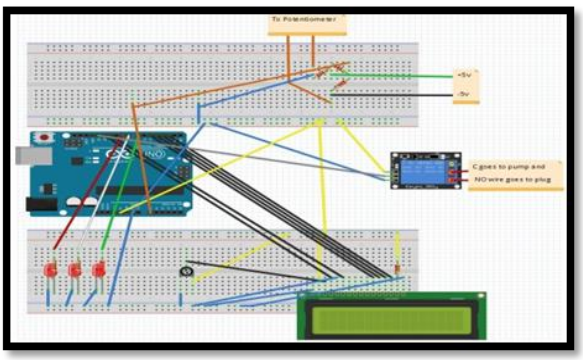


Fig. 2. Circuit connection of the system.

The connection diagram shows how the different elements are connected .The input measurand sensed by the potentiometric sensor is connected to Arduino board. One of the wires from the Wheatstone bridge is connected to Arduino board and another to the relay module. The ports of the Arduino board are connected to LCD display to indicate the three levels (LOW, MEDIUM, HIGH).The Arduino is programmed accordingly to indicate three levels and display it on the LCD display after sensing from the potentiometric sensor. The three different LED lights are glowed according to the level indicated in the LCD display. The different input levels indicated by three different wires (Red, White, Green) are connected from Arduino board to three different LEDs. The power

supply is fed to two arms of Wheatstone bridge. This describes total of overall mechanism.

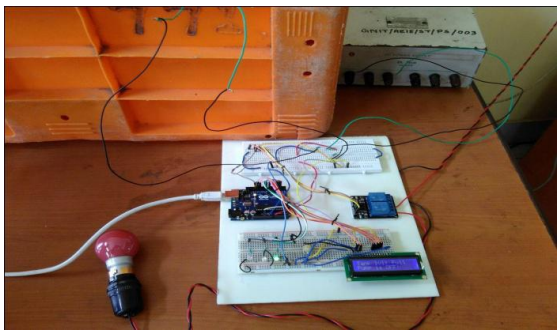


Fig. 3. Current state: water level low, pump is on.

3.6 Working Operation-

The working operation of the system is as follows-

As the Level of the water changes in the Tank the float's position changes. The end of the Float is attached to a Potentiometer.

Table 1. Variation of voltage with respect to water level.

Sl. No	Water Level (In Inches)	Sensor Reading (In v)
1	0	0.00
2	1	0.47
3	2	1.12
4	3	2.31
5	4	3.86
6	5	5.00

With the change in water level the potentiometer rotates and change in resistance occurs.

This change in resistance causes a change in the balance of the wheat stone bridge due to which the voltage across the wheat stone bridge varies from 0V to +5V.

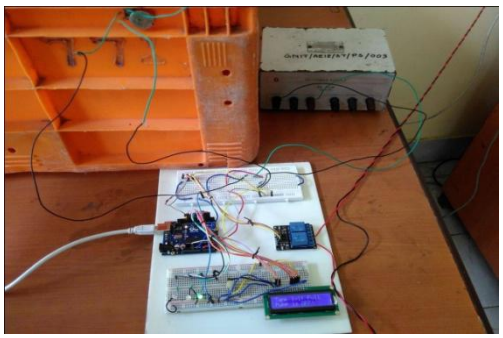


Fig. 4. Current state: water level high, pump is off.

This voltage across the Wheatstone bridge is sent into the Arduino to compare the voltage and control the water level by turn a water pump on and off.

The LCD display data is also controlled by the Arduino using the AtMega328P-Pu microcontroller.

4 CALLIBRATION AND ANALYSIS

During the working of the project some observations have been taken, which have been illustrated below-

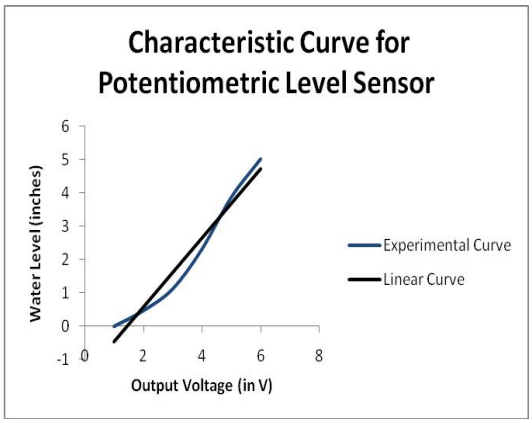
4.1 Data Observation

An observation table has been created which gives the information of height of water level (in inches) versus sensor reading (in volts).
The Pump is turned on when sensor reading is from 0.00V to 0.40V (Water Level is Low).

The Pump is turned off when sensor reading is 5.00V (Water Level is High).

4.2 Graphical Analysis

Graphical analysis based on the data of table 1 shows the exact plot of water level vs. sensor reading. The nature of the graph was firstly increasing slowly then increases steadily after 2V.



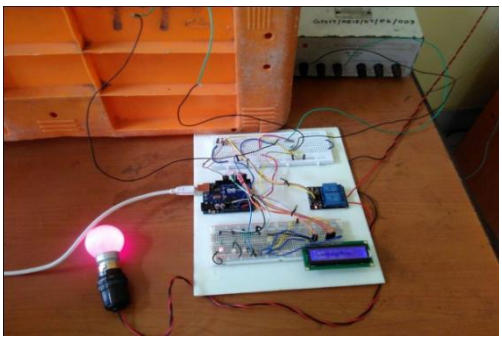


Fig. 5. Current State: Water Level Low, Pump is On (Hence the Bulb is glowing). (The Submerged Water pump is being replaced by a bulb in the next two figures for better understanding.)

5 SIMULATION

Now, in this section, the different simulation pictures are given based on what the logic is working on, and how the different blocks are working and how the whole system is flowing and making it possible to accurately sense and control the level of water.

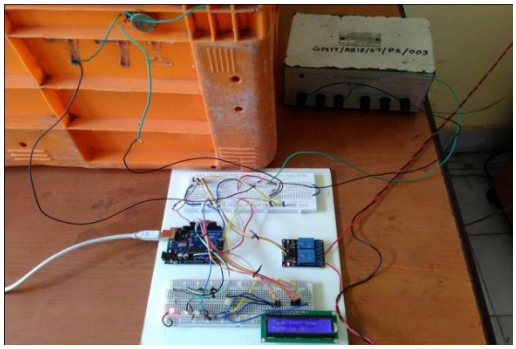


Fig. 6. Current state: water level high,pump is off.

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