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Design and Testing of an Automatic Water Level Controller (AWLC) using LED (Light Emitting Diode).

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Abstract

In this research work, the design and testing of automatic water level controller (AWLC) using LED has been established with series of electrical tests such as Individual component test, open circuit test, short circuit test and complete system test to meet the requirement of the electrical circuitry. The AWLC establishes probes at three different positions of the tank with LEDs as a sensing indicator to show the level of water in the tank (container) at different height from the pump. It has also been constructed to overcome the problem of water wastage over manual water level system (manual system). This has a great advantage in recent technology by a way of water conservation for household and industrial purposes.

Keywords: *Design, Test, Light Emitting Diodes (LEDs), Automatic Water Level Controller (AWLC).*

1.0 Introduction

In Scientific and technological researches, constructions and tests are observed so as to create comfort and simplicity in human life by tackling some associated problems in existence. Therefore, water being the most important nature's gift to mankind, without it there is no life. In the present era/decade water crisis is one of the important aspects of global risk (Soumiya et al, 2017). The growth of residential areas in great extent requires the increase in water supply facility with performance monitoring system (Gouthaan et al, 2011). More than 750 million people around the world lack access to safe water (Yuihana, 2014). Hence we should take necessary initiatives to save water. The process of requirement of water supply in many industries farms, hotels, hostels e.t.c include an overhead tank for water, which is usually fed through an electric pump that is switched off when the tank is filled up. As such, the most common way of knowing when the tank is filled is by observing when it overflows the brim. As a matter of fact, a Literature for the automated water distribution with monitoring the performance of the system through various application applied through the embedded system has been reviewed (Bhawarkar et al, 2014). Similarly, an automatic water flow meter has been developed for agricultural irrigation system to reduce the wastage of water (Ria et al, 2013). AWLC with Short Messaging Service (SMS) Notification was designed for water management during load shedding(Sanam et al, 2014).

Today technology of water tank system consists of mechanical sensor and water pump motor. When the water decrease from the actual level the mechanical sensor will detect that situation and it will send the signal to ON the water pump motor. After water reaches the actual level, the mechanical sensor will send the signal to switch OFF the water pump motor. The condition of water pump motor and mechanical sensor located in the water tank cannot be determined by consumer because there is no indication system in the water tank system. As a solution to this problem, an automatic water level

controller has been designed with light emitting diodes (LEDs). The difference between this design and existing technology is that, this design consists of indication system to show the condition of water tank system.

The AWLC consists of four basic units namely; Power-supply unit, sensing/indicating unit, relay driver unit and the pump motor unit.

The system (AWLC) works using DC power supply as their biasing source. Meaningfully, this is simply supplying appropriate voltages at different points of the circuit for its operation. Dry cell and batteries are forms of DC supply sources and have the advantages of being portable, ripple free and longevity depending on the circuit in which they have been used. Subsequently, sensing and indicating unit consists of three LEDS indicating water level at fullest, half and lower with the help of copper wire stands serving as a sensor. At the fullest level, green LED is used to indicate that the water in the tank is at the full state, yellow LED is used at the half level while a Red LED is used to indicate that the water level is low. Also relay unit consists of NPN transistor and relay. The relay is driven by the NPN transistor 2N2222A. The relay is used as a switch to the pump motor. Conclusively, pump pressure is a advice that moves fluid (liquid or gas), or sometimes slurries by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid direct lift, displacement and gravity pumps. Head (head of pump) is expressed in units of height such as meters or feet.

2. Materials and Methods

The following are the materials used for the design of the AWLC. Soldering iron, Soldering lead**,** Cutting pliers **,** Vero board, Aluminum wires, Copper wires, Resistor 10 kΩ**,** LED 1 kΩ, Pump pressure, Capacitor 10µf**,** Battery 9V, Transistor C1815 and a Container.

Firstly, series of tests such as Individual component test, Open circuit test, Short circuit test and complete system test were carried out on the system (AWLC) in order to ensure good system performance. Subsequently, circuit transistors (three transistors), a relay, pump motor and few passive components as listed above were assembled for a reasonable electrical circuitry. Here are the steps required for the design.

- Design power supply unit in a way that the sinusoidal input from the 9V AC sources is converted to 9V DC required for normal operation of the circuitry.
- Select IN4001 diode as a rectifier for the circuit because it is perfect for most low voltage circuit where the current is less than 1A.
- Place a capacitor across the output of the rectifier to smooth out the pulsating ripple in the rectified DC output.
- Design a sensing and indication with three LEDS (green, yellow and red) indicating water level at fullest, half and lower respectively with the help of copper wire stands serving as a sensor.
- Design a relay driver unit driven by the NPN transistor 2N2222A as a switch to the pump motor.

3. Result and Discussion

After carrying out series of tests such as individual component test to confirm its workability with the help of a digital multi-meter, open circuit test in order to correct any broken part such as broken wire, improper soldering which may lead to partial contact or cracked circuit board, short circuit test to ensure that all the conductors are connected properly, that is the jumpers do not make direct contact with each other or that there was no droplet of excess solder lead that can bridge the flow of current in the circuit and that all the point to be cut off were properly done. with subsequent assembly of circuit transistors (three transistors), a relay, pump motor and few passive components, a reasonable electrical circuitry is achieved for a good system performance (operation).

As shown in figure1 , with the 9V DC power supply, the circuit switches off the pump motor automatically when the water level in the tank reaches the full level. The first probe is positioned at the top, the second probe is positioned at the half of the tank and the third probe is positioned at the low respectively. The level sensing part of the circuit is built around transistors Q1, Q2 and Q3. At the fullest level, green LED is used to indicate that the water in the tank is at the full state, yellow LED is used at the half level while a Red LED is used to indicate that the water level is low. Similarly submersible pump is

turned off according to the water levels. Compared to other conventional method, the automatic water level controller shows excellent performance with its reliability, affordability, durability, and technological advantage. The automatic water level controller is a promising controller in terms of system response in water level control with respect to the non linearity introduced by pump and sensors. The motor pump is switched off when the over head tank (OHT) overflows.

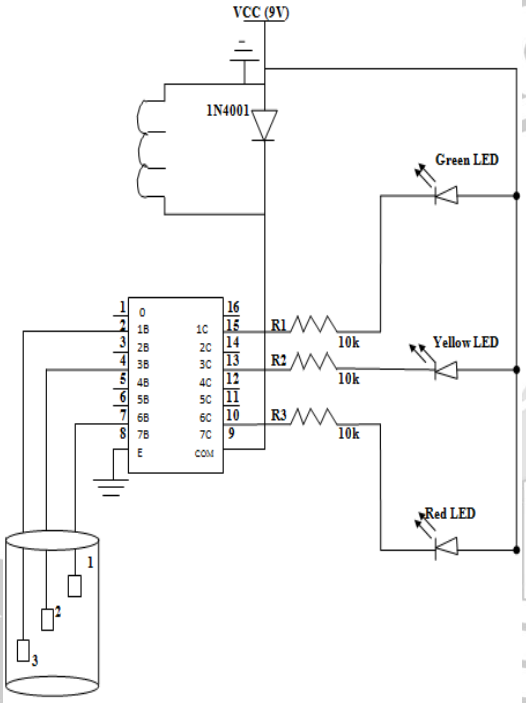

Figure 1: Circuit of the Automatic Water Level Controller using LED.

4.0 Conclusion

In this work the design and testing of an automatic water level controller (AWLC) using LED has been established with series of electrical test able to meet the requirement of circuitry. Three probes positioned at different levels are indicated by a level sensor with colored LEDs (green, yellow and red) to determine the level of water in the container at different height from the pump. The circuit switches off and on the pump motor automatically with the green and red LED sensing indicator as the water reaches the fullest and lowest level respectively. This prevents the risk of water wastage through storage and conservation. Consequently, a great deal in water storage capacity and management by overhead tanks for industrial and household advantage is highly maintained and achieved.

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