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Non-Contact Water Level Monitoring using Labview with Arduino and Ultrasonic Sensor

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***Abstract*—This project represents the water tank depth sensor system design for measurement of water level using Arduino and LabVIEW software. Ultrasonic sensor is used to measure the water depth, and from that measurement it calculates how full the tank is. Depending on the sensor reading LabVIEW program sends the data to Arduino and switches ON the pump when the water level in the tank goes low and switches it OFF as soon as the water level reaches a predetermined level. The ultrasonic sensor connected to the Arduino board as a input signal. The Arduino then reads the height of the water and reports the depth of the tank. The same program is interfaced with LabVIEW and in the front panel of LabVIEW and can visually see the level of water tank and how the motor is ON and OFF depend on the water level requirement.**

***Index Terms*— LabVIEW, arduino, sensor, DC pump.**

I. INTRODUCTION

Water is a precious resource in many parts of the world and many people rely on water tanks to supplement their water supply by storing collected rainwater or water pumped from a well or bore. But how do you measure how full a tank is? Tanks are constructed of opaque material to prevent algae growth and are often kept closed up to prevent mosquito infestation or access by rodents, so it's inconvenient to physically look inside. And besides, having a way to measure tank depth electronically opens up a world of possibilities, such as automatic control of pumps to fill tanks when they get low.

Ultrasonic sensor is used to measure the water depth, and from that measurement it calculates how full the tank is. This sensor switches ON the pump when the water level in the tank goes low and switches it OFF as soon as the water level reaches a predetermined level. The ultrasonic sensor connected to the Arduino board as a input signal. The Arduino then reads the height of the water and reports the depth of the tank. The same program is interfaced with LabVIEW and in the front panel of LabVIEW and can visually see the level of water tank and how the motor is ON and OFF depend on the water level requirement.

Generally Arduino alone is sufficient for the operation of the circuit. Lab view is used so that the graphical and visual operation can be obtained.

There are two methods to control the water level. i. Manual. ii. Automatic [2]

A. Manual method

Working of manual method: The purpose of this system is to maintain the liquid level (h) in the tank as close

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to the desired liquid level H as possible, even when the output flow rate is varied by opening the valve water level in tank so varies. So in manual method a human controls the liquid level close to the desired level using a sight tube. Using sight tube human compares the present level by the desired level and adjusts the valve accordingly.
Drawbacks of manual method: 1) Error due to human, 2) Error due to time wasted in opening and closing of valves, so there is a need of automatic (human less) system to increase the accuracy.

B. Automatic method

Working of automatic method: In the automatic method human is replaced by a controller to increase the accuracy. The liquid level is sensed by a float and sensed level is then fed to the controller, controller compares the sensed level with desired level and error signal is generated, according to that error signal actuator controls the output valve.
Advantage of automatic method: 1) Error is reduced by human by a controller, 2) Automatic method is more reliable as compared to manual method, it is more stable also it is costly comparatively but accuracy and stability provided by this method can cover the cost.

II. AURDINO UNO

Arduino is an open-source hardware kit with 8-bit Atmega AVR pre-programmed on- board microcontroller kit, with boot loader that uploads programs into microcontroller memory. It has 2KB of SRAM and 1KB of EEPROM. There are 14 digital I/Opins with serial transfer and external interrupts in which 6 pin can also be used as PWM pins. There are 6 analog I/O pins. Communication: The AT mega 328 provides UART TTL serial communication which is available on 0 and 1 digital pins, the 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. The Arduino provides an IDE for programming the Arduino Uno board. The Arduino Uno board can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

Figure 1.Arduino Uno Board

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.
"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

III. ULTRASONIC SENSOR(HC-SR 04)

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. A short ultrasonic pulse is transmitted at the time 0, reflected by an object. The senor receives this signal and converts it to an electric signal. If no obstacle is detected, the output pin will give a 38ms high level signal.

Figure 2.Ultrasonic Sensor

Working Voltage	-	DC 5v
Working Current	-	15mA
Working Frequency	-	40Hz
Max Range	-	4m
Min Range	-	2cm
Measuring Angle	-	15 degree
Trigger Signal	-	10µS TTL pulse
Echo Signal	-	Input TTL lever signal and the range in proportion
Echo Signal	-	45*20*15mm

In our work trigger is the output signal and is connected to 8th pin of Arduino board and echo I input signal and is connected to 9th pin in the board, VCC pin is connected to 5V and GND pin is connected to ground.

IV. 5V DC PUMP

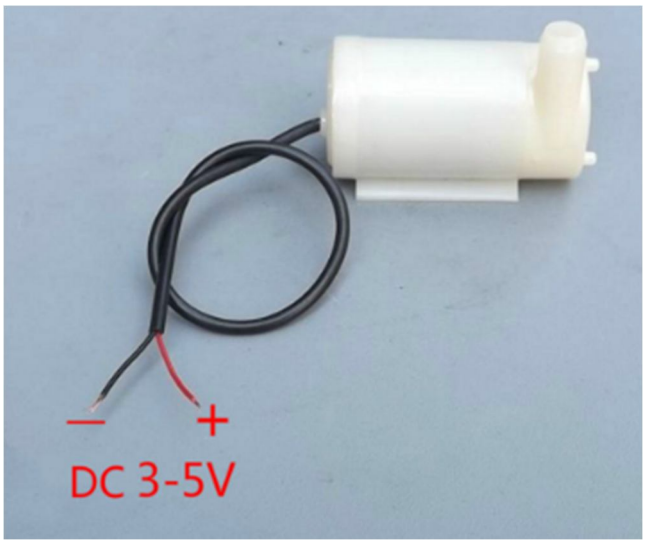

Figure 3.5V DC Pump

A submersible pump is a device which has a motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. Produced liquids, after being subjected to great centrifugal forces caused by the high rotational speed of the impeller, lose their kinetic energy in the diffuser where a conversion of kinetic to pressure energy takes place. This is the main operational mechanism of pumps.
The pump shaft is connected to the gas separator when fluids enter the pump through an intake screen and are lifted by the pump stages. Hence the water is pumped from one part to other part
In our work pump positive line is connected to 4th pin of the board and is used as data line and negative line is grounded.

V. BLOCK DIAGRAM

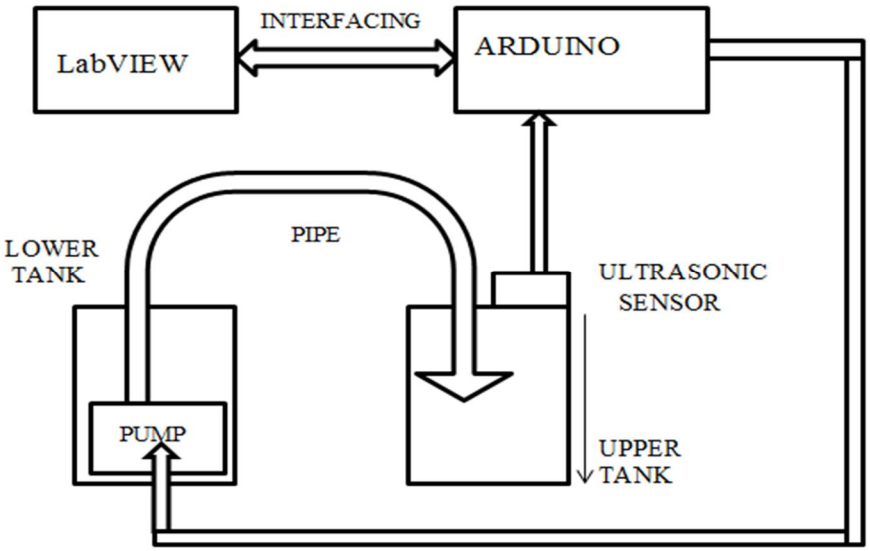

Figure 4.Block Diagram Non-Contact Water Level Monitoring Using LabVIEW with Arduino and Ultrasonic Sensor

VI. FLOWCHART

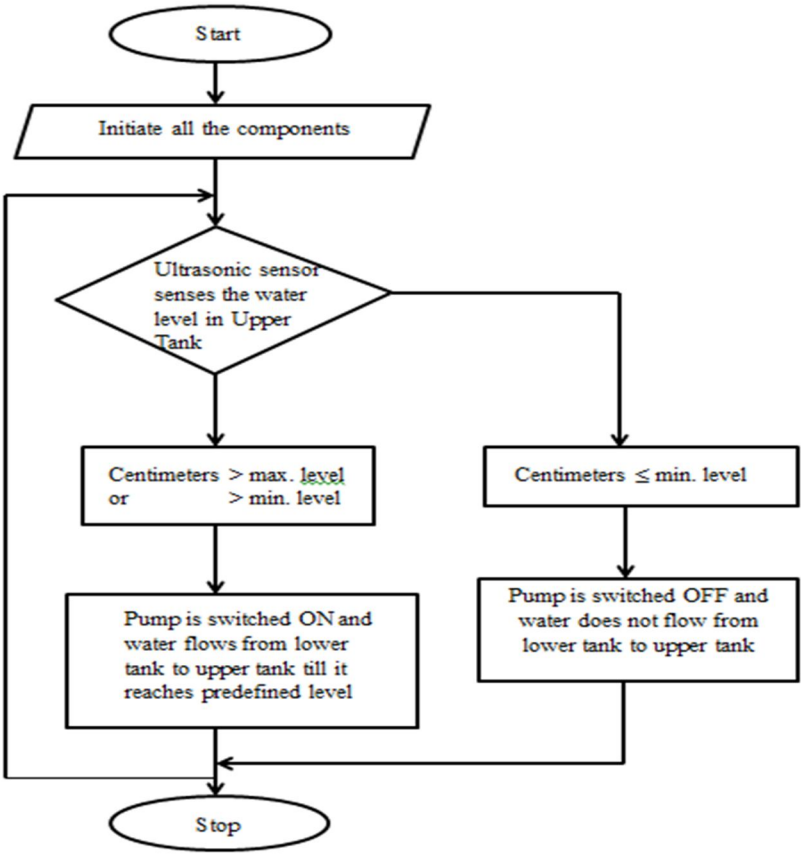

Figure 5.Flow Chart

VII. ADVANTAGES

1) Reduce the wastage of energy.
2) Reduce the wastage of water.
3) Reduce physical efforts.
4) Reduce maintenance.

VIII. APPLICATIONS

1) Automatic Water level Controller for Hotels, Factories, Homes Apartments, colleges, Commercial Complexes, etc.,
2) It can be fixed for open well, Bore well and Sump.
3) It can be used for irrigation system in agriculture.

XI. CONCLUSION

Thus we conclude that the design of non-contact water level monitoring using arduino and ultrasonic sensor has been achieved. This model can be used in various applications like factories, apartments, colleges and in agriculture. There may be other software used for designing this model but LabVIEW is the simplest of them all. Is because it uses the drag and drop principle, it does not need any code to run the software since it follows graphical coding.

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