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Tank Water Level Indicator & Controller Using Arduino

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ABSTRACT:The project is designed to give a display of water level in a tank and control a pump motor as required. The reading given is in the scale of 0 to 9. A priority encoder is interfaced to a decoder to get the display of water level on 7 segment display. This is the circuit designed for overhead tank digital water level indicator. It is built around priority encoder, BCD-to-7-segment decoder, 7-segment display and a few discrete components. Due to high input impedance, priority encoder senses water in the container from its nine input terminals. In this Arduino based automatic water level indicator and controller project we are going to measure the water level by using ultrasonic sensors. Basic principal of ultrasonic distance measurement is based on ECHO. When sound waves are transmitted in environment then they return back to the origin as ECHO after striking on any obstacle. So we have to only calculate its traveling time of both sounds means outgoing time and returning time to origin after striking on any obstacle. And after some calculation we can get a result that is the distance. This concept is used in our water controller project where the water motor pump is automatically turned on when water level in the tank becomes low.

KEYWORDS: Relay, Ultrasonic sensor, Arduino, Bridge Rectifier, Motor, 7- Segment Display, etc.

I.INTRODUCTION

In accordance with the current scenario, a lot of water is wasted every day from residential areas, offices and hospitals. Water is essential in various ways and such a huge amount of water wastage can lead to its scarcity in future. Nowadays everybody has overhead tank at their homes. Our Objective is used to measure and display the level of water in a container and avoid overflow of water. The idea can be implicitly used to ascertain and control the level of water in overhead tanks and prevent wastage. In this Arduino based automatic water level indicator and controller project the water level is being measured by using ultrasonic sensors.Working of IC is very simple. Initially consider that tank is empty, when power supply is on all the input of IC1 is high. From truth table of IC1 you can see that is if input is high then it will give you high on output pin also. This will make the input pin of IC2 low and 0 is displayed on seven segment display. Now when water in tank reaches level 1 than it will make the pin 11 of IC1 low and remaining pin remain pin high as a result we will get a output from pin 9 of IC1. Similarly when level in the tank reaches to level 2 it will make pin 12 of IC1 low and 11 is already low but 74147 is a priority encoder that's why output from pin 7 is received and again this low signals are converted into high output with the help of transistor T3 and we will get numeric 2 display son 7 segment display. This indicates that water has reached to level 2. When sound waves are transmitted in environment then they return back to the origin as ECHO after striking on any obstacle. So its traveling time of both sounds means outgoing time and returning time to origin after striking on any obstacle is being calculated. And after some calculation a result is obtained that is the distance. This concept is used in our water controller project where the water motor pump is automatically turned on when water level in the tank becomes low. As water in tank fills we will get numeric 3, 4 ....9 to be display. The circuit automatically switches the motor OFF when the tank is full. The water level is displayed on a 7 segment display.

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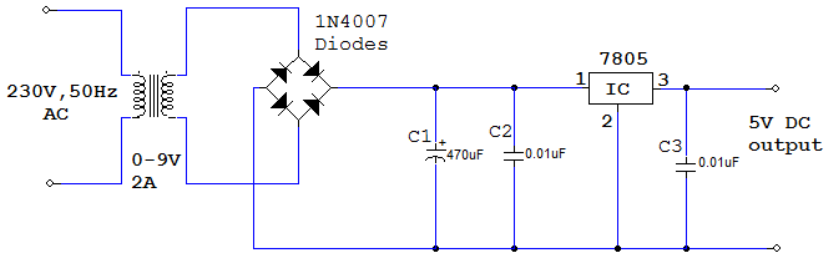
II.PROJECT DESCRIPTION

A.POWER SUPPLY

Power supply circuit, the name itself indicates that this circuit is used to supply the power to other electrical and electronic circuits or devices. There are different types of power supply circuits based on the power they are used to provide for devices. For example, the micro-controller based circuits, usually the 5V DC regulated power supply circuits, are used, which can be designed using different techniques for converting the available 230V AC power to 5V DC power.



B.ARDUINO

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. "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.

C.ULTRA SONIC SENSOR

Ultrasonic sensor HC-SR04 is used to measure distance in range of 2cm-400cm with accuracy of 3mm. The sensor module consists of ultrasonic transmitter, receiver and the control circuit.

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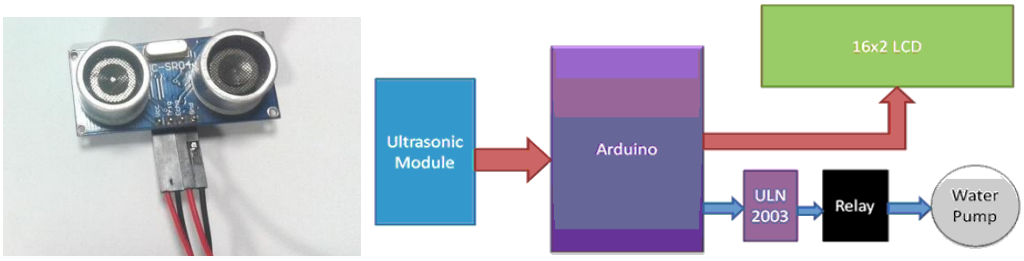

D. RELAY

Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate. A relay switch can be divided into two parts: input and output. The input section has a coil which generates magnetic field when a small voltage from an electronic circuit is applied to it. This voltage is called the operating voltage. Commonly used relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc.

E. 10-TO-4 LINE PRIORITY ENCODER

A priority encoder is a circuit or algorithm that compresses multiple binary inputs into a smaller number of outputs. The output of a priority encoder is the binary representation of the original number starting from zero of the most significant input bit. The 74HC/HCT147 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.IC 74147 is a 9 input priority encoder IC which accept data from nine active low input and convert it into 4 binary active low output. When 2 or 3 output goes high simultaneously than output with highest priority is display on output that's why it is called as priority encoder. This IC is also known as 10 line to 4 line priority encoder. The devices provide the 10-line to 4-line priority encoding function by use of the implied decimal "zero". The "zero" is encoded when all nine data inputs are HIGH, forcing all four outputs HIGH.

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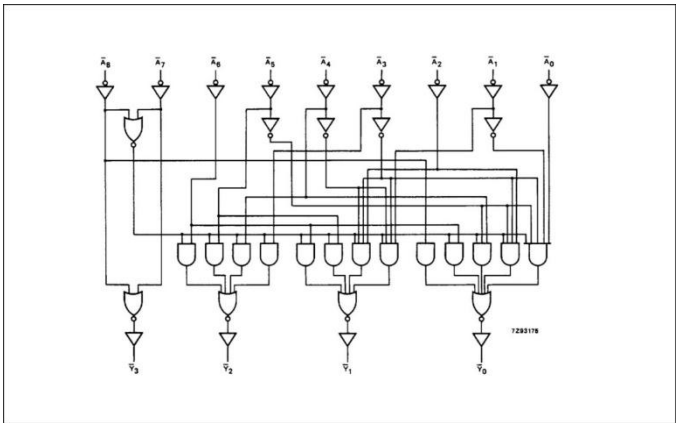
PIN NO.	SYMBOL	NAME AND FUNCTION
8	GND	Ground(0v)
9, 7, 6, 14	Y_0 TO Y_3	BCD address outputs (active LOW)
11, 12, 13, 1, 2, 3, 4, 5, 10	A_0 TO A_8	Decimal data inputs (active LOW)
15	n.c	Not connected
16	Vcc	Positive supply voltage



F. BCD-TO-7 SEGMENT DECODER

CD4511 is a CMOS BCD to seven segment latch/decoder. This IC provides the facility of 4-bit storage latch, an 8421 BCD-to-seven segment decoder. It also provide you the of facility lamp test (). It is used to check that all segments of 7 segments are working properly or not. For testing momentarily make the pin low, in short used to test the display. Blanking input () is use to turn off or vary the brightness of the display. Latch enable (LE) is used to store BCD codes. CD4511 is used in various applications like in clock, watches, computer, calculators etc

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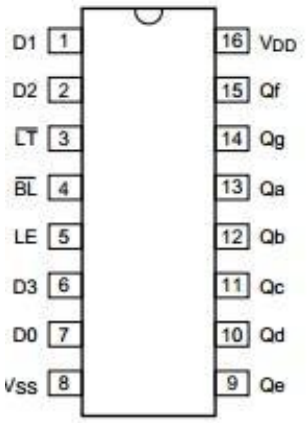
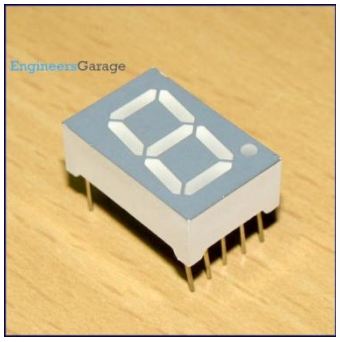
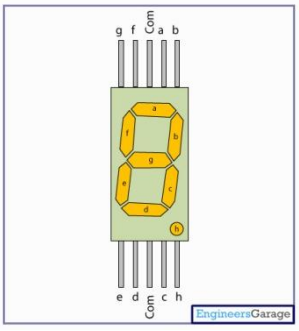


G.SEVEN SEGMENT DISPLAY

A seven segment display is the most basic electronic display device that can display digits from 0-9. They find wide application in devices that display numeric information like digital clocks, radio, microwave ovens, electronic meters etc. The most common configuration has an array of eight LEDs arranged in a special pattern to display these digits. They are laid out as a squared-off figure '8'. Every LED is assigned a name from 'a' to 'h' and is identified by its name. Seven LEDs 'a' to 'g' are used to display the numerals while eighth LED 'h' is used to display the dot/decimal.A seven segment is generally available in ten pin package as shown in fig no.2.24. While eight pins correspond to the eight LEDs, the remaining two pins (at middle) are common and internally shorted. In CC configuration, the negative terminals of all LEDs are connected to the common pins. The common is connected to ground and a particular LED glows when its corresponding pin is given high. In CA arrangement, the common pin is given a high logic and the LED pins are given low to display a number.





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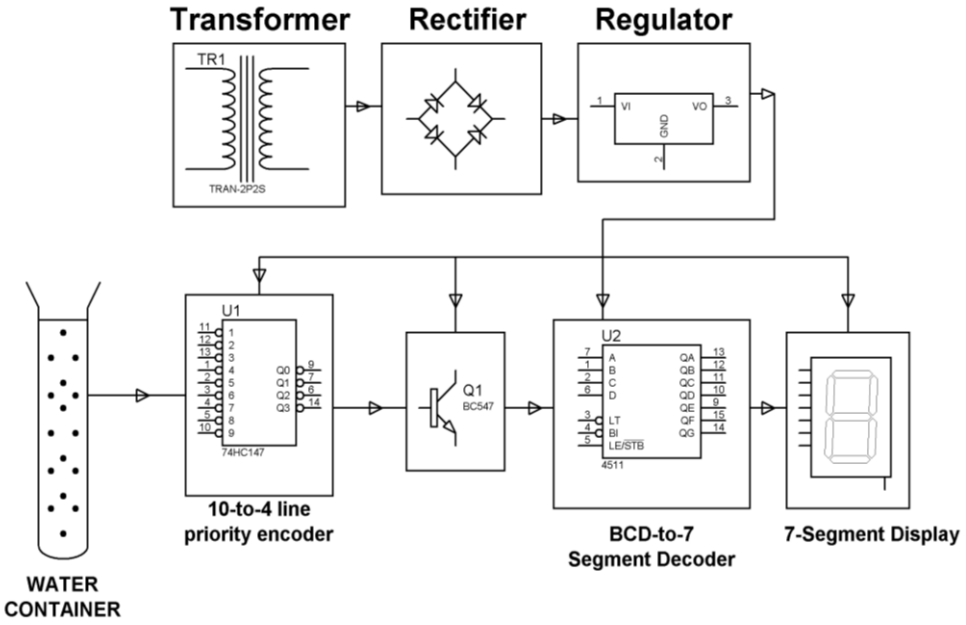
III. BLOCK DIAGRAM



IV. RESULT

When the tank is empty there is no conductive path between any of the 8 indicating probes and the common probe (which is connected to 5v+ supply) so the transistor base emitter region will not have sufficient biasing voltage hence it remains in cut off region and the output across its collector will be Vc approximately 4.2v. As in this case the microcontroller is used in the active low region (which means it considers 0-2 volts for HIGH and 3-5 volts for LOW) now the output of transistor which is 4.2v approximately will be considered as LOW by the microcontroller and hence the default value given by microcontroller to the seven segment display is 1 which indicates as the tank is empty. Now as the water starts filling in the tank a conductive path is established between the sensing probes and the common probe and the corresponding transistors get sufficient biasing at their base, they starts conducting and now the outputs will be Vce (i.e. 1.2v-1.8v) approximately which is given to microcontroller. Here the microcontroller is programmed as a priority encoder which detects the highest priority input . In this project while the water level reaches the 7th level i.e. last but one level along with display in seven segment . When the tank becomes full the seven segment display indicates “9”, the top level probe gets the conductive path through water and the corresponding transistor gets into conduction whose output given to microcontroller with this input microcontroller can switch off the motor and save water.

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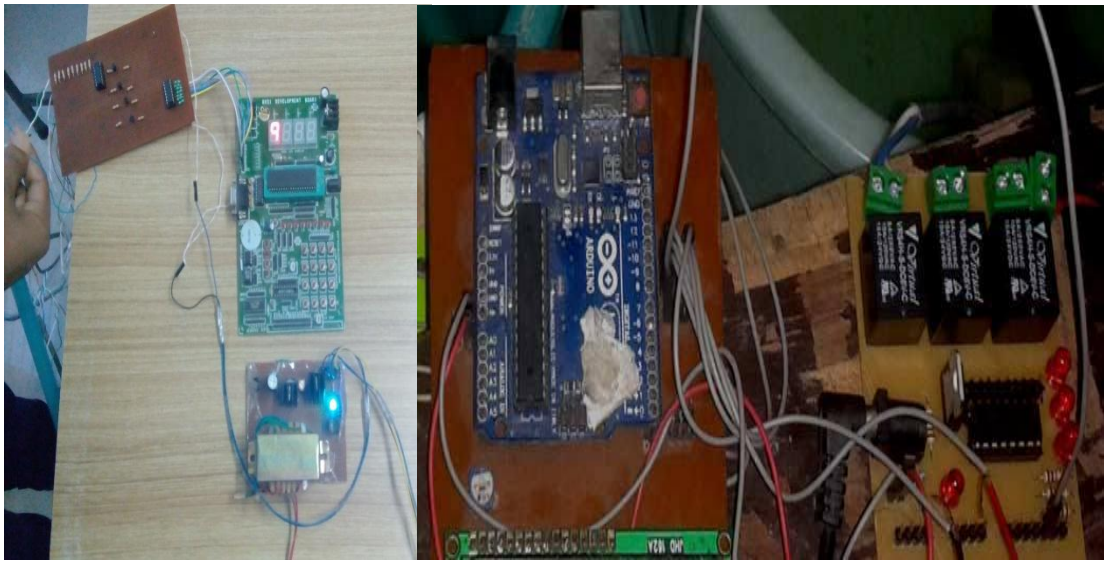

V.CONCLUSION

In present days, there are many parts on earth which face scarcity of water, calamities like draught etc. Energy production is laborious and cannot be misused. The water tank overflows as the height of water in the tank cannot be randomly guessed. This leads to extra energy consumption, which is a high concern in the present era. People also need to wait and stop doing their other activities until the tank is full. Hence, here is an idea which senses and indicates the water level so that the pump can be switched off on appropriate time and save water, electricity and time as well.

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