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# Design and Construct Intelligent Tank "Water Level Sensor"

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## Abstract

The system proposed in this paper design a system of intelligent reservoir " water level sensor" helps reduce thewaste percentage of water. Through the automatic control and control of the water level by determining the water proportion of the reservoir in terms of emptiness and fullness and is carried out using the concept of artificial intelligence with micro controls, where the use of a simple and cheap control is arduino and is stored and stored information is written in IDL program to determine the percentage of fullness and lack Depending on the need of the user of the reservoir with the management of electronic parts associated with the Arduino to fill the tank when it is free of water and stop the filling process when reaching the specified level of fullness while monitoring the level of water during use.

This system can be applied at the level of tanks reservoirs Cities and irrigation tanks and reservoirs for agricultural land with the development of electronic parts used in the control system to achieve the desired goal in preserving the amount of safe water for drinking and non-potable.

**Keywords:** Water Tank , Arduino, microcontroller , Control System, Water Level Sensor

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## 1. Introduction

Because many countries of the world suffer from problems of low water quantity, it is important to manage water level in a modern way in all areas of life in agriculture and industry and reduce waste [1][2].

And to achieve intelligent water management both at the level of dam reservoirs or at the level of reservoirs with local use for individuals in homes or water reservoirs for irrigation in agricultural lands that do not rely on rain water throughout the year[3]. The importance of intelligent control and management of the level of water in the reservoirs, which is of economic importance in preserving water and not wasting it, is mentioned[4]. In addition, this system helps in the industrial side to monitor and follow up the level of different types of dangerous fluids, which are preferred to follow them[5][6].

It is possible to achieve the level of water monitoring in a number of highways, which require many equipment, but in the system used in this paper is explained a simple system of control depends on the tools available and cheap, including sensors and ultrasonic sensor to monitor the water level in the tank Water-level ultrasonic and water level recording on the LCD screen to monitor the water level and use Bluetooth to send information about the water level of the screen by mobile phone, but the use of Bluetooth to monitor a certain distance commensurate with the extent of the Bluetooth broadcast .

It is also possible to control the filling of the tank when the water is connected to the access and stop the flow of water in the tank when it reaches the full extent specified by connecting the water supply and sensor and the screen of the plug and the Bluetooth chip by Arduino, which is fed information about the water level required in the reservoir in terms of fullness The library has been written in c language for each electronic part of the parts associated with Arduino to organize the work between the parts and achieve the desired goal of intelligent reservoir management and knowledge of water level in the reservoir and the optimal use of water and non-waste[7][8].

In this paper will show the following parts . At the first part' the basic concepts of system design'. Second part focuses on' design and implementation'. Third part deals with ' Design and Implementation part '. Fourth part describes conclusion and future work.

## 2. The Basic Concepts of System Design :

In this section, the basic parts that aggregated together to create the intelligent tank system and water level control will be explained below:

### 2.1 Water level monitor :

Water level monitor is consist of (LCD and cellular devices by using Bluetooth technique)

- Monitoring by LCD: A liquid-crystal display (LCD) is a flat electronic screen that produces light from liquid crystals that cannot send light directly so it uses a reflector to produce monochrome images. LED screens consist of 7 parts and use technology similar to the technology used in digital clocks. And displays arbitrary images or fixed images with low information content such as on the computer screen. However, other displays have larger elements than arbitrary images with a large number of pixels[9].

LCD interference in many applications such as TV sets, indoor and outdoor signs, and cockpit in aircraft And enter into mobile devices such as smart phones, watches, digital cameras, manual calculator. The sizes of the screens range from small to large, such as small digital clocks and large TV screens.

Because the LCD monitors do not use phosphorus, the fixed image does not burn if exposed for a long time on the screen, such as the inner mark of the aircraft table. LCDs are the best-selling CRT monitors for low power consumption.


**Figure 1: Screen Shot of LCD**

Journal of AL-Qadisiyah for computer science and mathematics Vol.10 No.3 Year 2018
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- Monitoring by Bluetooth : Bluetoothis a wireless technology found in mobile devices and computer peripherals is easier than WIFI .It is able to access the signal emanating from the devices in a short distance. Anyone can access Bluetooth because it is unauthorized. The frequencies that use in Bluetooth are '2.4 to 2.485 GHz band' .

**Figure 2: Bluetooth**

## 2.2 Water level Sensor :

Water level Sensor is consist of **(**Ultrasonic Sensor **)**

The Ultrasonic Sensor sends out sound in a high-frequency pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone) [10].

The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object. It uses the following mathematical equation:

'Distance = Time x Speed of Sound divided by 2'

'Time = the time between when an ultrasonic wave is transmitted and when it is received'

You divide this number by 2 because the sound wave has to travel to the object and back. The HC-SR04 Ultrasonic Sensor (shown in fig.3) is a very affordable proximity/distance sensor that has been used mainly for object avoidance in various robotics projects . It essentially gives your Arduino eyes / special awareness and can prevent your robot from crashing or falling off a table. It has also been used in turret applications, water level sensing, and even as a parking sensor. This simple project will use the HC-SR04 sensor with an Arduino and a Processing sketch to provide a neat little interactive display on your computer screen [11].

**Figure 3. HC-SR04 sensor**

It has 4 pins ( Vcc , Trig , Echo , GND )

Vcc : Connects to 5V of positive voltage for power

Trig : A pulse is sent here for the sensor to go into ranging mode for object detection

Echo : The echo sends a signal back if an object has been detected or not , if a signal is returned an Robjects has been detected , if not , no objects has been detected .

GND: complete electrical pathway of the power

### Electrical specifications:

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

## 2.3 Water level controller :

Water level control is consist of **(**Arduino microcontroller **)**

- The Arduino is the best microcontroller because it's easy to use and powerful board. Arduino is like a small computer achieve interact and control electromechanical devices[12]. Arduino works much better than a conventional desktop computer. Technically, arduino uses an open source software platform the system depend on a control board microcontroller (arduino) and Arduino IDEprogramas development environment for the' writing software'.

Journal of AL-Qadisiyah for computer science and mathematics Vol.10 No.3 Year 2018
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The strength of Arduino is in noticeable ability to management with other electronic parts, such as 'switches' or 'sensors', and use them to gain different data such as temperature or light intensity, furthermore being very effective in Control of 'motors', 'LEDs', 'lamps' and many other electronic parts. the execute of any Arduino projects via the 'computer-link' and perform a transaction on the device or the software can be run independently[13].


**Figure 4:- Arduinouno**

The Arduino has Characteristics make its potential is high and the able to control various electronic parts and software The arduinoorder is designed to meet the needs of all, 'professionals, professors and students' .these Characteristics comprise ('Simplicity,'Cheap Price','Open Source hardware','Open Source Software').and there are more types for arduino ('ARDUINO UNO','ARDUINO NANO','ARDUINO LILYPAD','ARDUINO MEGA 2560','ARDUINO MINI','ARDUINO BT').

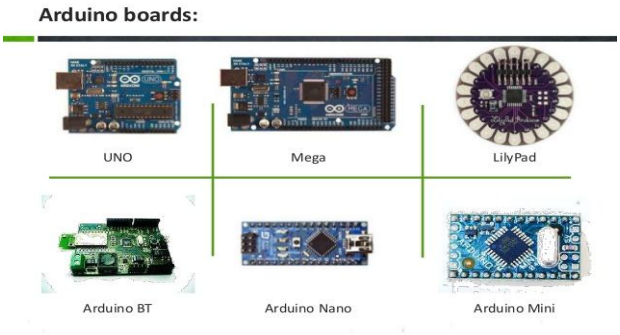


**Figure 5:- types of Arduino**

In this paper Arduino Uno (shown in Fig.3) was used as the development board to run the intelligent tank because it is a simple, inexpensive board with limited resources can be used to implement complex and intelligent tasks. Here used with pumper ,relay and LCD.

- **Relay**

A relay is defined as an electrically controlled device that opens and closes electrical contacts, or activates and deactivates operation of other devices in the same or another electrical circuit. Two types of relay technology are available, mechanical and solid state. A mechanical relay is essentially a combination of an inductor and a switch, where the

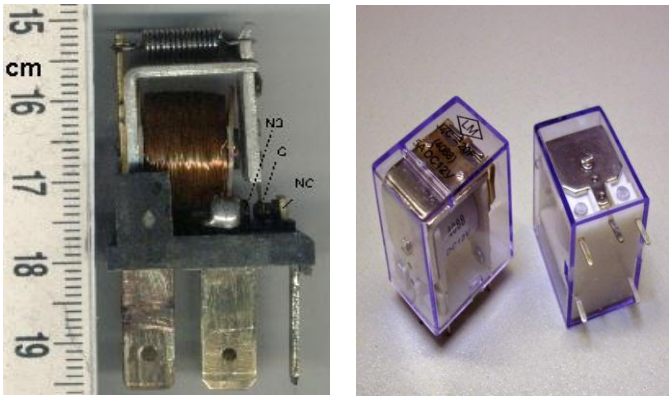


**Figure 6:- magnetic relay**

electromagnetic force of the inductor causes a switch to change position. A solid state relay accomplishes the same function with semiconductor devices changing impedance to effectively activate or deactivate a circuit open or closed. This document is intended to be a general guide to aid the designer in the appropriate selection of a relay for the intended application. Detailed information on the selection and use of relays can be found in MIL-STD-1346. [14]

Journal of AL-Qadisiyah for computer science and mathematics Vol.10 No.3 Year 2018
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- **Water pump**

It is a device that depends on the mechanical movement of fluid transport. The pumps are divided into three types according to the way the pump moves the liquid: direct lifting, displacement and gravity pumps. Pumps operate by energy consumption to perform mechanical work by moving the liquid. The pumps operate according to many sources of energy, including manual operation, electricity, motors and wind power.It is come in many sizes, from microscopic for use in medical applications to large industrial pumps.

Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, pond filtering and aeration, in the car industry for water-cooling and fuel injection, in the energy industry for pumping oil and natural gas or for operating cooling towers.

**Figure 7:- Water pump**

## 3.Implementation and Design :-

The goal of this paper is satisfy intelligent controlling on the electrical parts that's connected by microcontroller 'Arduino' to create smart tank. The part of smart execute by programming code written in 'C programming language' and feed inside 'Arduino'as a kind of artificial intelligence.

**3.1 Flowchart for Intelligent tank and Table :** This flowchart show the procedure of the work.

| Case | Height of the water in the tank | Turn the pump on or off | Tank Cases | Max Capacity |
|---|---|---|---|---|
| 1 | 2 cm | Pump is on | Tank is empty | 10 cm |
| 2 | 8 cm | Pump is off | Tank is full | 10 cm |

**Table 1:- The cases for Intelligent tank**

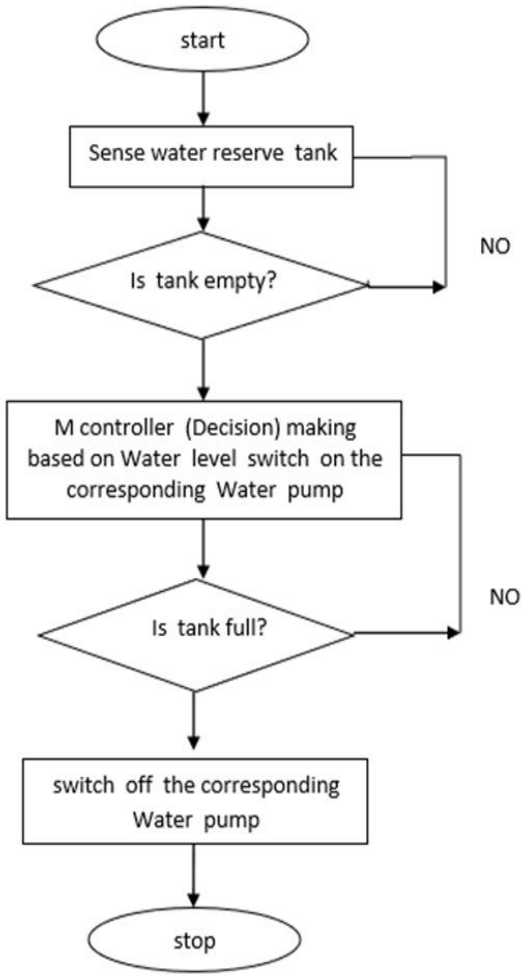


**Figure 8:-flowchart for Intelligent tank**

## 3.2 The Modules for Intelligent tank:

The paper contain three primary modules :

1. Water level monitor
2. Water level sensors
3. Water level controller

We use these components to managing the amount of water in the tank depend on the measurement of water level in the tankby using Ultrasonic Sensor that measure the distance between the sensorand Surface of the waterand Follow up readings by the LCD and mobilescreen.This monitor devices connected with Arduino (microcontroller) that control on the level of the water on the tank by matching the measures that come from theUltrasonic Sensorwith the data saved inside Arduino by set of orders written by' C programming language' as a type of artificial intelligence.

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When the tank supervises the water-free level according to the user-defined level, the controller activates the associated water to fill the tank. In case water reaches the specified level of fill, the microcontroller gives the pump order to a stopover. Which helps to solve the problem of waste water and avoid the consequent economic losses.

**Figure 9:-Intelligent tank**

Here use (HC-SR04Ultrasonic) to send and receive the ultrasonic waves and calculate the speed of waves and the time arriving (receive) by calculate the distance between the sensor and the water to know the water level.

## 3.2 Integrated development environment

Arduino is programmed through a special program called the Integrated Development Environment Brief for (IDE)

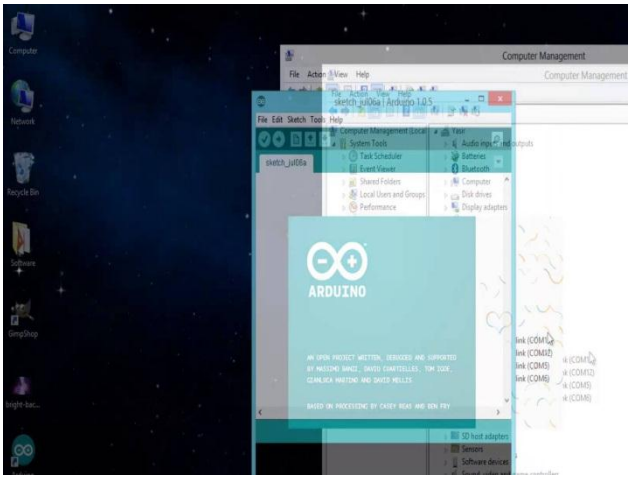


**Figure 10:-Arduino Interface**

## 3.3 Link method:

Connects common the variable resistance with pin3(V0) of the crystal and the rest of the sides with the VCC and Gn arduino, lcd pins RSS and RDD is feed from Gn and vccarduino ,also lcd pin4(RS) connected with pin4 for arduino , lcd pin5 (RW) with Gn,lcd pin 6(E) with arduino pin3 ,and lcd pins D4, D5, D6, and D7, respectively with arduino pin4, pin5, pin6, and pin7. In addition, the cathode lcd is connected to the Gn and anode with Vcc. The relay input (IN1) is connected with the pin 8 of the arduino and series with led and the buzzer , either the water pump is connected one wires with 220v source dirctly and other with the relay(NC) and common relay with 220v, finally the HC-SR04 sensor connects the echo input with the pin12, the trig input with the pin11, the vcc and the ground with Feed the Arduino. As well as connect VCC and Bluetooth to the ground with arduino feed and RX ,TX with RX, TX for arduino respectively.

**Figure 11:-Link method for components**

### 3.3.2 Pumping and discharge

Perform water pumping and discharge in one

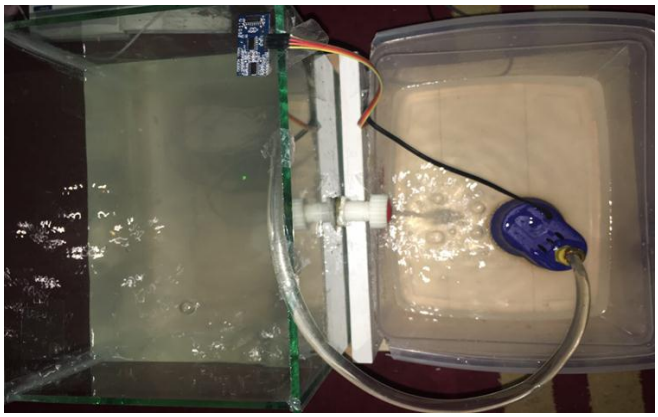

**Figure 11:- Water Pumping and Discharge**

## CONCLUSION

Due to the importance of water in the life of living organisms, can note that this paper focuses on the work of a control system that works accurately and automatically control the level of water in the reservoir, which prevents loss of water and the impact on the life of living organisms, industry, agriculture and affect the economy of countries. The proposed system is cheap and simple and has been successfully tested in the laboratory.

As a future view in this subject we can connect this system with internet and send the information from the Sensor to the database in the server and control on it by using mobile .

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# تصميم وبناء خزان ذكي (متحسس مستوى الماء)

**براء إسماعيل فرحان**
**كلية الحاسوب و تكنولوجيا المعلومات**
**جامعة واسط**

**المستخلص :**

النظام المقترح في هذه الورقة تصميم نظام خزان ذكي متحسس لمستوى المياه الذي يقل لنسبة الهدر في المياه من خلال التحكم التلقائي و السيطرة على مستوى المياه و ذلك بتحديد نسبة الماء في الخزان من حيث الخلو و الامتلاء وينفذ ذلك باستخدام مفهوم الذكاء الاصطناعي مع المسيطرات البسيطة حيث يتم استخدام مسيطر بسيط و رخيص يتمثل بالاوردوينو ويتم خزن معلومات كاملة تكتب في برنامج IDLالتحديد نسبة الامتلاء والخلو حسب حاجة مستخدم الخزان مع إدارة القطع الالكترونية المرتبطة مع الاردوينو لمليء الخزان عند خلوه من الماء و إيقاف عملية المليء عند الوصول إلى المستوى المحدد للامتلاء مع مراقبة مستوى المياه إثناء الاستخدام . ويمكن تطبيق هذا النظام على مستوى خزانات المنازل و خزانات المدن وخزانات الري للأراضي الزراعية مع تطوير القطع الالكترونية المستخدمة في نظام السيطرة لتحقيق الهدف المنشود في الحفاظ على كمية المياه الصالحة للشرب والمياه الغير صالحة للشرب .