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Design and Development of Automatic Water Dispenser using Arduino

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ABSTRACT

Water pumps are very useful for the water supply. In 1700s wooden pumps are used for the water supply, and then metal piston type pumps came into existence in mid 1800s. The first submersible pumps are used in 1920s, whereas in 2020s the automated pumps changed the people's life easier. This proposed Automatic Water Dispenser system performs a series of functions like controlling the water level, displaying the level of the water in the tank, indicating the value of water temperature, and automatic ejection of water.

Automatic Water Dispenser contains a temperature sensor, Arduino and 2 Ultrasonic sensors one for water level measurement and other to sense the presence of the water container. This proposal is built to assists the users in day-to-day activity.

The sensor senses the Container (object) which is placed in front of it. The sensed signal is applied to the Arduino to execute a program that operates a motor which runs the water dispenser machine accordingly. The sensed temperature of water and its level will be displayed simultaneously in the LCD panel also. The proposed system is more efficient and reliable. If all the manual taps are replaced with a smart one that opens and closes automatically, will not only save the water but also provides a healthier lifestyle, since the tap won't be touched by human hands. So, the AutomaticWater Dispenser using Arduino can automatically supply water when a glass is placed below the tap.

Keywords: Arduino Nano Micro controller, Temperature sensor LM35 &Ultrasonic sensor, float sensor,Relay, DC motor.

I. INTRODUCTION

In day to day life intelligent systems are used in a wide range and these are embedded in design. There are some physical elements which are needed to be controlled in day to day life in order for them to perform their expected task. The Automatic water dispenser has a series of functions to maintain each parameter of water such as water level, showing thevalue of temperature & level of water and automatic water ejection. A control system therefore can be defined as a device or set of devices that manages, commands, directs or regulates the

behaviour of other devices. How the room temperature can be measured? The answer to the simple question is with the help of a Temperature Sensor.

In this system, microcontroller is most important and plays a vital role in the smart system development. It has become an essential part in the current day to day technologies. This system is responsible for controlling the water level and flow of the water automatically based on the time limits that has been coded in the programming part. The system requires an ARDUINO board to implement a control to this system.

Many inventions were made to control the water dispurities in order to make the whole system automatic. The research result was flexible, proposed a web and cellular based monitoring service protocol to determine and sense water level globally. At first there was a need to store the water. Big tanks were made to collect the water when the pump fetched the water from the ground level to the tank. A water level sensor was used so that it can automatically cut off the supply from the pump to tank in order to avoid the wastage of water.

This system which is "Automatic Water Dispenser Using Arduino" has an ultrasonic sensor which senses the object and passes the signals to the arduino which is coded with certain time limit to fillthe container. If the ultrasonic sensor gets some back-and-forth signals to echo pin, then subsequently the arduino would passes the signals to the relay and that initiates the submerged DC motor to pump the water out. The programming part has done with certain litigations as distance, time limit and echo pin pulses.

II. PROPOSED SYSTEM

The proposed system is that the ultrasonic sensor which is placed on the card board which senses the object and passes the signals to the Arduino. In Arduino program coding is written which is coded with certain time limit to fillthe container with required amount of water. If the ultrasonic sensor gets some received echo signals that passes to the Arduino and it activates the relay so that the submerged DC motor starts to pump the water out. The coding part has done with certain processeslike distance, time limit and received echo pin pulses.

III. DIAGRAMS OF THE WORKING MODEL

BLOCK DIAGRAM

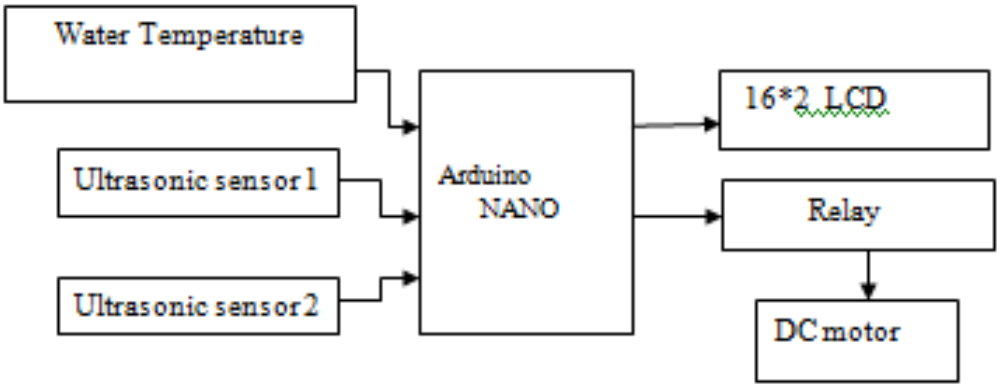

Fig.1 Block Diagram

CIRCUIT DIAGRAM

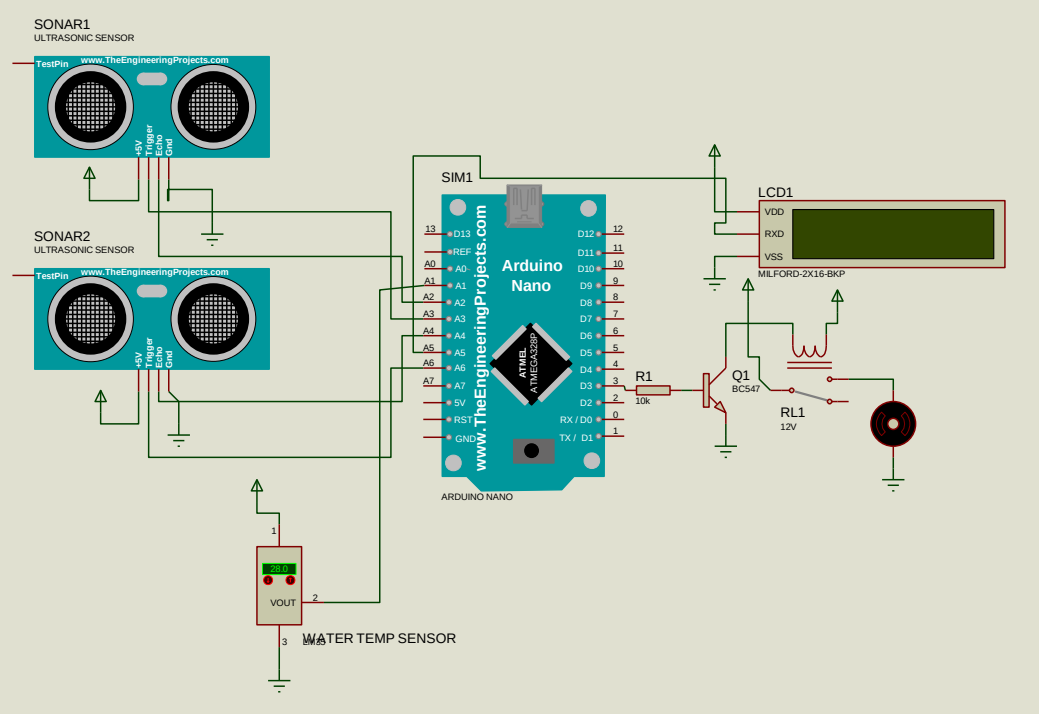

Fig. 2. Circuit Diagram

IV. TOOLS REQUIRED

Hardware Requirements

1. Arduino Nano
2. Temperature Sensor
3. Ultrasonic Sensor
4. Float Sensor
5. LCD Display
6. Relay
7. Resistor
8. DC motor
9. Bread board
10. Jumper wires

Software Requirements

Arduino is a single-board microcontroller. The Arduino provides an integrated development environment (IDE) based on Processing language.

Arduino Nano

Programming in Arduino

Arduino programs are written in the Arduino Integrated Development Environment (IDE). The Arduino programming language is based on a very simple hardware programming language called processing, which is similar to the C language. After the sketch is written in the Arduino IDE, it should be uploaded on the Arduino board for execution.

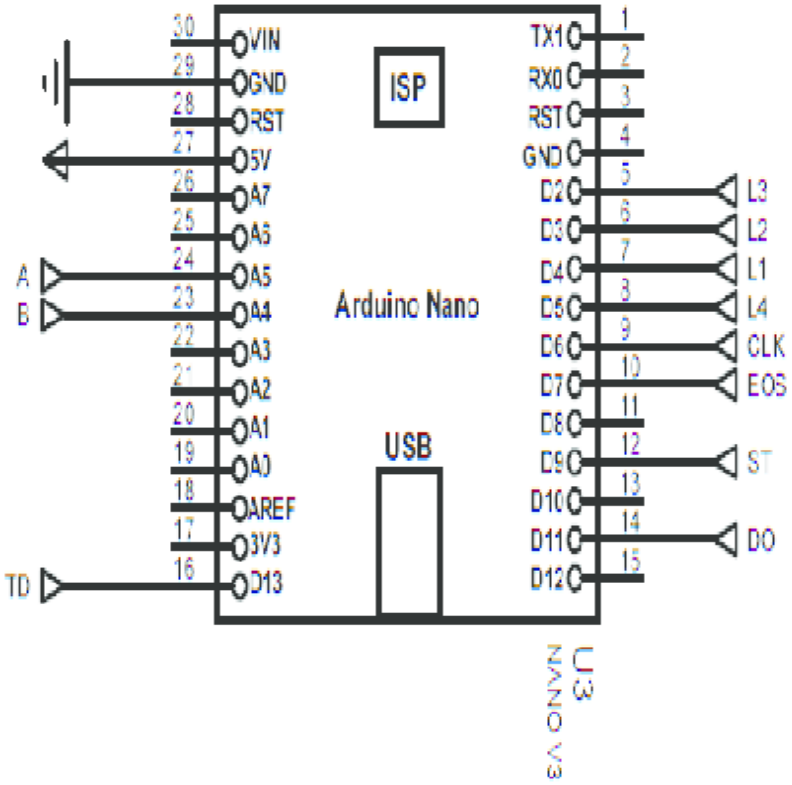

Fig. 3. Arduino Nano

Every Arduino sketch has two main parts to the program:

void setup () – Sets things up that have to be done once and then don't happen again.

void loop () – Contains the instructions that get repeated over and over until the board is turned off.

1) POWER SUPPLY

The Arduino board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

2) Temperature Sensor

TheDS18B20 sensor is usedas temperature sensor in this system. The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with non-volatile user-

programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply.

Fig. 4. DS18B20

Each DS18B20 has a unique 64-bit serial code, which allows multiple DS18B20s to function on the same 1-Wire bus. Thus, it is simple to use one microprocessor to control many DS18B20s distributed over a large area. HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control systems are some of the applications that can be benefited from this feature.

3) Ultrasonic sensor

Ultrasonic Sensors are also known as **transceivers** when they do both send and receive and work on a principle similar to radar or sonar **which** evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

Fig. 5. Ultrasonic Sensor

Vcc → Arduino +5V pin
Gnd → Arduino Gnd pin
Trig → Arduino Digital Pin 3
Echo → Arduino Digital Pin 2

The sensor is composed of two ultrasonic transducers. One is transmitter which outputs ultrasonic sound pulses and the other is receiver which listens for reflected waves.It emits an ultrasound at 40 000 Hz which travels

through the air and if there is an object or obstacle on its path. It will bounce back to the module. Considering the travel time and the speed of the sound the distancecan be calculated.

In order to generate the ultrasound, we need to set the Trig pin on a High State for 10 µs. That will send out an 8-cycle ultrasonic burst which will travel at the speed of sound. The Echo pins goes high right away after that 8-cycle ultrasonic burst is sent, and it starts listening or waiting for that wave to be reflected from an object.If there is no object or reflected pulse, the Echo pin will time-out after 38ms and get back to low state.

If a reflected pulse is received, the Echo pin will go down sooner than those 38ms. According to the amount of time the Echo pin was HIGH, the distance the sound wave traveledcan be determined, thus the distance from the sensor to the object.For that purpose, the distance can be calculated by,Distance = (Speed x Time)/2

This technology can be used for measuringthe amount of liquid in a tank, the sensor measures the distance to the surface of the fluid.

Operating Voltage	5V DC
Operating Current	15mA
Operating Frequency	40KHz
Min Range	2cm / 1 inch
Max Range	400cm / 13 feet
Accuracy	3mm
Measuring Angle	<15°
Dimension	45 x 20 x 15mm

4) LCD [Liquid crystal Display]

The LCD is a dot matrix liquid crystal display that displays alphanumeric characters and symbols. 16X2 LCD digital display has been used in the system to show the room temperature

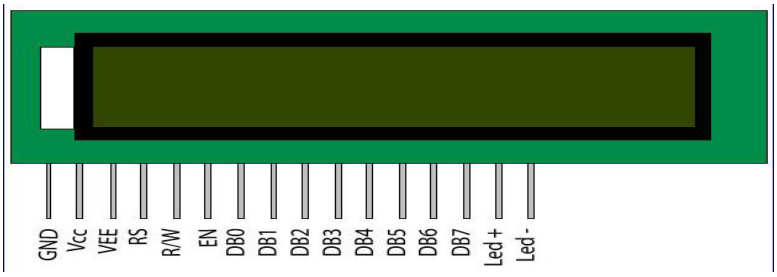

Fig. 6. LCD

Liquid Crystal Display screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.

5) RELAY

The electric relay is one of the most frequently used devices in modern technologicalsystems. It can be found in cars, washing machines, microwave ovens, and medical equipment as well as in tanks, aircraft, and ships. Practically no industry would functionwithout relays.

Fig. 7. Relay

In some complex automatic control systems in industry, the number of Relays is estimated in hundreds and even thousands. In the power-generation industry, no power device is allowed to operate without special protection relays. Certain electrical equipment, such as power transformers, may be protected by several different kinds of relays, each controlling different functions.

6) DC motor

Fig. 8. DC motor

A **DC motor** is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronicto periodically change the direction of current in part of the motor.

V. METHODOLOGY

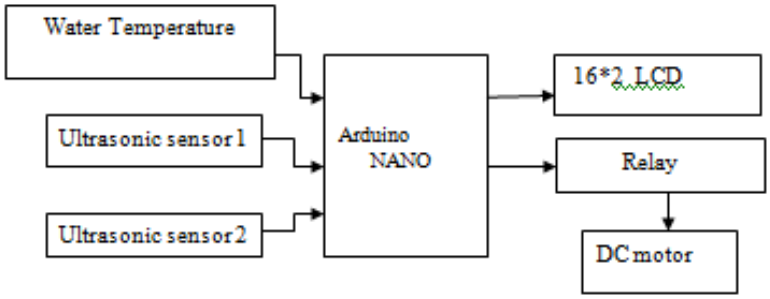

Fig 9. Block Diagram

The fig 9. represents the block diagram of the proposed concept. The temperature sensor and the two ultrasonic sensors are interfaced with Arduino to fetch the data of temperature and level of the water in the tank. The data is processed if the ultrasonic sensor1 detects the pulses and senses the signals and passes to the furtherzones.Moreover, if the temperature and the level cannot be managed but it would just show the accurate values of it. The data will then quickly displays on LCD for user interaction. Here the ultrasonic sensor2 is kept for the level detection of water. If everything processed then arduino fetches the data from outside and compares it to the data given then passes the signals to the relay and then to DC motor apparently.

VI. DESCRIPTION OF THE WORKING MODEL

- The connections from ultrasonic sensors 1&2 are connected to the Arduino NANO as shown in the fig 9. The pins VCC, Echo, Trigger, GND of ultrasonic sensors 1&2 are connected to the A2, A3 and A5, A6 of Arduino pins.
- The DS18b20 sensor is also connected to the NANO board to the pin A1. Subsequently from the Arduino NANO board the connections are dragged to the LCD and a relay module
- Additionally, a power supply cable and a battery areneeded to make this dispenser run and to fill the container.
- The Arduino is coded with 15 seconds of time to fill the container, and it stops and holds for a delay of 2 seconds.

VII. HARDWARE IMPLEMENTATION

Fig. 10. Proposed Hardware model

VIII. CONCLUSION

- Automatic water Dispenser system employs the use of different technologies in the whole design of its development and implementation.
- The system is used by the microcontroller to automatic process of the water which is used by human beings and it has the ability to detect the level of the water, the temperature of the water, and the use of the LCD in this system provides the output which is very useful for human beings.
- This project has successfully provided the improvement on existing water condition by which human beings get the good quality of water, and with this there will be no wastage of water.

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