

Automatic Water level Controller and testing water quality

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ABSTRACT

Water plays an important role in our everyday life. Water is one of the most common substances found in nature. It is used in our everyday activities. Sources of water include rain water, river water, lake water and sea water etc. Rain water is the most accessible source of water in most localities, but in the last century pipe – borne water was invented. This water is free from germs but contains some mineral salts; it is generally accepted in most countries and is used as a source of drinking water. The world is experiencing water shortage, which implies that water source should be managed so as to minimize wastage. For instance, in Modernized Societies, almost every bathroom is equipped with water heater tanks and in most buildings there are overhead water tanks. In some homes, we will find out that the boreholes and wells have tanks for water storage before pumping up to the overhead tank. People generally switch on their water pump when their tanks are short of water i.e. when the taps stop running and switch off the water pump when the tanks start over flowing. This results in unnecessary wastage and sometimes unavailability of water in cases of emergency. To avoid wastage and any form of exposure to hazard that may result from overflow of water, the need for an automatic water pump arose, hence this design work.

I. INTRODUCTION

The project proposes a very simple and realistically applicable solution to this problem. In this project a ultrasonic sensor is used to calculate the amount of water in the tank. Using this input to the controller the controller can turn on or off the electronics relay, which in turn operates the motor. The need to calculate the flow of the water through the tank has been realized with the help of flow sensor. Flow sensor allow to display the real time flow of the water from tank to the source.

Quality of water is can be subjective or objective, for example clear, taste are subjective while other factors such as pH, turbidity, etc are objective. Testing of these parameters can help in monitoring the quality of water in remote areas where lab testing facilities are not available. Our system proposes the use of turbidity sensor which helps to determine the amount of suspended particles in the liquid to determine the quality of the water.

II. LITERATURE SURVEY

1) Hussain A. Attia "Automatic water level sensor and controller system" the design of a water level sensor device that is able to detect and control the level of water in a certain water tank or a similar water storage system. The system firstly senses the amount of water available in the tank by the level detector part and then adjusts the state of the water pump in accordance to the water level information.

This electronic design achieves automation through sequential logic implemented using a flip flop. A seven segment display and a relay-based motor pump driving circuit are part of this integrated design. The water pump automatically turns on and starts filling the tank when the water level is empty or level ONE and turned-off and stop filling the tank when water level reaches maximum-level NINE; furthermore, the water pump will remain in its standstill state from level EIGHT down to TWO when the level is decreasing due to water consumption..

2) Kunal Chakraborty "Design of an Electronic Flow Transmitter Using LVDT & Hall Sensor" proposes a variable area type flow sensor is Rotameter in which the flow rate is measured by the position of float. Conventional Rotameter is generally used as a local indicator and hence special technique is needed to transmit the reading of rotameter to a remote distance. In the present paper, an improved hall probe based technique has been developed to convert the float movement into electrical current signal which can be transmitted to a remote station

3) O. Postolache "An IR Turbidity sensor: Design and application" This paper presents an infrared turbidity sensor characterised by a flexible structure that permits the materialisation of different turbidity measurement schemes (transmission, scattering, ratio) in order to increase the measurement accuracy limiting the critical design factors and diminishing the common mode factors. As parts of the work are mentioned the design, implementation, calibration and test of the new turbidity sensor. In many environmental applications, maintaining and verifying water quality is very

important. Turbidity (TU) is an indicator often used to find the amount of suspended particulate matter in water. The particulate matter consists of soils, sand or mud, may include also algae and other organic particles.

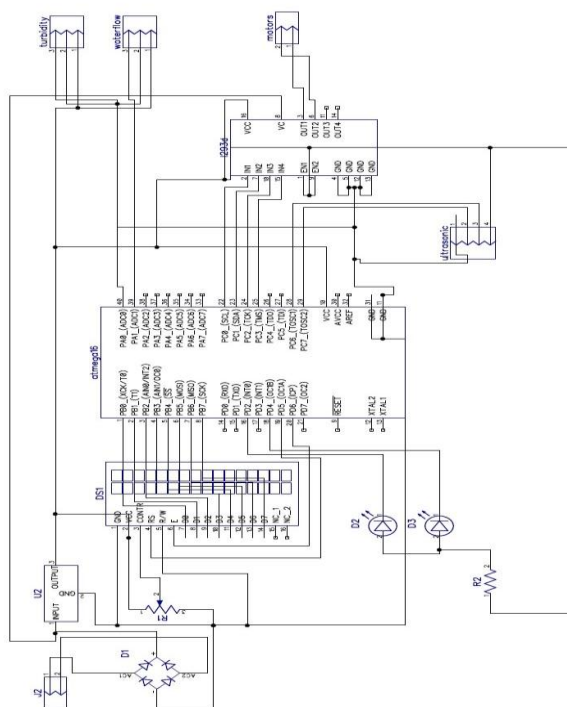


Fig: Circuit Diagram

III. SOFTWARE DESIGN

10.1 Atmel Studio 6

Atmel Studio 6 is the integrated development platform (IDP) for developing and debugging Atmel SMART ARM-based and Atmel AVR microcontroller (MCU) applications. Studio 6 supports all AVR and Atmel SMART MCUs. The Atmel Studio 6 IDP gives you a seamless and easy-to-use environment to write, build and debug your applications written in C/C++ or assembly code. It also connects seamlessly to Atmel debuggers and development kits.

As a Electronics student, I know that Atmel microcontrollers are intensively used in this field. A lot of tools for programming these devices are available, but many of them don't offer support for all of the microcontrollers from Atmel series. Atmel Studio is useful for both students and professionals, and offers a large variety of tools to help them develop and debug microcontroller applications.

This program is highly customizable. By accessing Options or Customize, you get access to a lot of setting options regarding the graphical user-interface or various program modules. Atmel Studio also includes many project templates which can be used for various purposes. They will save you precious time by automatically providing recurring portions of code that are present in multiple project files.

10.2 Diptrace

It is an advanced circuit design tool with support of multi-sheet and multi-level hierarchical schematics that delivers a number of features for visual and logical pin connections. Cross-module management ensures that principal circuits can be easily converted to PCB, back

annotated, or imported/exported from/to other EDA, CAD formats and net-lists. DipTrace Schematic has ERC Verification and Spice export for external simulation. Engineering tool for board design with smart manual routing, differential pairs, shape-based auto router, advanced verification, and wide import/export capabilities. Design requirements are defined by net classes, class-to-class rules, and detailed settings by object types for each class or layer. When routing with real-time DRC, the program reports errors on the fly before actually making them. DRC also checks length and phase tolerances for differential pairs. The board can be previewed in 3D and exported to STEP format for mechanical CAD modeling. Design Rule Check with in-depth detailing and Net Connectivity verification procedures are available.

This module includes real-time 3D preview & export feature. It shows the model of manufactured printed circuit board with all components installed. Rotate board in three axes, zoom in and out in real time, change colors of the board, copper areas, solder mask, silkscreen, and background. 3D preview works on all stages of the design. Board can be exported to STEP or VRML 2.0 formats for mechanical CAD modeling. More than 6500 3D models of PCB packages are supplied for free. Externally designed 3D models in *.wrl, *.step, *.iges, and *.3ds formats can be uploaded and attached to patterns in Pattern Editor or PCB Layout.

Features:-

- Simple UI
- Multi-sheet and hierarchical schematics
- High-speed shape-based autorouter
- Smart manual routing tools
- Differential pairs
- Wide import / export capabilities
- Advanced verifications with real-time DRC
- Real-time 3D PCB preview
- Export of PCB to STEP 3D file format
- ODB++ and Gerber manufacturing outputs

10.3 Algorithm

Algorithm for Automatic water control and quality measurement systems:

STEP 1: Start the program.

STEP 2: Initialize the LCD and display "Water Level: tr: flow: motor".

STEP 3: Initialize the motor.

STEP 4: Configure the relay and send status to the controller.

STEP 5: If the level of water is below certain value
Turn ON the relay.

STEP 6: If relay is turned ON the motor.

STEP 7: When the water level rises to desired level the relay turns OFF

STEP 8: Read the values of turbidity from the turbidity sensor

STEP 9: Read the values of the flow from the outlet of the water storage bucket.

STEP 10: Stop the program

IV. PCB DESIGN

PCB designing is the most important and requires great care during work. Because once PCB is designed, it is virtually impossible to alter it. While designing a circuit, designer should take care to avoid crossing of conducting paths (tracks) as possible. Crossovers are unavoidable then only of the jumper can be used. A circuit board carrying copper on both sides can also help to solve this problem when circuit is complicated.

PCB Making

When the master diagram probable twice the size of real PCB has been evolved, the text major step consists of etching or dissolving the unwanted metal from copper claded board to create the circuit as depicted by master diagram. It must be stressed that very accurate checking of master is essential at this stage. Then, the master point is mounted on a special frame on easy facing of a larger camera and with the aid of the very powerful illumination a master diagram is clearly photographed on a glass sensitive plate. This is developed to give photographic negative. In case of simple & need of number of less PCB, economic & advisable to use the following lab method of PCB making:

1. PLANNING THE CIRCUIT:

There are several important factors that need not be taken into account if the finished device is to work properly we must consider gain factor & ensure that the input & output parts are sufficiently well isolated to avoid the possibility. We are also to make sure that all components need to return to earth are properly connected & that possibility of common impedance arising in earth returned. Other factors that have to successfully studied include availability of adequate return points on board & its mounting from accessibility of switch connection made for mechanical fixing.

2. CLEANING THE BOARD:

The copper side of the board must be thoroughly cleaned before circuit plan is transferred to it. This is very important because even slightest trace of graze (from figure of instance) will impure the etching process & when the circuit plan has been neatly transferred to copper in this manner the board is held under, running tap & the allowed to dry before resist is applied.

3. TRANSFORMING THE PLAN:

Now, once cleaning is done plan has to transfer on copper surface of PCB material. A convenient way to do this is simply put a carbon paper between a copper surface of the board & working plan & carefully trace the lines of original plan with a ball pen.

4. RESIST:

Resist is nothing more than a substrate that is unaffected by presence etching chemicals. It is usually colored so that, it can be easily seen the copper surface. It is essential to resist through hardening before etching is started. Nail polished are better as they quickly & are less difficult to remove.

To overcome this drying effect & to the sharp edges of the trace on PCB, now-a-days etching taps along with IC pads are commonly used. To this, changes of short circulating due to paints are completely the avoid etching taps & pads are available in different sizes.

5. ETCHING:

Next comes etching of unwanted copper & whether a small single is all that required as quantity of board to be

produce certain precautions must be taken before operation is commenced the most use etchant I ferric chloride & to this is added small quantity of HCL to accelerate. Mixing 10 Grams of ferric Chloride & 25 grams of HCL with 15 grams of water can produced a good etchant.

6. AGITATION:

Small plastic bath is ideal for storing the etchant process. The depth of liquid must be sufficient to completely cover eliminates, the laminated board carrying the resist pattern circuit is then dropped into etchant bath gentle agitation takes 5 to 20 minutes to complete depending on the strength of the etchant temperature & thickness of copper foil.

7. FINISHING OFF:

When all unwanted copper is dissolved from areas between conductors, board should be taken from an etchant & washed in water. The resist must be removed using proper solvent. After this the copper surface must be polished with any kind of cleaner. It should be seen that there is no slight incomplete etching between the conducting paths of the PCB. The PCB's coated coating material for protection in lab coating material itself is a solder. This process is called Tinning. This process of coating involves tracks with solder. Advantages of tinning the effect of environment of conductors, then PCB is drilled i.e. holes for fillings & mounting the components on PCB are drilled with suitable drill bit.

8. ASSEMBLING OF PCB:

After the holes are drilled, the components have to be assembled on PCB before assembling the components it is necessary to clean soldering iron in order to get easy & accurate soldering. Removing impurity particles that are gathered on iron bit due to repetitive use clean soldering iron.

9. ARTWORK DESIGN:

According to the inter connections among different components, the concluding paths are drawn from component layout which will give shortest possible inter connections to avoid complexity of circuit. Selection of conductor width, thickness and spacing is done after analyzing their placement.

Coating Etching and Drilling

Proper protective coating is selected i.e. paint or plastic tapes can be used. The artwork mirror image is transferred on copper clad board. For most PCB applications, the dielectric base material is chosen e.g. Phenol resin impregnated paper. Acrylic polyester impregnated fiber glass cloth. Epoxy impregnated fibre glass cloth,

For these PCB is project, a paint is used for coating, after it is dried out, the etching is done with the help of FeCl₃ solution and small quantity of HCL is used as reagent. After sometime, we see Cu is removed from copper clad board except that Cu, which is painted. After cleaning the surface, the drilling is done with proper sized drill bit at required places for component mounting.

Component Layout

The layout of a PCB has to incorporate all the information on the board. The detailed circuit diagram is very important for the layout designer.

The following guidelines should be followed while making layout sketch.

The layout should be developed according to the direction of the signal flow to obtain shortest possible inter connections.

Among the components, larger ones are placed first and the space in between is filled with smaller ones. Component requiring input/output connections corner near the connectors.

Layout is designed by dividing the circuit into functional sub units. This will enable a faster testing and servicing of the board.

Layout of conductor pattern should be taken care of from cross talk leakage, shielding number of jumpers required and their placement etc.

Component Mounting

Before mounting any component, examine the PCB carefully for any cracks or other defects in the conducting paths. Components are checked again inserted in the holes on PCB carefully cut the leads of components so that above 3 mm of the end extends beyond the wiring side of the PCB. The ends of the leads are then bent at right angle to make contact with surface to which it is to be soldered.

Soldering

A light duty soldering iron is used to prevent damage to the printed circuit wiring by excessive heat. Excessive solder should not be used to avoid solder flowing to adjacent conducting paths may cause short circuit.

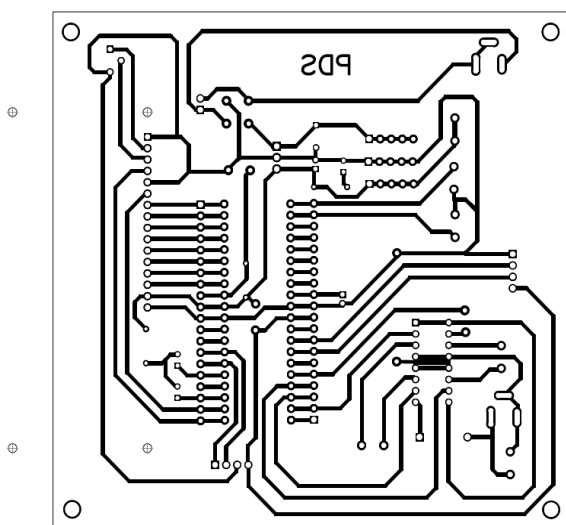


Fig. AVR Board

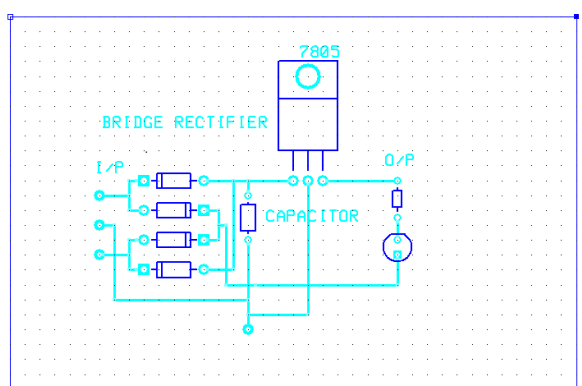


Fig. Power Supply PCB

V. RESULT AND ANALYSIS

Various tests on automatic water level controller and quality measurement have been carried out. Energy meter and GSM have been carried out. The system successfully turns ON/OFF the relay and motor and the reading from the turbidity sensor and the flow sensor are displayed on the LCD.



Fig. Display of Results

Flow measurement and water quality Testing Procedure:

1. Connect the controller to the power source.
2. Check the led if the led turns green the working of the relay.
3. Note the readings on the LCD display.
4. Turn on the power to the Motor.
5. The status of the Motor is displayed on the LCD screen.
6. Once the storage tank fills note the amount of water.
7. Turn off the motor.
8. Open the tap and empty the water in the tank to a bucket and measure the flow of the water that will be displayed on the LCD screen.



Fig. Images of hardware

VI. ADVANTAGES & APPLICATIONS

Advantages

1. Reduce the manual work
2. High accuracy
3. Low cost
4. Reliable
5. Reduces man power required.

Applications

- Useful for residential purpose
- Industrial applications.

VII. CONCLUSION

The automatic motor control provides a solution for effective management of water resource and at the same time providing real time data about water quality which can be used as a reference for quantitative measurement of water quality. This project enables industrial applications to manage water quality which can be a major issue during water crisis and the quality of water can be measured for critical applications.

VIII. REFERENCES

- 1.Real-Time Water Level Visualization with Pervasive IC Sensors Osamu Saitou; Yuji Kuwahara; Michitoshi Niibori; Masaru Kamada 2013 16th International Conference on Network-Based Information Systems Year: 2013
- 2.Towards an IoT based water management system for a campus Prachet Verma; Akshay Kumar; Nihesh Rathod; Pratik Jain; S. Mallikarjun;Renu Subramanian; Bharadwaj Amrutur; M. S. Mohan Kumar; Rajesh Sundaresan 2015 IEEE First International Smart Cities Conference (ISC2) Year: 2015 Pages: 1 - 6, DOI: 10.1109/ISC2.2015.7366152
- 3.A Fluidic Colorimetric Sensor Design for Water Hardness Detection Tonmoy Bhattacharjee; Hongrui Jiang; Nader Behdad IEEE Sensors Journal Year: 2015, Volume: 15, Issue: 2 Pages: 819 - 826, DOI: 10.1109/JSEN.2014.2351813
- 4.Pressure sensor for monitoring of distribution points of district utilities for heat and water
- 5.Andrei Drumea; Ioana Ilie; Paul Svasta 2009 32nd International Spring Seminar on Electronics Technology Year: 2009 Pages: 1 - 4, DOI: 10.1109/ISSE.2009.5207012 Cited by: Papers (1)
- 6.<http://ww1.microchip.com/downloads/en/DeviceDoc/39881D.pdf>
- 7.http://www.digikey.com/Web%20Export/Supplier%20Content/Meder_374/PDF/MEDER_Reed%20RelaysSwitchingLowMicrovoltsSignals.pdf
- 8.<http://www.orcad.com/buy/try-orcad-for-free>
- 9.<http://www.keithley.nl/products/dcac/sensitive/highresistance>