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# IoT Based Water Pump Controller for Apartments: A Survey

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***Abstract***-*Modern technology largely depends on automation and control system. Automation and control system refers to the use of various control systems for operating equipment's such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft, automobile and other applications with minimal or reduced human intervention. The greatest advantage of automation and control system is that it saves labour. A water level indicator system is a device that indicates the level of water in a tank or reservoir. It is widely used in industrial applications such as boilers in nuclear power plants and residential applications. The drawbacks in the existing systems of such application is the use of older technology for data transmission and monitoring. The project is to design a water level indicator with automatic water pump actuation. Water level sensor has been made to apprehend water level properly. Microcontroller is engaged to restrain the overall system accurately that reduces the control complexity. Two water level sensors monitor the water level of both the ground-level water reservoir and the rooftop residential water tank. The turning on and off of the pump is decided based on the upper and lower limits of the tank set by the user. This paper is based on the literature survey and the drawbacks of the existing systems.*

***Keywords-*** *automation, control system, pump controlling system, water pump, water level sensors, Arduino, IoT, Apartments.*

## I. INTRODUCTION

Water is an important aspect of life. Basic needs of every creature on this planet are food, water and shelter. In India, agriculture is the primary occupation of most of the people. The first pump invented by mankind was called Shadoof. It was a simple mechanism in which a clay pot was attached to collect water on one end and the other end was pulled by a person. Both the ends were connected on a wooden stick. It was used by Greek people to draw water from the Nile river. Later on, there were many scientific inventions in the areas of water pump and are today water pumps in various configurations depending on the type of supply needed, amount of water lifting capacity, etc.

In olden days, traditionally water used to be drawn from the wells with the help of a pair of bullocks. In farms, water is either drawn from wells or from water ponds which acts as a water reservoir. In order to draw water from either of them, a water pump is required to lift the water so that it can be used for irrigation. In order to turn on the pump, a person has to be physically present near the pump where the starter is located in order to press the button which in turn starts the motor. Same goes in the case of turning off of the water pump. A farmer with a smaller of piece of land can frequently travel to the pump station but in the case of a large piece of land, a lot of energy as well as time is wasted in making frequent trips to the pumping station just to turn it on and off. This wastes ample amount of time which can be utilized elsewhere for doing some fruitful work.

In industries which deal with chemicals, toxic liquid or the nuclear power plants which deal with very hazardous liquids which may be life-threatening if came in contact with, it is very difficult to monitor the liquids in the tanks without actually coming in contact with them. People working in such hazardous environment need to be c. In residential apartments or homes, turning on the pump, waiting till the tank is filled completely and then turning it off precisely in order to avoid water wastage can be a tedious job and it also wastes some time. The solution to all such problems can be an automatic water pump controller system which can be configured according to the user's requirement and is also scalable.

This paper gives a survey of water automation for water pump controller using android application. The remainder of the paper is organized as follows. Section II is about the literature review. The system of water automation of water pump controller using android application is given in Section III. The advantages of the proposed system are given in Section IV. Finally, the paper concludes in Section V.

## II. LITERATURE REVIEW

The literature review contains the brief discussion of some works of water automation for water pump controller system through android application.

*[a] Journal Paper survey:*

A model of variable rate microcontroller based automated irrigation system has been proposed in paper[1] named Automated Irrigation System Using Solar Power byJia Uddin, S.M. Taslim Reza. Solar power has used as the only source of power to control the entire process. Without visiting the agricultural land, farmers can find the information about the moisture level. Farmers can control the water pump based on the moisture level by sending a message from his/her cellular phone. Even when the farmers are away, the automated irrigation system always confirms the exact level of water in the agricultural lands.

In paper[2]S.Gowri, Pola Pranathi, Kodali Sravya proposes a water monitoring system by using An Automatic Overflow Control Circuit Unit. The proposal is designed from the perspective of monitoring the flow of water into the tanks automatically and from the perspective of setting as per the user demands using a Mobile Application. The advantages of the system are the conservation of water resource, reduction of the manual attempt, and time to time changes over the situation of water storage with the help of sensors.

A basic model of the android application is proposed in paper[3] Android Based Smart Water Pump Controller With Water Level Detection Techniqueby Souvik Paul, Mousumi Das, Anik Sau , Soumyadeep Patra which states that water pumps can be switched ON and OFF with the assistance of radio transmitters and Wi-Fi router. The wastage of water and the wastage of electricity can be avoided by this system. Users can check the water level of the tank and turn the pump ON and OFF from remotely using the android application.

In model[4] by Mazharul Islam Nayeem, Mahfida Amjad named Water Automation for Water Pump Controller using Android Application, the water level of water tank can be checked using android application. If water needs in water tanks, users can turn ON the water pump via an android application. Then they can turn OFF the water pump after reaching enough water in the tank. The advantage of the system is that it reduces human efforts and time. The disadvantage of the system is if the internet becomes slow the communication will also be slow.

Automated Water Management System (WMS)[5], is an automated system for water management to make daily life easy and efficient through the use of mobile application by Rakib Ahemed, Mahfida Amjad. It can control water distribution and take action for any current situation which created in the water tank according to the water surface by using sensors and data results. WMS is providing a system which can observe water tank and take action if water surface is high or low, it can auto generate to on/off motor and also if any user wants to change water temperature then he/she can also do it. When a user used his/her maximum rate of water then it must be cut off his/her line automatically. By using mobile messaging user get notifications before cut off his/her line and also show how much water he/she already used.

After studying the various papers, we came across certain limitation of the existing systems such as Bluetooth ranging issue, internet connectivity issue, power consumption, speed of operation, cost, etc. These issue have to be overcome in our working model and hence advanced technology has to be used. Implementation of several combinations can give the speedy and efficient outputs.

*[b] Patent survey:*

In patent[1] by John J. Fong (US 6,607,360 B2), the invention is a Constant-Pressure Pump Controller System for maintaining a Substantially uniform dis charge pressure of liquid output from a pump operated by an electric motor and where liquid is to be delivered to a plurality of Simultaneously-operating downstream outlets. In patent[2] titled (US 6,534,947 B2) Pump Controller by Steven A. Johnson and Kip M. Larson, the method includes the acts of providing an AC power Signal having a positive half cycle and a negative half cycle, measuring the Voltage of the AC power Signal and generating a first two-state output signal that is in a logic high State when the measured Voltage is on the positive half cycle and vice versa.

In patent[3] (4,676,914) Microprocessor Based Pump Controller for Back Washable Filter by Donald E. Mills, Rodger J. Grys, the present invention relates to electrical apparatus controllers for controlling fluid pumps or the like. It finds particular application in the cyclic control of fluid circulating pumps, such as the pumps for circulating water through swimming pool filter systems.

*[c] Market Survey:*

Water Pump Controllers available in the market are mostly ranging from Rs. 1500/- to Rs. 45000/- approximately.They are either manually or automatically operated.Water Pump Controllers works with various technologies like Wifi, Bluetooth, GSM, etc.They are used for tanks and irrigation purpose either for agriculture or household. Some are powered with conventional supply while some uses solar panels.

| Paramet ers | Manual Water Pump Controller | Automatic Water Pump Controller |
|---|---|---|

| Mode of Operatio n | Manual | Automatic |
|---|---|---|
| Controll er used | None | PIC,8051,Atmega 328P |
| Technol ogy used | Push Button | GSM, Zigbee, Bluetooth, IoT |
| Mainten ance | High | Low |
| Cost | Cheaper | Moderate |
| Image |  |  |

## III. METHODOLOGY

According to the above survey we came across various limitations of the existing systems and arrived at the conclusion that a system should be automated, cost effective and efficient, also it should be independent of human efforts. The design proposed in this section focuses mainly on controlling the water pump with android application &Internet of Things (IoT) from remote place. The proposed model works on a hybrid power supply i.e.in absence of the MSEB supply the system will switch to battery so that system will work without interference. The design consists of Arduino Uno, Node MCU, DC Water Pump, Switch, Relay, Ultrasonic Sensors and power supply unit. The system works on hybrid power supply where microcontroller is engaged with the overall working of the system. It takes input through the sensor unit that senses the water level. After taking input, output intends the pump's action (on/off) with respect to current water status of the tank. The water levels in the tanks are continuously monitored and regularly updated on the Cloud Server via. NodeMCU, which inturn displays them on the Android App on the condition NodeMCU must be provided with an internet connection to update the Cloud server. The device also monitors the state of level of water whether it is stable, increasing or decreasing with what velocity.

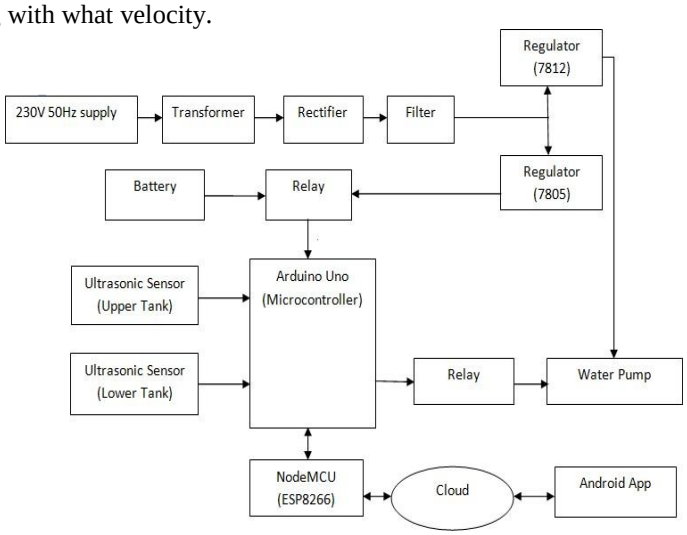


**Fig 1:** Block diagram of Proposed System

It also keeps monitoring whether the pumping is working well or not. If the level is increasing or decreasing every minute, then the indicator shows the motor pump is working well else after three minutes if the level remains stable then it shows there is a problem in the motor. Thus it also monitors the working performance of the pump. The Android App displays the status of the pump, whether it is on or off. It allows the user to set a value of the level of the tank falling below which the pump is actuated to increase the level to the required level. There are two modes of selection i.e. auto and manual. To set the device in the auto mode, the user needs to set a value of the level of the tank. If the water level falls below this level, the pump is actuated to drive the water and increase the water level in the tank to the required level. User will get a notification indicating that the water level in the tank has fallen below the preset value and the pump has been turned on. After the water level in the tank is maintained to the required level, the pump will turn off and the user will be

notified about the same. In manual mode, user has the control of switching of the pump. Just by a click on the button of the app, the pump will turn on or off.

## IV. ADVANTAGES OF THE SYSTEM

*Power Saver*: Living in an age where we need to be more conscious of the energy that we use, a water level controller is ideal at saving power. Normally, regulating water levels can consume electricity and wastewater. However, with automatic controllers, the electricity usage is limited as well as less water needed to regulate supply. *Cost Effective*: A water level controller helps save money by limiting the waste of water and electricity. These devices accurately regulate how much energy is used to protect against any unnecessary water/electricity usage. Over time, the money saved is quite substantial.

*Automatic*: Another notable advantage with these devices is that they regulate on their own. Eliminating manual operations with a timer switch, the frustrations of manual monitoring water tanks are minimized. Water levels are maintained at the appropriate levels thanks to the automatic operations of these devices.

*Water Maximization*: On average, water pumps are used more during midday. A water level controller can maximize the water usage provided during midday while automatically lessening the water usage at night. This results in an appropriate level of water at all times being maintained, while providing you with the maximum use of your water at the appropriate times.

*Reliable Electronic Design*: Addressing the durability problems found in earlier designs, the solid-state electronics in the newer models help to eliminate them. Not only do they help to eliminate the durability issues, but they also create considerable savings of the life span of the unit with an advanced modular design. In order to minimize problem areas of these designs, the only moving parts are the relays. These relays are easily replaced and tested by any skilled operator or electrician while being an inexpensive part.

## V. CONCLUSION

After carrying out the literature survey and patent survey based on the idea of our project, we came across various factors like technologies used, source of power supply used, etc. which showed us the areas which we could work on thereby making an overall project with less design complexity, simple user interface( in terms of Android App ) and low cost. The proposed system will reduce the time which gets wasted in terms of turning ON and OFF the water pump, waiting till the tank gets filled, by deploying an automatic system which eliminates the water wastage and requires a very little or no human interference. The use of a battery backup is an added advantage which will be really helpful in event of power failure. Real time data of the system can be seen on the App and also the system can be operated from anywhere in the world. A simplified structure with very less no. of components being used reduces the circuit complexity. This makes the system more economical and also easy in terms of maintenance.

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