OPTIMIZED WATER PUMPING SYSTEM USING ARDUINO FOR HOME AUTOMATION

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ABSTRACT
Water supply is of high importance to every home in this world, especially apartments with multistory which requires water in huge quantity to supply for each rooms. In Chennai, southern part of India summer seasons are at its peak bringing draught and all the water levels in well and underground bores tend to dry up, whatever water left underground are pumped by apartments and houses. The main drawback is that water is pumped in the morning by people for their daily routines, also these pumping happens between 6 AM to 9AM. Automatic pump controllers available in market tends to pumps water whenever water level hits bottom of reservoir and it is capable of controlling one pump only. After full utilization of underground water the people tend to buy water in tankers and fill in reservoir/ well.

To eradicate this water scarcity issue and feed water to an apartment with 7 rooms. A novel method and a control system is developed. As per water tables underground, one can find more than one water tunnel crossing under constructed location, so 2 bore-wells are dwelled and 1HP pump has been fixed on both the dwelled locations. A sump/reservoir with capacity to hold 100 liter dug underground
for preserving the water and one 1HP motor to pump water up to rooms. The commercially available Arduino UNO controller is chosen and programmed to control the setup. This setup has crossed two summer seasons and the apartment has not faced any water scarcity at any part of the season.

**Keywords:** Arduino controller, Automatic pump controller, contactor controller, optimized water usage, Pump on off.

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1. **INTRODUCTION**

In Chennai, India, summers are pretty hot and tend to dry up all the lakes as well, causing inconvenience to the residences. At times people tend to buy water in tankers and preserve it in reservoirs for further utilization. To overcome this government has insisted every house owners to setup rain water harvesting systems, still this has not fully eradicated the issue [2]. From the underground water tables [3] it is understandable that in a location or under a house we can find more than one water table running by, in traditional methods dowsing technique is utilized to find the presence of water table, still it does not specify the consistent of water available in that location all over the year.

Another issue is to fill the water into the reservoirs/ tank, manual switch on / off of pump is the conventional method. But in nowadays market automatic controllers are also available to fill the tank once the water level hits the bottom of tank, thus switching on the pump until water level rises as required [1]. One of the disadvantages of this controller is that, it can handle only one motor and to control two or more than one system with asynchronous control has to be laid. To overcome both the issues of water level of underground and control of more than one pump is addressed in this paper.

2. **EXPERIMENTAL SETUP**

2.1. **Suggested pump layout**

As discussed earlier, the underground water tables are more than one in an acre of land. So it is suggested to dig up more than one bore or well in the area to connect different under water tables. In our current work two underwater tables are fond and dug with help of a bore system and two 1 Hp pumps are connected to each of the bore to pump the water. Also along with the tank system which is usually in terrace of the building, an underground sump with 100 liters is constructed to collect the pumped water from both the bore pumps. To pump the water from sump to tank one ore 1 Hp motor is placed. The schematic of the setup is shown in Figure 1.
2.2 Experimental design

The concept suggested begins with pumping water from underground in specific timing especially at night times from both the pumps connected to underground bore and specific time to take it up to tank for usage by the rooms as in Table 1, these timings are followed to optimally utilize ground water only during night time. Also it is noted that every other house and apartments tend to pump in water in the early morning, which dries up the water table at a time. If a consecutive timing is followed by every apartment then the water can be more optimally utilized.

<table>
<thead>
<tr>
<th>Pumps</th>
<th>Timing 1</th>
<th>Timing 2</th>
<th>Timing 3</th>
<th>Timing 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underground Bore Pump1</td>
<td>11:00 PM – 11:10 PM</td>
<td>1:00 AM – 1:10 AM</td>
<td>3:00 AM – 3:10 AM</td>
<td>12:00 PM – 12:10 PM</td>
</tr>
<tr>
<td>Underground Bore Pump2</td>
<td>12:00 AM – 12:10 AM</td>
<td>2:00 AM – 2:10 AM</td>
<td>4:00 AM – 4:10 AM</td>
<td>1:00 PM – 1:10 PM</td>
</tr>
<tr>
<td>Tank Pump</td>
<td>5:00 AM – 5:10 AM</td>
<td>5:30 AM – 5:40 AM</td>
<td>3:00 PM – 3:10 PM</td>
<td>6:00 PM – 6:10 PM</td>
</tr>
</tbody>
</table>

Table 1 Pump control timings

The control hardware utilizes Arduino UNO due to its durability for longer time among other microcontrollers, apart from basic controlling there is a need of feedback device to run the system 100% automatic. A water flow meter is implemented in every pipeline, from the output line of pumps. This is carried out to understand if the motor is dry running and to understand the water level underground. In the sump and overhead tank float level meter with different height levels are attached to understand the water level and stop overflowing of tank, thus saving each drop of water from getting wasted. To control the motor with Arduino high
power manageable contactors are utilized which run in 20V, since microcontroller send out only 5V it is mandatory to have a 5 to 20V relay. The whole setup is shown in Fig 2.

![Schematic of controller](image)

**Figure 2** Schematic of controller

### 2.3 Program flow control
From the sensors available the program flow control comprises of multiple scenarios to take care while switching on pump.

- Current time is between the prescribed time gap
- Tank or sump water level less than the overflow limit
- Continues pump running only if flow rate is above zero else stop and switch on alarm

These conditions make sure that the program run on time and any disturbance like full tank or dry run detected the pump stops running. These data are stored and as addition it can be later retrieved to understand the water level during different seasons and usage of water by different set of people in apartments.

### 3. CONCLUSION

![Installed automatic water controller setup](image)

**Figure 4** Installed automatic water controller setup
The setup is installed in an apartment with 3 store building with 7 rooms in it as Fig 4. The system is successfully running with less maintenance of the system due to the durable components utilized, the price was rounded to Rs.8000 for establishing the whole setup. It is also fund during summer season, this system with optimal pumping time was able to manage with available water resources. Also it is predicted if the system is established around the locality, a specific timing of pumping can be provided and every apartment and houses shall have water for their day today use.

4. REFERENCES