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Automated Water Flow Control System in Overhead Tanks Using Internet of Things and Mobile Application

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Abstract Basically, automation in systems would help to reduce wastage of precious natural resources in various ways, wherein prevention of wastage of water resource to control the water tanks from overflow is crucial. In this automated world, the handling of any kind of devices with comfort is made to be the easiest factor everywhere. However, the overflow and underflow sensors and mobile application should be reliable so that the consumer can rely on this system. Automated water flow control system in overhead tanks using Internet of Things and mobile application uses reliable sensors and mobile application. The application is developed after testing various sensors and finding the best basing on the cost and work efficiency. The mobile application includes features that are not existing such as automated control of tank based on water level selected by user. For this case, three levels are proposed minimum, medium, high. The consumer can change his preference any time. This reduces the water stagnancy for long time. Hence, the proposed methodology has advantages over existing system in saving more water.

Keywords Overflow and underflow sensors · Automated water flow control system in overhead tanks (AWOT) · Internet of Things · Mobile application

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1 Introduction

A huge amount of water is being wasted because of uncontrolled use and exploitation of water resource. Some other automated water level monitoring systems are also present, but so far most of the methods have some shortcomings in practice. Many times people depend on borewells or municipal water which is usually diverted to a sump. Here, the consumer is worried about switching on the motor when he is at work or needs to go out of station. This issue multiplies for apartment maintenance team [1, 2].

Usually, this controlling requires continuous man intervention and monitoring. Power is wasted if motor is running continuously though tank is overflowing. Maintenance cost is very high. Hence, the operation is difficult. Nowadays, most of the people in urban areas are working, and they have less time to think about switching on/off the pumps. Hence, an automated system is required to continuously monitor the water levels of overhead tank and switch on automatically. This helps not only the public but also the health of motor and working condition. The system should be complex and should be protected from attacks. This should be reliable as the people's dependency increases and should not lose faith on the system [3].

There are other issues like power problems which are to be checked by user before switching on the motor that are common in summer. Here, user, either for individual house, group house, or apartment water tank controlling is a major issue. Many times the user need to go to roof top to check water levels. Small tools and sensors are used for controlling overhead tank level, and alarm systems to indicate overflow conditions are all feasible only if the consumer is at location. Water tank controlling in offices, institutes, and industries are also crucial. Hence, a system is required for effectively using this water and avoid wastage and stagnancy [4, 5].

2 Automated Water Flow Control System in Overhead Tanks (AWOT)

AWOT brings in technology into the house by mechanizing of household requirements, which make the work of water storage system much easier and convenient over handling. The overall system has a great impact in the prevention of water wastage more effective than the manual work. The objectives of the AWOT are listed as follows.

- Switching on or off the motor from anywhere over mobile.
- Check the overflow and underflow levels of water and automatically switch on/off the motor.
- Periodically update the tank water level and user can view a graphical image of overhead tank with water level in his mobile.
- Set the levels in the tank from 1 to 4, where user can set maximum level depending on usage in order to avoid water wastage.

- Generate the monthly report utilization of motor, water, and power consumption.

2.1 Architecture of AWOT

The main components of AWOT are mobile app, IOT kit, server. These components can be fitted to the regular water tank setup, and control can be automated without any additional cost.

1. Mobile app—Mobile app is developed for user to check periodic notifications. The best feature of AWOT compared to existing systems is user which can set the water level basing on his requirement for the particular day. This allows the user to use fresh ground water all the time.
2. IOT kit—Various sensors are tested, and finally, magnetic sensors are used as they are good in detecting the water level to the best. The sensors are fixed at various levels as per the choice of the user. Here, this is fixed to 30%, 60%, and 100%.
3. Server—Here, server stores all the data, and monthly or daily usage reports can be generated using the information obtained from server.

The architecture diagram is as shown in Fig. 1.
The pseudocode for the functioning of AWOT is as follows

1. The system periodically checks if water tank is empty. Then, notification is given to consumer, and motor is switched on automatically.
2. If the consumer is out of station and he doesn't want tank to be filled, then he can switch off setting timer. Consumer can set three water levels depending on
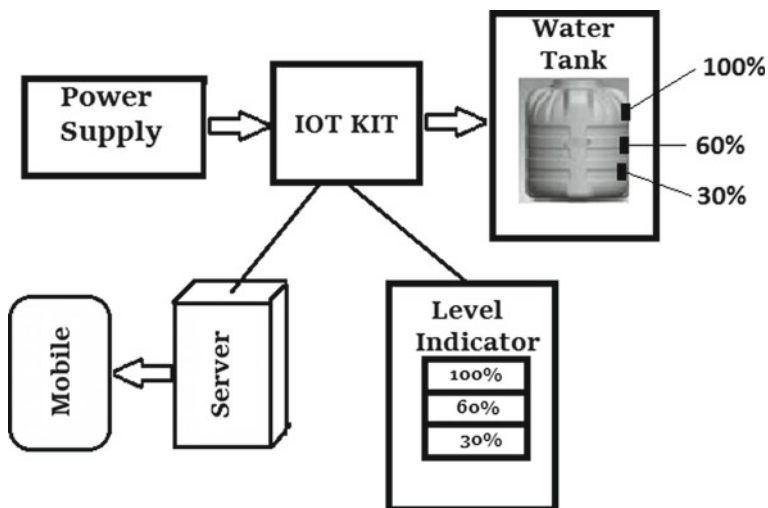

Fig. 1 Architecture diagram of AWOT

usage which indicates 30, 60, 100% of tank. This can be changed whenever user requirement changes.

3. If the water reaches the overflow condition, then the motor is switched off automatically. This is the water level chosen by the user.
4. Send notification to consumer directly by the app on any failure conditions.

The most important merits of the system are:

- The conservation of water resource.
- Manual effort reduction.
- Set water level basing on utilization.
- Time to time alters over the status water storage.

3 Results and Discussion

The AWOT system can be used in any areas from individual houses to huge apartment as an automated water controlling system. This can be used in water controlling basing on utilization that saves both power and water. The system is tested and is found reliable (Table 1).

3.1 Experimental Setup of AWOT

The components required in developing AWOT are NodeMCU, relay, resistors, voltage regulator, diode, floating switch, submersible pump. The main hardware components used in developing AWOT prototype are shown in Fig. 2.

NodeMCU has wi-fi module, USB, headers, power pins, reset, and flash buttons. It needs power of 5 V by the USB port. This is used to build IOT-based projects. Relay acts as switch, voltage regulator, diode are used for supporting NodeMCU. Floating switch is used to find the water levels in overhead tanks and send the data

Table 1 Comparison of manual system and AWOT system

Should run under human supervision. Requires a lot of manpower for huge systems	Fully automated system needs very less human intervention
Maintenance is high	Low maintenance
Power consumption is more	Power consumption is less
Motor wear and tear is more	Motor wear and tear is less
Continuous monitoring is required	Less monitoring is required
Overfilling results in water wastage	Water wastage is less
Does not depend on Internet	Requires Internet facility
Motor control and tank filling are difficult	Automated motor control and tank filling

Floating Switch
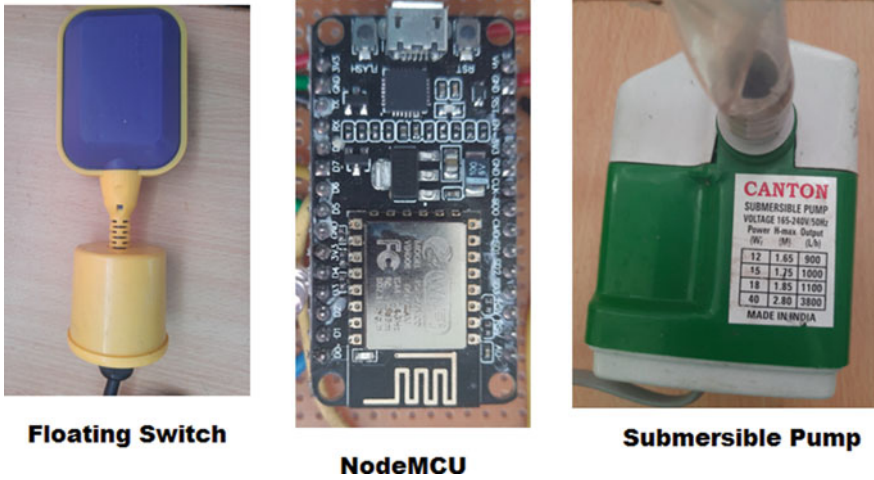
NodeMCU

Submersible Pump

Fig. 2 Main hardware components of AWOT prototype

to Node MCU. Submersible pump is switched on/off basing on specified conditions of water levels. The prototype of AWOT is shown in Fig. 3.

The green bucket is used to represent borewell and blue buckets to represent overhead tanks. The floating switch is placed in green bucket to find the water underflow

Fig. 3 Prototype of AWOT

condition and switch off motor automatically. The floating switches placed in blue buckets check the medium and high conditions and switch of automatically when the tank is in overflow condition. The level of water in the tank is displayed on the mobile app and the user can control the pump from anywhere basing on the utilization. This reduces water wastage and stagnance. The same concept can be implemented to check the water levels in borewell which increases the life of pump [6].

4　Conclusion

The AWOT system can be used in any areas from individual houses to huge apartment complex as an automated water controlling system. This is economical and can be used by any category of people as it is budget friendly. The system is utilized by numerous applications related to home, agriculture, industries. This can be used in water controlling basing on utilization that saves both power and water. The future scope of study involves quality testing of water and water management in industries.

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