Innovative Journal for Opportunities and Development in Science & Technology,
Volume 6, Issue 7, June. 2026
Paper Id: – IJ2025V6I7 -3 A-D
ISSN 2582-6026

AUTOMATIC WATER LEVEL DETECTION AND AC 1 HP MOTOR CONTROL SYSTEM

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ABSTRACT- Due to the inherent limits of traditional manual pumping systems, water management in residential, commercial, agricultural, and industrial sectors poses substantial operational issues. Conventional methods often result in tank overflow, water waste, excessive power consumption, and motor damage due to dry-running circumstances since they require constant human supervision for tank level monitoring and pump motor switching. An Automatic Water Level Detection and AC 1 HP Motor Control System is suggested and put into use to overcome these issues. This system's goal is to automatically and continually monitor water levels in above and subterranean tanks. operate a 1 HP AC water pump motor without the need for human assistance. In order to avoid overflow and provide dry-run protection, the system uses water level sensors interfaced with a control unit that initiates motor ON/OFF operations depending on predetermined threshold circumstances. Reliable motor actuation is guaranteed by relay-based switching logic, and real-time, closed-loop operation is supported by the whole design. By only running the motor when necessary, the implemented system successfully removes the need for human monitoring, lowers wasteful power consumption, and increases the pump motor's operational lifespan through condition-based management. The solution is a useful addition to contemporary automation as it is affordable, scalable, and adaptable to smart homes, apartments, hospitals, businesses, and agricultural settings.

Keywords: Water management automation, dry-run protection, overflow avoidance, AC motor control, automatic water level control,

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I. INTRODUCTION

Water is a vital resource for industrial, commercial, agricultural, and residential uses. Water is kept in subterranean reservoirs and above tanks in many buildings and businesses. Electric water pumps are often used to move water from the lower tank to the upper tank. The manual monitoring and operation of conventional pumping systems can lead to water overflow, dry running of pumps, water waste, and higher power usage.An **Automatic Water Level Detection and AC 1 HP Motor Control System** is created to address these issues. Conductive water level sensors are used by the system to continually check the water levels in the higher and lower tanks. When the water level is recognized, the controller automatically controller activates the motor and starts pumping water from the lower tank to the upper tank. As soon as the upper tank reaches the maximum level, the controller switches off the motor automatically, preventing overflow. Additionally, the system includes a dry-run protection feature that stops the motor when insufficient water is available in the lower tank, thereby protecting the pump from damage.The project utilizes a water level controller unit, relay-based motor control circuit, sensor probes, indicator LEDs, and a power supply section. The controller provides real-time indication of tank conditions such as tank empty, low level, middle level, high level, motor running status, and dry-run condition.The implementation of this system offers several advantages, including efficient water management, reduced manpower, prevention of water wastage, energy conservation, and increased lifespan of the water pump. Due to its reliability and low maintenance requirements, the system can be effectively used in residential buildings, apartments, schools, hospitals, industries, hotels, and agricultural water storage facilities.

The Automatic Water Level Detection and AC 1 HP Motor Control System is a practical and cost-effective solution for modern water management applications, ensuring efficient utilization of water resources while providing safe and automatic pump operation.

1.1 PROBLEM STATEMENT

In the commercial, industrial, residential, and agricultural sectors, water management is a significant concern. Water overflow, water resource waste, excessive power consumption, and pump motor damage from dry-running situations are common outcomes of conventional water pumping systems, which often need manual monitoring and operation. The procedure is laborious and ineffective as users have to manually turn the motor on and off and check tank levels on a regular basis.

Because the motor is frequently not turned off at the proper moment, the overhead tank may overflow. Similar to this, the pump may continue to run without water when the subterranean tank or water source runs out, which could lead to overheating and shorten the motor's lifespan. These problems result in higher maintenance expenses, wasteful electricity

use, and ineffective water use.Therefore, there is a need for an automated system that can continuously monitor water levels, automatically control the operation of a 1 HP AC water pump motor, prevent tank overflow, provide dry-run protection, and ensure efficient water utilization with minimal human intervention. The proposed Automatic Water Level Detection and AC 1 HP Motor Control System addresses these challenges by providing a reliable, cost-effective, and efficient solution for automatic water level monitoring and pump control.

1.2 OBJECTIVES OF THE PROJECT

The main objective of the **Automatic Water Level Detection and AC 1 HP Motor Control System** is to develop an efficient and reliable system for automatic monitoring of water levels and automatic control of the water pump motor. The system aims to reduce water wastage, save electrical energy, and minimize human intervention in water management operations.

General Objective

To design and implement an automatic water level detection and motor control system that maintains the required water level in storage tanks while ensuring safe and efficient operation of a 1 HP AC water pump motor.

1. To Automatically Track Water Levels
   Use sensor probes to measure the water levels in subterranean and overhanging tanks.
2. To Automatically Manage the Water Pump
   Depending on the water level, turn on and off the 1 HP AC motor.
3. To Avoid Water Overflow
   When the above tank reaches its maximum level, the motor will automatically turn off.
4. To Offer Protection During Dry Run
   When there is not enough water in the bottom tank, turn off the motor.
5. To Cut Down on Water Wastage o Make sure that water resources are used effectively and conserved.
6. To Conserve Electricity
   Reduce electricity usage by only using the motor when necessary.To Reduce Human Intervention
   Eliminate the need for continuous manual monitoring and motor operation.
7. To Improve Pump Safety
   Protect the motor from damage caused by dry running and improper operation.
8. To Increase Pump Life
   Enhance the operational lifespan of the water pump through automatic control.

9. To Provide Status Indication
   Display tank water levels and motor operating status using indicator LEDs.
10. To Develop a Reliable Water Management System
    Ensure consistent and uninterrupted water supply through automation.

II. LITERATURE SURVEY

The development of automatic water level monitoring and pump control systems has gained significant attention due to increasing water conservation requirements and the need for efficient resource management. Various researchers have proposed different techniques and technologies to automate water tank monitoring and motor control operations. The following literature survey summarizes the major developments related to water level detection and automatic pump control systems.

Paper 1: Automatic Water Level Controller Using Conductive Sensors

Researchers developed an automatic water level controller that uses conductive probes to detect water levels in storage tanks. The system automatically starts and stops the water pump based on predefined water levels. The proposed method reduced water wastage and minimized human intervention. However, the system was limited to small-scale applications and required proper maintenance of sensor electrodes.

Paper 2: Microcontroller-Based Water Level Monitoring System

This study introduced a microcontroller-based water level monitoring system that continuously measures water levels and controls water pumps automatically. The system utilized sensors, display units, and relay modules for pump operation. Results showed improved accuracy and efficient water utilization. The research demonstrated the effectiveness of embedded systems in water management applications.

Paper 3: IoT-Based Smart Water Tank Monitoring System

Researchers proposed an Internet of Things (IoT) based water tank monitoring solution that allows users to monitor tank levels remotely through mobile applications and cloud platforms. Real-time notifications were generated whenever water levels crossed predefined thresholds. The system improved accessibility and monitoring efficiency but required continuous internet connectivity.

Paper 4: Wireless Water Level Detection and Pump Automation

This research focused on wireless communication technologies for water level monitoring. Sensors installed at water tanks transmitted level information wirelessly to the control unit.

Automatic pump control was achieved without extensive wiring. The system provided flexibility in installation and reduced maintenance costs associated with wired networks.

Paper 5: Dry Run Protection System for Water Pumps

The study emphasized the importance of dry-run protection in pump control systems. A sensor-based mechanism was developed to detect insufficient water conditions and automatically stop the pump motor. Experimental results indicated that the system effectively prevented motor overheating and significantly increased pump lifespan.

Paper 6: PLC-Based Water Level Control System

Researchers implemented a Programmable Logic Controller (PLC) for water level monitoring and pump automation. The PLC continuously monitored sensor inputs and controlled the motor according to programmed logic. The system offered high reliability, fast response time, and suitability for industrial applications, although the implementation cost was relatively high.

III. METHODOLOGY

In addition to controlling the operation of a 1 HP AC water pump motor, the proposed Automatic Water Level Detection and AC 1 HP Motor Control System is intended to automatically monitor water levels in storage tanks. To guarantee effective water management and motor safety, the system makes use of conductive water level sensors, a water level controller unit, relay switching circuitry, and indication LEDs. Installing sensor probes at various depths in the overhead tank and subterranean water tank is the first step in the process. These sensors send data to the controller unit by continually detecting the presence or absence of water. The water level situation is ascertained by the controller after processing the sensor outputs. When the overhead tank's water level drops below the minimum state of the water level. The controller automatically deactivates the relay, turning off the motor, when the water level in the above tank reaches its maximum level. Water spillage and needless energy use are avoided as a result. To guarantee safe functioning, the controller simultaneously monitors the bottom tank's water availability. The system has a dry-run protection device to shield the motor from dry running conditions. The controller instantly stops the motor and turns on the dry-run indicator if the lower tank water level drops below the safe operating level. This function prolongs the life of the pump and keeps the motor from overheating.

Additionally, the system uses LEDs to show the current motor status and water level conditions. The automated process saves water, increases dependability, and does away with human interference.

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3.1 BLOCK DIAGRAM

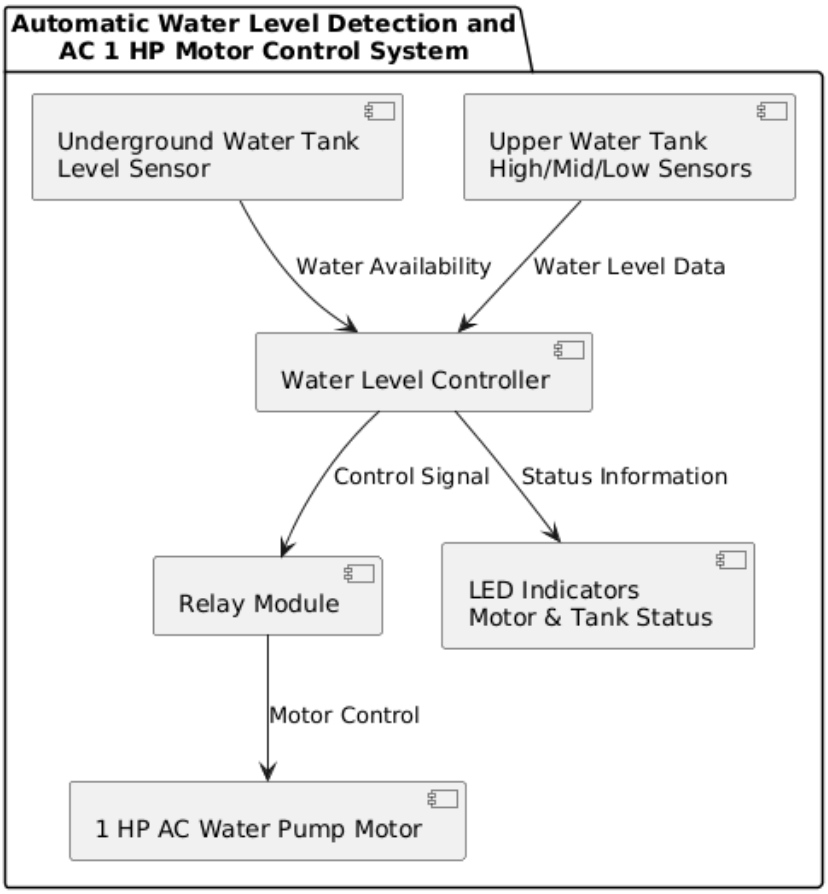

Fig.1- Block Diagram of Automatic Water Level Detection and AC 1 HP Motor Control System.

3.2 WORKING

The automated Water Level Detection and AC 1 HP Motor Control System relies on automated water level detection and control. Conductive sensors are used by the system to continually check the water levels in both tanks.

First, the sensor notifies the controller when the water level in the above tank drops below the minimal level. The controller then determines if the subterranean tank has enough water. The controller activates the relay and turns on the 1 HP AC motor if water is available.The motor pumps water from the underground tank to the overhead tank. During this process, the controller continuously receives signals from the tank sensors and monitors the filling process. When the water level reaches the maximum level in the overhead tank, the controller automatically deactivates the relay and switches OFF the motor.

If the underground tank becomes empty while the motor is running, the dry-run protection feature immediately stops the motor to prevent overheating and damage. The LED indicators provide real-time information regarding tank levels, motor operation, and dry-run conditions.

1. Dry-run protection activates if lower tank becomes empty.
2. LED indicators show system status.
3. Monitoring process repeats continuously.

This working mechanism ensures automatic water management, prevents overflow, protects the motor, and reduces electricity consumption while providing a reliable water supply system.

IV. SYSTEM DEVELOPMENT

4.1 SOFTWARE DETAILS

Water level monitoring, sensor input processing, and motor control are all handled by the software component of the Automatic Water Level Detection and AC 1 HP Motor Control System. The water level sensors in the above and subterranean tanks are constantly monitored by the controller. The program decides whether to start or stop the motor based on the sensor data.

The water pump only runs when necessary thanks to the software logic. When the overhead tank fills up, it turns off the motor to prevent tank overflow. Similarly, when there is not enough water in the bottom tank, it stops the motor, protecting the pump from dry-running situations.

The program is intended to operate consistently and dependably with little assistance from humans.

Features of Software

- Automatic water level monitoring.
- Automatic motor ON/OFF control.
- Dry-run protection logic.
- Real-time sensor data processing.
- Overflow prevention mechanism.
- Continuous monitoring operation.
- LED status indication control.
- Reliable and efficient performance.
- Low processing requirements.
- Easy maintenance and operation.
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V. SYSTEM PERFORMANCE

The Automatic Water Level Detection and AC 1 HP Motor Control System's capacity to automatically monitor water levels, regulate the water pump, stop overflow, and offer dry-run protection is used to assess its performance. The technology guarantees dependable water management and runs effectively with little human interaction.

Both overhead and subterranean tanks' water levels are effectively detected by the installed system, which then automatically regulates the pump motor in accordance with the water needs. The method increases the overall effectiveness of water distribution, saves energy, and minimizes water waste.

5.1 Advantages

The proposed system offers several advantages over conventional manual water pumping systems.

1. Automatic Operation
The system automatically starts and stops the motor without requiring human intervention.
2. Water Conservation
Prevents unnecessary water wastage caused by tank overflow.
3. Dry Run Protection
Protects the motor from damage when water is unavailable in the lower tank.
4. Energy Saving
Reduces electricity consumption by operating the motor only when required.
5. Increased Motor Life
Automatic control and protection mechanisms increase pump lifespan.
6. Reduced Human Effort
Eliminates the need for continuous monitoring of tank levels.
7. Reliable Performance
Provides consistent and dependable operation.
8. Easy Installation
Simple hardware design enables easy deployment.

VI. CONCLUSION

In order to offer an effective solution for automatic water management, the Automatic Water Level Detection and AC 1 HP Motor Control System was successfully designed and put into operation. The technology automatically regulates the water pump's operation based on the water demand while continually monitoring the water levels in the subterranean and above tanks.Water overflow is successfully avoided, water waste is decreased, and the pump motor is shielded from dry-running situations by the devised system. The system lowers human

labor, saves time, and increases overall operational efficiency by doing away with the need for manual monitoring and operation. Relay switching, control circuitry, water level sensors, and visual indicators are all integrated to provide dependable and secure functioning under a variety of environmental circumstances.The project shows that water level control systems that operate automatically can enhances system safety and reliability.The proposed system is economical, easy to install, It is appropriate for residential structures, apartments, educational institutions, hospitals, factories, commercial businesses, and agricultural purposes since it requires less upkeep. The project's successful execution attests to its efficacy as a workable and trustworthy water management system.To sum up, the Automatic Water Level Detection and AC 1 HP Motor Control System offers a clever, practical, and economical method of pump automation and water level monitoring. It is a useful solution for contemporary water management applications because it provides better water savings, lower operating costs, increased equipment protection, and dependable performance.

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