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IOT BASED DAM WATER LEVEL MONITERING AND ALERT SYSTEM USING NODEMCU

[1]Mr. A.Santhosh Kumar,[2]Chikoti Rishitha
[1]Assistant Professor,[2]Student
Department of ECE
Sree Chaitanya College of Engineering, Karimnagar

ABSTRACT:

Using an Arduino, water level sensor, and other complementing equipment, Oman Dams has developed a "smart IoT based disaster monitoring and management system." This research paper's concept is that a smart Internet of things system will gather current meteorological data and other relevant factors surrounding the dam. The sensors throughout the dam will be linked to an Arduino, which will be in charge of gathering data and sending it to the nodeMCU, which is also connected to an Arduino. The data will then be transformed by the nodeMCU to a cloud service, where it will be shown on the employee's app inside the dam. The technology will text the people living close to the dam if it detects any readings of flooding.

I. INTRODUCTION OF PROJECT

The internet of things, also known as the Internet of Things, is a network of interconnected electronic systems, mechanical and digital computers, objects, organisms, or people with the ability to transmit data over a network without requiring human-to-human or human-to-computer interaction and unique identifiers (UIDs) (S. Gillis, 2019). People will have complete control over their life and be able to live and work better thanks to the internet of things. IoT is essential for businesses in addition to offering mobile solutions that make life easier in the home. IoT gives businesses a real-time view of how their operations really work, providing insights about anything from supply chain and distribution activity to computer performance. Businesses may lower labour expenses and streamline processes thanks to the Internet of Things. In addition, it lowers waste and improves service quality, which lowers production and delivery costs and offers insight into customer purchasing patterns. One of the most significant technological advancements in modern life is the Internet of Things (IoT), which will become more popular as more sectors realise how smart technology can help them remain competitive (S. Gillis, 2019). The purpose of this research study is to provide a novel smart IoT-based catastrophe monitoring and dam management system for Oman. That intelligent IoT will contribute to the present system's development and security.

II. LITERATURE SURVEY

With the ability to transmit data over a network without requiring human-to-human or human-to-computer contact, the Internet of Things (IoT) is a collection of interconnected computing systems, mechanical and digital appliances, objects, animals, or people with unique UIDs (Margaret Rouse, 2020). A network of physical items is called the Internet of Things (IOT). The internet has evolved beyond just a computer network to become a network of all kinds of devices: automobiles, cellphones, household appliances, toys, cameras, medical equipment, industrial networks, people, animals, and homes. These devices are all connected, communicating, and exchanging information according to predetermined protocols to achieve safe, smart reorganisations, positioning, and mapping

(Keyur Patel, 2016). Dams are very important, mostly because they are used for irrigation and hydroelectricity generation. As a consequence, several dams have been built in potential areas throughout time. Since there are several risk factors associated with the life of these dams, it is crucial to set up an appropriate control and management system to guarantee a safe water level in dams when the shutters are opened. Man-made catastrophes may be caused by poor dam management. In our state, dams are presently overseen and managed manually. This manual intervention might increase the chance of mistake and cause a delay in decision-making. The creation and integration of an IoT-based framework for disaster monitoring and management for dams is the aim of this study.Fig. displays the suggested system's model diagram. The sensors gather data from the surrounding environment and the dam. Every detail is provided via a clever controller. A microcontroller is used to automatically operate the whole system, reducing the complexity of the control and system architecture. At the system's back end, it gathers parameter data from the pertinent sensors and uploads it to the database. Processed data is used for the online portal's hosting and subsequent decision-making (KAVITHA, 2021).

III. DESIGN OF HARDWARE

This chapter provides a quick explanation of the hardware. It goes into great depth about each module's circuit diagram.

ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno (datasheet). It has a 16 MHz ceramic resonator, 6 analogue inputs, 14 digital input/output pins (six of which may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC converter or connect it to a computer via a USB connection to get going.The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a serial-to-USB converter. The 8U2 HWB line on the Uno board is pulled to ground by a resistor, which facilitates DFU mode entry. The Arduino board now includes the following updates:

• 1.0 pin out: two further new pins, the IOREF, are positioned next to the RESET pin, the SDA and SCL pins that were introduced, and they enable the shields to adjust to the voltage supplied by the board. Shields will eventually work with both the Arduino Due, which runs on 3.3V, and the boards that utilise the AVR, which runs on 5V. The second pin is unconnected and set aside for future uses.

• A more robust RESET circuit.

• The 8U2 is replaced with an ATMega 16U2.

"Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future, the Arduino reference versions will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and the platform's standard model; see the index of Arduino boards for a comparison with earlier iterations.

Fig: ARDUINO UNO

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POWER SUPPLY:

The purpose of the power supplies is to convert the high voltage AC mains energy into a low voltage supply that is appropriate for use in electronic circuits and other devices. One may disassemble a power supply into a number of blocks, each of which carries out a specific task. "Regulated D.C. Power Supply" refers to a d.c. power supply that keeps the output voltage constant regardless of differences in the a.c. main or the load.

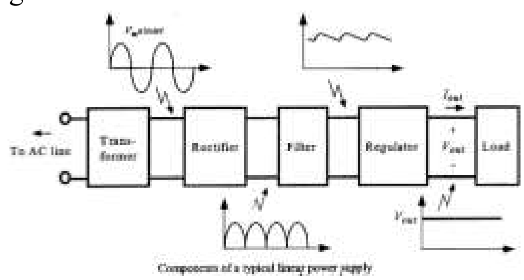


Fig: Block Diagram of Power Supply

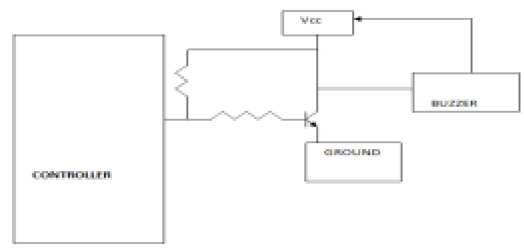
LCD DISPLAY

The model shown here is the one that is most often utilised in practice due to its cheap cost and enormous potential. Its HD44780 microcontroller (Hitachi) platform allows it to display messages in two lines of sixteen characters each. All of the alphabets, Greek letters, punctuation, mathematical symbols, etc., are shown. Furthermore, it is possible to show custom symbols created by the user. Some important features are the automatic changing of the message on the display (shift left and right), the presence of the pointer, the lighting, etc.

Fig: LCD

BUZZER

Relays, buzzer circuits, and other circuits cannot be driven by the current available on digital systems and microcontroller pins. The microcontroller pin can provide a maximum of 1-2 milliamps of current, even though these circuits need around 10 milliamps to work. Because of this, a driver—such as a power transistor—is positioned between the buzzer circuit and microcontroller.



WIFI MODULE:

A low-cost Wi-Fi microprocessor with complete TCP/IP stack and microcontroller functionality, the ESP8266 is made by Chinese firm Espressif Systems, located in Shanghai.[1]

In August 2014, a third-party producer named Ai-Thinker's ESP-01 module brought the chip to the attention of western manufacturers for the first time. With the help of this little module, microcontrollers may establish basic TCP/IP connections and connect to Wi-Fi networks by utilising Hayes-style instructions. But at the time, there wasn't much documentation available in English on the chip or the commands it could execute.[2] Many hackers were drawn to investigate the module, chip, and software on it as well as translate the Chinese documentation because of its very cheap cost and the fact that it had very few external components, suggesting that it may someday be very affordable in production.[3]

With its 1 MiB of integrated memory, the ESP8285 is an ESP8266 that enables single-chip Wi-Fi capable devices.[4]

The ESP32 is these microcontroller chips' replacement.

LED:

A light source made of semiconductors with two leads is called an LED. When turned on, this p-n junction diode generates light.[5] Within the device, electrons may recombine with electron holes when a proper voltage is given to the leads, releasing energy in the form of photons.

This phenomenon is known as electroluminescence, and the energy band gap of the semiconductor controls the colour of the light, which corresponds to the photon's energy. Since LEDs are usually tiny—less than 1 mm2—the radiation pattern may be modified by integrated optical components.

Early LEDs were often utilised to replace tiny incandescent bulbs as indication lighting for electrical equipment. They were quickly bundled into seven-segment displays for use as numeric readouts, and digital clocks became popular with them. Modern advancements have led to the creation of LEDs that are appropriate for task and ambient lighting. New displays and sensors have been made possible by LEDs, and enhanced communications technology has benefited from their rapid switching rates.Compared to incandescent light sources, LEDs are smaller, quicker switching, more physically resilient, need less energy, and have a longer lifespan. Applications for light-emitting diodes are many and include traffic signals, advertising, traffic lights, camera flashes, lit wallpaper, aircraft illumination, and car headlights. Additionally, they are much more energy-efficient, and their disposal may pose less environmental risks.

Water Level Indicator:

This is the circuit schematic for a straightforward water level indicator for homes and businesses that is free of corrosion. In reality, this circuit may be used to monitor the level of any conductive, non-corrosive liquid. Five transistor switches form the basis of the circuit. When the base of each transistor receives electricity from the electrode probes inserted into the water, the transistors are turned on to operate the respective LED.

At the base of the tank sits a single electrode probe (F) with 6V AC. Gradually, more probes are positioned above the lower probe. Each transistor's base connects electrically to 6 volts AC as the water level rises, using the matching probe and water. Transistors then conduct as a result, lighting an LED and indicating the water level. As shown by the circuit diagram, the ends of the probes for the water tank level indicator are attached to the appropriate locations in the circuit.

For the probe, insulated aluminium wires with the end insulation removed will work. Sort the probes in a depth-appropriate sequence on a PVC pipe, then submerge it in the

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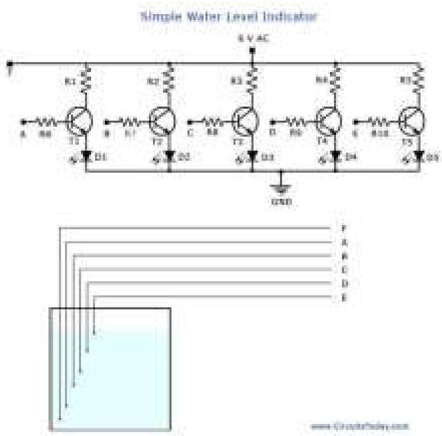
tank. To stop electrolysis at the probes, AC voltage is applied. This setup is going to take a long time. I promise little upkeep for a minimum of two years. That's what I have and am now using.



This is the most fundamental kind of measurement-based water level indicator. Try this circuit for a water level controller if you require a completely automated system. Transistors form the foundation of the circuit in its entirety. This circuit and the sensor part are quite identical, but the extra circuitry turns the pump on when the water level drops below a certain point and turns it off when the tank is full. The control part is implemented using an electromagnetic relay, a single 555IC, and a few transistors. The circuit is very simple, affordable, dependable, and has been successfully made by numerous men. Using the same float type fuel gauge technology used on bikes, I am also developing a float type water level indicator/controller. I've completed the level sensor component and am now working on the control circuitry.

Vibration Sensor

In order to provide an adjustable digital output dependent on the degree of vibration, this module includes an adjustable potentiometer, a vibration sensor, and an LM393 comparator chip. To get the required quantity, the potentiometer's sensitivity may be changed both up and down. When triggered, the module produces a logic level high (VCC), and when not, it outputs a logic level low (GND). In addition, when the module is activated, an integrated LED illuminates.

Specifics of the Sensor SW-420: Full induction trigger switch, single roller type. The product is in the ON conduction state when there is no tilt or vibration. In the steady state, a tilt or vibration would cause the switch to immediately disconnect as the conductive resistance rises, activating the circuit by producing a current pulse signal. These items come in fully sealed packaging and are dust- and waterproof-proof.

Principle

When a switch is in the ON state, it usually vibrates or moves due to the conduction current in the rollers. This movement or vibration might cause the current to flow through the disconnect or increase the resistance, which can then initiate a circuit. This switch's properties are generally general in the conduction state and momentarily detached resistance to vibration; thus, IC has established

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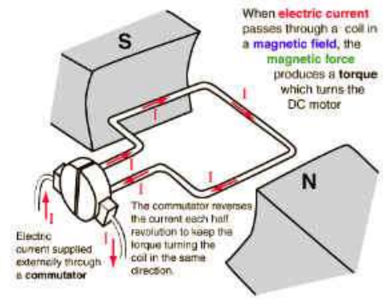
its high sensitivity settings, and customers may alter them based on their own sensitivity needs.

L293D:

Half-H drivers with triple high-current include the L293 and L293D. With voltages ranging from 4.5 V to 36 V, the L293 is intended to provide bidirectional driving currents of up to 1 A. Up to 600 mA of bidirectional driving current may be achieved with the L293D at voltages ranging from 4.5 V to 36 V. In positive-supply applications, these devices are intended to drive inductive loads such solenoids, relays, dc, and bipolar stepping motors, in addition to other high-current/high-voltage loads. Every input is compatible with TTL. With a pseudo-Darlington source and a Darlington transistor sink, each output is a full totem-pole driving circuit. Drivers 1 and 2 are enabled by 1,2EN, while drivers 3 and 4 are enabled by 3,4EN. Drivers are enabled in pairs. The corresponding drivers are activated and their outputs are active and in phase with their inputs when an enable input is high. These drivers are disabled and their outputs are turned off and in the high-impedance condition when the enable input is low. Each pair of drivers creates a full-H (or bridge) reversible drive appropriate for solenoid or motor applications when the right data inputs are provided.

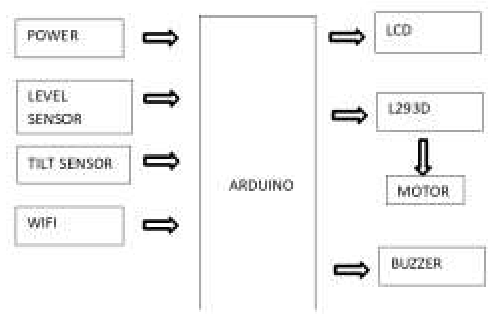
DC MOTOR

A DC motor is intended to operate with DC electricity. Michael Faraday's homopolar motor, which is rare, and the ball bearin motor, which is a recent invention, are two instances of pure DC designs. The two most popular forms of DC motors are brushed and brushless, which are not strictly speaking DC machines since they require internal and external commutation, respectively, to produce an oscillating AC current from the DC source.



IV. BLOCK DIAGRAM AND HARDWARE DISCRIPTION

BLOCK DIAGRAM:



WORKING:

Using NodeMCU, an ESP8266-based microcontroller with Wi-Fi capabilities, and water level sensors, the Internet of Things-based dam water level monitoring and alert system offers automatic alarm messages for dam management as well as real-time water level monitoring. This method allows for remote monitoring and early alerts to authorities by continually monitoring the dam's water level and sending data to a cloud platform.

1. System Initialization

- The water level sensor, Wi-Fi module, and alarm systems (such a buzzer or SMS notification system) are all initialised by the NodeMCU when it is switched on.
- The system uses the built-in Wi-Fi of the NodeMCU to connect to the internet, enabling connection with a cloud

platform (such ThingSpeak, Blynk, or Firebase) for data storage and remote monitoring.

2. Water Level Measurement

- The system measures the water level in the dam using float or ultrasonic sensors:
- Ultrasonic Sensor: This device sends out ultrasonic waves and timed the return of the echo to determine how far it is from the water's surface. The relationship between this distance and the water level is inverse.
- The NodeMCU receives sensor data and computes the water level. o Float Sensor: Tracks the location of a floating element that rises and falls with the water level. Usually, the water level data is mapped to distinct levels (low, medium, high, critical, etc.).

3. Data Processing and Threshold Check

- The water level is compared to specified threshold values by the NodeMCU after processing the sensor data:
- Normal Level: The water's level is safe.
- Warning Level: In order for authorities to take appropriate action, water has reached a specified height.
- Critical Level: The water level has risen to a hazardous level, necessitating an emergency evacuation or other action.
- The system decides whether to sound an alarm or take any action based on the water level.

4. Cloud Integration for IoT Monitoring

- A cloud platform receives the water level data continually via Wi-Fi. This makes it possible to remotely check the dam's condition from any internet-connected device.
- Typical platforms for Internet of Things (IoT) monitoring systems are:
- ThingSpeak: Shows data graphs of changes in water level in real time.
- Blynk: Offers real-time dashboards and alerts for mobile apps.
- Custom servers or Google Firebase for in-the-moment surveillance.
- The data is shown via graphs on the cloud platform, enabling authorities and dam operators to track patterns and anticipate when the water levels may approach catastrophic levels.

5. Real-Time Alerts and Notifications

- When the water level exceeds the critical or warning threshold, the NodeMCU initiates alarm systems like:
- Buzzer or siren: At the dam site, this device sounds an alarm to alert surrounding workers and people.
- SMS/Email Alerts: The system notifies authorities by SMS or email of the increasing water levels if it is linked with a GSM module or makes use of a cloud service that allows alerts.
- Push Notifications: The system can instantly deliver push notifications to mobile devices using services like Blynk or Firebase, guaranteeing that quick action may be performed.
- An example of an alert level is:
- Standard: Constant observation and no warnings.
- Alerts dam operators via email or SMS, requesting action.
- Critical: Sets off local alarms as well as immediate messages to all required staff.

6. Automatic Dam Gate Control (Optional)

- Automated dam gates that are managed by servo motors or actuators may be combined with certain sophisticated systems. The technology may automatically open the floodgates to discharge more water if the water level reaches a certain point.

- To assist avoid flooding, the NodeMCU sends signals to motor drivers telling them when to open or shut the gates depending on the current water level.

7. Remote Monitoring Dashboard

- A online dashboard or mobile app shows real-time data from the system. This portal allows authorised staff to log in and see historical data, the current water level, and any active alarms.
- By enabling users to track patterns and variations in water level over time, the dashboard assists dam administrators in making data-driven choices about the management of the dam.

8. Low-Power Operation and Solar Power (Optional)

- The system may be operated by solar panels with a battery backup for distant dam sites with low energy. NodeMCU's low power consumption makes it the perfect platform for solar energy operation.
- The system is sustainable in off-grid areas since it can run continuously and independently without requiring frequent operator intervention.

V. CONCLUSION

Physical techniques are the conventional method of monitoring dams. In order to solve the issues related to manual monitoring and control, they also created an Internet of Things-based disaster detection and management system for dams. In this system, we employ many sensors to monitor data in real time. Through the Wi-Fi ESP8266 module, they are sent to the cloud server for monitoring and management. All of the issues related to water might be resolved with the aid of the suggested system. Messages about public safety are also sent via the device. Therefore, our proposed method can effectively manage dams and prevent a disaster.

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