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Dam Safety and Water Management Using Iot

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Abstract: *Monitoring Dams safety and water management is extremely important considering both the situations like water scarcity and excess of water. It is of crucial importance and needs to develop information system based on existing system allowing utilization of intelligent sensors network. Basic idea is to describe possibilities of IoT applications in Dam Safety and water management. Here the entire dam and the main pipeline is sensed 24x7 through various sensors. These wireless sensor nodes connected with each other and transmits the data to a gateway. Common storage space 'CLOUD' stores and provides on line information to the observer. Employing an IoT for the said purpose will definitely help saving the most precious natural resource the water. Here in this paper an attempt is made proposing an electronic circuit design employing an Internet of Things concept for the purpose*

Keywords-*Monitoring, Managing, Intelligent Sensor, IoT (Internet of Things***)**

I. Introduction

Water being one of the most precious natural resources needs to be saved and utilized with great care. During both the extreme conditions like water scarcity and excess water and even normally monitoring the dam i.e. safety parameters and water management is very necessary

IoT (Internet of Things) plays a vital role in meeting the above requirements and can make available the online information about both the parameters to the remote operator.

Generally, the dams and the water management are monitored through traditional surveillance techniques except the water level in some of the dams which is atomized.

If the different sensors are deployed in various clusters of the dam, then the various parameters like 1. Water level 2 Pressure on the wall of dam 3. Vibrations on the dam wall 4. Water flowing out from the dam through main pipe line i.e. flow rate of water and5 Sensing of the pipeline leakage that to with approximately location can be sensed and the information regarding the concern parameter be made available to the observer at a glance. This will definitely lead to proper utilization of the natural resource water and ultimately it will be a great support towards the Nation.

Iot And Its Structure:

IoT is basically a technique to connect the things through an Internet for which the frequency range is in between 100 MHz to 5.8 GHz and it can be broadly explained as a 4-Layered structure;

- Tagging Things: Wherein the various objects can be tagged through RFID or similar techniques with which the tracing and addressability of an item can be done.
- Feeling Things: Various sensors acts as a primary devices to collect data from the various things in the environment.
- Shrinking Things: Miniaturization motivated the capability of smaller things to interact and connect within the things.
- Thinking Things: Embedding intelligence in devices through sensors and forming the network connection to the Internet can make the thing realizing the intelligent control.

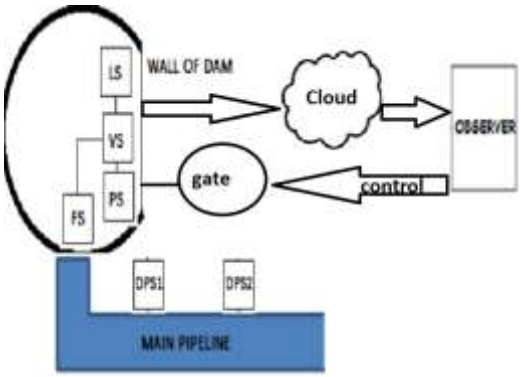

Fig. 1. Proposed Electronic Design

Here in this proposed electronic design the dam area is divided in various clusters and the different sensors sensing independent parameters are deployed as shown.

All the sensors in the cluster of dam namely Level Sensor (LS) / Vibration Sensor (VS) / Pressure Sensor (PS) and Flow Sensor (FS) senses Water level / Vibrations on the wall of dam / Pressure exerted on the wall of dam and the water flowing out from the dam into the main pipeline in Liters per minute respectively.

While the sensors DP1, DP2,.. are the Differential Pressure sensors fitted periodically along the main pipeline which will sense the pressure difference because of the breaking or leakage of the pipeline and will immediately be communicated to the observer.

All these sensor nodes are connected together through gateway to common storage area CLOUD and the observer can access the on line information from the cloud.

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1) ULTRASONIC SENSOR

q Ultrasonic sensors are transducer that convert ultrasonic wave to electric signal and vice versa. Many ultrasonic sensor work as both transceivers because they can both sense and transmit at the same time. The working principle is that the transducers used in radar systems evaluate attributes of a target by interpreting the echoes from radio waves. These sensors generate high frequency sound waves and evaluate the echo which is received by the sensor. The time taken by the signal to bounce back from the target to the sensor gives the estimate of the distance between the target and the ultrasonic sensor.

Fig. 2. Ultrasonic Sensor

2) VIBRATION SENSORS

Vibration sensors area unit sensors for activity, displaying, and analyzing linear rate, displacement and proximity, or acceleration. Therefore, vibration analysis is employed as a tool to see instrumentality condition yet because the specific location and sort of issues.

Show all Vibration Sensors Manufacturers Vibration sensor Vibration sensors are sensors for measuring, displaying, and analyzing linear velocity, displacement and proximity, or acceleration.

Vibration — but refined and unmarked by human senses — may be a telltale sign of machine condition. Abnormal vibration indicative of issues with Associate in Nursing industrial machine may be detected early and repaired before the event of machine failure; as a result of such a failure is probably expensive in terms of your time, cost, and productivity, vibration mensuration permits industrial plants to extend potency and save cash.

Fig. 3. Vibration sensor

3) RASPBERRY PI

The Raspberry Pi is a very cheap computer that runs Linux, but it also provides a set of GPIO (general purpose input/output) pins that allow you to control electronic components for physical computing and explore the Internet of Things (IoT).

The Raspberry Pi may be a low value, credit-card sized laptop that plugs into a laptop monitor or TV, and uses a customary keyboard and mouse.

It is a capable very little device that allows individuals of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

It's capable of doing everything you'd expect a PC to try and do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.

What's more, the Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras.

We want to examine the Raspberry Pi getting used by children everywhere the globe to be told to program and perceive however computers work.

Fig. 4. Raspberry pi

4) FLOW SENSOR

The Flow detector may be a device that is employed to live the water flow. This detector sits in line along with your water line and contains a pinwheel detector to live however much liquid has moved through it. There's an integrated magnetic hall effect sensor that outputs an electrical pulse with every revolution. Flow sensors use acoustic waves and electromagnetic fields to measure the flow through a givenarea via physical quantities, such as acceleration, frequency, pressure and volume. This sensors are solidly constructed and provide a digital pulse each time an amount of water passes through the pipe.

Features of Flow Sensor
Model: YF-S201
Sensor Type: Hall effect
Working Voltage: five to 18V DC (min tested operating voltage four.5V)
Max current draw: 15mA @ 5V
Output Type: 5V TTL
Working Flow Rate: 1 to 30 Liters/Minute
Working Temperature range: -25 to +80℃
Working Humidity Range: 35%-80% RH

Accuracy: ±10%
Maximum water pressure: 2.0 MPa
Output duty cycle: 50% +-10%
Output rise time: 0.04us
Output fall time: 0.18us
Flow rate pulse characteristics: Frequency (Hz) = seven.5 * flow (L/min)
Pulses per Liter: 450
Durability: minimum 300,000 cycles

Fig 5 flow sensor

II. Methodology

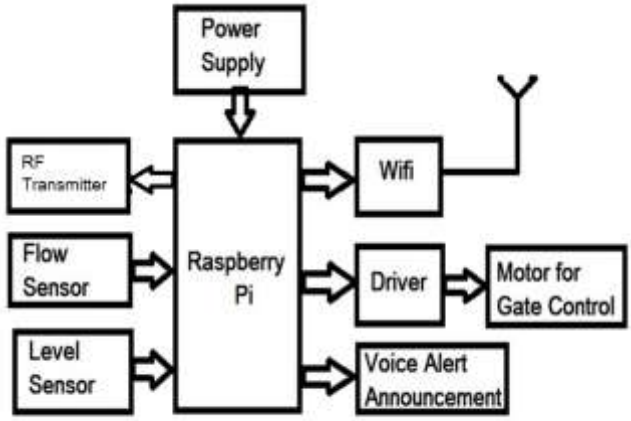

Fig. 5. BLOCK DIAGRAM OF DAM SAFETY AND WATER MANAGEMENT

All the sensors in the cluster of dam namely Level Sensor (LS) / Vibration Sensor (VS) / Pressure Sensor (PS) and Flow Sensor (FS) senses Water level Vibrations on the wall of dam / Pressure exerted on the wall of dam and the water flowing out from the dam into the main pipeline in Litre per minute respectively. While the sensors DP1, DP2,.. are the Differential Pressure sensors fitted periodically along the main pipeline which will sense the pressure difference because of the breaking or leakage of the pipeline and will immediately be communicated to the observer. All these sensor nodes are connected together through gateway to common storage area CLOUD and the observer can access the online information from the cloud.

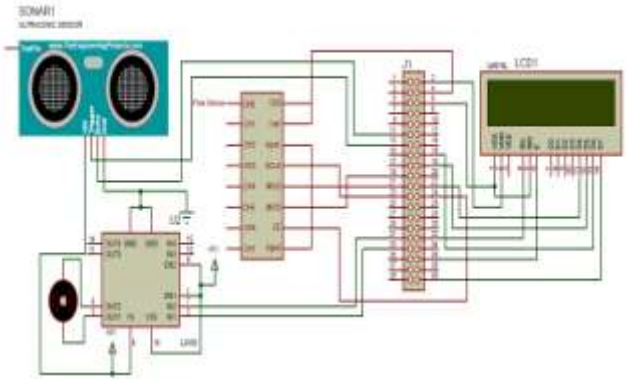

Fig. 6. Circuit diagram of DAM SAFETY AND WATER MANAGEMENT

III. Result

Hence, we have successfully designed DAM SAFETY AND WATER MANAGEMENT which provides a following desired output

- Automatic voice alert announcement to Village head.
- Water management and supply report to the office through the IOT in the form of excel sheet
- PUSHETA Notification send on mobile generated by controller
- Level monitoring and gate control through website

IV. Conclusion And Future Scope

Here in this paper application of upcoming technology like Internet of Things [IoT], Wireless sensors network with software for dam safety management is given which results in improving the functionality of dams. Demand for connecting information system with the real world is growing day by day and it can be possible with the advancement in Sensor technology, computer technology and network technology. Internet of Things, as a technology allows sensors to become intelligent by connecting them to the Internet. This allows sensors to communicate with each other. Implementation of the system for managing and monitoring dam safety and the implementation of new technology reduce the risk of a major failure of the dams in future. Finally,the conclusion can be drawn as;

a] 40-50% wastage due to cracking of pipelines can be brought down to appreciable level.
b] In both situations; Water Scarcity or Excess water, the dam safety as well as water management can be done.
c] Saving natural resource is a major contribution towards entire Nation
d] Standard protocol leads to better Global Governance
e] Interoperable technologies expected and last but not the least
f] Cyber Security will be a big Concern

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