Dam Water Level Monitoring and Alerting System

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Abstract : Man-made dams are designed to stop or interrupt the flow of water across a river. The history, culture, current and future socioeconomic status of India and its people are linked to the water resources which are available from dams. The water from the dam can be used for farming and producing electricity. The dams are acting as a reservoir for keep the water, at the same time improper dam management leads to flood. So a proper management system to be implemented for the sake of safety of people. At present the dam water level is measured and uploaded manually. This will cause time delay and may lead to sudden back water rise. This paper gives an idea for the implementation of an information system based on the traditional systems with the utilization of some sensors and IoT. In this paper we introduce an automatic system where the dam water level is raised above a threshold value, messages will be send to the mobile numbers.

Keywords—Water level, ultra sonic sensor, Thingspeak, Arduino, Dam

I.INTRODUCTION

Dam and Weather are playing a vital role in our day to day lives; these are consequential factors that cannot be neglected. Indian Economy is fastest growing economy and seventh largest in the world; the agricultural sector is the most immensely colossal employer in India's economy as well as contributes more in Indian GDP (17% in 2013 - 14) Now a days dam authority are facing problems regarding the dam and weather parameters monitoring as most of the small dams are still using manual data observation and older techniques of transmission system.

Dam researchers want to monitor the frequent changes in parameters of dam and the data for their research purpose. Since there is no such centralized database for the dam parameters, so they face problem regarding the availability of such sorted data. Common people like farmers are also unaware about these general parameters like water level, gate opening, amount of rainfall, temperature, humidity etc.; hence they face many problems in farming, which heavily affects the yields of the farms.

Due to heavy rainfall, the water level of dam increases suddenly due to which the Dam authority have to open the gates to prevent the dam from the risk of uncertainty issues. Also due to this the people living in nearby villages have to face a serious problem like flood in their farms. When back water of dam increases above its threshold level (danger level) it may cause damage to farms, villages, industries located nearby and lastly
the lives of the people living nearby. Manual data observation and transmission results in considerable time lag between the data observed, its transmission and for decision making. This may sometimes give little time for the decision taking. Also this causes loss of real time data and sometimes becomes the reason for upcoming disaster.

This system will help to reduce these problems which faced by Dam authority, researchers as well as common people like farmers. The conception about this system is to develop a web portal which will monitor and provide authentic time parameters related to Dam and weather like water level, rain fall, dam gate position, temperature, humidity etc.

In observation part the smart controller provides facility of dumping sensor observation values directly into database with specific time interval. It provides the facility of SMS for providing data. Also the system has an alarm which will give alerts and will help in knowing critical conditions.

As it is basically based on Internet data sharing with the help of web database, like weather parameters for Meteorological department, dam parameters to government authority etc., the Government of India wants to monitor the real time water level of reservoirs. Hence this work will help in Digital India Mission..

II.LITERATURE SURVEY

Today dam authority is facing problems related to the dam and weather parameter monitoring. Up to now most of the smaller dams are manually monitored and sending data with normal ways, this manual observation and transmission results in a time lag, between the data observed in dam site and decision taking level. This sometimes causes loss of beneficial real time data. Researchers want observed data to be readily available for research purpose as well as monitor the authentic time changes in various parameters. These parameters to be uploaded to cloud[1].

The sensors can be used to measure water level in rivers, lakes, lagoons and streams. For such purpose there is a sample project through a model that is constructed with a water level measurement sensor based on a simple open circuit that closes when in contact with water and experimentally tested into a water tub under a controlled environment. This model is developed on the basis of a programmable electronic board (Netduino Plus 2), an electronic circuit connected to electrical resistances that are located at a specific height, within a water tub; when the water level rises and reaches the resistors, varies the impedance, this shows the actual water level and so on for different heights. The information from water level sensor is transmitted via WiFi module to a controller, then this information is also seen in smartphones, where users can see the water level in rivers. Finally, the micro-model is tested by experimental tests under a controlled environment and satisfactory results are obtained[2].

The Internet of Things in monitoring and managing dams in Republic of Serbia. Large dams are important because of their use for electricity, but risks which are associated with it should be greatly taken into account. There is a need to analyze the data related to dam in order to use them for dam management in the Republic of Serbia. A database system has been developed based on the traditional systems, allowing utilization of intelligent network sensors. There is a huge possibilities of the Internet of Things application within a specific system for dam safety management. In order to incorporate a large number of intelligent sensors, a new data acquisition module for communication with sensors in the monitoring network is defined. The system should provide on time alerting in case security parameters deviate from the expected values. [3].

One of the major problems faced by most of the large institutions is maintaining drinking water in water dispensers at various places inside the institution. Monitoring a large number of water dispensers in huge buildings require a considerable amount of manual supervision. Here there is a sample system design, implementation and description of required tools and technologies to develop Internet of Things (IoT) based water level monitoring system which can be implemented in offices, colleges or buildings where many number of water dispensers are present. The smart water dispenser sends a notification when the level of water becomes low in the dispenser through an application to the authorized person. Once the person receives a notification for low water level, the application also provides him option to order water cans[4].

One of the other way to measure water level is reflected float mechanism in the presented design which helps in sensing the level to be measured. The proposed system has a simple and cheap concept and ease of installation. For accurate measurement, the presented design has been calibrated and tested for level measurement up to 226 cm and corresponding error have been considered. The error is under acceptable limits i.e. within ± 2 % of the measured value. The design is acceptable for measuring level in the range of 0.1 cm and it can be changed further as per the requirement, by simply varying the circuit parameters. Steps utilized to develop the presented design have been also mentioned to clearly present the design concept and required setup[5].

III.PROPOSED METHODOLOGY

Figure: 1 shows the system architecture of the dam and weather parameter monitoring system. It is mainly divided into four parts namely sensor inputs, controller, communication and output.

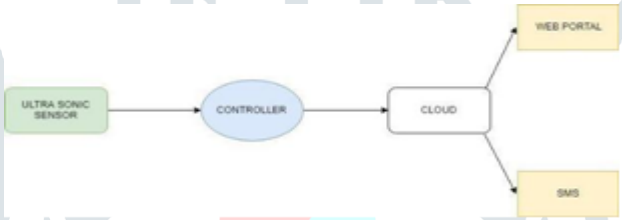

Figure 1 Block Diagram

The components used in this system are listed below

A. Arduino UNO

The Arduino Uno is a microcontroller board. It is based on micro controller ATmega328 AVR microcontroller. The board comes with a removable, dual-inline-package (DIP). It consist of 20 digital input/output pins. Out of which 6 can be used as PWM outputs and 6 can be used as analog inputs. Programs can be burned on to board from the Arduino development environment. Using a language derived from C and C++ Arduino boards are programmed in Integrated Development Environment (IDE). It consist of an ADC of 10 bit resolution is used to convert the analog voltage into bits. The Uno differs from all other boards in that it does not use the FTDI USB-to-serial driver chip.

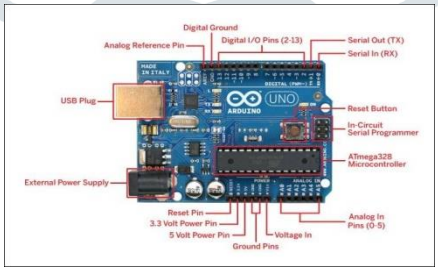

Figure 2 Arduino UNO

B. Ultrasonic Sensor

The HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is used for measuring distance or sensing objects are required. The sensor has two projections similar to eyes in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the formula that,

Distance = Speed × Time

Figure 3 HC- SR04

C. Wifi Module (ESP8266)

The ESP8266 is a low-cost Wi-Fi microchip. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayesstyle commands. At first there was no English-language documentation on the chip and the commands it accepted. The low price and the fact that there were very few external components on the module, which makes it could eventually be very inexpensive in volume which is attracted by many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation. The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

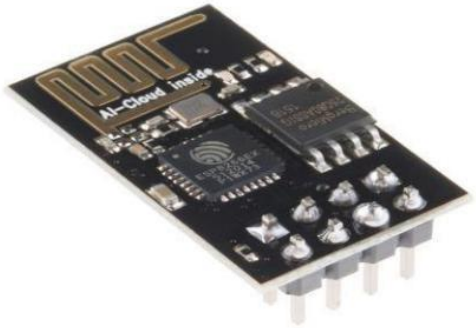

Figure 4 ESP8266

D. Thingspeak

ThingSpeak is an open source “Internet of Things” application used to store, collect, store and analyze and retrieve data from things using HTTP over the Internet with the help of API keys. It is also used to visualize sensor data in real-time. In addition to storing and retrieving, the ThingSpeak API allows numeric data processing such as time scaling, summing, median, averaging, and rounding. Each ThingSpeak Channel supports data entries of up to 8 data fields, elevation, longitude, latitude, and status.

E. IFTTT

IFTTT act like a website and a mobile app at the same time. The service of IFTTT is launched in 2010 for free with the following slogan: "Put the Internet to work for you". There is a huge change in these years, however. Now, we can connect all our "services" together with IFTTT. The tasks are completed automatically. There are many ways that we can connect all our services - and the resulting combinations are called "Applets".

F. Twilio

Twilio is a cloud based messaging service. It enables real time communication between mobile devices, applications, services, and systems. Twilio allows to send SMS and to make automated phone calls. Here the sensor value collected from controller is analyzed and send an alert using the Twilio service.

G. Zapier

Zapier is an online automation tool. It helps to connects many apps, such as Gmail and over 1,000 more. We can connect two or more apps using Zapier. So that we can automate repetitive tasks. The advantage of Zapier is that it can use without coding or relying on developers to build the integration. It will insert info between web apps automatically. Hence that we can focus on your most important work. It is easy to work with Zapier.

IV. IMPLEMENTATION

The implemented circuit diagram is given below. The ultrasonic sensor is used to measure the water level and the value is uploaded toThingSpeak using WiFi module ESP8266.

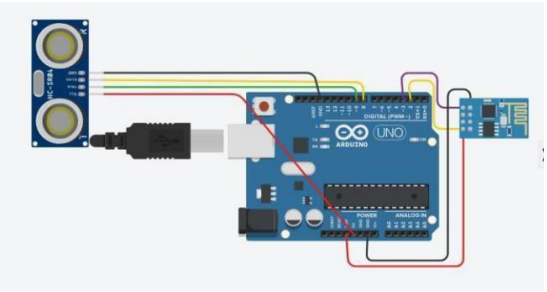

Figure 5 Circuit diagram

The alerting system works based on the following algorithm. When the water level rises above a threshold value the SMS alert is send by messaging service Twilio to a bunch of mobile numbers.

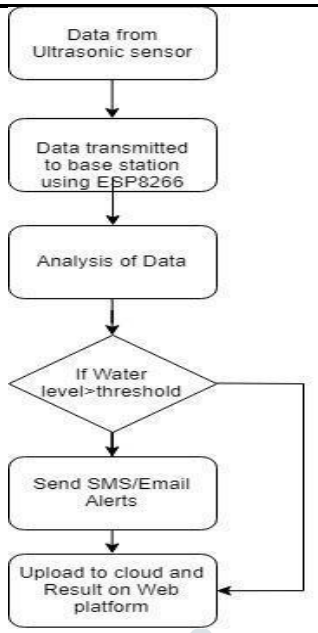

Figure 6 Algorithm

V.RESULTS AND DISCUSSIONS

Dam management is necessary to control the flood. Proper dam management will helps to reduce the impact of flood. So an alerting system will helps to remind the people about the danger and helps the authorities to take necessary actions.

The water level is collected with Ultra Sonic sensor and uploaded to the ThingSpeak. The uploaded data is given below.

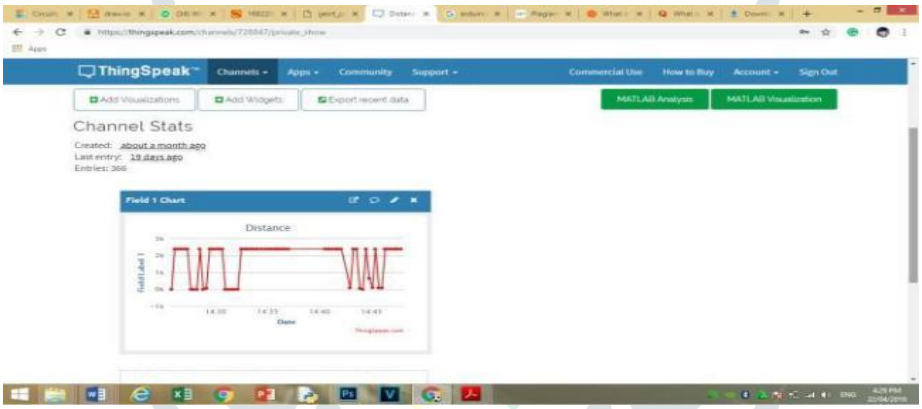

Figure 7 ThingSpeak

When the water level rises above a threshold , alert will be send to the registered mobile number using Twilio service.

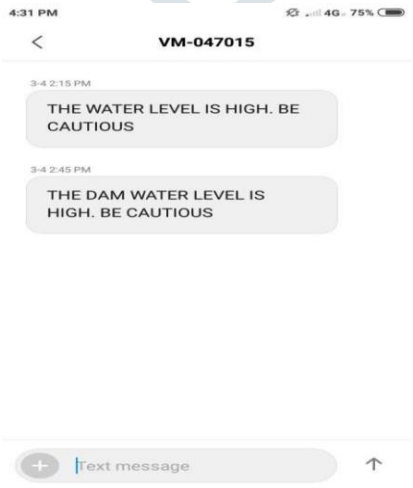

Figure 8 SMS Alert

VI.CONCLUSION

In our proposed system, the design consist of inexpensive realtime monitoring of water level in IoT environment. An ultra sonic sensors, Arduino Atmega328P core controller and a wifi module are used in this system. With the help of Arduino and Ultra sonic sensor we measured water level. It is costless, high efficient and doesn't require labors on duty. The core controller is capable of

collecting, analysing and sending data in to the cloud using IoT. The uploaded data can be viewed from anywhere in the world. Then the data can beanalysed and can make many conclusions from that. We will get the weather information from that like the rainfall and whether it is going to be flood or drought. Timely alerting will definitely help the people to escape from the danger situations. The SMS alert will helps the people and authorities about the danger. The proposed system can be implemented in any dams such as small or large one. The system has low power consumption and cost effective.

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