Cloud Computing Based Water Level Monitoring System

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Abstract- *With the growing field of automation, life is getting simpler and easier. In today's world manual systems are replaced with automatic systems. With the rapid increase in the number of users of internet over the past decade has made Internet a part of life, and IoT is the latest and emerging internet technology. This paper proposes water level monitoring to prevent flood by using Water level sensor, Temperature sensor and Humidity sensor to read the values and analyzing using ThingSpeak system via Raspberry Pi.ThingSpeak is an open source application platform for Internet of Things and using IBM Bluemix, application is developed to view the results around data collected by sensors. It process the dataand the processed data can be retrieved using application.*

Keywords- water level monitoring, Internet of Things, cloud.

I. INTRODUCTION

Embedded system combined with latest wireless technologies to find a complete solution to many problems.IoT[1] has a vast impact on every engineering practice.The devices are not only intelligent individually but when connected, it could perform better in different scenarios. A lot of industrial applications based on IoT have been developed and deployed in recent years.IoT and Cloud Computing in Automation of Assembly Modeling Systems [1] explain different applications of IoT. It also mentions that real-time data can be collected by numerous sensors and it can be shared for decision-making .

The "Internet of things" - IoT is a concept and model consisting of sensors and development boards interacting with each other connected over the internet without any human intervention resulting into a more intelligent system. The main principle of Internet of things (IoT) is that the sensor nodes identify, sense, process and communicate with each other [2]. The IoT can be classified based on their area of application such as smart wearable, smart home, smart city, smart environment and smart enterprises, based on the type of usage (individual or group of interconnected devices), based on the protocol used for M2M(machine to machine) communication etc.,

The idea of this project is to create awareness and also provide information about the current state of water level to prevent flood.The consequences of flood leads to loss of life and property. Therefore, to prevent such losses ,precautions as well as live video of that environment is provided.

A system supports water level monitoring. Water level monitoring is achieved by storing the collected data in the cloud, this data can be retrieved by the authorized person for analysis anywhere and any aberrancy will be timely detected.Bluemixuses MQTT(Message Queuing Telemetry Transport) protocol. Though it may be accurate the cost cannot be ignored.A perfect tradeoff between accuracy and cost of the system is accomplished by choosing appropriate sensors which are temperature sensor and water level sensor. Thelevel of the water at different time instants are measured by the sensors. The readings are shown in the form of graphs at IBM Watson IoT platform.

II. RELATED WORK

AmandeepKaur [3] monitored pulse rate, body temperature (vital body parameters) of the person with dedicated along with Raspberry pi and IoT. A system is wearable and also supports remote health monitoring. The data which is sensors collected from the sensors are stored in the Bluemixcloud and then it is analyzed by the doctor. Here the Bluemix uses MQTT(Message Queuing Telemetry Transport) protocol.The main idea of the paper is to monitor the temperature and the pulse rate of a person using IoT and IBM Bluemix cloud service.

ThinagaranPerumal [4] proposed an IoTbased water level monitoring system that measures water level in real-time. The main idea of the paper is that the level of the water can be very important parameter when it comes to the flood occurrences especially in disaster prone areas. A water level sensor is used to detect the desired parameter, and if the water level reaches the parameter, the signal will be feed in realtime to social network like Twitter. A cloud server was configured as data repository. The measurement of the water levels are displayed in remote dashboard.

ParthaPratim Ray [5] used Internet of Things based approach to measure the moisture content of wood (IoTEMC). Plotly and Xively enabled cloud services are incorporated so as to register the raw values of IoTEMC into the remote IoT cloud servers for permanent storage. Real-time visualization is performed on the captured values to aware the user about the condition of the wood.Serial output helps the user to monitor the process of capture of data, network connectivity, and data transmission towards the clouds.

III. EXISTING SYSTEM

In the existing system, IoT based water system is deployed using 2 different IoT sensors (i.e. ultrasonic, water sensor) by applying IEEE802.11 communication standards. The ultrasonic sensors are configured to determine the distance between the sensors and the water level in a tank. The sensor sends out the wave and reflected and transmits the data into LCD, display the distance in centimeter. A bespoke cloud server is deployed to host the water data analytics schema that manages the entire water monitoring system. The server collects the water monitoring data forwarded by the gateway and store in a database for analytics as well as displaying them in web-based dashboard. Data collection for the system is configured in terms of timestamp, days and week in the web-based dashboard. The system diagram of the existing system is shown below

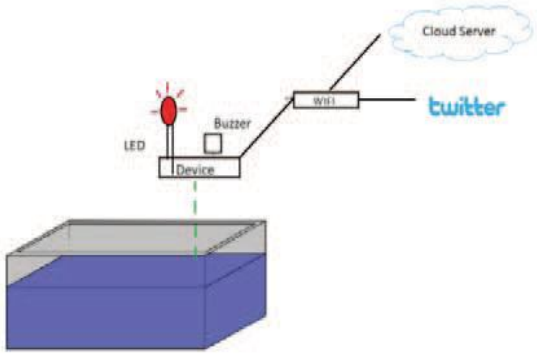

Fig.1.System diagram of IoT based water monitoring system.

During the experimental design, the distance between the water andultrasonic is converted into centimeters (cm). For benchmark and indicators, three levels of indicators are classified which are Safe level (distance greater than 45.0cm), Not Safe level (distance between 35.0cm and 45.0cm) and Danger level (distance less than 35.0cm). Both Not Safe level and Danger level will trigger the LED and subsequently update the results on web-based dashboard. Higher water level will indicate as danger level and trigger the buzzer alarm configured.

IV. PROPOSED SYSTEM

In the proposed system,Raspberrry Pi is used and instead of ultrasonic sensors, water level sensors are used. Because of that the system can perform more reliably and gives higher accuracy of water level detection reading.

The mobile application can be developed with the help of IBM Bluemix. Here MQTT protocol is used, hence the data security can be provided. The data collected from the sensors are stored in the cloud with the help of ThingSpeak platform and also IBM Bluemix cloud service is used for the development of application. With this ,the data can be globalized and the output can be viewed as a waveform in the web portal. Moreover, this output can be visualized as a waveform in the mobile application.

Camera is used to monitor the surroundingsand these can only be visualized locally. This means that the local server takes care of this work. By use of these local servers the recorded video can only be visible to that particular area people. Everything will be recorded and such data can also be used for future reference.

Raspberry Pi uses python as a language and the sensors are connected to the GPIO ports. The data collected by the sensors are stored in the cloud with the help of ThingSpeak platform. Such data can be processed and then it is analyzed. These analyzed data can be shared publicly on the cloud. Then with the required website the output is viewed in the form of graphs with respect to time. In addition, an application is developed to view the output which was developed using IBM Bluemix platform. From this, the level of the water, humidity, temperature of the surrounding environment is measured. If the level of the water is raised above the threshold level, then an alert is given to the people who are living in that area. The person who is viewing the result, if the water level is raised above particular level then he will aslo get an indication.

A. FLOW CHART

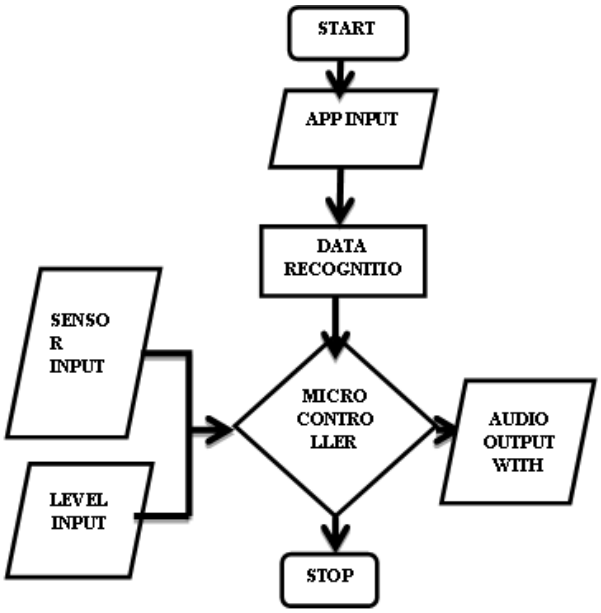

Fig.2. Flow chart of the process.

B. BLOCK DIAGRAM

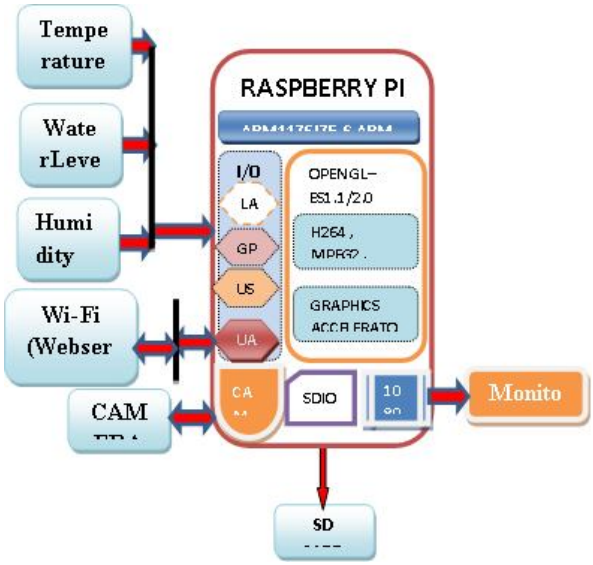

Fig.3. Block Diagram of the system.

DESIGN THEORY :

This system which consists of sensors, whose data are collected with the help of the microcontroller analog channel. After that those data gets stored temporarily in a variable. With the help of the ESP8266 Wi-Fi module we are getting the route permission to the IoT cloud. At last the channel to the cloud is made, therefore we can get the cloud update in IoT.

The block diagram showsthat the sensors are connected to raspberry pi and the some additional components such as camera, SD card. The camera is used to monitor the surroundings and what is happening in that area. SD card is used to store the results. These results can be used in the future analysis. The results are based on the water level with respect to time and also humidity and temperature follows the same. The recordings from the camera are stored in the local server and it can be visible only for the local area people. Sensors data are collected and stored in the cloud with the help of ThingSpeakIoT platform. Such data can be analyzed and globalized in the form of graphs. The changes can be updated every 50 seconds and the level of water can be easily monitored from remote place.

C. HARDWARE DESCRIPTION

The processor at the heart of the Raspberry Pi system is a Broadcom BCM2837 system-on-chip (SoC) multimedia processor. This means that the vast majority of the system's components, including its central and graphics processing units along with the audio and communications hardware, are built onto that single component hidden beneath the 256 MB memory chip at the centre of the board.Based on the latest ARMv7 32-bit processor it is powerful and faster than the previous models. Raspberry pi 2 model used in our system have the following technical specifications-Broadcom BCM2837 32 bit Quad Core processor running at 900 MHz but it can be overclocked if required. It has 1 GB SDRAM. 40 pin extended GPIO with 4 USB ports, Ethernet port, Full-size HDMI-MIPI camera port,MicroSD port for loading an operating system and storing data are the other Key features. It is a low power device which runs on 5V, 2A.

Water level sensors are called as the sensors which are used for the detectionof water level. In addition, these sensors can be defined as transducers or as integrated systems with instrumentation and control capabilities. This type of water level sensor is one of the most important sensors and plays a vital role in variety of industrial and consumer applications.

Fig.4.Water Level Sensor.

A humidity sensor is a sensor which is used to sense, measure and report the relative humidity level in the air. It therefore measures moisture level in the air. Relative humidity is defined as the ratio of actual moisture in

the air to the highest amount of moisture that can be held at that air temperature

The temperature sensors are the sensors , used to measure temperature in the environment.The temperature of the atmosphere is detected with the changes in the resistance. There are different types of temperature sensors used in the market today, including resistance temperature detectors (RTDs), thermocouples, thermistors, infrared sensor , and semiconductor sensors.

SD(Secure Digital) card is a small flash memory which is designed to produce high capacity memory in small size. Such cards can be used to store the results and these results are be viewed and then it is analyzed in the future. It can also be used to store the recorded video from the camera and this can be available only in the local server.

D. SOFTWARE DESCRIPTION

1. Cloud

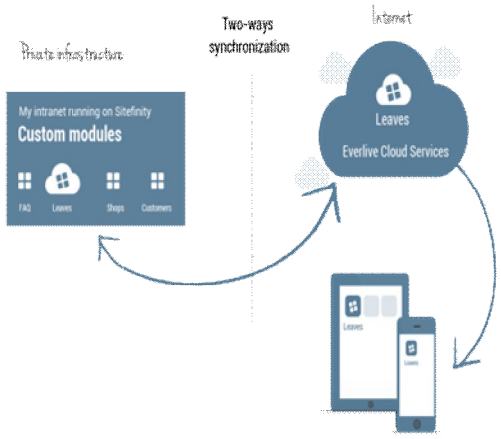

Fig.5. Simple Cloud Architecture.

Cloud computing architecture refers to the componentsthat are required for cloud computing. These componentsincludes front end platforms such as mobile devices, thin client and back end platforms includes servers, a cloud based delivery is obtained, and a network is used for communication.These combination gives cloud computing architecture.

Rather than using the local servers or personal computers, network of remote servers hosted on the internet to store, process and manage data, cloud computing is used. ThingSpeak is used in order to collect the data from the sensors and those data can be stored in the cloud. Those data from the cloud can be retrieved with the help of mqtt protocol. security to the data is also provided.

2. Python

Python programming language is developed in the late 1980's at the National Re-search Institute by Guido vanRossum. Python has grown popularly in recent years, and it is widely used commercially. Python is a flexible and powerful programming language so it is very easy to learn and follow. The clear syntax of Python makes it a valuable tool for users who wants to learn programming. This is one of the reasons why it is recommended by the Raspberry Pi Foundation.

Python is a high-level programming language. Python was used by the developers to build games and desktop applications. This is in marked contrast to low-level languages, like assembler, which are closer to how the computer "thinks" but almost impossible for a human to follow without experience.

This cross-platform support means that software written using Python on the raspberry pi can be used on computers running almost any other operating system as well—except where the program makes use of specific hardware such as raspberry pi GPIO Port. To learn how Python can be used to address this port.

3. Mqtt protocol

MQTT (Message Queuing Telemetry Transport) is a low bandwidth, a lightweight protocol which was developed in 1999 for connecting different devices and applications together especially for the machine to machine communication (M2M). Unlike HTTP protocol which uses request/response architecture, MQTT protocol follows publish/subscribe architecture. It provides great flexibility to the clients to connect as a publisher, subscriber or both. By using this protocol, the user gets connected to MQTT broker which is solely responsible for all the messages being transmitted and received.

Here MQTT protocol is used and this acts as a broker. This protocol uses publish/subscribe communication pattern between the machines. The broker is responsible for the transmission of the messages. Moreover, telemetry data goes from devices to broker or server. Security can be provided through MQTT protocol when the data is shared between servers and the end users.

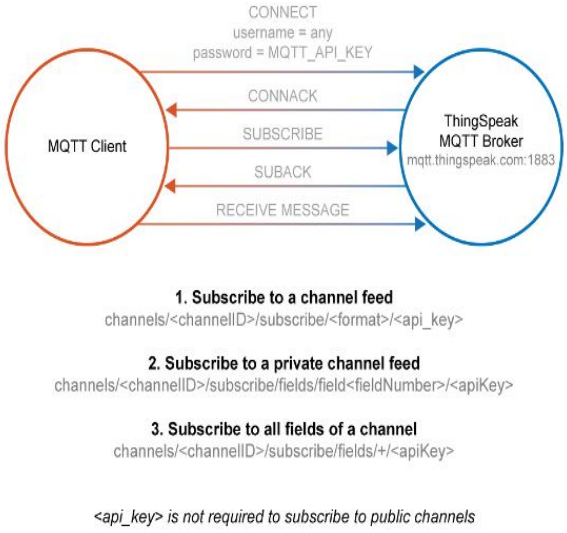

Fig.6. MQTT Protocol.

V. METHODOLOGY

Water level monitoring systems tend to be lightweight, low powered and small in size. The system consists of cheap-yet-serviceable, powerful Single board minicomputer Raspberry Pi [6]. our system has temperature sensor and water level sensor which are used to measure temperature of the surrounding environment and level of the water.Sensors are connected to the GPIO ports and the values obtained by them are analyzed. Camera is also connected to Raspberry Pi in order to monitor the environment around that particular area of deployment. The required output obtained from the sensors are converted and then the waveform is obtained for the converted values.Once our device i.e. Raspberry pi gets registered at the IBM Bluemix the values of the water level and temperature of the environment are sensed by the sensors will be transmitted from the raspberry pi to the cloud. Thus all the data gets stored in the cloud which can be accessed by the authorized persons by login id/password. On the other hand, a user can log into his/her mobile application and can check all parameters within the android based application by GUI and cloud.

VI. RESULTS AND OUTPUT

The graphs can be generated automatically on the dashboard of IBM Watson platform for both the parameters i.e temperature of the environment and level of the water is measured at different time instants. Temperature vs Time values are plotted since the values are converted to Degrees in Fahrenheit. And also Humidity with respect to time is measured and the respective output is obtained. From this we can detect the temperature of that particular area at any given time. Water level measurements can be obtained by analyzing the amplitude of the waveform with the threshold level. If the level of the waveform goes above the threshold level then an alert is given to the people. So, precaution can be given to the user beforehand itself inorder to avoid the future losses. Moreover, the dashboard presentation looks very attractive because of the different block designs available on IBM Watson platform.

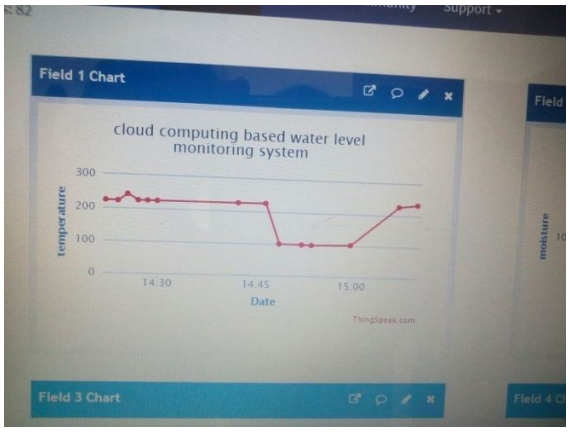

Fig.7.Temperature vs Time Graph.

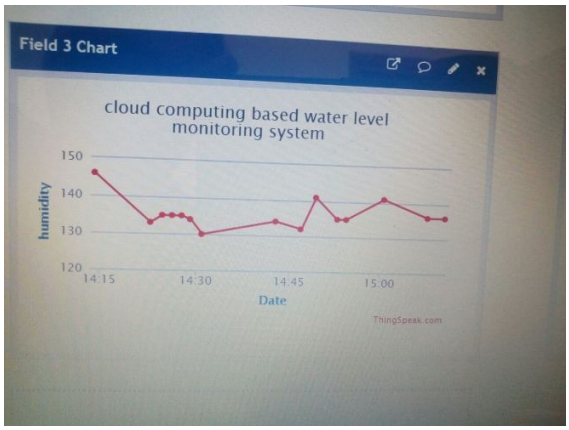

Fig.8. Humidity vs Time Graph.

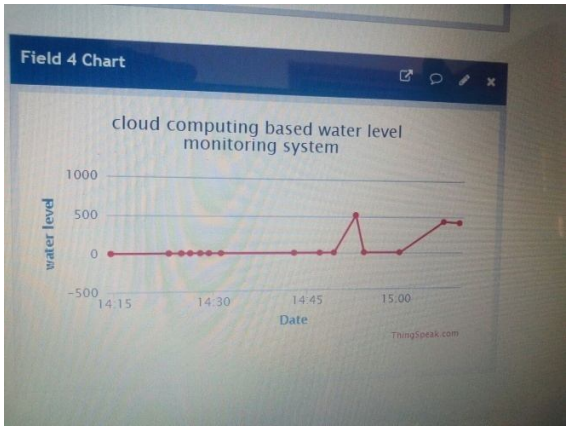

Fig.9. Water Level vs Time Graph.

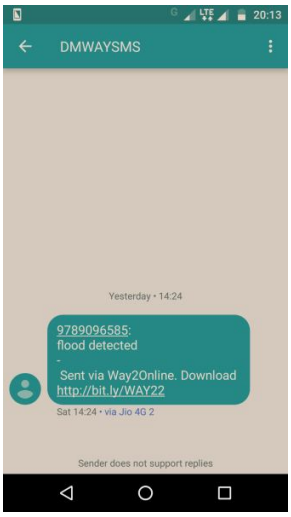

Fig.10.Dashboard representation of the data.

VIII. CONCLUSION

The proposed system provides accurate, low power and low cost system for water level monitoring for the welfare of the people in order to provide some precautions. The system makes use of single board minicomputer Raspberry pi and IBM Bluemix cloud which further makes use of MQTT protocol for reliable services. Accuracy and cost of the system are equally emphasized by using appropriate sensors. Remote sensing wearability, accuracy, low power and low cost make our system reliable and effective. Since the data are globalized any person can analyze the data from anywhere.

REFERENCES

[1] Wang, Chengen, Zhuming Bi, and Li Da Xu. "IoT and cloud computing in automation of assembly modeling systems." IEEE Transactions on Industrial Informatics 10.2 (2014): 1426-1434.

[2] Liu, X.,&Baiocchi, O. (2016, October)"A comparison of the definitions for smart sensors, smart objects and Things in IoT". 7th IEEE Conference In Information Technology, Electronics and Mobile Communication (IEMCON),pp. 1-4, 2016.

[3] AmandeepKaur and AshishJasuja "Health Monitoring Based on IoT using RASPBERRY PI". International Conference on Computing, Communication and Automation (ICCCA2017),pp.1-4,DEC2017.

[4] ThinagaranPerumal, MdNasirSulaiman, Leong.C.Y"Internet of Things (IoT) Enabled Water Monitoring System ".4th IEEE Global Conference on Consumer Electronics (GCCE),FEB2016.

[5] ParthaPratimRay " Internet of Things Based Smart Measurement and Monitoring of Wood Equilibrium Moisture Content". International Conference on Smart Sensors and Systems (IC-SSS) (2015).

[6] Maksimović, Mirjana, Vladimir Vujović, Nikola Davidović, Vladimir Milošević, and BrankoPerišić, "Raspberry Pi as Internet of things hardware: performances and constraints." p.8, design issues 3, 2014.

[7] Husni, E., Hertantyo, G. B., Wicaksono, D. W., Hasibuan, F. C., Rahayu, A. U., &Triawan, M. A,"Applied Internet of Things (IoT): Car monitoring system using IBM BlueMix",IEEE International Seminar on Intelligent Technology and Its Applications (ISITIA), pp. 417-422, July 2016.

[8] Gupta, M. Surya Deekshith, VamsikrishnaPatchava, and Virginia Menezes., "Healthcare based on IoT using Raspberry Pi." IEEE International Conference In Green Computing and Internet of Things (ICGCIoT), pp. 796-799, 2015.