

Water Level Management In Indian Railways Using IOT

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Abstract— Water is an essential resource for all life on the planet Water is the key to development and sustenance of all communities. Under conditions of increasing stress on this essential renewable but scarce natural resource, effective and efficient management of water is emerging as an urgent contemporary issue. The realization of its limited availability in space and time has necessitated the designing of new globally viable water management regimes aiming at striking a balance between the use of water as a basis for livelihood and its protection to help ensure its sustainability through present to future generations. If water is a basic resource necessary for sustaining all human activities, so we need to use this resource efficiently.

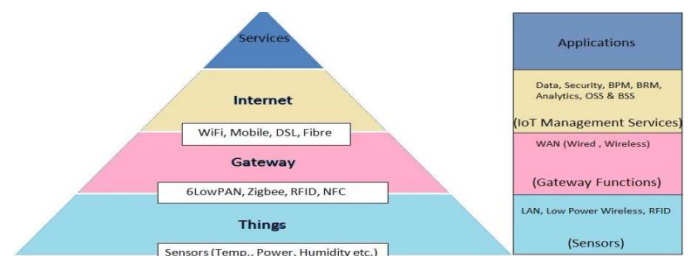
The purpose of this project is to introduce Railways water management using IOT. The term IOT stand for Internet of things .It is very clear by the name only that the Internet can be used for different sectors. One of such sector is water management in railways.

I. INTRODUCTION

By 2025, it is predicted that maximum things of day to day life will connect to the internet each second. It's not surprising then that the implications of the Internet of Things (IoT) are far-reaching and have already begun to affect what we do, when we do it, and how we do it. It will become even more interesting knowing that 99% of physical objects that may one day join the IoT are still unconnected.

In India right now we are having more than 300 million active smart phones .By using such system we can connect with internet and check out entire world in our hand, just we need to connect our personal resources(like car maintenance , water tanks level) to

internet by using different kind of facilities like WIFI ,LAN etc. By which we can get their information directly from internet and make our day to day life easier.



LAYERS OF IOT fig 1

One such example is the Indian Railways. Today Indian Railway have vital problem in the shortage of water this is not only because of scarcity of water rather it is more because of lakh of information .Till today our Indian Railways is checking the shortage of water manually when the train is at standing position and it is very difficult to check water level manually in Railway tanks. This also requires large manpower for checking each bogie individually. Also there is one more problem that there is no record of amount of water used per day at every station.

In today's day all such problem can be resolved by using latest technologies like IOT, sensor and Microcontroller (that is embedded system). Thus with the help of our project we can provide many facilities such as

- 1.) It can provide information about the shortage of water in tank of each boogie to the next station before the train reaches there.

2.) It can reduce the manpower as there will be prior information about which selected Boogie tank have less water hence it reduces cost expenditure of Manpower.

3.) It also helps in maintaining everyday record of water utility. Hence in this way it also provides the transparency which can beat the corruption

II. PROTOTYPE IMPLEMENTATION

The IOT based water management system in Indian Railway which is having average 20-22coaches (bogies). So we need to control water level in around twenty tanks. For that purpose we are breaking our system in two modules that first one is used for half coaches and another one is used for half coaches. This is because of we have used ultrasonic sensor in our project which calculate distance on the basis of duration between high and low pulse (that trig and echo pulse of ultrasonic sensor).

If we used a single MCU then there will be some delay or jitter (due to large length of 600meters) add in total duration due to which we can get wrong information.

The IoT based water system is developed using ultrasonic sensor which calculate distance by which we can determine the space of vacant tank and water level as well. The ultrasonic sensor uses ultrasonic wave to calculate distance, this waves reflect from water or any obstacle and gives rise the distance between obstacle and sensor This distance is based on time required by the ultrasonic wave for transmission and reception which is accurate if there aren't any delays or jitters in our system. We can send this data from microcontroller Unit to internet wirelessly by applying IEEE802.11g/b/n communication standards. The data transmission of those sensors is done by integrating a wireless gateway within the consumer network.

Figure 2 below shows the system diagram of the proposed system

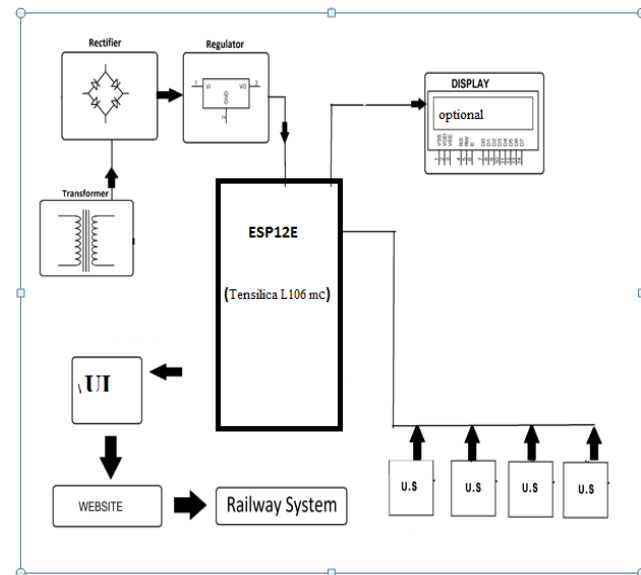


Fig2-System diagram

In this project we are using ESP12E module, this module perform the function of MCU as well as WIFI module to connect with network. Ai-thinker Team launched ESP-12E Wi-Fi module. Core processor of ESP12 is available in compact package sizes the module with Tensilica L106 integrates industry-leading ultra-low power 32-bit MCU microcontroller. This module includes 32 bit processor and it is easily available under 300RS in market. If you look towards this microcontroller unit or module as a design engineer then you will found this module is more efficient because this will reduces the NRE cost of prototype which is a very important point if you are designing an embedded system or any electronic product.

The ultrasonic sensors are used to sense a water level in tank:

Ultrasonic ranging module having name HC - SR04 provides a wide range for distance calculation from 2cm - 400cm non-contact measurement mechanism, the ranging accuracy can reach to 2mm. The modules consist of ultrasonic transmitters, receiver and control circuit. The basic principle of work: Using IO trigger for at least 10us high level signal, The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back. If there is any obstacle in front of signal then signal reflect back to ultrasonic

receiver. The distance is calculated by using time duration in which the signal come back. Distance = (high level velocity x duration of sound (340M/S) / 2.

This sensed data then send to ESP12E WIFI module contain Tensilica L106 microcontroller for processing this module sends this data over internet by connecting WIFI router. In our project we have used two protocols for sending data on internet or cloud that are HTTP and MQTT. We have also created a website to display water level on internet which is hosted by hostinger web hoster partner. This is providing 20GB virtual server in free of cost.

III. EXPERIMENTAL RESULTS

Thus we have made a project in which the ultrasonic sensor detects the accurate level of water in the tank and give signal to the microcontroller unit of ESP12E. The microcontroller processes the data and displays it on the serial monitor. What we are getting from serial monitor screen as shown in fig bellow is the water level in tank .The Ultrasonic sensor are very accurate to indicate distance

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COM2 (Arduino/Genuino Uno)
15 cm WATER LEVEL IN TANK
14 cm WATER LEVEL IN TANK
16 cm WATER LEVEL IN TANK
19 cm WATER LEVEL IN TANK
241 cm WATER LEVEL IN TANK
242 cm WATER LEVEL IN TANK
242 cm WATER LEVEL IN TANK
226 cm WATER LEVEL IN TANK
225 cm WATER LEVEL IN TANK
224 cm WATER LEVEL IN TANK
225 cm WATER LEVEL IN TANK
226 cm WATER LEVEL IN TANK
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Fig.3- water level

After that we have been sending this data on web server. To represent this data of each train in proper

manner we have developed a website. In that website there is list of train

In which we can choose particular train for which we are travelling to check water level.



Fig.4- Website representation

Here after selecting a particular train you will find further there is a list of bogies/coaches. In that list you will a particular tank having little water. The figure mention below shows the representation of water in tank.

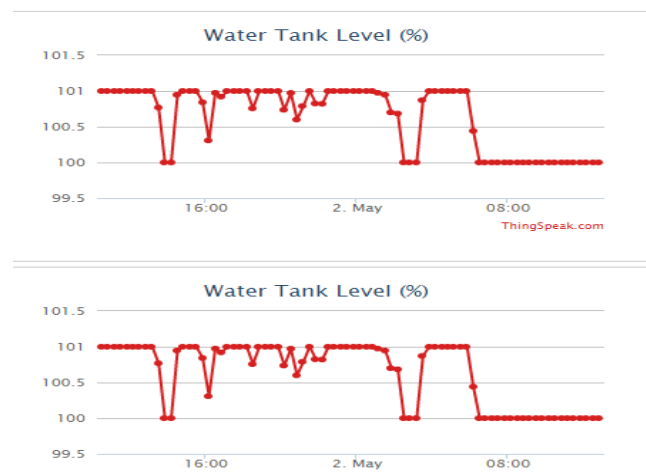


Fig-5 Final Result at website

IV. CONCLUSIONS AND FUTURE WORK

We have made a project in which the ultrasonic sensor detects the accurate level of water in the tank and give signal to the microcontroller unit of ESP12E. We have used 32 bit ultralow power industrial based microcontroller Tensilica L106. By using this microcontroller we can compact our embedded system size and we can also reduce power consumptions. So we conclude that we can accurately measure water level in tanks and we can successfully send multiple sensor data on web server by using ESP12 wifi module. This wifi module uses protocols like MQTT, HTTP, TCP or UDP by which we can send our data on web server or cloud .To that data we have provided user friendly interface through any website or application and android app

In the future, the ultra-sonic sensor could be replaced by precise water level sensor, so that the system can able to perform more reliably. The size of system is also reduce by using that sensor.

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