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Water Pipeline Leakage Detection and Control Management System Using Iot

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Abstract: Water is always an ultimate resource for every living thing but in water distribution network, it has been estimated that about 20-30% water is drained as waste worldwide. Now it became essential to minimize wastage of water through pipe line leakage. Here, the designed model will measure the water flow in end to end monitoring system. This system will monitor the water leakage by measuring the flow of liquid through water pipeline network. In addition to this the flow and leakage of water can be monitored from anywhere using IoT which provides minimum operational cost.

Keywords: Internet of Things(IoT), Micro controller, Solenoid valve, Water Flow Sensor.

I. INTRODUCTION

Water is most primitive resource for any living things in order to lead the life. Due to global environmental conditions the conservation of water became essential part of life. In addition to this, water is much needed resource for industries, Household and power generation. This ultimate resource is waster through leakage in pipes because of burst, cracks, corrosion in pipes and also through overflow of water in tanks. It became serious issue now a day.

At Present, IoT Plays major role in cloud based controlling techniques which has significant impact on the evolution of industrial operation and control. Example, Mr. Ravichandran developed outstanding device which detect the accurate level of a liquid and prevent it from overflowing and leakage problem. This intelligent device provides information about flow of liquid and level of a liquid in tank system using wireless technology[1][2][3]. In addition, IoT provides device- device communication which enables the exchange of information among them. This provides smart control over the devices[4]. In this application IoT is utilized to interconnect the sensors , control valves and actuators for remote monitoring and control. Now days, all the field devices and sensors can communicate with all devices which are connected in same network with the help of internet or local area networks or other communication protocols. IoT provides the platform for those devices to communicate with each other. This feature leads to effective monitoring and utilization of all those field devices under a single umbrella. This allows the industries to become more organized in order to minimization of errors in the process. The evolution of IoT took a decade with dynamic changes in industry in numerous field of Engineering. In wireless network, tagging of each device with individual device id will helps for identification, Monitoring and controllingit[5].

Now, it is important to detect and monitoring water leakage in most effective way which can be utilize recent techniques [6]. If efficient use of Water in industries, Institutions, office and other domestic places is followed then water management system will be potential. For this management purpose recent technologies like Internet of Things (IoT) can be utilized for remote control and monitoring[7]. Otherwise, IoT plays vital role latest environment in industry which offers flexibility in transferring the data from field to remote locations. Data storage in Cloud computing provides access of data worldwide with simple internet connection which is more reliable and effective [8][9]. This also allows users to control the process from remote locations. Internet protocols like Local area Network, Wi-Fi and other protocols helps in end to end interaction between user and field devices[9].

II. LITERATUREINVESTIGATION

Water may be an influential natural resources and it is extensively manipulated as roughly, with a estimation of one third of world water practical uses having a loss of water of around 40% thanks to leaked out [7]. A long before established pipeline leakage detection called for frequent assessment with personage participation, which can make our time and in efficacious for promptly and sporty diagnosement. This results in a rise within

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the build out of methods to fix leaking, detecting, and locating, and it is something we are able to sight in innumerable dissimilar projects.

A very early told, the market started to offer riposte for technical use, chiefly with compatible piece of equipment's that are utilized in keeping good conditional situations which called for human support. Those piece of equipment's are commonly formed from acoustic or ultrasonic sensors that will discover the leakage in vacant pipes by employing sound, such as in [8–10].Then the most stumbling-block of these set-up, aside from their extortionate cost and prerequisite of man workforce, is that the paucity of real-time scrutiny, which might only trace that a discharge exists but is ineffectual to trace-out when it takes place.

In the scholastic domain, this field hand out the assorted papers, chiefly without the employment of ML methodology.

In [11], the creator generated a system to tell and sway water consumption in buildings and households. The set-up that is established straightaway on pipes manipulates a water pulse meter to capture the continuity and intensity of water passage along the utility so as to find-out water spouts. The stumbling-block of the following method are that it only discover the leaks if a unexpected diminish within the water passage occurred which it cannot identify where the dropout were raised, only that it fallen out. Also, the set-up wasn't evaluated on a real circumstances, therefore the precision of the conceptualization isn't within easy reach.

The creators of [12] also arise a WSN using thermal piece of equipment's for the water leaks in pipes. In this scenario, this setup will trace-out temperature switchingof the soil above the spouts, and permitting the user to be notified of a feasible leak location. The creators proposed system will detect the spouts when the soil switching's by 0.5 ◦C but also affirmed a significant shortcoming in their set-up, until now ambient circumstances will enormously influence the outcomes. Apart from that, this setup also remains on the belief that soil consist of sands, like so not having the ability to figure in brick or concrete.

To thrive a sensible meter with discharge-detection capabilities, the creator of [13] utilize a collection of basic piece of equipment's, chiefly through passage meters, to collect data about water motion in pipes, transferring that data to a cloud setup by employing LoRaWAN. To trace-out the existence of spouts, an easy about juxtaposition of adjutant piece of equipment is executed, analyzing a possible spouts supported the droplets of flow between these two spots. Even though this setup was ably presented and also the procedure followed was analogous to the one,who presented during these paper, our way-out of benefits from this actual certainty that they applied machine learning to trace-out the leakages, with a more elaborated scrutiny's. Also, their point of view were dissimilar with the employment of Narrow-Band IoT (NB-IoT) transmits the information to the cloud, as LoRaWAN portals are until now scarce, as it was pointed by the creators. NB-IoT permits for supplemental capability to put in a system that wherever,everywhere,anywhere within the world.

III. IMPLEMENTATION

3.1. SystemDesign

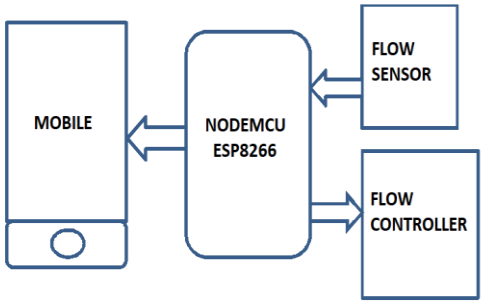

Fig. 1 Design of Water Management System

The representation of the water management system is exhibited in fig.1 and different sensors which sense the flow of water and so transmit through the micro controller. After analyzing the varied parameters of water, the microcontroller will start transmitting the information to the particular authority via NodeMCUESP8266.

3.2. Circuit Diagram

The circuit for our system showed in Fig.2. It comprise of the water flow sensor, Arduino MEGA, and

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ESP8266, The sensor information are executed within the Arduino moduleand then relocated by means of the ESP8266 Wi-Fi data transfer unit to the most servers. The sanctioned users can approach this information by organizing their account employing a Consumer ID and password. The composed data is, sustaining through numerous stages like processing, analyzing, transmitting, and eventually displaying the info to real-time users. The NodeMCU ESP8266 may be a self-contained Wi-Fi Module with inbuilt TCP/IP protocol stack. It allows the microcontroller unit to the right of entry to the WiFi system. This affordable Wi-Fi microchip is assembled by M/S Espruino . This Arduino microcontroller unit was predicated on embedded trace support and real-time emulation. This NodeMCU ESP8266 uses a serial transmitter/receiver (Tx/Rx) for transmitting and receiving the information at Ethernet buffers, and serial commands to uncertainty and modify the configurations of the Wi-Fimodule.

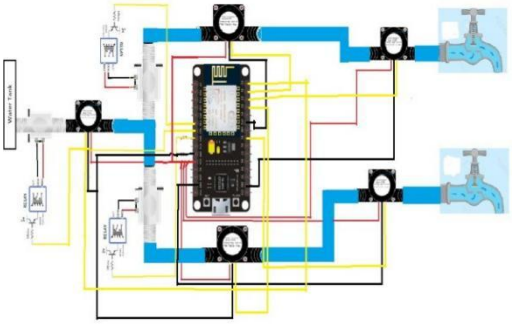

Fig. 2 Circuit of the proposed project

This module is directly tethering the microcontroller, so we can begin approaching the data until to the main server.

IV. COMPONENTS DESCRIPTION

A sensor is a device which is employed to detect and response to some form of input from the physical surroundings. the precise inputs are pressure, motion, heat, light, moisture or the other environmental phenomenon. Generally a sign is also produced as outcome which is modified to legible display within the piece of equipment locality or transferred by machine over a set- up for scrutinizing the signal for enhanced processing. the following sensors are employed in this research work.

4.1. Water Flow Sensor

The sensor YF-S201 placed in track with our water line and uses a pinwheel sensor to live what quantity of liquid has moved through it. Integrated Hall Effect sensor outputs an electrical pulse with every revolution. For every single revolution Hall Effect sensor produces an electrical pulse. The Hall Effect sensor place in water pipe will be sealed by water proof material for maintain sensor safe and dry. Hall Effect sensor comes with three wires.

-Red(5-24VDCPower)
-Black(ground)
-Yellow(Hall effect pulse output).

The output water flow can measure by calculating pulses from the sensor,Every pulse approximately indicates 2.25 milliliters. Hall effect sensor is not precision sensor and therefore the pulse does not very for a small amount flow rate, pressure of fluid and orientation of sensor. In order to achieve better result from sensor calibration should be done carefully.

4.2. NodeMCU ESP8266

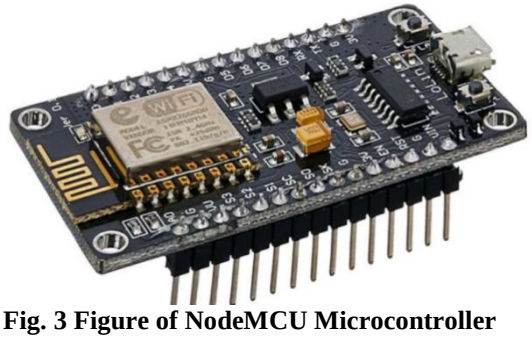

Fig. 3 Figure of NodeMCU Microcontroller

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Development board (NodeMCU ESP8266) provided with the ESP-12E, and this module contain ESP8266 chip with TensilicaXtensa which is 32-bit LX106 RISC Processor. This chip supports real time operating system with operating frequency of 80MHz to 160 MHz.NodeMCU contain 4MB of flash memory for storing programs and related data , it also has 128 KB of RAM for processing.It has extraordinary power for processing with built-in Bluetooth/ Wi-Fi and deep sleep operating features in order make it as ideal for IoT Applications. NodeMCU is powered with help of USB port and Vin pin. It is capable of SPI, I2C and UART interfaces.It is an open source Luabased firmware and development board specially targeted for IoT basedApplications. NodeMCu contains software which runs on ESP8266 Wi-Fi SoC by Espressif systems, hardware module based on ESP-12.

It contains the following control pins which are EN, RST and reset pin of the controller. Analog signals are measure using analog pin A0 with voltage range of 0-3.3 V. There are 16 general purpose pins which are named as GPIO1 to GPIO16. For SPI communication four pins are available and they are SD1,CMD,SD0,CLK. In order to upload the programs UART pins are used which are TXD0, RXD0, TXD1 and RXD2. It has I2C functionality for supporting internal operation of these pins. It has clock speed of 80 MHz, Flash Memory of 4MB , SRAM of 64 KB, USB-TTL based on CP2102 is included onboard, Enabling Plug n Play, PCB Antenna and finally it is small sized module to fit smartly inside your IoT projects.

4.3. Flow Sensor YF-S201

This sensible device engages with the following three different wire types: red colour (5-24 DC power), black colour (ground) and yellow colour (Hall Effect pulsing output). By computing the pulses observed from the out-turn of the sensor. Each pulse is approximately 2.25 milliliters. The pulse signal is a simple square wave so its trouble-free to log and transform into liters per minute

Fig.4 Figure of Flow Sensor

4.4. Solenoid Valve NC

The flow of liquid and gas can be controlled using electromechanical device called solenoid valve which used to automate the control of liquid and gas flow. It offers high reliability, quick operation, high durability and compact in size. Normally NC type solenoid valve can be used to control the flow of liquid and gas. When normally closed type solenoid valve is energized , the magnetic field produced in its coil makes the plunger to rise. This process makes to liquid to flow through valve by unsealing it.

Fig. 5 Figure of Flow Controller

V. SOFTWARE IMPLEMENTATION

5.1. Arduino IDE

The Arduino IDE (Integrated Development Environment) is a cross platform application used for operating systems like Microsoft windows, Linux and MacOS. This platform is created by using languages like C and C++, It used to create application based programs and writes it into the Arduino compatible circuit board. This can be

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used for third party development boards as well. The IDE source code has been released under public license called GNU.Integrated development environment also compatible with C and C++ languages with specific set of rules of code structure. IDE contain set of library file to write the codes for specific applications. User code requires two basic functions one for starting the of function and next one for main function loop, that complied and link with stub main() program.

VI.OPERATION OF DEVELOPED MODEL

The analog data's will be apprehended by above analog to digital converter which will be transmitted through microcontroller. After executing the digitalized information inside the microcontroller field,it will started to finishing the analysis and therefore the water flow will be identified and that results were sent to the definite person, who is working with the device via Wi-Fi. Using the Wi-Fi module, the online page is tethered with the microcontroller. The central monitoring system receives the measured value supported the acquired data, the corresponding official will take required action for his or her supplemental decision. The simulation code was developed using Embedded - Csoftware.

VII.INTERNET OF THINGS(IOT)

Internet of Things is an online platform which is upcoming trendsetter in the near future.Maybe this type of IoT based things will be available on everyone's house as an important role playing appliances(i.e)washing machine, fan, television everything can be monitored, visualized and controlling from everywhere in the world.In brief, IoT is an internet service based material which can transmit the observed data or information to its own cloud and retrieves it to the user.

7.1. ThingsSpeak

ThingSpeak is an analytics based IoT platform service which allows users to collect, visualize and analysis datas from cloud in online mode. Data from any device can be send to ThingSpeak for visualization of data lively and send alerts to the concern people. This helps to send data's of any local sensor network data's to cloud and view those data's with help of MATLab[14].

VIII. RESULTS

ThingSpeak Cloud platform enables the definite users to approach the uniformed data by registering on at their internet service based ambience. By declaring the take downed password and consumer ID, that parameters will going to be display. In order to avoid wasting water for the longer- term world, the IoT Based Smart Water Leakage Detection and Manager for apartments and houses are built. The findings of this analysis study are presented and discussed in various parts on the premise of the framework for research methodology. Important results of every study, including the foremost promising wearable devices and sensors for building safety applications and trends are presented. Last, we explain the scenario we identify for validation, and therefore the list of features that we are going to test at this station established an experimental station.

IX.CONCLUSION

The leakage detection parameters such as the Water Flow sensor are recorded and examined in real-time. Based on the measured data, that person will get an alert. It will help them to prevent leakage of pipeline water within the threshold limit. actions can be taken to control tremendous levels of leakage like in the case of the 100 storey buildings and Luxury Star Hotels. The ultimate advantage of the proposed work is, simple for installation and it can be placed near enough to the target area. This device can be operated even the persons who didn't known to operate the internet based devices as well.

In future, this work can be extended to detection of leakage for pipe length of more than 2 meters in long and accuracy of leakage detection can be improved. Also it can be extended to large network of pipe line which has more branches and connection.

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