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Gray Water Recycling and Water Quality Management using IOT

Prof.Mr.A.H.Ansari[1], Sagar Sonawane[2], Pravin Khade[3], Kanchan Jondhale[4]

[1]*Prof. Dept. of Electronics and Telecommunication Engineering, Pravara Rural Engineering College, Loni, India*

[2,3,4] *Students, Dept. of Electronics and Telecommunication Engineering, Pravara Rural Engineering College, Loni,India*

Abstract - Water pollution is one of the biggest fears for the green globalization. In this paper we present a design and development of a low cost system for real time monitoring of the water quality in iot(internet of things).the main objective of the project was to recycle grey water. It is comprised of three parts. The first part being, recycling of grey water using tri-layer filter tank, second for generating energy from grey water by using turbines and last part was water quality management using IOT. The grey water recycling system components were designed and they consist of piping system, filtration system. The project includes collection tank, filtration tanks and storage tank. The filtering media used are charcoal, sand and foam. Turbine produced the electrical energy. This turbine converts the energy of flowing water into mechanical energy. This projected water quality observation interfaces sensors with quality observation with IOT setting. In this WQM implementation model that consists of different sensor devices and other modules. In this implementation model we used PH sensor. WQM selects parameters of water like PH level, water. This methodology sends the information to the web server using IOT. The data updated at intervals within the server may be retrieved or accessed from anyplace within the world.

Key Words: Grey water electricity generation, IOT, Water Purifier, PH Sensor, Water Turbine.

1. INTRODUCTION

Now a day's water is polluted due to many reasons. In this existing system the equipment cost is high and it takes a lot of time to process. Traditional methods have the disadvantages like complicated methodology, long waiting time for results low measurement precision and high cost.The economical and effective system of water quality observation is the toughest implementation of impure water. Drinking water could be terribly precious for all people as water utilities face more challenges. These challenges arise due to high population, less water resources etc. So, different methods are used to monitor in the real time water quality. To make sure that safe distribution of water is done, it should be monitored in real time for new approach in IOT based water quality has been projected.

Producing power through renewable energy systems in buildings, known as green buildings, is becoming more and more crucial and also popular in these days.Energy consumption in developed as well as developing countries is high, especially in the residential and commercial building sectors. Researchers have been working on several technologies for the reduction of energy consumption in buildings; among them, energy-harvesting techniques are quite promising. In this paper, we explore a possibility of harnessing energy from grey water, while it flows down through high-raised buildings. We propose the usage of a micro/pico hydro turbine installed at the ground floor of a high rise building that utilizes the energy of grey water falling from floors above, to generate electricity. The electrical energy generated from the turbine can be utilized further in numerous ways. Scaled prototype of the same has been developed and tested. The proposed design of a gravity-energized wastewater system in high-rise buildings for generation of hydroelectricity is being checked for its feasibility in Indian markets. Calculation shows that the proposed system is commercially promising for most of the major cities in India. We also discuss cost benefits analysis of the proposed system to support our claims for possible commercialization of this technology.

This projected water quality observation interfaces sensors with quality observation with IOT setting. WQM selects parameters of water like pH level, water. This methodology sends the information to the web server. The data updated at intervals within the server may be retrieved or accessed from anyplace within the world. If the sensors do not work or get into abnormal conditions then a buzzer will be ON.

1.2. LITERATURE REVIEW

A brief digest of previous works in this field is given bellow

USHA .D, ANSALIN J implements the " Grey water recycling system" that will provide water to meet the needs of the house and irrigation purpose around the house. The water can be used for cleaning and flushing purposes. The grey water recycling system components were designed and they consist of piping system, diversion system, Filtration and storing system. The project includes collection tank, filtration tanks and storage tank. The filtering media used are Alum and Bio-sand.The filtered water is stored in storage tank and the overall process will be controlled by Arduino Mega, monitored by IOT Technology.[1]

J. S. Lambe , R. S. Chougule *entitled "grey water treatment and reuse"* this paper describes to ensure alternative resources include rainwater and bulk of water used in household will emerge as grey water and contain some minerals, organic waste materials dissolved and suspended in it. When this is allowed to flow out this will join the sewage and bacteriologically contaminated, resulting in a sewage stream. It is possible to intercept this grey water, at the household

level, treat it so that it can be recycled for garden washing and flushing purposes.[2]

Jayti Bhatt, Jignesh published "Real-time water quality monitoring system". This research ensures a safe supply of drinking water the quality should be monitor in real time for that purpose new approach IOT based water quality monitoring has been proposed. This system consists of different water parameter like PH, turbidity, conductivity, dissolve- oxygen, tempreture etc. The microcontroller processes the data. At last data from the sensors is viewed on the web server. [3]

Sajad Mir5varzandeh, Sina Baghbani Kordmahale entitled "Turning Wastewater (Greywater) Into Electrical Energy In BuildingS" this paper describes the Producing power through renewable energy systems in buildings, known as green buildings, is becoming more and more crucial and also popular in these days. In this paper we are introducing a new system by which it is possible to produce more than 1000 watts electrical power. The system works by wastewater generated from domestic activities such as laundry, dishwashing and bathing, known as greywater. This Waste to Energy (WtE) system is capable to provide notable electrical power of needful light or other public electrical facilities of a typical building complex. The turbine can produce electrical energy according to the height of the building (sewage plumbing) and its habitancy. The higher and more habitant the building, the more energy is produced. The micro turbine generates electrical power according to the height of the building and its habitancy (amount of water which is used and amount of greywater which produced. It has to be mentioned that for making such systems which works via a turbine, system is in need of continues flow in order to increase efficiency. Before any act it has to be asked and calculated that after accumulation of greywater behind the dam and reaching to a proper height, can the building provide such amount of greywater that its level doesn't come down in the plumbing system? Moreover, choosing a proper turbine is crucial. Many types of turbines are available, so it is important to match the machine to the site's conditions of head and flow. It is possible that the electricity be used directly or be saved in a battery.[4]

Vaishnavi V. Daigavane ,Dr. M.A Gaikawad published the "Water Quality Monitoring System Based on IOT" .in this paper they describes the present a design and development of a low cost system for real time monitoring of the water quality in IOT(internet of things).This system consist of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured. The measured values from the sensors can be processed by the core controller. The Arduino model can be used as a core controller. Finally, the sensor data can be viewed on internet using WI-FI system.[5]

2. PROPOSED SYSTEM

In this water quality management implementation model that consists of different sensor devices and other modules .In this implementation model we used PH sensor.

WQM selects parameters of water like PH level, water. This methodology sends the information to the web server. The data updated at intervals within the server may be retrieved or accessed from anyplace within the world. If the sensors do not work or get into abnormal conditions then a buzzer will be on. Real time water quality observation is monitored by data acquisition, method and transmission with increase in the wireless device network technology in internet of things. The measured values from the sensors are interfaced

Here we are using PIC 18f4520 microcontroller, which is 40 pin IC. We needed 12V and 5V power supply.

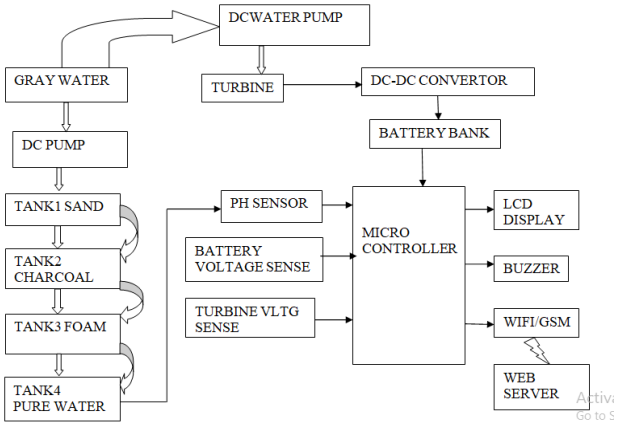

Fig -1: Block Diagram

2.1 PIC 18F4520 MICROCONTROLLER:

Data Memory up to 4k bytesn Data register map - with 12-bit address bus 000-FFF

- Divided into 256-byte banks
- There are total of F banks
- Half of bank 0 and half ofbank 15 form a virtual (oraccess) bank that is accessibleno matter which bank isselected – this selection isdone via 8-bits
- Program memory is 16-bits wide accessed through a separate program data bus and address bus inside the PIC18.
- Program memory stores the program and also static data in the system.
- On-chip External
- On-chip program memory is either PROM or EEPROM.

- The PROM version is called OTP (one-time programmable) (PIC18C) The EEPROM version is called Flash memory (PIC18F).
- Maximum size for program memory is 2M n Program memory addresses are 21-bit address starting at location 0x000000

Fig -2: PIC18f4520

2.2 PH Sensor

The PH of a solution is the measure of the acidity or alkalinity of that solution. The PH scale is a logarithmic scale whose range is from 0-14 with a neutral point being 7. Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. It operates on 5V power supply and it is easy to interface with PIC18F4520 Microcontroller. The normal range of PH is 6 to 8.5.

PH is the most important parameter of water. It indicates alkalinity or acidity of a sample. It's an analog sensor manufactured by DF Robot. Though digital meter is much accurate and gives continuous reading, we have to tradeoff between budget of my project and accuracy. PH value is measured in the scale of zero to fourteen and temperature value is found between zero to eighty degree Celsius.

Fig -3: PH Sensor

2.3 GSM Module:

SIM800 is a complete Quad-band GSM/GPRS solution in a LGA type which can be embedded in the customer applications.SIM800 support Quad-band 850/900/1800/1900mhz, it can transmit Voice, SMS and data information with low power consumption. With tiny size of 15.8*17.8*2.4 mm, it can fit into slim and compact demands of customer design. Featuring and Embedded AT, it allows total cost savings and fast time-to-market for customer applications.

Using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open a connection to that COM port at 9600 baud rate, which is the default baud rate of this modem. Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands.

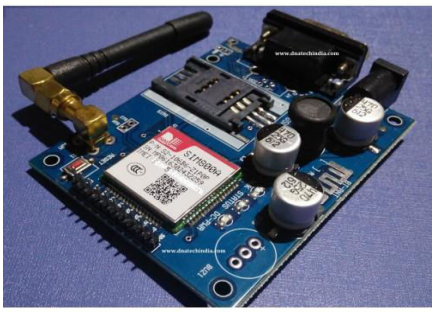

Fig -4: GSM Module

2.4. Relay Unit:

A relay driver circuit is a circuit which can drive, or operate, a relay so that it can function appropriately in a circuit.

The driven relay can then operate as a switch in the circuit which can open or close, according to the needs of the circuit and its operation.

Now that we're using a transistor to drive the relay, we can use considerably less power to get the relay driven. Because a transistor is an amplifier, we just have to make sure that the base lead gets enough current to cause a larger current to flow from the emitter of the transistor to the collector. Once the base receives sufficient power, the transistor will conduct from emitter to collector and power the relay.

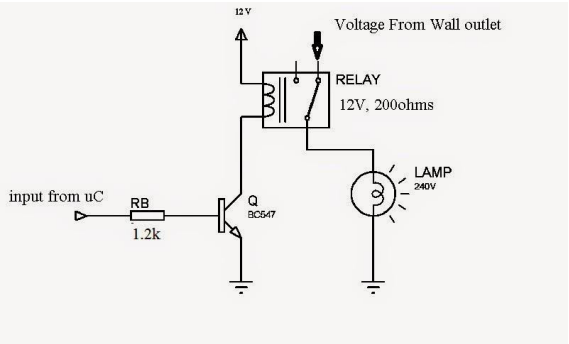

Fig -5: Relay Unit

2.5. **LCD display**:

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

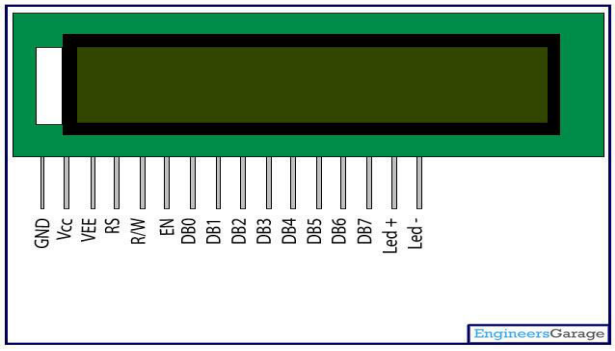

Fig -6: LCD Display

2.6. **DC Motor**:

"A DC motor is an electrical machine which converts electrical energy into mechanical energy. The basic working principle of the DC motor is that whenever a current carrying conductor places in the magnetic field, it experiences a mechanical force**.**

Fig -7: DC Motor

3. Result:

Here we successfully implemented "Grey Water Recycling and Water Quality Management over IOT ". Photographs of actual hardware shown in fig 8(a) and fig.8(b).

Fig -8(a): photograph of Actual Hardware

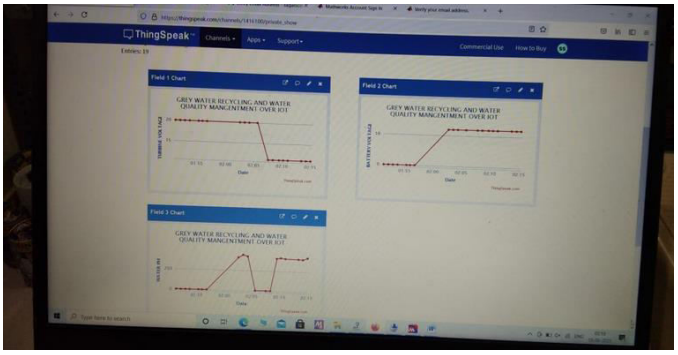

Fig -8(b): photograph of IOT web Page

4. CONCLUSIONS

The Grey water recycling System proposed can greatly eliminate the scope of manual labor, While cities moving towards solutions which can diminish the existing problems in water recycling systems. And here is one more extra advantage we get electrical energy from grey water by using turbine.it Monitoring of PH of Water makes use of water detection sensor with unique advantage and existing IOT platform. It can be installed for cleaning toilets, Gardening, Vessel washing and Furthermore, it can be used for Floor washing in home. The growing emphasis on smart cities and environment friendly alternatives necessitate a technologically competent means of combating the problem of water demand. The system is more eco-friendly as well as having fully automatic operation.
The system can monitor water quality automatically, and it is low in cost and does not require people on duty. So the water quality testing is likely to be more economical, convenient and fast. The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters. The operation is simple.

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