ZKG INTERNATIONAL

ISSN: 2366-1313

RAIN WATER HARVESTING AND WATER QUALITY MONITORING USING IoT

Mr. K. Dhanumjaya[1] R. Bhagya Sri[2] R. Praveen Kumar[3] Sk. M . Sudais [4] Sk. Nizam Ahamed [5]

[1,2,3,4,5] Department of ECE, Audisankara College of Engineering &Technology, Gudur, Andhra Pradesh, India.

***Abstract*— Water is one of the most important and basic natural resources. While the total amount of water available in the world is constant and is generally said to be adequate to meet all the demands of mankind, its quality and distribution over different regions of the world is uneven and causes problems of scarcity and suitability. In this paper, a more efficient way of rainwater harvesting is proposed. Due to vast globalization, urbanization and modernization the quality of our surroundings is degraded, which in turn, affects the natural phenomenon of rains too. The burning of fossil fuels at a vast level, the fumes from the exhaust of automobiles and oil refineries lead to the formation of toxic gases like sulphur dioxide, carbon monoxide, nitrogen dioxide etc. These gases get transported by air and wind currents. Sulphur dioxide and nitrogen dioxide mixes with water and other material to form sulphuric acid and nitric acid and cause acid rain. The problem in harvesting rainwater arises here. As we know the filtration processes is quite expensive, so if we can check the quality of water before storing it into reservoir or sending it to ground water table. It would be easier to decide for what purpose we can use the harvested water and also we can save the groundwater from getting polluted by the acid rainwater.**

Keywords: **Water Harvesting System, Water Quality, Global Water Crises, Urban Water Recycle, Drinking Water, Sensors, IoT**

I. INTRODUCTION

Sensors were integrated into a dual-channel device which operated as detection and a reference We demonstrated a miniaturized bacteria-based Bio sensing platform for sensitive, reliable and practical on-line monitoring of water quality. Two sensor, respectively. By providing a reference-compensated sensing response, the device was capable of minimizing environmental interferences such as soil and ph rate, ultimately leading to high sensitivity and reliability in water quality monitoring.

We used PH sensor as for the detection of water quality substances in water. Each sensor incorporated Arduino, which substantially decreased the device complexity and enhanced the practicability as a real-world application. By controlling the introduction time of the toxic samplewith sequential injection of the fresh media into thedetection channel, the biosensor is completely reusable and is potentially applicable to long-term in-situ monitoring of water quality.

II. RELATED WORK

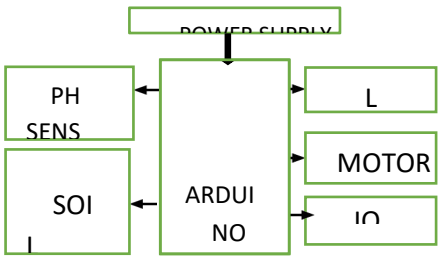
Rainwater is widely collected and stored in cisterns for domestic use due to extreme water scarcity and poor water quality on the Loess Plateau, China. However, little information exists on the effects of cistern materials and construction methods on water quality. This study assessed the quality of rainwater and harvested rainwater stored in different types of cisterns, using multivariate statistical analysis techniques.

The harvesting system consisted of ditches underground to direct the water stream collected by catchments through pipes to the two-stage grit chambers, the rainwater runoff ultimately being fed into the cisterns. The harvested rainwater generally did not meet drinking water standards due to severe bacterial contamination.

III. PROPOSED WORK

The proposed water monitoring system is used to measure the water quality using PH sensor. When the Water level is below the threshold level means that area can be send to the server immediately through the IOT Module. When the pH is in abnormal the threshold level means that area can be send to the server immediately through the IOT module. Water recycle system can start the process for recycle the water. By using the advanced sensor networks, we can detect the quality of water easily and protect humans from attacking of unwanted diseases. Using this sensor values it is easy to identify the purification levels in water. Water filling Motor is used to fill the water in tank when Water level is low.

IV. CONCEPTUAL DESIGN OF THE SYSTEM



ISSN: 2366-1313

Fig. 1. Block Diagram of the System

A. Hardware Used

1) Arduino UNO R3

An Arduino is actually a microcontroller-based kit which can be either used directly by purchasing from the vendor or can be made at home using the components, owing to its open-source hardware feature. It is basically used in communications and in controlling or operating many devices. It was founded by Massimo Banzi and David Cuartielles in 2005.The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward.

The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions.

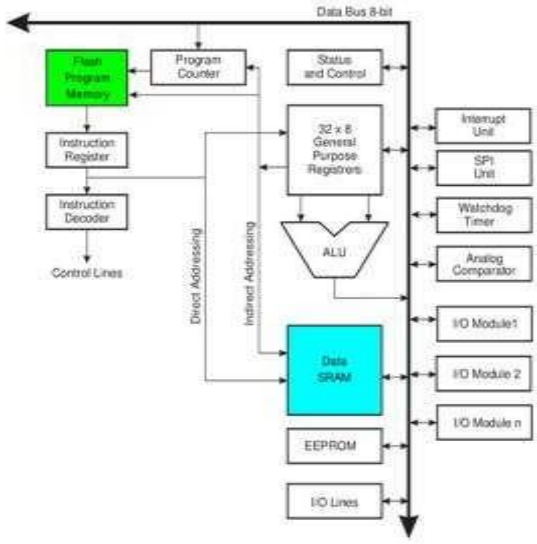


Fig.2 . Architecture of Arduino UNO

2) PH Sensor

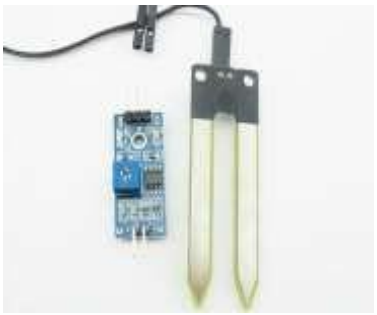
This multi-purpose meter to help provide a healthy growing environment for all plants. It tests for soil alkalinity / acidity, soil moisture, and sunlight. pH measurement is a determination of the activity of hydrogen ions in an aqueous solution. Many important properties of a solution can be determined from an accurate measurement of pH, including the acidity of a solution and the extent of a reaction in the solution.

2.1) pH of water at different temperatures

Temperature	K_w	pH
0° C	0.114×10^{-14}	7.46
25° C	1.01×10^{-14}	7
100° C	49×10^{-14}	6.15

3) Soil Sensor

This Soil Moisture Sensor can be used to detect the moisture of soil or judge If there is water around the sensor, let the plants in your garden reach out for help. Insert human this module into the soil and then adjust the on-board potentiometer to adjust the sensitivity. The sensor would outputs logic HIGH/LOW when the moisture is higher/lower than the threshold set by



potentiometer.

4) LCD Display

An LCD is made with either a passive matrix or an active-matrix display grid. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active-matrix display can be switched on and off more frequently, improving the screen refresh time. Passive matrix LCD's have dual scanning, meaning that they scan the grid twice with current in the same.

5) DC MOTOR

An Electric DC motor is a machine which converts electric energy into mechanical energy. The working of DC motor is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a mechanical force. The direction of mechanical force is given by Fleming's Left-hand Rule and its magnitude is given by F = B I l Newton.

ISSN: 2366-1313

There is no basic difference in the construction of a DC generator and a DC motor. In fact, the same D.C. machine can be used interchangeably as a generator or as a motor. Like generators DC motors are also classified in to shunt-wound, series-wound and compound-wound.

B. Software Used

Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing.

Embedded C uses most of the syntax and semantics of standard C, e.g., main () function, variable definition, datatype declaration, conditional statements (if, switch, case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, etc. A Technical Report was published in 2004 and a second revision in 2006.

C. Technology Used

The technology used in this project is the Internet of Things (IoT). sensors were integrated into a dual-channel device which operated as detection and a reference We demonstrated a miniaturized bacteria-based Bio sensing platform for sensitive, reliable and practical on-line monitoring of water quality. Two sensors, respectively. By providing a reference-compensated sensing response, the device was capable of minimizing environmental interferences such as soil and PH rate, ultimately leading to high sensitivity and reliability in water quality monitoring. Thus, we use IoT technology.

V) SYSTEM DESIGN OF MODEL

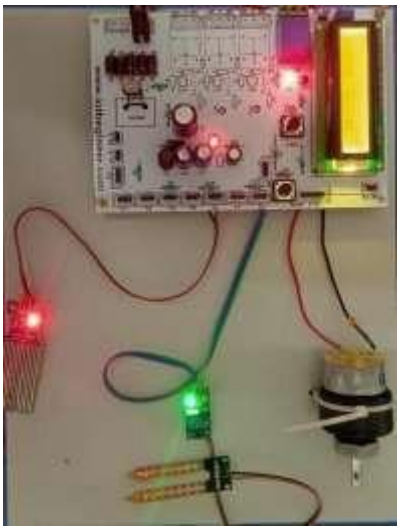


Fig3: System design model of waterquality monitoring system using IOT

VI. SYSTEM ANALYSIS

The purpose of the System Analysis is to produce the brief analysis task and also to establish complete information about the concept, behavior and other constraints such as performance measure and system optimization. The goal of System Analysis is to completely specify the technical details for the main concept in a concise and unambiguous manner.

A) PACKAGES SELECTED

The package selected to develop Finger print matching is MATLAB and the package has more advanced features. As the system is to be developed in Finger print matching, MATLAB platform with windows Application is preferred.

B) FEASIBLITY STUDY

The objective of feasibility study is not only to solve During the study, the problem definition was crystallized and aspects of the problem to be included in the system are determined. Consequently, benefits are estimated with greater accuracy at this stage. The key considerations are:

- Economic feasibility
- Technical feasibility
- Operational feasibility

ECONOMIC FEASIBILITY

Economic feasibility studies not only the cost of hardware, software is included but also the benefits in the form of reduced costs are considered here. This project, if installed will certainly be beneficial since there will be reduction in manual work and increase in the speed of work.

ISSN: 2366-1313

TECHNICAL FEASIBILITY

Technical feasibility evaluates the hardware requirements, software technology, available personnel etc., as per the requirements it provides sufficient memory to hold and process.

OPERATIONAL FEASIBILITY

This is the most important step of the feasibility study this study helps to predict the operational ability of the system that is being developed. This study also helps to analyze the approach towards which the system must be developed by which development effort is reduced. Proposed system is beneficial only if they can be turned into information systems, that will meet the organization requirements. This system supports in producing good results and reduces manual work. Only by spending time to evaluate the feasibility, do we reduce the chances from extreme embarrassments at larger stager of the project. Effort spends on a feasibility analysis that results in the cancellation of a proposed project is not a wasted effort.

VII. SYSTEM TESTING

Testing is a set of activities that can be planned in advance and conducted systematically. For this reason, a template for software testing, a set of steps into which we can place specific test case design techniques and testing methods should be defined for software process. Testing often accounts for more effort than any other software engineering activity. If it is conducted haphazardly, time is wasted, unnecessary effort is expanded, and even worse, errors sneak through undetected. It would therefore seem reasonable to establish a systematic strategy for testing software

Type of Testing:

There are two types of testing according their behaviors
1. Unconventional Testing
2. Conventional Testing

UNCONVENTIONAL TESTING

Unconventional testing is a process of verification which is doing by SQA (Software Quality Assurance) team. It is a prevention technique which is performing from begging to ending of the project development. In this process SQA team verifies project development activities and insuring that developing project is fulfilling the requirement of the client or not.

In this testing the SQA team follows these methods:
1. Peer review
2. Code walk and throw
3. Inspection
4. Document Verification

CONVENTIONAL TESTING

Conventional Testing is a process of finding the bugs and validating the project. Testing team involves in this testing process and validating that developed project is according to client requirement or not. This process is a correction technique where testing team find bugs and reporting to the development team for correction on developed project built.

TESTING STRATEGIES

A number of software testing strategies have been proposed in the literature. All provide the software developer with a template for testing and all have the following generic characteristics: Testing begins at the component level and works“outward” toward the integration of the entire computer-based system.
1) Different testing techniques are appropriate at different points in time.
2) The developer of the s/w conducts testing and for large projects, independent test group.
3) Testing and debugging are different activities, but debugging must be accommodated in any testing strategy.

VIII) RESULT & DISCUSSION

Arduino is connected to rain water sensor ,when the rain starts (when the water is roped) Rain water detector sensor will automatically open the pit, and water level sensor is attached inside the pit. The water level sensor is to find the water level and when the pit is filled automatically GSM module send the information to the water board and finally pit willbe closed.

The result is Arduino serial monitor was updated to the water level. Future work will be camera monitoring and human alert method.

ISSN: 2366-1313

The following shows the real time outputs for rainwater harvesting as

Fig4: Real Time Outputs for Soil and Water Sensors by Using IoT BeginnerApp.

VIII .CONCLUSION

There are many ongoing researches in this field. We were successful in implementing this model. Involving IoT gives edge over other traditional RWHS. This makes our model handier and it solves most of the problems of traditional RWHS. Some of the application are:

• Domestic: It can be used to provide drinking water, water for plants and for replenishing groundwater levels.

• Industry: It can be used for toilet flushing, cleaning the air conditioning system, washing vehicles, fire extinguishing.

•Economical: Pumping of underground water is costlier than RWH.

• Potable Water: Since the water is segregated on the basis of pH level, it is fit for drinking. Due to urbanization and concretization precious rainwater is lost in rainy season.

Fast replenishing ground water due to illegal boring is not being charged by rainwater resulting in depletion of groundwater to alarming levels. In this project an effort has been made to retain quality of precious rainwater and also to collect rainwater in areas of small size houses. In future more focus may be made on security and privacy so that user data stays safe. Also, machine learning may be involved so that prediction regarding temperature and rainfall can be made.

VIII. REFERENCES

[1] Unesco.org. (2019). 2006 - Water, a Shared Responsibility | United Nations Educational, Scientific and Cultural Organization. [online]

[2] Mcgranahan,G.(s2002). [online] Available at: https://www.researchgate.net/publication/228701911_DemandSide_Water_Strategies_and_the_Urban_Poor [Accessed 21 Dec. 2019].

[3] SARAH DOWDEY, S. (2007). How Acid Rain Works. [online] HowStuffWorks.com Available at: https://science.howstuffworks.com/nature/climatweather/atmospheric/acid-rain1.html [Accessed 21 Dec. 2019]

[4] En.wikipedia.org. (2019). Red rain in Kerala. [online]https://en.wikipedia.org/wiki/Red_rain_in_Kerala [Accessed 21 Dec. 2019].

[5] N. Sunar et al., "Development of Smart Kit Rainwater Harvesting System for Potable Water Purpose", www.sciencepubco.com/index.php/IJET 2018.https://www.researchgate.net/publication/332677712_Development_of_Smart_Kit_Rainwater_Harvesting_System_for_Potable_Water_Purpose. [Accessed: 22- Dec- 2019].

[6] J. Vinoj and S. Gavaskar, "Smart City Rain Water Harvesting (IOT) Techniques", Ijsdr.org, 2018.[Online].Available:http://www.ijsdr.org/papers/IJSDR1809001.pdf. [Accessed: 22- Dec2019].

[7] A. Patel and P. Shah, "Rainwater Harvesting-A Case Study of Amba Township, Gandhinagar", 2015.[Online].Available:https://www.researchgate.net/publication/317379414_Rainwater_Har vesting-A_Case_Study_of_Amba_Township_Gandhinagar. [Accessed: 17- Feb- 2020].

[8] AL. Saravanan, "PH SENSOR - PIC,8051,AVR ,USBPROGRAMMER,DEVELOPMENTBOARS alselectro",Alselectro.com,2019.[Online].Available :http://www.alselectro.com/phsensor.html.

ISSN: 2366-1313

[9] "File:NodeMCU DEVKIT 1.0.jpg - Wikimedia Commons",Commons.wikimedia.org,2019.Availab le:https://commons.wikimedia.org/wiki/File:Node MCU_DEVKIT_1.0.jpg.

[10] "Rain Sensor : Working, Pin Configuration and Applications", ElProCus - Electronic Projects for Engineering Students, 2019. [Online]. Available: https://www.elprocus.com/rainsensor-working-and-its-applications/.

[11] "HC-SR04 Ultrasonic Sensor: Working, Pin Diagram,Description&Datasheet",Components 101. com,2017Available:https://components101.com/co mment/36#comment-36. [Accessed: 25- Dec- 2019].

[12] Servo Motor Basics, Working Principle & Theory", Circuitdigest.com, 2015. [Online]. Available: https://circuitdigest.com/article/servo- motor-basics. [Accessed: 25- Dec- 2019].