Water Leakage Detection Using IOT

Yogita Y. Kininge[1], Ankita C. Hogade[2], Jyoti S. Shirse[3], Vaishnavi B. Kamble[4] and Pro. Mrs.V.A.Jujare[5]

[1] *Student, Computer Science and Engineering, Sharad Institute of Technology College of Engineering, Maharashtra, India*
[2] *Student, Computer Science and Engineering, Sharad Institute of Technology College of Engineering, Maharashtra, India*
[3] *Student, Computer Science and Engineering, Sharad Institute of Technology College of Engineering, Maharashtra, India*
[4] *Student, Computer Science and Engineering, Sharad Institute of Technology College of Engineering, Maharashtra, India*

ABSTRACT

The water supply shortage has increased in recent years due to overpopulation,climate change and obsolete water facilities, where deteriorated pipes cause most of the water leaks. The problem is not the size of the leak, but the time it takes to detect it. This paper presents the implementation of a system installed in the hydraulic facilities of a residence, to detect water leaks. The system consists of a water sensor installed by a water reservoir of interest, a microprocessor to interpret the data and evaluate whether it is a water leak or not, an SMS alert message, and an electrical actuator to shut off the main water supply to avoid leakage.

Keyword: - *Detection, leak, location, methodologies, systems*

1. INTRODUCTION

The growth of the world population, the demand of fresh water has increased causing serious problems in the field of water supply. Therefore, control of water has become a considerable issue today. Scientists, technicians, politicians, and generally, many other inhabitants of the planet become increasingly educated on the subject. The threat of pollution hovers over and limits water supplies. The shortage of this vital liquid requires great attention. The proportion of fresh water found in rivers, lakes, and underground sources comprise only 3% of the total amount of water on earth. In addition, the water found needs treatment for human consumption, to eliminate particles and organism harmful to health, and ultimately must distribute through pipes to homes safely. The reference number should be shown in square bracket [1]. However the authors name can be used along with the reference number in the running text. The order of reference in the running text should match with the list of references at the end of the paper.

In a big project, we need to write code in a more familiar way that anyone from our colleagues can read it and understand it ideally. As long as we take care about the time, we have to make sure that it should take less time and should contain code that is readable. Using automation we can achieve these types of goals by using machine learning for understanding the problem statement and natural language processing for generating the specific instructions.

2. LITERATURE SURVEY

We analyzed numerous existing systems built by researchers in order to construct a model of good quality. During the study of parameters like temperature, pH and electrical conductivity, pressure different authors proposed

differential model to test water quality and water leakage. We have developed a smart water control device that can perform all these monitoring functions by looking at all these details. The author indicated that the Internet of Things applications has been rising tremendously in smart homes recently. The wide variety of various IoT systems typically contributes to interoperability needs. Current IoT projects are implemented using physical platforms which lack decision-making intelligence. In order to solve management of the heterogeneous IoTs in smart home, it is proposed an architecture that implements Event Condition-Action (ECA) process. Developed using a central repository for continuous data on IoT schedules, the constructive architecture has proven perfect for addressing interoperability in clever homes.

There must also be systems in place that actively test water quality and provide articulated sources to villages, towns and communities and the rivers, creeks and shores surrounding our towns and towns for drinking. Better water quality is important to avoid waterborne diseases outbreaks as well as to improve the quality of life. Fiji Islands are located in the vast Pacific which demands a frequent water quality monitoring network and the current measurements can be enhanced by IoT and RS. This paper presents a smart water quality monitoring system for Fiji, using IoT and remote sensing technology. This problem affects various processes in water management, such as water consumption, distribution, system identification and equipment maintenance.

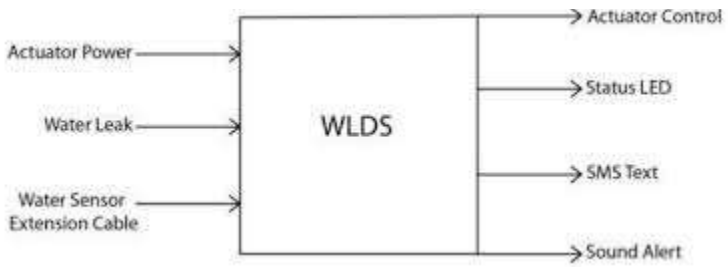
OPC UA (Object Linking and Embedding for Process Control Unified Architecture) is a platform independent service-oriented architecture for the control of processes in the logistic and manufacturing sectors. Based on this standard we propose a smart water management model combining Internet of Things technologies with business processes coordination and decision support systems. We provide an architecture for sub-system interaction and a detailed description of the physical scenario in which we will test our implementation, allowing specific vendor equipment to be manageable and interoperable in the specific context of processes water management. In the author shown how to monitor the water level of water systems such as water tanks, rivers, ground water table, and bore wells remotely. They also have shown that how to control the working of pump automatically and remotely. It can be used to remotely monitor the flood affected areas wirelessly and information can be sent to mobile wirelessly. This system is designed to monitor the level of water with the help of water level sensors.

3. METHODOLOGY

- SDLC Methodology
- Agile Methodology

3.1 SDLC Methodology

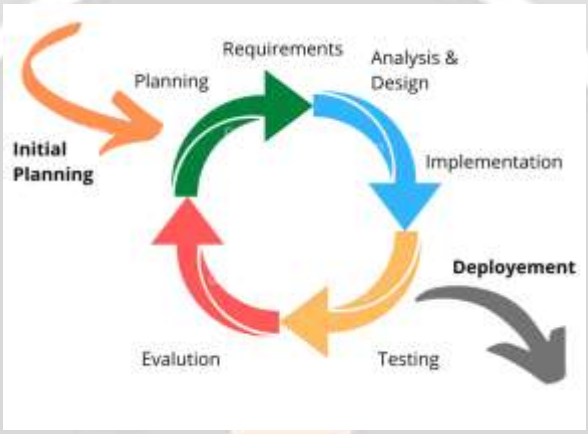
A methodology is a set of step-by-step methods for creating a product. There are several software development methodologies such as waterfall methodology, agile methodology, and so on. A software development methodology also can be defined as “the formalized process for handling large projects where documentation, training, integrity, and security are vital to the project's success”. SDLC projects naturally use object-oriented analysis and design. The selected software development methodology used was the Agile model. Agile methods and constant delivery are most well suited for dealing with the demands of the connected device. With Agile, the testing suits an important element of each stage of the development process at each stage.



3.2 Agile Methodology

Agile Methodology is chosen because at every stage of this project testing becomes an important element of each stage of the development process since it involves the devices that were connected with the microcontroller and to produce output according to thesystem of that project (Water Pipe Leakage Detection System). Also, it helps when there is a change in the requirements, technology, or tools that are used in the project so due to that it makes it easy to adjust your approach to target high-priority issues. The agile model mostly is used in the development of the IoT project. While there is an advantage of using the Waterfall model, but Agile is a very crucial important software development method in the IoT project.

DESIGN AND DEVELOPMENT- System Architecture Architectural diagram refers to the conceptual model that defines the structure and behavior of a system. An architecture diagram is used to show the relationships, constraints, and boundaries between components. The second subpart is the internet part in which the data is passed from the sensing subpart into a cloud (database server) subpart which is the more reliable storage location, later the user receives the data about the detection of the water leakage through the LCD screen display or the web-based system.



Agile Methodology

4. WORKING

The proposed systemwork as follows:

4.1 The system consists of a water sensor installed by a water reservoir of interest, a microprocessor to interpret the data and evaluate whether it is a water leak or not, an SMS alert message, and an electrical actuator to shut off the main water supply to avoid leakage.

4.2 Water sensors detect the presence of water and, when placed in locations where water should not be present, a leak. When Wi-Fi is enabled, the sensor can send out a notification through a smartphone LCD.

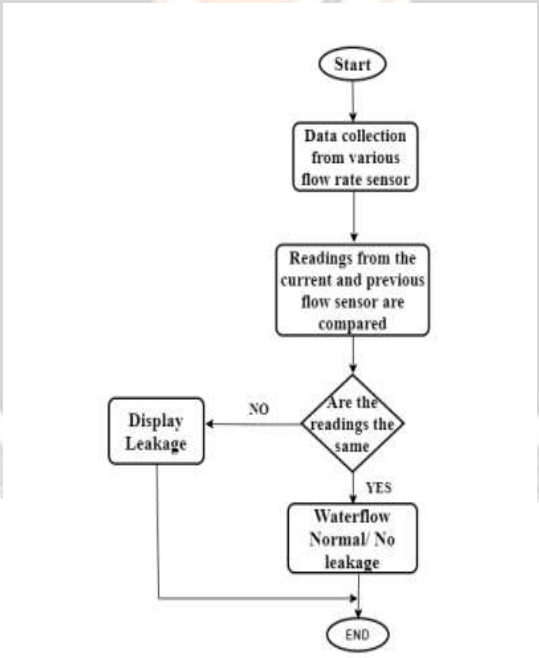
4.3 The proposed model to forecast and monitor the consumption of water basically consists of flow meter, microcontroller, micro-computer The flow meter measures the flow rate of the water and generates a pulse signal accordingly. The flow meter is wired with arduino so as to sense the pulses from flow meter. Raspberry Pi a microcomputer receives the data from Arduino micro-controller which is connected to the flow meter. The end users via web interface are able to visualize the data. The data from the database will then be utilized by data prediction algorithm for making predictions as needed by the users. The request for the prediction comes from the users via the web interface.

5. CASES STUDIED

5.1 Sensitivity-
The sensitivity in the leak detection systems turns essential due to the fact that the higher sensitivity system allows detecting very small leaks, but also it can prevent great damages of the pipelines because it can detect small faults as leaks due to corrosion

5.2 Capability of detect more than one leak-
If several small leaks appear into a pipe, the waste of fluid could be similar to a big leak. Therefore, the capability of detecting more than one leak may be an important factor to choose the appropriate system which might be suitable to detect and locate more than one leak. Among these systems we could find for instance: the acoustical, tracer probes, tracer gas and thermographic.

5.3 Capability of detecting a new leak while the test is already running-
Some systems cannot detect a leak that it is originated while the test is already running in consequence locate it, therefore, even if the water leak detection system is working correctly, a leak could be ignored. Therefore, the capability of detecting a new leak that is generated while the system is being tested, depends on the new position of the leak. For example in the case of the acoustical and tracer gas systems, if the leak appears in a pipe previously inspected by the operator, then the leak becomes undetectable and it could happen the same with the tracer probes. In an acoustical correlation case, if the test was running without a leak, it would detect it and finally, in a thermographic system the leak could be detected if it is big enough to be displayed in a thermographic picture



Activity Diagram

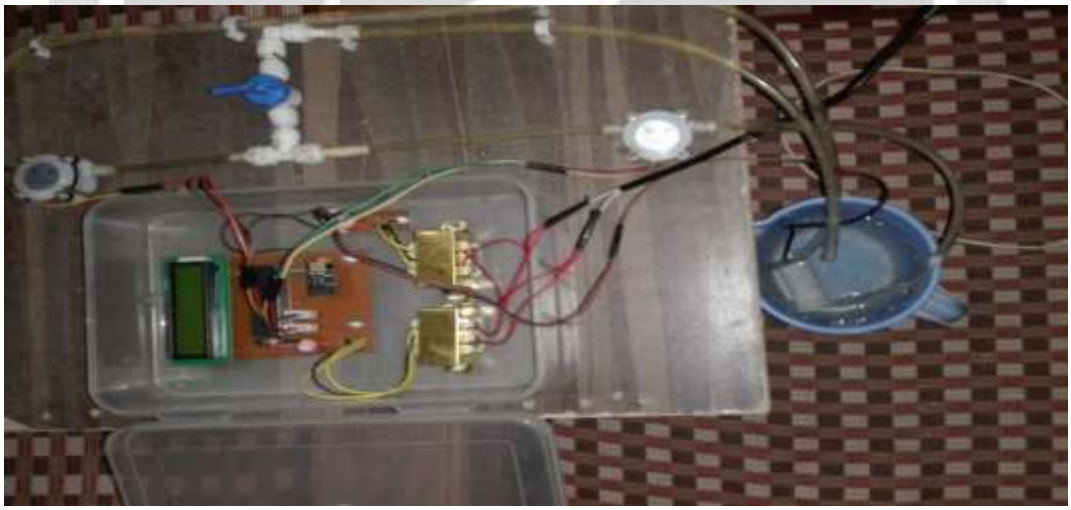
6. CHALLENGES AND LIMITATIONS

Online proctoring allows teachers to facilitate remote examination and minimize academic misconduct. The system would either use webcams to monitor students' test surroundings or integrate software's into their computers to control the use of other online sources while taking exams. Proctoring can also involve human participation - for example, online proctors who are present to supervise students' performance remotely.

- The current system is very time consuming.
- To take exam of more candidates more invigilators are required but no need of invigilator in case of online examination.
- The chances of paper leakage are more in current systemas compared to proposed system.
- Result processing takes more time as it is done manually.

7. EXPECTED RESULT

The main goal of this project is to provide an autonomous system that prevents excessive water damage within a household. After working on this project, I better understand the difficulties people face when trying to create a product from scratch. The WLDS detects a water leak anywhere the user chooses to put it and alerts the user with a text message, in case of house vacancy. The WLDS differentiates itself from many products on the market today, because when leakage occurs, not only does it alert the user with an alarm and text message, but it also powers an actuator installed at the main water pump which shuts offthe main water preventing further leakage. This project is more proof of theory than application, because of time and money constraints. This means that I only created one sensor network and created communication between the sensor and actuator, but if I had more time, the creation of multiple around the house would increase the product efficiency.In addition, incorporating the actuator into the piping creates a better water shutoff network because it doesn't shut off all the water in the house, instead, just where leakage occurs.All the specifications listed are met besides the price constraints.



8. CONCLUSIONS

This project was undertaken to design a water leakage detection system using IoT. The prototype method was adopted whereby two sensors were placed at each end of the pipe. The study has found that water flowing from the source to the destination can be measured to determine if there is any leak during distribution. Considerably more work will need to be done to determine the exact location where the pipe leaks to assist water distribution authorities to manage this scarce resource properly. A greater focus on distance calculation could produce interesting findings that account for more research on IoT monitoring systems.

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