Analysis on the application of an IoT Based Water Level Monitoring and Alert System

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Abstract- ***The aim of this paper is to provide an IoT based water level monitoring and alert system with the use of water pumping sensor. The system should be able to provide the following as its objectives: automatically detect the water level and initiate the pumping by the sensor and integration of a relay that could allow the user to pause the water pumping in case of emergency. The study employed object oriented analysis design (OOADM) methodology as a guide towards the analytical view of construction and design of the new water level monitoring system. With the steps involved in OOADM, the paper was able to analysis the system by following the process: analysis of the existing system, analysis/design of the proposed system diagram, analysis of the proposed system through the use case diagram, analysis of the proposed system through the High Level Model and then proposed system result analysis. The result after the construction of the proposed system uses the IoT microcontroller, ESP8266 Wi-Fi, water level sensor and other components to provide the IoT Based Water Level Monitoring and Alert.***

Indexed Terms- ***Internet of Things, Water Pumping and Monitoring, Automatic water level monitory, IoT water level monitoring and alert system, Sensor based water monitoring architecture***

I. INTRODUCTION

Advancement of internet originated by connecting computers and later many computers were connected together which created World Wide Web (WWW). These new concepts made it possible for new mobile devices to be able to connect to the internet which leads to mobile-Internet technique (Soumyalatha and Hegde, 2017). Furthermore, people started using the internet via social networks before the idea of connecting daily objects to the internet was proposed, which lead to the Internet of Things technology (Perera, Liu and Jayawardena, 2015). As reported by (Gubbia, *et al.*, 2013), the word Internet of Things was first used used by Kevin Ashton in 1998 presentation. As stated by Kevin Ashton, Internet of Things has the potential to change the world, just as the Internet while during 2001; MIT AutoID Lab center presented their view on IoT. Then during 2005, IoT was formally recognized by the International Telecommunication Union (ITU). Nevertheless, IoT has created a world where all the objects (also called smart objects) around our environment could be connected to the Internet and communicate with each other with minimum human intervention. The crucial objective is to create a better world for humans', an environment where objects around us know what we like, what we want, and what we need and act accordingly without explicit instructions. Currently most researches are focusing on how to provide a smart system using IoT that could enable objects around us to understand our feelings, hear and smell the physical world by themselves remotely and make them connected to share the observations (Soumyalatha and Hegde, 2017). With these new features, it will be easier for object monitoring and decision making from the human side to the machine side. This paper will make use of approaches and an object oriented analysis design (OOADM) methodology to guide in the analytical view of construction and design of the new water level monitoring system. It is far much important to note that IoT base components such as water pumping and monitory sensors and other sensor can be used to neither detect nor alert the presents of objects automatically and in this paper, the scholars made much effort to uncover so much related literatures involving the use of IoT components in water level monitoring. This paper is organized in as follows: Introduction: presents general introduction of Internet of Things IoT and the importance and uses of IoT in safe guiding our environment and properties without limitation to location nor distance, Literature Review: looks at generally the literature review on related works, structural design of internet of things (IOT),

and some advantages of using IoT, Methodology: methodology adoption for the study, proposed system diagram, use case diagram of the proposed system, analysis of the existing system, and High Level Model of the Proposed System, proposed system result analysis, conclusion and recommendation of the study and reference.

II. LITERATURE REVIEW

Thamaraimanalan *et al.* (2018) worked on a Smart garden monitoring system using IoT to monitor water level in the water tank placed in the garden. Application of IoT technology in various aspects has been helpful not only in computing profession but also in other field like agriculture. These scholars (Thamaraimanalan *et al.*, 2018) notice the high increase of pants not surviving in the garden because of lack of water supply. Most time inability to pump water into the water tank some overflow of the water during pumping which cause some of the plant to have access of water which they did not need, therefore designing an automatic system that can monitor the threshold and maximum level of water in the tank is very much paramount. The study applied NodeMCU which was used to connect the various sensors placed in the water tanks, an android software platform which they used to develop the application for monitoring the parameters generated in the garden which automatically trigger the pumping of water into the water tank. All data generated are stored into the database created by firebase software with the connection of a WI-FI network. Yasin *et al.* (2021) carried out a review on an IoT and ICT based Smart Water Management, Monitoring and Controlling System. The review focused on already existing studies on water control, management and monitoring. In their review they were able to showcase various types of sensors, and areas these new IoT and ICT could be applied such as in the industries, agriculture, homes, security, and also in the health sector to monitor ill patients.

III. METHODOLOGY

Object Oriented Analysis Design Methodology (OOADM) was adopted because of its ability to handle technical approach for analyzing and designing an application, system, and its flexibility to handle the IoT based water monitoring and detecting software development as a business by applying the object-oriented programming concepts, as well as using visual modeling approach throughout the development life cycles to foster better stakeholder communication and product quality. OOADM stages involves: Object-Oriented Analysis, Object-Oriented Design and Object-Oriented Implementation.

Object-Oriented Analysis: This stage help to analyze both the entire IoT based water pumping system and the existing system on water pumping by various persons. The proposed system as explained better with the use case model where all the actors and activities on the system are diagrammatically represented with various privileges which include: Domestic User Requirement Module and Admin User Requirement Module represented with the uses case diagram shown in the figure 1.0 below:

IV. ANALYSIS OF THE EXISTING SYSTEM

The existing system analysis only provided access for various users to check on the signal either LOW or HIGH through the IoT microcontroller. The microcontroller can switch ON/OFF the water pumping machine and an alert/notification could be triggered and shown on the IoT display screen as shown below on figure 1.0.

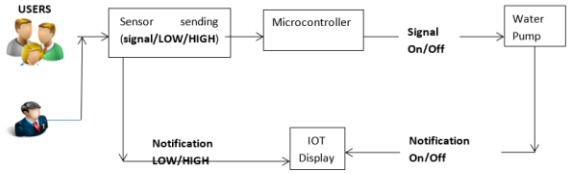


Figure 1.0: Analysis of the existing System (water level monitoring system using IOT)

V. WEAKNESSES OF THE EXISTING SYSTEM

The following are some of the weaknesses of the existing system identified by the researcher include:

1. Existing studies uses automatic switching of water pump either to alert the user on the level of the water when filled or to alert the user of the pumping like the study of (Patil *et al.*, 2021). Therefore most of the existing designs have both

automatic pumping and stopping but could not handle the water tank during emergency.

2. Inability to decide either to pump or not to pump the water because all are automatically handled.
3. Inability to generate real data for further studies

VI. ANALYSIS OF THE PROPOSED SYSTEM USING USECASE DIAGRAM

The analysis of the proposed system was achieved by following usecase diagram where all the various users' activities and privileges are shown and to further make it easier for implementation purpose. The diagram at figure 1.1 below shows the proposed system usecase diagram.

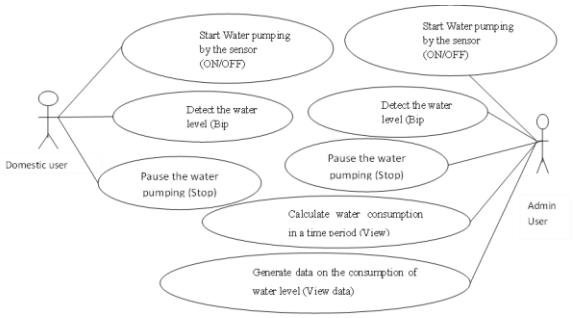
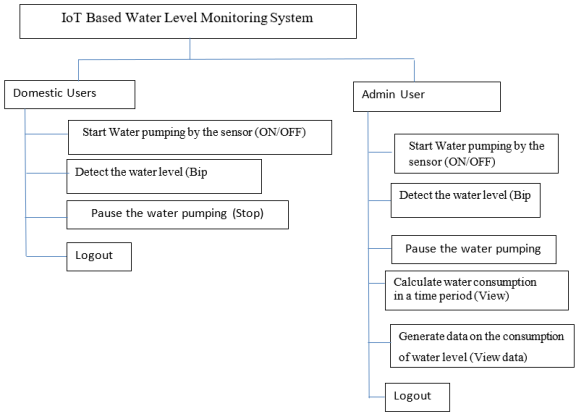


Figure 1.1: Use Case Diagram of Proposed System

VII. HIGH LEVEL MODEL OF THE PROPOSED SYSTEM



V. PROPOSED SYSTEM RESULT ANALYSIS

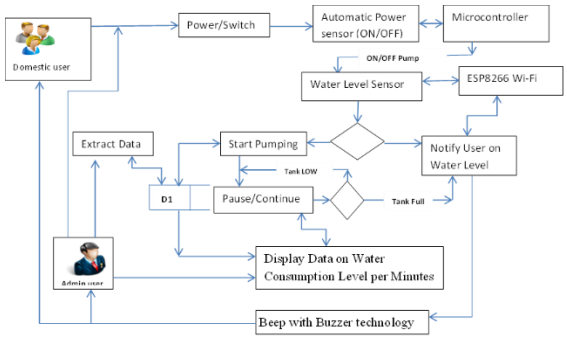


Figure 1.3: Proposed System Architectural Design

The proposed system architecture shown in figure 1.3 above has two different users domestic and admin users, as a domestic user, once the power switch is switched on, the automatic power sensor which is connected to the microcontroller receives the power supply and then all other components connected to the microcontroller becomes active and ready to perform action. Once the water pump is switched ON, the water level sensor first checks the current level of water in the tank, then decides to start pumping of water or to notify user on the level of water in the tank. If the water level is low, the pumping continues and once tank full Up, it will automatically alert the user through the Beep with Buzzer technology which is connected with a Wifi internet connectivity and then automatically stops pumping. The proposed system also has the ability to allow admin user to extract generated data on water consumption which are stored in the database represented as D1 and to check on all the water level consumptions per minutes as shown in figure 1.3 above.

VI. ADVANTAGES OF THE PROPOSED SYSTEM

The proposed System advantage over the existing studies and practices can never be over emphasized as its benefits to the various users is huge significantly important starting with total eradication of soil pollution/environmental disaster. Other advantage includes:

1. Eradication of distance constraints as witnesses in the existing studies
2. With the introduction of Wi-Fi internet connection, users can monitor the water level remotely and initiate water pumping automatically

3. Emergency situations can be averted as the proposed system have the ability to pause or continue water pumping if need arise
4. Data are generated on water consumption level and used for further research and improvement for new developments
5. Introduction of various users privileges as it will help monitor and control usage and help in proper management of the water pumping activities.

CONCLUSION

As earlier stated, that the aim of this study is to carry out an analysis on the application of an IoT based water level monitoring and alert System by applying an OOADM methodology. As shown in figure 1.3 above, the various users has different activities but it can be seen that the WIFI sensor is responsible of triggering alert to various users on the water level in the water tank when full by the beep with Buzzer technology. Also automatic calculation and storage of water consumption Level per Minutes can be achieved, which could help owner take action nor assist for further study on the use of IoT technologies in advancing human lives remotely.

RECOMMENDATION

The researcher therefore recommends the following:

1. Full adoption of IoT tools should be used in solving real life challenging problems more especially in security and control on our environments
2. Practical construction of the automatic water level monitoring using wifi sensor should be looked into by other scholars
3. Integration of Machine learning models and IoT technologies could help in producing a more accurate and intelligent technologies for future use.

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