

SMART WATER LEVEL INDICATOR FOR OVERHEAD TANKS USING IoT

A Project Report Phase – II

Submitted in partial fulfillment of the requirements for the award of

**Bachelor of Engineering Degree in
Electronics and Communication Engineering**
by

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS
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**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade “A” by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **G. BHARGAVI** (39130068) and **R. DHANA LAKSHMI** (39130112) who carried out project entitled **"SMART WATER LEVEL INDICATOR FOR OVERHEAD TANKS USING IoT"** under our supervision from NOVEMBER 2022 to APRIL 2023.

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DECLARATION

We, **G. BHARGAVI** (39130068) and **R. DHANA LAKSHMI** (39130112) hereby declare that the Project Report entitled “**SMART WATER LEVEL INDICATOR FOR OVERHEAD TANKS USING IoT**” done by us under the guidance of **Dr. S. EMALDA ROSLIN, M.E., Ph.D.** at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

DATE: 24.4.2023

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ABSTRACT

Water is most profitable and valuable source since it is the fundamental need of all the individuals. These days we are facing many issues is that regarding water wastage monitoring in tanks. This project proposes a proficient method to water level in the overhead tanks by lessening the present water wastage with IoT technology is efficiently utilized to monitor the water level. The venture is about overhead tank checking framework that is we screen the level of water in the overhead tank. Firstly, we have the issue of filling the tanks which are situated far, and for this we have executed a little hypothesis that we put level sensors in the tank, that level sensors detect the water level in the tank and sends us message about water level in the tank. secondly preferred standpoint is that we utilize different parameter sensors like worldwide turned to the Internet-of-Things (IoT) technology to efficiently monitor water levels, refill tanks whenever needed. Notably, this technology can also supply real-time feedback to end-users and other experts through a (webpage) or a smart phone. IoT-controlled water storage tanks (IoT-WST). Some important contributions of our work include surveying contemporary work on IoT-WST, elaborating current techniques and technologies in IoT-WST, targeting proper hardware, and selecting a secure IoT cloud server.

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CHAPTER 1

INTRODUCTION

Water has gained an inestimable value in the recent past. This scenario arises mainly because of the various faces. Population, ageing infrastructure, dilapidated technologies and ground water contamination have been the fore-runners of the many challenges that water faces. These challenges have pushed drinking water to an extent where it has become an amenity rather than utility. This phenomenon of scanty drinking water demands a methodology which is both achievable and efficient. One such process is the over-head tank. In this process a group of tanks situated in locality are considered as an entity. An ultra-sonic sensor is used to detect the water level of the tank and turbidity sensor are used. Observing the level of water in the tank we can regulate the amount of water that locality is using. Through this observation we could send extra amount of water to that locality if the demand is more or consequently curb the amount of water if the supply is more to avoid wastage of drinking water. The data from the sensor is collected and Smart water tank executes IoT, with which, the client can specifically screen and control the working of tank through the cell phone and from wherever in this world. The android application is made with the goal that the information assembled from the cloud is sent to app. Water is one of the most important elements of environment and essential for all living objects in planet earth.

According to United State geological survey about 1.7 trillion of water are wasted ever year over world. A family can waste 9400 gallons of water every year. Water is also wasted when water pump runs even after water tank is full. Alongside this there is only 1% of drinking water available where water marks up around 71% of the earth surface and availability of drinking water is subsiding every year. It's now a duty of every people on the earth to save water.

This project introduces an IoT SMS enabled gadget that monitor water level and switches motor automatically when water goes above or below a certain level. All the stated information is sent to user through SMS.

Water is necessary for life on our planet. Seventy-one percent of the earth's surface is covered with water. No doubt, this quantity is much smaller compared with the total earth volume. The oceans contain around 97% of the total water on earth. Unfortunately, ocean water also has very heavy salt content and thus cannot be used directly for many household needs such as drinking, cooking, etc. The rest of the total water is available as freshwater.

1.1 WATER LEVEL MONITORING TECHNIQUES

Fresh water, which has relatively low salt contents and other dissolved solids is the main component in many human activities, including agriculture, industries, and domestic applications. Unfortunately, this small quantity is not entirely available to us because around 69% of freshwater is trapped in the glaciers and polar icecaps. Around 30% of fresh water exists as groundwater, i.e., water under the earth's surface. Collectively, around 1% of total freshwater is available for all forms of human consumption. Research shows that worldwide, freshwater resources are rapidly diminishing, causing tension among different nations.

The primary reasons for this crisis are

- (i) uneven distribution of the water resources around the globe
- (ii) rapid growth in urbanization,
- (iii) drastic increase in industrial activities and
- (iv) a lack of awareness about water consumption.

Food and freshwater are linked, and both are necessary for survival. Agriculture activities consume a large portion of fresh water to produce crops, fruits, plants, etc. As stated in the demand for food is expected to rise by more than 50% over the coming 30 years due to the continuous growth of the world's population.

To mitigate the effect of the water crisis, many initiatives are taking place worldwide to take care of our freshwater resources. For instance, the water monitoring day was established in 2003 by the America Clean Water Foundation, aiming to create public awareness of water contamination. In addition, the World Health Organization (WHO) and the United States Environmental Protection Agency (USEPA) have constantly been updating their recommendations and guidelines on water-borne diseases and pollution.

The “World Water Council” report indicates that the global population may rise by 40 to 50% over the next 50 years. This super growth, along with urbanization and industrialization, might increase the overall demand for water resulting in a strong impact on the world ecosystem. Water pollution and the use of unsafe water result in death and disease and are, therefore, significant health concerns. Fortunately, numerous research efforts are going on to improve water quality monitoring. Due to this fact, the scope of our study has intentionally been confined to the IoT application in smart water tank-monitoring.

1.2 MOTIVATION

In many cases, a significant amount of liquid is wasted due to overflow and leakage, cumulatively resulting in a loss of resource and money. In order to avoid such circumstances it is better to monitor the level of the liquid in consideration, and prevent overflow.

- As the water level increases from the base of the tank the number of glowing LEDS increases subsequently.
- Amount of water present in a water tank can be easily measured.

The drinking water crisis in India is reaching alarming proportions. It might very soon attain the nature of global crisis. Hence, it is of extreme importance to preserve water. In home based water tank, the one problem is very common to us that the control of water level of overhead tank, as a result the wastage of water is increasing day by day. But we all know water is very precious to us. This problem can be controlled by a simple electronic circuit consists with some cheap electronic components, that circuit is called 'Water Level Indicator.

A Water Level Indicator is used to detect and indicate the water level in an overhead tank or any other water container. In this paper, we investigated the design of a water level sensor device using Arudino UNO, that can detect the level of water in a water storage system.

Hence our projects aims to conserving water . Water is most profitable and valuable source since it is the fundamental need of all the individuals. Now a day we are facing many issues regarding water wastage .This paper proposes a proficient method to water level observing in the overhead tanks to lessen the present water wastage. The venture is about overhead tank checking framework that is we screen the level of water in the overhead tank .

Recent years have seen a tremendous increase in the value of water. The different faces are mostly responsible for this predicament. Ground water pollution, ageing infrastructure, a growing population, and outdated technology have been the forerunners of many of the difficulties that water faces today. Due to these difficulties, drinking water has shifted from being a need to being an amenity. This issue of scarce drinking water need an approach that is both practical and effective.

The overhead tank and monitor system is one such procedure. In this approach a group of tanks positioned in vicinity are treated as an entity. The water level of the tank is determined by an ultrasonic sensor to monitor the level of the water. We can control how much water is used in that area by keeping an eye on the water level in the tank. With this observation, we may determine whether there is a greater need for water in that area

and therefore send more or, if there is a greater supply, send less, in order to prevent drinking water from being wasted.

The purity verification is aided by quality parameters. If the findings indicate that the water is tainted and impure, the municipal department, which engages people to take hygienic steps to clean the tank, is informed. So that the water's purity might be restored. The data from the sensor is gathered, and the Smart Water Tank implements IoT. so that the customer may specifically monitor and control the operation of the tank using a mobile device and from any location in the globe.

A Water Level Indicator is used to detect and indicate the water level in an overhead tank or any other water container. In this paper, we investigated the design of a water level sensor device using Arudino UNO, that can detect the level of water in a water storage system. Hence our projects aims to conserving water . Water is most profitable and valuable source since it is the fundamental need of all the individuals. Now a day we arefacing many issues regarding water wastage.

1.3 OBJECTIVES

- The drinking water crisis in Asia is reaching alarming proportions.
- It might very soon attain the nature of global crisis.
- Hence, it is of utmost importance to preserve water for human beings.
- In many houses there is unnecessary wastage of water due to overflow in overhead tanks.
- Need of this project is to avoid wastage of water. Because sometimes people forget to off the motor when tank is full, because of that water get wasted.

- To avoid this problem this project came into picture.
- By using this project we can monitor water level and consumption of water.

1.4 SCOPE OF THE PROJECT

In many houses there is unnecessary wastage of water due to overflow in overhead tanks. The working of water level monitoring & controlling system is very easy. A water level controller is a device that manages water levels in water tanks, pumps, and for filling any type of liquid in the tank. Basic function of a water level controller is to limit the water wastage & protect against unnecessary electricity usage. This is because level of water is controlled automatically, which limits the amount of electricity used. As a result less water and electricity is used to regulate a water supply.

CHAPTER 2

LITERATURE REVIEW

2.1 LITERATURE SURVEY

Sai Sreekar Siddula, Phaneendra Babu, P.C. Jai(2018) , proposed a novel idea of collecting and sharing real time information about water levelsto an authorized central command center through far communication. The authorized central command center then takes a call whether to release the water by opening dam gates or keep them closed. One of the easiest way to measure water level is using submersible pressure transducers (wet sensors) which are easy to install and require very little maintenance. For the very reason, they are often used for temporary installations and installations in remote locations. They are supposed to be installed in a fixed position and should remain fully submersed at all times. It works on the concept of application of hydrostatic pressure to a strain gauge, which converts mechanical movement into an electrical signal which is in turn measured by the station data logger and converted into pressure, level and discharge. The current dam control technology is manual where in the handler operates the gate on command. This gives room for irregular water sharing between two properties, human error which can result in floodsor unnecessary wastage of water. Our proposed system removes these possibilities incorporating automated dam control system. The entire system is also partially self- powered. The design involves energy harvesting thereby making the system self- sustained.

Mr.Patil K.N., Mr.Kadam Tushar, Ms.Sawant Swaranjali, Ms.AmangeShreya(2020), introduced the notion of water level monitoring and management for lake water storage source for villages. More specifically, we introduced the raspberry pi as controller for water level sensing and controlling in a wired and wireless environment. Water Level management approach would help in reducing the time required for water allocation, need of water in summer season, drought and as well as overcome the wastage of water.

GSM through data transmission systems for water management in office. Moreover, cellular phones with relative high computation power and high quality graphical user interface became available recently. From the users perspective it is required to reuse such valuable resource in a mobile application. Finally, we proposed a web and cellular based monitoring service protocol would determine and sense water level to all people needed the information about available water in lake. This paper is organized in the following ways. The second point concentrated with the basic concepts of the system design. In third we described the concrete idea of Raspberry pi 3 model b. Design and Implementation part is described in chapter fourth. Fifth point describes about our proposed monitoring and controlling network.

V. Jeevagan, S. Prem Kumar (2019), proposed Water source is fundamental for all and a significant factor in agriculture, cultivating and it's a key for nature of our life. Monitoring water level of a water supply, For example, Lakes, River, Waterways and Pond etc., plays a major part in rural and agricultural. Even it's helpful for our everyday needs. For example the amount of water drops under the edge level in a bore well, the motor pump may get affected due to dry running. There are many several alternative things wherever water level monitoring is an important task. The current paper focuses on smart water management system to overcome above drawback. The RFID is used for user identification. so we can identify how many liters of water uses by consumer. The billing system is done on the basis of amount of water usage. Paper focuses on an application of wireless sensor networks for leakage detection in underground water pipes to overcome the problem of water dispersion in water distribution networks. The authors have designed a wireless network system making use of mobile wireless sensors able to detect breaks and save energy, time and save energy. Leakage prevention and breaks identification in water distribution networks are fundamental for an adequate use of natural resources. To address this problem, and simplify the leakage identification process, the authors have designed a wireless network system making use of mobile wireless sensors able to detect breaks and save energy, time and cost with having Smart Water Leakage

Detection (SWLD) in pipelines, measure water level in tank and control in pump to turn it on when water level is low. It focuses mainly on two parts: The first part is alarm based on Global System for Mobile technology (GSM) to send Short Message Service (SMS) to the owner.

Dr K. Raghava Rao, Sanagala Srinija, Kukkala Hima Bindu, D Satish Kumar(2018), proposed a proficient method to water level and quality observing in the overhead tanks to lessen the present water wastage and give better water quality. The venture is about overhead tank checking framework that is we screen the level of water in the overhead tank and furthermore we decide nature of water. Firstly, we have the issue of filling the tanks which are situated far, and for this we have executed a little hypothesis that we put level sensors in the tank, that level sensors detect the water level in the tank and sends us message about water level in the tank. Also, the second preferred standpoint is that really, we utilize different quality parametersensors like pH and turbidity sensors to screen the water quality in the tank. Water is a limited resource and energy, agriculture and essential for all life on earth among men. Images are formed from some of the inequality of man and of beast, in the water, it would cause great suffering for the salvation and continue to move, and the ecological balance are not among the species. Most were in the 21st century, but by the time it was warming pollution, and by doing so that water is not the world's population. And he hath not drunk water, and with precious stones is dearer to him of all men, that is, what is in the water ought to be in the nature, the pull period of time.

Suraj S, Bharath V, Sridhar N K,(2018), emphasizes about the essentiality of water for human beings, plants and animals. The key aim of the paper is to reduce human intervention to reduce percentage water wastage in agricultural farms using a water level controller with wireless technology. The paper has said about the development of 4 stages of water pumping system. The paper has also compared between the wired and wireless Bluetooth based water level controller. They have used an Ultrasonic sensor, Arduino uno microcontroller, pump, relay and Bluetooth module HC-12. The controller

decides unique code for water level based on 4 stages of water pumping. Distance is calculated using formula $d = S \cdot (T/2) = 0.03435 \cdot (T/2)$, where S is speed of sound, T is duration of transmission and reception of sound wave from an ultrasonic sensor. $S = 0.003435$ cm/microsecond. The paper also displays drawbacks of wired controller, which includes limited wire length, which paved way for introducing wireless automatic water level controller.

Beza Negash Getu, Hussain A Attia (2015), proposed about the issue due to excessive water usage in the domestic or commercial purposes, which in turn may lead to further problems like problem with weather patterns. The paper has said about the development of a system comprising of a water level sensor, digital logic processing unit or integrated circuit(IC), for input signal processing, 7 segment display, JK flip flop sequential circuit, motor driver controlled by relay. The data from the water level sensor is encoded using a digital encoding circuit, where water level is encoded to decimal, indicating the water level from 0 to 9. The decimal is then decoded from BCD to 7 segment using BCD to 7 segment decoder (IC7447). Digital logic controller, responsible for the turning on or off of the pump, turns the pump whenever the water level reaches ONE, and turns off when it reaches level NINE. A JK flip flop is used as a driver circuit to turn on or off the motor. Relay is used as a switch, which turns on the motor and also turns it off whenever the tank reaches full capacity.

Steven Sachio, Augustus Noertjahyana, Resmana Lim (2018), explains the importance of internet for communication, and also objects communicating with each other, otherwise called Internet of Things(IoT). The paper also says that a process of water filling, causes overflowing and wastes water. The paper says about development of Blynk IoT and PHP web based programming to provide water level sensing. They have also said that system has an error of 2cm controlling the water level. They have used an ESP8266 as a microcontroller, which has capability of connecting to the internet. They use an ultrasonic sensor for water level sensing.

The Blynk app is used to provide connectivity both to the ESP8266 and also smartphone or any smart device. The microcontroller communicates with the PHP web based water container monitoring information system via Blynk Server. The pump can be controlled automatically and also semi automatically. They have given the result that the pump runs at a range between 15 to 35 cm of water level in the container or tank.

P Siva Nagendra Reddy, K Tharun Kumar Reddy, P Ajay Kumar Reddy, Dr G N Kodanda Ramaiah, S Nanda Kisho(2016), described about the controlling and monitoring of home appliances, using an android application using internet, thus controlling the device both in home and remotely, making it easier for physically challenged people, this particular paper uses WiFi (Wireless Fidelity) as connectivity protocol. The paper also describes about usage of Arduino Mega Microcontroller, WiFi module for communicating with the phone, which acts as a bridge between the Smartphone and Arduino Mega. They use an Android SDK based application. The sensors used here are Temperature Sensor, Light Dependent Resistor(LDR) and also includes other components like Servo Motor, Relays, IC MAX232, LCD display and finally a bulb. The WiFi module use here is HLK-RM04. The paper also describes the working of the system developed, in which Arduino is interfaced with temperature sensor, rain sensor to control the fan speed, and also status of the fan is monitored using Android app and also displayed on the LCD display.

Eltaieb A.M and Z. J. Min,(2017) ,proposed an automatic water level controller is developed and implemented. Arduino Uno is used to automate the process of water pump. Water level detection in both source and overhead tanks, switch on/off the pump accordingly are the main controlling signals the circuit. Liquid Crystal Display (LCD) is used to show the data on the screen. Moreover, a microcontroller based automated water level sensing and controlling is proposed that covers both design and implementation issues. Hani and Myaing (2011) developed a microcontroller-based water flow control system. In this system, automatic water flow control system is implemented, and can be used as process control system. A sensing unit, photo interrupter, and slotted disk are used to produce pulse train for frequency input of the microcontroller. The sensor signal is counted as frequency and converted to the flow rate by using software program in PIC.

This flow rate is compared to the set point value. This PIC16F628 can control the water valve by using DC motor to vary the water flow rate based on this comparison.

Augustus Noertjahyana, Resmana Lim, "IoT based water level control system".The paper explains the importance of internet for communication, and also objects communicating with each other, otherwise called Internet of Things(IoT). The paper also says that a process of water filling, causes overflowing and wastes water. The paper says about development of Blynk IoT and PHP web based programming to provide water level sensing. They have also said that system has an error of 2cm controlling the water level. They have used an ESP8266 as a microcontroller, which has capability of connecting to the internet. They use an ultrasonic sensor for water level sensing. The Blynk app is used to provide connectivity both to the ESP8266 and also smart phone or any smart device. The microcontroller communicates with the PHP web based water container monitoring information system via Blynk Server. The pump can be controlled automatically and also semi automatically. They have given the result that the pump runs at a range between 15 to 35 cm of water level in the container or tank.

P Ajay Kumar Reddy, Dr G N Kodanda Ramaiah, S Nanda Kishor "An IoT based Home Automation using Android Application", International Conference on Signal Processing. The paper has described about the controlling and monitoring of home appliances, using an android application using internet, thus controlling the device both in home and remotely, making it easier for physically challenged people, this particular paper uses WiFi (Wireless Fidelity) as connectivity protocol. The paper also describes about usage of Arduino Mega Microcontroller, WiFi module for communicating with the phone, which acts as a bridge between the Smartphone and Arduino Mega.

2.2 SUMMARY OF LITERATURE SURVEY

The various classification techniques used in the literature are GSM ,RFID Bluetooth module HC-12,BCD to 7 segment using BCD to 7 segment decoder (IC7447) ,ESP8266 ,Internet of Things(IoT) ,Arduino Mega Microcontroller ,WiFi (Wireless Fidelity). To address these issues, researchers worldwide turned to the Internet-of- Things (IoT) technology to efficiently monitor water levels, detect leakage. Notably, this technology can also supply real-time feedback to end-users and other experts through a webpage or a smartphone. Literature reveals a plethora of review articles on smart water monitoring, including water quality, supply pipes leakage, and water waste recycling. However, none of the reviews focus on the IoT-based solution to monitor water level, detect water leakage. The water level indicator circuits are used in factories,chemical plants, and electrical substations and in other liquid storage systems. There are many possible uses for this simple system, examples include monitoring a sump pit (to control pump activation), rainfall detection, and leakage detection. A Water Level Indicator is used to detect and indicate the water level in an overhead tank or any other water container. In this paper, we investigated the design of a water level sensor device using Arudino UNO, that can detect the level of water in a water storage system. A water level indicator is a system that relays information back to a control panel to indicate whether a body of water has a high or low water level. Some water level indicators use a combination of probe sensors or float switches to sense water levels. “The Water Level Indicator employs a simple mechanism to detect and indicate the water level in an overhead tank or any other water container.” water level indicator sensor, also known as a probe sensor, is what tells the control panel that corrective action is needed. A combination of high and low sensors are used to tell the control panel when water levels are too high or too low. The control panel will then automatically turn the pump on or off depending on the corrective action needed.

CHAPTER 3

SMART WATER LEVEL INDICATOR USING IoT

3.1 BLOCK DIAGRAM OF PROPOSED SYSTEM

This group project will monitor the water levels, while it's rising it will show the time when the water is beginning to fill the tank and reach maximum volume. The average water flow speed is in liters per minute and the total water to your tank is in liters. The circuit consists of a water flow sensor known as the Hall Effect Water Flow Meter (YF-S201), an Arduino board which is the brains of the project, a Global System for Mobile Communications (GSM module), a SIM 800 or SIM 900 for receiving SMS alerts on water supply, and a real time clock module for tracking the correct time for water supply initiation and termination of water supply. Nine Volts of energy is desirable for powering the Arduino board and the GSM module, it is recommended to provide the power supply from nine-volt adapters or well-built homemade transformer based (LM 7809) supply.

After a minute powering the circuit ON, you will get an SMS saying that the system is ready. When the water starts flowing through the sensor, the system will notify the user with time. After the water supply is terminated the system will send another alert and summarize the session with time, average water flow and total water delivered to your tank.

The time of water arrival the water must free flow, meaning if there is any block or tap which is closed will not notify you. Get all of the supplies that you need first such as LEDs, a buzzer, and sensing wires. Then build the circuit and attach the battery. Watch the LEDs light up as the water level rises when the level gets too high.

Overhead tank digital water level indicator with an LCD display is to show the rising/falling water level in the tank. In already existing system there is only to tell the water level through some messages type. In proposed we are going to use water level sensor is used

to identify the water level in the tanks. Depend upon the level of water, when the tank is filled. It will intimate through the Gmail, SMS and etc.

Here we implement the IOT concept and also the remote controlling. When the water level is low, it's automatically give the information to your mobile and saved the data in cloud because it is highly used to identify the how much water we consume in month. If the water is about to fill or if the water is low in the tank then water level sensor will send a message through the mobile phone. This project we are implementing in our college.

The automated multiple water tanks control system is designed and implemented for the usefulness of household, industries and manufacturing processes. Also, for the control and monitoring of water overflow or chemicals in the overhead tanks, as result of common wastage of water runoff from the overhead tanks. The system failure rate, and some relevant constraints are the challenges.

The experimental design of this system was realized and demonstrated in the laboratory using ATmega microcontroller chip and FPGA technology. The proposed system experimentation was carried out to show the comparative performance of Field programmable gate array (FPGA) to its counterpart intelligent microchip (ATmega) application for industrial system manufacturing. In this research, an automated multiple water tanks control system was practically demonstrated in the laboratory to control the overflow and monitor the water level of the overhead tanks.

Water resources in numerous countries are becoming scarce due to over urbanization, rapid industrial growth, and current global warming. This paper proposes a proficient method to water level and quality observing in the overhead tanks to lessen the present water wastage and give better water quality. The venture is about overhead tank checking framework that is we screen the level of water in the overhead tank.

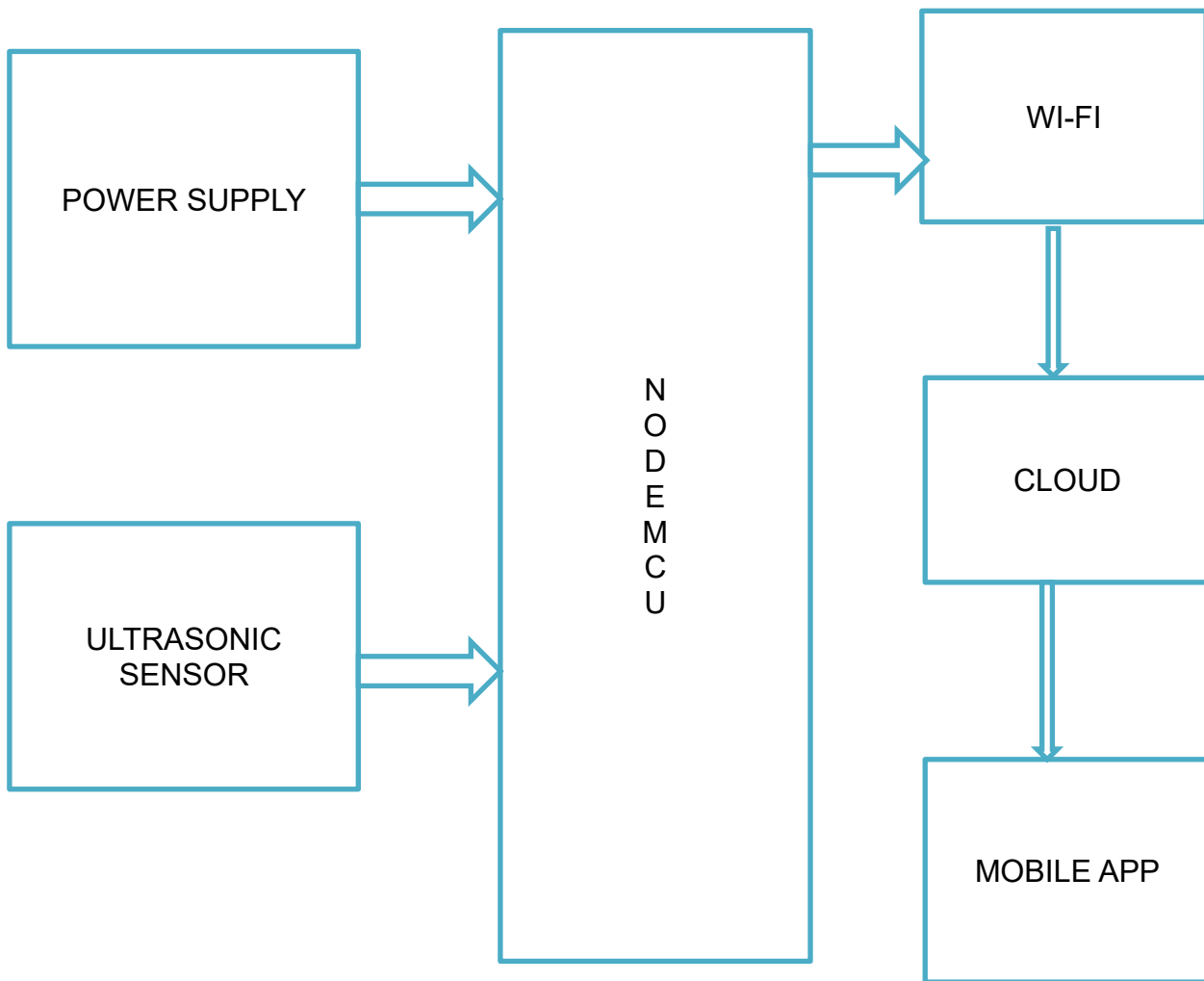


Fig.3.1 Block diagram of proposed work

This is one of the motivations for the current work and to deploy techniques in order to save water and help the environment which in turn ensures water for the future. Hence, it is of utmost importance to preserve and save water. In many houses there exists unnecessary wastage of water due to overflow from overhead tanks etc. Automatic Water Level Controller can provide a solution to this problem. Present work does not use any microcontrollers etc.

The operation of water level controller is based on the fact that water conducts electricity. The proposed system experimentation was carried out to show the comparative performance of Field programmable gate array (FPGA) to its counterpart intelligent microchip (ATmega) application for industrial system manufacturing.

In developing countries, these tanks are maintained manually, and in some cases, water is wasted due to human negligence. In addition, water could also leak out from tanks and supply pipes due to the decayed infrastructure. To address these issues, researchers worldwide turned to the Internet-of-Things (IoT) technology to efficiently monitor water levels, detect leakage. Notably, this technology can also supply real-time feedback to end-users and other experts through a webpage or a smart phone. Literature reveals a plethora of review articles on smart water monitoring, including water quality, supply pipes leakage, and water waste recycling. However, none of the reviews focus on the IoT-based solution to monitor water level, detect water leakage, and auto control water pumps, especially at the individual level that form a vast proportion of water consumers worldwide.

The composed framework applies to an IoT module for getting to sensor information from center controller to cloud. The sensor information can be seen on cloud. At last information will be assembled and through Wi-Fi information can be seen on versatile device through android app. Based on data in the app workers will be sent to clean the tank. Because sometimes people forget to off the motor when tank is full, because of that water get wasted. To avoid this problem this project came into picture. By using this water level indicator system we can monitor water level and consumption of water. we have the issue of filling the tanks which are situated far, and for this we have executed a little hypothesis that we put level sensors in the tank, that level sensors detect the water level in the tank and sends us message about water level in the tank.

3.2 FLOWCHART REPRESENTATION

A flowchart shown is a System schematic that explains the procedure that will be carried out within it as shown in figure 3.2. The sensor's maximum and minimum values are first provided in the app. The app should be alerted about the level and quality of the tank's status based on those metrics. Additionally, the app reminds users of the tank's current value.

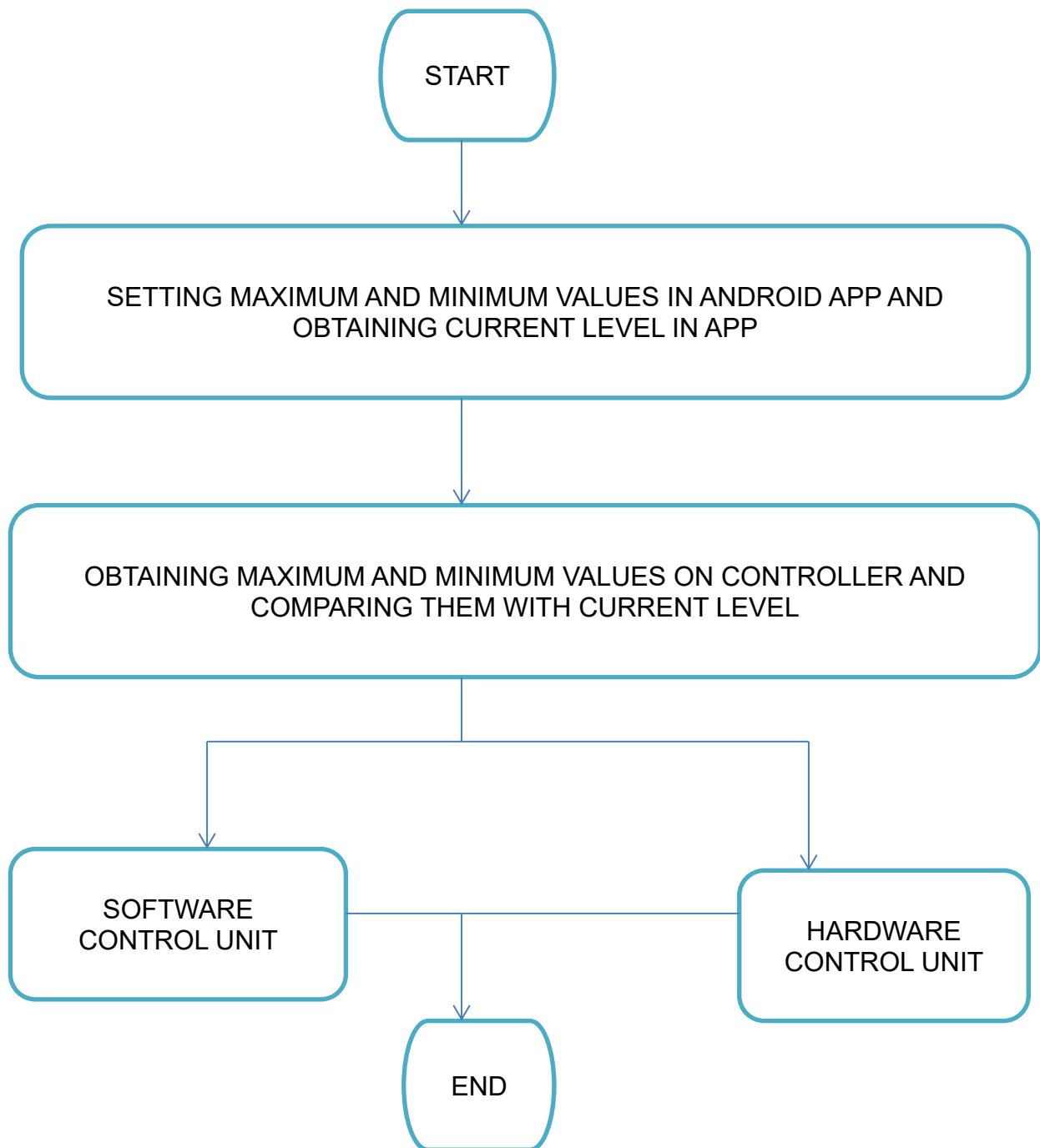


Fig.3.2 Flowchart about procedure

The app will display the status of the tank. If the present number is less than the lesser number, the app will display a notification saying that the tank is neat and clean, and the water level is adequate which is low if it is less than 10%. It Sends an message to the concerned department so that we can see it in real time if exceeds the maximum value, as indicated by a notification that should appear. If the current value is between the lowest and highest value, the noticed value will be communicated, allowing the real-time value to be displayed on the app. it follow as shown in the figure 3.3.

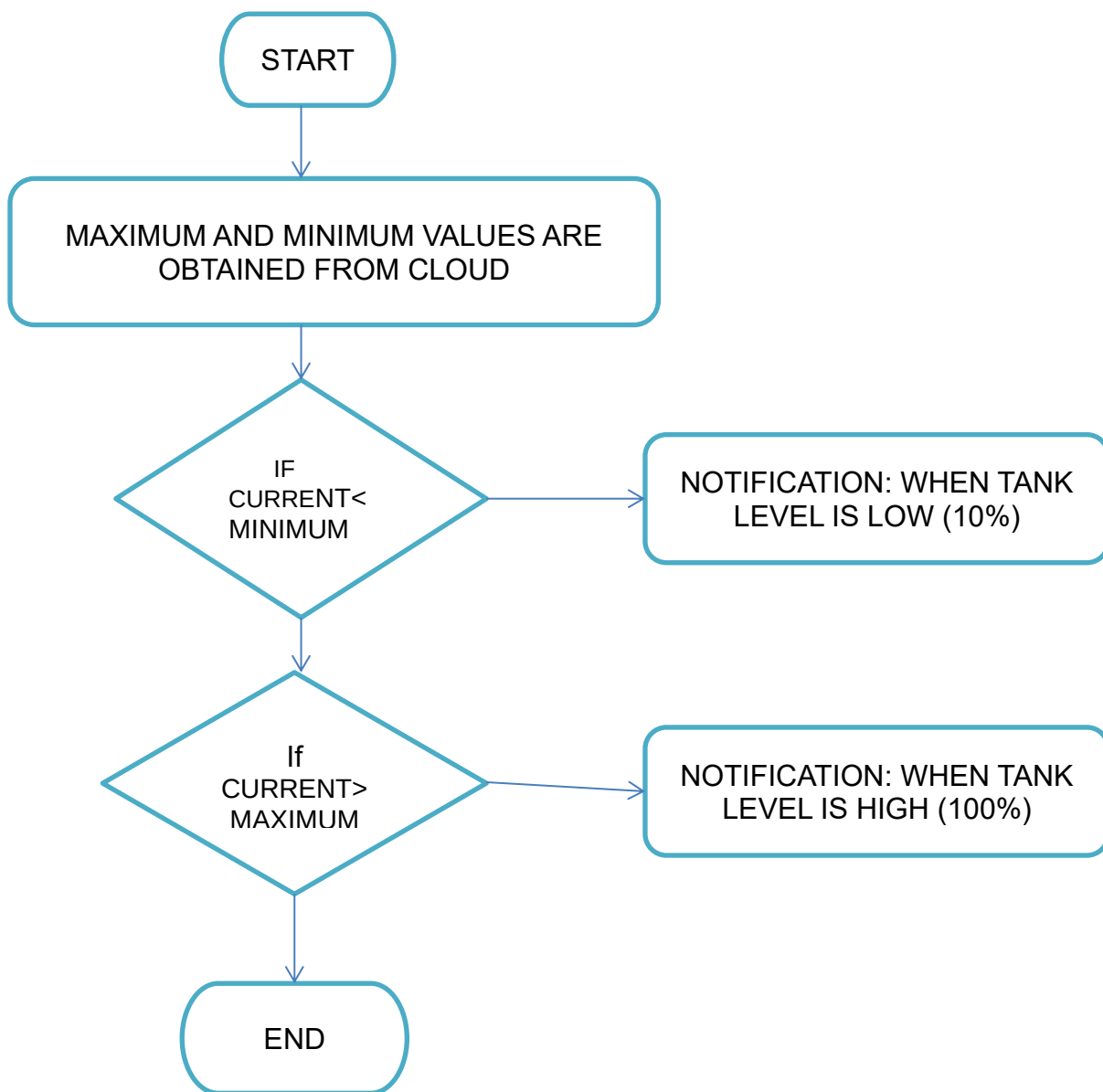


Fig.3.3 Flowchart for Android App

3.3 HARDWARE REQUIRED

- Ultrasonic sensor
- ESP8266 NODEMCU
- Jumper wires
- Voltage Regulator Breakout
- Mount
- PCB Board

This chapter mainly deals with the hardware of the project. This chapter consists of various components used in the system. It also consists of its working, and other attributes of the components. The important peripherals of the system are the various sensors and the Node MCU. The sensors used in the system give us outputs from the bus and the node MCU is used to give the live data of the water level of the overhead tank.

NODE MCU

Node MCU is an open-source firmware and development kit that plays a vital role in designing your own IoT product using a few Lua script lines. Multiple GPIO pins on the board allow you to connect the board with other peripherals and are capable of generating PWM, I2C, SPI, and UART serial communications. The interface of the module is mainly divided into two parts including both Firmware and Hardware where former runs on the ESP8266 Wi-Fi SoC and later is based on the ESP-12 module.

The firmware is based on Lua – A scripting language that is easy to learn, giving a simple programming environment layered with a language that connects you with a well-known developer community. It enables the end user to keep an eye on the tank's water level and manage water pumps as needed. The NodeMCU is added to this design, the ESP8266 transceiver, which is housed inside a 32-bit MCU, is the NodeMCU with many peripherals, including a Wi-Fi module, I/O pins, one ADC pin. NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit).Strictly speaking, the term "NodeMCU" refers to the firmware rather than the associated development kits.

Both the firmware and prototyping board designs are open source.

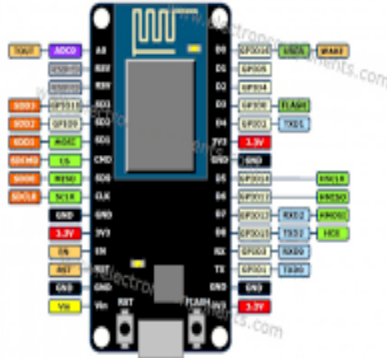


Fig.3.4 Node MCU ESP8266

An opensource firmware gives you the flexibility to edit, modify and rebuilt the existing module and keep changing the entire interface until you succeed in optimizing the module as per your requirements.

- USB to UART converter is added on the module that helps in converting USB data to UART data which mainly understands the language of serial communication.
- Instead of the regular USB port, Micro USB port is included in the module that connects it with the computer for dual purposes: programming and powering up the board.
- The board incorporates status LED that blinks and turns off immediately, giving you the current status of the module if it is running properly when connected with the computer.

NODE MCU PINOUT

Node MCU comes with a number of GPIO Pins. Following figure shows the Pinout of the board. There is a candid difference between VIN and VU where former is the regulated voltage that may stand somewhere between 7 to 12 V while later is the power voltage for USB that must be kept around 5 V.

FEATURES OF NODE MCU

- Open-source
- Arduino-like hardware
- Status LED
- Micro USB port
- Reset/Flash buttons
- Interactive and Programmable
- Low cost 28
- ESP8266 with inbuilt Wi-Fi
- USB to UART converter
- GPIO pins

As mentioned above, a cable supporting USB port is used to connect the board. As you connect the board with a computer, LED will flash. You may need some drivers to be installed on your computer if it fails to detect the Node MCU board. We use Arduino IDE software for programming this module. It is important to note that the pin configuration appearing on the board is different from the configuration we use to program the board on the software i.e. when we write code for targeting pin 16 on the Arduino IDE, it will actually help in laying out the communication with the D0 pin on the module. There are five ground pins and three 3V3 pins on the board.

The board can be powered up using the following three ways.

USB Power: It proves to be an ideal choice for loading programs unless the project you aim to design requires separate interface i.e. disconnected from the computer.

Provide 3.3V: This is another great option to power up the module. If you have your own off-board regulator, you can generate an instant power source for your development kit.

Power Vin: This is a voltage regulator that comes with the ability to support up to 800 mA. It can handle somewhere between 7 to 12 V. You cannot power the devices operating at 3.3 V, as this regulator is unable to generate as low as 3.3V.

APPLICATIONS

Node MCU V3 is mainly used in the Wi-Fi Applications which most of the other embedded modules fail to process unless incorporated with some external Wi-Fi protocol.

Following are some major applications used for Node MCU V3.

- Internet Smoked Alarm
- VR Tracker
- Octopod
- Serial Port Monitor
- ESP Lamp
- Incubator Controller
- IoT home automation
- Security Alarms

ULTRASONIC SENSOR

An ultrasonic sensor is used to generate ultrasonic sound waves that bombard the water's surface. This sensor consists of a speaker that emits an ultrasonic sound wave and a microphone that can pick up that particular sound wave. Since we updated the ultrasonic sensor, there is no water contact with the sensor, ensuring the sensor's extended lifespan of sensor. As the name indicates, ultrasonic sensor is used to measure distance by using ultrasonic waves. It has 4 pins. VCC and ground for switching the sensor on. Trigger pin to send the ultrasonic signal which are being received by echo pin. The arduino calculate the signals sending and receiving time and gives the result in distance by some calculation.



Fig.3.5 Ultrasonic sensor HC-SR04

TYPES OF ULTRASONIC SENSOR

Ultrasonic sensors are classified into different types depending on the applications. There are different types of ultrasonic sensors, but most operate by detecting the distance between the objects. There are several types of ultrasonic sensors, including Ultrasonic Proximity Sensors, Ultrasonic 2 Point Proximity Switches, Ultrasonic Retro-reflective Sensors, Ultrasonic through Beam Sensors.

There are four major different types of ultrasonic sensors are currently in used,

- **Ultrasonic Proximity Sensors:** In this ultrasonic proximity sensor, a special type of sonic transducer is used for alternate transmission and reception of sound wave. This sonic transducer emits the sonic waves which are reflected by an object and after this emission, this sensor switched into receive mode. The total time which is passed between emitting and receiving of sound wave is inversely proportional to the distance of object from sensor. The digital output is only possible or sensed with in detection area. Sensing range can adjust with sensor's potentiometer.
- **Ultrasonic 2 Point Proximity Switches:** This sensor consists of 2 points for switching, therefore it is called 2-point proximity switches. It is almost similar with standard sensor only differ the 2-touch set up key and this function is called Tech-in function. Its switches Sde1 and Sde2 could be easily programmed within the sensing range with the help of built in Tech-in button.

- **Ultrasonic Retro-reflective Sensors:** The operation of ultrasonic retro-reflective sensor is similar with ultrasonic proximity sensor. Only difference, in this sensor the distance between sensor to reflector is measured by measuring the propagation time. In this sensor, the stationary object could be used as a reflector and sensing distance (SD) could be adjust by adjusting the potentiometer resistance with in ultrasonic sensor. Its working is so much simple, when any object comes with in sensing distance then its propagation time is changed and by changing this propagation time, the sensor has switched into active mod. This sensor also allows the detection of sound absorbent and object deflecting sound.
- **Ultrasonic Through Beam Sensors:** For measuring speed with ultrasonic sensor, a microcontroller or any controller such as Arduino is necessary to connect with this sensor. Ultrasonic sensor consists of two transducers one is act as a speaker which converts the electrical pulses into sound pulses and then emit them with high frequency almost 40KHz. Similarly the other one acts as a microphone for receiving the sound pulses which are reflected after the Collision of specific object.

WORKING PRINCIPLE OF ULTRASONIC SENSOR

The ultrasonic sensor circuit consists of set of ultrasonic transmitter and receiver which are operated at same frequency. When anything or object comes into the area of covered circuit then its frequency sound reflected to receiver and alarm is triggered. Ultrasonic sensor circuit is very sensitive and it could be reset automatically or still in triggered until it is reset manually.

This sensor consists of two NAND gates which are wired as an inverter to form the multi vibrator output for driving the transduce. It also consists of two trimmers P1 and P2. P1 is used for adjusting the amplification factor of inverting and non-inverting circuit or op-amp. P2 is used for adjusting the output frequency of transmitter and for acquiring good efficiency the output frequency should be same as resonance frequency of traducer which is in use. Transducer is used for receiving the output signal which is reflected after the collision and this signal is amplified through the resistor TR3. Its working is so much simple, then its propagation time is changed and by changing this propagation time, the sensor has switched into active mod.

ADVANTAGES

- These sensors are easy to use, and they do not damage the environment in which they are used.
- Most if not all of the ultrasonic sensor types can be easily interfaced with a microcontroller.
- They can easily sense the nature, shape and orientation of objects in their vicinity.

APPLICATIONS

- The ultrasonic sensors can be used for high speed counting. This means that if they are coupled to an embedded system, it will be able to quickly process the data input, thus showing the relevant results very quickly.
- It is used in robots as well as in applications with a device that needs to move autonomously. A good example of this is a line following and obstacle detection robot.
- This sensor can be used in measurement applications. It can be used to measure the amount of a liquid present. For example, it can measure the amount of oil, chemicals present, or water levels. These results are can then be fed to an embedded control system to perform relevant actions e.g. shut the valves if the liquid level is above a certain, predetermined value.
- It is also used in car parking system. In such systems a barrier will be present and will need to automatically stay up as long as vehicles are present. This prevents the obvious damage that will occur.

JUMPER WIRES

Jumper wires typically come in three versions: male-to-male, male-to-female and female-to-female. The difference between each is in the end point of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into. Male-to-male jumper wires are the most common and what you likely will use most often. When connecting two ports on a breadboard, a male-to-male wire is what

you'll need. The nominal thickness of the PVC insulation shall be 0.25mm. Over all Insulated Conductor Diameter = 1.10 mm with a tolerance of +0.01mm. The insulation shall neither be loose around the wire nor adhere to it.

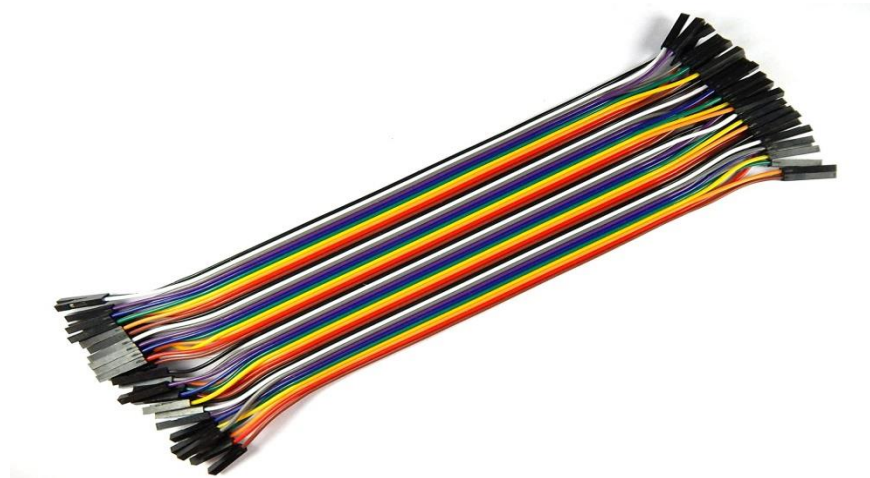


Fig.3.6 Jumper wires

VOLTAGE REGULATOR BREAKOUT

A voltage regulator generates a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions. There are two types of voltage regulators:



Fig.3.7 Voltage regulator breakout

- Linear regulator
- Switching regulator

If you do not feel comfortable soldering, the Dimension Engineering Voltage Regulator Breakout Board can help. It extends the regulator's connection pins to a set of screw terminals that are easier to manipulate. To use the board, plug in the voltage regulator you want with the correct orientation. Then you can connect your power source and load by stripping wires and clamping them into the screw terminals.

WORKING PRINCIPLE OF VOLTAGE REGULATOR

A voltage regulator is a circuit that, regardless of changes to the input voltage or load conditions, creates and maintains a defined output voltage. The battery in your car that gets powered from the alternator, the plug in your house that supplies all the energy you want, the mobile phone that you probably have on hand every minute of the day, all of which require a particular voltage to operate. Fluctuating outputs jumping from $\pm 2V$ will trigger your charging devices to have an inefficient operation and likely even harm. There are a number of reasons why a voltage fluctuation can occur: the state of the power grid, turning off and on other appliances, time of day, environmental influences, etc. Join the voltage regulator, because of the need for a stable, continuous voltage.

Voltage regulators (VRs) regulate the voltages within a range that is consistent with the other electrical elements of a power supply. While voltage regulators are more generally used for converting DC/DC power, some may also convert AC/AC or AC/DC power. DC/DC voltage regulators will be the subject of this report.

ADVANTAGES

- It gives a low ripple voltage as output
- Fast response time to load
- Less noise and Low electromagnetic interference

APPLICATIONS

- To power sensors, op-amps, and other electronic modules that require both voltages, positive and negative voltage regulators can be used together.
- Using the LM7805 output on the 5 V pin, all **popular microcontroller** production boards, such as those from Arduino and Raspberry Pi, can be driven. Arduino boards also have an onboard low-dropout voltage regulator to regulate the power input coming from the barrel jack or Vin, such as On Semiconductor's NCP1117S.
- One of the most significant elements of an electrical circuit is voltage regulators. Extremely high voltage regulators use high current electrical circuits in industrial environments on heavy equipment with high power ratings.

MOUNT

A mount board is a thin white, black or coloured card that artwork is placed inside for decorative purposes. Using an art frame mount presents artwork professionally, creating a clean and crisp finish.

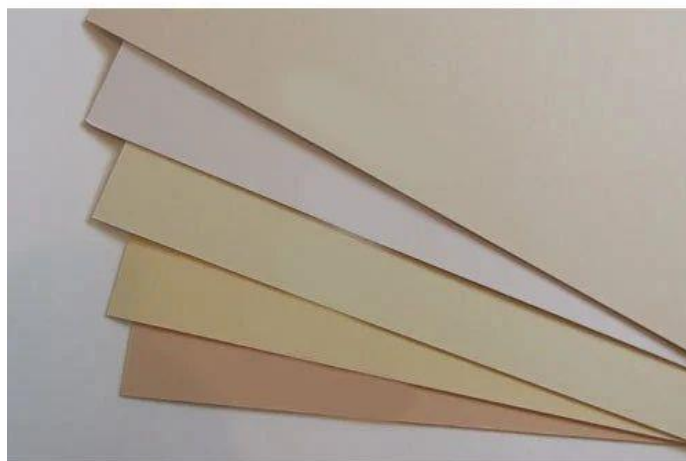


Fig.3.8 Mount

PCB BOARD

Copper core circuit boards are a type of metal core PCB. With their layered design using a copper base, these PCBs offer superior thermal conductivity. Base layer: The base layer is made of a copper substrate that offers high thermal conductivity and heat transfer. Two types of copper foils are typically used in manufacturing PCBs:

- Electrodeposited (ED)
- Rolled-Annealed (RA) Copper.

PCB materials are generally made up of three elements that work together to meet the specific needs of the electronic system: Copper, Resin and Glass. PCBs were used mainly as coolants and lubricants in transformers, capacitors, and other electrical equipment. They were also used in fluorescent lighting fixtures, microscope oil, and hydraulic fluids.

- Single Sided PCB or Single Layer PCB.
- Double Sided PCB or Double Layer PCB.
- Multilayer PCB.
- Rigid PCB.

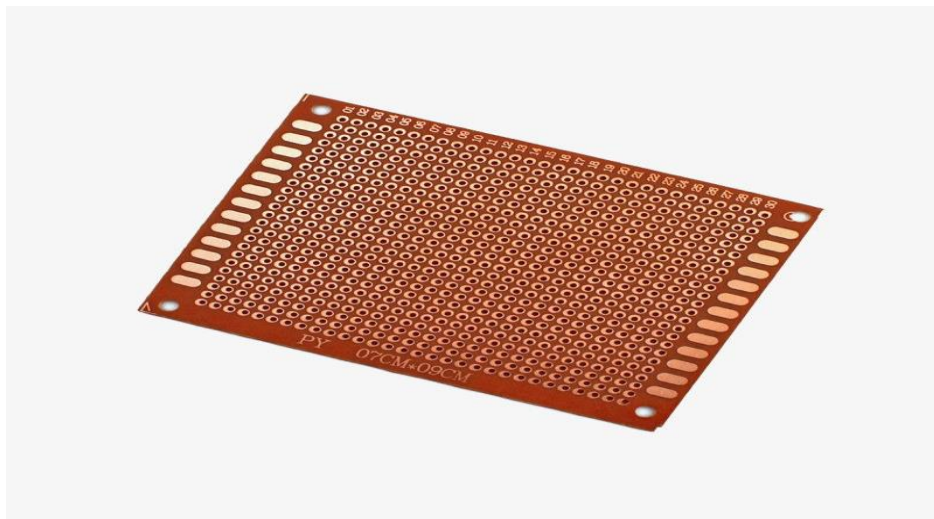


Fig.3.9 Copper PCB

APPLICATIONS

- Irrigation
- Flood monitoring
- Open Channel Flow
- Sea, Pond, Lake and River level data
- Manure Pit monitoring
- Waste water level
- Tide and Wave measurements
- Towing tanks
- Water Vessel operations; flying hydrofoil measurements or vessel pitch & roll
- Water Tank monitoring

ADVANTAGES

- The regulation of water control consumes more electricity and may waste wastewater but with the use of an automatic controller, we can save electricity, and also less water is used to regulate supply.
- It can also help in saving money over some time as it avoids unnecessary usage of electricity and water.
- The automatic system fitted in the controller can reduce manual operations with a timer switch.
- Water pumping is majorly used during mid-day so these automatic controllers can maximize the water pumping during the day time and minimize its usage at night.
- It requires very little maintenance. Compact Solution. A printed circuit board can contain a number of parts and elements.
- Saving Time and Energy.
- No Loose Connections.
- A Reliable Option.
- Low Costs.
- Importance of a Good Manufacturer.

3.4 SOFTWARE REQUIRED

- Cloud computing
- Application development for Android
- Blynk App
- Arduino IDE

CLOUD COMPUTING:

A cloud platform for professional companies that are just starting the Blynk application provides a cloud environment for creating IoT apps. The Blynk app continuously collects data, relational mapping, the ability to build extension and programmes that work with online businesses of collected data as charts. The Blynk app receives data received from the controller. Continuous monitoring of this cloud data at given time intervals produces graphs of relevant sensors.

APPLICATION FOR ANDROID DEVELOPMENT:

It's a programming framework designed to help developers build and test Android applications. A program has been created with this software. Consumers have to Set the tank's highest and lowest water levels via the app. The app will display the the tank's current level of water. The customer also has to define the values when the trigger her message should be sent so that the tank can process the data. Real-time data is displayed by the app. Workers are allocated to clean the tank based on this value.

BLYNK APP

Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and NodeMCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the appropriate address on the available widgets.

There are three major components in the platform:

Blynk App - allows to you create amazing interfaces for your projects using various widgets we provide.

Blynk Server - responsible for all the communications between the smart phone and hardware.

Blynk Cloud - to run your private Blynk server locally.

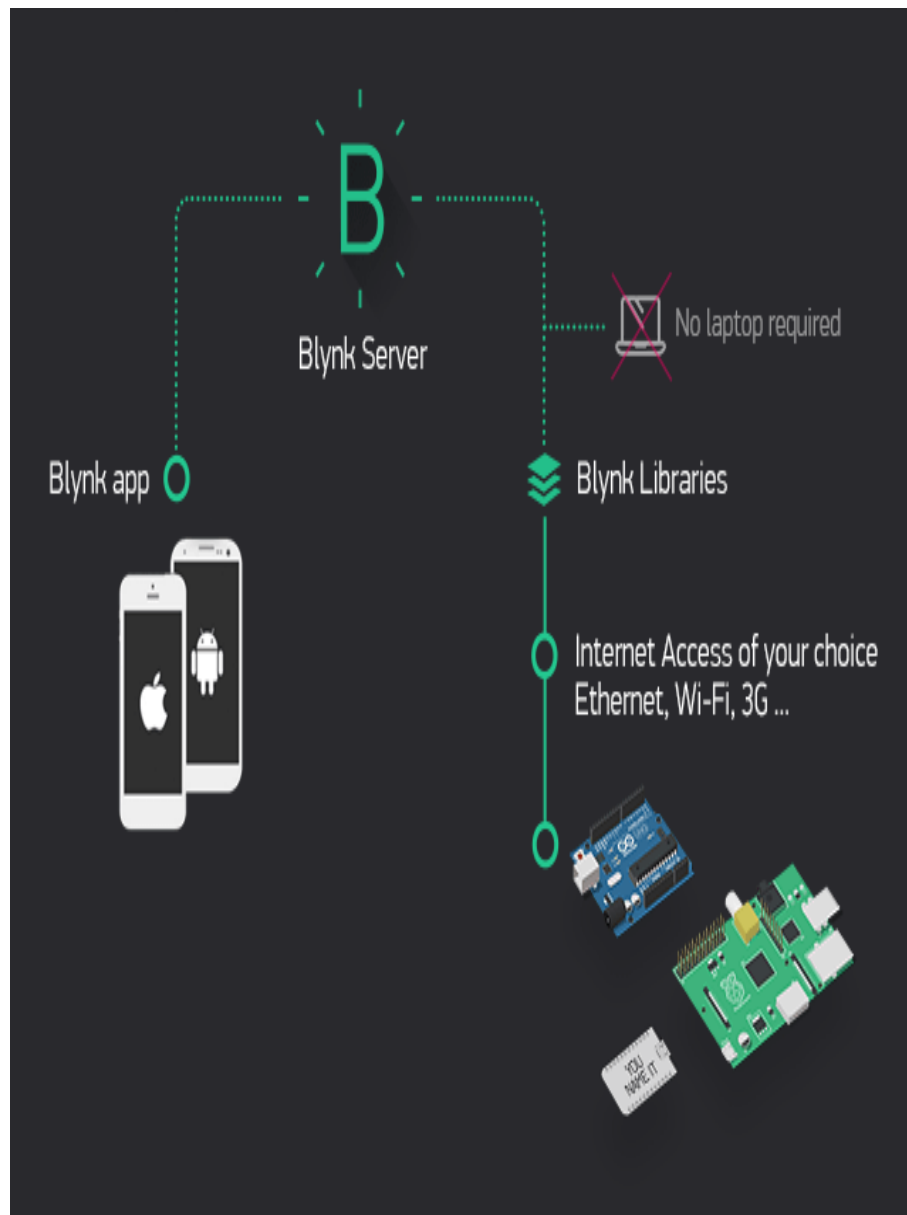


Fig.3.10 Working of Blynk app

FEATURES:

- Similar API & UI for all supported hardware & devices
- Wi-Fi
- Bluetooth and BLE
- Ethernet
- USB (Serial)

SMART MONITORING SYSTEM

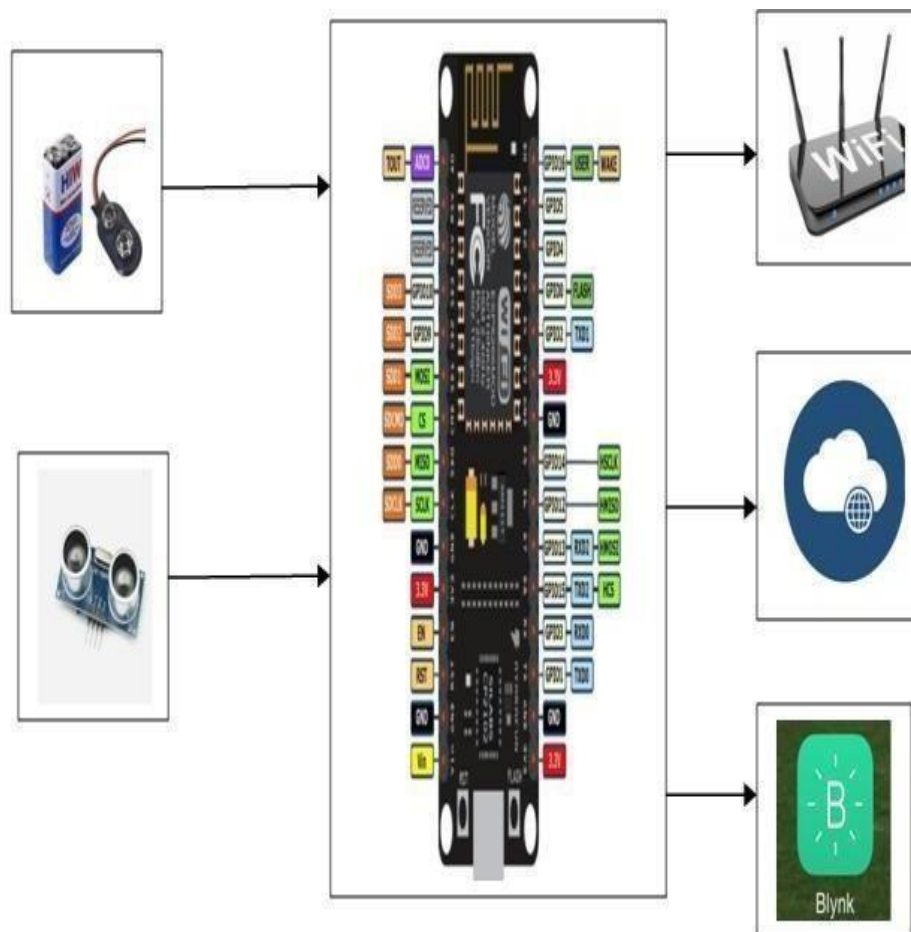


Fig.3.11 Smart monitoring system

3.5 STANDARDS

IEEE has a number of existing standards (current and under development), activities, and events that are directly related to creating the environment needed for a vibrant IoT, recognizing the value of the IoT to industry and the benefits this technology innovation brings to the public. Some key standards activities are:

- Architectural framework: The focus of IEEE P2413-2019 is to develop a standard for the architectural framework for the Internet of Things, which includes descriptions of various IoT domains, definitions of IoT domain abstractions, and identification of commonalities between different IoT domains. The architectural framework defined in this standard will promote cross domain interaction, aid system interoperability and functional compatibility.
- Harmonization and security of IoT: The IEEE 1451-99 is focused on developing a standard for harmonization of Internet of Things (IoT) devices and systems. This standard defines a method for data sharing, interoperability, and security of messages over a network, where sensors, actuators and other devices can interoperate, regardless of underlying communication technology.
- Sensor Performance and Quality: Sensors are fundamental to IoT ecosystem with large volume of different sensors integrated into a complex framework. IEEE 2700 proposes a common framework for sensor performance specification terminology, units, conditions and limits is provided. IEEE P2510 defines quality measures, controls, parameters and definitions for sensor data related to Internet of Things (IoT) implementations.

3.6 CONSTRAINTS

Water is one of the most important basic need for living beings, yet it is wasted. Water quality is also equally important. After some days water in the tank will be contaminated

by dry leaves and dust. The amount of alkalinity present in the water pH range should always be between 0- 14 for any liquid. If pH value ranges from 0-6.9 then it is acidic. If pH is between 6.9-7.9 the liquid is neither acidic nor basic and can use for household purposes.

CHAPTER 4

RESULTS AND DISCUSSION

The system “Smart water level monitoring and management system using IoT” is an innovative method of water level monitoring. It uses an esp8266 module as its core hardware component and ultrasonic sensor an nodemcu is connected using jumper wires as shown in the circuit diagram follows the figure 4.1. The distance is tracked with an ultrasonic sensor that senses the level of water present in the tank or sump respectively. By using the jumper wires we are connected ground of the nodemcu to ground of the ultrasonic sensor. VCC and ground for switching the sensor on. Trigger pin to send the ultrasonic signal which are being received by echo pin. The arduino calculate the signals sending. IoT technology provides the ability to monitor the river water or stream levels with the help of sensors. These devices are installed on the appropriate surface, where they detect the water levels and collect data for further analysis.

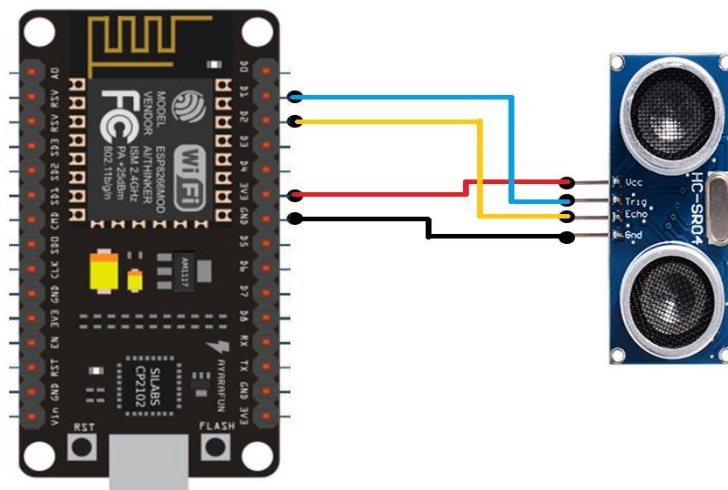


Fig.4.1 Circuit diagram

4.1 HARDWARE IMPLEMENTATION

- Hardware Integration
- Dashboard of Blynk
- Alert message
- Output in Gmail
- Data in blynk app Indicating water is low
- Data in blynk app Indicating water is high

4.2 OUTPUT IMAGES OF THE PROJECT

HARDWARE INTEGRATION

By using ultrasonic sensor and node mcu connected with the jumper wires as shown in figure 4.2.

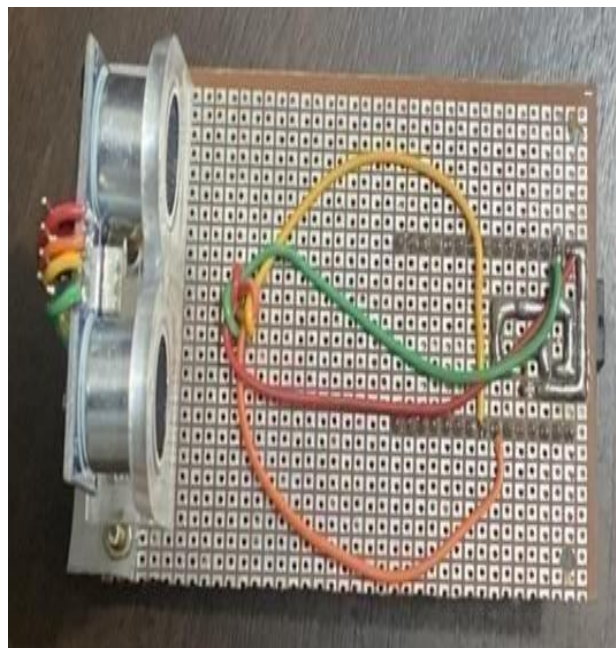


Fig.4.2 Hardware connection



Fig.4.3 Prototype of the project

ALERT MESSAGE

When the water level is low it sends alert message in the form of mail as shown in the figure below figure 4.4.

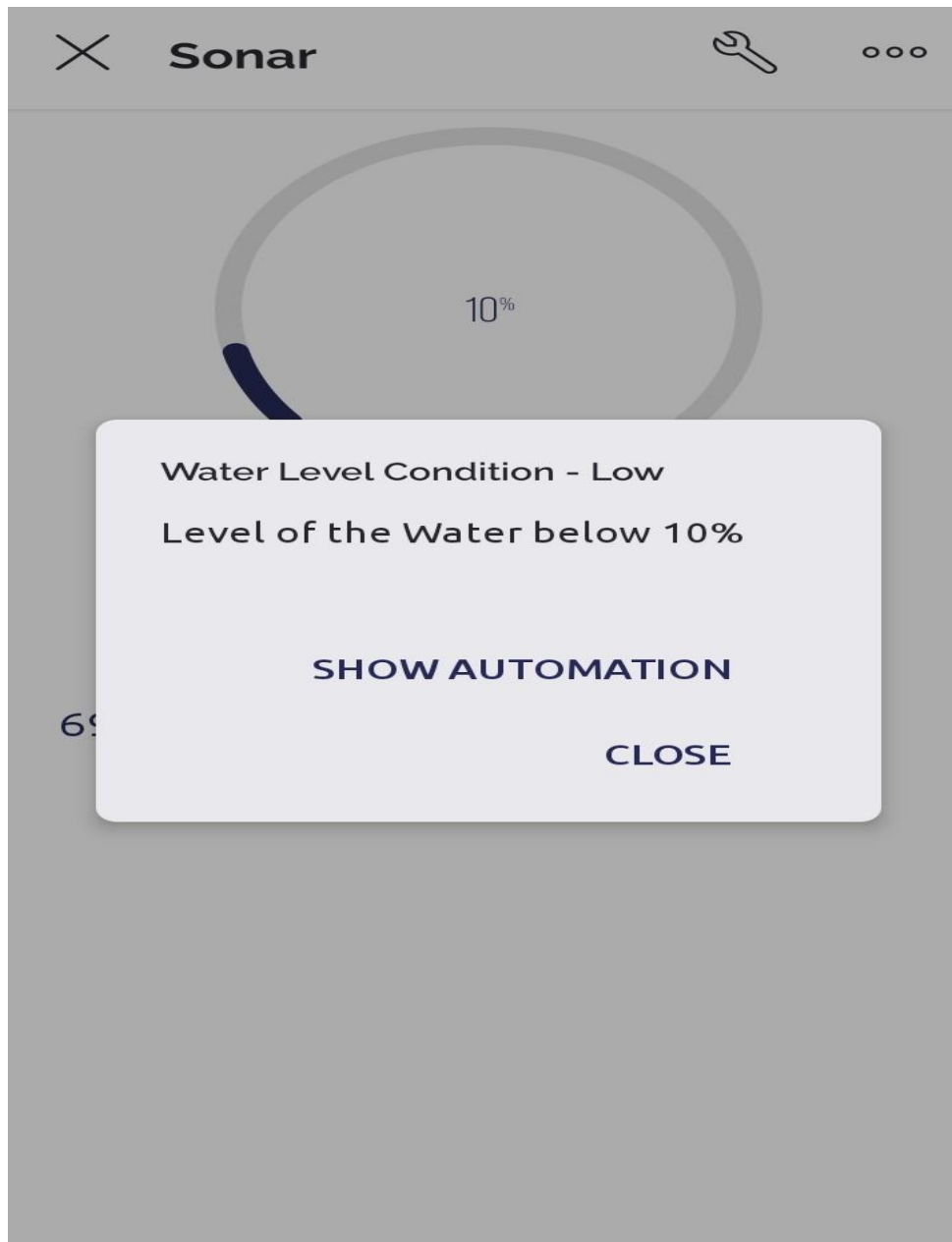


Fig.4.4 Alert message

OUTPUT IN GMAIL DATA IN BLYNK APP

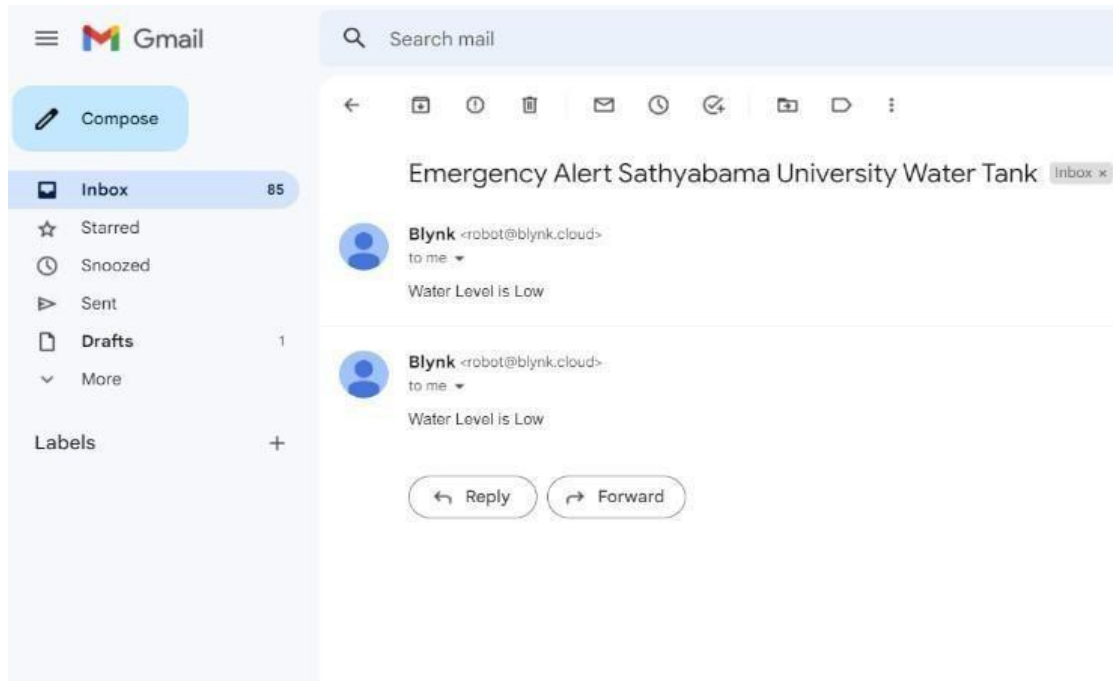


Fig.4.5 Output in Gmail

DATA IN BLYNK APP

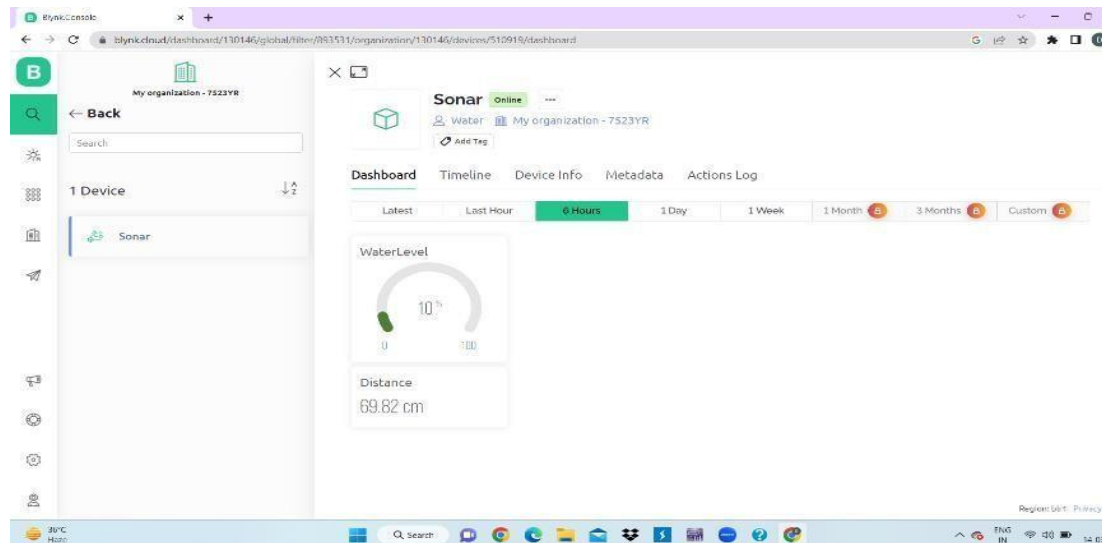


Fig.4.6 Data in blynk app Indicating water is low

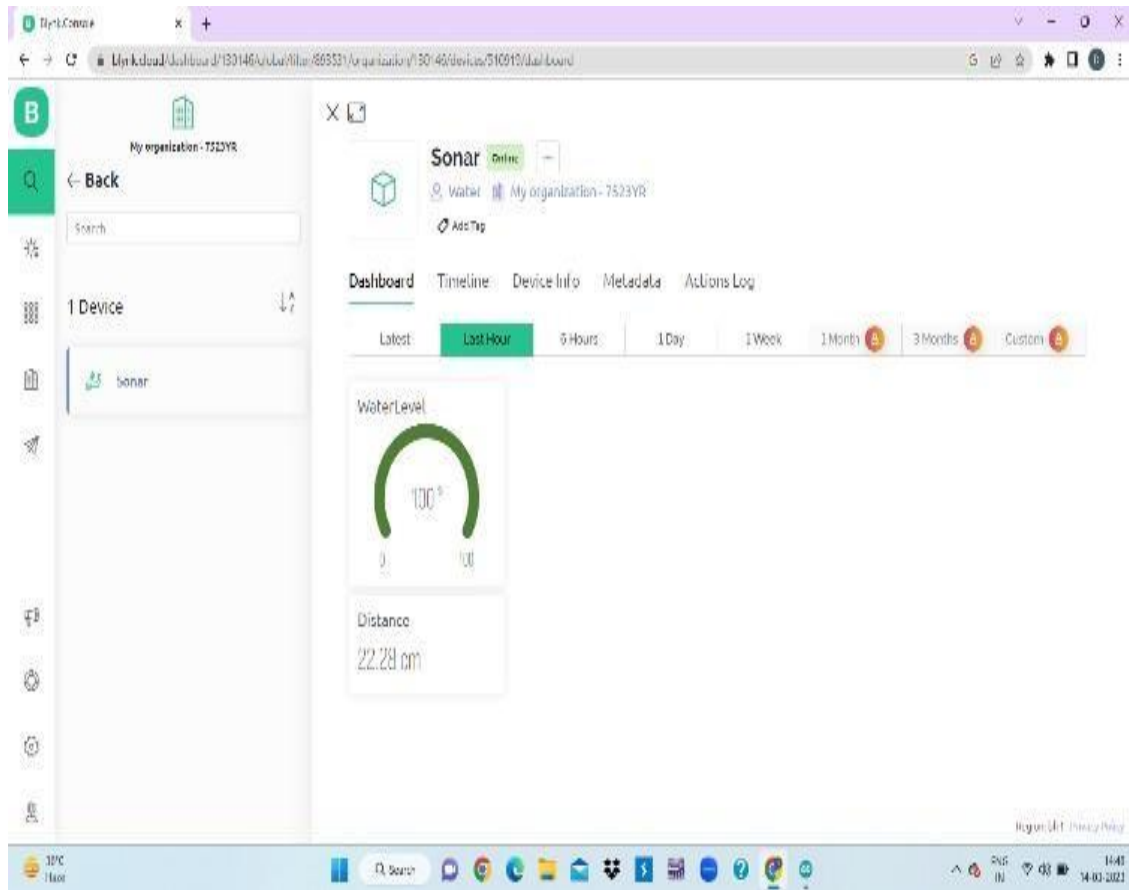


Fig.4.7 Data in blynk app Indicating water is high

The email message received as an indication for water tank overflow is shown in figure 4.5. In figure 4.6, the data shown in blynk app indicating the water level is low is given. In figure 4.7, the data shown in blynk app indicating the water level is low is given.

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1 CONCLUSION

Now a days we are facing many issues is that regarding water wastage monitoring in tanks. This project proposes a proficient method to water level in the overhead tanks by lessening the present water wastage with IoT technology is efficiently utilized to monitor the water level. The Water Level Indicator employs a simple mechanism to detect and indicate the water level in an overhead tank or any other water container. This is one of the motivations for the current work and to deploy techniques in order to save water and help the environment which in turn ensures water for the future.

The purpose of a water level indicator is to gauge and manage water levels in a water tank. It useful continuous monitor the water in tank. The control panel can also be programmed to send message and GMAIL once water level get too low and high to the adequate level. In proposed we are going to use water level by ultrasonic sensor is used to identify the water level in the tanks depend upon the level of water, when the tank is filled. voltage regulator Specifies the Arduino uno it becomes easy with other components. It can be used to communicate with a computer.

Water is one of the most basic needs that all living things have. Oceans and seas entirely made up of water. Suggesting that only 10% of the available water is provided as sparkling water of this 10%, only 10% is available for human use. Unfortunately, a significant amount of water that is being squandered as a result of unchecked use and

abuse of water assistance. A few different automatic water stage monitoring structures are also available, however most of the methods have some practical drawbacks as of yet. We created a green automated water degree tracking and controlling system in an effort to overcome such issues. Our goal in conducting these tests was to create a flexible, affordable, our concern with water waste. The Raspberry Pi, Turbidity sensor, Ultrasonic sensor and pH sensor are used in this project, which successfully decreases cost. Additionally, this project can make use of existing water tanks rather special tank.

5.2 FUTURE SCOPE

Water is very essential for all living being. But unfortunately excessive water is being wasted. We tried to overcome this problem by using water level controller system. Main aim of this project is to stop the unnecessary wastage of water and reduce the burden of the operator. In agricultural sector water level monitoring has good scope in future. Whole system operates automatically, so it does not need any expert person to operate it. The system has scope for future development of city. We know that the major place where water gets wasted is industries and homes. This system can be also used to atomize the control of dams without human interface, so now we do not have to worry about overflow anymore. There are many areas where we need to control the wastage of water. It could be agricultural fields, overhead tanks, etc. This project can be implemented in domestic areas, factories, work places with some modifications. It will also help in creating a smart city centered around the idea of water preservation.

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