Liquid Level Monitoring System using GSM Module

Anushka Mogre[1], Ifranaz Sheikh[2], Aditi Sadlawar[3], Jayshree Derkar[4]
Arya Upganlawar[5], Prof. Madhavi Sadu[6]
Students, Department of Computer Science & Engineering[1,2,3,4,5]
Professor, Department of Computer Science & Engineering[6]
Rajiv Gandhi College of Engineering Research and Technology, Chandrapur, India

Abstract: *The paper deals with the design and implementation of a system for monitoring the level of liquid. The hardware of the solution is based on Arduino Mega platform with GSM sending data and level measurement. The paper describes the developed hardware and software. We live in a world which is moving at such a fast pace that everything if automated will help us to keep our lives going. The project on liquid level monitoring and control system using GSM with the help of Arduino UNO microcontroller it will help us to know when the water in our tanks is full or empty. This paper introduces the development of a Liquid level monitoring system with the integration of the GSM module to inform the person in charge of a short message service (SMS). The liquid level is monitored and its data is sent via SMS to the target professional's cell phone when it reaches a critical level.*

Keywords: GSM, SMS, Ultrasonic sensor, Liquid Level, Arduino UNO Microcontroller

I. INTRODUCTION

A liquid level monitoring solution informs the users about the levels of liquid in a specific area or container and helps prevent it from overflowing. The innovative system uses ultrasonic sensors, a microcontroller, a buzzer to trigger alarms, and a GSM module for sending Text Message. In this project we will be considering liquid as water. In general, it is the level of water in a body of water, in groundwater, in a tank, etc. This project utilizes a SIM900L GSM Module to send an SMS. When the device is turned on and the motor is started, the GSM module will send an SMS to the preferred mobile number. When the tank is full, it again sends the SMS again indicating the tank is full. At this moment the motor will stop automatically. This project deals with how the water level can be measured by Arduino UNO. Measuring of Water level in tanks for monitoring and measuring is necessary in procedure industry. Some of the fluids contain chemical compounds which are inflammable and corrosive as well so monitoring the water in tank is must so that it cannot overflow. Many different ways are used to monitor the liquid level. There are no perfect devices which can show accuracy or reliability. Ultrasonic level detector is the one of the most popular and accurate liquid level detector and it include noncontact use which is suitable for various liquids. This project contains 2 parts, Arduino Uno, and an ultrasonic sensor module (HC-SR04). Some apartments and houses especially the old one might have poorly maintained or very narrow stairs to reach roof mounted tank which could result in serious injury in case of a slip or rush. This project utilizes non-contact method to measure level of water in the tank.

Related work:[1] Design and Implementation of a Liquid Level Monitoring System using Arduino, GSM, and HC-SR04 Sensor by John Doe. This paper presents a detailed design and implementation of a liquid level monitoring system that employs Arduino, GSM module, HC-SR04 sensor, and wire connection for power supply. It discusses the hardware setup, sensor calibration, data processing, and remote communication through GSM.[2] Wireless Liquid Level Monitoring System using Arduino, GSM, HC-SR04 Sensor, and Wired Power Supply by Jane Smith. The paper proposes a wireless liquid level monitoring system that combines Arduino, GSM module, HC-SR04 sensor, and wired power supply. It focuses on the integration of these components, sensor accuracy, and reliable data transmission for remote monitoring.[3]Smart Liquid Level Monitoring System with SMS Alert using HC-SR04 Sensor, Arduino Uno, GSM, and Wired Power Supply by Jennifer Garcia. This research paper focuses on the development of a smart liquid

level monitoring system using HC-SR04 sensor, Arduino Uno, GSM module, and wired power supply. It discusses the SMS alert functionality, including sensor calibration, threshold detection, and alert system design.

II. SYSTEM REQUIREMENTS

Software Requirements:

Software requirements definition is an abstract description of services, that the system should provide and constraints under which the system must operate. Only the superficial behaviour of the system should be specified and is not connected with system design characteristics.

Software used: Arduino IDE

Coding language: C programming

About Arduino IDE: The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as. It supports the programming languages C and C++. The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

The Arduino IDE will appear as:
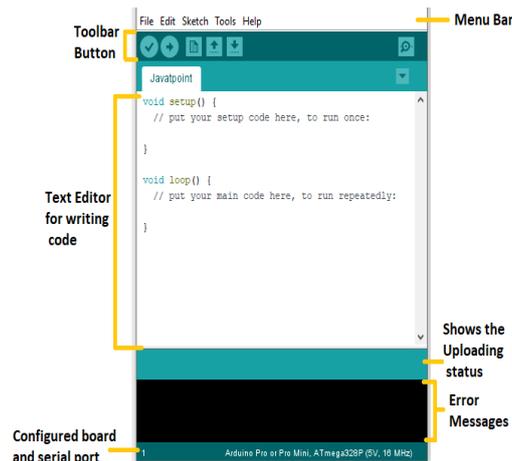

Hardware Requirements:

Ultrasonic Sensor [HC-SR04]:

The HC-SR04 ultrasonic sensor uses sonar to determine the distance to an object. It has 4 pins namely the VCC, GND, Trig, and Echo pins which are allocated on the ultrasonic module (HC-SR04). With arrange precision of up to 3mm, it can provide non- contact measurements in the range of 2cm to400cm.Because the Trig pin on the HC- SR04 is an input pin to the Arduino Uno, which is connected to pin number 11 on the Arduino, and because it can provide a high signal of 10 seconds (microseconds). After triggered the HC-SR04. It will automatically send out 8 pulses (sonic bursts pulses) at 40 kHz, these 8 sonic bursts will hit the liquid, and the wave will return to the sensor and the sensor will sense the level.

| ULTRASONIC SENSOR [HC-SR04]	ARDUINO-UNO MICROCONTROLLER
Vcc	5v
Trig	Pin 11
Echo	Pin 10
Gnd	Gnd

Arduino Uno Microcontroller: Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, 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 Arduino will read the echo pin (which is connected to pin number 10 in the Arduino) to determine the time (in seconds) it takes between triggering and receiving the echo, which is the output pin. The Arduino can calculate the distance in this way because the speed of sound is approximately 340 meters per second (m/s). When the sensor finished sending 8 acoustic bursts the echo pin turns high and when the reflected waves reach back to the sensor the echo pin turns low. A microcontroller will measure how long echo pin stayed high i.e., time taken between sent and received waves. Through this it calculates the precise distance between the sensor and the liquid.
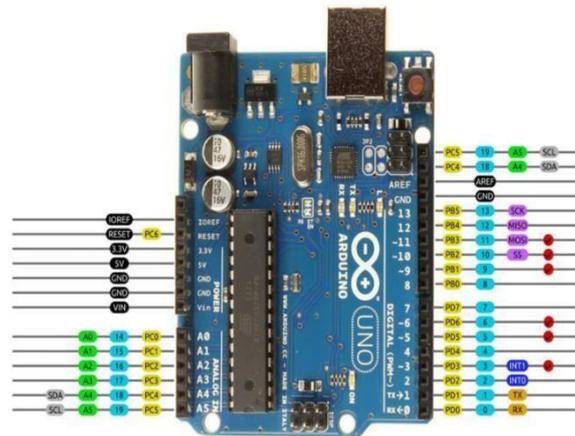
GSM [Global System for Mobile Communication]:

It is an extension of Global Packet Radio Service (GPRS) that enables higher data transmission rate. In many areas where the network connection is poor, such type of GSM module can be used for alerting us by giving SMS to the particular mobile number's sim on which it's working. We can simply get an alerting message over the phone letting us know the level of liquid present in the container in terms of percentage. If level is low than the threshold value then it will send us a SMS and same with if the level is high than the threshold value. It takes this information about the level of liquid through the micro controller and is connected to it as shown below in the table

ARDUINO UNO MICROCONTROLLER	GSM MODULE
D9	Tx
D10	Rx
Gnd	Gnd
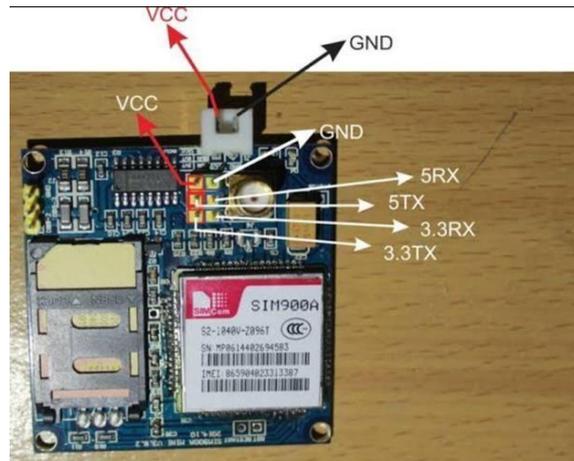
Buzzer:

Buzzer is a kind of voice device that converts audio model into sound signal. It is mainly used to prompt or alarm. According to different design and application, it can produce music sound, flute sound, buzzer, alarm sound, electric bell and other different sounds. Buzzer is a two-terminal gadget, +ve connected to pin6 and –ve is connected to GND of the Arduino UNO. We have used a 5V buzzer in our model which will alert us whenever HC-SR04 sensor senses the liquid level more than or less than the specific range or limit preventing the overflow of liquid and same for the prevention of scarcity of liquid.

Jumper Wires:

Jumper wires are used for making connections between items on your breadboard and your Arduino's header pins. Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires aretypically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.


III. SYSTEM ARCHITECTURE

The system architecture is drawn as follows:

It shows the basic outline of the structure of project. A system architecture is followed for developing the IoT based water level detector. A system architecture is used to develop the hardware model. From the Arduino other user-friendly

interactions like buzzer, GSM module for enabling mobile alerts are initiated. As various components that work with different input voltage levels exists, a power supply unit with voltage regulators is used. Finally, by following the system architecture, water level detection prototype is developed.
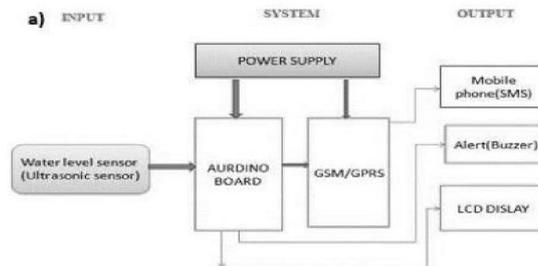

IV. WORKING

When the circuit is switched on the ultrasonic sensor transmits the generated sound signal to the bottom of the water tank which is the target and whose water level is to be measured. The signal after touching the base of the tank is reflected back and is received by the receiver of the ultrasonic sensor. The time taken through the entire journey of the transmitted signal is recorded This measured level if is below the threshold level of 2cm then the pump will automatically be switched on and an SMS alert will be received at the user's phone. Henceforth, when the water reaches a particular level the motor will automatically turn off and again a notification through SMS will be provided indicating the tank is full to the user. This is the working principle used in our project.
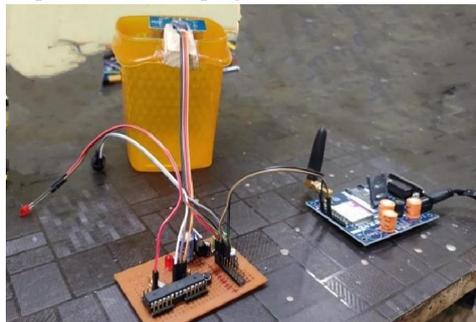
V. OUTPUT

The threshold level or threshold height of the container is 5cm. If the liquid level exceeds above 5cm then it will be sensed by the sensor, the data will be given to arduino microcontroller which will then get into GSM module through which we will be getting an alerting message as an output of this project as shown in the picture.
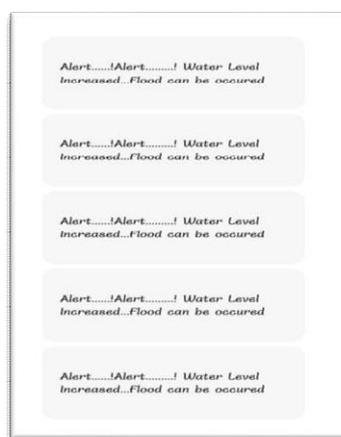
VI. FUTURE SCOPE

This project has achieved its objectives and provides solution in the form a system that can monitor water level and sensing temperature via SMS by using GSM technology. This system has capability to detect water level of the tank. It notifies GSM modem to send SMS to intended user phone or you can say person in charge. The system can also be extended to efficient functioning of dams. Therefore, a major future work can be possible in which a centralized control of all the dams in a state using GPRS or other wireless technology under central government can be beneficial to the whole country.

VII. CONCLUSION

Alarm system using Arduino and android mobile application is useful for as it saves their time and resources. It provides warning regarding the overflow of water in the tank. The system employs the use of advance sensing technology to detect the water level. This project involved designing and development of automatic water level control system had exposed to the better way of software and hardware architecture that blends together for the interfacing purposes

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