AUTOMATIC AND LOWCOST SALINE LEVEL MONITORING USING ARUDINO AND GSM MODULE

A Major Project report submitted to

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR, ANANTHAPURAMU

in partial fulfillment of the requirement for the award of degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

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G. PULLA REDDY ENGINEERING COLLEGE (AUTONOMOUS): KURNOOL

(Accredited by NBA of AICTE and NAAC of UGC with A grade)

(AFFILIATED TO JNTUA, ANANTHAPURAMU)

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CERTIFICATE

This is to certify that the major project work entitled

AUTOMATIC AND LOWCOST SALINE LEVEL MONITORING USING ARUDINO AND GSM MODULE

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BACHELOR OF TECHNOLOGY IN
ELECTRONICS AND COMMUNICATION ENGINEERING

PROJECT GUIDE

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We also extend our sincere thanks to the entire faculty and staff members of the ECE Department, who have been a source of information throughout the course and for extending all support to us in the form of technical literature and excellent guidance.

DECLARATION

We hereby declare that the major project titled **"AUTOMATIC AND LOWCOST SALINE LEVEL MONITORING USING ARUDINO AND GSM MODULE"** is an authenticated work carried out by us as the students of **G. PULLA REDDY ENGINEERING COLLEGE**(Autonomous), Kurnool, during 2023- 2024 and has not been the award of any degree or diploma in part or in full to any institute.

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ABSTRACT

Traditional methods used for health care are becoming obsolete due to increase in population. Current health care system requires manual care takers and their heavy duties which is very time-consuming job. Innovative health monitoring systems are required with less human intervention which will be available at low cost in rural as well as urban areas. Engineering technologies are getting coupled with medical field to solve this problem. Sophisticated health monitoring systems are getting developed with the help of electronic components Arduino UNO R3 and a Level Sensor and GSM module800L with easy interfacing.

This project mainly focuses on providing advanced saline level monitoring system. The idea is to provide cost effective, reliable and automatic saline flow monitoring system which can be easily implemented in any hospital and can be easy for doctors as well as nurses to monitor the saline flow from a distance. The proposed system eliminates continuous on sight monitoring of patient by nurses or doctors. For patients who require continuous saline, assessment and replacement of saline bottles require manual interface which may not be accurate sometimes i.e., due to the busy schedule, observers may tend to forget to change the saline bottle at the appropriate time. This project continuously monitors the level of saline in the absence of any hospital staff.

The whole system is remotely controlled by an Android OS smartphone based on Internet of Things (IoT). When the load of the saline bottle reaches a very low level then an alert message will be sent to the nurse and doctor. The same circuit can be reused for another saline bottle giving only one time investment.

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1.INTRODUCTION

1.INTRODUCTION

Introducing an innovative solution for medical infusion systems, our automatic and low-cost saline level monitoring system leverages the power of Arduino, GSM technology, and a precision level sensor. This cutting-edge integration ensures a seamless and efficient monitoring process, crucial for patient safety and healthcare management. At the heart of the system lies Arduino, functioning as the intelligent controller. It receives real-time data from a highly sensitive level sensor embedded in the saline line. This sensor provides accurate and continuous measurements of the saline levels, ensuring a reliable monitoring mechanism.

The incorporation of GSM technology enables remote monitoring and control. Instant notifications are sent to healthcare professionals in case of deviations or critical levels, allowing for swift intervention. This not only enhances the efficiency of healthcare delivery but also provides a cost-effective solution for seamless communication. The low-cost nature of the system, coupled with the versatility of Arduino, makes it an accessible and adaptable solution for various healthcare settings. By addressing the vital need for automated saline level monitoring, this technology ensures patient well-being while presenting an affordable and efficient alternative in medical infusion management.

1.1 BACKGROUND

In the realm of medical care, where precision and efficiency are paramount, our solution emerges as a groundbreaking advancement in saline level monitoring. With a focus on automation and cost-effectiveness, we integrate Arduino, GSM technology, and a sophisticated level sensor to create a comprehensive monitoring system.

Historically, manual saline level checks have been labor-intensive and prone to human error. Recognizing this gap, our system leverages the computational prowess of Arduino, serving as the brain orchestrating the entire process. The real-time data acquisition from the precision level sensor embedded in the saline line ensures accuracy beyond the capabilities of traditional monitoring methods.

The inclusion of GSM technology catapults the system into the era of remote healthcare management. Healthcare professionals receive instantaneous notifications regarding saline levels, allowing for timely interventions. This not only optimizes patient care but also streamlines the healthcare workflow.

What sets this innovation apart is its cost-effective design. By harnessing the accessibility and affordability of Arduino, we make automated saline level monitoring an achievable reality for diverse healthcare settings. In doing so, we bridge the gap between cutting-edge technology and practical healthcare needs, revolutionizing infusion systems and contributing to a safer and more efficient patient care landscape.

1.2 PROBLEM STATEMENT

Traditional manual saline level monitoring in medical infusion systems is susceptible to errors, inefficiencies, and delays, posing risks to patient safety. Our solution tackles this issue head-on by automating the monitoring process through the integration of Arduino, GSM technology, and a precision level sensor. This innovative approach not only ensures heightened accuracy in saline level measurements but also facilitates real-time monitoring. The incorporation of cost-effective components, particularly Arduino, makes this technology accessible for various healthcare settings, promising a transformative impact on infusion systems.

1.3 MAIN OBJECTIVES

The primary objective of our project is to revolutionize saline level monitoring in medical infusion systems by introducing an automated and cost-effective solution. The manual nature of traditional monitoring methods poses considerable risks to patient safety due to potential human errors, inefficiencies, and delays. By integrating Arduino, GSM technology, and a precision level sensor, our system aims to address these challenges comprehensively.

The core focus is on automating the saline level monitoring process, leveraging the computational capabilities of Arduino. The precision level sensor provides accurate real-time data, ensuring a reliable and continuous monitoring mechanism. The incorporation of GSM technology enables remote monitoring, allowing healthcare professionals to receive instant notifications regarding saline levels.

The cost-effective design is a key aspect of our objective. Utilizing accessible and affordable components, particularly Arduino, makes automated saline level monitoring feasible for various healthcare settings. This democratization of advanced technology ensures that the benefits of real-time monitoring and intervention are not limited to resource-rich environments. Ultimately, our objective is to enhance patient care, streamline healthcare workflows, and contribute to a safer and more efficient healthcare landscape through the innovative integration of Arduino, GSM, and a precision level sensor in saline level monitoring.

2. LITERATURE REVIEW

2. LITERATURE REVIEW

2.1 REVIEW OF RELATED LITERATURES

1. Mansi G. Chidgopkar & Aruna P. Phatale "AUTOMATIC AND LOW COST SALINE LEVEL MONITORING SYSTEM USING WIRELESS BLUETOOTH MODULE AND CC2500 TRANSRECEIVER" in IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308.

Primary Finding:

This system monitors the saline flow and it also predicts the remaining time to empty the saline. There is a buzzer which is fixed near to the patient bed and when the saline is going to empty, the buzzer starts to ring.

2. M. Chengathir Selvi , T. Bhuvaneswari , R. Naga Priyadarshini , R. Chitralekha , R. Ramya "IoT ba" in Journal of Pharmaceutical Negative Results ¦ Volume 13 ¦ Special Issue 3 ¦ 2022

Primary Finding:

Level sensor is used in this system which provides the accurate readings. If the saline level goes below the threshold point, notifications sent to the nurses by using bluetooth device but it slowly drains the battery of the cell phone.

3. Mr. Jayant Ingale & Ms. Sharvari Sahare, "AUTOMATIC SALINE LEVEL MONITORING SYSTEM USING IOT" in IJCRT2105912 International Journal of Creative Research Thoughts (IJCRT) 2021 IJCRT | Volume 9, Issue 5 May 2021 | ISSN: 2320-2882

Primary Finding:

This framework proposed to monitor the saline level, patient's heart rate and temperature. The sensors data are sent to the firebase database and the patient details can be viewed through the android application.

4. Darshana Baviskar, Pooja Patil, **"**IOT BASED SALINE LEVEL MONITORING" in OAIJSE open access international journal of science and engineering | Volume 4 , Issue 4 , April 2019 | ISO 3297:2007

Primary Finding:

This system proposed IoT based drips monitoring at hospitals. This system monitors the saline level with a different component called load cell and also sends the alert messages if the saline gets completed.

3.CONCEPTS OF EMBEDDED SYSTEMS

3. CONCEPTS OF EMBEDDED SYSTEMS

An embedded system can be defined as a computing device that does a specific focused job. Appliances such as the air-conditioner, VCD player, DVD player, printer, fax machine, mobile phone etc. are examples of embedded systems. Each of these appliances will have a processor and special hardware to meet the specific requirement of the application along with the embedded software that is executed by the processor for meeting that specific requirement. The embedded software is also called “firm ware”. The desktop/laptop computer is a general-purpose computer. You can use it for a variety of applications such as playing games, word processing, accounting, software development and so on.

3.1 TYPES OF EMBEDDED SYSTEMS

Embedded systems are specialized computer systems designed to perform specific functions within larger systems. They are used in a wide range of applications, from consumer electronics to industrial automation. There are several different types of embedded systems, including:

Real-time embedded systems: These systems are designed to respond to external events in real-time, often with strict timing requirements. They are commonly used in applications such as control systems, medical devices, and automotive systems.

Standalone embedded systems: These systems operate independently of other systems and do not require communication with other devices. They are commonly used in applications such as home appliances, toys, and security systems.

Networked embedded systems: These systems are designed to communicate with other devices over a network, such as the internet or a local area network. They are commonly used in applications such as smart homes, industrial automation, and telecommunications.

3.2 Block diagram of Embedded Systems

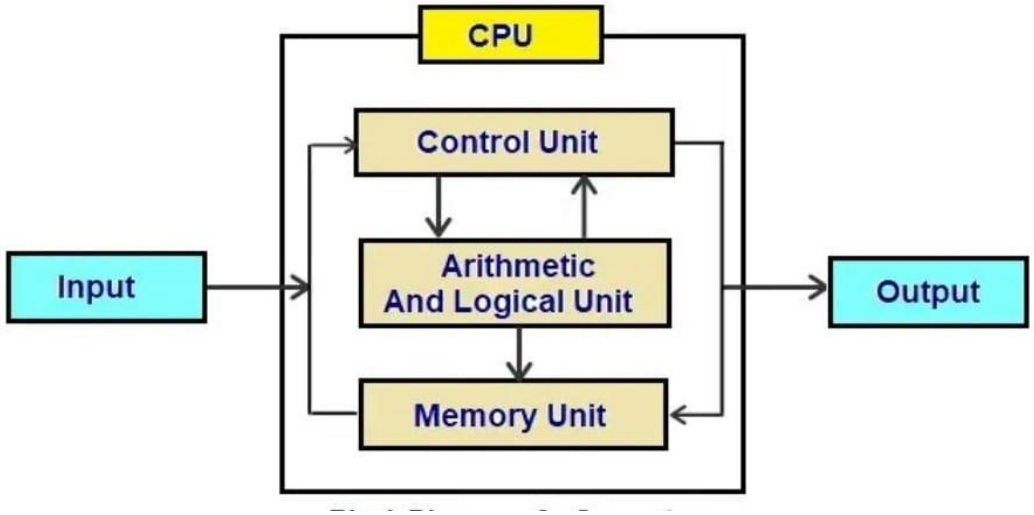

Figure-3.2 Block diagram of Embedded systems

Central Processing Unit:

The Central Processing Unit (processor, in short) can be any of the following: microcontroller, microprocessor or Digital Signal Processor (DSP). A micro-controller is a low-cost processor.

- **Memory:**

The memory is categorized as Random Access Memory (RAM) and Read Only Memory (ROM).

- **Input Devices**:

Unlike the desktops, the input devices to an embedded system have very limited capability. There will be no keyboard or a mouse, and hence interacting with the embedded system is no easy task.

- **Output Devices:**

The output devices of the embedded systems also have very limited capability. Some embedded systems will have a few Light Emitting Diodes (LEDs) to indicate the health status of the system modules, or for visual indication of alarms.

ADVANTAGES

- They are designed to do a specific task and have real time performance constraints which must be met.
- They allow the system hardware to be simplified so costs are reduced.
- They are usually in the form of small computerized parts in larger devices which serve a general purpose.

APPLICATIONS

- Consumer Appliances
- Office Automation
- Industrial Automation
- Medical Electronics
- Computer Networking
- Tele Communications
- Wireless Technologies

3.3 Components of Embedded Systems

3.3.1 MICRO CONTROLLER

The microcontroller is the brain of the embedded system. It is responsible for processing data and executing instructions. It typically includes a processor, memory, and input/output peripherals.

3.3.2 SENSORS AND ACTUATORS

Sensors are used to detect changes in the environment and convert them into electrical signals. Actuators are used to control physical processes based on the data received from the sensors. Examples of sensors include temperature sensors, light sensors, and motion sensors.

3.3.3 POWER SUPPLY

Embedded systems require a power supply to operate. This can be a battery or an external power source. The power supply must be able to provide the necessary voltage and current for the components.

3.4 COMMUNICATION INTERFACES

Embedded systems often require communication with other systems or devices. Communication interfaces allow the embedded system to send and receive data. Examples of communication interfaces include USB, Ethernet, and Bluetooth.

3.5 CHALLENGES IN EMEBEDDED SYSTEMS

Developing embedded systems presents a unique set of challenges that are not typically encountered in other software development projects. Some of the key challenges include

Limited Resources: Embedded systems are often designed to operate with limited resources, including memory, processing power, and energy. This requires developers to optimize their code to ensure that it can run efficiently on the target hardware.

Real-time Constraints: Many embedded systems are designed to perform critical functions in real-time, such as controlling machinery or monitoring vital signs.

3.6 HARDWARE CONSTRAINTS

3.6.1 Limited Memory

Embedded systems often have limited memory, which can make it challenging to store and process data efficiently.

3.6.2 Power Constraints

Embedded systems often have tight power constraints, which can limit the functionality of the system and make it challenging to optimize power usage.

4.PROJECT METHODOLOGY

4.PROJECT METHODOLOGY

4.1 BLOCK DIAGRAM OF SALINE MONITORING SYSTEM

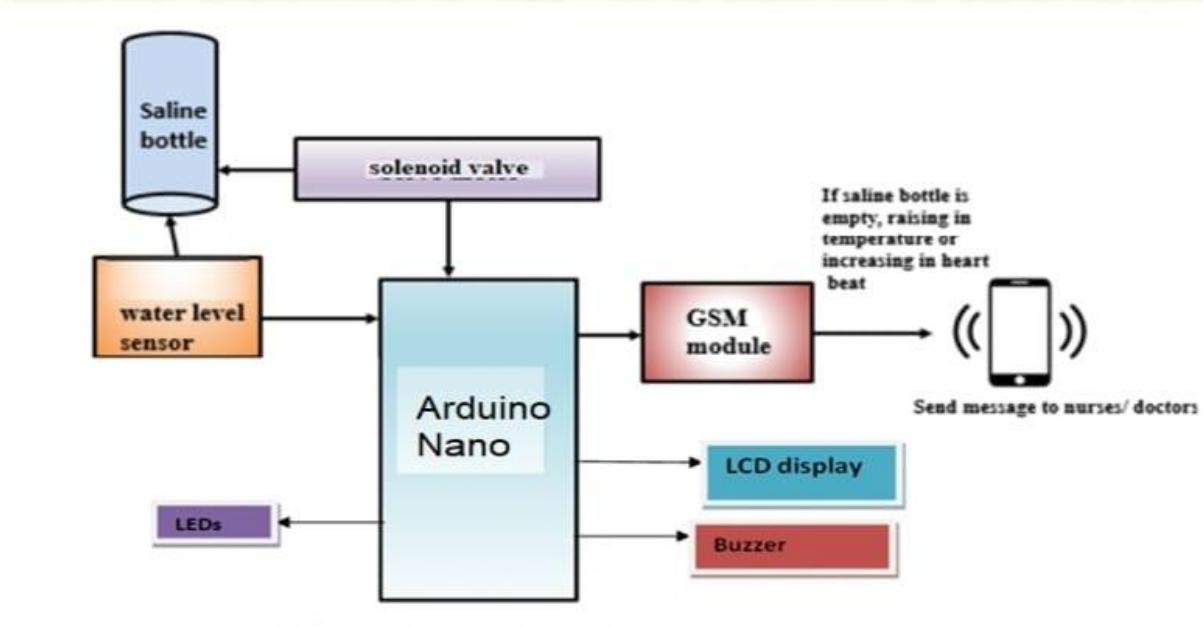

Figure 4.1 Block diagram of saline monitoring system

The block diagram shown in the figure 4.1 depicts the various methods and steps we include in the proposed method.

The architectural design for the GSM based Saline Monitoring System is shown in Figure The proposed GSM based saline monitoring system has four modules. the alert message sent to the nurses/ doctors when the patient is in emergency. That is, when the saline bottle gets empty.

The hardware components used in this project are Wireless water level sensor, Arduino nano, GSM module SIM800L and servo motor. The above level sensor is connected to the Arduino nano and when there is any discrepancy seen in patient's health, then the alert messages will be sent to the mobile devices through the GSM module. A Solenoid valve is connected to stop the flow of saline which prevents the blood may flow backward from the patient's body to the saline bottle or the air bubbles may enter into the blood stream from the saline bottle. Figure 1 shows the components connection.

Algorithm for prediction of saline fluid

1. Connect the sensor to Arduino nano
2. Initial saline_level=0
3. Place the sensor in saline bottle
4. If (saline_level == 0)
5. Print “The saline bottle is not empty”
6. Else if (saline_level ==1)
7. Send the alert message to nurse
8. Print “The saline bottle is about to empty”

4.2 Working Principle

The working principle of our automated saline level monitoring system revolves around the seamless integration of Arduino, GSM technology, and a precision level sensor. The Arduino, functioning as the central control unit, constantly receives real-time data from the precision level sensor embedded in the saline line. This sensor, designed for accuracy and reliability, provides continuous measurements of the saline levels.

The Arduino processes this data and, based on programmed thresholds, triggers the GSM module to send instant notifications to healthcare professionals in case of deviations. The precision and efficiency of this automated process eliminate the risks associated with manual monitoring, ensuring timely interventions and enhancing overall patient safety. The cost-effective nature of the system, driven by Arduino's accessibility, makes this innovative solution practical and adaptable for diverse healthcare settings, marking a significant advancement in infusion system management.

The system's working principle further emphasizes efficiency and real-time communication in saline level monitoring. The precision level sensor, sensitive to changes in saline levels, feeds continuous data to Arduino, which acts as the brain orchestrating the entire process. Arduino's programming logic interprets this data, enabling it to make informed decisions regarding the saline levels. When predefined thresholds are surpassed, Arduino activates the GSM module, initiating instant communication. This two-way interaction allows healthcare professionals to receive timely notifications about critical saline levels, empowering them to take swift and precise actions.

The cost-effective and user-friendly design ensures that this advanced monitoring system is not only reliable but also accessible for various healthcare environments, marking a significant stride towards enhanced patient care and efficient healthcare management.

4.3 Circuit Diagram of Saline Monitoring System

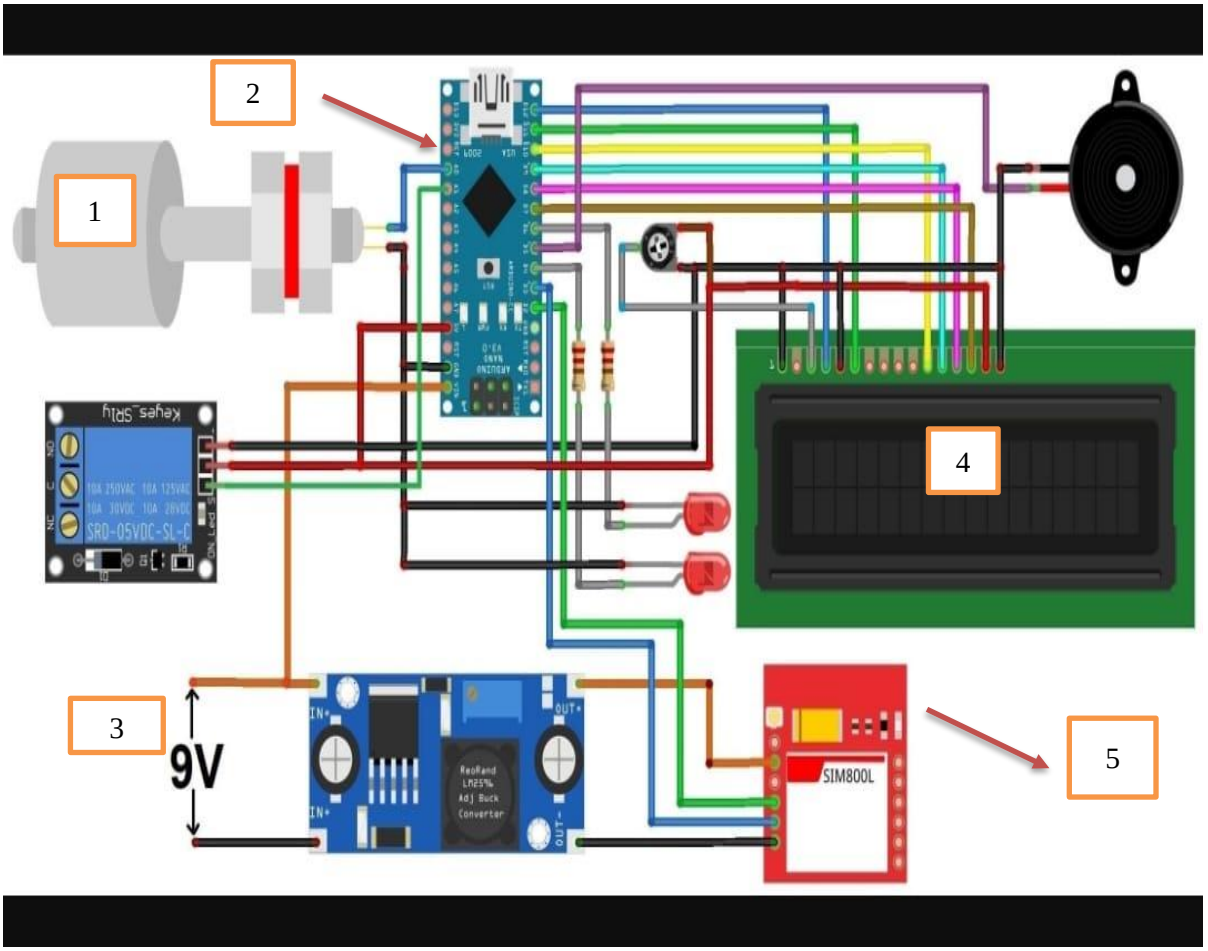

Figure 4.2 Circuit Diagram of Saline Monitoring System

1. Relay Module
2. Arduino Nano
3. Power Supply
4. LCD Display
5. GSM Module

In the circuit diagram for the automated saline level monitoring system, the key components include Arduino, a GSM module, and a precision level sensor. The precision level sensor is connected to one of Arduino's analog input pins, providing continuous analog data representing the saline levels. The Arduino's digital output pins are connected to a relay module, serving as the control interface for interrupting saline flow.

Arduino's programming logic interprets the analog data from the level sensor and sets predefined thresholds for saline levels. When these thresholds are exceeded, the Arduino triggers the relay to cut off the saline flow. Simultaneously, the Arduino activates the GSM module through its digital output pins, facilitating communication with healthcare professionals.

The GSM module, connected to Arduino, enables the system to send instant notifications via SMS to predefined contacts. This two-way communication allows healthcare professionals to receive timely alerts about critical saline levels and take necessary actions remotely. The cost-effective and accessible nature of Arduino makes the circuit design practical for diverse healthcare settings, ensuring a reliable and efficient automated saline level monitoring system.

5.HARDWARE COMPONENTS DESCRIPTION

5.HARDWARE COMPONENTS DESCRIPTION

5.1 ArduinoNano:

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. It is like the brain of a project.

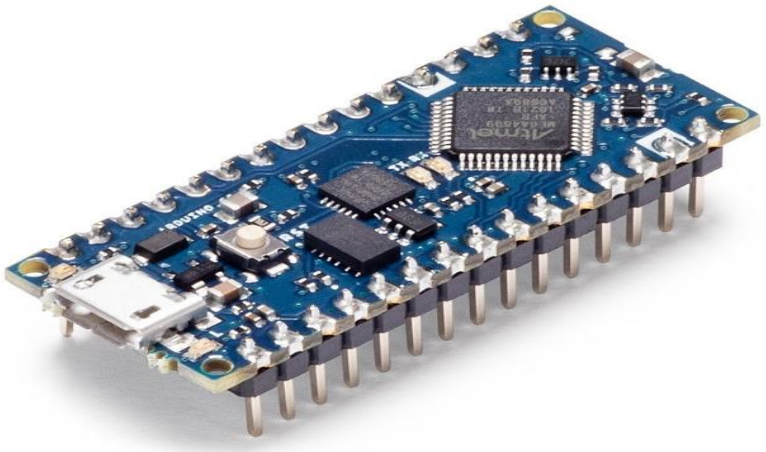

Figure 5.1.1 Arduino Nano Diagram

Pin Specifications:

Microcontroller	Atmel ATmega328
Operating Voltage (logic level)	5 V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 mA
Flash Memory	32 KB (of which 2KB used by bootloader

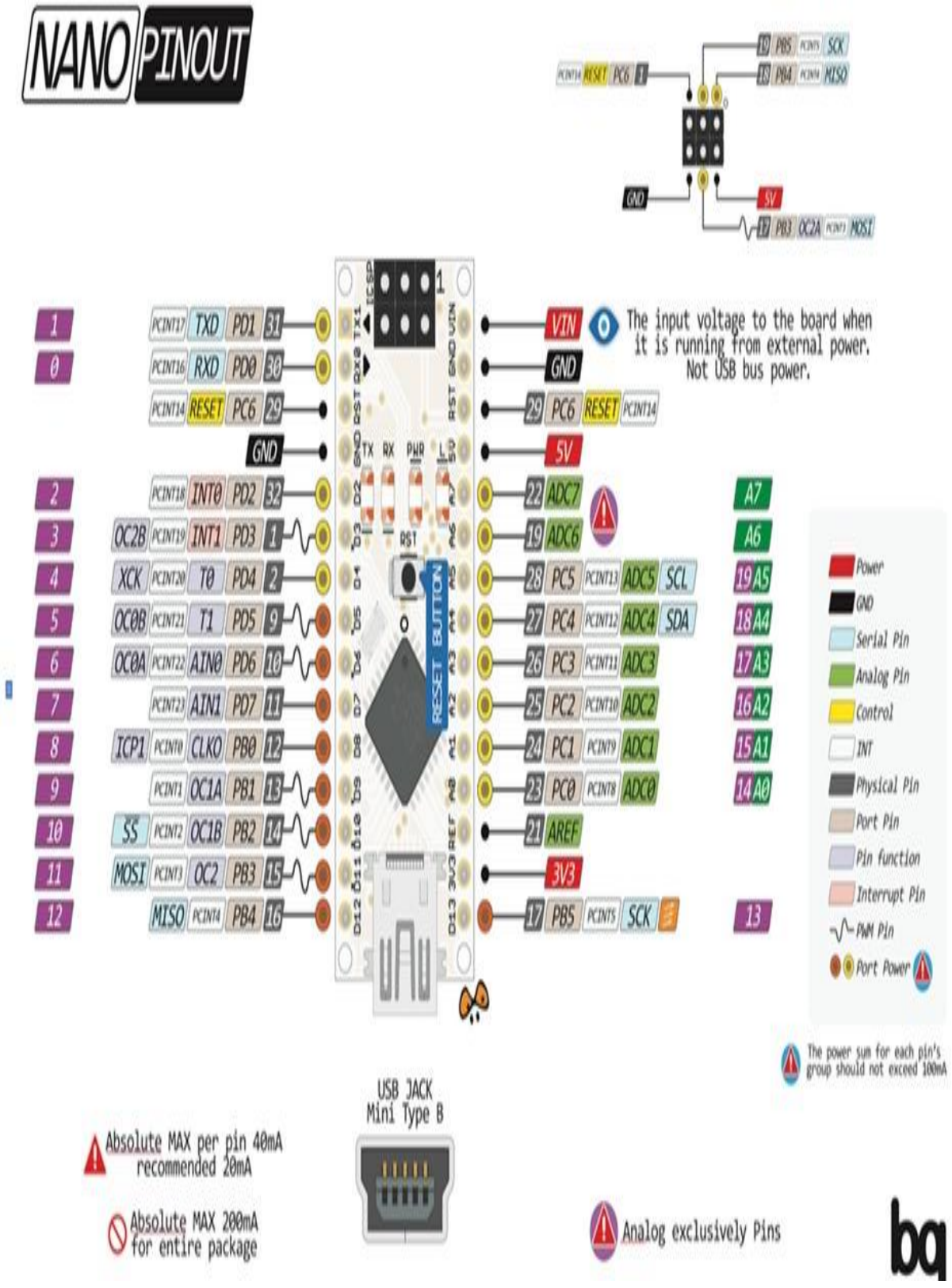

Figure 5.1.2 Arduino Nano Pin out

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.

5.2 LCD:

LCD is a dot matrix liquid display crystal that displays alphanumeric, Kana (Japanese) characters and symbols. All the functions required for dot matrix LCD drive are internally provided. Built-inoscillator circuit. Liquid Crystal Display (LCD) is a flat-panel technology used in screens and monitors, employing liquid crystals trapped between two polarized glass layers. Electric currents control the orientation of these crystals, manipulating light to produce images. Each pixelcomprises red, green, and blue subpixels, mixing to create a spectrum of colors.

Backlighting provides illumination, enabling visibility. LCDs offer thin profiles, energy efficiency, and sharp images. While prevalent in TVs, computers, and smartphones for their affordability and versatility, they face competition from newer display technologieslike OLED due to limitations in contrast, viewing angles, and black levels.

Figure 5.2 LCD DISPLAY

5.3 I2C Module LCD Serial Display Adapter:

I2C Module is a parallel to serial converter compatible with LCD2004 and LCD1602. By using this module, LCD can be interfaced with using only 2 wires. LCD displays take 8 pins so sometimes user can get out of resources, mostly using Arduino Uno and Nano, but this device helps to save the resources as it takes only 4 pins.

Features:

Compatible with 16×2 and 20×4 LCD display

Saves resources using only 4 pins

LCD can be interfaced using 2 wires

Easy to interface

Standard 5V supply voltage

Contras is adjustable

The backlight can be turned on and off using sorting jumper

Application

Address range: 0x20 to 0x27 (Selectable)

Default address range: 0x27

Operating voltage: 5V

Figure 5.3 I2C Module LCD Serial Display Adapter

5.4 Capacitor

A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store energy electrostatically in an electric field. Unlike a resistor, a capacitor does not dissipate energy. Instead, a capacitor stores energy in the form of an electrostatic field between its plates.

Capacitor, device for storing electrical energy, consisting of two conductors in close proximity and insulated from each other. A simple example of such a storage device is the parallel-plate capacitor. If positive charges with total charge +Q are deposited on one of the conductors and an equal amount of negative charge −Q is deposited on the second conductor, the capacitor is said to have a charge Q.

Figure 5.4 Capacitor

5.5 GSM Module SIM 800L:

Sim800L Module is low cost, low form factor GSM module based on SIM800L chipset. Sim800L module supports quad-band GSM and GPRS network.

This breakout board is perfect for application where size and cost is a constraint. Sim800l GSM module also supports quad band which means that it can work anywhere in the world. This low cost module is perfect for launching your next IoT project. Using this module you can almost make your own cellphone.

Using this module you can:-

Send Text Messages (SMS)

Make or receive Phone calls

Connect to Internet via GPRS

TCP/IP It can be a single image or a collection of images**.**

The main drawback of this module is works on 3.7 to 4.2 volts so you cannot power it directly through Arduino or Raspberry Pi. Moreover the sim800L GSM and GPRS module requires upto 2 ampere current so accordingly design your power supply. You can use a 3.7 volt battery to directly power the GSM module.

Figure 5.5 GSM Module 800L

5.6 Level sensor:

The Water Level Depth Detection Sensor for Arduino has Operating voltage DC3-5V and Operating current less than 20mA. The Sensor is the Analog type which produces analog output signals according to the water pressure with its Detection Area of 40x16mm.

- Operating voltage: DC3-5V
- Operating current: less than 20mA
- Sensor Type: Analog
- Detection Area: 40mmx16mm
- Operating temperature: 10℃-30℃
- Humidity: 10% -90% non-condensing

Figure 5.7 Level sensor

The Water Level Sensor is an easy-to-use and cost-effective with high level/drop recognition sensor by having a series of parallel wires exposed traces measure droplets/water volume in order to determine the water level.

Easy to complete water to analog signal conversion and output analog values can be directly read Arduino development board to achieve the level alarm effect.

5.7 BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

A buzzer, a simple yet effective device, emits a distinctive sound, often resembling a sharp, consistent buzz or beep. Employed in various settings, from electronic devices to game shows, its purpose spans alerting, signaling, or indicating events. Comprised of an electromechanical component, it converts electrical energy into audible vibrations through oscillating mechanisms. Activation occurs by completing an electrical circuit, causing the buzzer to resonate at a specific frequency, generating the characteristic noise. Its versatility renders it indispensable across applications, facilitating notifications, warnings, and alarms with its recognizable, attention-grabbing tone.

Figure 5.7 Buzzer

We are using a piezoelectric buzzer.The piezo buzzer produces sound based on reverse of the piezoelectric effect.The generation of pressure variation or strain by the application of electric potential across a piezoelectric material is the underlying principle.The buzzer produces a same noisy sound irrespective of the voltage variation applied to it

5.8 Relay Tripping:

Relay tripping is a pivotal control mechanism in various applications. It involves the use of an electromechanical switch to open or close circuits. Commonly used in automation, it esures timely response to changing conditions. Relays are crucial for safety, preventing damage or hazards in electrical systems. In the context of Arduino, relay tripping can be programmed based on sensor inputs. Arduino's digital outputs are utilized to control the state of the relay. This on/off switching capability is fundamental for managing connected devices.

Introducing an innovative solution for medical infusion systems, our automatic and low- cost saline level monitoring system leverages the power of Arduino, GSM technology, and a precision level sensor. This cutting-edge integration ensures a seamless and efficient monitoring process, crucial for patient safety and healthcare management

Relay tripping is employed in industrial automation for machinery control. It plays a role in home automation, enabling remote control of appliances. In medical devices, relay tripping can be utilized for patient safety measures. The speed and reliability of relay operation make it suitable for diverse scenarios.

It acts as a safeguard by interrupting power in case of abnormal conditions. Overcurrent protection is a common use, preventing damage to electrical components. In Arduino projects, relay modules are often used for simplicity and efficiency. Relay tripping is employed in HVAC systems for temperature regulation.

6.SOFTWARE TOOL

6.SOFTWARE TOOL

AURDINO-IDE

The Arduino Integrated Development Environment (IDE) serves as a pivotal software platform for programming and developing projects using Arduino microcontrollers. This user-friendly environment provides a streamlined interface, simplifying the process of writing, compiling, and uploading code to Arduino boards.

Features:

The IDE supports various programming languages, primarily based on Wiring, a simplified version of C and C++. Its simplicity makes it accessible to both beginners and seasoned developers. The IDE includes a text editor where users write their code, along with a message area that displays feedback during compilation and uploading.

Functionality:

Upon writing the code, users compile it using the IDE's compiler. The software translates the human-readable code into machine-readable instructions, checking for errors in the process. Once successfully compiled, the code is uploaded to the connected Arduino board, allowing it to execute the specified tasks.

Libraries and Examples:

Arduino IDE offers a range of libraries and examples that simplify programming tasks by providing pre-written code for specific functionalities like controlling motors, interfacing with sensors, or communicating with other devices. These resources save time and effort, enabling users to incorporate complex functionalities into their projects without starting from scratch.

Compatibility:

It supports various Arduino boards, ensuring compatibility with different hardware configurations. Additionally, it’s compatible with multiple operating systems like Windows, macOS, and Linux, broadening its accessibility.

Community and Support:

Arduino boasts a robust community where users share projects, insights, and troubleshooting tips. This collective knowledge serves as a valuable resource for beginners seeking guidance or seasoned developers exploring innovative applications.

Extensibility:

Advanced users can expand the capabilities of the IDE by integrating additional libraries, tools, or even modifying the IDE itself, owing to its open-source nature. This flexibility encourages experimentation and customization to suit specific project requirements.

In essence, the Arduino IDE acts as a foundational tool, enabling users to unleash the potential of Arduino boards by providing an intuitive and comprehensive environment for programming and development.

Testing:

With the knowledge of operation of the system was tested step by step to the transistor output and the load was connected across the collector terminal of the transistor.

ASSEMBLING

The whole system was packed in a plastic casing and provision was made for the IR to sense light from the outside.

Software installation:

A bootloader needs to be flashed using USB to Serial or ST-Link (SWD). See Flashing the bootloader.

Figure 6.1 Arduino Nano Software Tool

White Box Testing

White box testing is testing where we use the info available from the code of the component to generate tests**.**

This info is usually used to achieve coverage in one way or another – e.g.

- Code coverage
- Path coverage
- Decision coverage
- Debugging will always be white-box testing

Black Box Testing:

Black box testing is also called functional testing. The main ideas are simple:

Define initial component state, input and expected output for the test.

Set the component in the required state.

7.SIMULATION RESULTS

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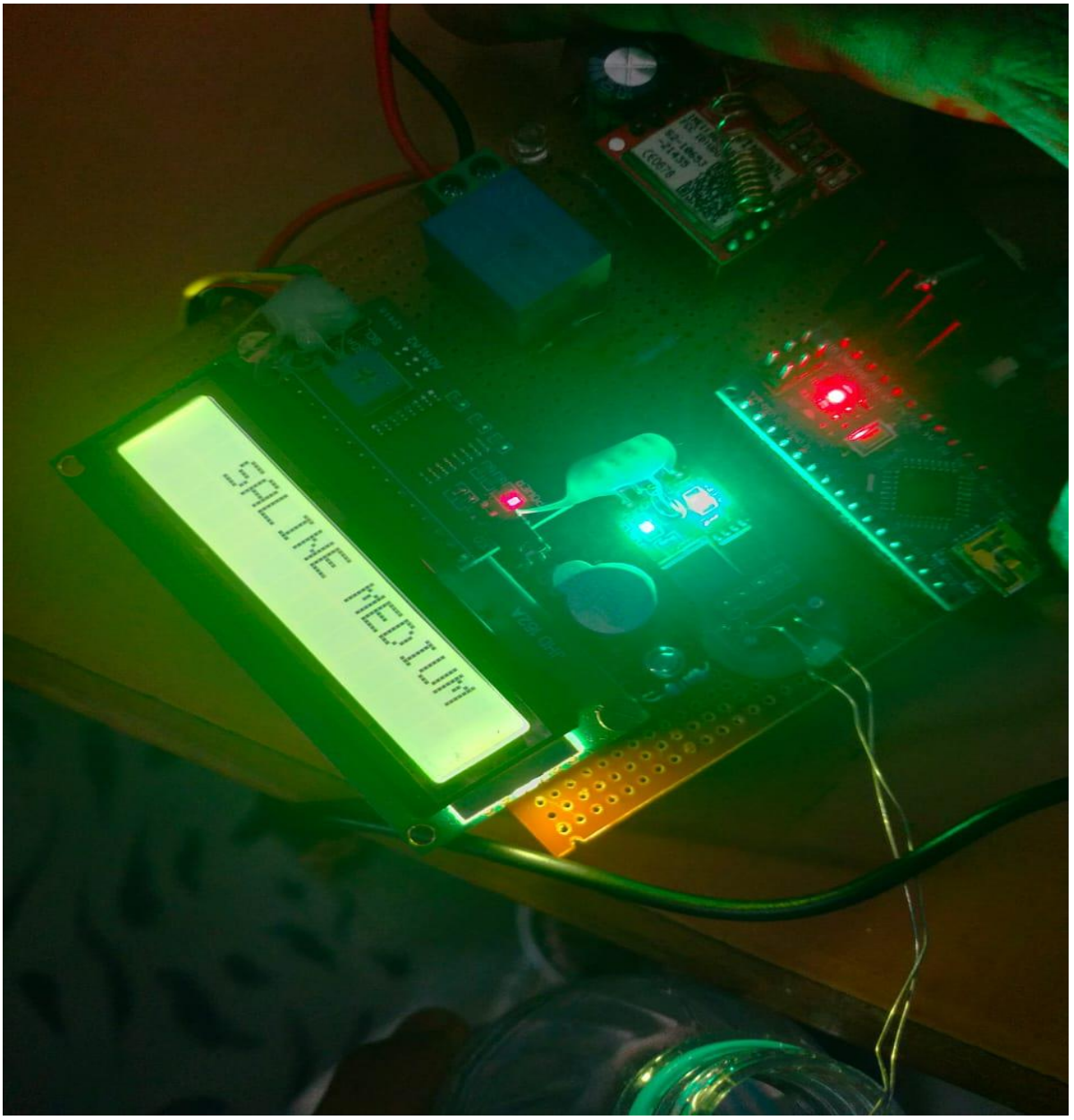

Figure 7.1 Saline Medium

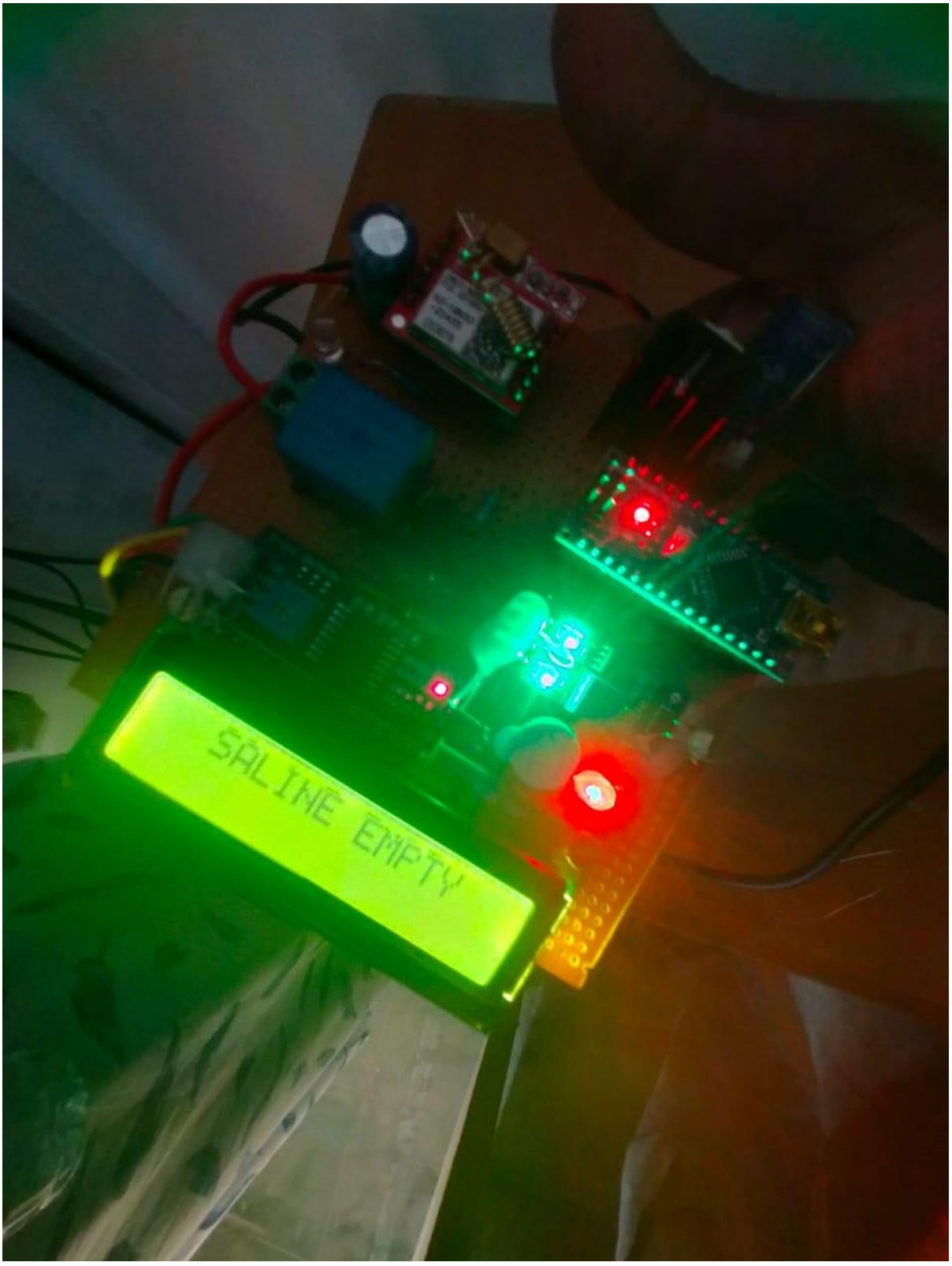

Figure 7.2 Saline Empty

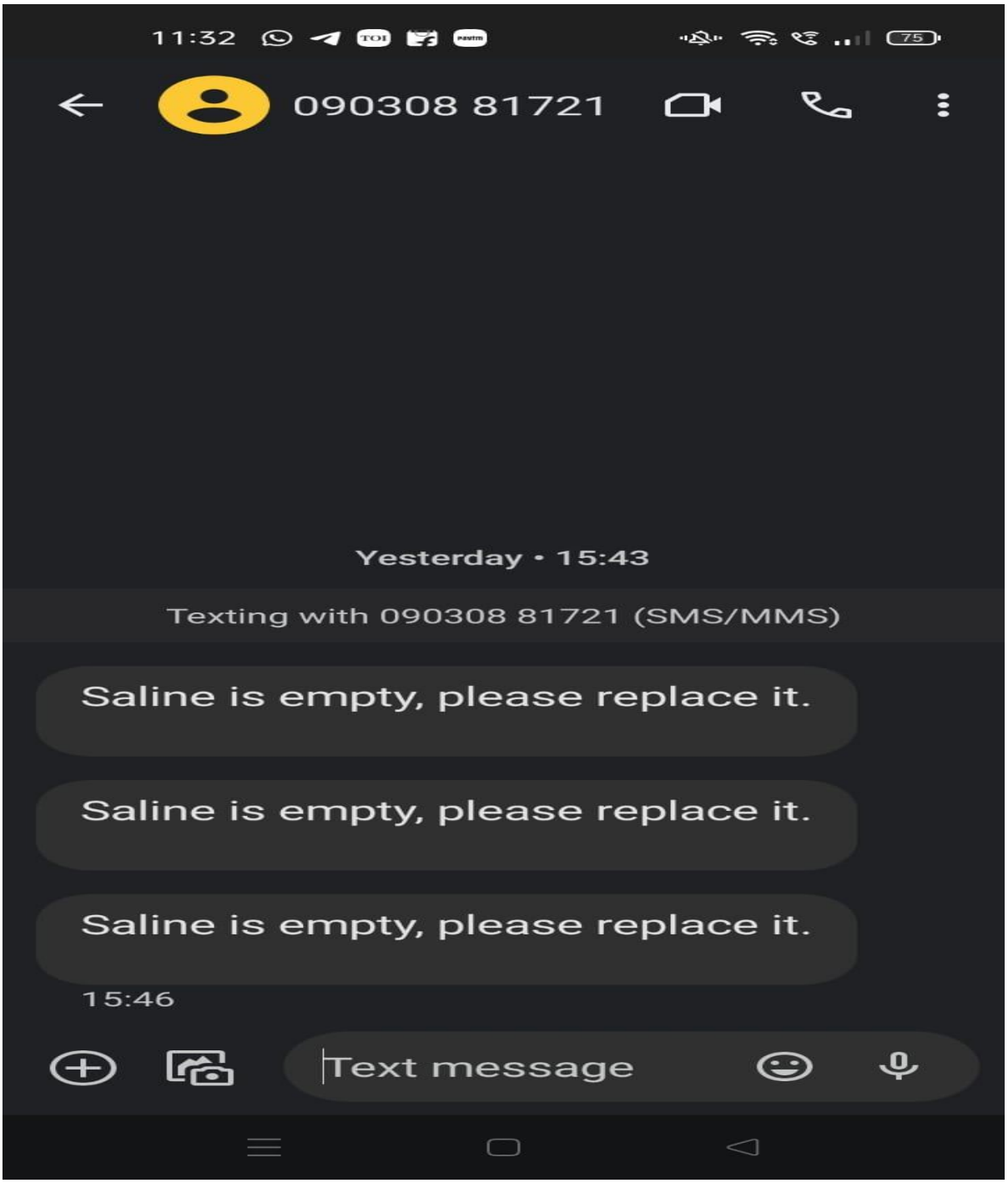

Figure 7.3 Alert Message

8.ADVANTAGES AND APPLICATIONS

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Advantages

Main advantage of system is that to monitor the saline level and notify the current level of the saline to the nurse. And when the saline gets finished system automatically stops the flow of saline with the help of solenoid valve.

- Every time it is not necessary to watch a patient who is injected Saline bottle.
- Continuous monitoring of bottle is not required.
- The system is simple to use.
- As our phone gets SMS Notification, the staff get alerted immediately.
- There is no chance of backflow.
- Man power can be reduced.
- User friendly.
- Free of noise.
- This system is reliable and cost effective.
- No safety requirements is been needed as our system is purely software oriented

Applications:

- By using this system the patient can be analysed by doctors in any part of the hospital.
- we have proposed can be integrated into a small compact unit as small as a cell phone.

9. CONCLUSION AND FUTURE SCOPE

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9.1 CONCLUSION:

This paper proposes the automated approach to monitoring the Saline Fluid in the bottle and furthermore to stop the flow of saline using solenoid valve. The proposed system is suitable for use in hospitals via a computer or smartphone, doctors or nurses can screen the Saline level can be accessed at any time and from any place. As the entire proposed frame-work is automated, it requires exceptionally less human intervention. It is particularly useful for the nurses especially at the hospitals where numerous patients are allotted to 2-3 nurses. Consequently, this system is user friendly and any native user with a little training can easily utilize this system. It can be reused for the next saline bottle. With GSM based saline level monitoring system, the manual effort on the part of the nurses is saved. As the entire proposed system is automated, it requires very less human intervention. It will be advantageous at night as there will be no such requirement for the nurses to visit patient's bed every time to check the level of saline in the bottle since an alert SMS will be sent to the nurses, doctors, caretakers when saline reaches the critical level. It will save the life of the patients. This will reduce the stress in continual monitoring by the doctor or nurse at an affordable cost.

9.2 FUTURE SCOPE:

Monitoring saline levels with Arduino and a GSM module sounds like a promising project.

It could find applications in aquaculture, agriculture, or even medical settings.

You could explore enhancing it with data analytics for predictive insights or integrating it into a larger IoT network for comprehensive monitoring.

The possibilities are wide open

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REFERENCES

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