# Project

ON

## “SALINE MONITORING SYSTEM”

IS SUBMITTED TO

SANT GADGE BABA AMRAVATI UNIVERSITY

IN THE PARTIAL FULFILLMENT OF THE DEGREE OF

**BACHELORS OF ENGINEERING**

**IN**

**COMPUTER SCIENCE AND ENGINEERING**

BY

**Mr. Soham R. Banarase**

GUIDED BY

**Prof. A.V.Sable**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**(ACCREDITED BY NBA)**

**SIPNA COLLEGE OF ENGINEERING AND TECHNOLOGY, AMRAVATI**

**(AN ISO 9001:2015 CERTIFIED INSTITUTE & NAAC ACCREDITED)**

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**

**2020-2021**

A

PROJECT REPORT

ON

# SALINE MONITORING SYSTEM

***Submitted by***

Mr. Soham R. Banarase

***In partial fulfillment of the requirement for the project the award of the Degree in***

COMPUTER SCIENCE & ENGINEERING

Under the Guidance of

**Prof. A.V.SABLE SIR**

Department of Computer Science & Engineering

Sipna College of Engineering & Technology, Amravati

**SIPNA COLLEGE OF ENGINEERING & TECHNOLOGY**

**AMRAVATI**

# Certificate

This is to certify that **The Team** has satisfactorily completed the project work towards the **Bachelor of Engineering** Degree of Sant Gadge Baba Amravati University, Amravati in **Computer Science & Engineering** discipline on the topic entitled **"SALINE MONITORING SYSTEM"** during the academic year 2020-2021 under my supervision and guidance.

Date: /06/2021

Prof. A. V. Sable
**Guide**

Dr. V. K. Shandilya
**Head of Department**

Dr.H.M.Kherde
**Principle**

## EXAMINAR'S CERTIFICATE

This is to certify that the project work of the DEGREE Course in Computer Science & Engineering, at

**SIPNA COLLEGE OF ENGINEERING & TECHNOLOGY**

Has been fully completed by

Mr. Soham R. Banarase

Under

SANT GADGE BABA AMRAVATI UNIVERCITY

For The Year 2020-2021

Were examined in the project entitled

# “SALINE MOINITORING SYSTEM”

Internal Examiner

Prof :……..

:……..

External Examiner

Prof

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

**SIPNA COLLEGE OF ENGINEERING &TECHNOLOGY**

**AMRAVATI**

# Acknowledgement

A moment of pause, to express a deep gratitude to several individuals, without whom this project could not have been completed.

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**Name of student(s)**
Mr. Soham R. Banarase

# Abstract

During recent years, due to the technological advancements many sophisticated techniques has been evolved for assuring fast recovery of the patients in hospitals. Need for good patient care in hospitals, assessment and management of fluid and electrolyte is the most fundamental thing required. All most in all hospital, an assist/nurse is responsible for monitoring the Glucose bottle level. But unfortunately most of the time, the observer may forget to change the saline bottle at correct time due to their busy schedule. To overcome this critical situation, a GSM based automatic alerting and indicating device is proposed where weight sensor is used as a level sensor. It is based on the principle that the IR sensor output voltage level changes when intravenous fluid level is below certain limit. A comparator is used to continuously compare the message output with predefined threshold. When the transceiver output is negative then the Arduino controller identifies the fluid level is too low and it alerts the observer through the mounted LCD display and mobile phone at the control room indicates the room number of the patient for quick recovery.

**Keywords**: Glucose bottle, load cell, weight sensor, Arduino Controller, GSM modem, LCD

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# INTRODUCTION

## 1.1 INTRODUCTION TO PROJECT

Saline solution is used in the hospital whenever some energy needs to be supplied to the patient in form of liquid. But there are some issues with this saline injection process. As there is more quantity to be injected it takes time to complete this process. In this injection process, continuous monitoring is required, where it is difficult in many hospitals. The monitoring staff may forget about the patient. This forgetting may result in serious danger to the patient. when the saline bottle is about to empty the blood from the body of the patient flows back into the bottle. This flowing back of blood causes serious damage to the patient. The patient might be in a situation of unable to check his own saline bottle level. 1.1 Site visited We have visited Seva Hospital, Yavatmal. They were having a serious problem regarding the continuous monitoring of the infusion bottle. They also have cases where backflow has happened. we have identified this problem as the major issue they were facing. We have interacted with the hospital Management team and with some of the Doctors and Nurses. After a healthy discussion with the hospital staff, we came to know what problems they are facing frequently. We found that there are some problems that are needed to be eliminated in order to provide proper patient care in hospitals as patient care is a crucial part of the hospital sector. So we concentrated more on the problems that affect patient care.

## 1.2 . PURPOSE OF THE PROJECT

This device provides an efficient method and a beneficial communication medium for health and saline monitoring. It monitors saline level and notifies doctors and nurses when saline level is critical or below some threshold hence the nurses can attend the patient when required. It also notifies the user when saline flow stops due to blockage in tube or any other reasons.

## 1.3. PROBLEM IN EXISTING SYSTEM

The alarm signal can disturb the patient. It requires the caretaker of the patient to request the hospital staff to replace the bottle. Absence of intimation may cause major issue for the patient.

## 1.4. SOLUTION OF THESE PROBLEMS

1. This system eliminates the constant manual monitoring of the level of liquid in a bottle. The first intimation is given when 50 ml of liquid is left so that the hospital staff gets enough time to reach the room and replace the bottle. The second intimation is sent in the form of a call alert to indicate the urgent need to replace the bottle.

# 2 . LITRATURE REVIEW

## 2.1. INTRODUCTION

Due to increase in the population, there is a need for improvement in health care. As the saline goes below the critical level, it is necessary to change the saline bottle. So new idea called IOT based Saline Level Monitoring System is emerged. The motivation of the project is, 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 notification will be sent to the nurses, doctors 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.

## 2.1 EXISTING SYSTEM

In current health care measures, nursing professionals are responsible for managing, monitoring and providing care to the patient receiving saline. The roller clamp is used to manually control the saline infusion rate in hospitals. If the roller clamp rotates one way, it compresses the intravenous tube harder, which makes the tube thinner and allows saline fluid to flow through a slower rate. If it is rolled in another direction, it loosens or releases saline tubing, which makes the tubing thinner and allows saline fluid to flow through a faster rate. In today's world, there is no monitoring system that reduces patient dependence on nurses, doctors, and also reduces the need for nurses to go to the patient's bed every time to check each patient's saline status.

Therefore, the development of an IoT-based saline level monitoring system is required.

## 2.2 Purposed System

This may initially be inferred as a casual phenomenon, but the consequences are often fatal. Shortly after the saline has finished, blood returns to the saline bottle due to the difference in blood pressure and the empty bottle. Thus, innovative health monitoring systems are being developed with less human intervention, which will be available at low cost in rural and urban areas. The proposed system aims to solve problems of the above mentioned problem effectively. With this, the nurse can monitor the amount of saline even in the control room. Automatic salt level monitoring consists of level sensors that are used to determine the status of the liquid in the bottle, either normal or alert. The detection of saline drop rate is quite reliable. The output obtained from the sensor is processed to verify that the saline bottle is empty.

# 3. SYSTEM ANALYSIS

## 3.1. Introduction

Embedded systems are electronic devices that incorporate microprocessors within their implementations. The main purposes of the microprocessors are to simplify the system design and provide flexibility. Having a microprocessor in the device means that removing the bugs, making modifications, or adding new features are only matters of rewriting the software that controls the device. Or in other words embedded computer systems are electronic systems that include a microcomputer to perform a specific dedicated application. The computer is hidden inside these products. Embedded systems are ubiquitous. Every week millions of tiny computer chips come pouring out of factories finding their way into our everyday products.

## 3.2 HARDWARE AND SOFTWARE SPECIFICATIONS

Hardware Requirements

- ARDUINO UNO R3
- GSM MODEM
- 16X2 LCD DISPLAY
- Hx711 loadcell

Software Requirements

- ARDUINO UNO R3
- EMBEDDED C language.

## 3.3 Study of the System

1. Load Cell

A load cell is a type of active transducer, which converts mechanical input into an electrical output, which needs to be weighed probably uses a load cell to do so. Load cells come in many different shapes and sizes to be added to various machinery and weighing equipment. Using load cell, we measure the weight of the glucose bottle. Its output will be analog. The maximum weight estimated in the load cell is 1kg. If the glucose bottle's weight is below 300ml or 0.3 kg, the buzzer alarm and the LED is triggered.

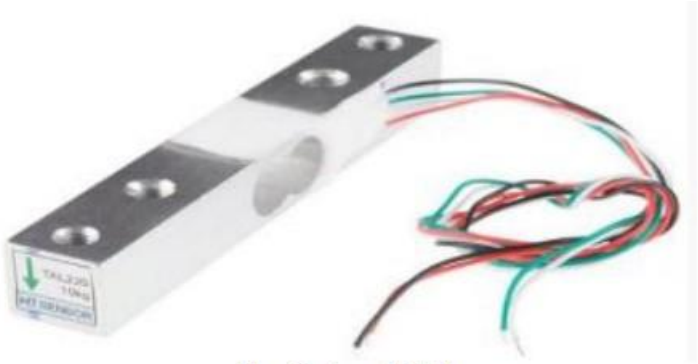


Fig. 2 Load Cell

2. Load Cell Sensor 24 Bit ADC-HX711

The HX711 load cell amplifier is used to get measurable data from a load cell. The HX711 is 24-bit analog-to-digital converter (ADC) designed for weight measurement and industrial applications to connect with a sensor. It is made for amplifying signals from cells and reporting them to another microcontroller. Here, the load cell's measurements which provide output in millivolts will be amplified and passed on to Arduino by hx711.

Fig. 3 Load Cell Sensor 24 Bit ADC-HX711

3. Arduino UNO

Arduino board can read inputs like lights using sensor, a finger in a button sensor, a Twitter message and turn it into an output - activating a motor, turning on an LED, publishing something online. Arduino act as Controller [1].


Fig. 4 Arduino UNO

4.GSM

The Global System for Mobile Communications is a standard developed by the European Telecommunications Standards Institute to describe the protocols for second-generation digital cellular networks used by mobile devices such as mobile phones and tablets.


## 3.4 NUMBER OF MODULES

The system after careful analysis has been identified to be presented with the following modules:

Software Module:

1.User Registration

2.Ward No

3.Bed no

Hardware Module:

1. Circuit with Arduino, Gsm module, LCD module and max242 for power

# 4. System Design

## 4.1. DATA FLOW DIAGRAM

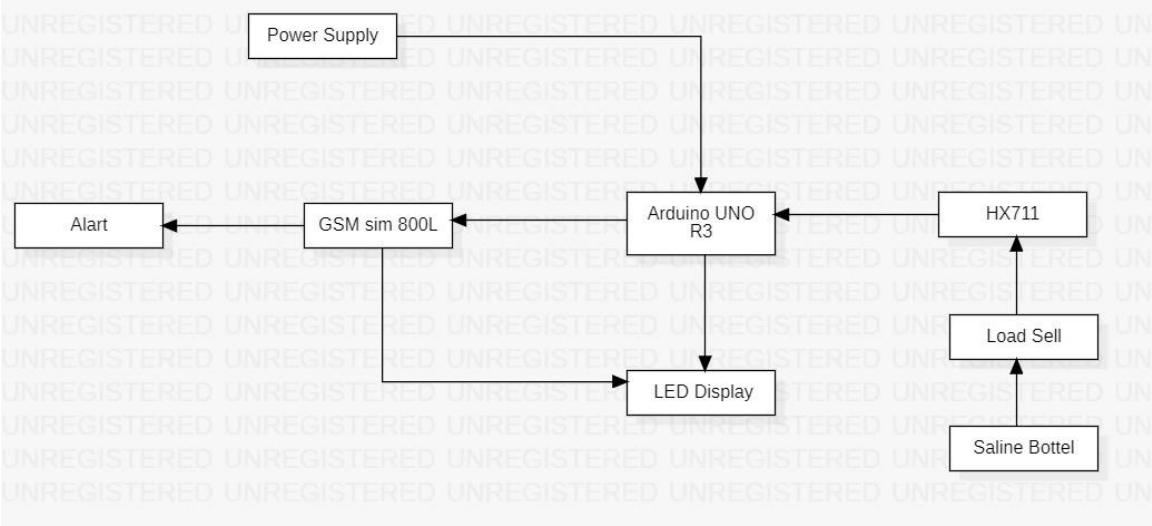
### 4.1.1 DATA FLOW

1. A Data Flow has only one direction of flow between symbols. It may flow in both directions between a process and a data store to show a read before an update. The latter is usually indicated however by two separate arrows since these happen at different type.
2. A join in DFD means that exactly the same data comes from any of two or more different processes data store or sink to a common location.
3. A data flow cannot go directly back to the same process it leads. There must be at least one other process that handles the data flow produce some other data flow returns the original data into the beginning process.
4. A Data flow to a data store means update (delete or change).
5. A data Flow from a data store means retrieve or use.

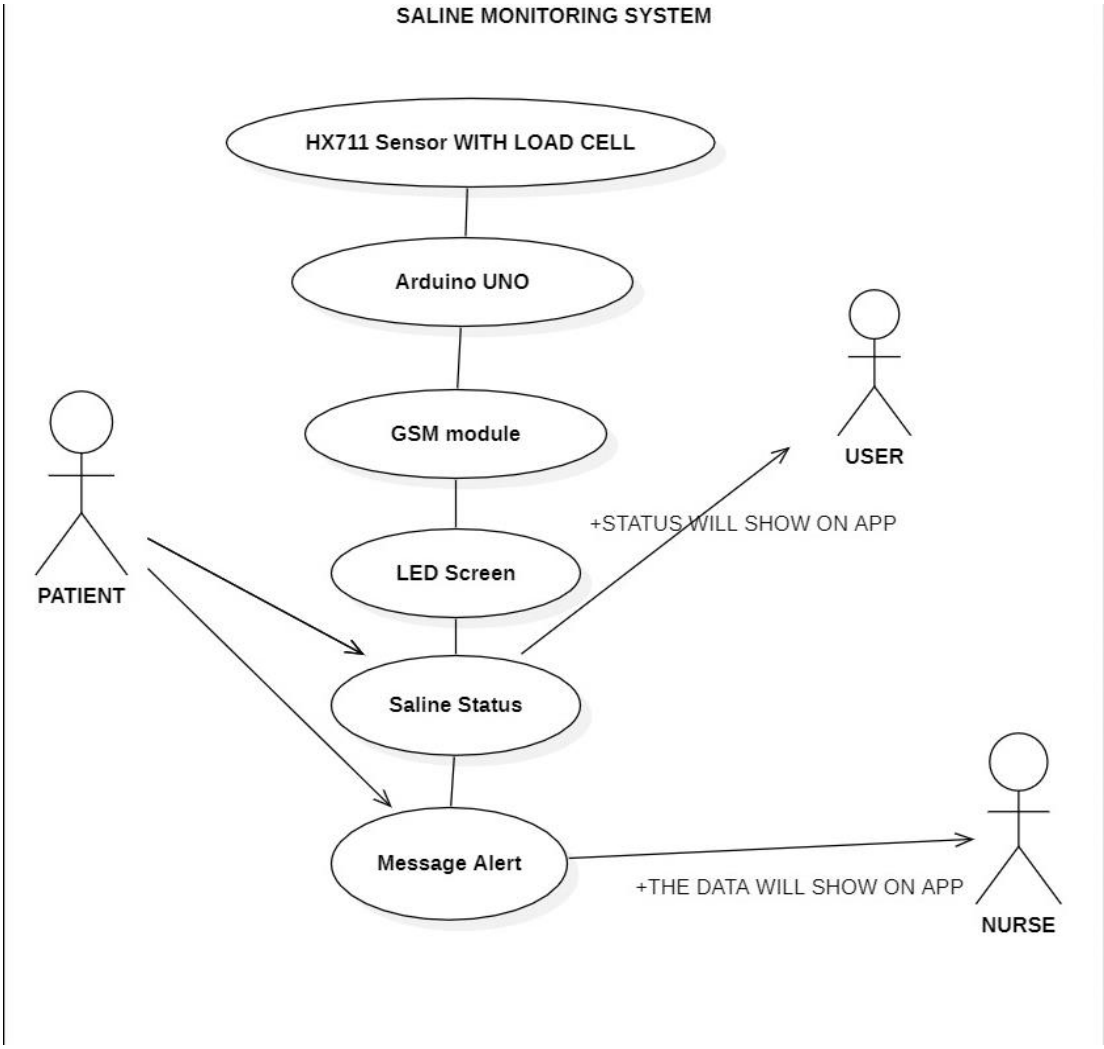
## 4.2. E – R DIAGRAMS

- The relation upon the system is structure through a conceptual ER-Diagram, which not only specifics the existential entities but also the standard relations through which the system exists and the cardinalities that are necessary for the system state to continue.
- The entity Relationship Diagram (ERD) depicts the relationship between the data objects. The ERD is the notation that is used to conduct the date modeling activity the attributes of each data object noted is the ERD can be described resign a data object descriptions.

- The set of primary components that are identified by the ERD are
    - Data object
    - Relationships
    - Attributes

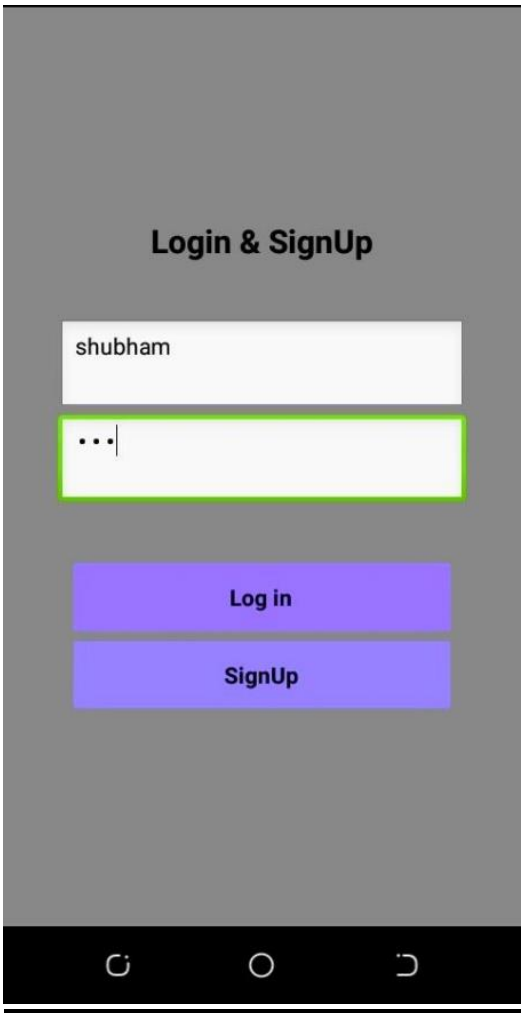


## 4.3. USE CASE DESIGN



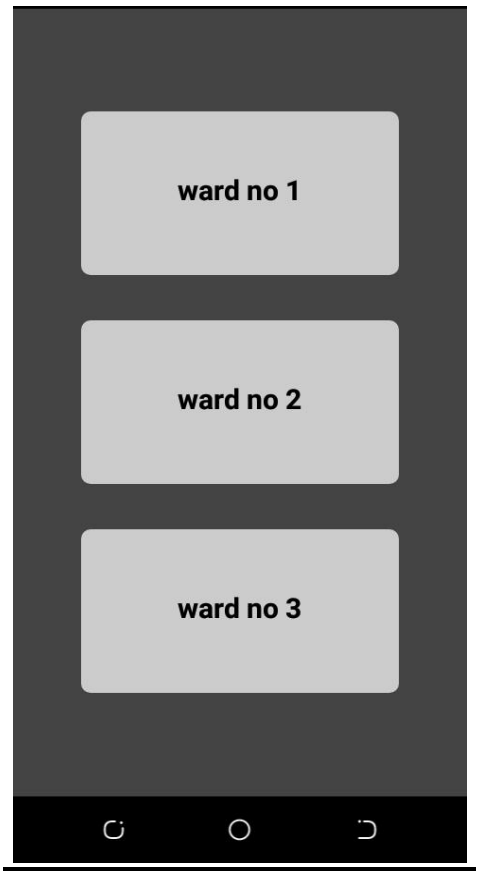
## 6.Screenshots

As shown below, after opening the application the user has to login or signup using his/her credentials.




**(1)**

Once logged in, icons representing ward numbers will be seen, each of them consisting of more icons showing beds in the respective ward.

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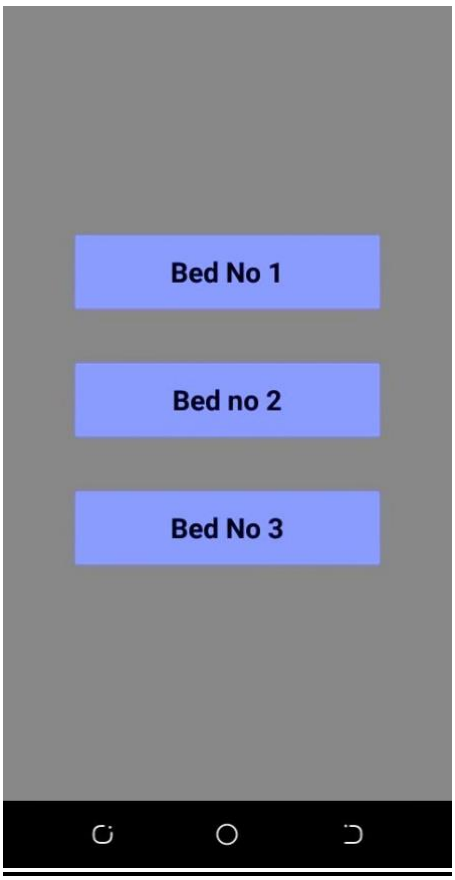
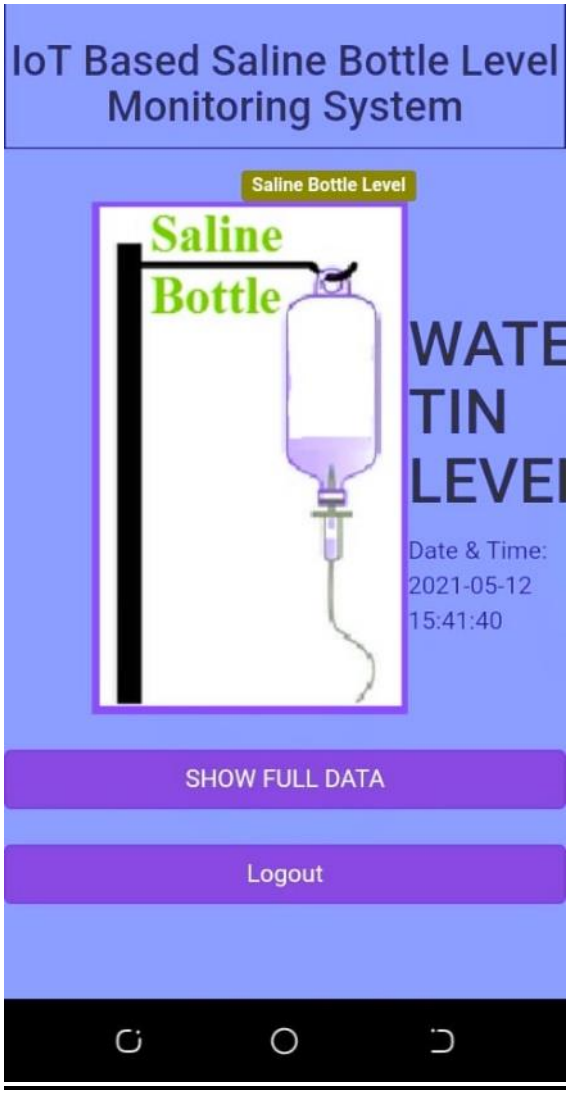



**(3)**

On clicking a particular bed number, the user will be able to see the state of the saline bottle assigned to that bed.




**(4)**

# 6. Testing

## 6.1. Introduction of system

Software testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding. In fact, testing is the one step in the software engineering process that could be viewed as destructive rather than constructive.

## 6.2. UNIT TESTING

Unit testing focuses verification effort on the smallest unit of software design, the module. The unit testing we have is white box oriented and some modules the steps are conducted in parallel.

### 6.2.1. WHITE BOX TESTING

This type of testing ensures that

- All independent paths have been exercised at least once
- All logical decisions have been exercised on their true and false sides
- All loops are executed at their boundaries and within their operational bounds
- All internal data structures have been exercised to assure their validity.

To follow the concept of white box testing we have tested each form .we have created independently to verify that Data flow is correct, All conditions are exercised to check their validity, All loops are executed on their boundaries.

### 6.2.2. CONDITIONAL TESTING

In this part of the testing each of the conditions were tested to both true and false aspects. And all the resulting paths were tested. So that each path that may be generate on particular condition is traced to uncover any possible errors.

### 6.2.3. DATA FLOW TESTING

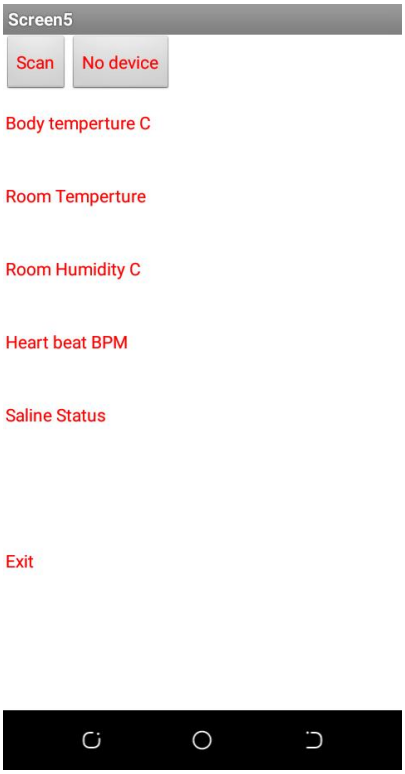
This type of testing selects the path of the program according to the location of definition and use of variables. This kind of testing was used only when some local variable were declared. The definition-use chain method was used in this type of testing. These were particularly useful in nested statements.

## 7. Future Scope

Apart from Saline level monitoring the application will include many other aspects like –

- Body temperature of the patient
- Room temperature
- Room humidity
- And also the heart rate of the patient

Moreover, worried relatives who are not able to see the patient in person will be able to keep track of the patient's health without stirring from home as this live data will also be shared on their respective phones.



## 8. Conclusion

With IoT 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. Itwill be advantageous at night as there will be no such requirement for the nurses to visit patient's bedevery time to check the level of saline in the bottle since an alert notification 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. This automatic saline level monitoring system provides more flexibility to doctors, thereby the patients caring is enhanced. Hence it saves lots of time for doctor or nurse who is on duty. It also proposes the system which can automatically monitor the saline flow by using micro controller. The system is reliable, cost effective and convenient for nurses. It can be reused for the next saline bottle. The system helps nurses to monitor the saline flow from a distance. It is mainly advantageous at night timing as there is no need for nurses to go to patient's bed to check the level of saline in the bottle.

## 9. References

[1]. Goepel, Ernst. "The ink drop sensor-a means of making ink-jet printers more reliable." CompEuro'89.,'VLSI and Computer Peripherals. VLSI and Microelectronic Applications in Intelligent Peripherals and their Interconnection Networks', Proceedings..IEEE, 1989.

[2]. Ishijima M [1993]. “Monitoring of Electro cardiograms in Bed without Utilizing Body Surface Electrodes”, IEEE Transactions on Biomedical Engineering.

[3]. Nash, J. H., G. G. Leiter, and F. Grimm. "Sampling Device for Liquid Droplets." Review of Scientific Instruments 38.1 (2004).

[4]. Peter Leijdekkers and Valerie Gay [2008]. “A self-test to detect a heart attack using a mobile phone and wearable sensors”, Proceedings of the 21st IEEE International Symposium on Computer-Based Medical Systems.

[5]. Zeng, H., and Y. Zhao. "Design and implementation of liquid droplet based motion sensing." Solid-State Sensors, Actuators and Microsystems Conference, 2009.TRANSDUCERS 2009.International.IEEE, 2009.

[6]. C.C. Gavimath, KrishnamurtyBhat, C. L. Chayalakshmi, R. S. Hooli, B. E. Ravishankera (2012) Design and Development Of Versatile Saline Flow rate Measurement System and GSM based remote monitoring device International Journal of Pharmaceutical Applications ISSN 0976-2639.Vol 3, http://www.bipublication.com

[7]. Thongpance, Nuntachai, YuttanaPititeeraphab, and MatidaOphasphanichayakul. "The design and construction of infusion pump calibrator." Biomedical Engineering International Conference (BMEiCON), 2012.IEEE, 2012.