

**IV MONITORING ALERT SYSTEM WITH MODERN
DEHYDRATION DETECTION AND AUTO FEEDBACK
RECOMMENDATION SYSTEM FOR PREGNANT WOMEN**

Submitted in partial fulfillment of the requirement for Bachelor of Technology in
B. Tech Biomedical Engineering

By

N. STEFFY REENA (39240038)

A. ANCY HANNAH CHARLET (39240007)



**DEPARTMENT OF BIOMEDICAL ENGINEERING
SCHOOL OF BIO AND CHEMICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **A. ANCY HANNAH CHARLET (39240007)**, and **N. STEFFY REENA (39240038)**, who carried out the project entitled **"IV MONITORING ALERT SYSTEM WITH MODERN DEHYDRATION DETECTION AND AUTOFEEDBACK RECOMMENDATION SYSTEM FOR PREGNANT WOMEN"** under my supervision from **October 2022** to **April 2023**.

Internal Guide

Dr. S. KRISHNAKUMAR, MSc., PhD

HEAD OF THE DEPARTMENT
DEPARTMENT OF BIOMEDICAL ENGINEERING
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Head of the department

Dr. T. SUDHAKAR, MSc., PhD

Chennai - 600 710

Submitted for Viva-voce Examination held on 18/04/2023

Internal examiner

External examiner

DECLARATION

We A. ANCY HANNAH CHARLET (39240007), and N. STEFFY REENA (39240038). Here bydeclare that the Project Report entitled "IV MONITORING ALERT SYSTEM WITH MODERN DEHYDRATION DETECTION AND AUTOFEEDBACK RECOMMENDATION SYSTEM FOR PREGNANT WOMEN" done by us under the guidance of Dr. S. KRISHNAKUMAR MSc.,PhD at Sathyabama institute of science and technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Technology degree in Biomedical Engineering.

DATE: 18/04/2023

PLACE: CHENNAI

A. Ancy Hannah Charlet

1. A. Ancy Hannah Charlet

N. Steffy Reena

2. N. Steffy Reena

SIGNATURE OF THE CANDIDATE

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ABSTRACT

Today Technology has grown to that level where rapid support could be provided to patient's health and provide them with early recovery. In hospitals, almost all patients, mainly ICU Patients, have to regulate the volume of fluids which is done using drip. These Drips needs regular monitoring or changing to maintain a constant flow of Fluids in our system we will be using load cell to measure the weight, though this system looks less complex, overcrowded medical facilities and lesser medical team support can put patients at risk which may affect the health of patient severely .Manual observing of drips level sometimes get missed or they are not able to monitor intensely because of hectic work schedule and overcrowded patients by using our system the risk of manual observation comes down and IoT based autonomous monitoring is done effectively. Since we are using an IoT Cloud Platform to store the data, health parameters of the patient are vital for us the know their rate of recovery which helps to solve the existing challenges which is in the current usage along with this we also integrate solution for dehydration for Pregnant women and women's working in field. Dehydration is more normal during pregnancy than at different occasions. Although most cases of dehydration in pregnancy are mild, severe dehydration can be dangerous for both the mother and the baby. The baby puts a lot of demands on the body, therefore pregnant women need to eat a lot of extra nutrients and drink a lot of water. Morning sickness, like conditions that induce excessive vomiting, can contribute to dehydration. When dehydration becomes severe, thirst feelings may disappear. Dizziness and disorientation, a beating heart, and changes in the baby's rhythmic movement are all signs of more significant dehydration during pregnancy. A serious shortage of hydration can result in poor amniotic fluid production and organ malfunction, which can lead to the infant's growth being stunted. We created a Modern Dehydration Detecting and Auto Feedback Recommendation System for Pregnant Women to address this dehydration problem in pregnant women and we have also in addition integrated fall detection sensor to analyse fall and send Emergency Notification for Immediate Rescue.

KEYWORDS- Drips, Load cell, IoT Cloud Platform, Dehydration, Autofeedback recommendation, Fall detection.

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LIST OF ABBREVIATIONS

ABBREVIATION	FULL FORM
AC	Alternating current
ADC	Analog to digital conversation
AM	Ante meridiem
DC	Direct current
DMP	Digital Motion Processor
EMI	Electromagnetic interference
GND	Ground
GSM	Global system mobile communication
GSR	Galvanic skin response
ICSP	In-circuit serial programming
IDE	Integrated development environment
IOT	Internet of things
IR	Infrared
IV	Intravenous therapy
LCD	Liquid crystal display
PCB	Printed circuit board
PDIP	Plastic dual- inline package
PM	Post meridiem
PWM	Pulse width modulation
RF	Radiofrequency
RST	Reset
RTC	Real-Time Clock
SIM	Subscriber identity module
SNR	Signal-to-noise ratio
SPO ₂	Saturation of peripheral oxygen
TCXO	Temperature compensated crystal oscillator
UART	Universal asynchronous receiver transmitter
VSB	Vestigial sideband modulation
Wi-Fi	Wireless fidelity

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CHAPTER – 1

INTRODUCTION

Controlling the amount of fluid you receive intravenously, or through your bloodstream, is known as intravenous fluid regulation. A bag attached to an intravenous line is used to administer the liquids. This is a little tube that is put into a vein and is frequently referred to as an IV (Kamran Manzoor,2012). During intravenous therapy, there are two ways to control the flow and volume of fluids administered: manually or using an electric pump. For both procedures, the nurse must frequently check the IV to make sure whether the patient is receiving the right amount of fluid (Anand et. al.,2018). In manual observation, one can manually control the rate at which fluid drips from a bag into an IV. To either slow down or speed up the rate of flow, the nurse adjusts the pressure that a clamp applies to an intravenous tube. To ensure the rate of flow is appropriate, they can count the number of droplets per minute and make any necessary adjustments. An electric pump can also be used to control the IV's flow rate. The nurse sets up the pump to inject the appropriate volume of fluid into the IV at the appropriate rate (Mohammed Arfan et. al.,2020).

A load cell is used to measure the weight of the IV bag. An electrical signal that can be measured and standardized is produced when a force, such as tension, compression, pressure, or torque, is converted into a load cell (Ajibola et. al.,2018). A force transducer, that is. The electrical signal varies in response to the force acting on the load cell. Pneumatic, hydraulic, and strain gauge load cells are the most used varieties. A load cell will be attached to the saline stand model, and the bottle would be hung based on the variation of the weight. Along with that vital parameters like pulse detection and SPO2 detection of the subject are monitored and the data are stored in the IoT Cloud platform.

IoT cloud platforms combine the functionality of IoT devices and cloud computing, which is provided as a seamless service. Additionally, they go under other names as Cloud Service IoT Platform. With billions of devices currently online, there is an increasing opportunity to use various apps to effectively process the huge data that these devices collect (Ramisha rani et. al.,2017).

The loss of water and salts necessary for healthy body function is dehydration. Pregnancy issues include neural tube abnormalities, low amniotic fluid, insufficient production of breast milk, and even early childbirth can all result from dehydration during pregnancy. The signs of mild to moderate dehydration are sticky, dry mouth, headache, constipation, and decreased dizziness. To measure the degree of dehydration in a person's body, dehydration monitoring systems come in a variety of products kinds, such as mobile devices or wearable hydration monitoring devices. Dehydration monitoring systems are increasingly in demand due to their wide range of uses in the diagnosis of diseases, the detection of drug addiction, and the enhancement of athletic performance (Hayley Miller,2015). The market for dehydration monitoring systems is expected to grow as a result of these devices, which are primarily integrated with standalone sensor systems that assess dehydration (Kripa et. al.,2021).

To address the issue of pregnant women's dehydration, an automated feedback recommendation system has been developed. A fall detection sensor is used to analyze falls and transmit emergency notifications for immediate rescue.

1.1 EXISTING METHOD

1.1.1 IV MONITORING USING IR SENSOR

The current health care system relies on manual carers, whose strenuous tasks in the modern world constitute social problems and time-consuming jobs. We are putting forth a system where a hospital-specific remote drip infusion monitoring and control system has been created. The system includes a control system, a number of infusion monitoring devices, and a central monitor. The infusion monitoring device uses an IR sensor to detect or sense the drip infusion rate (drops per minute), remaining time, an empty infusion solution bag at a specific critical set level, and to display the remaining infusion capacity on a central monitor. This information is wirelessly transmitted to the crucial or central monitor located in the nurse's control room, and nurses can also access the central monitor from there (Muskah Jindal et. al., 2021)

1.1.2 IV MONITORING USING ULTRASONIC SENSOR

Ultrasonic sensor is used to detect the level of fluid and a light sensor to detect the level of fluid and light sensor to detect any bubble formation in the IV infusion bag. A control mechanism can alert the nurses or doctors if the fluid levels in the IV infusion bag drops down a certain level to prevent air embolism and avoid reverse flow of blood (Sangeetha et. al., 2021) as shown in Fig 1.1.



Fig 1.1 IV monitoring using ultrasonic sensor

1.1.3 EXISTING PRODUCTS

Few drip rate monitoring devices already exist like Drip Assist, Drip-Alert, Auto Clamp, etc. which are accurate and stable fluid infusion devices. These devices monitor the drip rate and alarms to indicate if there is any deviation from the pre-set value of the drip-rate. A few of the existing devices are mentioned in detail below.



Fig 1.2 Drip Assist Infusion Rate Monitor

Drip Assist Infusion Rate Monitor (Fig 1.2) device is known to deliver precise and fast IV infusion. It can manage and monitor IV drip without pump, easily and can use gravity infusion. There is no need for the following parameters like maintenance, calibration, or asset tracking. It is a small device and has appreciable versatility and portability. The drip count is accurate and reliable for any fluid or medication.



Fig 1.3 Auto clamp

In Auto Clamp as shown in Fig 1.2, the medication is administered to patient with precision and safety. The rate of flow of the fluid is detected when the drops pass through the infrared sensing device. At the lower compartment of the drip chamber, a controller enables to set the desired infusion value to adjust the flow rate. No other tubes are used other than the tubing set for Auto Clamp® to get precise readings.



Fig 1.4 Drip alert device

Drip-Alert device as shown in Fig 1.4 is a simple device which alerts by audio and visual alarm if there is any variation in the drip rate or instability or if it deviates from the required drip rate set initially.

The conclusion can be drawn that out of all the existing products that existing approaches are limited to measuring of drip rate.

Advantages of drip rate monitoring devices (Satwik Tanwar et. al.,2020)

1. Operation is simple
2. Care and time of nurse is minimized
3. Easy to use
4. Audible and visual alarm function
5. Accurate and stable fluid infusion

Disadvantages of drip rate monitoring devices:

1. High maintenance
2. Specific to a single drip set
3. Bulky
4. Not cost-effective
5. It only monitors the drip rate

1.2 PROPOSED METHOD

Esp32 and Atmega168 (Nano Microcontrollers), which are the two Microcontrollers that will serve as the project's brains in the proposed system, will be connected to all of the experiment's inputs and outputs to measure the weight load cell, which is how Hx711 is used.

Additionally, we are monitoring the subject's vital signs to keep track of their health and storing the data to the cloud platform. A GSR Sensor is used to detect sweat conductance (Manimegala, et. al.,2021), and GSM is also integrated. A load cell will be connected to the saline stand model, and the bottle will be hung based on the variation of the weight. The MPU6050 Sensor is utilised for the Auto-Feedback Recommendation System as well as for Emergency Alerts in order to identify subject weariness and potential falls (Suliman Mohamed fati et. al.,2018). It will be very helpful to them in understanding their healing process and based on which the medical specialists can advise them on their course of therapy.

An example of a transducer is a load cell, which transforms mechanical force into a quantifiable electrical output. A load cell is likely used to measure the weight of anything that needs to be measured.

Also, we incorporate a dehydration remedy for working ladies who are pregnant and women in the field, as our bodies lose more water and fluids than we take in, we become dehydrated. Pregnancy makes dehydration more common than at other times. Although most cases of pregnancy-related dehydration are moderate, severe occurrences can be harmful to both the mother and the fetus (Kory Taylor et. al.,2022). Pregnant women need to eat a lot more food and drink a lot more water since the baby puts a lot of demands on the body. Dehydration can be a result of morning sickness and other disorders that cause excessive vomiting. Severe dehydration may cause thirst sensations to vanish.

A pounding heart, alterations in the baby's rhythmic movement, dizziness, and disorientation are all symptoms of more severe dehydration during pregnancy. An infant's growth may be stunted as a result of insufficient amniotic fluid production, organ malfunction, and severe dehydration (Tharun et. al., 2022) To address the issue of dehydration in pregnant women, we developed a Modern Dehydration Detection and Auto Feedback Recommendation System for Pregnant Women. In addition, we added a fall detection sensor.

1.2.1 ADVANTAGES OF THE PROPOSED METHOD

1. Automatic IV Bag Monitoring and Alert.
2. Data Logging as well as IOT Online Transmission.
3. Easy to operate.
4. Makes it easier for a single individual to manage multiple patients.
5. Low power consumption.
6. Automatic Data logging.
7. Accurate and stable fluid infusion.

CHAPTER – 2

LITERATURE SURVEY

Mohammed Arfan and Lavanya (2020) Intravenous (IV) Drip rate controlling and monitoring for risk-free IV delivery. In this paper they discussed the advantages and risks of IV drip set, the importance IV drip rate, existing infusion pumps and their drawbacks, attempts made to overcome the drawbacks of infusion pumps and finally the need for next generation IV drip set which can not only monitor but also control the drip set.

Ramisha Rani et. al., (2017) Smart drip infusion monitoring system for alert through nRF24L01. This project work involves trickle implantation observing framework for use in hospitals. The framework comprises of a drip infusion, sugar level observing gadgets and a monitoring screen. The mixture observing gadget utilizing a pressure sensor (MPX10GP) technology module can identify the trickle implantation rate and a vacant imbue ment arrangement sack, and after that, this information is sent to the monitoring screen put at the medical caretaker's station by means of the radio frequency (nrf24L01). The monitoring screen gets the information from trickle implantation observing gadgets and after that shows graphically them. When pressure sensor value reaches the threshold value, control valve will close which stops immediately flow of fluid without any airflow in patient's vein. In this manner, the created framework can screen seriously the dribble implantation circumstance of the few patients at the medical caretakers' station.

Satwik Tanwar, et. al., (2021) IoT Based Drip Infusion Monitoring System, This study proposes an IoT-based monitoring and control platform for IV infusion setup. The suggested work decreases the amount of time and effort required to monitor the infusion setup and allows for wireless monitoring. It helps in ensuring there is zero margin of error as improper administration of drip can lead to many problems. It also improves clinical efficiency, safety and patient experience in hospitals and makes home care possible for many patients. The use of an ultrasonic sensor simplifies and expedites system implementation because it eliminates the need to calibrate the system for different fluids. LDR is used to detect bubble formation of the fluid

which eliminates the risk of arterial air embolism which can cause heart attacks, stroke or respiratory failure. This system may be quickly installed on the stand where the drip bottle is hung, making replacing the bottle simple without having to bother about all the gear.

Kripa et. al., (2021) Modern Dehydration Detecting and Alerting System for Pregnant Women. Created a Modern Dehydration Detecting and Alerting System for Pregnant Women to address this dehydration problem in pregnant women. Utilised an Arduino UNO, a power supply, a sweat sensor, an LCD display, and embedded C software in this system. Utilised a sweat sensor to detect dehydration in pregnant women, which will be sent to the Arduino UNO, which will analyse the data and present it on the LCD display. The degree of dehydration and metabolic activity are constantly monitored by this system. Pregnant women can maintain their hydration levels and have appropriate fetal development with the aid of this device.

Hayley Miller (2015) Dehydration in the older adult. Dehydration affects 20% to 30% of older adults. It has a greater negative outcome in this population than in younger adults and increases mortality, morbidity, and disability. Dehydration is often caused by water deprivation in older adults, although excess water loss may also be a cause. Traditional markers for dehydration do not take into consideration many of the physiological differences present in older adults. Clinical assessment of dehydration in older adults poses different findings, yet is not always diagnostic. Treatment of dehydration should focus on prevention and early diagnosis before it negatively effects health and gives rise to comorbidities. The current article discusses what has most thoroughly been studied; the best strategies and assessment tools for evaluation, diagnosis, and treatment of dehydration in older adults; and what needs to be researched further.

Jayoung Kim, et. al., (2018). Simultaneous monitoring of sweat and interstitial fluid using the concept is successfully realized through sweat stimulation (via transdermal pilocarpine delivery) at an anode, alongside extraction of interstitial fluid (ISF) at a cathode. The system thus allows on-demand, controlled sampling of the two epidermal biofluids at the same time, at two physically separate locations (on the same flexible platform) containing different electrochemical biosensors for

monitoring the corresponding biomarkers. The performance of the developed wearable device is demonstrated by measuring sweat-alcohol and ISF-glucose in human subjects consuming food and alcoholic drinks. The different compositions of sweat and ISF with good correlations of their chemical constituents to their blood levels make the developed platform extremely attractive for enhancing the power and scope of next-generation non-invasive epidermal biosensing systems.

Seung Yun Oh, et. al., (2018). Skin-attachable, stretchable electrochemical sweat sensor for glucose and Ph detection. In this study, they report on the fabrication of a stretchable and skin-attachable electrochemical sensor for detecting glucose and pH in sweat. A patterned stretchable electrode was fabricated via layer-by-layer deposition of carbon nanotubes (CNTs) on top of patterned Au nanosheets (AuNS) prepared by filtration onto stretchable substrate. For the detection of glucose and pH, CoWO₄/CNT and polyaniline/CNT nanocomposites were coated onto the CNT–AuNS electrodes, respectively. A reference electrode was prepared via chlorination of silver nanowires. The sensor also showed good adhesion even to wet skin, allowing the detection of glucose and pH in sweat from running while being attached onto the skin. This work suggests the application of our stretchable and skin-attachable electrochemical sensor to health management as a high-performance healthcare wearable device.

Manimegala, et. al., (2021) Dehydration measurement using sweat sensor patch. Technology has increased visibly large. People find ways to easily detect their conditions. Heartbeat and dehydration level is one of the most common among people especially athletes. Athletes are drifted towards wearable technologies to track their training and recovery. Usually, a dehydrated person sweat more. The sweat contains various physiological substance and health data. Based on studies sweat consists of salts and ions like [Na⁺], [K⁺], [Cl⁻] lactate, glucose, and ammonia. We are developing a wearable sweat analyser that can detect the raise in concentration of sodium and potassium. The sweat patch consists of a counter electrode created by screen printing Silver Chloride (AgCl) nanoparticles on Polydimethylsiloxane (PDMS) material and reference electrode (RE) created on the patch material by adding a platinum nanoparticle. This sweat sensor patch is connected to a microcontroller along with a temperature sensor and a Bluetooth

module. The data which is collected by the sweat patch and the temperature sensor is sent via Bluetooth to mobile application where the data is displayed.

Vidhya Balaji, et. al., (2017) Sensing body dehydration, they consider various methods of sensing hydration level, and present our own approach. Dehydration has long-term effects on gastrointestinal, kidney, and heart function, contributing to constipation, chronic kidney disease, and coronary heart disease. In combination, these symptoms can lead to major health degradation, as well as loss of productivity in the workplace or at school/college.

Tharun, et. al., (2022), Sensing based non-invasive context aware dehydration alert system using machine learning algorithm, The development of an Android application over Bluetooth to connect with wearable EDA sensor integrated wristband to track hydration levels of the user's real time and instantly alert to the users when the hydration level goes beyond the danger level. To validate the developed tool's performance, they recruit 5 users, carefully designed the water intake routines to annotate the dehydration ground truth and trained state-of-art machine learning models to predict instant hydration level i.e., well-hydrated, hydrated, dehydrated, and very dehydrated.

CHAPTER – 3

AIM AND SCOPE

3.1 AIM

- IV monitoring alert system is done efficiently to monitor the drip infusion level
- To ensure the rate of flow is appropriate, and to count the number of droplets per minute and make necessary adjustments.
- To measure the sweat conductance level for detecting dehydration and fall detection

3.2 OBJECTIVE

- To reduce the manual observation of IV monitoring and to address the issue of pregnant women's dehydration, an automated feedback recommendation system has been developed.
- A fall detection sensor is used to analyze falls and transmit emergency notifications for immediate rescue.

3.3 SCOPE

Facilitates in monitoring the fluid level by the load cell. It can provide ease of accessibility for observer or nurse. When administering IV fluids to a patient, the nurse can continually monitor the patient's fluid and electrolyte status to evaluate the effectiveness of the infusion and to avoid potential complications of fluid overload and electrolyte imbalance. Modern dehydration detection sensor receives personalized health insights and notifications to help the pregnant women to stay safe and improve the times by tracking the hydration and electrolyte balance.

CHAPTER – 4

MATERIALS AND METHODS

4.1 BLOCK DIAGRAM

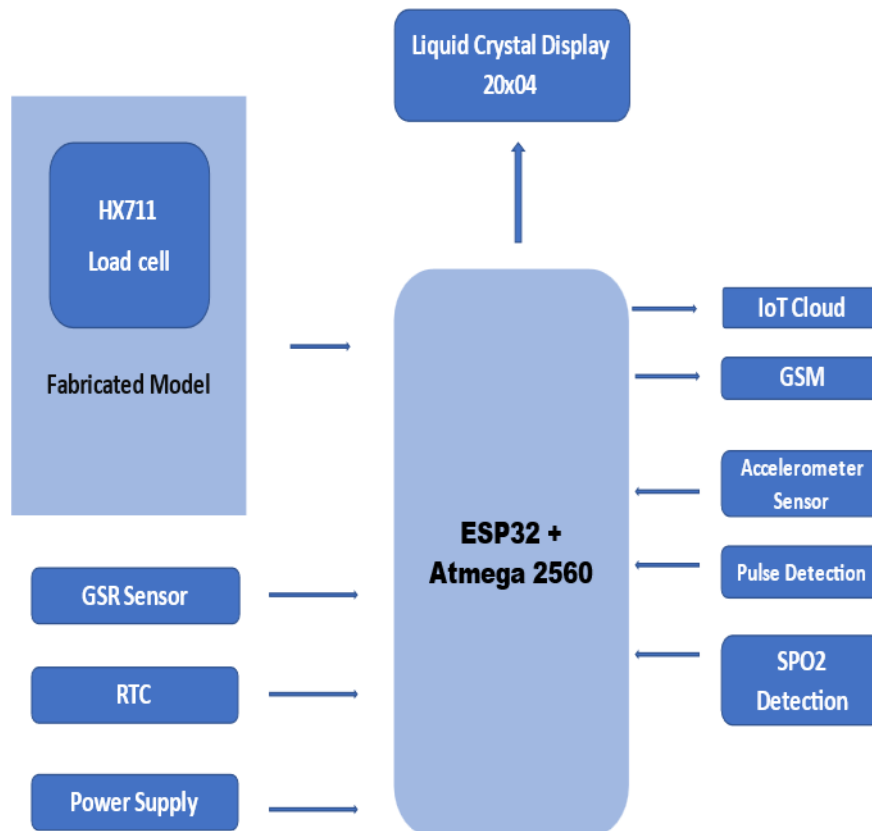


Fig 4.1 Block diagram IV monitoring alert system with modern dehydration detection and autofeedback recommendation system for pregnant women

In Fig 4.1, two microcontrollers ESP 32 and Atmega 2560 are the major controllers. The fabricated model that is the IV stand is connected to the microcontrollers. The fabricated model consists of HX711 load cell. HX711 Load cell is used to measure the weight of the saline bag. When there is a variation in the weight of the saline bag the SMS alert will be given through GSM and the data are stored in the IOT cloud platform. The outputs are shown graphically and also in Excel form.

Additionally, pulse detection and SPO2 detection are also detected by MAX 30100 Sensor and the outputs are IOT cloud platform. In our project we are using Thing speak as a IOT platform.

In addition to its GSR sensor is used for measuring the sweat conductance of the body and the readings will be displayed in the LCD display. And Accelerometer sensor MPU 6050 is used for fall detection. RTC is real-time clock is used to provide accurate time and date that can be used in a variety of applications. The outputs are shown in LCD crystal display 20x4. A power supply is used to energize the working of the prototype.

4.2 MATERIALS USED

HARDWARE REQUIREMENTS

- ESP32 Microcontroller
- Arduino mega Microcontroller
- Arduino nano Microcontroller
- MAX 30100 Pulse and Heart rate sensor
- HX711 Load cell
- MPU6050 Accelerometer sensor
- GSR Sensor
- GSM Module
- RTC
- LCD display
- Fabricated PVC IV Stand

SOFTWARE REQUIREMENTS

- Arduino IDE
- ThingSpeak

4.2.1 ESP32 MICROCONTROLLER

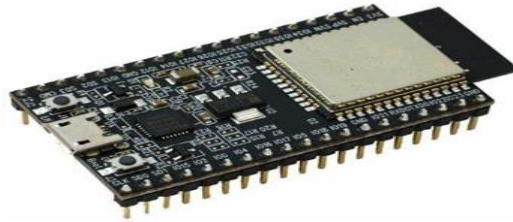


Fig 4.2 ESP32 Microcontroller

A single 2.4 GHz Wi-Fi and Bluetooth combination chip called the ESP32 (Fig 4.2) was created using TSMC's ultra-low-power 40 nm technology. It is made with the best RF and power performance in mind, and it exhibits resilience, adaptability, and dependability in a number of power scenarios. The ESP32 series of chips contains the following models: ESP32-D0WD-V3, ESP32-D0WDR2-V3, ESP32-U4WDH, ESP32-S0WD, ESP32-D0WDQ6-V3 (NRND), ESP32-D0WD (NRND), and ESP32-D0WDQ6 (NRND). Of these, ESP32-D0WD-V3, ESP32-D0WDR2-. The ESP32 is made for Internet-of-Things (IoT) and wearable electronics applications. It includes fine-grained clock gating, numerous power modes, and dynamic power scaling, among other cutting-edge traits of low-power processors. For instance, ESP32 is only periodically awakened in a low-power IoT sensor hub application scenario when a specific situation is recognized. To reduce the amount of energy the chip uses, low-duty cycles are used. The power amplifier's output can also be changed, which aids in finding the best balance between communication range, data rate, and power usage. With about 20 external components, ESP32 is a highly integrated solution for Wi-Fi and Bluetooth IoT applications. Antenna switch, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules are all integrated into the ESP32. Because of this, the overall system uses a small amount of printed circuit board (PCB) space. The ESP32 employs CMOS for single-chip, fully integrated radio and baseband, and it also incorporates sophisticated calibration circuitries that enable the solution to fix flaws in external circuits or adapt to changes in the environment. As a result, costly and specialist Wi-Fi testing apparatus is not necessary for the mass production of ESP32 solutions (Fig 4.3).

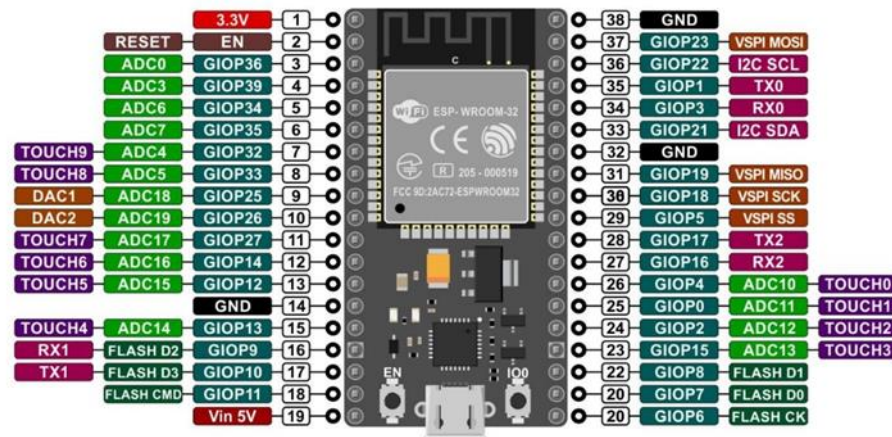


Fig 4.3 Pin diagram of ESP32 Microcontroller

4.2.2 ARDUINO MEGA MICROCONTROLLER



Fig 4.4 Arduino Mega Microcontroller

A microcontroller board called the Arduino Mega 2560 (Fig 4.4) is based on the ATmega2560 (datasheet). It contains 16 analogue inputs, 4 hardware serial ports (UARTs), a 16 MHz crystal oscillator, 54 digital input/output pins (14 of which can be utilised as PWM outputs), a USB connector, a power jack, an ICSP header, and a reset button. It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or a battery. The majority of shields made for the Arduino Duemilanove or Diecimila are compatible with the Mega. Either an external power source or the USB connection can be used to power the Arduino Mega2560. The power source is automatically chosen. Either a battery

or an AC-to-DC adapter (wall wart) can provide external (non-USB) power. A 2.1mm center-positive plug can be used to connect the adapter by inserting it into the board's power connector. The GND and Vin pin headers of the POWER connection can accept battery leads. The board can be powered by a 6 to 20-volt external supply. The 5V pin, however, may deliver less than five volts if supplied with less than seven volts, and the board may become unstable. The voltage regulator could overheat and harm the board if more than 12V is used. Because it does not employ the FTDI USB-to-serial driver chip, the Mega2560 differs from all earlier boards. Instead, it has an Atmega8U2 that has been configured to act as a USB-to-serial converter. VIN, as opposed to 5 volts from the USB connection or another regulated power supply, is the input voltage to the Arduino board when it is using an external power source (Yusuf Abdullahi Badamasi ,2014). This pin can be used to access voltage that has been supplied via the power jack or to feed voltage to it. The microprocessor and other components on the board are powered by a controlled 5V power source. This can be supplied by USB or another regulated 5V source, or it can be obtained from VIN via an onboard regulator.3V3. an internal regulator-generated 3.3-volt supply. A 50-mA maximum current consumption is allowed. GND. drilled pins. The pin Mode (), digital Write (), and digital Read () routines allow you to use any one of the 54 digital pins of the Mega as an input or output. They use 5 volts to work. Each pin includes a 20–50K ohm internal pull-up resistor that is unconnected by default and has a maximum current capacity of 40 mA. A computer, another Arduino, or other microcontrollers can all be communicated with using the Arduino Mega2560's many communication features. Four hardware UARTs are available on the ATmega2560 for TTL (5V) serial connection. A virtual COM port is provided to software on the computer by an ATmega8U2 on the board (Windows machines require an. inf file, whereas OSX and Linux machines natively detect the board as a COM port). Simple textual data can be transmitted to and received from the board using the serial monitor that is part of the Arduino software. When data is transmitted using the ATmega8U2 chip and USB connection to the computer, the RX and TX LEDs on the board will flash (but not for serial transmission on pins 0) (Fig. 4.5).

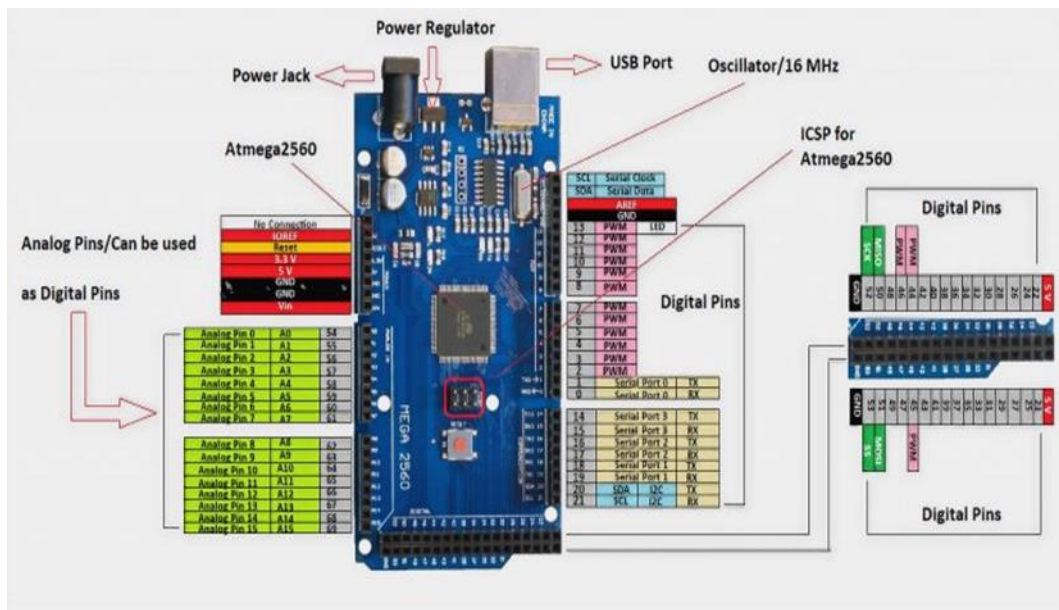


Fig 4.5 Pin diagram of Arduino Mega Microcontroller

4.2.3 ARDUINO NANO MICROCONTROLLER



Fig 4.6 Arduino Nano microcontroller

A compact Arduino board called the Nano is built around an ATmega328P (Fig. 4.6) or ATmega628 microcontroller. The Arduino UNO board has the same connection. A sustainable, compact, reliable, and adaptable microcontroller board is referred to as a Nano board. In comparison to the UNO board, it is modest in size. The Arduino (IDE), which is available for a number of platforms, is used to arrange the Arduino Nano. Integrated Development Environment is referred to in this sentence. The Arduino IDE and micro-USB are the tools needed to get our projects running on the Arduino Nano board. On the laptop or desktop, the Arduino IDE programme needs to be installed. The Arduino Nano board receives the code from the computer via the tiny USB. Compared to the Arduino UNO, the Arduino Nano is smaller and

comes with a little USB cable. Because both Nano and UNO use the ATmega328p microcontroller, we can use Nano in place of UNO. It's also simpler to find the Arduino UNO than the Nano. It is regarded as the industry standard board and is simple to use for newcomers or novices. While the Arduino UNO is available in TQFP, the Nano is available in PDIP (Plastic Dual - Inline Package) (Plastic Quad Flat Pack). The Arduino UNO has 14 digital pins, a USB port, a power jack, and an ICSP (In-Circuit Serial Programming) header in addition to 6 analogue pin inputs. There are 14 digital pins and 8 analogue pins on the Arduino Nano's I/O pin set. Additionally, 6 Power. The Nano board's operational voltage ranges from 5V to 12V. Nano has a total of 22 input/output pins. There are 8 analogue pins and 14 digital pins. The 14 digital pins include 6 PWM (Pulse Width Modulation) pins (Fig.4.7). The Arduino Nano's 6 PWM pins are used to translate digital signals into analogue impulses. The conversion is accomplished by changing the pulse's width. The Arduino Nano's crystal oscillator operates at a 16MHz frequency. Numerous applications, including robotics, control systems, instrumentation, automation, and embedded systems, employ the Arduino Nano. QR Code Scanner, DIY Arduino Pedometer, and other projects were developed using Arduino Nano. Additionally, we may link an Arduino Nano to the WIFI. Nano's features are comparable to those of the Arduino UNO. Nano is a special option for making electronic projects and devices with a small footprint because to its adaptability and eco-friendliness.

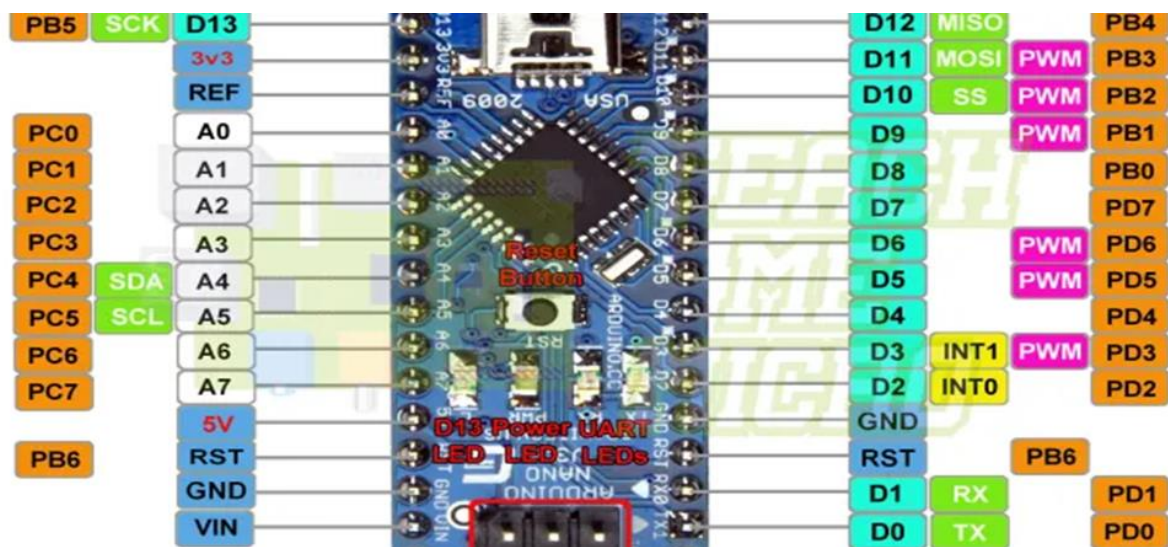


Fig 4.7 Pin diagram of Arduino Nano Microcontroller

4.2.4 MAX 30100 PULSE AND HEART RATE SENSOR



Fig 4.8 MAX 30100 Pulse and Heart rate sensor

The MAX30100 (Fig 4.8) is a sensor solution with integrated pulse oximetry and heart-rate monitoring. It combines a pair of LEDs, to detect pulse oximetry and heart rate signals, a photodetector, improved optics, and low-noise analogue signal processing are used. The MAX30100 may be turned down using software and runs on 1.8V and 3.3V power supplies. Very little standby current enables the power supply to always be connected. Integrated LEDs, a photo sensor, and a high-performance analogue front-end simplify design with a complete pulse oximeter and heart-rate sensor solution. Tiny 14-Pin Optically Enhanced System-in-Package, 5.6mm x 2.8mm x 1.2mm. Programmable sample rate and LED current for power savings. Ultra-Low Shutdown Current (0.7A, typ), Advanced Functionality, Increases Battery Life for Wearable Devices, Improves Measurement Performance A robust motion artefact resistance is provided by high SNR. High Sample Rate Capability, Fast Data Output Capability, Integrated Ambient Light Cancellation (Fig 4.9).

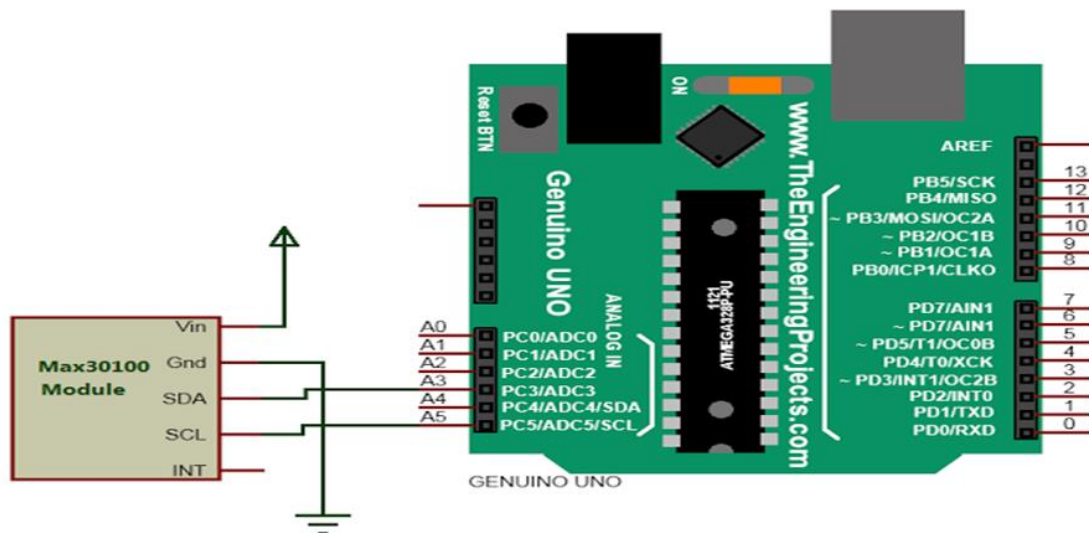


Fig 4.9 Pin diagram of MAX30100 Pulse and Heart rate sensor

4.2.5 HX711 LOAD CELL



Fig 4.10 HX711 Load cell

A load cell and strain gauge are used in conjunction with the HX711 load cell (Fig 4.10) amplifier to produce quantifiable data. Five wires from the load cell are accepted by the HX711 Load Cell Amplifier. These pins have the colours RED, BLK, WHT, GRN, and YLW written on them. Red, black, green, and white wires come from the strain gauge on the load cell, and yellow is an optional ground wire that is not connected to the strain gauge but is there to ground any small outside EMI (electromagnetic interference). These colours correspond to the traditional colour coding of load cells. Sometimes a bigger black wire, foil, or loose wires are used in

place of a yellow wire to cover the signal wires and reduce EMI. A 24-bit analogue to digital converter (ADC) IC is called HX711. It has an integrated preamplifier for boosting low voltage signals. The HX711 chip outputs digital values after accepting voltage signals as input. Low voltages are handled by the preamplifier. External supply regulator is not needed because it has an on-chip power supply regulator that supplies analogue power. A bridge sensor can be directly interfaced with. There are two analogue channels, A and B, on this chip. Channel "A" gain can be programmed to either 128 or 64. Channel B, on the other hand, has a constant gain of 32. HX711 applications are automatic doors, weight scales, industrial process control.

4.2.6 MPU6050 ACCELEROMETER SENSOR



Fig 4.11 MPU6050 accelerometer sensor

Due to the immense value, it provides to the end-user experience, makers of smartphones and tablets are adopting Motion Interface™ as a "must-have" feature. Applications include gesture instructions for applications and phone control, improved gaming, and augmented reality employ in smartphones. Navigation for pedestrians and vehicles, as well as the taking and viewing of panoramic photos. Motion Tracking technology transforms smartphones and tablets into powerful 3D intelligent devices that may be utilized in applications ranging from location-based services to tracking user motions with great accuracy and precision. Small package size, low power consumption, excellent precision and repeatability, high shock

tolerance, and application-specific performance programmability are essential requirements for Motion Interface enabled devices, all at a cheap consumer price point. In a compact 4x4x0.9mm design, the MPU-60X0 is the first integrated 6-axis Motion Tracking device in the world. It includes a 3-axis gyroscope, a 3-axis accelerometer, and a Digital Motion Processor™ (DMP). It provides a full 9-axis MotionFusion™ output by directly accepting inputs from an external 3-axis compass over its dedicated I2C sensor bus. The MPU-60X0 (Fig 4.11) Motion Tracking device allows manufacturers to forego the pricey and time-consuming selection, qualification, and system level integration of discrete devices thanks to its 6-axis integration, on-board MotionFusion™, and run-time calibration firmware, consumer-friendly motion performance. On its auxiliary I/O, the MPU-60X0 is also intended to interface with numerous non-inertial digital sensors, such as pressure sensors. I2C port. The footprint of the MPU-60X0 with the MPU-30X0 series compatible. (Fig 4.12) represents the pin diagram of MPU6050.

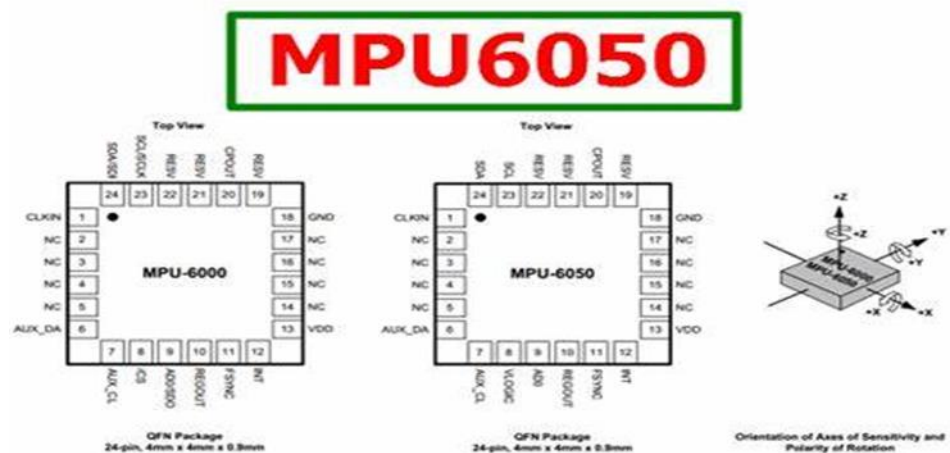


Fig 4.12 Pin diagram of MPU6050 Accelerometer

4.2.7 GSR SENSOR

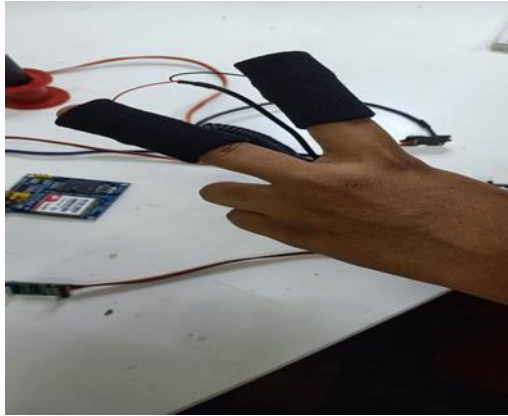


Fig 4.13 GSR Sensor

The GSR (Galvanic Skin Reaction) sensor (Fig 4.13) detects the electrical conductivity of our skin. In direct relation to the skin's moisture content, the electric conductivity varies. The GSR value varies depending on the level of mental or physiological stimulation as shown by skin sweating. By properly positioning electrodes at the fingertips, typically the index and middle fingers, the GSR value is determined. These fingers' fingertips have less-thick skin and fewer hair. Consequently, compared to other fingers, it produces better results. The conductive voltage of the skin reveals distinct emotional states, such as stress or relaxation. The nervous system-controlled sweat glands' ability to create sweat is what determines the conductive voltage. Sweat secretion and subsequently its voltage cause variations in the conductivity of the skin. To ascertain a person's emotional states, the voltage is measured. Features of GSR sensor detects skin conductance and electrode finger straps every grove user. Technical details are dimensions 24mm x 20mm x 9.80mm, weight G.W 29g, Battery Exclude Input Voltage 5V/3.3V , Sensitivity adjustable via a potentiometer.

4.2.8 GSM MODULE



Fig 4.14 GSM module

SIM900A (Fig 4.14) is a dual-band GSM/GPRS engine that operates on the frequencies EGSM 900MHz and DCS 1800MHz and was created for the global market. The SIM900A supports the GPRS coding schemes CS-1, CS-2, CS-3, and CS-4 and offers GPRS multi-slot class 10/class 8 (optional). The SIM900A may almost entirely satisfy the space needs in your applications, including M2M, smart phones, PDAs, and other mobile devices, thanks to its small configuration of 24mm x 24mm x 3mm. A 68-pin SMT pad serves as the physical interface to the mobile application and offers all hardware interfaces between the module and customers' boards. The SPI display interface and keypad will allow you the freedom to create unique applications. Quickly construct the programmes with the help of the serial port and debug port. An audio channel has a speaker output and a microphone input. General Purpose Programmable Input & Output. The SIM900A is built with energy-saving techniques, resulting in a SLEEP mode current usage of only 1.5mA. The TCP/IP protocol is integrated with the SIM900A, and enhanced TCP/IP AT commands have been created to make it easier for customers to use the protocol, which is particularly beneficial for those data transfer applications.

4.2.9 DS3231 RTC



Fig 4.15 DS3231 RTC

The DS3231(Fig 4.15) is a low-cost, incredibly precise I2C device. temperature-compensated crystal oscillator (TCXO) and integrated crystal in a real-time clock (RTC). When the device's primary power source is disrupted, the device's battery input ensures precise timekeeping. The addition of the crystal resonator improves the instrument's long-term precision while also lowering the number of pieces required to complete a production run. The DS3231 comes in a 16-pin, 300-mil SO box and is offered in commercial and industrial temperature ranges. The RTC keeps track of information regarding seconds, minutes, hours, days, dates, months, and years. For months with fewer than 31 days, the date at the end of the month is automatically changed to account for leap years. The clock has an AM/PM indicator and may run on either a 24- or 12-hour schedule. There are two programmable time-of-day alarms as well as a programmable square-wave output. I2C bidirectional bus is used to serially transport address and data. A precise temperature-compensated voltage reference and comparator circuit keeps track of VCC's condition to detect power outages, offer a reset output, and, if necessary, switch automatically to the backup source. Additionally, a pushbutton input for creating a P reset is monitored on the RST pi.

4.2.10 20x4 LCD DISPLAY



Fig 4.16 LCD display

Features are ST 7066 built-in controller; Type: Character; Display Format: 20 x 4 characters (or equivalent), Duty cycle: 1/16; 5 x 8 dots with cursor; + 5 V power supply (also available at + 3 V); and 5 x 8 dots with cursor, N.V. is optional for +3 V power supply and can be driven by pin 1, pin 2, pin 15, pin 16, or pin A and K. The RW1063 controller IC, which offers 6800, 4-line SPI, or I2C interface options, is integrated into this 20x4 Character LCD Display (Fig 4.16). The WH2004G 20x4 LCD Display has a lower shape and VA size but the same AA size and pin assignment as the current WH2004A and WH2004B character LCD modules.

4.2.11 FABRICATED PVC IV STAND



Fig 4.17 Fabricated PVC IV stand

4.2.12 ARDUINO IDE

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 Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

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.'

4.2.13 THING SPEAK

The Internet of Things (IoT) describes an emerging trend where a large number of embedded devices(things) are connected to the Internet (David Nettikadan et. al.,2020). These connected devices communicate with people and other things and often provide sensor data to cloud storage and cloud computing resources where the data is processed and analyzed to gain important insights. Cheap cloud computing power and increased device connectivity is enabling this trend(Jebane et. al.,2021). IoT solutions are built for many vertical applications such as environmental monitoring and control, health monitoring, vehicle fleet monitoring, industrial monitoring and control, and home automation.

ThingSpeak Key Features:

- Easily configure devices to send data to ThingSpeak using popular IoT protocols.
- Visualize your sensor data in real-time.
- Aggregate data on-demand from third-party sources.
- Use the power of MATLAB to make sense of your IoT data.
- Run your IoT analytics automatically based on schedules or events.
- Prototype and build IoT systems without setting up servers or developing web software.
- Automatically act on your data and communicate using third-party services like Twilio® or Twitter.

CHAPTER – 5

RESULTS AND DISCUSSION

5.1 RESULTS

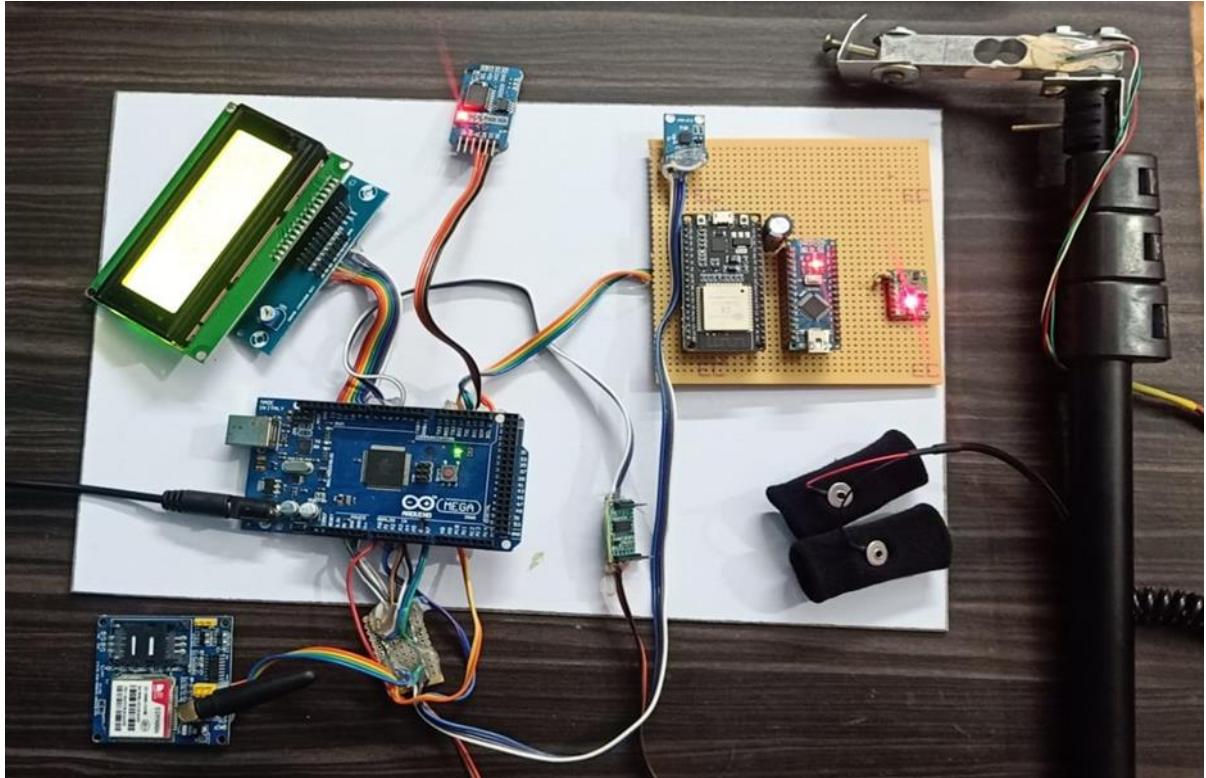


Fig 5.1 Prototype of IV monitoring alert system with modern dehydration detection and auto feedback recommendation system for pregnant women

In Fig 5.1, The Arduino Mega collects data from all connected sensors and sends it to the ESP32. The Wi-Fi module requires access to our Wi-Fi network in order to upload data to ThingSpeak. ThingSpeak uses HTTP and MQTT protocols to send data from IoT devices to its cloud. In ThingSpeak, we can see live data streams from all of the sensors. Automatic graphs are plotted for visualization, which becomes more accurate as the values are received. In addition, we receive the values in an excel sheet that we can use for future reference. The diagram below depicts the ThingSpeak interface. Also, the drip level is monitored, and if it drops below 40%, alert messages are transmitted through GSM to the emergency contact number. if the drip level falls below 20%, the process is performed once more.

Fig 5.2 represents the graph of the variations in drip level, where X axis is the drip level and Y axis is the date. Fig 5.3 represents the graph of the variations in Heart rate, where X axis is Heart rate and Y axis is date. Fig 5.4 represents the graph of the variations in SPO2 level where X axis is SPO2 level and Y axis is date. Fig 5.5 represents the graph of the variations in Sweat conductance level, Here the X axis is GSR and Y axis is date. Fig 5.6 and Fig 5.7 represents the graph of the variations in fall detection, where X axis is the angle depicted by the person and Y axis is the date. Fig 5.8 and Fig 5.9 represents the outputs that are displayed in LCD. In Fig 5.8 G refers to the value of the GSR value, W refers to the weight of the saline bag HB refers to the heartbeat value, O refers to the SPO2 value and it also indicates the date and time for real-time application. In 5,9 alert reminder is shown for drinking water.



Fig 5.2 Graph of the drip level



Fig 5.3 Graph of Heart rate

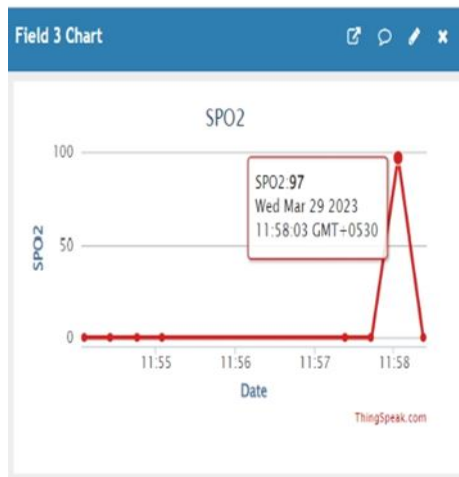


Fig 5.4 Graph of SPO2 level

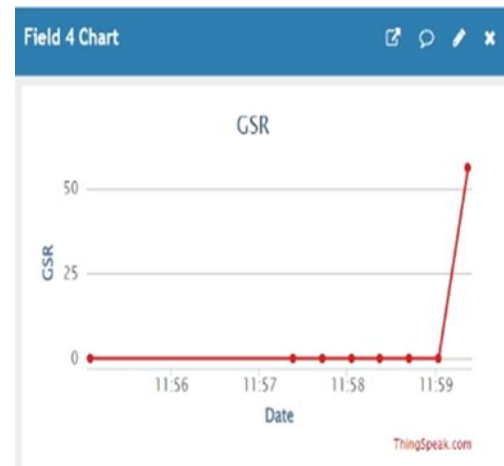


Fig 5.5 Graph of GSR

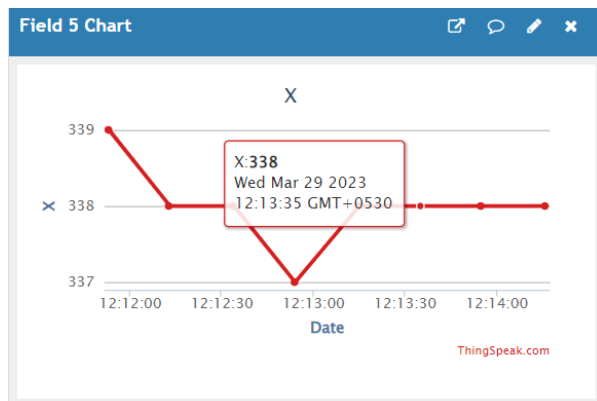


Fig 5.6 Graph for fall detection-X

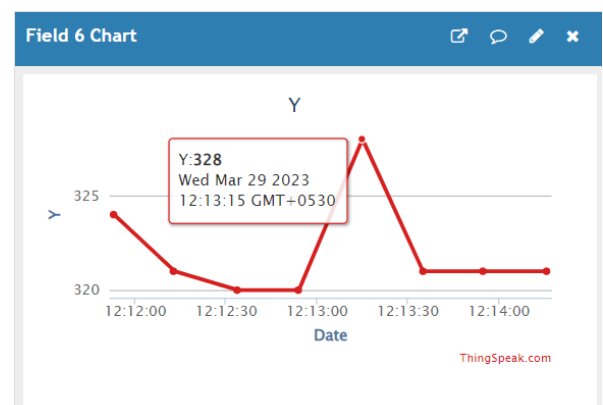


Fig 5.7 Graph for fall detection-Y



Fig 5.8 Output of LCD display 1



Fig 5.9 Output of LCD display 2

Table 5.1 Excel Output of Health parameters and Drip level

Created _at	Entry_id	Field 1 (Drip level)	Field 2 (Heart rate)	Field 3 (SPO ₂)	Field 4 (GSR)	Field 5 (Fall detection-X)	Field 6 (Fall detection-Y)
2023-03-2	1	100	77	97	56	332	322
2023-03-2	2	95	82	96	55	334	324
2023-03-2	3	93	97	97	51	333	324
2023-03-2	4	88	70	93	52	336	322

5.2 DISCUSSION

Inappropriate intravenous fluid therapy is a notable cause of patient morbidity and mortality and may result from either improper volume (too much or too little) or improper type of fluid. Extravasation, is a condition where the fluid leaks into the tissues surrounding the IV site, which occurs when the wall of vein is pierced or when the fluid is flowing into the neighbouring tissue rather than into the vein. This occurs when the needle or cannula accidentally slips out of the vein. Infiltration causes the tissue to swell giving the area involved a bulgy appearance due to accumulation of fluid. Air embolism is a condition where an amount of air inadvertently enters the vascular system and causes heart attack. The accumulation of up to 10 mls of air intravascularly can have serious or even fatal effects. Catheter embolism occurs when a bit of a plastic cannula breaks off and flows into the vascular system.

Mechanical complications occur as a result of: changes in the needle position in the vein, position of the patient, height of the solution, amount of solution remaining in the container, venospasm, kinked tubes, plugged air vents and plugged needles or cannula. Priyadharshini et. al., (2015) proposed Automatic Intravenous Fluid Level Indication System for Hospitals using a low-cost RF based automatic alerting and indicating device where IR sensor is used as a level sensor. Simon Peter Sskitoleko, et. al., (2012) proposed a design of a low-cost electronically controlled gravity-feed infusion set using a sensor housing that contains a reference light source located at a fixed distance from the photocell, to define a fixed optical sensing gap between them, with a reference light source normally intruding upon the photocell. But these two methods are costly compared to our project and we have integrated dehydration detection sensor especially for pregnant women. In our project the arrangement of the monitoring system is shown where a HX711 load cell sensor is used to weigh the IV bag and give a proportional level of liquid. This idea can be implemented in any size of IV bag and the infusing fluid is not affected when sensed. The load cell would be used to measure the weight of the IV bag, which would change as the fluid flows out of the bag. This change in weight can be used to calculate the flow rate of the IV fluid. The load cell would be connected to a microcontroller or a computer, which would process the data and send it to the health monitoring system. The health monitoring system would include sensors for measuring pulse, SpO₂, and dehydration. These sensors would be connected to the microcontroller or computer, which would collect the data and send it to the ThingSpeak IoT platform for storage and analysis. The emergency SOS button would be connected to the microcontroller or computer as well. In case of an emergency, the user would press the button, and the system would immediately send a notification to a designated emergency contact, along with the location of the user. Finally, the data would be stored on the ThingSpeak IoT platform, which would allow for easy analysis and visualization of the data. The platform could be used to monitor the patient's health over time, identify any trends or issues, and provide alerts or recommendations based on the data.

CHAPTER – 6

SUMMARY AND CONCLUSION

6.1 SUMMARY

During the peak of the Covid-19 Pandemic, healthcare professionals found themselves spread thin among the ever-increasing wave of incoming patients. In such times, it is not possible for frontline workers to monitor and tend to each and every patient personally. Intravenous therapy is a medical technique used to deliver fluids, medications and nutrition directly into a person's vein. IV therapy is commonly used for rehydration and to provide nutrients and is crucial to help an individual with making a speedy recovery. However, IV drips need to be regularly monitored and replaced. The flow of the fluid also needs to be metered depending on the patient and their ailment. This IoT Intravenous Fluid Monitoring uses a load cell to detect as the fluid level in the IV Infusion bottle goes down and transmits the data over IoT. Once the system detects that the bottle has gone empty, it sends an alert over IoT. The IV Monitoring Alert system provides the following advantages:

- Automatic IV Bag Monitoring and Alert
- Data Logging as well as IOT Online Transmission
- Easy to operate
- Makes it easier for a single individual to manage multiple patients.

Additionally, we are monitoring the subject's vital signs to keep track of their health and storing the data to the cloud platform. Dehydration monitoring systems are increasingly in demand due to their wide range of uses in the diagnosis of diseases, the detection of drug addiction, and the enhancement of athletic performance. The market for dehydration monitoring systems is expected to grow as a result of these devices, which are primarily integrated with standalone sensor systems that assess dehydration. To address the issue of pregnant women's dehydration, an automated feedback recommendation system has been developed. A fall detection sensor is used to analyze falls and transmit emergency notifications for immediate rescue.

6.2 CONCLUSION

In this work, we suggested a modern dehydration detection method with an auto-feedback recommendation system for an IV drip monitoring alert system for pregnant women. The drip level is measured by the load cell, and when it reaches a certain limit, the GSM sends alert messages. Along with this health metrics are also checked, and to detect dehydration, a GSR sensor is employed. These parameters are tracked, and the data is stored in the IoT cloud platform thingspeak. In thingspeak, the data is shown both graphically and on an excel sheet, which is helpful for future reference. As a result, this system is quite helpful for pregnant women because it continuously tracks and stores health parameter data, which is very helpful for doctors to diagnose. The technology can be simply integrated into already-existing healthcare institutions, offering a powerful monitoring tool that can enhance patient safety. Healthcare workers found themselves overburdened at the height of the Covid-19 Epidemic due to the constant influx of new patients. Frontline staff members cannot directly monitor and care for every patient during such periods. The following benefits are offered by the IoT intravenous fluid monitoring and alerting system: Automated IV Bag Monitoring and Alarm; Data Recording and IOT Online Transmission; Simple to Use; Facilitates the management of several patients by a single person. This project overcomes the consequences that occur due to negligence of monitoring the IV flow. Using proposed monitoring, one can monitor the level of bottle from a distant position which will aid in building smart healthcare system. This is an affordable, precise and efficient system that works in a smooth manner.

6.3 FUTURE DEVELOPMENTS

- Develop a compact design
- Materials like polymers can be used for constructing the hardware components to reduce the weight of the IV stand
- Can use the portable electro-dermal sensor for sensing dehydration level
- Can use load cell of less weight than 5 Kg for real-time application

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APPENDICES

```
#include <LiquidCrystal.h>
```

```
#include <SoftwareSerial.h>
```

```
#include "HX711.h"
```

```
#include <RtcDS3231.h>
```

```
#include <Wire.h>
```

```
RtcDS3231<TwoWire> Rtc(Wire);
```

```
#define splash splash2
```

```
#define ard_node Serial2
```

```
#define ard_nano Serial2
```

```
#define gsm_g Serial3
```

```
HX711 scale(7, 6);
```

```
// float calibration_factor = 240000;
```

```
float calibration_factor = 497999;
```

```
//LiquidCrystal lcd(13, 12, 11, 10, 9, 8);
```

```
LiquidCrystal lcd(8, 9, 10, 11, 12, 13);
```

```
#define gsr A0
```

```
#define acx1 A1
```

```
#define acy1 A2
```

```
String smsmsg, text;
```

```
String usernum = "09789024906";
```

```
int dis_t = 10;
```

```
int disp = dis_t;
```

```
int H_B, SPO_2;
```

```
int gsr_r, acx1_r, acy1_r;
```

```
float kg_r, gr_r;
```

```
int time_rem = 0;
```

```
int max_weight = 450, min_weight = 0.9, drip_alert = 40;
```

```
int weight_per;
```

```
int drip_alert_enable;
```

```
int drip_alert_status;
```

```
int rem_msg;
```

```
void (*resetFunc)(void) = 0;
```

```
void setup() {
```

```
    // put your setup code here, to run once:
```

```
    Serial.begin(115200);
```

```
    ard_node.begin(115200);
```

```
    gsm_g.begin(19200);
```

```
    Rtc.Begin();
```

```
    LcDSet();
```

```
    delay(1000);
```

```
    Serial.println("Wait for a Second");
```

```

Serial.println("Remove all weight from scale");

scale.set_scale();

scale.tare();

long zero_factor = scale.read_average();

String SS = "";

String SSs = "";

while (ard_node.available() > 0) {

    char S = ard_node.read();

    SS += S;

    delay(10);

}

lcd.clear();

SendSmS(usernum, "GSM Initialized!!!", "Sending SMS.....");

}

void LcdSet() {

```

```

lcd.begin(20, 4);

splash(0, "IV Monitoring");

splash(1, "");

splash(2, "");

splash(3, "");

delay(3000);

}

void loop() {

  // put your main code here, to run repeatedly:

  getArd();

  getSensor();

  remind();

  String Date = getDate();

  String time_ = getTime(0);

  disp++;

  // Serial.println(disp);

```

```

if (disp > dis_t) {

    lcd.setCursor(0, 0);

    lcd.print("G :      ");

    lcd.setCursor(3, 0);

    lcd.print(gsr_r);

    lcd.print(" % ");


    lcd.setCursor(9, 0);

    lcd.print("W :      ");

    lcd.setCursor(12, 0);

    lcd.print(weight_per);

    lcd.print(" % ");

    lcd.setCursor(0, 1);

    lcd.print("HB:      ");

    lcd.setCursor(3, 1);

    lcd.print(H_B);

    lcd.setCursor(9, 1);


    lcd.print("O :      ");

    lcd.setCursor(12, 1);

```

```
lcd.print(SPO_2);
```

```
lcd.print(" % ");
```

```
lcd.setCursor(0, 2);
```

```
lcd.print("Date:      ");
```

```
lcd.setCursor(5, 2);
```

```
lcd.print(Date);
```

```
lcd.setCursor(0, 3);
```

```
lcd.print("Time:      ");
```

```
lcd.setCursor(5, 3);
```

```
lcd.print(time_);
```

```
Serial.print("Heart rate:");
```

```
Serial.print(H_B);
```

```
Serial.print("bpm / SpO2:");
```

```
Serial.print(SPO_2);
```

```
Serial.print("% ");
```

```
Serial.print("GSR ");
```

```
Serial.print(gsr_r);
```

```
Serial.print(" ACX1 ");
```

```
Serial.print(acx1_r);
```

```
Serial.print(" ACY1 ");
```

```
Serial.print(acy1_r);
```

```
Serial.print(" Weight: ");
```

```
Serial.print(kg_r);
```

```
Serial.print("Kg");
```

```
Serial.print(" Weight: ");
```

```
Serial.print(gr_r);
```

```
Serial.print("g");
```

```
Serial.println();
```

```
Serial.println();

ard_node.print(H_B);

ard_node.print(",");

ard_node.print(SPO_2);

ard_node.print(",");


ard_node.print(weight_per);

ard_node.print(",");


ard_node.print(gsr_r);

ard_node.print(",");


ard_node.print(acx1_r);

ard_node.print(",");

ard_node.print(acy1_r);

ard_node.print(",");


// Serial.println();

disp = 0;
```

```
}  
  
delay(10);  
  
}
```

```
void remind() {  
  
    String time_ = getTime(2);  
  
    int timee = time_.toInt();  
  
    if (timee % 5 == 0 and time_rem == 0) {  
  
        splash(2, "Tablet Name");  
  
        splash(3, "Paracetamol");  
  
        delay(2000);  
  
        time_rem = 1;  
  
    } else if (timee % 5 != 0) {  
  
        time_rem = 0;  
  
    }  
}
```

```
}
```

```
void getSensor() {
```

```
    gsr_r = analogRead(gsr);
```

```
    gsr_r = map(gsr_r, 0, 1023, 100, 0);
```

```
    scale.set_scale(calibration_factor);
```

```
    kg_r = scale.get_units();
```

```
    gr_r = kg_r * 1000;
```

```
    if (gr_r < 1) {
```

```
        gr_r = 0;
```

```
    }
```

```
    if (gr_r >= max_weight) {
```

```
        gr_r = max_weight;
```

```
    } else if (gr_r <= min_weight) {
```

```
        gr_r = min_weight;
```

```
}
```

```
weight_per = map(gr_r, min_weight, max_weight, 0, 100);
```

```
if (weight_per >= 100) {
```

```
    drip_alert_enable = 1;
```

```
}
```

```
if (weight_per <= 0) {
```

```
    drip_alert_enable = 0;
```

```
}
```

```
if (drip_alert_enable) {
```

```
    if (weight_per < drip_alert and drip_alert_status == 0) {
```

```
        SendSmS(usernum, ("Drip level = " + String(weight_per) + "%"), "Sending  
SMS.....");
```

```
        drip_alert_status = 1;
```

```
        drip_alert -= 10;
```

```
    } else if (weight_per < drip_alert) {
```

```
        drip_alert_status = 0;
```

```

    drip_alert -= 10;

}

}

if (gsr_r <= 37) {

    gsr_r = 0;

}

acx1_r = analogRead(acx1);

acy1_r = analogRead(acy1);


// if (acx1_r < 360 or acy1_r < 360) {


// }

// if (acx1_r > 450 or acy1_r > 450) {


// }

}

void getArd() {

    String SS = "";

    String SSs = "";

```

```

while (ard_nano.available() > 0) {

    char S = ard_nano.read();

    SS += S;

    delay(10);

}

if (SS.length() > 0) {

    // Serial.println(SS);

    String a = getSplitValue(SS, ',', 0);

    String b = getSplitValue(SS, ',', 1);

    H_B = a.toInt();

    SPO_2 = b.toInt();

    ard_nano.flush();

}

}

```



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NATIONAL CONFERENCE ON RESEARCHES IN SCIENCE AND TECHNOLOGY (NCRST - 23)

1st April 2023 Chennai, India

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Authors Name: Ancy Hannah Charlet. A, Steffy Reena. N, Krishnakumar. S

Dear Authors,

We are pleased to inform you that your paper has been accepted by the review committee for Oral Presentation at the **NATIONAL CONFERENCE ON RESEARCHES IN SCIENCE AND TECHNOLOGY (NCRST - 23)**

Article Title: "IV DRIP MONITORING ALERT SYSTEM WITH MODERN DEHYDRATION DETECTION WITH AUTO FEEDBACK RECOMMENDATION SYSTEM FOR PREGNANT WOMEN"

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