

Improvement of Alarming System for Clotting Inside the Blood Units and Maintain the Criteria of the Blood Bag

Safaa Hassan Ali, Mustafa Saad Shamal, AL-Mortada Abbas Abd AL-Hussein

Biomedical Engineering Department, University of Technology

Assistant Professor Dr. Awfa Abd AL-Rusual Abdullah, Lecture Dalia Mohammed Ali

Biomedical Engineering Department, University of Technology

Abstract: The device refers to the process of extracting meaningful information from the shaking and weight measurement data obtained from a device monitoring a blood bag. This abstracted information can provide valuable insights into the quality, integrity, and safety of the blood product. Shaking data involves monitoring the movement and agitation of the blood bag. By abstracting this data, we can identify patterns or irregularities that may impact the blood bag's stability. For example, excessive shaking or unusual shaking patterns could indicate the presence of clots or other issues that could affect the efficacy of the blood product.

Additionally, weight measurement data can be obtained to track any changes in the weight of the blood bag over time. This data allows us to identify any unexpected weight loss or gain, which could indicate potential leaks, evaporation, or changes in the composition of the blood product. The process involves analyzing and processing the shaking and weight data using various techniques such as statistical analysis, machine learning, and artificial intelligence. Statistical analysis can help identify correlations or trends in the data, while machine learning and algorithms can learn from large datasets to make predictions or classifications related to the quality and safety of the blood product.

Overall, the device extracts essential information from the shaking and weight data to assess the quality and integrity of the blood product, and to enable device monitoring and intervention for safe transfusions.

1. INTRODUCTION

1.1. Background

Blood transfusion is a process important to people who suffer from blood diseases or people who have been exposed to accidents and lost large amounts of blood. This is done as an action to replace blood loss due to bleeding or to those who need it, and consisting of plasma and formed elements such as red blood cells, white blood cells, and platelets. It plays a crucial role in transporting oxygen, nutrients, hormones, and waste products throughout the body. The components of blood work together to support various physiological functions and contribute to the overall health and functionality of the body.[1]

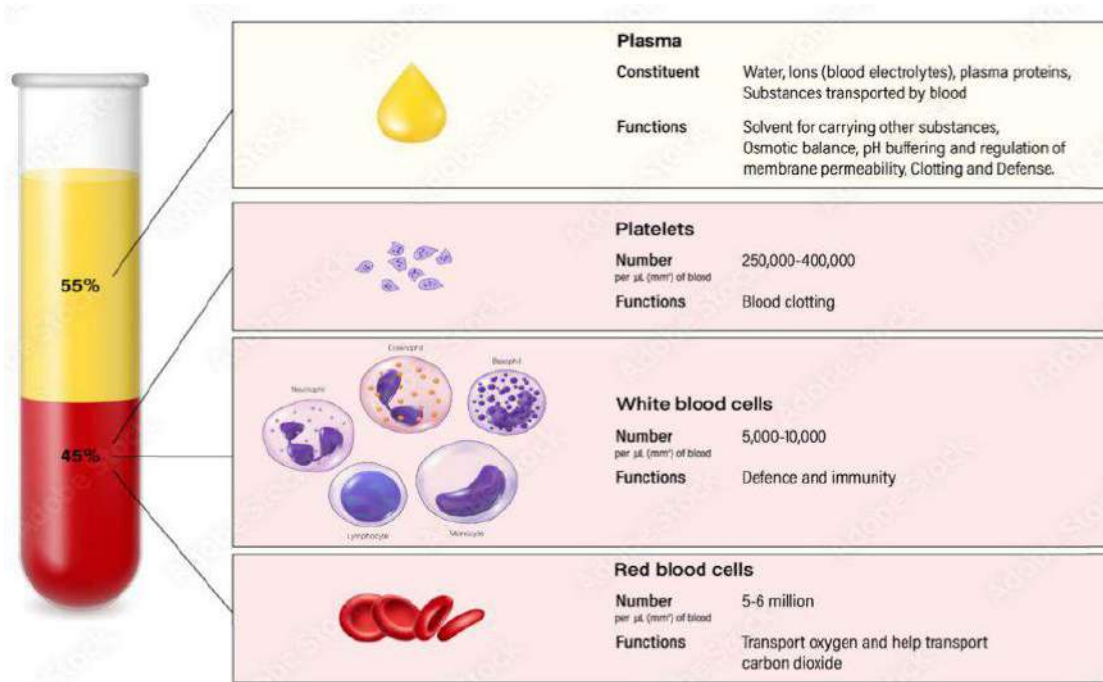
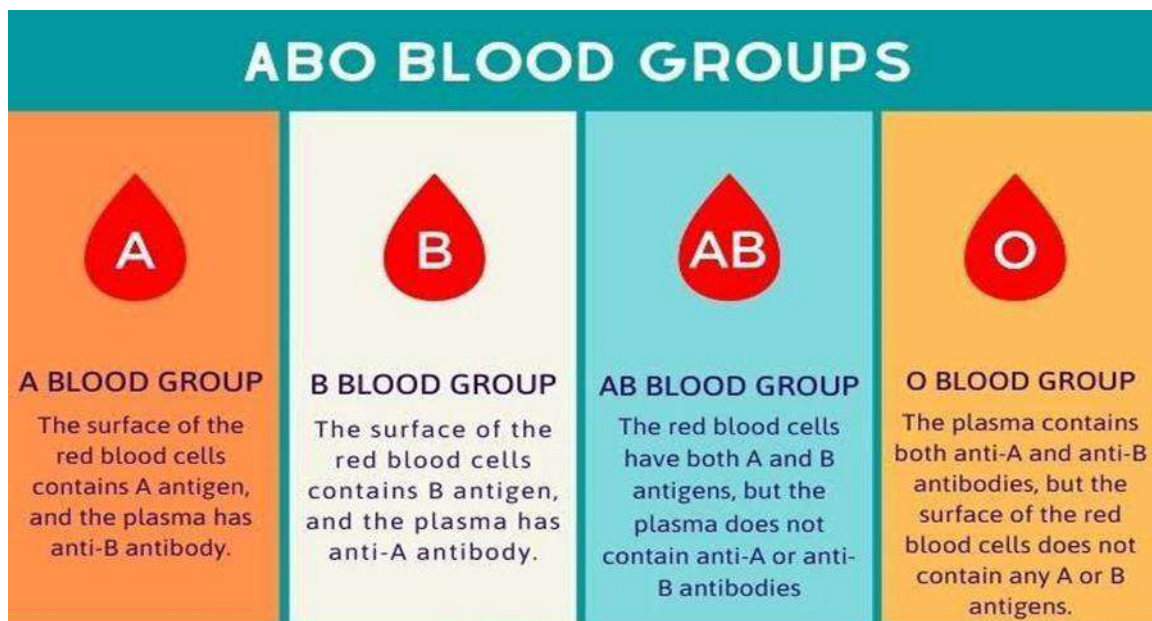


Fig (1-1). Composition of blood

the importance of blood types lies in their impact on medical procedures, transfusions, transplants, and Blood Donations. Understanding blood types ensures safe and effective healthcare practices, and The four main blood types are determined by the presence or absence of specific antigens on the surface of red blood cells.[2]



Blood Group	Antigens	Antibodies	Can give blood to	Can receive blood from
AB	A and B	None	AB	AB, A, B, O
A	A	B	A and AB	A and O
B	B	A	B and AB	B and O
O	None	A and B	AB, A, B, O	O

Fig (1-2). Shows blood groups

and Before a person donates blood, several procedures are in place to ensure the safety of both the donor and the recipient:

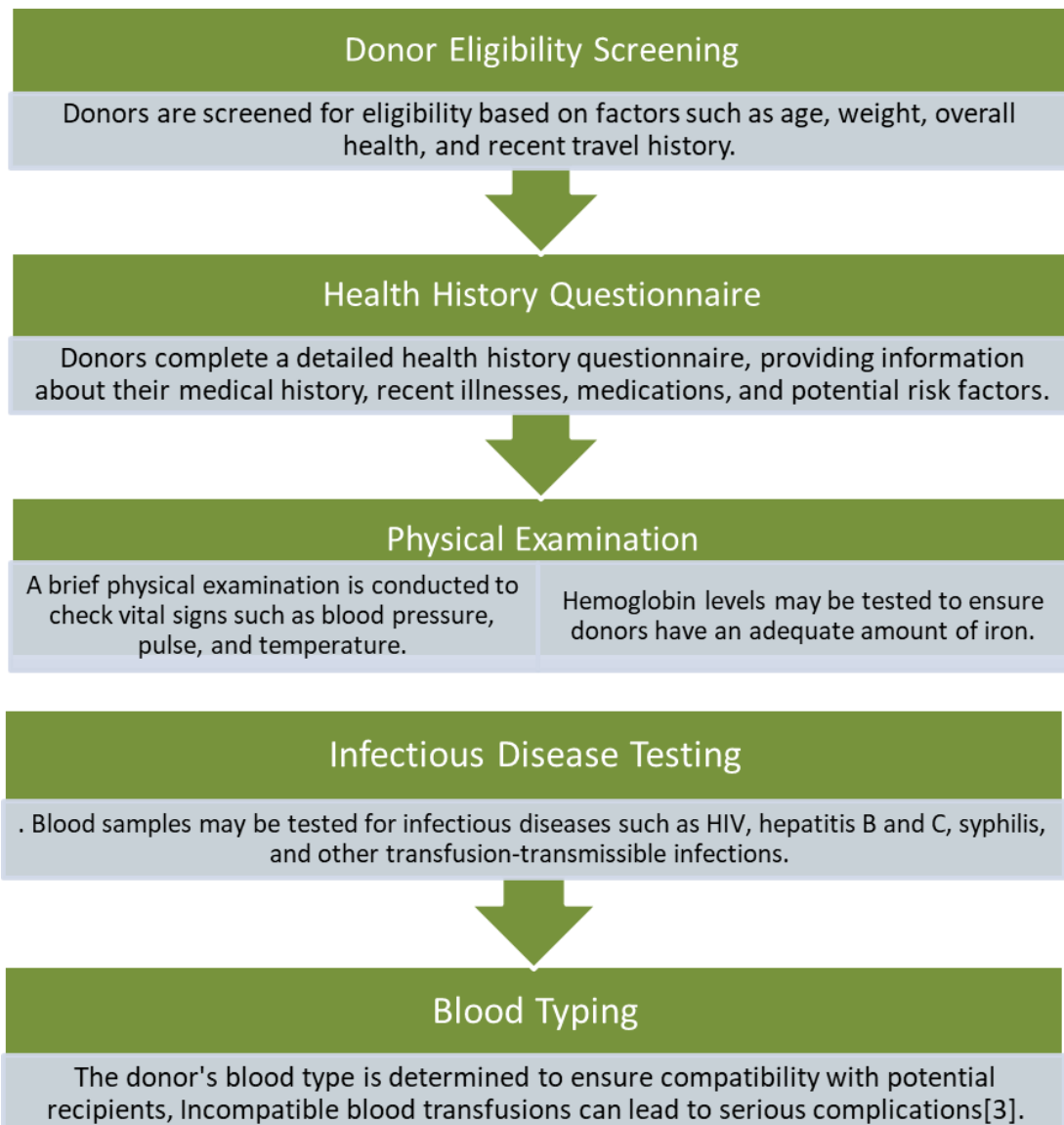


Fig (1-3) Several procedures Before a person donates blood

after blood donation, Blood bags are typically stored in specialized refrigerators known as blood bank refrigerators. These refrigerators are designed to meet the specific storage requirements for blood and blood components to ensure their safety and efficacy, The preservation and storage process typically involves the following steps:

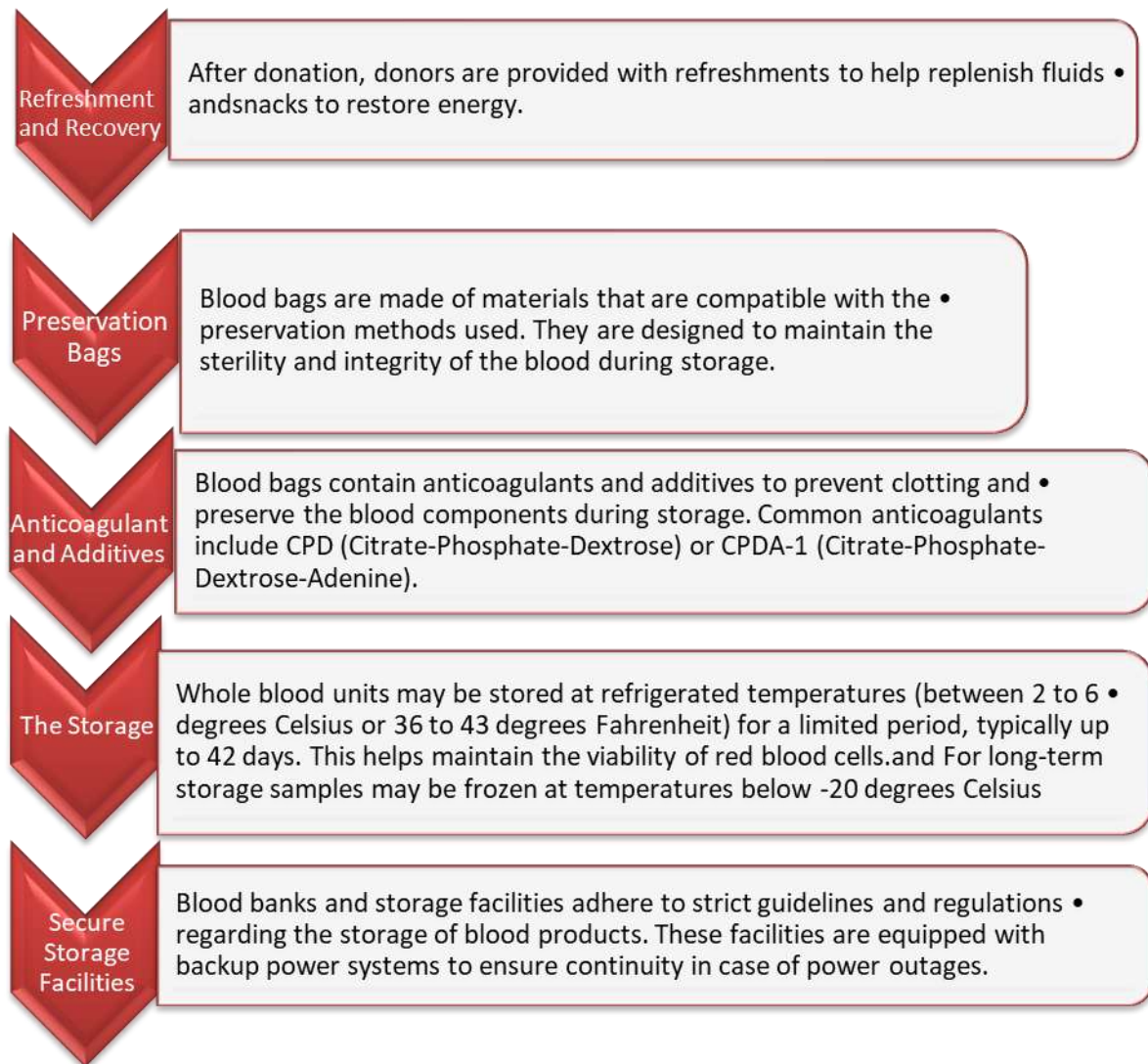


Fig (1-4). Shows procedures of Steps Blood bags

The information written on a blood bag typically includes: name, age, sex, Blood Type, Donor identification number or code, Date and time of donation, Expiration Date, Testing Information, Storage Temperature and Special Instructions.

Blood bags are typically made from plastic materials that are compatible with medical applications and safe for storing blood. The primary plastic material used for manufacturing blood bags is polyvinyl chloride (PVC) or a combination with other plasticizers. PVC provides flexibility and durability, making it suitable for the design and construction of blood bags.[4]

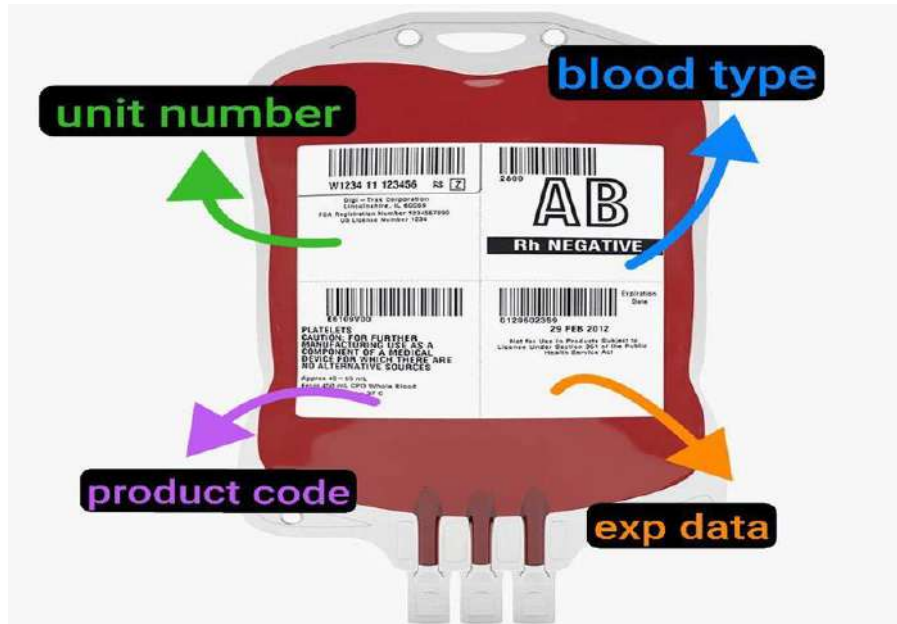


Fig (1-5). blood bag label

Administering a blood transfusion involves several critical steps to ensure the safe and effective transfer of blood from the blood bag to the patient. Here are the general procedures:

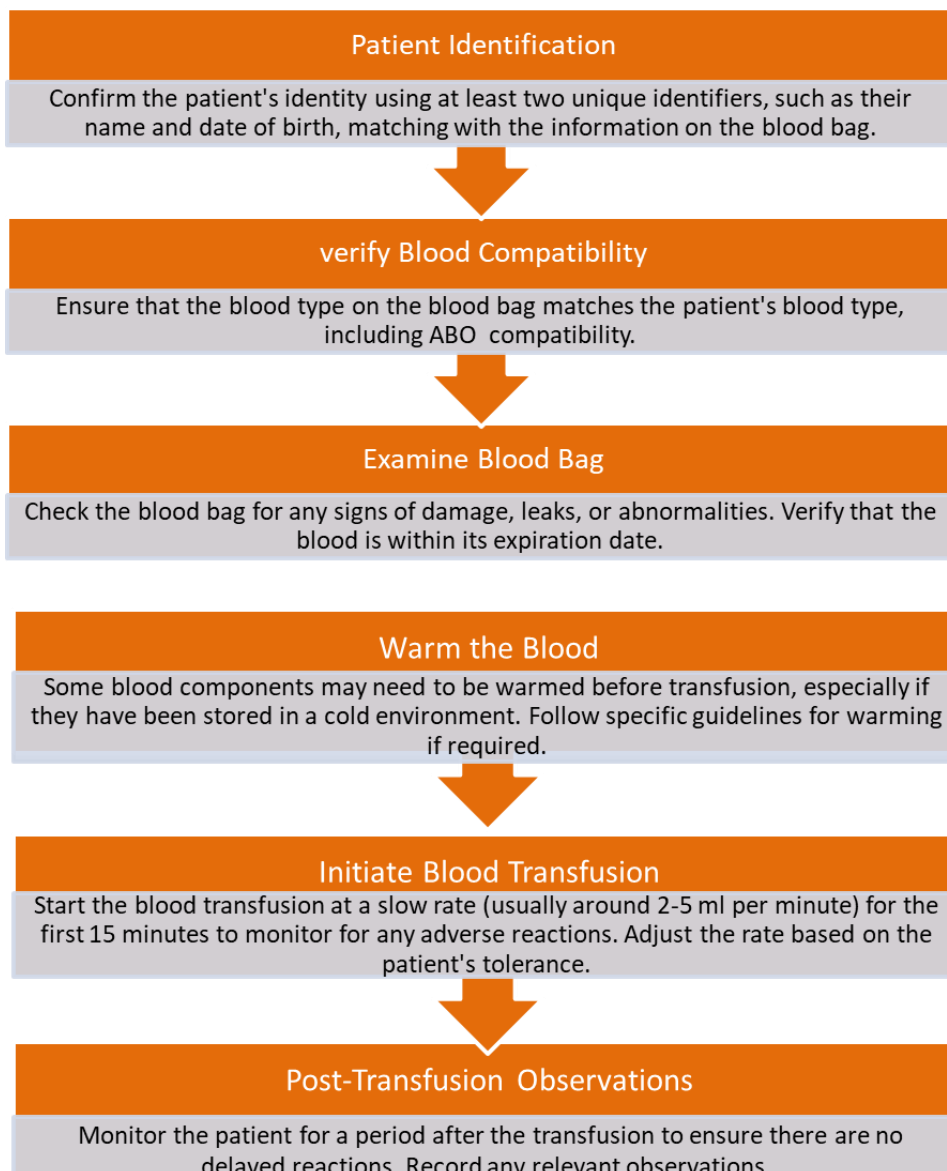


Fig (1-6). Shows procedures of Steps transferring of blood bag to the patient [5].

Blood bag storage refrigerators, also known as blood bank refrigerators, are specialized refrigeration units designed for storing blood and blood components under controlled conditions. These refrigerators play a crucial role in maintaining the integrity, viability, and safety of blood products until they are needed for transfusion or other medical purposes. Key features of blood bag storage refrigerators include:

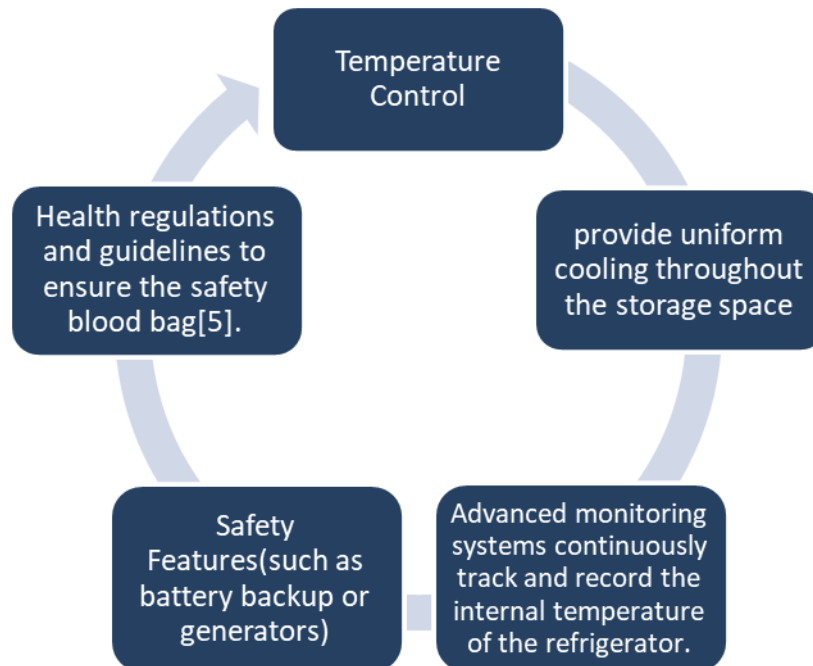


Fig (1-7). blood bag storage refrigerators

Shaking of a blood bag is a controlled mechanical process used to mix the different components of blood and prevent any separation or settling. It ensures the uniform distribution of red blood cells, platelets, plasma, and other components within the bag. Shaking also helps prevent clotting and maintains the integrity of the blood product. The donations were collected into a closed set of sterile blood packs with Citrate Phosphate Dextrose Adenine anticoagulant/preservative. The lower temperature at standard condition keeps the rate of glycolysis and other cellular activities at lower limit and minimizes the proliferation of bacteria. Blood collection mixer tool is a tool used to assist the implementation of blood donations in avoiding the process of blood clots or clots in blood bags that come from donors, by placing blood bags in blood bag containers. Then the container where the blood bag is shaken with the help of a motor that is in this tool [6]. The function of shaking the blood bag is so that the anticoagulant solution in the blood bag is mixed with blood from the donor. The solution in the bag is "Anticoagulant Citrate Phosphate and Dextrose Adenine Solution (CPDA-1)". This solution serves to prevent blood clots or (coagulation) from the donor as long as the blood is in the blood bag [7]. The tool works when the blood transfusion process takes place, blood bags

that have been placed on the device, then in a mixer so that the blood entering the bag becomes homogeneous or the blood does not clot and can spread properly throughout the blood bag [8]. and Weight measurement of a blood bag is crucial for determining the volume of blood or blood components present. This measurement allows healthcare professionals to accurately assess the amount of blood or product being collected, stored, or transfused. It helps in dosing medications correctly and ensures patient safety during transfusion. When the blood bag weight has reached the volume selection setting, the device will automatically stop the flow of blood in the blood bag tube. For the process of using a tool that is placing a blood bag with a size that has been chosen to place a blood bag on the device, and the blood bag tube is passed on a clamp on the device [9]. The Blood Collection Monitor tool generally also analyzes blood flow every second during the donation process. In accordance with the tool's instruction manual, flow rates during a transfusion can be categorized into three levels as follows: low flow, optimal flow, and high flow rate. "Low flow" indicates a flow rate of less than 10 mL every 30 seconds, whereas "high flow" is more than 90 mL every 30 seconds, and it is considered optimal when the flow rate is between 10 mL and 90 mL every 30 seconds [10].

Table (1-1). Shows Differences between the original device and the improved device of blood shaking device.

	Old Device	New Device
Technology	The old device may rely on traditional mechanical mechanisms for measuring weight and vibration, with limited automation and precision.	The new device likely incorporates advanced sensor technology and digital controls for precise measurement and automation.
Accuracy	The accuracy of weight and vibration measurements may vary and be less reliable due to manual operation.	The new device offers improved accuracy in weight and vibration measurements, thanks to advanced sensors and automated controls.
Integration	The old device may operate as a standalone unit with limited connectivity or integration capabilities.	The new device is likely designed for seamless integration into digital healthcare systems, allowing for real-time monitoring and data recording.
User Interface	The user interface of the old device may be basic, with manual controls and limited feedback.	The new device features a modern user interface with touchscreen displays, intuitive controls, and visual feedback for easy operation.
Maintenance	Maintenance of the old device may require frequent manual checks and adjustments, leading to downtime and potential reliability issues.	The new device is designed for easier maintenance, with self-diagnostic capabilities and remote monitoring features to minimize downtime and ensure continuous operation.
Size and Portability	The old device may be bulky and less portable, limiting its flexibility in various healthcare settings.	The new device is likely more compact and lightweight, making it easier to transport and deploy in different clinical environments.

1.2. AIM OF THE PROJECT

The aim of this study is to develop a model for the Shaking and weight of the blood bag The best and least expensive way with the possibility of the device to work even in the worst conditions so the primary goal of this research study is:

1. Development and implement a laboratory a model for the Shaking and weight of the blood bag that is low in cost and has few flaws.
2. Providing a system to control the natural blood temperature with time synchronization.
3. Providing a Wi-Fi network to control results via phone with the lowest error rate.

the dependency devices on external electric power sources limits its application in rural areas as well as large-scale donation camps. The present study offers a mechanical blood collection monitor which does not require any external power for its functioning and thereby overcomes the drawbacks of the conventional device.



Fig (1-8). Shaking of Blood Bags Device

2. THEORETICAL PART

2.1. Literature Review

"Design and Development of an Automated Blood Bag Shaker" by S Chandra Bimantara, S. Her Gumiwang Ariswati1, and Muzni Zahar. focuses on the design and development of a device specifically aimed at shaking blood bags in a controlled and consistent manner. This automated blood bag shaker is intended to simulate transportation conditions and assess the impact of shaking on blood integrity.

The paper starts by discussing the importance of proper blood bag shaking during transportation. Blood bags need to be shaken to prevent clot formation and ensure proper mixing of blood

components, such as red blood cells and additives. However, excessive shaking can lead to hemolysis (rupturing of red blood cells) or other undesirable effects. Therefore, an automated shaker that can control the intensity and duration of shaking is crucial to maintain the quality of the blood.

The authors describe the design of their automated blood bag shaker, which consists of several key components. The heart of the device is a motor that provides the shaking motion. The motor is connected to a control circuit, which regulates the speed and duration of shaking. The authors also discuss the considerations in choosing an appropriate motor and control mechanism to ensure precise and consistent shaking.

To enable the user to monitor and control the shaking parameters, the device includes a user interface. This interface allows the user to set the shaking speed, duration, and intensity based on specific requirements or standards. The authors highlight the importance of providing a user-friendly interface to facilitate easy operation and customization.

In terms of safety features, the device incorporates mechanisms to prevent excessive shaking or damage to the blood bags. These include sensors and feedback systems that detect abnormal vibrations or forces. halt the shaking process to avoid potential harm.

The researchers also discuss the validation process of their automated blood bag shaker. They describe the experiments conducted to ensure that the device produces consistent shaking patterns and does not cause any damage to the blood bags. The validation process involves testing the device with different blood bag sizes, monitoring for any signs of hemolysis or clot formation, and comparing the results with manual shaking methods.

Overall, the paper provides a comprehensive insight into the design and development of an automated blood bag shaker. The device aims to address the need for controlled and consistent shaking of blood bags during transportation and storage. By offering a user interface, safety features, and validation results, the researchers present a practical solution for maintaining the quality and integrity of blood products during transit[11].

2.2. System design Of Shaking Blood Bag Device

The theme of system design in relation to shaking and weight of the blood bag primarily revolves around the development of an automated mechanism to shake blood bags and the consideration of their weight during the design process. Let's explore this in more detail:



Fig (2-1). Shaking of Blood Bags Device

1. Shaking of Blood Bags: Shaking blood bags is an essential part of the blood processing procedure. It ensures proper mixing of the contents within the bag, such as the blood component, anticoagulant solution, and preservatives. The shaking motion helps maintain homogeneity and prevents clotting or settling of specific components. By automating the shaking process, the aim is to improve efficiency, accuracy, and consistency in blood processing and handling.

2. System Design Considerations: When designing an automated blood bag shaker system, several factors need to be considered:

a. Shaking Mechanism: The system should incorporate a reliable and precise shaking mechanism. This can include a motor-driven mechanism or different motion types such as oscillatory, reciprocal, or vibratory motion. The design should ensure that the shaking motion is gentle enough to prevent damage to the blood bag while being robust enough for efficient mixing.

b. Control System: An effective control system needs to be integrated into the design. It should allow for adjustable shaking time and intensity parameters to accommodate different blood bag sizes and requirements. The control system should also provide feedback and monitoring capabilities to

ensure the shaking process is consistent and optimal.[12]

- 1- [START] Switch
- 2- [END] Switch
- 3- [TIME] Switch
- 4- [CLAMP] Switch
- 5- LCD Display Panel
- 6- [UP] Switch
- 7- [DOWN] Switch
- 8- [PRESET] Switch

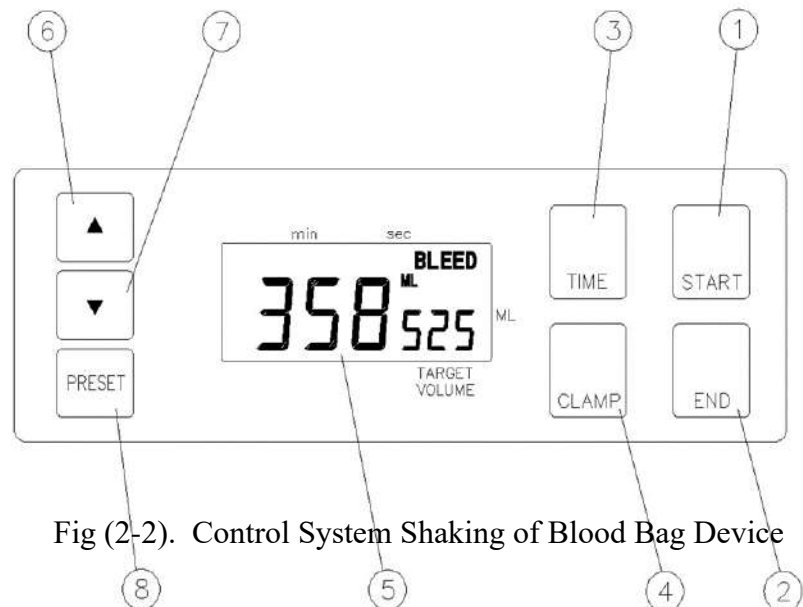


Fig (2-2). Control System Shaking of Blood Bag Device

c. Safety Measures: Safety is paramount in the design of any system involving biological materials like blood bags. The system should incorporate safety features to prevent accidents, such as mechanisms to secure the blood bags during shaking, emergency stop functions, and protective enclosures to minimize the risk of exposure to hazards.

3. Weight Considerations:

The weight of the blood bag is another important aspect to consider in system design. The weight can vary based on the volume and type of blood component contained within the bag. It is crucial to accurately measure and monitor the weight during the shaking process. This can be achieved through load sensors or other weighing mechanisms integrated into the system. Monitoring the weight enables the system to detect abnormalities, such as leakage or insufficient volume, ensuring the quality and integrity of the blood product.[12]

- 1- Main Display (Volume/Weight)
- 2- Preset Target Volume Display
- 3- Low Battery Indicator
- 4- [ALARM] Indicator
- 5- [TIME] Indicator
- 6- [BLEED] Indicator
- 7- [END] Indicator
- 8- [ML] Indicator
- 9- [GRAM] Indicator

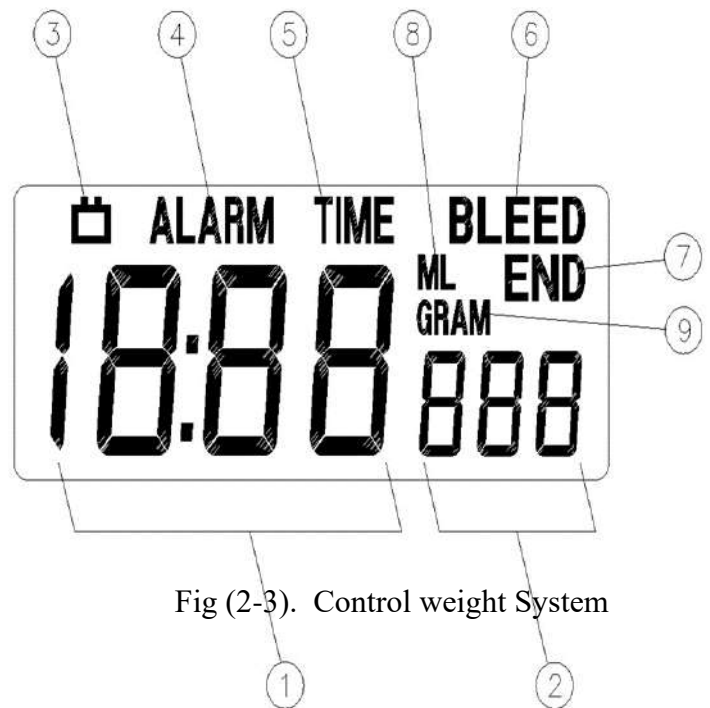


Fig (2-3). Control weight System

2.3. Sensor Calibration Shaking Of Blood Bag:

Sensor calibration is crucial for accurate data acquisition. It involves adjusting the sensor's output to match the known values of the quantity being measured. Calibration typically involves comparing sensor readings to known reference values and adjusting sensor settings accordingly.

1. Sensor Calibration for Shaking:

when designing a system involving shaking blood bags, it is important to incorporate sensors for monitoring and controlling the shaking process. These sensors, such as accelerometers or motion sensors, measure the intensity, frequency, and duration of the shaking motion. Proper calibration of these sensors is crucial to ensure accurate and consistent measurements. Calibration involves mapping the sensor's output to known reference values and adjusting its response to minimize errors. [13]

2. Sensor Calibration for Weight Measurement:

Accurate weight measurement of blood bags is crucial for determining the correct volume of blood components and ensuring their quality. To achieve this, load sensors or weighing mechanisms are used in the system and must be calibrated regularly. Calibration involves determining the sensitivity, linearity, and zero offset of the sensor by comparing its output to known weights. This calibration process establishes a relationship between the sensor's output and the corresponding weight, allowing for accurate weight readings. Regular calibration is necessary to account for changes in sensor performance caused by factors such as temperature variations or sensor drift. By maintaining accuracy and consistency in weight measurements, the system can ensure the integrity and quality of blood components throughout its operation [13].

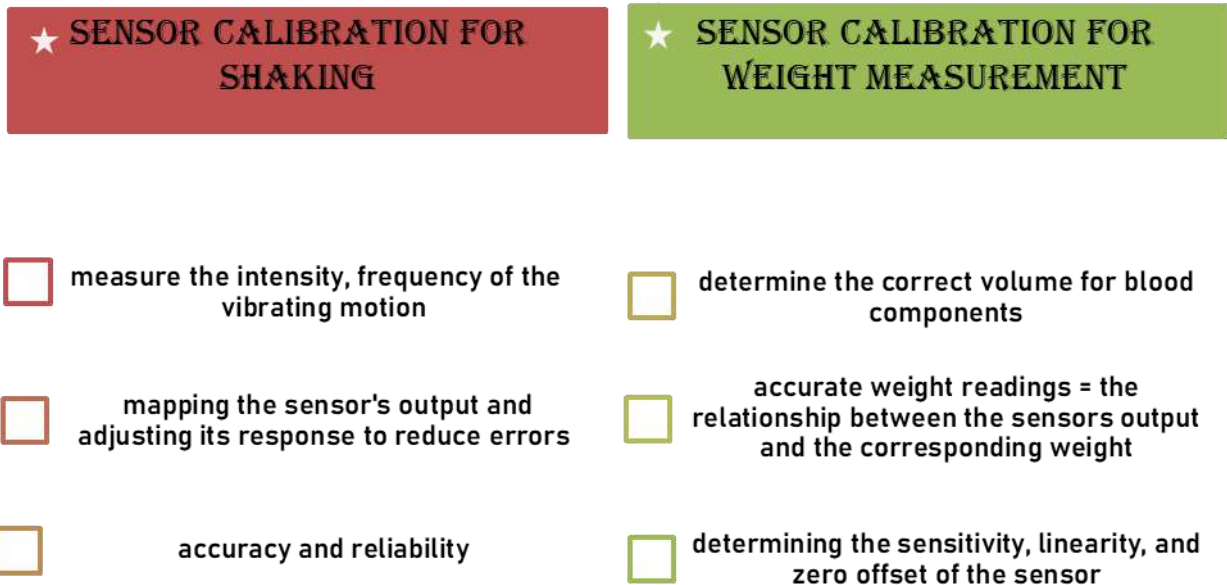


Fig (2-4). Sensor Calibration for Shaking and Weight Measurement Of Shaking Blood Bag

2.4. Data Acquisition Shaking of Blood Bags Device:

To acquire data from a shaking blood device, you typically need sensors to measure parameters such as temperature and weight . These sensors gather data which can be recorded and analyzed to monitor the device's performance and the quality of the blood samples.

1. Data Acquisition for Shaking:

Data acquisition for shaking involves capturing and recording various parameters related to the shaking process, such as the amplitude, frequency, acceleration, and duration of the motion.To acquire this data, sensors like accelerometers or motion sensors are utilized to measure the physical parameters associated with shaking.. data acquisition systems consist of hardware components, such as the sensors, signal conditioning circuits, and an analog-to-digital converter (ADC), which converts the analog sensor signal into digital data.[14]

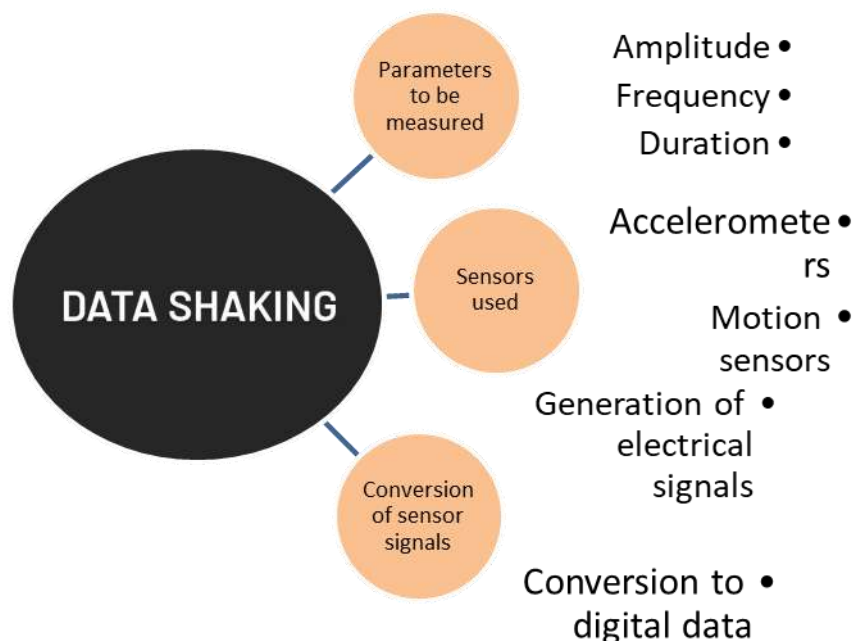


Fig (2-5). Data Acquisition for Shaking Blood Bags Device

2. Data Acquisition for Weight Measurement Shaking Blood Bags Device:

Data acquisition for weight measurement involves capturing and recording the weight of the blood bag accurately. Load sensors or weighing mechanisms are typically used to acquire weight data. These sensors generate electrical signals proportional to the weight, which are then converted into digital format for data processing. sensors, signal conditioning circuits, and an ADC. The digital data is then stored and used for further analysis or control [14].

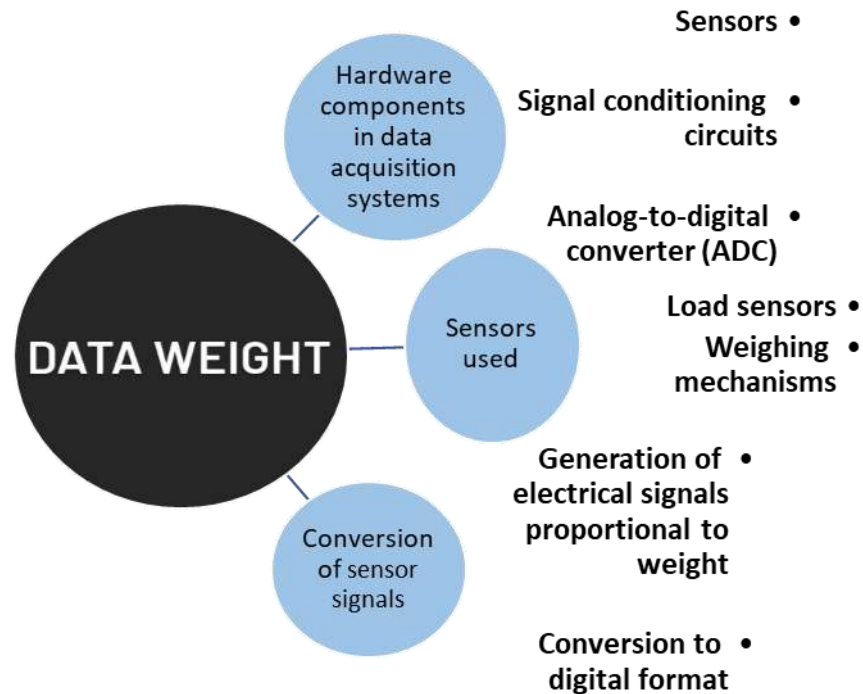


Fig (2-6). Data Acquisition for Weight Measurement Shaking of Blood Bags Device

2.5. Date Analysis Shaking of Blood Bags Device:

Data analysis is a crucial process in evaluating blood bags' shaking and weight aspects. By examining and interpreting the collected data during testing and validation, manufacturers can uncover patterns, trends, and relationships. Shaking data analysis focuses on assessing the bag's ability to withstand mechanical stress, identifying weaknesses in design or construction, and making informed decisions to improve durability. Weight data analysis ensures compliance with specified standards, identifying variations that may impact accurate blood component measurements. Analyzing data across multiple samples helps identify trends and correlations, optimizing manufacturing processes. Advanced techniques like machine learning and predictive modeling enable the development of models that forecast bag behavior under different shaking conditions or estimate expected weight. Adhering to privacy and regulatory guidelines is crucial in handling patient data securely. In summary, data analysis provides valuable insights into the structural integrity, durability, and adherence to weight standards of blood bags. [15].

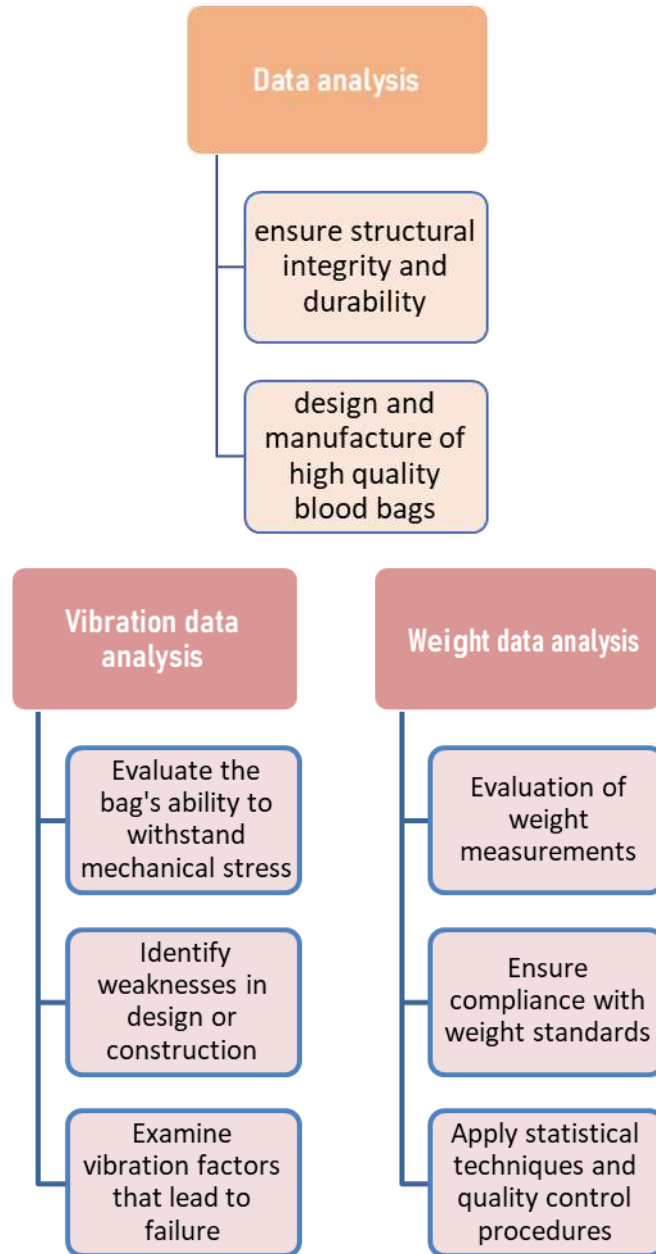


Fig (2-7). Date Analysis Shaking of Blood Bags Device

2.6. System integration Shaking of Blood Bags Device:

Data analysis is a crucial process in evaluating blood bags' shaking and weight aspects. By examining and interpreting the collected data during testing and validation, manufacturers can uncover patterns, trends, and relationships.[16]

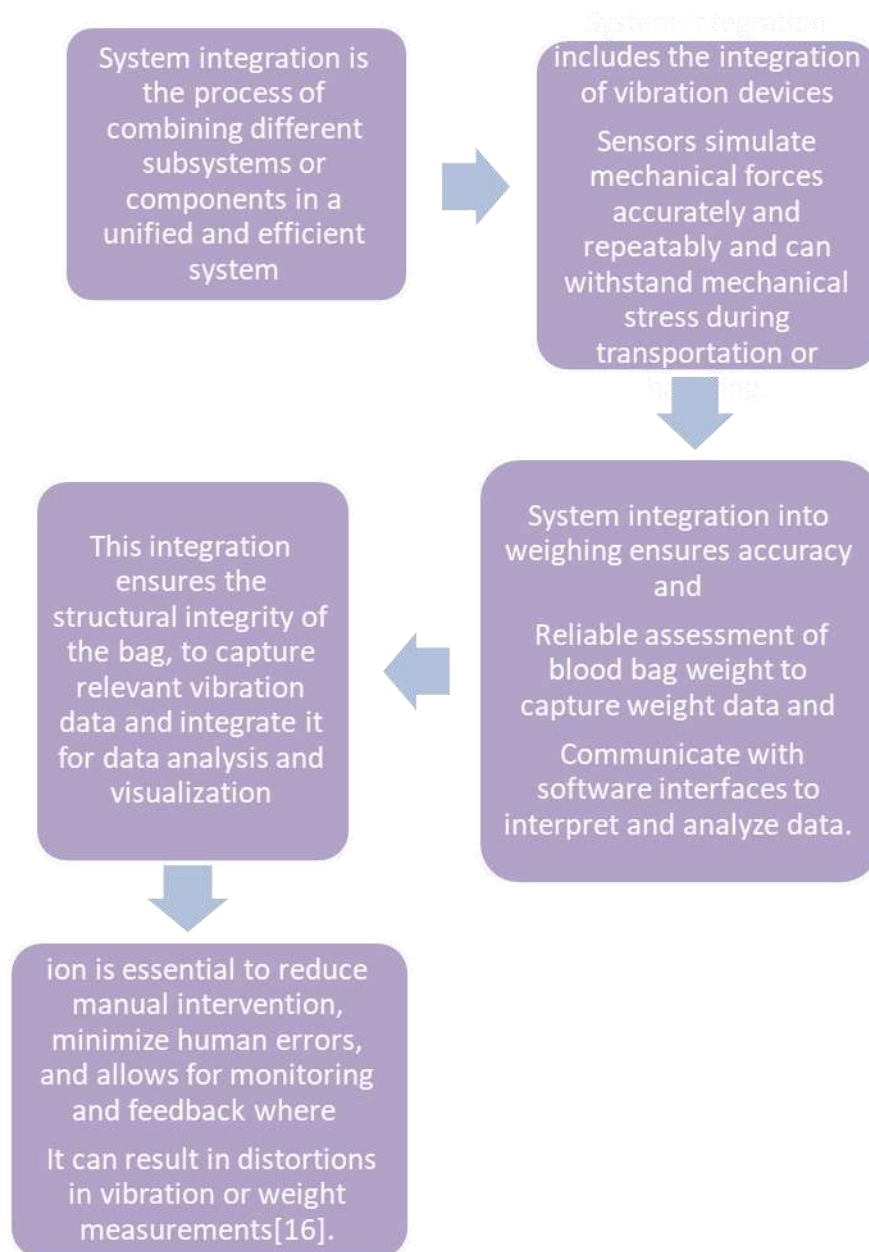


Fig (2-8). System integration Shaking of Blood Bags Device

2.7. Evaluation Shaking Of Blood Bag:

The evaluation of shaking and weight of blood bags is crucial for ensuring their quality, safety, and reliability in medical procedures. Shaking evaluation involves subjecting the bags to controlled mechanical stress to assess their ability to withstand real-world conditions without compromising integrity or causing leakage. Various aspects, such as deformation resistance, closure system functionality, and visual inspections for damage, are observed and measured during this evaluation. Weight evaluation focuses on accurately measuring the weight of blood bags, as it corresponds to the volume of blood or component contained within. Precise weight measurements are essential for dosage calculations, transfusion compatibility, and quality control. Calibrated weighing scales or load cells specifically designed for blood bags are used for weight evaluation. Standards and guidelines are in place to ensure consistent and comparable results. Data management and analysis, using automated systems and software, aid in capturing, recording, and analyzing evaluation parameters and measurements. Trained personnel play a vital role in adhering to evaluation protocols and maintaining accuracy. Overall, the evaluation of shaking and weight ensures the safety and reliability of blood bags, identifying weaknesses or defects before their use in medical procedures, and maintaining patient safety and optimal outcomes in blood transfusion practices[17].

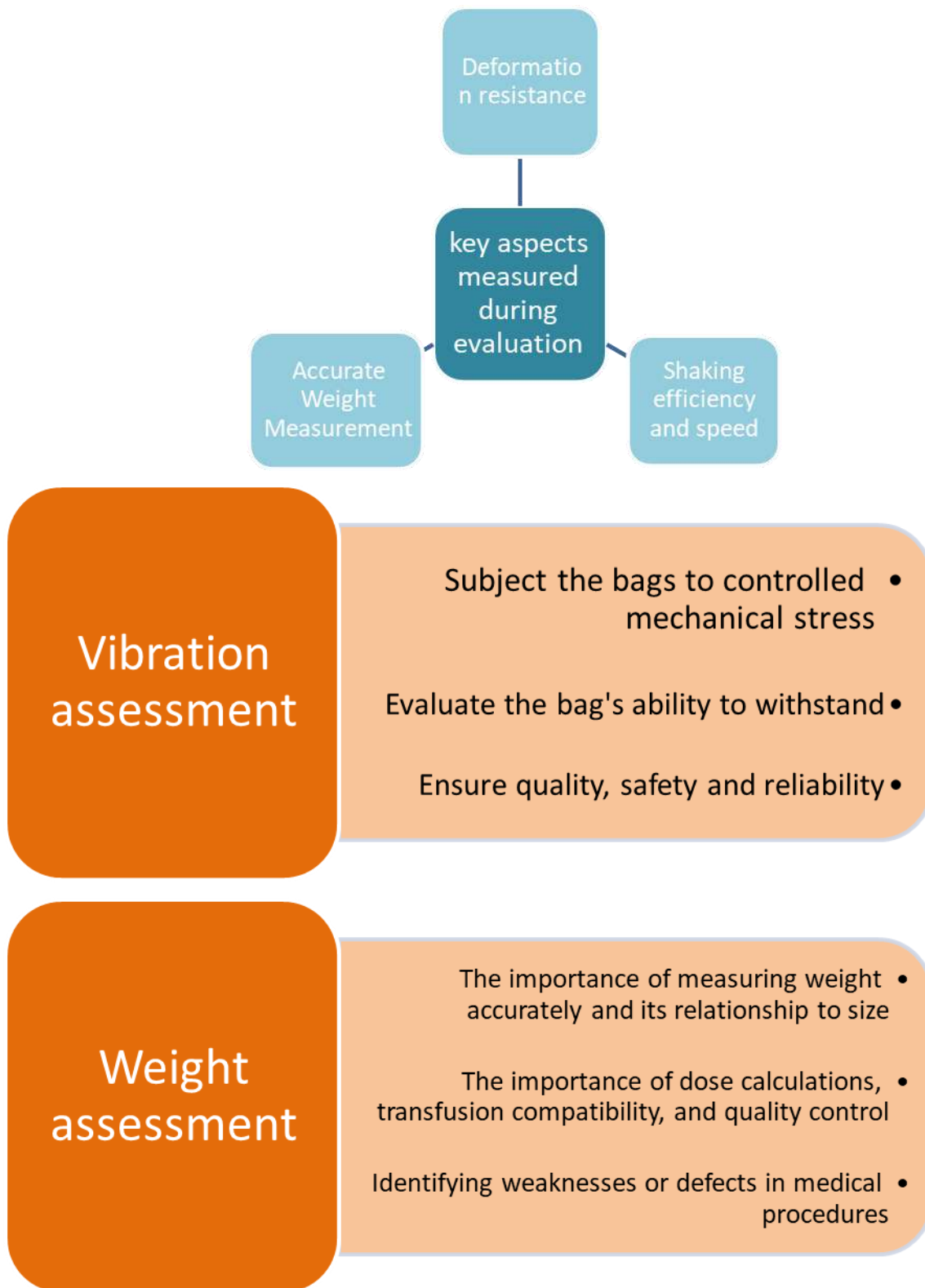


Fig (2-9). Evaluation (Vibration assessment and Weight assessment) Shaking Blood Bag

3. PRACTICAL IMPLANTATION

3.1. System Overview

The device typically consists of a platform that oscillates or rotates, effectively mixing the contents without causing hemolysis (rupture of red blood cells).

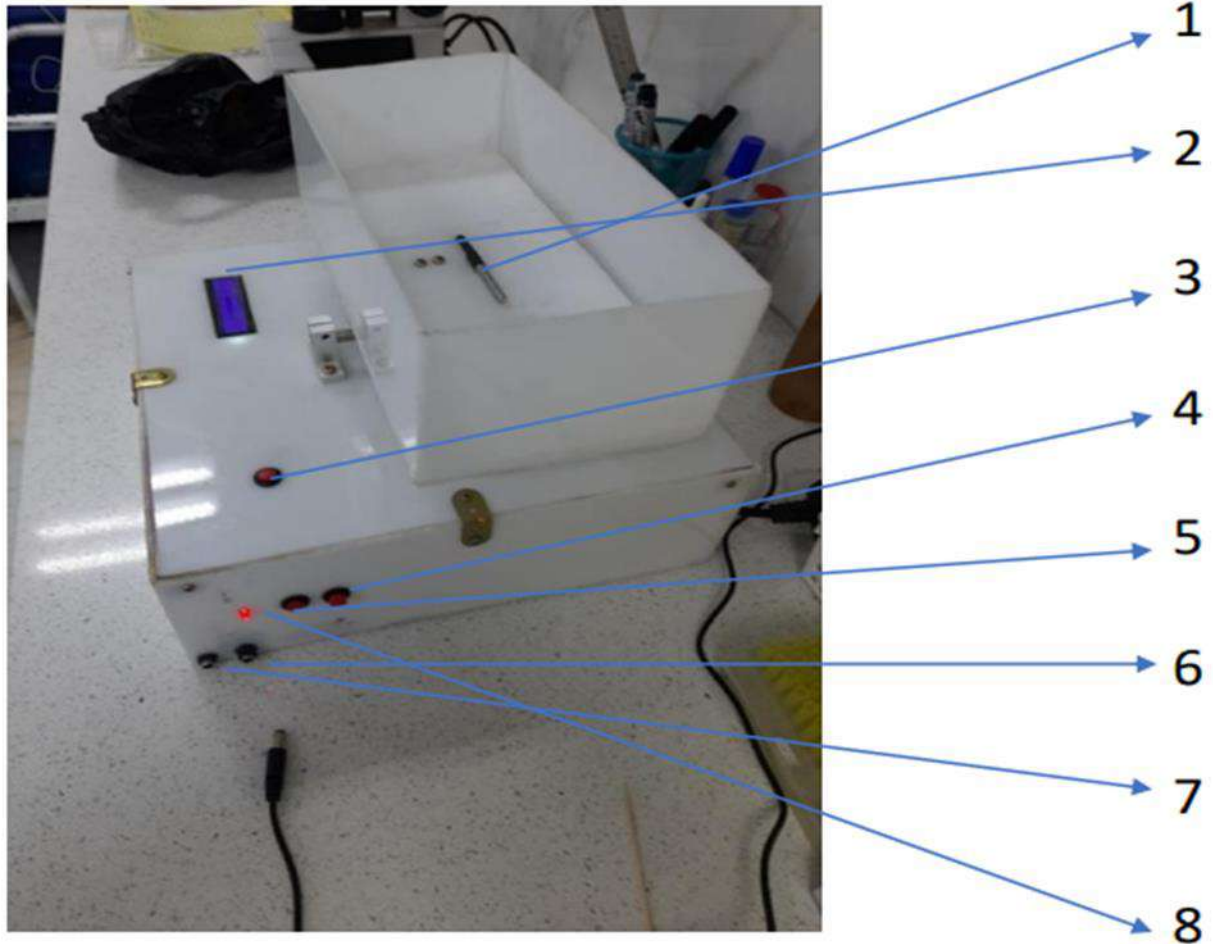


Fig (3-1). Component Of Shaking Blood Bag Device

1. Temperature sensors: These sensors can monitor the temperature of the samples.
2. display screens :Enables users to specify the blood bag weight and temperature.
3. The operation port of a display screen and temperature sensor.
4. the operation button might be used to initiate the shaking process, pause or stop the shaking motion.
5. A battery port :This feature provides portability and flexibility.
6. electrical port :This port allows the device to receive electrical power.
7. Power supply: Provides electricity to the device for operation.
8. The alarm sensor : designed to detect certain conditions or events and trigger an alarm to alert the user.

3.1.1. Operation Shaking Blood Bag Device

1. Startup and Operation

The Blood Mixer can be run on either AC line power using the included power supply or battery power using the included battery. Running the unit on line power with the battery installed will charge the battery. Fit the barrel jack connector of the line cord into the port on the back of the Blood Mixer and turn the power switch to the on (I) position. The Blood Mixer will initialize and immediately tare the scale. Once this activity completes, the unit is ready for use and the following screen appears

3.1.2. Settings Screen Of Shaking Blood Bag

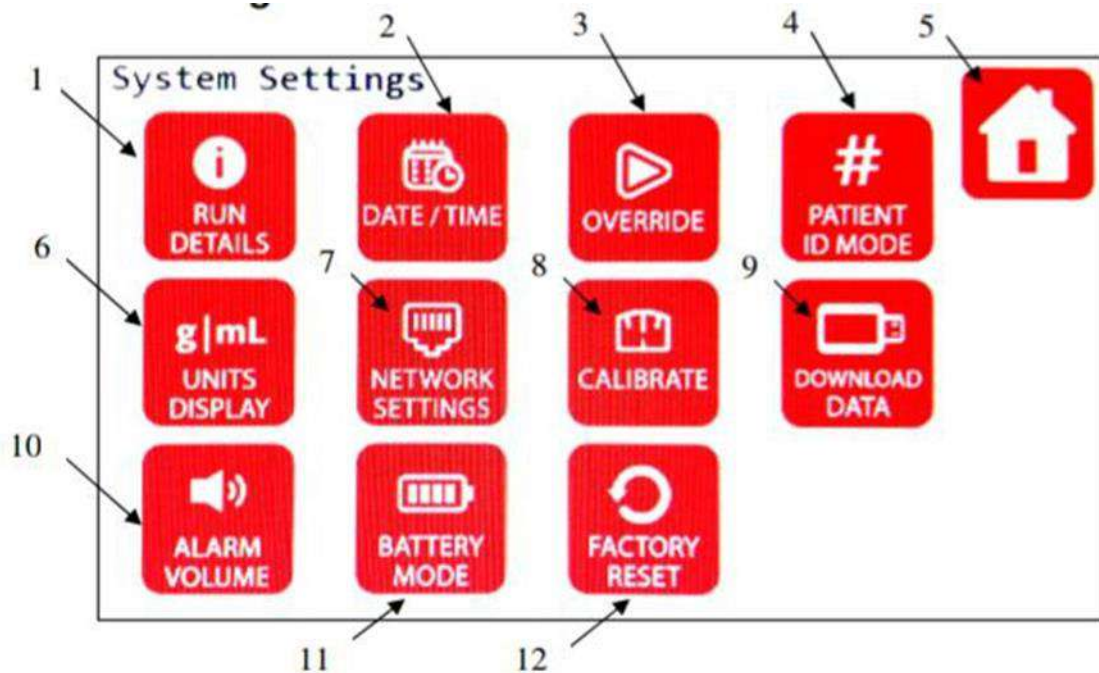


Fig (3-2). Settings Screen Of Shaking Blood Bag

1. **RUN DETAILS:** Shows the full data on the current run.
2. **DATE/TIME:** Set the current date and time. Does not auto-update for Daylight Savings or other time changes. Date and time are factory set and verified to EST and will need to be changed and verified based on actual time zone unit is being used in. It is recommended to conduct periodic time verifications as necessary.
3. **OVERVERRIDE:** Allows continuation of the run if the target has been reached during a therapeutic collection.
4. **PATIENT ID MODE:** Enable or disable the Patient ID Mode. When enabled, the device will request the Patient ID for a run.
5. **HOME:** Returns to the home screen.
6. **UNITS DISPLAY:** Select among displaying milliliters, grams, or both.
7. **NETWORK SETTINGS:** Allows for assignment of static or dynamic IP address, and other network settings.
8. **CALIBRATE:** Used to calibrate weigh scale. Suggested calibration weights are an empty tray for the zero value and a tray with an independently calibrated 500g weight. Calibration should be performed annually or whenever unit is moved or being returned to service after maintenance.

9. **DOWNLOAD DATA:** Used to download the data stored on the device memory in user-selectable time increments (last 24 hours, last 7 days, last 1 month, or all data in the memory). A USB flash drive must be connected to the USB port on the left side of the unit.
10. **ALARM VOLUME:** The audible volume of system alarms can be increased or decreased by pressing the + and – buttons, respectively.
11. **BATTERY MODE:** Toggle between low power mode on and off.
12. **FACTORY RESET:** Resets all calibration values and user changes to the unit [18].

3.1.3. Arduino Nano Pinout Of Shaking Blood Bag

The Arduino Nano is a compact and versatile microcontroller board based on the ATmega328P microcontroller. It is similar to the Arduino Uno, but smaller in size and has a lower power consumption. The Nano has a USB interface for easy programming and communication with a computer, and can be powered either by USB or an external power supply. The board has 14 digital input/output pins (of which 6 can be used as PWM outputs), 8 analog inputs, and a 16 MHz quartz crystal. It also has a mini USB connector, a reset button, and a power LED indicator. The Arduino Nano is widely used in various DIY electronics projects, and its small size makes it ideal for embedding into prototypes and projects with limited space. It can be programmed using the Arduino IDE, which is available for free download online, and has a large community of users and resources for support and inspiration. The Arduino board PINOUT discretion as shown in fig (3). [19]:

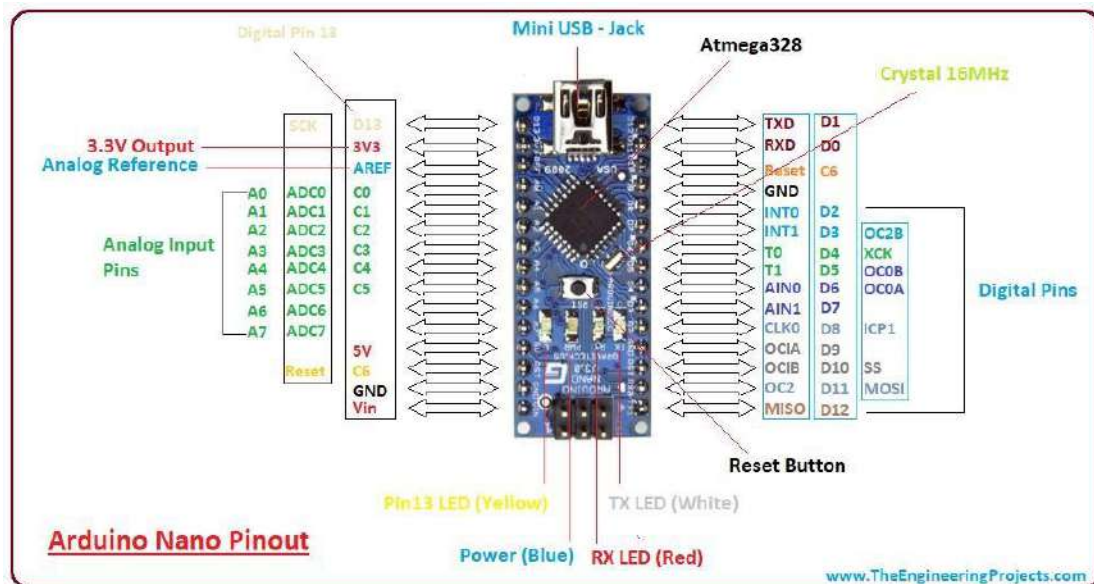


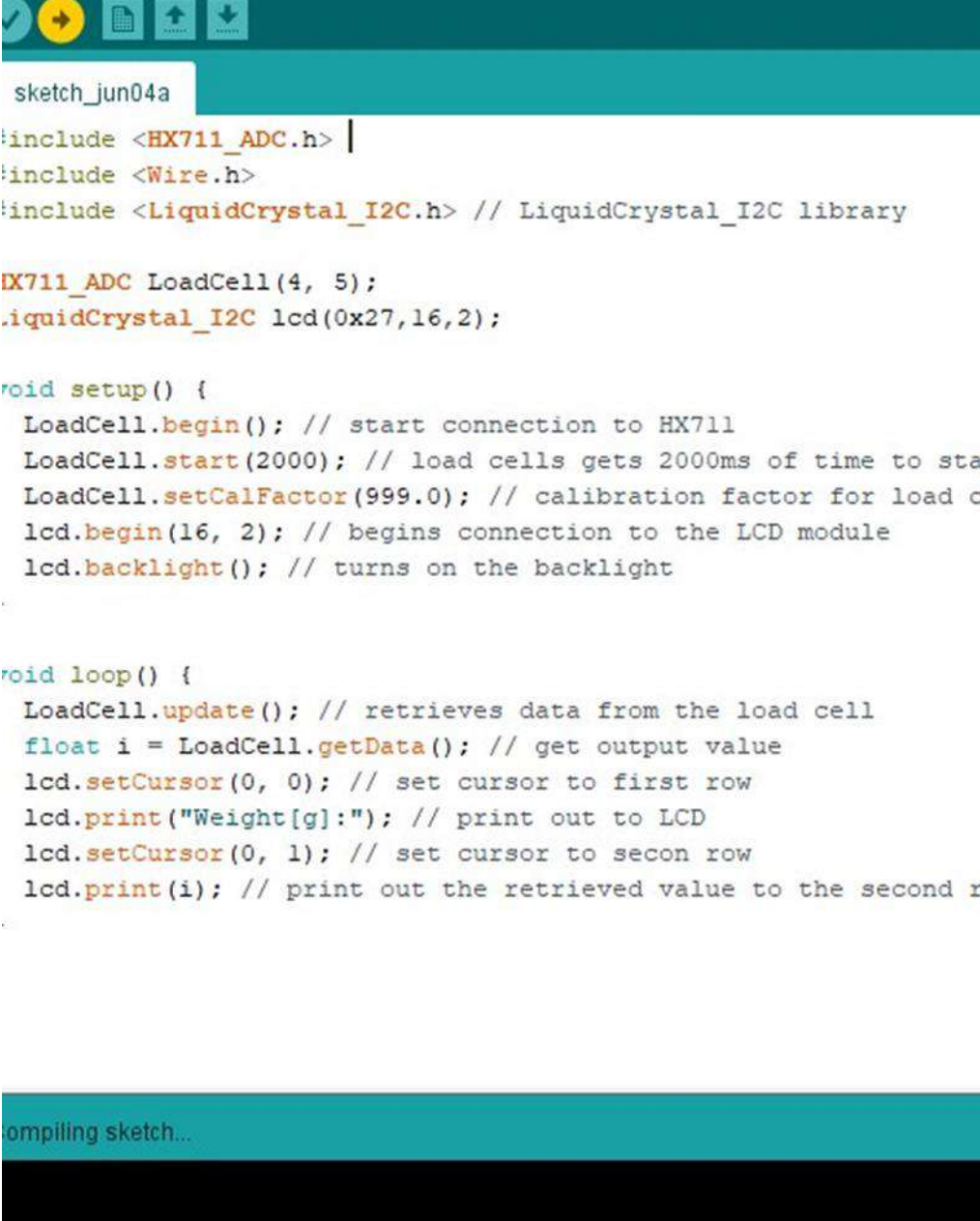
Fig (3-3) Arduino Nano Pinout Of Shaking Blood Device

Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

1. **Inexpensive** - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than \$50.
2. **Cross-platform** - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
3. **Simple, clear programming environment** - The Arduino Software (IDE) is easy-touse for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
4. **Open source and extensible software** - The Arduino software is published as open-source tools, available for extension by experienced programmers. The language can be expanded through

C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.

5. Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money[19].



```

sketch_jun04a
#include <HX711_ADC.h> |
#include <Wire.h>
#include <LiquidCrystal_I2C.h> // LiquidCrystal_I2C library

HX711_ADC LoadCell(4, 5);
LiquidCrystal_I2C lcd(0x27,16,2);

void setup() {
  LoadCell.begin(); // start connection to HX711
  LoadCell.start(2000); // load cells gets 2000ms of time to sta
  LoadCell.setCalFactor(999.0); // calibration factor for load c
  lcd.begin(16, 2); // begins connection to the LCD module
  lcd.backlight(); // turns on the backlight

void loop() {
  LoadCell.update(); // retrieves data from the load cell
  float i = LoadCell.getData(); // get output value
  lcd.setCursor(0, 0); // set cursor to first row
  lcd.print("Weight[g]:"); // print out to LCD
  lcd.setCursor(0, 1); // set cursor to secon row
  lcd.print(i); // print out the retrieved value to the second r
  
```

compiling sketch...

Fig (3-4). Shows A CODE Programming Arduino Nano Pinout Of Shaking Blood Bag

3.1.4. Gear Motor High Torque (DC 12V 200RPM)

A **DC motor** is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor. DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. The advent of

power electronics has made replacement of DC motors with AC motors possible in many applications.[20]



Fig (3-5). DC Motor Of Shaking Blood Bad Device

Specifications:

Rated Voltage: 12V

Speed: 200RPM

Material: Metal

Rated Torque: 2.2Kg.cm

Reduction Ratio: 1:24

Rated Current: 0.5A

D Shaped Output Shaft Size: 6*14mm (0.24" x 0.55") (D*L)

Gearbox Size: 37 x 24.5mm (1.46" x 0.96") (D*L)

Motor Size: 36.2 x 33.3mm (1.43" x 1.31") (D*L)

Mounting Hole Size: M3 (not included) **Application:** Vending equipments, pan camera, slot machine, money detector, coin refund devices, automatic doors, peritoneal machine, toys motor etc.

NOTES

1. Use tolerance: Pay attention to the use of voltage and current range, otherwise the motor performance and motor life will decline.
2. Handling motors: Gently, as far as possible the use of motor shell part.
3. Motor wiring: Red lead to the positive electrode, black lead to the negative pole, if reversed, the motor rotation in the opposite direction.
4. Overload: As far as possible within the specified load range, prohibit motor blocking or close to the stall state for too long time to runs. Otherwise, the motor will burn out.
5. Motor storage:
 - Storage temperature: 0°C - 40°C;
 - Storage humidity: 15% -90% RH;
 - Avoid placing in high temperature, high humidity and corrosive gases.

3.1.5. DC-DC Power Supply Step Down Module (LM2596S)

The voltage-regulating module can output voltage values ranging from 1.25V to 35V by adjusting potentiometer with ease.

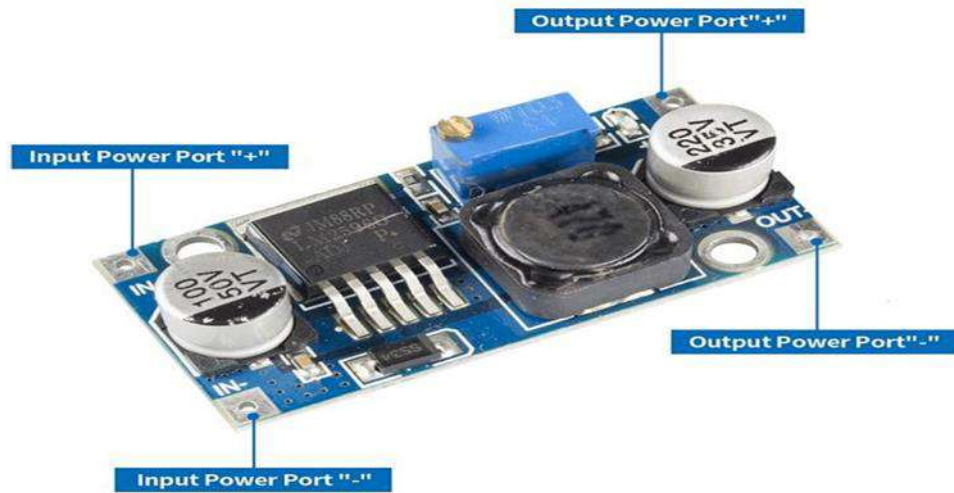


Fig (3-6) DC-DC converter pinout Of Shaking Blood Bag Device

Main Features

- Input Voltage: 3.2V ~ 40V
- Output Voltage: 1.25V ~ 35V(Adjustable)
- Output Current: $\leq 3A$ □ Conversion Efficiency: $\leq 92\%$
- Output Ripple: $< 30mV$
- Switching Frequency: 65KHz
- Working Temperature: $-45^{\circ}C \sim +85^{\circ}C$
- Standard Size: 43.2mm x 21.0mm x 14.0mm (Length x Width x Height)

3.1.6. Working Principle

1. Input Voltage Range: DC 3.2V~40V (the input voltage must be more than 1.5V higher than the voltage to be output.)
2. Output Voltage Range: DC 1.25V~35V continuous adjustable voltage with high efficiency (up to 92%); the output current can reach 3A. Get a power supply (3-40v), the power indicator light is on and the module is working well.
3. Adjust the blue potentiometer knob (generally clockwise rotation makes boost, and turning counter-clockwise makes step-down). [21]

3.1.7. Screen Of Shaking Blood Bag (LCD 16×2)

Nowadays, we always use the devices which are made up of LCDs such as CD players, DVD players, digital watches, computers, etc. These are commonly used in the screen industries to replace the utilization of CRTs. Cathode Ray Tubes use huge power when compared with LCDs, and CRTs heavier as well as bigger. These devices are thinner as well power consumption is extremely less. The LCD 16×2 working principle is, it blocks the light rather than dissipate. This article discusses an overview of LCD 16X2, pin configuration and its working. The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.[21]

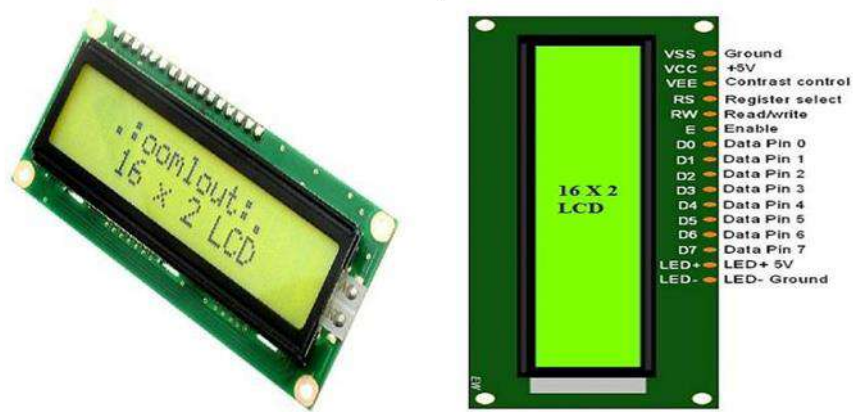


Fig (3-7). Screen Of Shaking Blood Bag (LCD 16×2)

3.1.8. Screen Of Shaking blood bag LCD (16×2) Pinout.

- **Pin1** (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- **Pin2** (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- **Pin3** (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- **Pin4** (Register Select/Control Pin): This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1 (0 = data mode, and 1 = command mode).
- **Pin5** (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- **Pin 6** (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- **Pins 7-14** (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
- **Pin15** (+ve pin of the LED): This pin is connected to +5V
- **Pin 16** (-ve pin of the LED): This pin is connected to GND. [21]

3.1.9. Features of LCD16x2 Shaking blood bag.

The features of this LCD mainly include the following.

- The operating voltage of this LCD is 4.7V-5.3V
- It includes two rows where each row can produce 16-characters.
- The utilization of current is 1mA with no backlight
- Every character can be built with a 5×8 pixel box
- The alphanumeric LCDs alphabets & numbers
- Is display can work on two modes like 4-bit & 8-bit
- These are obtainable in Blue & Green Backlight
- It displays a few custom generated characters [21].

3.2. Load Cell Amplifier (HX711) Of Shaking Blood Device

The Load Cell Amplifier is a small breakout board for the **HX711 IC** that allows you to easily read load cells to measure weight. By connecting the amplifier to your microcontroller, you will be able

to read the changes in the resistance of the load cell, and with some calibration, you'll be able to get very accurate weight measurements. The HX711 uses a two-wire interface (Clock and Data) for communication. Check the hookup guide below for more information. Load cells use a four-wire Wheatstone bridge configuration to connect to the HX711. These are commonly colored RED, BLK, WHT, GRN, and YLW. Each color corresponds to the conventional color coding of load cells[22]:

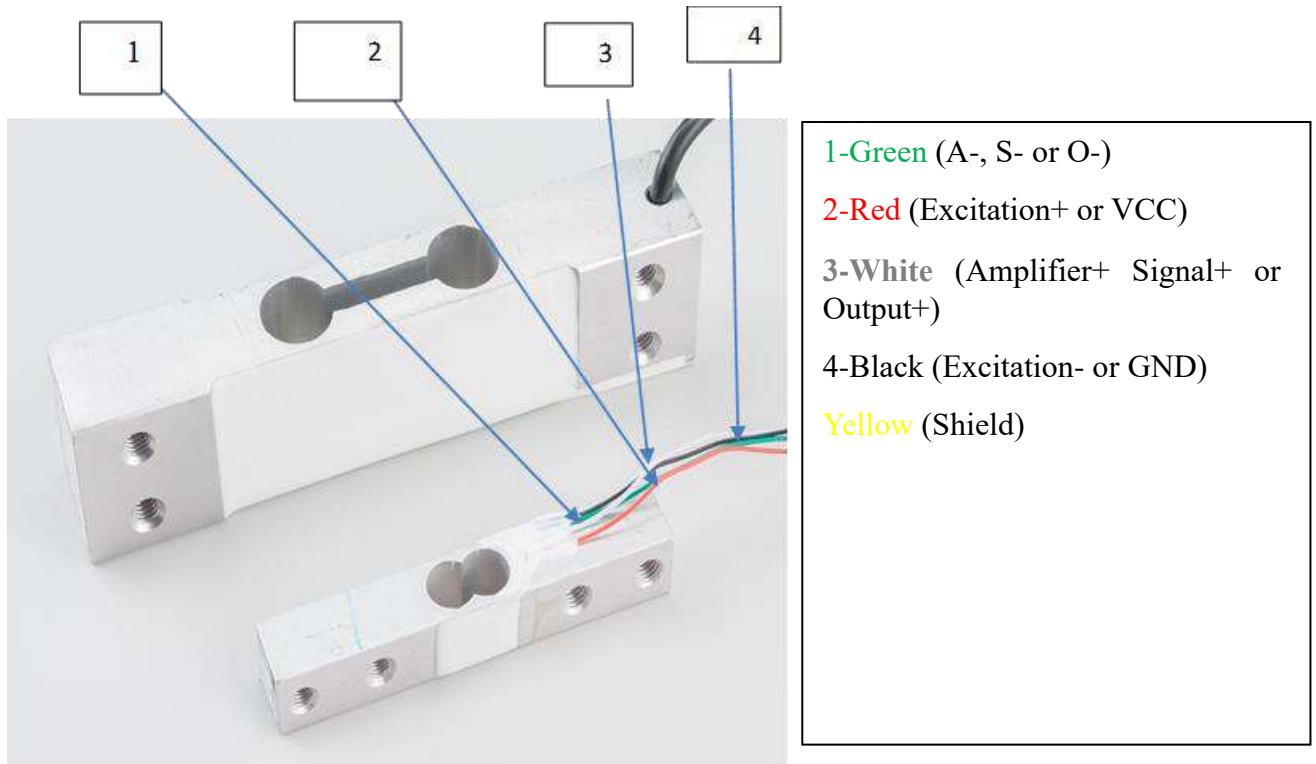


Fig (3-8) Load Cell Amplifier (HX711) Of Shaking Blood Device

3.2.1. Design & Consideration Of Shaking Blood Device

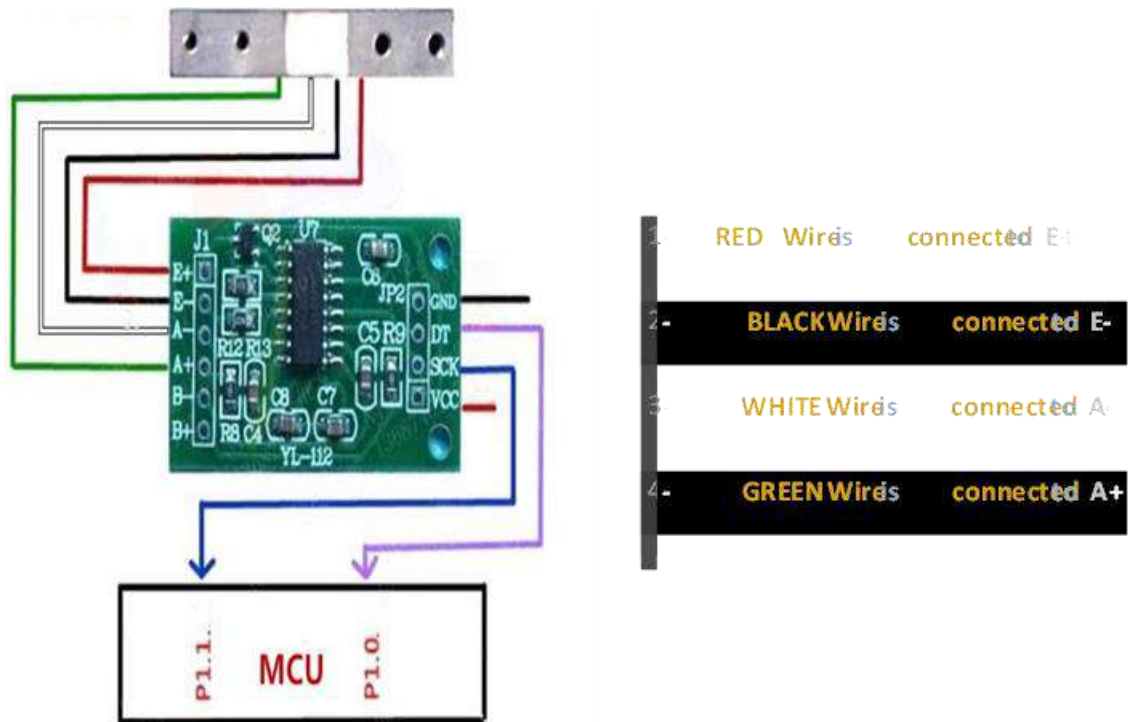


Fig (3-9) load Cell and HX711 Connection Of Shaking Blood Device

3.2.2. Design and Implementation Of Shaking Blood Device

In this chapter, we will talk about connecting the electronic parts that we explained in the previous chapter

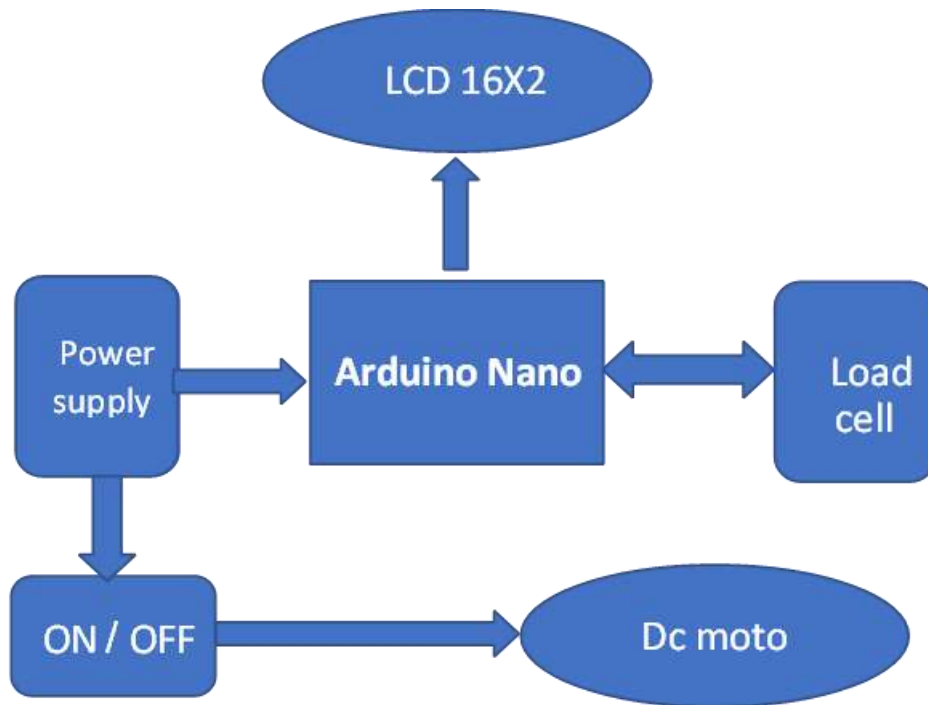


Fig (3-10). Shows how to connect the components that we used in the project [22].

3.2.3. Circuit Diagram Connection

Circuit Connection can be illustrated in the following steps:-

1. Connected the load cell (Hx711) to Arduino Nano as shown in fig (11).

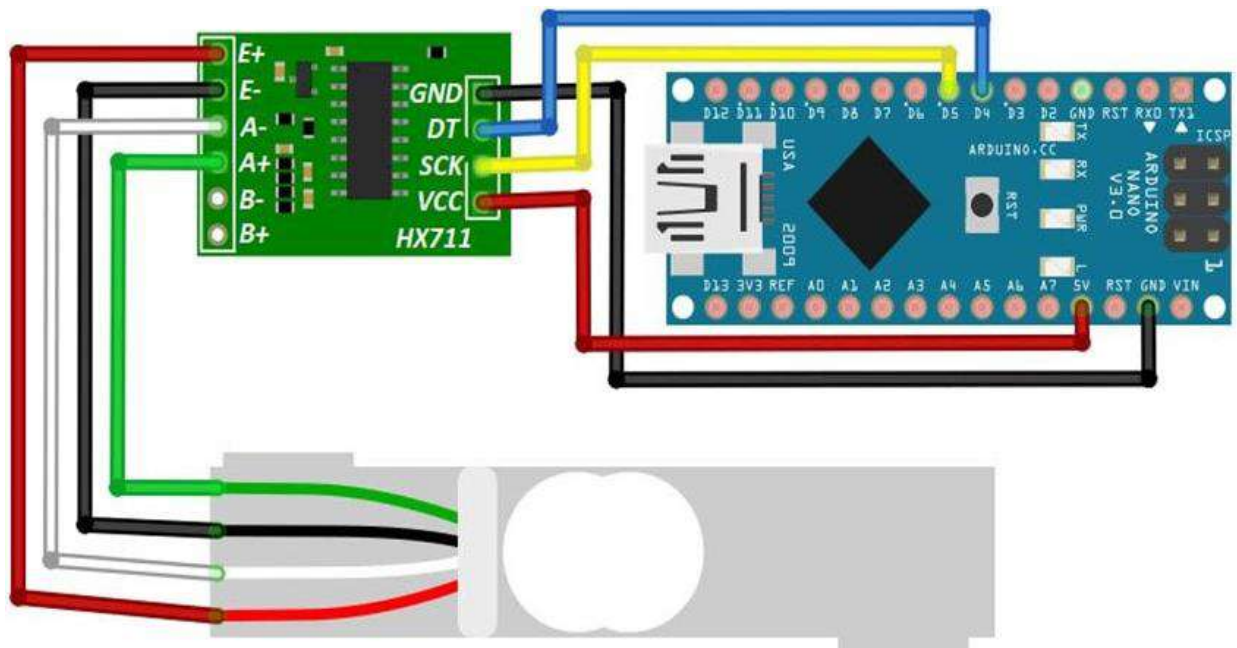


Fig (3-11) Arduino to load cell connection for Shaking Blood Bag

2. Connected LCD 16 x 2 to Arduino Nano as shown in fig (12).

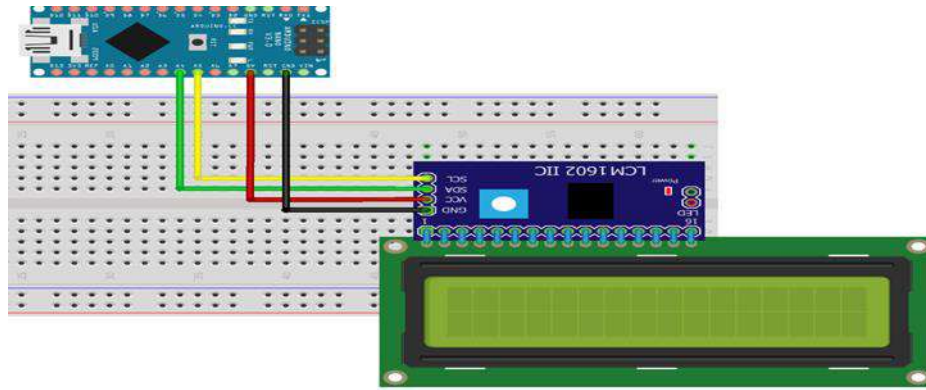


Fig (3-12) Arduino to LCD connection For Shaking Blood Bag

3. After connected all components we upload the code on Arduino board by using Arduino IDE as shown in APENDIX A
4. Install the components on suitable box and put DC motor in side it as shown in fig (13) .

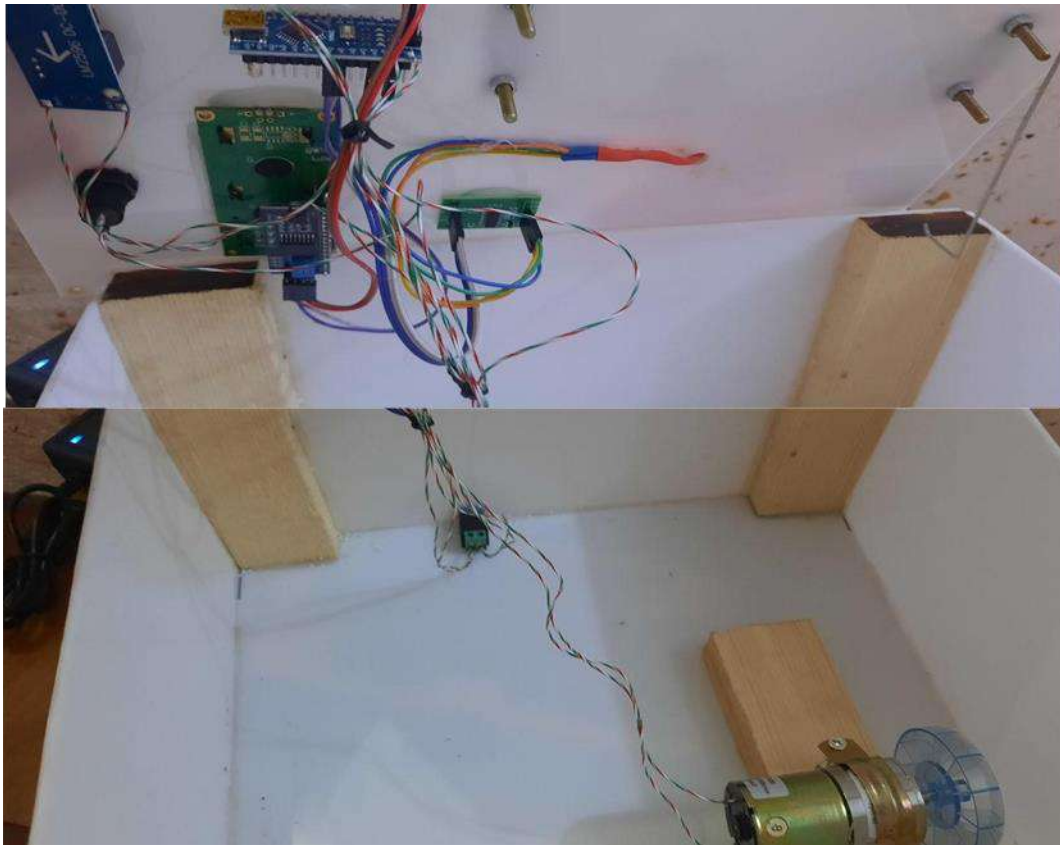


Fig (3-13). installing of project component inside of Shaking Blood Bag

5. After installed the components closing the box and turn on device. after finish work the device becomes as shown Fig (14). [23]



Fig (3-14) Shaking Blood Bag Device

3.3. Future Work:-

The factors should be added in the future to a vibrating device that measures blood bag weight:

1. **Advanced sensors:** Utilizing advanced sensors, such as accelerometers and load cells, could enhance the accuracy and reliability of vibration and weight measurements. These sensors could provide more precise data and feedback.
2. **Automated calibration and maintenance:** Implementing automated calibration and maintenance features could streamline the upkeep of vibrating devices and weight measurement systems and reducing downtime and maintenance costs.
3. **Enhanced user interface:** Improving the user interface of vibrating devices and weight measurement systems could enhance usability and accessibility for healthcare professionals.
4. **Data analytics and insights:** Integrating data analytics capabilities into vibrating devices and weight measurement systems could provide valuable insights into blood bag handling and transfusion processes.

By incorporating these advancements, future vibrating devices and weight measurement systems for blood bags could offer improved functionality, accuracy, usability, and integration, ultimately enhancing the safety and efficiency of blood transfusion processes.

4. RESULTS AND DISCUSSIONS

4.1. RESULTS

All the results of our present study are shown in tables below:-

Table 1 shows the results of complete male information blood bag. **Table 2** shows the results of complete female information blood bag.

Stability of RBC counts, WBC counts, Hemoglobin, Platelets

There is no statistical significance in the variation of these values of samples stored at room temperature and refrigeration at 2-8 C° .

Stability of Weight[g]: Through the information results, we noticed that there is a slight difference between the weight of a man’s blood bag and the weight of a woman’s blood bag, as shown in the **Table3**.

Stability of Temperature: Through the information results, we noticed that there is a slight difference between the temperature of a man’s blood bag and the temperature of a woman’s blood bag, as shown in the **Table3**.

Table(4-1). Shown blood bag for male

No	Male	
1	Name	Sabah Hammoud
2	Age	35 years
3	Date	2023/10/21
4	Type blood	B-
5	HIV	Non-Reaction
6	HBV	Non-Reaction
7	HCV	Non-Reaction
8	Syphilis	Negative



Fig (4-1). Shown blood bag for male

Table (4-2). Shown blood bag for female

No	Female	
1	Name	Suzan Najah
2	Age	32
3	Date	2024/4/2
4	Type blood	B+
5	HIV	Non-Reaction
6	HBV	Non-Reaction
7	HCV	Non-Reaction
8	Syphilis	Positive



Fig (4-2). Shown blood bag for female

Before measuring the temperature and weight of male and female blood bag samples in the blood bag shaking device, we'll want to ensure the following steps:

1. **Preparation of Equipment:** Make sure the blood bag shaking device is clean and calibrated properly according to manufacturer guidelines.
2. **Sample Identification:** Clearly label each blood bag sample with appropriate identifiers, including gender (male or female) and any other relevant information.
3. **Room Temperature:** Ensure the room where the measurements will take place is at a stable temperature, preferably within the range recommended for blood storage.
4. **Sample Equilibration:** Allow the blood bag samples to equilibrate to room temperature for a specified period to ensure accurate measurements.
5. **Verification of Sample Integrity:** Check each blood bag for any signs of damage or leakage that could affect the accuracy of measurements.
6. **Procedure Familiarization:** Familiarize yourself with the operation of the blood bag shaking device and the process for measuring temperature and weight accurately.
7. **Safety Precautions:** Follow all necessary safety precautions, including wearing appropriate personal protective equipment and handling blood samples according to established guidelines.

Once these steps are completed, you can proceed with measuring the temperature and weight of the blood bag samples using the blood bag shaking device.

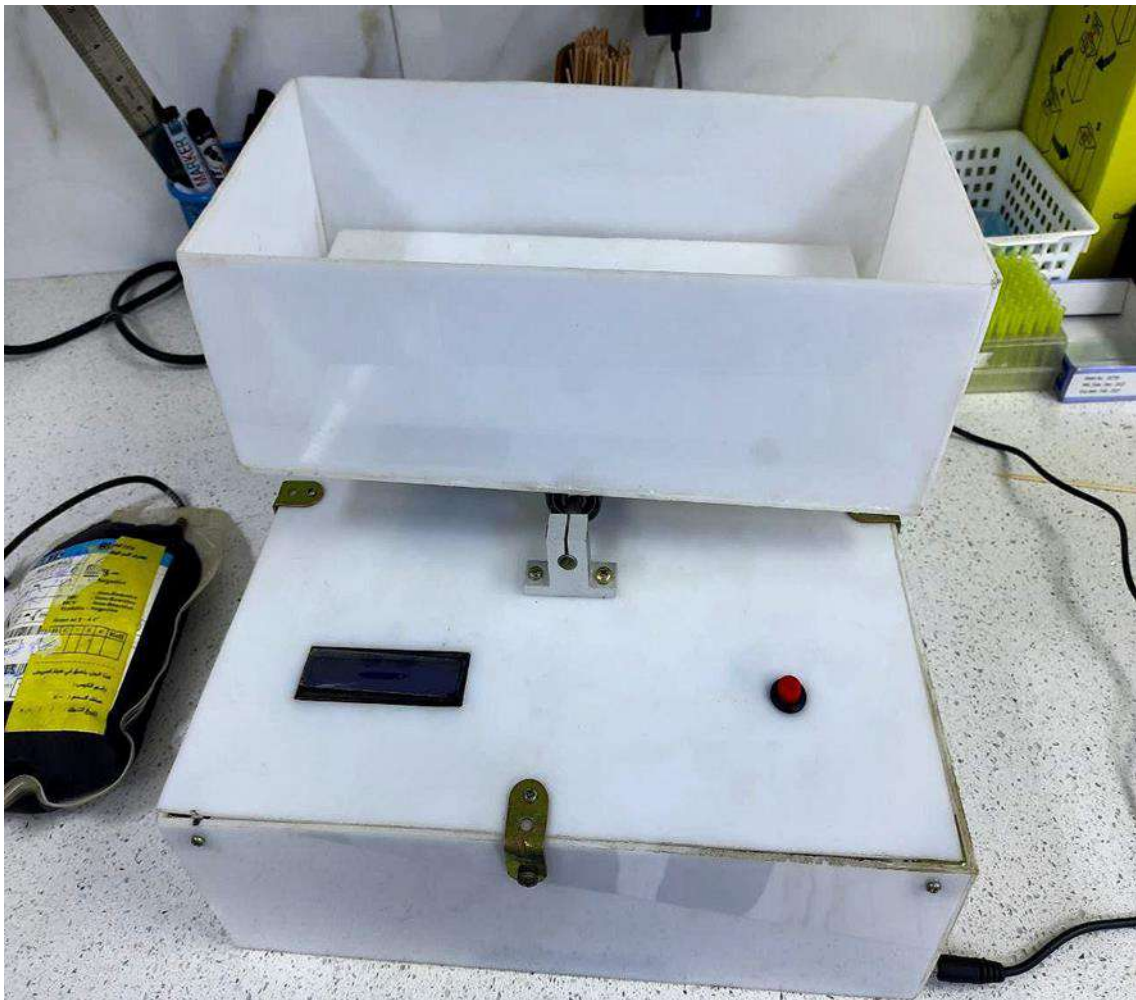


Fig (4-3). The appearance of Shaking Blood Bag Device

Table (4-3). Shown Temperature and Weight Data before operating The Device

No		
1	Weight[g]	0.00
2	Temperature	Non-available



Fig (4-4). Shown Temperature and Weight After operation of the Shaking Blood Bag Device

Table (4-4). Shown Temperature and Weight Data After operation The Device

No		
1	Weight[g]	0.00
2	Temperature	22.94C°

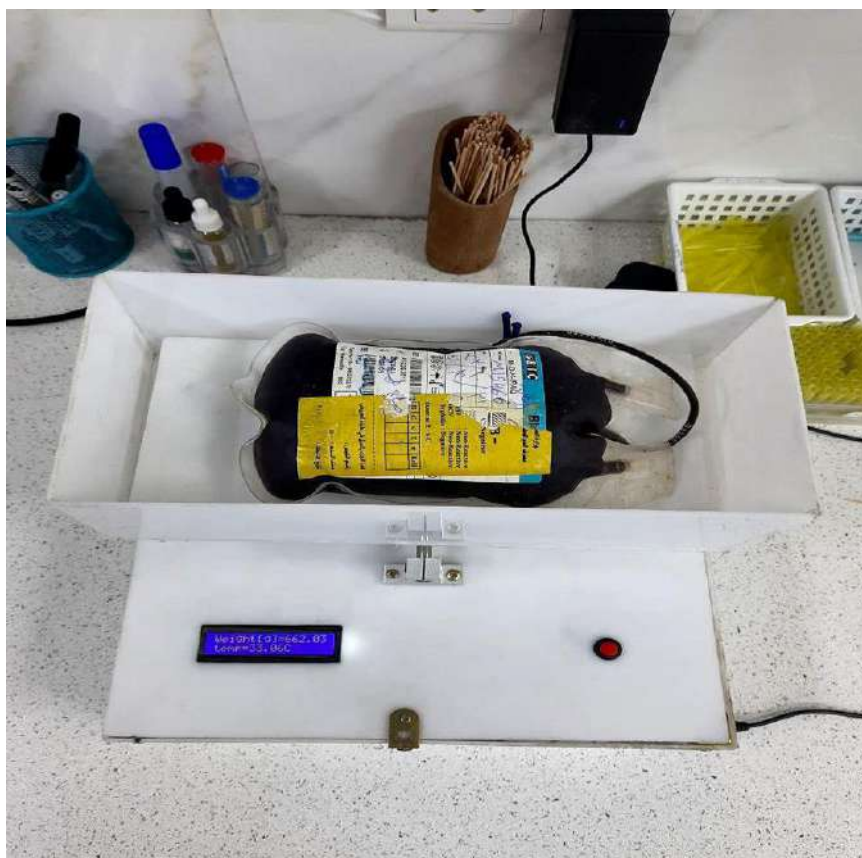


Fig (4-5). The shape of the device when placing a blood bag for a male.

Table (4-5). Shown Temperature and Weight Data After operation The Device For male

No		
1	Weight[g]	662.03g
2	Temperature	33.06C°



Fig (4-6). The shape of the device when placing a blood bag on a woman.

Table (4-6). Temperature and Weight Data After operation The Device For female

No		
1	Weight[g]	585.48g
2	Temperature	31.81C°



Fig (4-7). Conducting the Experiment in one of the laboratories of Al _ Zafaraniya Hospital.



Fig (4-8). Form of a blood storage refrigerator from a blood bank.

4.2. DISCUSSIONS

Delay in the sample analysis often occurs in routine clinical and hematology practice. Various reasons for delay in analysis are:

1. sample collection in camps or transportation delay, exposure of the samples to high temperature during transport and increase in waiting time with only one dedicated cell analyzer in the laboratory.
2. Anticoagulants and storage temperature also affects the hematological parameters and blood smear examination.
3. It is essential to know the influence of climatic conditions on the hematological parameters mainly in tropical areas to give correct and accurate hematology report.
4. A prolonged duration of high-temperature storage might cause variations in the various hematological parameters and have a negative impact on the final report's accuracy. Therefore, it's crucial to understand which factors change clinically while stored at high temperatures and which ones are largely constant under the same circumstances.

Hematologic values should ideally be examined right after collection. Refrigeration at 2-8°C is ideal if a delay is anticipated. Whenever blood is kept below 2 °C RBCs suffer hemolysis due to freezing damage, while unidentified bacteria overgrow when the temperature is above 8 °C. In the present study, hematological parameters affected when stored at room temperature were RBC, HCT, MCV, MCH, MCHC, RDW and Platelet count. While at 2-8°C refrigeration, all the hematological parameters were stabilized and changes were not statistically significant.

Our study was:-

1. conducted under controlled circumstances with samples coming from a diverse range of patients, which might be a possible drawback.
2. Different outcomes might theoretically occur from real-world temperature variations.
3. confounding variables brought on by faulty draw, mixing, anticoagulation, or individual factors such as the presence of antibodies and activated complement.
4. Studies comparing patient samples to normal samples have revealed minimal differences; these variations are expected to be minor and should not have an impact on the study's findings.
5. The analytical stability of a parameter relies on the analyser utilised, which must be taken into consideration while interpreting the current study. Variations may occur in the storage stability of parameters on other analysers that employ a different methodology.

4.3. CONCLUSION

After completing the connection of the device, as we mentioned in the previous chapter 3, we connect the device to the power source by feeding 220 AC volts as we mentioned in the previous chapter 4. We have two operating keys in the front shape of the device, the right key to operate the motor and the second key to measure the weight of the blood bag. Where the user can measure the weight of the blood bag and the result will appear on the screen.

The results of EDTA blood storage samples indicated that:-

1. each parameter of the blood components remains the same over time with the temperature remaining constant, ranging from 8-2 and the temperature in each measurement.
2. The results showed that there is a slight difference between the weight of the blood bag in males and females.
3. The temperature also changes according to storage conditions.
4. Complete blood count results should be tested as soon as possible to avoid variability, since delaying testing might cause changes to the CBC parameters.
5. Our research report supports performing the assay right away after drawing the CBC and performing the blood cell morphological analysis in order to prevent the misinterpretation of results.
6. Standardized storage conditions reduce pre-analytical variation and the hematological parameters affected by storage and temperature in a way that could influence clinical decisions.
7. Therefore, to provide an accurate report if there is a known delay in the interpretation of the sample, refrigeration of EDTA blood samples at 2-8°C is advised.

The device can be developed by connecting it via the Internet, controlling the operation and extinguishing it remotely, making a control unit for more than one device at the same time, receiving data and the ability to store and display it at the required time.

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