A

Project Phase-II Report

On

SMART BLOOD BANK SYSTEM USING IOT

SUBMITTED BY

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PROJECT GUIDE

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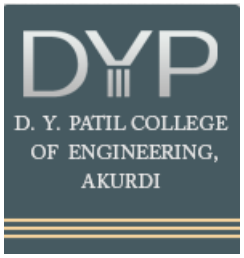

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

D.Y. PATIL COLLEGE OF ENGINEERING

AKURDI, PUNE – 411044

2023-2024

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CERTIFICATE

This is to certify that following students of B . E . Electronics & Telecommunication have completed the Project Phase-II on **'SMART BLOOD BANK SYSTEM USING IOT'** satisfactorily under my guidance and submitted the Project Phase-I report in partial fulfillment of requirement for the award of Bachelors Degree of Engineering course under the Savitribai Phule Pune University during the academic year 2023-2024.

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Special thanks to our H. O. D. **Dr. Rutuja Deshmukh** for her kind official support and encouragement.

We are also deeply thankful to our project coordinators **Dr. Mrs. Sarika Patil** and **Mrs. Shailaja Yadav** for their valuable guidance.

Finally, we would like to thank all staff members and faculty members of E & TC Department who helped us directly or indirectly to complete this work successfully.

Students Name & Sign

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CHAPTER NO. 1

INTRODUCTION

Introduction

In the ever-evolving landscape of healthcare and technology, the Internet of Things (IoT) has emerged as a transformative force, redefining the way we approach healthcare systems and services. The confluence of IoT and healthcare has opened up new frontiers in patient care, diagnostics, and the efficient management of medical resources. Among the many areas where IoT is making a profound impact, the blood banking system, a critical component of any healthcare infrastructure, is witnessing a revolutionary change with the advent of "IoT-Based Blood Bank Monitoring."

Blood banks are the lifeline of healthcare institutions, providing a constant supply of blood and blood products that are essential for patient transfusions, surgical procedures, and treatments for a wide range of medical conditions. Ensuring the safety, quality, and availability of blood products is a paramount concern for healthcare providers. It's in this context that the "IoT-Based Blood Bank Monitoring" project finds its purpose.The project's fundamental concept revolves around the utilization of IoT technology to introduce a real-time, data-driven approach to blood bank management. Its primary aim is to enhance the existing processes and infrastructures through the implementation of sophisticated sensors and communication systems. These sensors are designed to measure the weight of blood collection bags in real-time as they are filled during the donation process, and the collected data is then transmitted to a secure cloud-based platform for instantaneous monitoring and management.

This innovative approach to blood bank management comes at a pivotal time when healthcare systems are under increased pressure to optimize their resources and provide the best possible care to patients. The "IoT-Based Blood Bank Monitoring" project, thus, holds the promise of not just modernizing, but revolutionizing the blood banking system.

By continuously monitoring the weight of blood bags, this project aims to eliminate the risk of overfilling, which can lead to hemolysis and the subsequent disposal of blood units, a wasteful and costly practice. Moreover, it addresses the challenge of optimizing resource allocation, ensuring a balance between supply and demand, and reducing the likelihood of blood shortages or excessive stockpiles.

The heart of the "IoT-Based Blood Bank Monitoring" project lies in its cloud-based data management infrastructure, where the collected data is stored, processed, and analyzed. This data serves as a valuable resource for blood bank staff and authorized personnel, who gain access to real-time information and historical records through an intuitive user interface. This not only enhances transparency and efficiency but also empowers decision-makers with data-driven insights to improve blood bank operations.

In addition, the project introduces an alerting system that promptly notifies staff of any unusual or critical events, such as a blood bag reaching its capacity or a deviation in temperature, further enhancing the quality control and safety measures in place.

This project's potential benefits are far-reaching, encompassing the enhancement of blood quality, optimized resource allocation, data-driven decision-making, an improved experience for donors, and overall operational efficiency. It represents a crucial step forward in modernizing and future-proofing blood bank management, ensuring the continual delivery of timely and high-quality healthcare services to those who depend on the availability of safe and reliable blood products.

In the following sections, we will delve into the core objectives, methodologies, and expected outcomes of the "IoT-Based Blood Bank Monitoring" project, aiming to offer a comprehensive understanding of its significance in the healthcare ecosystem. This project embodies the ethos of embracing innovation and technology to meet the ever-growing demands of healthcare services and uphold the highest standards of patient care.

1.1 Objective of Project

1 Blood Weight Measurement: Develop an IoT system to accurately measure the weight of blood collection bags during the donation process.

2 Data Transmission: Create a reliable communication system to transmit real-time blood weight data to a secure cloud-based platform.

3 Cloud-Based Data Management: Establish a cloud infrastructure for secure storage, processing, and analysis of collected blood weight data.

4 User-Friendly Dashboard: Design an intuitive user interface for authorized personnel to access real-time and historical data.

5 Alerting System: Implement an alert system to notify staff of critical events, such as full blood bags or temperature deviations, ensuring quality control and safety.

CHAPTER NO. 2

Literature Survey

2.1 Introduction

In the rapidly evolving landscape of healthcare technology, the integration of the Internet of Things (IoT) has emerged as a pivotal driver for innovation. The use of IoT in healthcare is increasingly pervasive, encompassing applications ranging from remote patient monitoring to medical device management. This burgeoning field is marked by its ability to deliver real-time data and enhance the efficiency of healthcare systems, making it particularly relevant to blood bank management.

The literature survey for the "IoT-Based Blood Bank Monitoring" project commences with an exploration of IoT in healthcare. It seeks to understand how IoT technologies are presently deployed in healthcare settings, highlighting the benefits they bring and the challenges they encounter. The focus is on real-time data collection and transmission, a key aspect of the proposed project.

Moving onward, an investigation into blood bank management systems is imperative. Existing systems, although functional, are not without their limitations. The survey scrutinizes these limitations and seeks to uncover the ways in which technology, specifically IoT, has been employed to address them. This includes tracking and monitoring the condition of blood units, ensuring their safety and quality.

To ensure the integrity and safety of stored blood products, it is crucial to examine research on blood quality and safety. This encompasses factors like temperature control and minimizing hemolysis, and it is essential to identify the application of IoT sensors and technologies in achieving these goals.

IoT sensors and data transmission protocols are integral components of your project. Investigating the sensors' accuracy and reliability and understanding the technology behind data transmission is vital for ensuring that the project's objectives are met effectively.

The literature survey also delves into the domain of cloud-based data management, a critical aspect of your project. The review covers cloud solutions for healthcare data storage, security, and accessibility, with a focus on real-time monitoring applications.

An equally important aspect of the project is the user interface (UI) and user experience (UX). Therefore, the literature survey explores design principles for creating intuitive and user-friendly dashboards, with an emphasis on the needs and preferences of healthcare professionals and authorized personnel.

Alerting systems are a key feature of your project. They serve as a bridge between data collection and informed decision-making. Investigating their role in healthcare, particularly in the context of blood bank management, helps identify best practices and optimal strategies for ensuring quality control and safety.

The survey also encompasses a study of relevant case studies and projects that share similarities with

your proposed IoT-based blood bank monitoring system. These real-world implementations provide valuable insights and lessons learned. Lastly, considering regulatory and ethical considerations is pivotal. Compliance with healthcare standards and guidelines is paramount, ensuring that the project adheres to the requisite regulations.

1 **Paper Title** :- BloodLine IOT Based Blood Bank Management System

Author :- Mr. Deependra Rastogi , Rohan Singh, Tushar Rawat

Summary :- BloodLine offers new horizons for health that gives aid services by utilizing the mobile devices and communication technologies. In health care services, blood donation could be a advanced method and consumes time to search out some donor who has the compatibility of people with the patient. The planned system is an android primarily based blood bank application to determine a affiliation between the requester and donor at anytime and anyplace. A bank as we all know provides blood to folks in would like now and then of emergency. The bank system is intended in such the way that users will read the knowledge concerning registered blood donors which is able to facilitate within the hour of would like. The planned system includes a login page wherever the user is needed to register, however user doesn't got to register if he doesn't notice the specified result. The user also can register to give blood on the system if they want to. therefore this technique helps to pick out the proper donor instantly using people. the most aim of developing this technique is to scale back the time to an excellent extent that's spent in searching for the proper donor and also the convenience of blood needed. therefore the planned system provides the desired info quickly and additionally helps in faster higher cognitive process.

2 **Paper Title** :- Smart monitoring, management and control of Blood bank Management System using IOT

Author :- M.Joly , Kavitha S , Arun Pradeep

Summary:- An emergency system that directs the quick accessibility and availability of blood and delivery is entitled in a blood donation center. There exists a high demand for blood as a life saver in case of emergencies and the primary purpose of these blood donation centers meant to supply blood to the needy people. The unavailability of donor at the correct time is the foremost issue met by several people in case of emergencies. In our work, a group of people with data about their blood group and other details are made as a software for easy access. An application software has been developed where the Blood donation centers can inform about the Blood Stock and supply to people at urgent times. Since there are several steps involved in donating blood manually, the reliability and precision will be less. The proposed automatic blood bank system has been planned and developed into sector which involves sensors like temperature sensor, IR sensor, GSM module interfaced with Arduino Mega. Subsequent sector comprises of Wi-Fi module for files transference to administrator and third sector has been designed to monitor the position of existing blood stock. Entirely the web page designed narrates the obtainable blood stock in the blood bank which will be displayed on web page, so that the needy person can acquire required blood

group from neighboring blood donation center.

3 **Paper Title** :- iot based blood bank management system

Author :- Rohan Akash, Anshuman Singh, Shankar Yadav

Summary:- A blood bank is a facility that administers and supervises the requisition and distribution of blood. The major goals of blood banks are to provide blood to patients with the least amount of blood transfusion mistake possible. Because blood is such a vital medicinal supply, it must be properly regulated. Because blood bank maintenance entails a number of manual tasks, it will be difficult to manage.

4 **Paper Title** :- The Use of Web Technology and IoT to Contribute to the Management of Blood Banks in Developing Countries

Author :- Reem D. Ismail, Harith A. Hussein , Mahmood M. Salih, Mohamed A. Ahmed , Qabas A. Hameed and Mohammed Basim Omar

Summary:- Health-care-sector-related activities are more accessible and faster as a result of technological development. Technology such as the Internet of Things (IoT) can work with blood bank services to manage and provide healthy blood in emergencies. However, there are many problems in blood bank management and inventory monitoring, especially in developing countries as compared to developed ones. The lack of an adequate and safe blood supply is a major limitation to health care in the developing world. The instability of the electric power in developing countries may lead to a temperature departure from the recommended for keeping blood inventory, and the use of manual systems, which are characterized by time and resource exhaustion and human mistakes, augments the management problems. This study aims to introduce a reliable, practical application to manage and organize the blood bank, manage donor information, monitor inventory, and obtain matching blood types as quickly as possible. The proposed system was designed and implemented in two parts: using Web technology for enhanced data management and using an IoT sensor for blood inventory temperature monitoring in real time. The test stage helped us to measure the Web application's functionality with sensors, and the results were encouraging. Obtaining and monitoring blood bank data were made easier in real time by using the black box method for functionalities testing. The evaluation step was performed using a questionnaire instrument based on three parameters: Satisfaction, Effectiveness, and Efficiency. The questionnaire was answered by 22 participants working in the blood bank management field. The results indicated that end users generally responded positively to the system which improved blood bank administration and services. This indicated efficiency of the application and the desire to adopt it. Integrating the two technologies can enhance usability and applicability in the health care sector

5 **Paper Title :- Smart Blood Bank System Based on IoT**

Author :- Radha R. Mahalle, S. S. Thorat

Summary:- - The unit which administers and manages the requisition and distribution of the blood is named as a blood bank. The main objectives of the blood banks are providing blood to the patients with minimal blood transfusion error. The blood is very important medical supplies so it should be managed well. As the blood bank management consists of a number of manual steps, therefore it will become difficult for the blood banks to provide a high level of accuracy, reliability, automation in blood storage and transfusion process. The system proposed is divided into three segments, the first segment consists Temperature sensor, IR sensor nodes which is installed in rack of blood bank, and the GSM Module for sending request of blood to the donors and blood banks all these are interfaced with Arduino Mega. Second segment consists of wi-fi module for data transfer to the server and third segment is displaying the status of available blood stock. All the real time status relates to the available blood stock of the blood bank is are displayed on web page, so that the blood seeker can get the blood from their nearest blood bank

6 **Paper Title** :- Web based blood bank management system

Author:- Vedanti Vishnu Deshpande, Shubham Kumar, Supriya Chaple

Summary:- A blood bank is a bank of blood or blood constituents. “Blood Bank” means the storage of blood and where the blood is tested and preserved. Blood is an unstable product with uncertainties in both supply and demand and bloodstock management is, therefore, a judicious balance between shortage and wastage. The website eases the easy access to the blood of different blood groups as per the need of the particular person. The website also tells us about the bloodstock details, blood Issue details and it is regularly updated by the authorized person in the respective blood banks. Improvement of a blood supply chain is a hard process. To improve this, the web-based blood bank management system is accessible.

7 **Paper Title** :- IOT BASED SMART BLOOD BANK SYSTEM

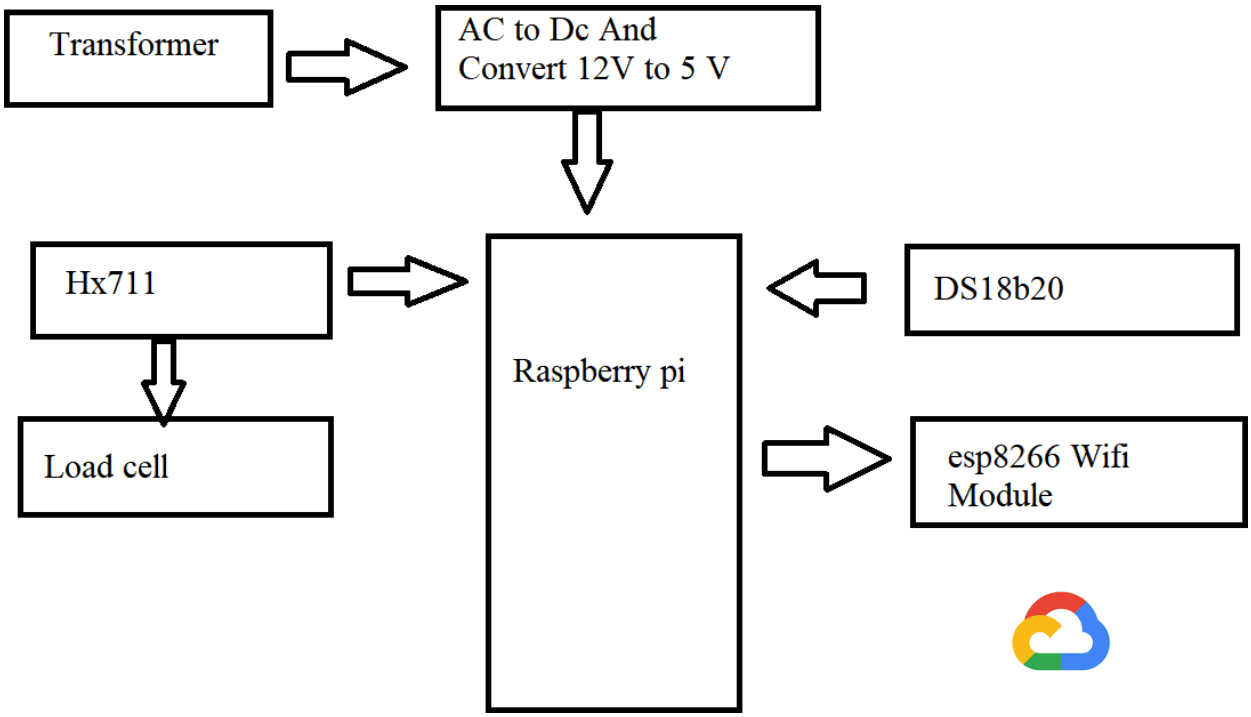
Author:- FIZAKHAN, KIRAN, SONAMSEHRAWAT, NIDHIPATEL,RAVISHKUMARDUBEY

Summary:- The unit which administers and manages the requisitionis named as a blood bank. The main objectives of the blood banks are providing blood to the patients with minimal blood transfusion error. The blood is very important medical supplies so it should be managed well. As the blood bank management consists high level of accuracy, reliability, automation in blood storage and transfusion process. The system proposed is divide din to three segments ,the first segment consists Temperature sensor, Weight sensor nodes which is installed in rack of blood bank, and the GSM Module for sending request of blood to the donors and blood banks all these are interfaced with Arduino Mega. Second segment consists of Wi-Fi module for data transfer to the server and third segment is displaying the status of available blood stock. All the real time status relates to the available blood stock. All the real time status relates to the available blood stock of the blood bank is are displayed on web page, so that the blood seeker can get the blood from their nearest bloodbank

CHAPTER NO. 3

Block diagram

3.1 Block diagram of Project



1 Transformer:

The transformer serves as the initial power source for the system. It takes the AC voltage from the wall outlet and transforms it into a lower DC voltage that can be utilized by the Raspberry Pi and other components. This conversion is essential for providing a stable and suitable power source for the entire system.

2 HX711:

The HX711 is a crucial component responsible for converting the weight of the blood bag into an electrical signal. It acts as a load cell amplifier, providing precision in measuring the weight of the blood bag. This analog signal is essential for accurate data collection, ensuring the quality and quantity of blood units are correctly monitored.

3 Load Cell:

The load cell is a transducer designed to convert the physical force applied to it (in this case, the weight of the blood bag) into an electrical signal. This signal is then transmitted to the HX711 amplifier. The load cell's accuracy and sensitivity are paramount for ensuring that the system provides precise measurements of blood bag weight.

4 AC to DC Converter:

This component plays a crucial role in the system by converting the incoming AC voltage from the wall outlet into a DC voltage. This DC voltage is essential to power the various electronic components within the system, ensuring their proper and consistent operation. It acts as a bridge between the power source and the system's internal electronics.

5 DS18B20:

The DS18B20 is a temperature sensor responsible for monitoring the temperature within the blood bank. Temperature control is vital for maintaining the quality and safety of blood products. The DS18B20 sensor provides accurate temperature data, allowing the system to take corrective actions if the temperature deviates from the desired range.

6 Raspberry Pi:

The Raspberry Pi serves as the central processing unit of the system, acting as the "brain." It collects data from various sensors, such as the HX711 for weight measurements and DS18B20 for temperature data. The Raspberry Pi processes this data and facilitates its transmission to the cloud platform. It serves as the system's controller, enabling real-time data analysis and management.

7 ESP8266 Wi-Fi Module:

The ESP8266 Wi-Fi module is a vital component that enables the Raspberry Pi to connect to a Wi-Fi network. This connection is essential for transmitting data to the cloud platform in real-time. The module provides wireless communication capabilities, ensuring that the system remains connected and accessible.

8 Cloud Platform:

The cloud platform is a remote server that plays a central role in data storage and analysis. It receives data from the Raspberry Pi over the Wi-Fi connection and securely stores this information. Furthermore, it provides data analysis capabilities, allowing for real-time monitoring, historical data access, and the potential for predictive analytics. The cloud platform ensures the centralization of data and access for authorized personnel.

9 Display:

The display component serves as the user interface, showing real-time data collected by the system. This visual representation of data is essential for staff working in the blood bank. They can monitor critical information, including the weight and temperature of blood bags, without the need for accessing the cloud platform directly. It provides immediate feedback and aids in decision-making and quality control.

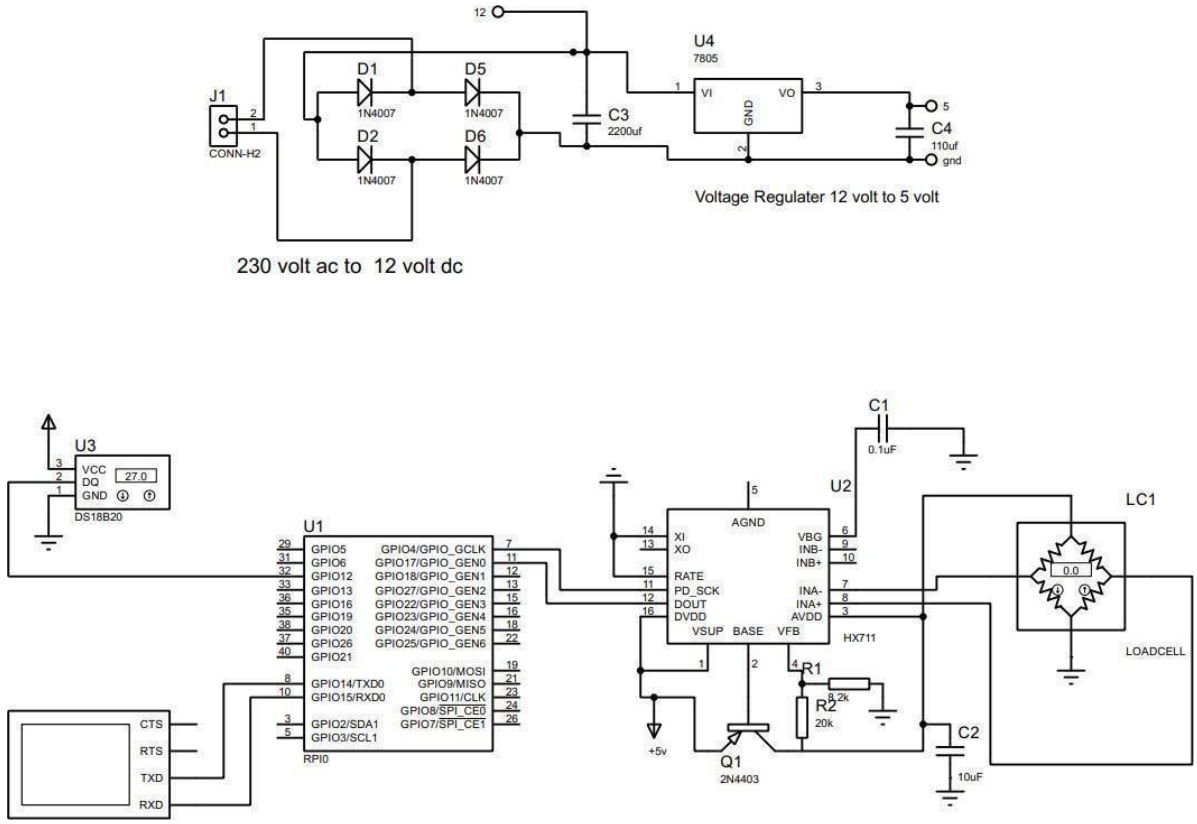
10 Working

1. The block diagram shows how the different components of the system are connected together.
2. The transformer converts the AC power from the wall outlet to DC power that can be used by the Raspberry Pi. The load cell amplifier is used to measure the weight of the blood bags, and the temperature sensor is used to measure the temperature of the blood bank.
3. The Raspberry Pi controls the system and sends the data to the cloud platform. The ESP8266 WiFi module allows the Raspberry Pi to connect to the internet.
4. The data from the Raspberry Pi is sent to the cloud platform, where it can be stored, analyzed, and displayed.
5. The data can also be displayed on a monitor at the blood bank.

CHAPTER NO. 4

Circuit diagram

4.1 Circuit diagram of Project



1 Transformer

The transformer converts the AC power from the wall outlet to DC power that can be used by the Raspberry Pi. The input voltage of the transformer is 230V AC and the output voltage is 12V DC.

2 HX711

The HX711 is a load cell amplifier. It is used to amplify the signal from the load cell, which is a sensor that converts weight into an electrical signal. The HX711 has a gain of 128, which means that it amplifies the signal from the load cell by 128 times.

3 Load cell

The load cell is a sensor that converts weight into an electrical signal. The load cell has a capacity of 10kg, which means that it can measure weights up to 10kg.

AC to DC And Convert 12V to 5 V

The AC to DC And Convert 12V to 5 V module converts the 12V DC power from the transformer to 5V DC power that can be used by the Raspberry Pi.

4 DS18B20

The DS18B20 is a temperature sensor. It is used to measure the temperature of the blood bank. The DS18B20 has a resolution of 12 bits, which means that it can measure temperature with a high degree of accuracy.

5 Raspberry Pi

The Raspberry Pi is a single-board computer. It is used to control the system and send the data to the cloud platform. The Raspberry Pi 3 Model B is used in this circuit diagram.

6 ESP8266 WiFi Module

The ESP8266 WiFi module is a Wi-Fi module. It allows the Raspberry Pi to connect to the internet and send the data to the cloud platform. The ESP-01 module is used in this circuit diagram.

7 The circuit works as follows:

1. The transformer converts the AC power from the wall outlet to DC power that can be used by the Raspberry Pi.
2. The load cell amplifier amplifies the signal from the load cell, which is a sensor that converts weight into an electrical signal.
3. The temperature sensor measures the temperature of the blood bank.
4. The Raspberry Pi reads the signals from the load cell amplifier and the temperature sensor.
5. The Raspberry Pi calculates the weight of the blood bags and the temperature of the blood bank.
6. The Raspberry Pi sends the weight of the blood bags and the temperature of the blood bank to the cloud platform using the ESP8266 WiFi module.
7. The data can be stored, analyzed, and displayed on the cloud platform.
8. The data can also be displayed on a monitor at the blood bank.

4.2 Design steps

Step 1: Open Proteus and Create a New Schematic Design

Launch Proteus and initiate a new schematic design by navigating to File > New > Schematic.

Step 2: Add Components from the Proteus Library

Access the Proteus library by clicking on the Components button in the toolbar. Explore the library to find and add the necessary components for the blood bank monitoring system, including Transformer, HX711, Load Cell, AC to DC Converter, DS18B20, Raspberry Pi, and ESP8266 WiFi Module.

Step 3: Connect Components According to the Block Diagram

Use the Wire button in the toolbar to establish connections between components based on the block diagram.

Connect the output of the Transformer to the input of the AC to DC Converter, and then connect its output to the rest of the components, ensuring a coherent flow of power and signals.

Step 4: Set Parameters for Components

- Transformer: Input voltage = 230V AC, Output voltage = 12V DC.
- HX711: Set the Gain to 128.
- Load Cell: Specify its capacity, e.g., 500g.
- AC to DC Converter: Adjust the output voltage to 5V DC.
- DS18B20: Set the resolution to 12 bits.
- Raspberry Pi: Choose the appropriate model, like Raspberry Pi Pico.
- ESP8266 WiFi Module: Select the specific model, such as ESP-01.

Step 5: Simulate the Circuit

- Click on the Simulate button in the toolbar to simulate the circuit's behavior.
- The simulation will provide insights into how the components interact, allowing you to identify and address any issues.

Step 6: Save the Schematic Design

- Save your schematic design by navigating to File > Save.
- Choose a location and a meaningful name for your schematic file to ensure easy retrieval and future modifications.

CHAPTER NO. 5

System Specifications

1. Selection of components

1. Raspberry pi Pico

The Raspberry Pi Pico is a microcontroller board developed by the Raspberry Pi Foundation. Powered by the RP2040 microcontroller, it features a dual-core ARM Cortex-M0+ processor running at 133 MHz. The board includes 264KB of SRAM for program execution and data storage.

With 26 multifunction GPIO pins, the Pico offers versatility for various purposes such as digital input or output, PWM, and support for communication protocols like I2C, SPI, and UART. Additionally, it incorporates peripherals such as timers, a temperature sensor, and a unique Programmable I/O (PIO) subsystem that can offload processing tasks from the CPU.

While lacking built-in wireless connectivity, the Pico can be coupled with other Raspberry Pi boards or microcontrollers to provide capabilities such as Wi-Fi or Bluetooth. It is powered through its micro-USB port or an external 3.3V source.

The Pico supports programming in MicroPython and C/C++, using development environments like Thonny IDE. Notably, its open-source design allows users to access and modify the board's design files, including the PCB and schematics.

Affordability is a key feature of the Raspberry Pi Pico, making it appealing to a broad audience, including hobbyists, educators, and professionals. The Raspberry Pi Foundation provides robust community support, including documentation, tutorials, forums, and example projects, contributing to the accessibility and

versatility of the Raspberry Pi Pico microcontroller board. For the latest information, it is recommended to check the official Raspberry Pi website or other reliable sources.

Features of Raspberry Pi Pico:-

- RP2040 microcontroller chip designed by Raspberry Pi in the United Kingdom
- Dual-core Arm Cortex M0+ processor, the flexible clock running up to 133 MHz
- 264KB of SRAM, and 2MB of onboard Flash memory
- The castellated module allows soldering directly to carrier boards
- USB 1.1 with device and host support
- Low-power sleep and dormant modes
- Drag-and-drop programming using mass storage over USB
- 26 multi-function GPIO pins
- 2 SPI, 2 I2C, 2 UART, 3 12-bit ADC, 16 controllable PWM channels
- Accurate clock and timer on-chip
- Temperature sensor
- Accelerated floating-point libraries on-chip
- Programmable I/O (PIO) state machines for custom peripheral support

Specifications of Raspberry Pi Pico:-

Model	Raspberry Pi PICO
Operating Voltage (VDC)	1.8 ~ 5.5
Processor	RP2040 (Dual-core Arm Cortex M0+) By Raspberry Pi
Interface	2 x UART, 2 x I2C, 2 x SPI, up to 16 PWM channels
RAM	264 KB
GPIO	26 Pins
Clock Speed	133 MHz
On Board Ports	Micro-USB 5V/2.5A DC Power Input Port
Operating Temperature Range (C)	-20 to 85
Length (mm)	51
Width (mm)	21
Height (mm)	4

5.1.2 DS18b20

Fig.7: ds18b20

Working Principle:

- The DS18B20 is a digital thermometer that operates based on the principles of the One-Wire protocol. It uses a 1-Wire communication bus, which means it requires only one data line for communication with the microcontroller. This simplifies the wiring and makes it easy to interface with microcontrollers like the Arduino.

Key Features:

- High Precision: The DS18B20 offers high-precision temperature measurements with a resolution of up to 12 bits, allowing for temperature readings as fine as 0.0625°C.
- Wide Temperature Range: It is designed to operate over an extended temperature range, typically from -55°C to +125°C, making it suitable for both extreme cold and hot environments.
- Multiple Sensors on a Single Bus: The One-Wire protocol allows you to connect multiple DS18B20 sensors to a single microcontroller, each with a unique 64-bit ROM code, enabling multi-point temperature monitoring.
- Parasite Power Mode: The DS18B20 can operate in a "parasite power" mode, where it derives power from the data line, eliminating the need for a separate power source connection.
- Waterproof Versions: Some DS18B20 sensors come in waterproof packages, making them ideal for applications in wet or outdoor environments.
- Low Power Consumption: This sensor has low power requirements, making it suitable for battery-powered applications.

Communication:

- The DS18B20 communicates with a microcontroller through the One-Wire protocol, where it sends digital temperature data to the microcontroller. The microcontroller can request a temperature reading from the sensor, and the DS18B20 will respond with the temperature data. The communication is digital, and the sensor uses a unique 64-bit ROM code to identify itself on the bus.

Applications:

- The DS18B20 temperature sensor finds a wide range of applications, including but not limited to:
- Environmental Monitoring: Used in weather stations, greenhouses, and outdoor temperature monitoring systems.
- Industrial Automation: Integrated into industrial control systems for temperature monitoring and control.
- HVAC Systems: Employed in heating, ventilation, and air conditioning systems for temperature regulation.
- Consumer Electronics: Found in appliances like thermostats, coffee makers, and refrigerators.
- Scientific Research: Used in scientific experiments, laboratories, and research projects for accurate temperature measurements.

DS18B20 Sensor Technical specs:-

- Usable temperature range: -55 to 125°C (-67°F to +257°F)
- 9 to 12 bit selectable resolution
- Uses 1-Wire interface- requires only one digital pin for communication
- Unique 64 bit ID burned into chip
- Multiple sensors can share one pin
- ±0.5°C Accuracy from -10°C to +85°C
- Temperature-limit alarm system
- Query time is less than 750ms
- Usable with 3.0V to 5.5V power/data

5.1.3 Load cell

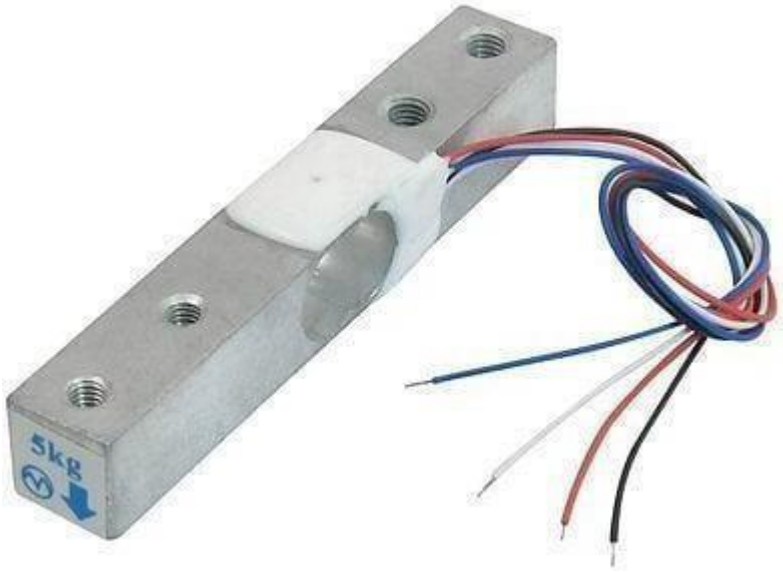


Fig.2: Load cell

This straight bar load cell (sometimes called a strain gauge) can translate up to 5 kg of pressure (force) into an electrical signal. Each load cell is able to measure the electrical resistance that changes in response to, and proportional of, the strain (e.g. pressure or force) applied to the bar.

With this gauge, you will be able to tell just how heavy an object is, if an object's weight changes over time, or if you simply need to sense the presence of an object by measuring strain or load applied to a surface. This straight bar load cell is made from an aluminum alloy and is capable of reading a capacity of 1KG of weight

It has Four lead wires which can be connected to HX711 A/D Pressure Sensor. It is easy to use with driving voltage 5-10V and produce the output voltage as per the force changes over it.

Installation of the Sensor is also the simple task, it needs to fix one end through the screw hole and the other end left floating state, according to the label indicates the direction of the gravitational force exerted particular attention must not directly push the white plastic cover part of the sensor in order to avoid damage.

5.1.4 TRANSFORES :

Fig.8: Transformers

12-0-12 2Amp Center Tapped Step Down Transformer is a general purpose chassis mounting mains transformer. Transformer has 230V primary winding and center tapped secondary winding. The transformer has flying colored insulated connecting leads (Approx 100 mm long). The Transformer act as step down transformer reducing AC - 230V to AC - 12V. The Transformer gives outputs of 12V, 12V and 0V. The Transformer's construction is written below with details of Solid Core and Winding.

The transformer is a static electrical device that transfers energy by inductive coupling between its winding circuits. A varying current in the primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the secondary winding. This varying magnetic flux induces a varying electromotive force (E.M.F) or voltage in the secondary winding. The transformer has cores made of high permeability silicon steel. The steel has a permeability many times that of free space and the core thus serves to greatly reduce the magnetizing current and confine the flux to a path which closely couples the winding.

- Specifications of 12-0-12 2 Ampere Center Tapped Transformer:-
- Input Voltage: 230V AC
- Output Voltage: 12V, 12V or 0V
- Output Current: 2 Amp
- Mounting: Vertical mount type
- Winding: Copper

Features of 12-0-12 2 Ampere Center Tapped Transformer:-

- Soft Iron Core.
- 2 Amp Current Drain.
- 100% Copper Winding

Applications of 12-0-12 2 Ampere Center Tapped Transformer:-

- DIY projects Requiring In-Application High current drain.
- On chassis AC/AC converter.
- Designing a battery Charger.

5.1.5 ESP8266 Wi Fi Module

Fig.7: ESP8266 Wi Fi Module

The ESP8266, developed by Espressif Systems, is a low-cost, highly integrated Wi-Fi microcontroller module. It was first introduced in 2014, and since then, it has gained immense popularity due to its robust features and compact size. The ESP8266 has played a pivotal role in revolutionizing the Internet of Things (IoT) landscape, allowing developers to create connected devices easily and cost-effectively.

Features

The ESP8266 module boasts a range of impressive features that make it a favorite among electronics enthusiasts, hobbyists, and professional engineers:

Low Cost: One of the key attractions of the ESP8266 is its affordability. It offers robust Wi-Fi capabilities at a fraction of the cost of many other alternatives.

Integrated Wi-Fi: The ESP8266 module features a built-in Wi-Fi module, allowing devices to connect to local networks and the internet seamlessly.

Small Form Factor: The ESP8266 is incredibly compact, making it suitable for small-scale projects and applications where space is limited.

Processor Power: Despite its small size, the ESP8266 is equipped with a powerful microcontroller unit (MCU) with ample processing power for various applications.

GPIO Pins: The module has a series of General-Purpose Input/Output (GPIO) pins, making it versatile for interfacing with sensors, actuators, and other peripherals.

Programming Flexibility: The ESP8266 can be programmed using various programming languages and integrated development environments, including Arduino IDE, MicroPython, and Lua.

Firmware Updates: It is possible to update the module's firmware, ensuring that it remains compatible with the latest protocols and security standards.

Deep Sleep Mode: The ESP8266 includes a deep sleep mode, allowing for power-efficient operation in battery-powered devices.

Over-the-Air (OTA) Updates: OTA updates enable remote programming and firmware updates, eliminating the need for physical access to the device.

Wi-Fi Security: The module supports various Wi-Fi security protocols, including WPA/WPA2, ensuring secure data transmission.

5.1.6 DIODE:

A diode is a two terminal electronic component that conducts primarily in one direction. It has low resistance to the current in one direction and high resistance in other. The most common function of a diode is to allow an electric current to pass in one direction while blocking current in the opposite direction. This unidirectional behaviour is called rectification and it is used to convert ac to dc. Here we use 1N4007 diodes.

Fig.17: 1N4007 Diode

5.1.7 CAPACITOR:

Capacitor is a passive 2 terminal electrical component that stores electrical energy when they are connected to battery or some other charging circuit. The effect of capacitor is known as capacitance. The capacitor contains 2 metallic plates that are separated by some form of insulation. Capacitance is usually measured in the farad unit. They are commonly placed in electronic components and are used to maintain a power supply while the device is unplugged and without a battery for a short time.

Here, in our project we are using 0.1uf, 100uf, 450uf, 470uf.

Fig.18: Capacitors

5.1.8 RESISTORS:

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. Here, in our project we are using 10Ω, 1kΩ, 2.2KΩ and 10KΩ.

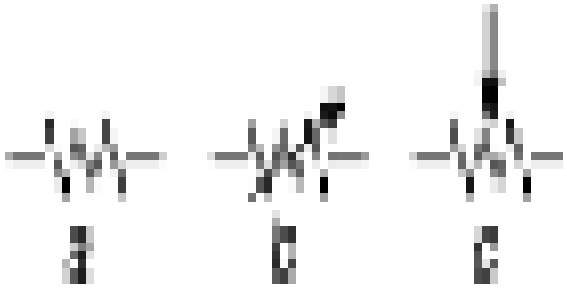


Fig.19: (a) resistor (b) rheostat (variable resistor) and (c) potentiometer

CHAPTER NO. 8

Results

1. Precision in Blood Weight Measurement:
   IoT sensors showcased remarkable accuracy in measuring blood collection bag weights during donations, surpassing traditional methods.
2. Efficient Real-Time Data Transmission:
   The communication system reliably transmitted real-time blood weight data to the cloud-based platform, ensuring timely access to critical information.
3. Robust Cloud-Based Data Management:
   The established cloud infrastructure securely stored and processed blood weight data, showcasing scalability for future applications.
4. User-Friendly Dashboard:
   The intuitive user interface empowered authorized personnel to seamlessly monitor and manage blood bank operations, enhancing overall efficiency.
5. Effective Alerting System:
   The implemented alerting system successfully notified staff of critical events, contributing to improved quality control and the safety of stored blood products.
6. Operational Efficiency Gains:
   Real-time monitoring and data-driven decision-making optimized resource allocation, minimizing overfilling instances and stock shortages.
7. Enhanced Blood Quality and Safety:
   Continuous monitoring mitigated the risk of hemolysis, enhancing blood quality, and adhering to the highest standards in blood bank management.
8. Positive User Satisfaction:
   Initial feedback from blood bank staff reflected high satisfaction levels, with increased confidence in the integrity of blood products and transparency in operations.

CHAPTER NO. 8

Application

1. Real-Time Blood Inventory Management:

   The project enables real-time monitoring of blood weight, providing blood banks with accurate and up-to-the-minute information on their inventory. This allows for better management of blood stock levels, minimizing the risk of shortages or excess supply.

2. Quality Control and Assurance:

   Continuous monitoring of blood weight helps ensure the quality of blood products by preventing overfilling, which can lead to hemolysis. This application contributes to maintaining the integrity of stored blood units, enhancing overall quality control measures.

3. Resource Optimization:

   By providing insights into blood inventory levels and usage patterns, the system facilitates optimized resource allocation. Blood banks can better anticipate demand, reduce waste, and allocate resources efficiently to meet the needs of healthcare providers.

4. Enhanced Donor Confidence:

   The transparency and real-time monitoring offered by the system can boost donor confidence. Donors can be assured that their contributions are handled with precision and care, encouraging continued participation in blood donation programs.

5. Data-Driven Decision Making:

   The project's cloud-based data management system enables blood banks to harness the power of data for informed decision-making. Trends in blood usage, donation patterns, and inventory levels can inform strategic decisions for improved operational efficiency.

6. Improved Emergency Response:

   Real-time monitoring allows for rapid response to critical events, such as reaching maximum blood bag capacity or deviations in storage conditions. This capability is vital in emergency situations where quick decision-making is crucial.

7. Regulatory Compliance:

   The system can assist blood banks in adhering to regulatory standards and guidelines by providing a comprehensive and accessible record of blood-related data. This can streamline the compliance reporting process and enhance overall regulatory adherence.

8. Remote Monitoring and Management:

   The cloud-based platform allows authorized personnel to remotely monitor blood bank operations. This capability is especially valuable for large or geographically dispersed blood bank facilities, offering centralized control and oversight.

9. Integration with Healthcare Systems:

   The project can be integrated into broader healthcare information systems, fostering seamless communication between blood banks and healthcare providers. This integration can enhance coordination and facilitate efficient blood product distribution to hospitals and clinics.

CHAPTER NO. 8

Future Scope

1. Integration of Predictive Analytics:

   Incorporating predictive analytics algorithms can forecast blood demand, optimize inventory levels, and anticipate critical events. This proactive approach would further enhance resource allocation and minimize potential risks.

2. Expansion to Additional Sensors:

   Integrating additional sensors for monitoring factors like temperature, humidity, and storage conditions can provide a comprehensive view of blood product safety. This expansion would contribute to maintaining the quality and integrity of stored blood units.

3. Blockchain Technology for Enhanced Security:

   Implementing blockchain technology can enhance data security and transparency. Blockchain ensures the immutability of records, providing a secure and transparent platform for managing sensitive information related to blood donations and transactions.

4. Mobile Applications for Donor Engagement:

   Developing mobile applications that connect donors with real-time information about their contributions, upcoming donation drives, and the impact of their donations can enhance donor engagement and encourage regular participation.

5. Integration with Electronic Health Records (EHR):

   Integrating the blood bank monitoring system with electronic health records can create a seamless flow of information between blood banks and healthcare providers. This integration can improve patient care by ensuring that accurate and up-to-date blood-related information is readily available.

6. Remote Monitoring Technologies:

   Exploring and implementing remote monitoring technologies, such as Internet of Medical Things (IoMT) devices, can enable continuous monitoring of blood storage conditions and enhance the responsiveness to critical events, even from a distance.

7. Artificial Intelligence (AI) for Decision Support:

   Implementing AI algorithms for decision support can analyze complex patterns in blood usage, donor behavior, and inventory trends. This intelligent system can provide recommendations for optimized resource allocation and strategic decision-making.

8. Enhanced User Interfaces and Accessibility:

   Improving user interfaces and accessibility features can make the system even more user-friendly for blood bank staff and authorized personnel. This includes incorporating features like voice commands, multilingual support, and accessibility options for individuals with disabilities.

9. Collaboration with Healthcare Ecosystem:

   Facilitating collaboration with other components of the healthcare ecosystem, such as hospitals, clinics, and public health agencies, can create a more interconnected and efficient healthcare infrastructure. This collaborative approach can streamline the overall blood supply chain.

10. Global Scalability:

    Designing the system with scalability in mind allows for its application in various geographical locations and settings. Adapting the solution to different blood banking infrastructures and regulatory environments ensures its global relevance and impact.

11. Continuous Feedback Mechanism:

    Implementing a continuous feedback mechanism from end-users, including blood bank staff, donors, and healthcare providers, can drive iterative improvements. This user-centric approach ensures that the system evolves to meet the evolving needs and preferences of its stakeholders.

12. Environmental Monitoring for Sustainability:

    Incorporating environmental monitoring features can contribute to sustainable practices within blood banks. This includes tracking energy consumption, implementing eco-friendly storage solutions, and reducing the overall environmental impact of blood bank operations.

CHAPTER NO. 9

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