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Mini Project Report On

Automatic Sanitary Napkin Dispenser

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology

in

Electronics and Communication Engineering

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CERTIFICATE

This is to certify that the mini project report entitled ***"Automatic Sanitary Napkin Dispenser"*** *is a bonafide record of the work done by* ***Chessla Elizabeth Saji(U2101054)****, submitted to the Rajagiri School of Engineering & Technology (RSET) (Autonomous) in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B. Tech.) in "Electronics and Communication Engineering" during the academic year 2023-2024.*

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Abstract

The Automatic Sanitary Napkin Dispenser, which is a remarkable innovation, offers an easier solution for the need of female sanitary products in public restrooms and facilities. The cutting edge system operates on a multifaceted framework that starts with its high-tech usage of infrared (IR) sensors whose responsibility is to serve as frontline detection mechanism that quickly identifies user presence and activates the dispensing mechanism with great precision and accuracy.

The addition of an LCD indicator provides ease of use while giving users clear immediate feedback about dispenser operation. Whether it signals readiness for use or indicates maintenance requirement, this visual indication will ensure that users are kept informed and empowered throughout their interaction with the dispenser.

The main advantage of the automatic sanitary napkin dispenser is its connection to the Blynk app. This allows us to check napkin levels remotely and receive alerts when refills are needed. This ensures the dispenser is always stocked and working well, improving efficiency and reliability for users.

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Chapter 1

Introduction

The Automatic Sanitary Napkin Dispenser is a helpful device for public restrooms and facilities. It uses infrared (IR) sensors to detect when someone is near and then dispenses a napkin accurately. An LCD screen on the dispenser provides clear information, showing if the dispenser is ready to use or needs maintenance. The dispenser is also connected to the Blynk app, which lets us check napkin levels remotely and receive refill alerts. This ensures the dispenser is always stocked and working properly, making it reliable and easy to use.

1.1 Background

Managing periods is a significant challenge for women and girls worldwide, particularly in low-income areas where access to sanitary products is limited. This lack of access can lead to health issues, missed school or work, and feelings of shame. Automated sanitary napkin dispensers offer a solution to these problems. These machines ensure that pads are always available in public restrooms, schools, and offices. They are contactless, making them clean and easy to use. The dispensers are connected to the internet, allowing for remote monitoring and timely refilling or maintenance. An LCD screen on the dispenser provides information about its status, and there is a button to press if there is an issue. This technology represents a significant advancement in menstrual hygiene, ensuring women and girls receive the dignity and support they deserve.

1.2 Problem Definition

This project tackles the main problem of limited access to sanitary napkins in public spaces, especially in low-income areas, leading to poor menstrual hygiene management. This results in infections and other health problems, with girls missing school and women

missing work. The current system of manual distribution is inefficient, prone to supply shortages, and lacks real-time monitoring. This project seeks to address these issues by developing an automated sanitary napkin dispenser. It will have IR sensors for hygienic, contactless dispensing and IoT capabilities. These ensure real-time inventory tracking and maintenance alerts for a continuous and reliable supply of sanitary napkins.

1.3 Scope and Motivation

1.3.1.Scope of the Automatic Sanitary Napkin Dispenser

The scope of the Automatic Sanitary Napkin Dispenser project encompasses the design, development, implementation, and maintenance of a user-friendly, efficient, and reliable system that provides sanitary napkins to individuals in public and private settings. The project aims to address the following key areas:

1. Design and Development:
    - Creation of a dispenser that is easy to use, hygienic, and durable.
    - Integration of sensors and automation technology to ensure seamless dispensing.
    - Development of a user interface that is accessible and simple to operate.
2. Implementation:
    - Installation of dispensers in various locations such as schools, colleges, workplaces, public restrooms, and community centers.
    - Ensuring the dispensers are accessible to all individuals who need them, regardless of their socio-economic status.
3. Maintenance and Sustainability:
    - Establishment of a regular maintenance schedule to ensure the dispensers are always stocked and functional.
    - Implementation of monitoring systems to track usage patterns and optimize the restocking process.

- Exploration of sustainable and eco-friendly materials for both the dispensers and the sanitary napkins.

4. Education and Awareness:

   - Development of educational programs and materials to promote awareness about menstrual health and hygiene.
   - Collaboration with organizations and institutions to support and promote the use of the dispensers.

5. Data Collection and Analysis:

   - Collection of data on the usage of the dispensers to understand demand and improve service.
   - Analysis of data to identify trends and areas for improvement in the distribution and accessibility of sanitary napkins.

1.3.2.Motivation for the Automatic Sanitary Napkin Dispenser

The motivation for developing an Automatic Sanitary Napkin Dispenser stems from several pressing needs and societal benefits:

1. Promoting Menstrual Hygiene:

   - Many individuals, especially in underserved communities, lack access to sanitary napkins, leading to poor menstrual hygiene and associated health issues.
   - Providing easy access to sanitary napkins helps in promoting better menstrual hygiene practices.

2. Reducing Stigma and Improving Education:

   - Menstruation is often surrounded by stigma and misinformation. By making sanitary napkins readily available, the project aims to normalize menstruation and reduce the associated stigma.
   - Educational initiatives linked to the dispensers can further enhance awareness and understanding of menstrual health.

3. Supporting Gender Equality and Empowerment:

    - Access to sanitary napkins is crucial for ensuring that menstruation does not become a barrier to education, work, or social activities.
    - By providing sanitary napkins for free, the project supports the empowerment of individuals who menstruate, contributing to greater gender equality.

4. Improving Public Health:

    - Ensuring access to sanitary napkins helps prevent infections and other health issues related to poor menstrual hygiene.
    - The project contributes to broader public health goals by addressing a critical aspect of personal health and hygiene.

5. Innovative and Sustainable Solutions:

    - The use of automation and smart technology in the dispensers represents an innovative approach to addressing a long-standing issue.
    - Emphasizing sustainability in the materials and processes used aligns with global efforts to reduce environmental impact and promote sustainable development.

By addressing these areas, the Automatic Sanitary Napkin Dispenser project aims to create a significant positive impact on individuals' health, well-being, and overall quality of life.

1.4 Objectives

- Provide Access to Sanitary Napkins

Develop an automated dispenser to ensure convenient and free access to sanitary napkins in public spaces, schools, and workplaces.

- Ensure Hygienic Dispensing

Implement IR sensors for touch-free dispensing to maintain hygienic standards and reduce the risk of contamination.

- Real-Time Monitoring

Integrate IoT capabilities to monitor inventory levels in real-time and send alerts when the napkin count falls below a certain threshold, ensuring timely replenishment.

- Enhance User Experience

Incorporate an LCD display to provide users with clear information about the dispensing status, promoting transparency and ease of use.

- Promote Menstrual Health and Hygiene

Ultimately, the project aims to promote menstrual health and hygiene, reduce absenteeism from school and work, and contribute to breaking the stigma surrounding menstruation.

1.5 Challenges

1. Technical Complexity: Integrating various components such as IR sensors, microcontrollers, dispensing mechanisms, LCD displays, and IoT connectivity requires expertise in electronics, programming, and system integration.

2. Hygiene Standards: Ensuring the dispenser maintains high hygiene standards is crucial, as any contamination could lead to health risks. Designing a robust and easy-to-clean dispensing mechanism is essential.

3. IoT Connectivity and Security: Establishing reliable IoT connectivity and ensuring data security are paramount. Issues such as network reliability, data privacy, and secure communication protocols need to be addressed.

4. Power Supply and Reliability: The dispenser requires a reliable power supply to operate continuously. Implementing backup power solutions or energy-efficient designs may be necessary, especially in areas prone to power outages. 5. User Acceptance and Behavior: User acceptance and behavior play a significant role in the success of the project. Educating users about the dispenser's functionality and promoting its usage may be necessary to overcome any reluctance or skepticism.

1.6 Societal / Industrial Relevance

The societal and industrial relevance of our project is significant, as it addresses a critical aspect of public health and gender equality. By providing free and accessible sanitary napkins in public spaces, schools, and workplaces, it contribute to improving menstrual hygiene management, reducing health risks, and breaking the stigma surrounding menstruation. This project aligns with global efforts to promote women's health and empowerment, as access to menstrual hygiene products is essential for women and girls to participate fully in education, work, and social activities. From an industrial perspective, the development of an automated sanitary napkin dispenser represents innovation in both hardware and software integration, with potential applications in various sectors beyond menstrual hygiene, such as healthcare and hospitality

Chapter 2

Literature Survey

Menstrual hygiene remains a challenge, especially for girls who are uneducated and lack access to sanitary products. This study examines existing research to explore how technology can bridge this gap. We explore research on the importance of menstruation based on the development of IoT-based dispensers (Samba Siva Rao et al.) and advanced vending machine designs (Kamalanathan et al.) (Jogdand Yerpude, 2011). By understanding these areas, we aim to identify how technology can empower women and girls in managing their menstrual health.

2.1 Community based study on menstrual hygiene among adolescent girls

Jogdand Yerpude (2011) conducted a community-based study that examined menstrual hygiene practices among adolescent girls in India. A study published in the Indian Journal of Maternal and Child Health (Volume 13, Issue 3, pp. 1-6) identified a significant gap in premenstrual education. Notably, 64% of the girls surveyed lacked prior knowledge about menstruation. This highlights the importance of explicit communication between mothers and daughters along with the integration of menstrual hygiene education into the school curriculum. The study also highlights the need for affordable sanitary products to ensure adequate menstrual hygiene. However, further research is needed to develop a comprehensive understanding of menstrual hygiene practices and challenges faced by adolescent girls in India.

2.2 Iot Based Intelligent Sanitary Napkin Disposer

Samba Siva Rao etal's literature survey conducted for the report on the Solar Powered IoT based Intelligent Sanitary Napkin Dispenser revealed several key findings from previous research. Studies have explored the implementation of cashless and secure payment

systems using RFID technology , indicating a shift towards more convenient and efficient transaction methods. Additionally, research on Single Electron Device-based automatic tea vending machines in the realm of Information and Communication Technology in Electrical Sciences highlights the potential for innovative solutions in vending technology. Furthermore, the development of PLC-based industrial timer controllers for multiple machines and the enhancement of weigher efficiency using PLC controllers demonstrate the versatility and applicability of programmable logic controllers in various industrial settings. Moreover, investigations into controlling vending machines over the World Wide Web using Java technology showcase the integration of web-based solutions for remote monitoring and management. These references collectively contribute to a comprehensive understanding of the technological landscape surrounding IoT integration and solar power utilization in the context of sanitary napkin dispensers.

2.3 Design Of Portable Sanitary Napkin Vending Machine

K.Subashchandrabose ,G.Moulieshwaran ,M.Raghul ,V.Dhinesh ,S.SaravananThe journal reveals the critical need to promote the use of sanitary napkins, particularly in rural areas where access and awareness are limited. Studies indicate low usage rates among women in India, leading to hygiene issues and educational barriers for girls during menstruation. The design of a portable sanitary napkin vending machine, equipped with an infrared sensor for detection, aims to address these challenges by providing easy access to sanitary napkins in schools and colleges. By educating girls and women about menstrual hygiene and facilitating access to sanitary napkins, the system seeks to improve health outcomes, reduce societal stigmas, and contribute to gender equality and poverty eradication efforts. The survey also highlights related research on renewable energy systems and power quality improvement, emphasizing the interdisciplinary nature of addressing health and environmental challenges in innovative ways.

2.4 Automatic Paper Vending Machine

Kamalanathan.P,Irshath Ahmed,Mohamed Aamir,Kalaiselvan.P as listed in this literature survey delves into the design and manufacturing aspects of pad dispensing machines, focusing on the accessibility of sanitary napkins for women. By reviewing existing research,

it aims to identify trends and innovations in automated dispensing systems. Previous studies, such as those by Samba Siva Rao et al. and Mohan SukraGond et al., have explored intelligent dispensers and user interface design. The current system, as discussed in the literature, often relies on coin mechanisms and stepper motors, leading to challenges like bulkiness and limited capacity. To address these issues, the proposed vending machine utilizes three parallel coil spring mechanisms controlled by an ATMEGA 8 controller and a DC motor for increased pad capacity. Material selection, manufacturing processes, and assembly considerations are crucial for ensuring the durability and efficiency of these machines. This survey underscores the significance of continuous innovation in designing pad dispensing machines to enhance women's hygiene and accessibility to essential sanitary products.

Chapter 3

Methodology

3.1 Problem Statement

Many of women do not have access to menstrual hygiene products which are vital for their health and dignity because of limited financial resources or lack of availability. In educational institutions, workplaces, and public facilities, the absence of sanitary pads can make those affected uncomfortable, embarrassed and lose out on opportunities. The present remedies mostly don't automate or report in real time thus leading to intermittent scarcity as well as maintenance problems contributing towards inaccessibility.

Our project seeks to resolve these challenges through creation of an automatic sanitary pad vending machine that has infrared sensors fitted on it and a Blynk application that is IoT based. With this system free sanitary pads are always available by alerting the attendant when there is need for restocking or repairs via short message service. It also contains a liquid crystal display panel that shows whether dispensation is taking place meaning it enhances clients' experience and dependability. Our solution employs IoT to enable better accessibility in menstrual hygiene, support wellbeing and health while breaking the taboos around menstruation.

3.2 Block Diagram

The automatic sanitary napkin dispenser takes advantage of a microcontroller at its central parts, and it is the platform where the management of the machine is done. The IR having two sensors serves the purpose of the detection of user motion. As a result, the activating process of the dispenser will only be carried out when needed, thereby preventing waste of soap or sanitizer. On the detection of motion, the microcontroller pin connects to the motor driver board and then activates the motor which is attached to a spring mechanism. This in turn rotates the motor pi's like screw that dispenses the

napkins. The dispensing operation status of users is displayed on the LCD screen such as "Dispensing now","Tissue Dispensed" and "Not dispensed". The system is incorporated into an IoT module that is linked to the Blynk app which indicates water levels that is running low as well as any maintenance requirement, thus guaranteeing constant and proper performance. One push button button is also made to send an alert to dispatcher, which will not only enhance usability but also efficiency.

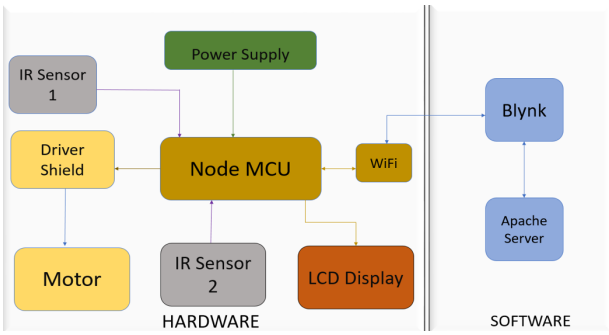

Figure 3.1: Block Diagram

3.3 Implementation

3.3.1 Flowchart

This is the flowchart for the desired prototype

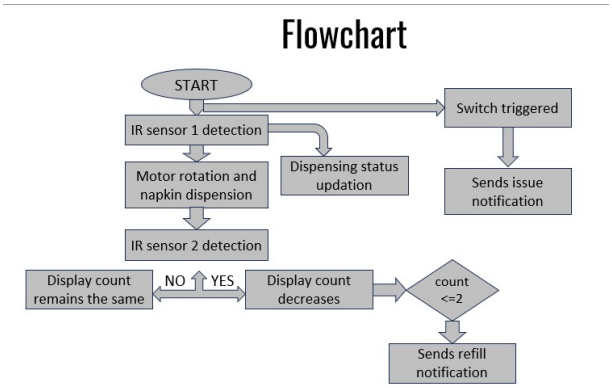

Figure 3.2: Flowchart

The flowchart for the automatic sanitary napkin dispenser project begins with the system initialization, where the microcontroller and connected components are powered

on. The IR sensors continuously monitor for user motion. When motion is detected, the microcontroller signals the motor driver to activate the DC motor, which rotates the spring mechanism to dispense a napkin. Concurrently, the LCD display updates to show 'Dispensing' followed by 'Dispensed' once the process is complete. The system then checks napkin levels; if low, a notification is sent to the Blynk app for refilling.

3.3.2 Circuit Setup

The automatic sanitary napkin dispenser utilizes a microcontroller at its core, which coordinates the system's operations. Two IR sensors are employed to detect user motion, ensuring the dispenser is activated only when needed. Upon detecting motion, the microcontroller signals a motor driver to activate a DC motor connected to a spring mechanism, which rotates to dispense a napkin. The dispensing process status is communicated to users through an LCD display, indicating messages such as 'Dispensing' or 'Dispensed.' The system is integrated with an IoT module connected to the Blynk app, which sends real-time notifications for refilling needs and maintenance issues, ensuring continuous and reliable operation.

This is the circuit setup for the desired prototype of automatic sanitary napkin dispenser

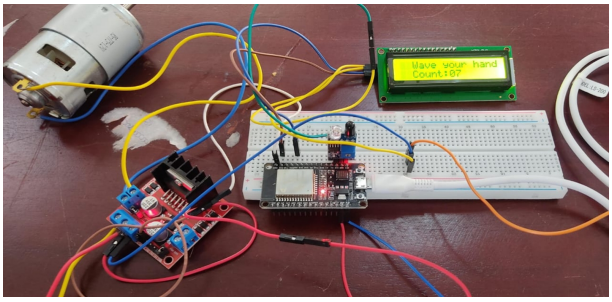

Figure 3.3: Circuit Setup

3.3.3 Experimental Setup

The experimental setup for the automatic sanitary napkin dispenser includes an IR sensor placed on the right side of the dispenser case to detect motion and send a signal to the NodeMCU ESP32. The motor driver connected to the ESP32 controls the DC motor, enabling it to rotate and dispense a napkin through a spring mounted on a shaft coupling.

An LCD display on the front provides users with clear information about the dispensing status and napkin count, promoting transparency and enhancing the user experience. This display helps ensure users are well-informed and can trust the system's reliability. A second IR sensor is located where the napkin is collected to send a signal to the ESP32, updating the dispensing status and reducing the count on the LCD display. This dual-sensor setup minimizes errors and ensures accurate tracking of the napkin count. When the napkin count displayed on the LCD, mounted on the top right side of the casing, reaches two, a notification is sent to the worker's phone through the Blynk app. Figure 3.4 and figure 3.5 shows the experimental setup.

Figure 3.4: Experimental Setup(1)

Figure 3.5: Experimental Setup(2)

Chapter 4

Hardware and Software Details

4.1 Hardware Details

4.1.1 ESP32

ESP32-WROOM-32 is one of the popular models of ESP32 series with integrated Wi-Fi and Bluetooth capabilities, making it an ideal choice for IoT projects. It features a dual-core Tensilica LX6 processor running at speeds of up to 240 MHz, thus guaranteeing high performance. It offers 520 KB of SRAM and externally expandable SPI flash memory (typically 4 MB), which makes it possible to perform memory-intensive tasks effectively. It has a wide range of peripheral interfaces such as UART, SPI and I2C that are responsible for simplified hardware integration. Also, its versatility is improved by capacitance touch support in addition to hall and temperature sensors. Meanwhile, this variant may contain up to thirty four GPIO pins allowing for various connectivity possibilities. Figure 4.1 shows the ESP32-WROOM-32.

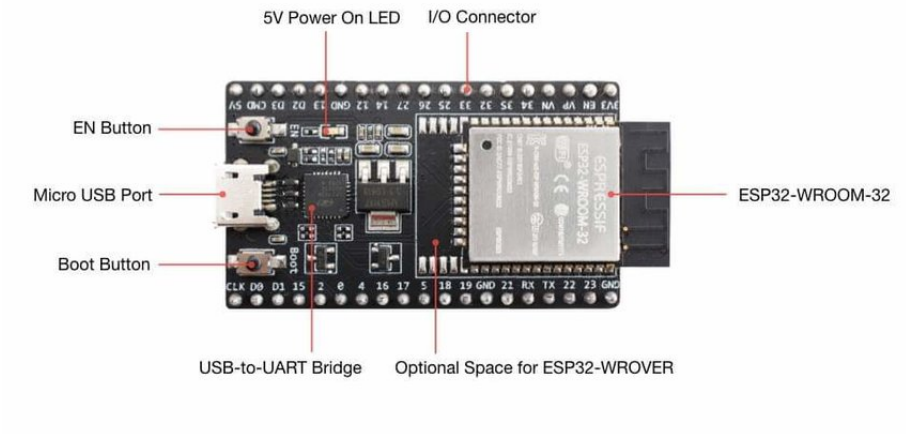

Figure 4.1: ESP32-WROOM-32

4.1.2 L298N Motor Driver Sheild

The L298N motor driver shield can be used to control DC and stepper motors in electronics projects flexibly. It is designed with dual H-Bridge, which permits an independent control of two motors up to 2A on each channel continuously and peak currents as high as 3A. The L298N supports input voltages from 5V to 35V and provides for PWM-based speed control and direction management through digital inputs. In general, power inputs (12V, GND), control pins (IN1, IN2, IN3, IN4), enable pins (EN1, EN2), motor outputs are the main connections for such a module (OUT1, OUT2, OUT3, OUT4). For instance in Arduino setup these pins must be defined first before using 'digitalWrite' and 'analogWrite' to control the motors. Applications include robotics as well as automation along with educational prototyping among others. Figure 4.2 shows the L298N motor driver shield.

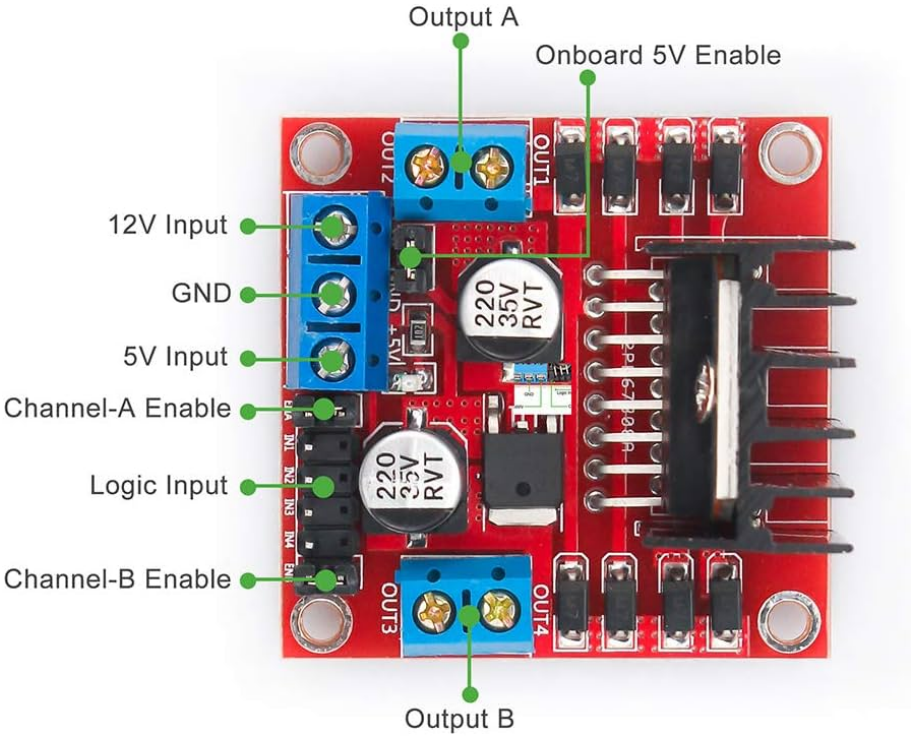

Figure 4.2: L298N motor driver shield

4.1.3 LCD Display

A 16 by using 2 LCD display features a screen divided into traces, every able to showing as much as 16 characters horizontally. These shows, usually employed in digital devices,

utilize liquid crystal generation to provide textual statistics in a compact layout. They normally comprise popular character sizes, regularly using a 5x7 or 5x8 dot matrix for each person. Control of the show is controlled with the aid of dedicated controller chips like the Hitachi HD 44780, which deal with tasks which include statistics processing and communication with the host tool. Power necessities commonly variety from 3.3V to 5V, with power consumption various primarily based on factors such as back light usage. These shows discover application in a number devices, consisting of digital clocks, temperature displays, and small text-based interfaces, wherein conveying simple textual information is crucial. Figure 4.3 shows the LCD display.

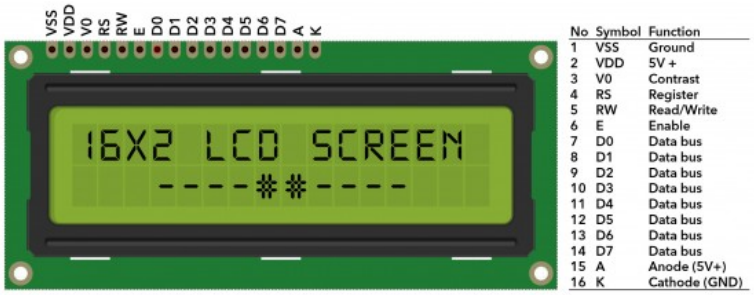

Figure 4.3: LCD Display

4.1.4 R775 DC motor

The R775 DC motor is a rugged and high-torque engine this is often utilized in demanding programs consisting of energy equipment, robotics, and automated systems. It operates efficiently among 12V to 24V, giving it the potential to perform extraordinary obligations. Its lengthy-lasting overall performance and dependability are ensured by using its difficult metal case and brushes of excessive nice. When running at better RPMs this motor may

be suitable for quick paintings; while its massive torque makes it desirable for heavy duty jobs like drills, saws or conveyor belts. The commonly encountered specifications include voltage starting from 12 volts to 24 volts, varying with load specifications on modern running among one ampere to five amperes, and speeds reaching up to 3000 RPMs. Figure 4.4 shows the R775 DC motor.

Figure 4.4: R775 DC motor

4.1.5 IR Sensor

Invisible to the human eye however can be felt as warmth, an IR (infrared) sensor is an electronic equipment that discovers infrared radiation. There are predominant sorts: active and passive. Reflecting or sending IR mild, active IR sensors degree this mirrored image to feel gadgets, that's typically determined in faraway controls and proximity detectors. Passive IR sensors discover the presence of IR radiations emitted by way of warm items can be broadly utilized in motion detectors for protection structures and automatic lights. Typical specs for IR sensors include a wavelength range of 700 nm to one mm, detection stages from some centimeters to numerous meters and fields of view that vary greatly. Response times may be within the millisecond range, and they frequently operate at voltages between 3.3V and 5V.Figure 4.5 shows the IR sensor

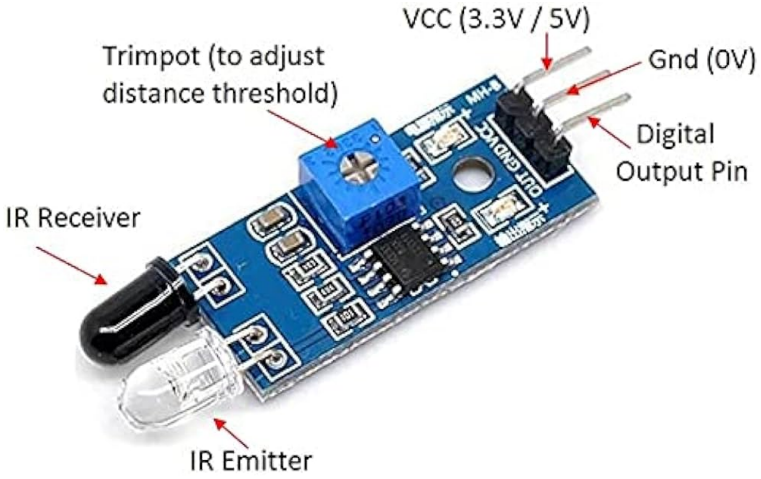

Figure 4.5: IR Sensor

4.2 Software Details

4.2.1 Arduino IDE

Arduino IDE is an intuitive software platform that facilitates writing, compiling and uploading of code to Arduino compatible microcontrollers. It has a simple and powerful code editor with syntax highlighting and auto-indentation for easy coding by even beginners. Sketches, as they are known within the IDE, are based on two main functions in this case 'setup()' and 'loop()" which allow microcontroller initializations as well as continuous operations. The library manager enables simple integration of ready-written code while the serial monitor provides a communication link for debugging purposes among others.C++ is used to program the NodeMCU ESP32, enabling it to control the sensors and dispenser mechanism in the automatic sanitary napkin dispenser. This makes sure the dispenser operates smoothly and stays connected to the Blynk app for easy remote monitoring and management.

Chapter 5

Results and Discussions

5.1 Results

The project successfully developed an automatic sanitary napkin dispenser using IR sensors, an LCD display, and an IoT-based notification system with the Blynk application.

1. LCD Display Status Updates The LCD display provided clear and concise status updates regarding the dispensing process. The statuses displayed were:

- "Dispensing now": Indicated when the napkin was in the process of being dispensed. This status helped manage user expectations and provided assurance that the dispenser was functioning.
- "Tissue Dispensed": Confirmed that the napkin had been successfully dispensed. This feedback loop was critical for user satisfaction.
- "Not Dispensed": Indicated a failure in the dispensing process. This status was essential for identifying and troubleshooting issues promptly.

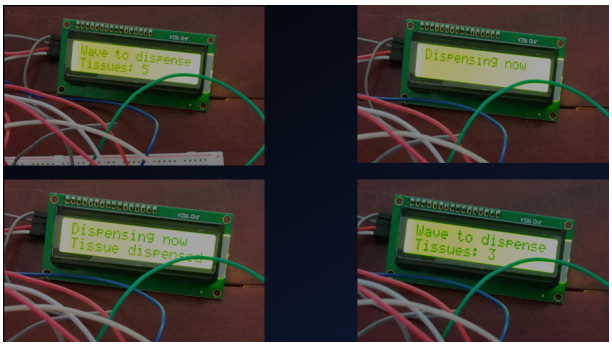

Figure 5.1: LCD Display Status

2. IoT Integration and Blynk Notifications The integration of the IoT-based application, Blynk, was implemented to send notifications regarding the dispenser's status, particularly for re-filling alerts:

- Refill Alerts: The system successfully sent notifications to the designated phones when the napkin count is below 3. This notification ensured that the dispenser was re-filled in a timely manner, maintaining continuous availability.

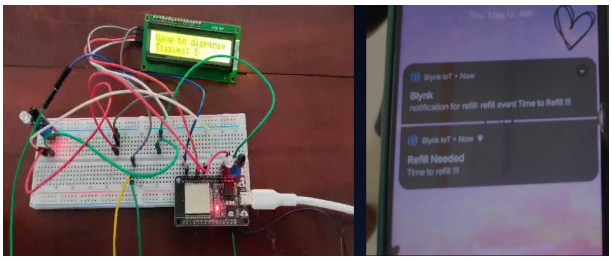

Figure 5.2: Refill Notification

5.2 Advantages

- Improved Accessibility: Free dispensing mechanism reduces barriers to access.
- Automation and Convenience: IR sensors enable hands-free operation.
- Real-Time Monitoring: IoT integration ensures timely maintenance and restocking.
- Enhanced User Experience: LCD display provides clear feedback during use.
- Cost-Effective: Uses affordable components and open-source technology.
- Health Promotion: Supports better menstrual health and hygiene.
- Scalability: Modular design allows for easy customization and expansion.
- Social Impact: Reduces stigma, promotes gender equality, and supports education.

5.3 Disadvantages

- Maintenance Requirements: Regular refilling, technical checks, and cleaning needed for proper function.

- Dependency on Power and Internet: Relies on continuous power and internet, susceptible to interruptions in unstable areas.
- Technical Complexity: Integration of hardware and IoT features requires technical expertise for troubleshooting.
- Vandalism and Misuse: Risk of damage or misuse in public settings, leading to increased maintenance and downtime.
- Limited Capacity: Finite napkin storage requires frequent refilling in high-traffic areas.
- Potential Sensor Failures: IR sensors and electronics can malfunction due to environmental factors or wear and tear.

Chapter 6

Conclusions & Future Scope

6.1 Conclusion

Our automated sanitary napkin dispenser, fused with IoT capabilities, represents a significant step forward in addressing menstrual hygiene. Utilizing technologies such as the ESP32 microcontroller, IR sensors, and the Blynk application, our business offers a convenient, hygienic and efficient solution for sanitary napkin dispensing. The system increases accessibility, ensuring that those in need of menstrual hygiene products can get them readily, thus promoting health and wellbeing The combination of refill and maintenance real-time monitoring and information ensures that the dispenser is operational and stocked, reducing downtime and increasing reliability. Despite some challenges such as the cost of initial design, maintenance requirements, and reliance on electricity and the Internet, there are advantages to our system—such as advanced, productivity in a passive manner, and the improved user experience—overcome these shortcomings In conclusion, our functional sanitary napkin dispenser not only addresses an important public health issue, but also promotes a supportive environment that promotes dignity and equality. If properly implemented and managed, this project has the potential to make a meaningful impact on educational institutions, workplaces and public buildings, contribute to better management of menstrual hygiene and promote gender equality.

6.2 Future Scope

In the future our automated sanitary napkin dispenser business has many developments aimed at improving efficiency and expanding its impact Combining advanced sensors with AI will be able to predict usage patterns and provide planning insertion to increase efficiency. Solar co-ops provide sustainable electricity solutions, especially in areas with unreliable power supplies. Multilingual support on the LCD display will make the system

more accessible to different types of people. Additional features such as checking napkin availability and proximity to the dispensing location can be provided by developing a dedicated mobile app. Using data analytics provides valuable insights into usage patterns, which will help monitor inventory efficiency and service delivery. Advanced security features such as customizable delivery methods and biometric access can enhance the user experience and prevent abuse. Scaling the project to more organizations and partnering with public health systems will maximize the impact of the project. In addition, the inclusion of biodegradable or recyclable storage containers can improve environmental sustainability. These future developments are aimed at improving the efficiency, convenience and environmental friendliness of the supply chain, and addressing the critical health needs of the population.

References

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Appendix A: Questions and Answers

Questions and Answers

1) In what manner does the NodeMCU ESP32 enable complex operation and control of the sanitary napkin dispenser system?

Answer : The NodeMCU ESP32 serves as a central controller for the dispenser system. It uses input from the IR sensor to determine presence and sends commands to the L298N Motor Driver Shield so that it drives RS-775 DC motor accurately, hence facilitating proper dispensing.

2) How is user attendance detected by an IR sensor and how does it tell ESP32 about this?

Answer : An IR sensor has an infrared beam emitting transmitter and a beam detector receiver. When a person moves towards the device causing obstruction in its path, this is sensed by the interrupter which then relays this data electrically to ESP32.The above signal received by ESP32 helps in starting dispensing process.

3) Explain how RS-775 DC Motor is controlled to dispense a sanitary napkin by ESP32 and L298N Motor Driver Shield.

Answer : As soon as a user is detected by IR sensor, the ESP32 transmits control signals to the L298N Motor Driver Shield. The motor driver understands the signal in order to make the RS-775 DC motor function. To deliver one sanitary napkin, the dc motor rotates in an ordered way. This kind of coordination is done by commands from the ESP32 with precise control from L298N.

4) What are some of the ways in which integration of Blynk application enhances operational efficiency and maintenance of a Sanitary Napkin Dispenser using an ESP 32?

Answer : The Blynk app integrated with ESP32 enables real-time monitoring and remote management over this device. So, through Blynk app, various data concerning dispenser's operations such as stock levels for pads can be sent from ESP 32 to it. Users are alerted for maintenance checks and replenishment that allows timely re stocking before any downtime happens via alerts send by specially designed apps hence improving operational efficiency tremendously due to users' satisfaction.

Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes

Vision, Mission, Programme Outcomes and Course Outcomes

Institute Vision

To evolve into a premier technological and research institution, moulding eminent professionals with creative minds,innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind

Institute Mission

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

Department Vision

To evolve into a centre of excellence in electronics and communication engineering, moulding professionals having inquisitive,innovative and creative minds with sound practical skills who can strive for the betterment of mankind.

Department Mission

To impart state-of-the-art knowledge to students in Electronics and Communication Engineering and to inculcate in them a high degree of social consciousness and a sense of human values, thereby enabling them to face challenges with courage and conviction

Programme Outcomes (PO)

Engineering Graduates will be able to:
PO 1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. Problem analysis: Identify, formulate, review research literature, and analyze

complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4. Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. Individual and Team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO 10. Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO 11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO 12. Life-long learning: Recognize the need for, and have the preparation and

ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

PSO 1: Demonstrate their skills in designing, implementing and testing analogue and digital electronic circuits, including microprocessor systems, for signal processing, communication, networking, VLSI and embedded systems applications.

PSO 2: Apply their knowledge and skills to conduct experiments and develop applications using electronic design automation (EDA) tools.

PSO 3: Demonstrate a sense of professional ethics, recognize the impor- tance of continued learning, and be able to carry out their professional and entrepreneurial responsibilities in electronics engineering field giving due consideration to environment protection and sustainability.

Course Outcomes (CO)

Course Outcome 1:Be able to practice acquired knowledge within the selected area of technology for project development.

Course Outcome 2:Identify, discuss and justify the techni- cal aspects and design aspects of the project with a systematic approach.

Course Outcome 3:Reproduce, improve and refine techni- cal aspects for engineering projects.

Course Outcome 4:Work as a team in development of technical projects.

Course Outcome 5:Communicate and report effectively project related activities and findings.

Project Outcomes (PRO)

Project Outcome 1:Developed an Accurate User Detection Mechanism

Project Outcome 2:Created an Intuitive User Interface

Project Outcome 3:Integrated Remote Monitoring Capabilities

Project Outcome 4:Ensured Continuous Operational Efficiency

Project Outcome 5:Prepared a technical report on LaTex

Appendix C: CO-PO-PSO Mapping

Mapping CO and Project Objectives with PO-PSO

The following tables shows the mapping for course outcome for PO and PSO and the mapping of project objectives with POs and PSOs. The mapping specifications are as follows:
1-Low, 2-Medium ,3-High

CO - PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	3	3	2	-	3	-	-	2	-	-	2
2	3	3	3	2	-	3	-	-	-	2	3	2
3	3	3	3	2	-	3	-	-	-	-	3	2
4	-	-	-	-	-	-	-	3	2	3	3	2
5	-	-	-	-	-	-	-	3	3	3	-	2

CO - PSO Mapping

CO	PSO 1	PSO 2	PSO 3
1	2	1	-
2	2	2	-
3	2	2	-
4	2	1	1
5	2	1	1

PRO - PO Mapping

PRO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	2	3	2	1	2	2	2	2	1	2	1	2
2	2	1	2	-	1	-	-	3	1	-	-	-
3	-	-	-	-	-	-	-	-	3	1	2	1
4	-	-	-	-	3	-	-	-	2	2	3	2
5	-	-	-	-	1	-	-	2	2	3	1	1

PRO - PSO Mapping

PRO	PSO 1	PSO 2	PSO 3
1	2	3	2
2	3	2	3
3	2	3	2
4	3	2	1
5	2	1	2

Justification

Mapping	Justification
PRO1-PO1	Applied fundamental engineering knowledge to a limited extent
PRO1-PO2	Conducted a basic analysis and formulation of the detection mechanism with moderate depth
PRO1-PO3	Designed a solution to improve user detection with considerations for safety and usability
PRO1-PO4	Conducted experiments to test the accuracy of the user detection mechanism and interpreted the data to validate the solution
PRO1-PO5	Utilizied modern tools for sensor implementation
PRO1-PO6	Assessed societal and safety impacts of the user detection mechanism
PRO1-PO7	Considered the environmental impact and sustainability of the solution
PRO1-PO8	Adhered to ethical standards during the development and testing phases
PRO1-PO9	Worked effectively both individually and in a team to develop the user detection mechanism
PRO1-PO10	Communicated findings and results clearly within the engineering team and in documentation
PRO1-PO11	Managed the development process efficiently, including time and resources
PRO1-PO12	Engaged in continuous learning to stay updated with new technologies relevant to user detection
PRO2-PO1	Applied engineering principles to design an intuitive interface
PRO2-PO2	Analyzed user requirements and interface usability issues

Justification

Mapping	**Justification**
PRO2-PO3	Focused on creating a moderately user-friendly interface
PRO2-PO5	Utilizied modern design tools to a moderate extent
PRO2-PO7	Ensured the interface design was environmentally friendly by optimizing resource usage
PRO2-PO8	Followed ethical guidelines in designing an accessible and non-discriminatory interface
PRO2-PO9	Collaborated effectively with team members to design the interface
PRO3-PO9	Collaborated with multidisciplinary teams to integrate remote monitoring capabilities
PRO3-PO10	Communicated integration requirements and procedures effectively
PRO3-PO11	Managed the project to ensure successful integration within the timeline and budget
PRO3-PO12	Continued learning about remote monitoring technologies to enhance integration
PRO4-PO5	Applied modern tools to monitor and enhance operational efficiency
PRO4-PO9	Worked as part of a team to continuously improve operational processes
PRO4-PO10	Communicated operational improvements and procedures effectively
PRO4-PO11	Managed resources and processes to ensure continuous operational efficiency
PRO4-PO12	Engaged in ongoing learning to improve operational efficiency strategies
PRO5-PO4	Conducted a detailed investigation and analysis to compile information for the technical report
PRO5-PO5	Utilized LaTeX, a modern tool, to prepare the report
PR05-PO10	Demonstrated effective communication through the preparation of a well-structured technical report
PR05-PO11	Managed the project of report preparation efficiently, including data collection and organization
PR05-PO12	Learned and applied new LaTeX skills to prepare the report

Justification

Mapping	**Justification**
PRO1-PSO1	Utilized skills in designing and testing IR sensor circuits for accurate user detection
PRO1-PSO2	Applied tools to ensure reliable detection
PRO1-PSO3	Ensured accuracy and continuous improvement of the detection mechanism
PR02-PSO1	Designed a user-friendly LCD interface
PR02-PSO2	Conducted experiments and usability tests using tools to refine the user interface
PR02-PSO3	Maintained ethical considerations and continuous improvement practices to create a user-friendly and sustainable interface
PR03-PSO1	Designed remote monitoring features using the Blynk app
PR03-PSO2	Utilized tools to develop and implement remote monitoring features using the Blynk app
PR03-PSO3	Optimized solutions for sustainability
PR04-PSO1	Designed and implemented solutions to maintain and improve the operational efficiency of the dispenser.
PR04-PSO2	Applied tools to monitor and Monitored the efficiency
PR04-PSO3	Emphasized ethical and sustainable practices
PR05-PSO1	Documented technical processes and findings
PR05-PSO2	Applied tools for report preparation
PR05-PSO3	Highlighted professional ethics and sustainability in the report