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NAAC Accredited Autonomous Institution
Approved by AICTE & Affiliated to Anna University
ISO 9001:2015 Certified Institution
Thalavapalayam, Karur - 639 113, TAMILNADU.

A Minor Project Report

On

AUTOMATED STOCK MONITORING AND NOTIFICATION SYSTEM FOR SUPERMARKET

Submitted by

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BONAFIDE CERTIFICATE

Certified that this Report titled **"AUTOMATED STOCK MONITORING AND NOTIFICATION SYSTEM FOR SUPERMARKET"** is the bonafide work of **DEEPIKA S (927622BEE018), DURGADEVI N(927622BEE028), KAVIN V (927622BEE055), KISHORE S (927622BEE059)** who carried out the work during the academic year (2024-2025) under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other project report.

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Submitted for Minor Project III (18EEP301L) viva-voce Examination held at M. Kumarasamy College of Engineering, Karur-639113 on ……..

DECLARATION

We affirm that the Minor Project III report titled "**AUTOMATED STOCK MONITORING AND NOTIFICATION SYSTEM FOR SUPERMARKET"** being submitted in partial fulfillment for the award of **Bachelor of Engineering in Electrical and Electronics Engineering** is the original work carried out by us.

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VISION AND MISSION OF THE INSTITUTION

VISION

- ✓ To emerge as a leader among the top institutions in the field of technical education

MISSION

- ✓ Produce smart technocrats with empirical knowledge who can surmount the global Challenges.
- ✓ Create a diverse, fully-engaged, learner - centric campus environment to provide Quality education to the students.
- ✓ Maintain mutually beneficial partnerships with our alumni, industry and Professional associations.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To produce smart and dynamic professionals with profound theoretical and practical knowledge comparable with the best in the field.

MISSION

- ✓ Produce hi-tech professionals in the field of Electrical and Electronics Engineering by inculcating core knowledge.
- ✓ Produce highly competent professionals with thrust on research.
- ✓ Provide personalized training to the students for enriching their skills.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs)

- ✓ **PEO1:** Graduates will have flourishing career in the core areas of Electrical Engineering and also allied disciplines.
- ✓ **PEO2:** Graduates will pursue higher studies and succeed in academic/research careers
- ✓ **PEO3:** Graduates will be a successful entrepreneur in creating jobs related to Electrical and Electronics Engineering /allied disciplines.
- ✓ **PEO4:** Graduates will practice ethics and have habit of continuous learning for their success in the chosen career.

PROGRAMME OUTCOMES(POs)

After the successful completion of the B.E. Electrical and Electronics Engineering degree program, the students will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: 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.

PO3: 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.

PO4: Conduct Investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: 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.

PO6: The Engineer and Society: Apply reasoning in formed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: 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.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

The following are the Program Specific Outcomes of Engineering Students:

PSO1: Apply the basic concepts of mathematics and science to analyse and design circuits, controls, Electrical machines and drives to solve complex problems.

PSO2: Apply relevant models, resources and emerging tools and techniques to provide solutions to power and energy related issues & challenges.

PSO3: Design, Develop and implement methods and concepts to facilitate solutions for electrical and electronics engineering related real world problems.

Abstract (Key Words)	Mapping of Pos and PSOs
Supermarket, stock monitoring, sensing signal, send notification	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11, PO12, PSO1, PSO2, PSO3

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ABSTRACT

The Automated Stock Monitoring and Notification System for Supermarkets aims to optimize inventory management by leveraging modern technology. The system integrates ultrasonic sensors, load cells, and a GSM module to provide real-time monitoring and notification services. Ultrasonic sensors measure the distance to items on shelves, ensuring precise stock level detection. Load cells measure the weight of the items to detect any changes in inventory. The GSM module facilitates communication by sending SMS alerts to supermarket staff when stock levels drop below a predefined threshold or when items are misplaced. This system reduces the need for manual inventory checks, ensures shelves are adequately stocked, and enhances overall operational efficiency. By maintaining optimal stock levels, supermarkets can minimize stockouts, improve customer satisfaction, and make informed restocking decisions based on accurate, real-time data. The integration of these technologies not only streamlines inventory management but also provides valuable insights into consumer behaviour through the analysis of stock movement patterns. This data-driven approach helps supermarkets to better understand customer preferences and adjust their inventory accordingly. Ultimately, the system contributes to a more efficient and responsive retail environment, benefiting both customers and store operators alike.

PROBLEM IDENTIFICATION

The main problem that the Automated Stock Monitoring and Notification System solves is the difficulty and inaccuracy of traditional inventory management in supermarkets. In many stores, staff members have to manually check shelves to see if products are running low. This takes a lot of time, effort, and can lead to mistakes. Because of this, restocking can be slow, causing empty shelves and lost sales, which can frustrate customers and hurt the store's earnings. Manual checks can also lead to overstocking, where too many items are ordered, leading to wasted space, higher costs, and possible spoilage, especially with perishable goods. Without accurate and real-time data, it is harder for managers to track sales trends and decide when to restock products. In large supermarkets with many different products, manual monitoring is even harder to manage effectively. The proposed system aims to solve these problems by automating stock monitoring, sending timely alerts when items are low, and providing clear data for better decision-making. This helps stores save time, reduce errors, lower costs, and keep customers happy by ensuring products are always available.

CHAPTER 1
LITERATURE REVIEW

Paper 1

Title: Supermarket Shelf Monitoring Using ROS based Robot

Inference: This paper introduces a robotic system that automates checking product quantities on supermarket shelves and refilling them when necessary. Traditional shelf monitoring is costly and infrequent, leading to customer dissatisfaction and revenue loss. The system uses a ROS-based autonomous robot for efficient and reliable operation. It utilizes GAZEBO for virtual simulations, G-mapping for navigation and mapping, and OpenCV for image analysis and object detection. This ensures precise monitoring and proactive restocking of shelves.

Paper 2

Title: Research on the Optimization of Supermarket Staff Scheduling Based on Intelligent Algorithm Combined with Binary Coding

Inference: This paper delves into the core problem of supermarket staff scheduling optimization, especially in terms of reducing human resource costs and increasing corporate profits. Genetic algorithm is adopted as the solution method, and the raw data are exhaustively pre-processed and converted into formats at the initial stage. During the application of the genetic algorithm, the Binary 0–1 gene coding method and targeted fitness function were designed. The staff scheduling was successfully optimized through genetic crossover, mutation, and elimination mechanisms. On this basis, employee qualification and efficiency are introduced as new optimization indexes, and the model and fitness function are adjusted accordingly to further enhance the effectiveness of the scheduling scheme.

Paper 3

Title: AI-Driven Produce Management and Self-Checkout System for Supermarkets

Inference: This paper introduces a deep learning-based system to streamline the purchase and stocking of fruits and vegetables in supermarkets. The proposed system automates the billing process by recognizing and classifying produce, which reduces checkout times and minimizes manual labor. It provides real-time inventory tracking and notifications to ensure timely restocking and minimize waste. Despite potential challenges in recognition accuracy, this approach significantly enhances the shopping experience and operational efficiency, giving supermarkets a competitive edge.

Paper 4

Title: Real-time Scene Change Detection with Object Detection for Automated Stock Verification

Inference: This paper proposes an automated stock management system using computer vision to reduce manpower in supermarkets. When product levels fall below a set threshold, an SMS or email alerts the relevant authority, aided by an optical character recognition module that identifies the product. An experimental study using a mobile camera as an IP camera demonstrates the system's reliability in a supermarket environment. This approach enhances efficiency and ensures timely product restocking.

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Paper 5

Title: Use Low-power IoT Cameras to Monitor Store Shelves

Inference: This paper proposes using low-power IoT cameras for shelf status detection in large shopping malls. The system replaces manual inspections with cameras that identify when shelves are empty by recognizing specific photos placed on the shelf. It uses an ultralow-power FPGA chip and a CNN model for image recognition. Experimental results show that the system effectively monitors shelves, offering lower costs, low power consumption, and easy maintenance compared to existing solutions.

CHAPTER 2
PROPOSED METHODOLOGY

2.1 BLOCK DIAGRAM

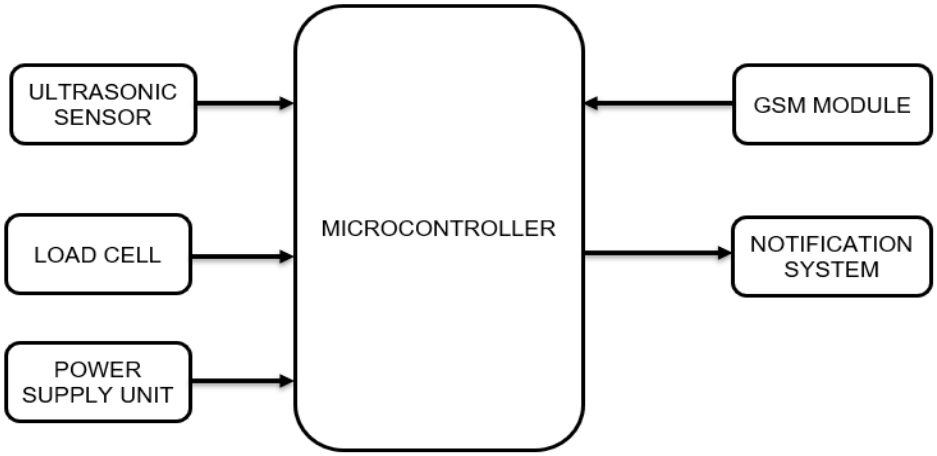

fig 2.1 BLOCK DIAGRAM

2.2 DESCRIPTION

An Automated Stock Monitoring and Notification System for Supermarkets leverages advanced sensors and communication technology to efficiently manage inventory. The system uses ultrasonic sensors to detect the presence and height of items on the shelf, identifying when stock levels are low by measuring the distance between the sensor and the products. For more precise monitoring, load cells measure the weight of items, triggering alerts when the weight falls below a specified threshold. The collected data from these sensors is processed by a microcontroller and transmitted through an IoT platform for real-time monitoring. To ensure quick response, a GSM module sends SMS notifications directly to the store manager when stock levels are low, eliminating the need for manual stock checks. This system enables a seamless, automated approach to inventory management, ensuring that shelves are replenished promptly and reducing the risk of product shortages, ultimately enhancing the shopping experience for customers.

2.3 PROJECT - TOTAL COST

SNO	COMPONENTS DESCRIPTION	QUANTITY	PRIZE
1	ULTRASONIC SENSOR	1	200
2	LOAD CELL	1	150
3	MICROCONTROLLER	1	500
4	GSM MODULE	1	300
5	ADDITIONAL COMPONENTS	2	500
6		TOTAL	1650

table 2.3 PROJECT-TOTAL COST

CHAPTER 3
RESULT AND DISCUSSION

3.1 HARDWARE COMPONENTS DESCRIPTION

3.1.1 ULTRASONIC SENSOR

The ultrasonic sensor is used to detect the presence or absence of products on the shelf. If the distance indicates that a product is missing or the shelf is empty, the system triggers a notification for restocking. Ultrasonic sensors measure distance by emitting ultrasonic waves and calculating the time taken for the echo to return. They are widely used in applications like distance measurement, object detection, and robotics. These sensors are valued for their accuracy, reliability, and ability to function in various environmental conditions.

fig 3.1.1 ULTRASONIC SENSOR

3.1.2 LOAD CELL

Weight sensors, or load cells, measure the force or weight applied to them by converting it into an electrical signal. They are widely used in applications like industrial scales, automotive safety systems, and digital kitchen scales. These sensors ensure accurate weight measurements, improving efficiency, safety, and quality control. Their precise data is crucial for numerous fields, including manufacturing and consumer products.

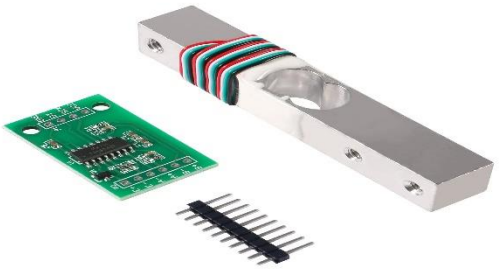

fig 3.1.2 LOAD CELL

3.1.3 MICROCONTROLLER

The microcontroller operates by executing instructions stored in its memory. During operation, the microcontroller can interact with external devices or sensors, read input signals, process data, and generate output signals. It can also communicate with other devices or systems using various communication protocols. Overall, the microcontroller operates by executing instructions, interacting with peripherals, and performing tasks based on the programmed code. It's a powerful and flexible platform for building a wide range of applications.

fig 3.1.3 MICROCONTROLLER

3.1.4 GSM MODULE

The GSM module in an automated stock monitoring system enables communication by sending and receiving data over the cellular network. It connects to the network using a SIM card and communicates with the microcontroller via AT commands. When stock levels fall below thresholds, the microcontroller triggers the GSM module to send SMS notifications to supermarket staff, ensuring timely restocking. This setup allows for real-time monitoring and efficient inventory management.

fig 3.1.4 GSM MODULE

3.2 HARDWARE KIT

The following figure shows that the automated stock monitoring system for a supermarket. It helps to monitor the stock level and send notification to the user once the stock level is low. With the help of the load cell and ultrasonic sensor, we can easily check the stock levels. Thus, the system helps to reduce need of manual check and also minimizing the risk of stockouts.

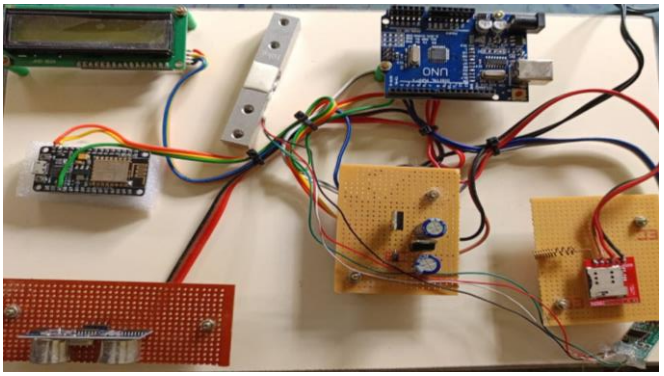

fig 3.2 HARDWARE KIT

2.3 WORKING PRINCIPLE

The working principle for this system is that it uses smart technology to make inventory management easier and faster. It relies on ultrasonic sensors and load cells to keep track of stock levels. Ultrasonic sensors measure the distance to items on a shelf, helping to detect when products are running low. Load cells measure the weight of items, giving accurate data about how much is left, especially useful for products sold by weight. This information is gathered and checked by a microcontroller. If the data shows that stock is below a set limit, the system sends an alert. A GSM module is used to send an SMS notification directly to the store manager's phone, letting them know which shelves need to be restocked without the need for manual checks. At the same time, the data is sent to an IoT platform, which allows store managers to monitor stock levels online using a computer or mobile app. This platform provides a clear view of inventory and trends, helping managers make smarter decisions about ordering and restocking. Overall, this system saves time and reduces the effort needed for manual inventory checks. It helps prevent empty shelves by sending timely alerts, ensuring that popular items are always available. By automating stock monitoring, the system improves store efficiency and keeps customers satisfied with well-stocked products. This innovative system combines real-time monitoring, timely alerts, and predictive insights to enhance the overall efficiency and reliability of storage management.

CHAPTER 4
FUTURE SCOPE AND ITS IMPLEMENTATION

The future of automated stock monitoring and notification systems in supermarkets is highly promising. With advancements in technology, these systems will become more intelligent and efficient. AI algorithms and machine learning will enable precise inventory predictions, ensuring popular products are always in stock and reducing waste. Sophisticated sensors, such as computer vision systems, will provide accurate tracking by visually monitoring shelves and detecting discrepancies in real time. This accuracy will minimize human error and improve inventory management. Blockchain technology can enhance transparency and traceability within the supply chain, ensuring product authenticity and quality control. Enhanced connectivity with smart devices will lead to seamless retail environments. Real-time data sharing with suppliers will automate restocking, reducing delays and ensuring continuous product availability. This connectivity can personalize shopping experiences, analyzing customer data to suggest products and offer discounts, enhancing satisfaction. These advancements will result in more efficient, accurate, and responsive inventory management.

Implementing an Automated Stock Monitoring and Notification System involves setting up hardware, such as ultrasonic sensors to measure item distance and load cells to measure weight, which provide precise inventory data. A GSM module sends SMS notifications when stock levels drop below thresholds. These components connect to a microcontroller, like an Arduino or Raspberry Pi, which processes data and manages notifications. Software programs the microcontroller to collect data and set thresholds, triggering alerts when needed. After setup and testing, the system is installed, ensuring accurate sensor placement and programming. This system reduces manual checks and ensures shelves are well-stocked, improving efficiency and customer satisfaction.

CHAPTER 5
CONCLUSION

The Automated Stock Monitoring and Notification System provides a reliable and efficient solution for managing inventory in supermarkets. By using ultrasonic sensors, load cells, GSM communication, the system ensures real-time tracking of stock levels and timely alerts when items need to be restocked. This reduces the need for manual checks, minimizes the risk of empty shelves. This technology-driven approach streamlines store operations, ultimately leading to cost savings and a more seamless shopping experience for customers. By implementing this project, supermarkets can operate more efficiently, improve customer satisfaction, and make better inventory decisions based on accurate, real-time data.

REFERENCES

[1] Rohit Nilesh Mehta, Mansing Rathod, Inziya Dossa, Sarika Mane, “Supermarket Shelf Monitoring Using ROS based Robot” 5th International Conference on Trends in Electronics and Informatics (ICOEI)2021.

[2] Zhitong Chen, Dongsheng Liu, Hexing Wang, “Research on the Optimization of Supermarket Staff Scheduling Based on Intelligent Algorithm Combined with Binary Coding” IEEE 3rd International Conference on Electrical Engineering, Big Data and Algorithms (EEBDA),2024

[3] V. Nandhakumar, B. Jyothsna, S. Ghanapriya**,** “AI-Driven Produce Management and Self-Checkout System for Supermarkets”, 4th International Conference on Electronics and Sustainable Communication Systems (ICESC),2023

[4] Sandeep Kumar Yelda, V.M. Manikandan, V. Panchami, “Real-time Scene Change Detection with Object Detection for Automated Stock Verification” 5th International Conference on Devices, Circuits and Systems (ICDCS),2022.

[5] Xiaotian Fan, Yubo Yan, Panlong Yang, Feiyu Han,” Use Low-power IoT Cameras to Monitor Store Shelves” 7th International Conference on Big Data Computing and Communications (BigCom),2021.

LINKS:

1. **https://youtu.be/VGbnXDa-evQ?si=GH1ssRfyRkQQQyw8**
2. **https://youtu.be/5MCoFo1rUnk?si=O6Nke--MLNAE_H8g**
3. **https://youtu.be/hHfeQkCeF5s?si=1QA-55JJYoF68JxI**
4. **https://youtu.be/jOxOska_fQA?si=MWoGdlhYmxbjTIep**
5. **https://youtu.be/S2sz_YE-KsA?si=9gTukhsJtzgYSOIE**