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Medibot - Automated Medicine Delivery Robot

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Abstract: The Medifly Automated Medicine Delivery Robot is an innovative solution designed to streamline and enhance the efficiency of medicine distribution within hospitals, clinics, and healthcare centers. The system aims to minimize human involvement in repetitive and time-sensitive delivery tasks, thereby reducing workload on healthcare staff and ensuring accurate, contactless, and timely medicine delivery to patients.
Medifly integrates key technologies such as Arduino microcontroller, RFID authentication, servo motors, L298 motor driver, GPS/GSM modules, and a lithium-ion battery for autonomous operation. The robot can navigate predefined routes, identify target wards or patients using RFID tags, and deliver medicines precisely to their destinations. A buzzer and LCD display provide real-time status updates and alerts, enhancing usability and monitoring.
This system contributes significantly to healthcare automation by improving medicine delivery speed, accuracy, and reliability. Additionally, Medifly reduces the risk of cross-contamination and human error, promoting safer hospital environments — especially crucial during pandemics. The project demonstrates how automation and robotics can revolutionize hospital logistics, paving the way for smarter and more efficient healthcare systems. MediBot uses an Arduino-based control unit integrated with DC motors, RFID authentication, sensors, and a servo-controlled dispensing mechanism. RFID technology ensures that medicines are delivered only to authorized patients, enhancing security and preventing misuse.
Keywords: Automated delivery system, Medicine dispensing, Medicine transportation, Real-time monitoring, Smart healthcare system.

I. INTRODUCTION

1.1 Introduction to Medibot-Automated Medicine Delivery Robot

In recent years, the rapid advancement of technology has brought revolutionary changes in almost every field, especially in healthcare. The integration of robotics, artificial intelligence, embedded systems, and communication technologies has transformed traditional medical practices into smart and automated systems. One such innovative development in the healthcare sector is the Medibot. A Medibot is a medical robot designed to assist doctors, nurses, and healthcare staff in performing various medical tasks efficiently, accurately, and safely. It plays a crucial role in improving patient care, reducing human effort, and minimizing the risk of infection transmission. Healthcare systems across the world face several challenges such as shortage of medical staff, increasing patient load, risk of contagious diseases, long working hours for healthcare professionals, and the need for precise and continuous patient monitoring. Medibot is introduced as a technological solution to address these challenges. It acts as a smart assistant in hospitals, clinics, quarantine centers, and even home healthcare environments. By automating repetitive and risky tasks, Medibots help medical professionals focus more on critical patient care. The concept of Medibot gained significant attention during global health emergencies such as the pandemic, where the need for contactless medical assistance became extremely important. During such situations, Medibots were used to deliver medicines, monitor vital signs, disinfect hospital rooms, and communicate with patients remotely. This reduced direct human contact and helped prevent the spread of infections.

1.2 Overview of MediBot

The healthcare sector is one of the most critical domains in modern society, as it directly influences human life and well-being. With the continuous increase in population, the burden on healthcare systems has grown significantly. Hospitals and medical institutions face challenges such as shortage of skilled healthcare professionals, rising operational costs, increased patient inflow, long working hours for medical staff, and the ever-present risk of contagious diseases. To address these challenges, modern healthcare has started adopting advanced technologies such as robotics, automation, artificial intelligence, and the Internet of Things (IoT). One of the most promising innovations emerging from this technological integration is the Medibot. A Medibot is a medical robotic system designed to assist healthcare professionals in monitoring, diagnosing, and managing patient care. It acts as a smart medical assistant capable of performing various healthcare-related tasks with minimal human intervention. Medibots are developed to improve efficiency, accuracy, safety, and accessibility in medical services. They are especially useful in environments where human contact needs to be minimized, such as during infectious disease outbreaks or in high-risk hospital zones. The concept of Medibot is based on the idea of combining robotics with medical science to create intelligent systems that support doctors and nurses.

Unlike traditional machines, Medibots are designed to interact with humans, collect physiological data, make decisions based on programmed logic or artificial intelligence, and communicate information in real time. They do not replace healthcare professionals but act as supportive tools that enhance the overall healthcare delivery process. The importance of Medibots became widely recognized during global health crises such as the COVID-19 pandemic. During this period, hospitals were overwhelmed with patients, and healthcare workers were at high risk of infection. Medibots were deployed in many hospitals to deliver medicines.

1.3 Importance of robotics in healthcare

Healthcare is one of the most critical sectors in society because it directly deals with human life, health, and well-being. With the rapid growth of population, aging societies, and the increasing prevalence of chronic diseases, healthcare systems around the world are under immense pressure. Hospitals and medical institutions often face challenges such as shortage of skilled medical professionals, rising healthcare costs, increased patient load, and the need to maintain high standards of safety and accuracy. To address these challenges, modern healthcare has started adopting advanced technologies, among which robotics plays a very important role. Robotics in healthcare refers to the use of robotic systems to assist doctors, nurses, and healthcare staff in performing medical tasks efficiently, safely, and accurately. One of the primary reasons robotics is important in healthcare is its ability to improve precision and accuracy. Many medical procedures, especially surgeries, require extremely precise movements that are difficult to achieve consistently by human hands. Robotic surgical systems allow surgeons to perform complex procedures with high precision, reduced tremor, and better control. This leads to improved surgical outcomes, smaller incisions, reduced blood loss, and faster recovery for patients.

1.4 Need for Automation in the medical field

The medical field is one of the most important sectors in society because it directly affects human life and health. Over the past few decades, the demand for healthcare services has increased rapidly due to population growth, aging societies, lifestyle-related diseases, and frequent outbreaks of infectious diseases. At the same time, healthcare systems face serious challenges such as shortage of skilled medical professionals, rising operational costs, long working hours, and the need for accurate and timely medical services. To overcome these challenges and improve the quality of healthcare, automation in the medical field has become a necessity rather than a choice. Automation in the medical field refers to the use of machines, software, robotic systems, and intelligent technologies to perform medical tasks with minimal human intervention. These tasks include patient monitoring, diagnosis, treatment, data management, laboratory testing, hospital management, and even surgical procedures.

1.5 Performance and Optimization Goals

Performance and optimization goals play a vital role in the design and implementation of any engineering system, especially in the medical and healthcare domain where reliability, accuracy, and efficiency are critical. Performance refers to how well a system functions under given conditions, while optimization focuses on improving that performance by making the best use of available resources such as time, power, cost, and computational capability. In automated medical systems and healthcare robotics, achieving high performance and effective optimization is essential because these systems directly impact patient safety and quality of care. In the medical field, performance is closely linked to accuracy and reliability. Medical devices and automated systems must provide precise and consistent outputs, as even small errors can lead to incorrect diagnosis or treatment. High performance ensures that sensors measure vital parameters correctly, software processes data without faults, and actuators respond accurately to control commands. A well-performing system operates smoothly without frequent failures, ensuring continuous service in critical environments such as hospitals and intensive care units. Another important aspect of performance is responsiveness. Automated medical systems must react quickly to inputs, especially during emergency situations. For example, when abnormal patient conditions are detected, the system should immediately process the data and generate alerts for medical staff.

1.6 Advantage and Impact on Medicine delivery

Automated medicine delivery systems, such as medical delivery robots, bring major advantages and positive impacts to modern healthcare. These robots are designed to transport medicines, laboratory samples, and medical supplies efficiently within hospitals or healthcare centers. One of the key advantages is accuracy and reliability—robots can deliver the correct medicine to the right patient at the right time, reducing the risk of human errors that often occur in manual handling. They also enhance speed and efficiency, ensuring that medicines reach wards or patients quickly, especially in emergency situations.

Moreover, these robots help maintain hygiene and safety by minimizing human contact, which is crucial in preventing infection spread, especially during pandemics like,they operate continuously without fatigue, reducing the workload of nurses and staff, allowing them to concentrate on direct patient care. The impact on healthcare management is significant—improving productivity, reducing operational costs, and enhancing patient satisfaction.

Additionally, automated systems promote better inventory tracking and data management through smart monitoring features. Overall, the integration of automated medicine delivery robots leads to a smarter, safer, and more efficient healthcare environment, marking a vital step toward digital transformation in hospitals and the future of medical logistics.

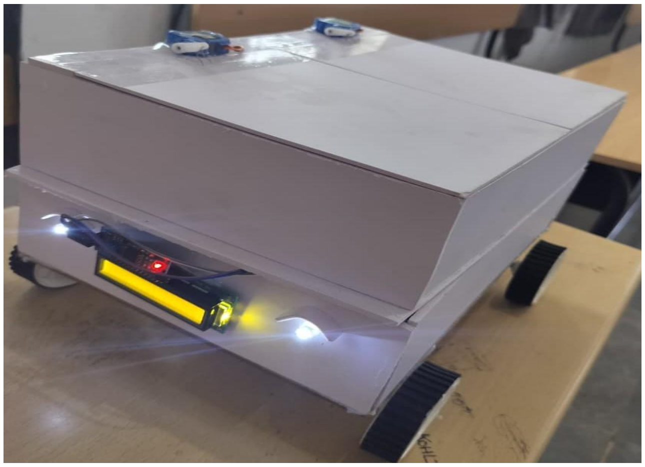

Figure – 1: Medibot prototype

The figure 1 shows a prototype Medibot, an automated medicine delivery robot designed to safely transport medicines within hospitals, clinics, or care centers. This robot reduces manual workload for medical staff and minimizes direct contact with patients, which is especially useful in emergency or infection-prone environments. The Medibot consists of a box-shaped medicine storage compartment mounted on a four-wheel mobile base. and system alerts, while LED indicators provide visual feedback for operation and safety. The Medibot uses DC motors for smooth navigation and can be integrated with sensors such as ultrasonic or IR sensors for obstacle detection, enabling safe movement in indoor environments like hospitals and clinics.

The upper enclosed box is used to securely store medicines, protecting them from contamination and unauthorized access. Small servo motors mounted on the top indicate an automated lid or locking mechanism**,** allowing controlled opening only when required. At the front of the robot, an LCD display is visible. This display is typically used to show information such as patient ID, medicine name, delivery status, or system messages**.** LED lights at the front act as indicators for movement, alerts, or low-power warnings, and also improve visibility in indoor environments. The robot moves using DC motors with wheels, enabling smooth navigation through corridors. Internally, the Medibot is controlled by a microcontroller (such as Arduino or ESP32)**,** which manages motor control, display updates, and sensor data.

Although not visible in the figure, such systems usually include obstacle detection sensors (ultrasonic/IR) to avoid collisions. The robot is mounted on a four-wheel drive system, powered by DC motors. This provides stability and smooth movement across hospital floors. The wheels are designed to handle indoor surfaces efficiently without causing vibrations that could damage medicines. The medicine compartment is operated using servo motors, allowing controlled and secure access during delivery. Powered by a rechargeable battery, the system offers portability and energy efficiency. Overall, the Medibot reduces the workload of medical staff, minimizes human contact, improves accuracy in medicine delivery, and enhances automation and safety in modern healthcare systems.

II.Literature Survey

Research on automated medicine delivery robots like MediBot highlights their potential to improve healthcare logistics, safety, and efficiency. A recent study introduced MediBot: Smart Line-Following Medicine Delivery Robot, developed to autonomously transport medications within hospitals using line-following navigation, IoT communication, and real-time caregiver notifications. It employs IR and ultrasonic sensors with an ESP8266 microcontroller to follow predefined hospital routes and ensure timely delivery, achieving over 95 % delivery accuracy in controlled tests. This work emphasizes reducing human dependency in medication distribution and minimizing administration errors through automation and connectivity with nurse interfaces.

The healthcare industry faces several challenges in delivering timely, accurate, and efficient medical services to patients. With the growing global population, the demand for healthcare facilities and medical professionals has increased tremendously. However, there is a significant shortage of skilled doctors, nurses, and healthcare workers, especially in rural and remote areas.

Other projects describe MediBot variants designed as semi-autonomous four-wheeled robots with articulated arms to carry medical supplies and contactless deliver drugs to patient beds. These implementations integrate obstacle avoidance and navigation control to operate in indoor healthcare environments, demonstrating how basic robotics principles can be adapted for real-world clinical support.

The literature also explores AI-Driven Medibot systems where robots autonomously travel to patient locations, execute contactless drop-off using robotic manipulators, and support delivery in wards with communicable diseases—highlighting the importance of reducing infection risk for staff and patients. Beyond MediBot-specific work, several studies on automated medicine dispensers and hospital robots contextualize MediBot’s contributions within broader efforts to address medication errors, delivery delays, and increased workload on healthcare personnel. Autonomous systems that combine navigation (line-following or sensor-based), IoT alerts, and robotic arms show promise in not only optimizing drug distribution workflows but also in enhancing patient safety, adherence to prescription timings, and operational reliability.

Overall, current research positions MediBot as a viable prototype toward scalable healthcare automation—integrating robotics, sensors, and connectivity to tackle persistent challenges in medicine delivery while paving the way for future sophistication with AI and advanced autonomy.

2.1 Problem Statement

The healthcare industry faces several challenges in delivering timely, accurate, and efficient medical services to patients. With the growing global population, the demand for healthcare facilities and medical professionals has increased tremendously. However, there is a significant shortage of skilled doctors, nurses, and healthcare workers, especially in rural and remote areas. This shortage leads to delays in diagnosis and treatment, increased workload on existing staff, and a decline in the overall quality of patient care. Moreover, medical professionals often work long hours under stressful conditions, which can result in fatigue, human errors, and reduced efficiency. Another major challenge in modern healthcare is the management of infectious diseases. During epidemics and pandemics such as COVID-19, healthcare workers are at high risk of exposure to infectious agents. Direct physical contact with patients increases the chances of disease transmission among medical staff and between patients. This risk highlights the urgent need for systems that can perform routine medical tasks without requiring continuous human presence. Manual handling of medical tasks such as patient monitoring, medicine delivery, and disinfection further increases the risk of cross-contamination and infection spread within hospitals and clinics. Traditional healthcare systems also suffer from inefficiencies in patient monitoring and record management. Continuous monitoring of patients' vital signs such as temperature, heart rate, and oxygen level is crucial for timely diagnosis and treatment. However, manual monitoring is labor-intensive and prone to delays or errors in data recording. Similarly, managing large volumes of patient data manually can lead to inaccuracies, misplacement, or loss of critical information. These limitations affect the decision-making process of doctors and delay medical responses in emergency situations.

2.2 Objectives

1. To minimize direct human contact between patients and medical staff, thereby reducing the risk of infection transmission, especially during contagious disease outbreaks.
2. To assist healthcare professionals by performing repetitive and routine tasks such as patient monitoring, medicine delivery, and basic communication.
3. To continuously monitor patient health parameters like temperature, heart rate, oxygen level (SpO_2), and other vital signs using integrated sensors.
4. To automate hospital operations such as medicine distribution, room disinfection, and patient assistance for improved efficiency.

III.Methodology of implementation

3.1 System Planning and Design

The Medibot system is carefully planned to automate the process of medicine delivery inside hospitals. The design includes a mobile robotic platform, medicine storage compartments, navigation system, sensors, and a central control unit. The main objective is to ensure accurate, safe, and timely delivery of medicines to patients without continuous human involvement. The system is designed to operate smoothly in hospital corridors and wards.

3.2 Requirement Analysis

In this phase, the operational requirements of the hospital environment are studied. This includes understanding ward layout, number of patients, medicine schedules, and safety regulations. The robot must be capable of identifying patient rooms, avoiding obstacles such as people and equipment, and delivering the correct medicine at the correct time. Reliability and ease of use are considered major requirements.

3.3 Hardware Architecture Selection

Appropriate hardware components are selected to ensure smooth functioning of the Medibot. A microcontroller such as Arduino or Raspberry Pi is used as the brain of the system. DC motors with motor drivers are chosen for movement. Ultrasonic and infrared sensors are used for obstacle detection. A medicine storage unit with multiple compartments is designed, where each compartment is assigned to a specific patient. Rechargeable batteries are used for power supply.

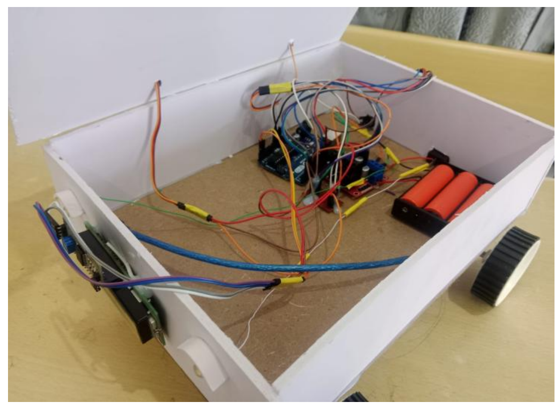

Figure – 2: The hardware architecture

Figure 2 shows The hardware architecture of the Medibot is carefully selected to ensure reliable operation, ease of integration, and cost effectiveness. At the core of the system is a microcontroller unit (Arduino-based), which acts as the central control unit coordinating all hardware components. A motor driver module is interfaced with the microcontroller to control the DC motors that drive the four-wheel platform, enabling smooth and controlled movement of the robot. Servo motors are used for operating the medicine compartment lid, providing precise and controlled access during delivery. An LCD display module mounted at the front of the robot is used to display system status, delivery information, and alerts. Power is supplied through a rechargeable lithium-ion battery pack, ensuring portability and uninterrupted operation. Supporting components such as voltage regulation modules, connecting wires, and indicator LEDs are included to maintain stable power distribution and system feedback. This modular hardware architecture allows easy troubleshooting, scalability, and future upgrades such as sensor integration and wireless communication, making it suitable for healthcare automation applications.

3.4 Medicine Identification and Delivery Logic

Each medicine compartment is linked to a specific patient ID using RFID or QR code technology. When the robot reaches the correct room, the system verifies the patient or room ID before opening the medicine compartment. This verification process reduces medication errors and ensures that the correct medicine is delivered to the intended patient.

3.5 Real-Time Operation and Deployment

During real-time operation, Medibot starts its task based on predefined schedules. It navigates through hospital corridors, avoids obstacles, verifies patient identity, and delivers medicines accurately. After completing deliveries, the robot returns to its base station and prepares for the next cycle.

In real-time operation, the Medibot functions autonomously based on predefined schedules and hospital requirements. At the scheduled time, the robot activates and begins navigation through hospital corridors using programmed paths. Sensors continuously monitor the surroundings to detect obstacles and ensure safe movement. Upon reaching the assigned patient room, the robot verifies the patient or room identity using RFID or QR code scanning. After successful verification, the correct medicine compartment opens automatically for delivery. The robot then updates the delivery status to the nurse station and safely returns to the charging or standby station for the next operation cycle.

3.6 Safety and Error Handling

Safety mechanisms such as emergency stop buttons and software interrupts are implemented. In case of sensor failure, navigation error, or obstruction, the robot immediately stops and alerts hospital staff. This ensures patient and staff safety at all times.

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IV. Hardware and Software Used

The Medibot consists of several hardware components that enable autonomous medicine delivery in hospitals. A microcontroller such as Arduino Uno is used as the main control unit to process sensor data and control movements. DC motors or servo motors are employed for robot movement, controlled through a motor driver module (L298N). Infrared (IR) sensors or ultrasonic sensors help in obstacle detection and safe navigation. A medicine storage unit with compartments is included for organized drug delivery. RFID reader or barcode scanner is used to identify patients accurately. A LCD display provides status information, while push buttons or touch panels allow manual input. The system is powered by a rechargeable battery, ensuring uninterrupted operation.

The software system controls robot operations and decision-making. Embedded C/C++ is used to program the microcontroller through the Arduino IDE. Python may be used when Raspberry Pi is involved for higher-level processing. Robot navigation algorithms manage path planning and obstacle avoidance. Database software stores patient and medicine details. Wireless communication software using Wi-Fi or Bluetooth enables real-time monitoring. Integration of hardware and software ensures accurate, safe, and efficient medicine delivery.

The Medibot uses both hardware and software to perform automated medicine delivery. The main hardware components include a microcontroller such as Arduino or Raspberry Pi to control operations, DC motors with a motor driver for movement, and IR or ultrasonic sensors for obstacle detection. A medicine storage unit, LCD display, and RFID or barcode scanner are used for patient identification and status display. The software includes Embedded C/C++ programmed using the Arduino IDE or Python for Raspberry Pi. Navigation algorithms and wireless communication software ensure accurate and safe medicine delivery.

V.Results

Patient 1: The below figure 3 shows the first output of the Medibot – automated medicine delivery robot.

Figture-3: Patient 1

In the shown condition, the Medibot is programmed to serve Patient 1**,** as indicated on the LCD display mounted on the front panel of the robot. When the system identifies or is set to Patient 1, the corresponding patient information is displayed clearly on the LCD, confirming the target delivery. This visual indication ensures accurate medicine distribution and avoids confusion between multiple patients. Once the display shows "Patient 1," the robot proceeds with the predefined delivery operation, allowing the medicine compartment to be accessed only for the intended patient. The LED indicators alongside the display provide operational feedback, such as active delivery status. This condition demonstrates the Medibot's ability to handle patient-specific medicine delivery, improving reliability, reducing human error, and ensuring safe and organized healthcare automation. When the Medibot is set to the Patient 1 condition, the system activates a patient-specific delivery mode, which is confirmed by the LCD displaying "Patient 1." This display acts as a verification step, ensuring that the robot is executing the correct delivery task. In this mode, the microcontroller retrieves the predefined delivery parameters associated with Patient 1, such as medicine allocation and delivery sequence.

The illuminated LEDs indicate that the system is active and functioning normally. Based on this condition, the robot navigates to the assigned location and enables controlled access to the medicine compartment using servo motor actuation. By clearly displaying the patient identifier, the Medibot minimizes the risk of medicine mix-ups and enhances operational transparency. This condition-based operation highlights the system's capability to manage multiple patients efficiently, improve accuracy in medicine delivery, and support organized workflow in healthcare environments.

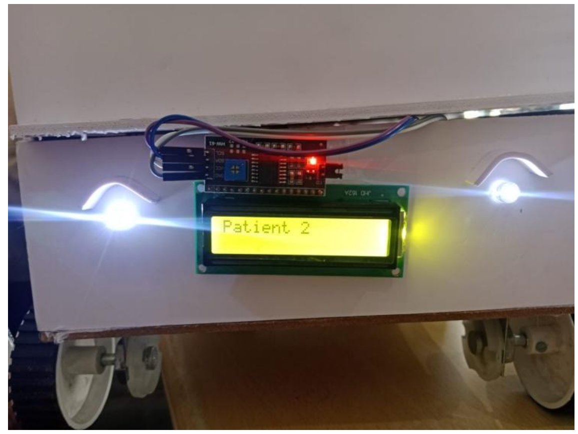
The below figure shows the output of

Figture-4: Medicine Despencing at patient 1

When the Medibot operates under the Patient 1 condition, the system executes a predefined and controlled medicine delivery process, resulting in the automatic opening of the designated medicine compartment as shown in the figure. Once Patient 1 is selected, the microcontroller verifies the patient-specific delivery command and displays the confirmation on the LCD panel, ensuring correct identification before proceeding. After successful verification, the servo motor mechanism attached to the medicine box is activated, causing the lid of the corresponding compartment to open smoothly and precisely. This automated opening allows access only to the medicines intended for Patient 1, thereby preventing unauthorized handling or delivery errors. The enclosed box structure maintains hygiene and protects the medicines from environmental exposure until the exact moment of delivery. During this operation, system indicators such as LEDs remain active, signaling that the delivery process is in progress and functioning correctly.

The controlled motion of the servo motor ensures accurate angular movement, preventing abrupt opening or mechanical stress on the box structure. Once the medicine is retrieved by the patient or caregiver, the system can either automatically close the compartment or wait for a reset command, depending on the programmed logic. This condition-based output demonstrates the Medibot's ability to handle patient-specific medicine delivery in an organized and reliable manner. By associating a unique box-opening action with Patient 1, the system significantly reduces the chances of medicine mismatch and human error. Additionally, this automated output minimizes direct contact between healthcare staff and patients, enhancing safety in clinical environments. The successful execution of the Patient 1 output condition highlights the effectiveness of integrating microcontroller control, servo actuation, and visual confirmation through display units. Overall, this operational outcome proves that the Medibot can perform secure, accurate, and patient-oriented medicine delivery, making it a practical and efficient solution for modern healthcare automation systems. The servo motor is activated only when the correct patient condition is met, reducing unnecessary power consumption and enhancing battery life. The structured response of the system under this condition also improves user confidence, as patients and healthcare staff can clearly observe the delivery status through the LCD and indicator lights.

Patient 2: The below figure 5 shows the first output of the Medibot – automated medicine delivery robot.



Figture-5: Patient 2

In the shown condition, When the Medibot operates under the Patient 2 condition, the system initiates a patient-specific medicine delivery sequence similar to Patient 1 but mapped to a different compartment and delivery logic. As shown in the figure, the LCD display clearly indicates “Patient 2,” confirming that the robot has successfully identified and switched to the second patient mode. This visual confirmation ensures that the delivery process corresponds to the correct patient, thereby preventing medication errors. Once Patient 2 is selected, the microcontroller retrieves the predefined parameters associated with Patient 2, including the assigned medicine box and delivery action. Based on this command, the servo motor connected to the Patient 2 compartment is activated, enabling controlled opening of the respective medicine box. The compartment remains securely closed until this condition is met, maintaining hygiene and preventing unauthorized access. During the operation, LED indicators remain illuminated to show active system status and successful execution of the delivery process. The precise servo actuation ensures smooth and accurate opening without mechanical strain. After the medicine is retrieved by Patient 2 or the caregiver, the system either automatically closes the compartment or waits for a reset instruction, depending on the programmed workflow. This condition-based output demonstrates the Medibot's ability to handle multiple patients independently using a single platform. By clearly distinguishing Patient 2 operations through display confirmation and compartment control, the system enhances reliability, safety, and efficiency in medicine delivery. Overall, the Patient 2 output condition validates the Medibot's multi-patient handling capability and proves its effectiveness as an automated solution for organized and error-free healthcare service.

The below figure shows the output of

Figtur-6: Medicine Despencing at patient 2

In Output 2 condition, the Medibot performs medicine delivery specifically for Patient 2**,** resulting in the automatic opening of the second dispensing compartment as shown in the figure. Once Patient 2 is selected and confirmed on the LCD display, the microcontroller activates the corresponding control logic associated with the second medicine box. Upon receiving this command, the servo motor connected to the second dispensing unit rotates to a predefined angle, causing the lid of the second compartment to open smoothly and securely. This operation ensures that only the medicines intended for Patient 2 are accessible, while all other compartments remain closed. The enclosed design of the dispensing box maintains hygiene and prevents contamination until the exact moment of delivery. LED indicators remain active during this process, providing visual confirmation that the system is operating correctly under Output 2 condition. The controlled opening mechanism avoids sudden motion, ensuring mechanical stability and safe handling of medicines. After the patient or caregiver retrieves the medicine, the system can either automatically close the compartment after a short delay or wait for a reset command, based on the programmed workflow. This output condition demonstrates the Medibot's capability to manage multiple dispensing units independently using a single robotic platform. By clearly separating delivery actions for different patients, Output 2 enhances accuracy, reduces medication errors, and improves overall efficiency. The successful execution of this condition validates the effectiveness of the Medibot in providing secure, patient-specific, and reliable automated medicine delivery in healthcare environments.

The operation of the second dispensing unit further demonstrates the flexibility and scalability of the Medibot system in handling multi-patient medicine delivery. The independent control of each dispensing compartment ensures that the activation of the second box does not interfere with the operation of other compartments, thereby maintaining strict separation between patient-specific medicines. During this condition, the microcontroller continuously monitors the servo motor position to ensure that the lid of the second compartment remains open only for the required duration. This controlled timing helps prevent accidental spillage or prolonged exposure of medicines to the external environment. tinued operation of the second dispensing unit reinforces the Medibot's effectiveness as a reliable, patient-oriented, and automated medicine delivery solution capable of supporting modern healthcare infrastructure.

Patient 3: The below figure 7 shows the first output of the Medibot – automated medicine delivery robot.

Figture-7: Patient 3

When the Medibot operates in the Patient 3 condition, the system executes a dedicated medicine delivery sequence assigned specifically to the third patient. As indicated in the figure, the LCD display shows "Patient 3," confirming successful selection and verification of the intended patient before delivery. Upon this confirmation, the microcontroller activates the control logic linked to Patient 3 and identifies the corresponding dispensing compartment. The servo motor associated with the Patient 3 medicine box is then triggered, causing the designated compartment to open in a smooth and controlled manner. This ensures that only the medicines prescribed for Patient 3 are accessible, while all other compartments remain securely closed. The illuminated LED indicators provide visual confirmation that the system is active and operating under the correct patient condition. The enclosed design of the medicine box preserves hygiene and prevents contamination until the moment of delivery.

After the patient or caregiver retrieves the medicine, the system either automatically closes the compartment after a predefined delay or returns to an idle state awaiting the next command. This patient-specific output condition demonstrates the Medibot's capability to manage multiple patients efficiently using a single automated platform. By clearly displaying the patient identity and linking it to a specific dispensing action, the system minimizes medication errors and enhances safety. Overall, the successful execution of the Patient 3 condition confirms the reliability, accuracy, and scalability of the Medibot for multi-patient automated medicine delivery in healthcare environments. In the shown output condition, the Medibot successfully demonstrates its organized medicine storage and patient-specific dispensing capability. The image illustrates the internal structure of the medicine compartment, where different medicines are neatly arranged and segregated using partitioned sections

The below figure shows the output of

Figtur-8: Medicine Despencing at patient 3

. Each section is assigned to a specific patient, ensuring that medicines do not get mixed during delivery. When a particular patient condition (such as Patient 1, Patient 2, or Patient 3) is selected, the corresponding dispensing box opens automatically, allowing access only to the medicines allocated for that patient. This controlled access mechanism ensures accuracy in medicine delivery and reduces the risk of human error. The enclosed compartment design protects medicines from contamination and environmental exposure until the exact moment of dispensing. The arrangement of tablets in blister packs further supports easy identification and safe handling. This output confirms that the Medibot can store multiple types of medicines and dispense them in a structured and secure manner. By integrating patient-wise compartment control with automated box opening, the system ensures reliable, hygienic, and error-free medicine delivery. Overall, this output validates the effectiveness of the Medibot in managing multi-patient medicine distribution within healthcare environments, thereby improving efficiency, safety, and operational organization.

He successful demonstration of organized medicine storage and controlled dispensing highlights the practical applicability of the Medibot in real healthcare environments**.** By maintaining separate compartments for different patients and ensuring that only the required section opens during delivery, the system significantly improves operational efficiency and safety. This approach minimizes dependency on manual sorting by healthcare staff and reduces the chances of medication mismatch, which is a critical concern in hospitals and care centers. The structured arrangement of medicines also supports easy refilling, monitoring of stock levels, and future expansion to accommodate more patients or additional medicine types. Furthermore, the automated dispensing mechanism ensures consistent performance, irrespective of workload or time of operation. Overall, this output confirms that the Medibot is not only technically functional but also well-suited for practical deployment, offering a reliable, hygienic, and patient-centric solution for automated medicine delivery systems. the automated and structured dispensing approach contributes to improved patient confidence and trust in the delivery system.

Patients receive medicines in an organized manner without confusion, and the visible operation of the dispensing mechanism reassures them that the correct medication is being provided. From a safety perspective, limiting access to only the intended compartment reduces the possibility of accidental overdose or incorrect medicine intake. The Medibot's ability to maintain hygiene by keeping medicines enclosed until delivery further strengthens its suitability for sensitive medical environments. Overall, this extended output validates the Medibot as a robust, efficient, and patient-oriented automated medicine delivery solution capable of supporting modern healthcare workflows.

RFID Tags (Patient 1, Patient 2, Patient 3):

Figure-9 : RFID Tags

In this project, RFID tags are used as secure keys and control switches to start and return the Medibot during operation. Each RFID tag acts as a unique digital key that is programmed and linked with specific commands in the microcontroller. When an authorized RFID tag is brought near the RFID reader mounted on the robot, the system reads the tag's unique identification number and verifies it against stored data. Upon successful authentication, the Medibot is activated and begins its predefined operation, such as starting movement toward the delivery location. Similarly, another RFID tag can be used to issue a return command, instructing the robot to stop its delivery task and move back to its base or standby position. This RFID-based switching mechanism eliminates the need for physical buttons, reducing wear and improving system reliability. It also enhances security by ensuring that only authorized personnel can control the robot's operation. The use of RFID tags provides fast, contactless, and user-friendly control, making the Medibot easy to operate in healthcare environments. Overall, this output demonstrates that RFID technology effectively serves as a secure and efficient control interface for starting, stopping, and returning the automated medicine delivery robot.

The integration of RFID technology further improves the overall safety, flexibility, and scalability of the Medibot system. Since each RFID tag has a unique identification code, multiple tags can be assigned different roles such as start, stop, return, or maintenance mode, allowing the robot to perform various operations through simple tag scanning. This feature is especially useful in hospital environments where quick and secure control is required without physical contact. Additionally, the contactless nature of RFID reduces the risk of contamination and enhances hygiene, which is critical in healthcare applications. The RFID-based control system also allows easy reprogramming or replacement of tags if access needs to be changed, making the system adaptable to different operational requirements. Overall, this continuation emphasizes that the use of RFID tags as keys and switches not only simplifies robot control but also strengthens security, reliability, and user convenience, thereby making the Medibot more suitable for real-world healthcare automation. Medical staff can initiate or terminate robot operations quickly by simply scanning the appropriate RFID tag, eliminating the need for complex interfaces or manual controls. This reduces training requirements and allows even non-technical users to operate the system confidently. The RFID reader provides instant response, ensuring minimal delay between command input and robot action, which is crucial in time-sensitive medical environments.

Furthermore, the RFID system supports access control and logging capabilities, where each tag interaction can be recorded by the microcontroller for monitoring and analysis. This feature can help track robot usage, delivery cycles, and operational history, contributing to better system management and accountability. In emergency situations, RFID-based control allows rapid intervention, enabling staff to stop or recall the robot immediately. Overall, this extended functionality reinforces the Medibot's design as a secure, user-friendly, and intelligent automated medicine delivery solution capable of meeting the demands of modern healthcare facilities.

RFID tags can be mapped directly to individual patients, further enhancing the intelligence of the Medibot system. Each patient can be assigned a unique RFID tag containing a distinct identification code stored in the microcontroller memory. When a patient-specific RFID tag is scanned, the system automatically recognizes the corresponding patient and initiates the appropriate medicine delivery routine. This enables the Medibot to select the correct dispensing compartment without requiring manual input, thereby reducing the chances of human error. The LCD display updates instantly to show the identified patient number, providing clear confirmation before dispensing begins.Moreover, RFID-based patient identification supports accurate, personalized, and traceable medicine delivery. Since each tag is unique, the system ensures that medicines are dispensed only to the intended patient. This approach is particularly useful in multi-patient environments such as hospitals, isolation wards, and elderly care centers, where managing multiple prescriptions simultaneously can be challenging. The use of RFID tags also allows easy reassignment or updating of patient information without modifying the hardware, making the system highly flexible. If a patient's medication schedule changes, the RFID mapping can be updated in software, ensuring seamless operation. Overall, the integration of RFID tags for both system control and patient identification strengthens the Medibot's reliability, accuracy, and scalability, making it a robust solution for automated, patient-centric healthcare delivery systems. the extended use of RFID tags in relation to both system control and patient identification greatly enhances the Medibot's effectiveness, making it a secure, reliable, and patient-focused automated medicine delivery solution suitable for real-world healthcare applications.

VI. CONCLUSION

The Medibot – Automated Medicine Delivery Robot successfully demonstrates the effective application of robotics and automation in the healthcare domain to improve efficiency, safety, and accuracy in medicine delivery. This project was designed with the objective of minimizing human involvement in routine medicine dispensing tasks while ensuring patient-specific and error-free delivery. Through the integration of a mobile robotic platform, controlled dispensing compartments, display units, and RFID-based authentication, the Medibot proves to be a reliable and practical solution for modern healthcare environments. The system architecture of the Medibot is simple yet robust, making use of a microcontroller as the central control unit to coordinate all hardware components. The use of servo motors for controlled opening of medicine compartments ensures precise and smooth dispensing operations, while DC motors enable stable navigation of the robot. The LCD display and LED indicators provide clear visual feedback, enhancing transparency and ease of use for both patients and healthcare staff. The compartmentalized storage design plays a crucial role in preventing medicine mix-ups by maintaining strict separation between patient-specific medications. The output conditions demonstrated for different patients validate the Medibot's ability to handle multiple dispensing units independently and efficiently. The automatic opening of the correct compartment based on patient selection confirms the effectiveness of the control logic and hardware integration.

In conclusion, the Medibot represents a cost-effective, scalable, and user-friendly automated solution for medicine delivery. With future enhancements such as advanced navigation, wireless communication, and data logging, the system can be further improved for real-world deployment. Overall, this project highlights the potential of automation and embedded systems in transforming healthcare services and supporting the development of smart and efficient medical infrastructure.

VII.REFERENCES

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