Humanoid Service Robot- Future of Health Care

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***Abstract*—The healthcare sector's lack of focus on technological innovations has created new opportunities to enhance service robots that can assist patients in dealing with their illnesses and providing better solutions. The COVID-19 pandemic has acted as a catalyst for developing service robots in the healthcare sector to overcome the difficulties and hardships caused by this virus. Humanoid Service Robots are advantageous as they not only prevent the spread of infection and reduce human error but also allow front-line staff to reduce direct contact, focusing their attention on higher-priority tasks and creating separation from direct exposure to infection. Robots have been used to perform tasks that would otherwise put healthcare workers at risk, such as delivering medicine, food and supplies to patients in isolation.**

***Index Terms*—ESP32, L298 motor, healthcare, Service.**

I. Introduction

In recent years, there has been a growing interest in leveraging robotics technology to enhance healthcare services and alleviate the risks healthcare workers face. Robots have emerged as powerful tools capable of performing a wide range of tasks, particularly those that involve contact with potentially infectious patients or hazardous environments. This has become particularly relevant in light of recent global health crises, such as the COVID-19 pandemic, where the safety and well-being of healthcare professionals have been a paramount concern.

One notable application of robots in healthcare is their role in delivering essential items, including medicine, food, and supplies, to patients in isolation. Traditionally, healthcare workers have had to interact directly with isolated patients, risking exposure to infectious diseases and compromising their health. However, introducing robots into the healthcare ecosystem has revolutionized this aspect of patient care.

Robots equipped with advanced navigation systems, sensors, and manipulation capabilities can navigate hospital corridors and deliver medications, meals, and other supplies directly to patients' rooms, all while minimizing the need for human contact. By performing these tasks, robots mitigate the risk of disease transmission between patients and healthcare workers and enable healthcare professionals to allocate their time and expertise to more critical and specialized care tasks.

Moreover, using robots to deliver medical items and supplies brings additional benefits beyond infection control. These autonomous or semi-autonomous machines can operate around the clock, ensuring timely delivery and reducing patient wait times. They can navigate complex hospital layouts efficiently, avoiding obstacles and optimizing delivery routes. Furthermore, robots can be equipped with sensors to monitor environmental conditions, such as temperature and humidity, ensuring the integrity of sensitive medical supplies during transportation.

While using robots in healthcare delivery is a promising development, it raises essential considerations and challenges. Ethical concerns must be addressed, such as maintaining patient privacy and ensuring the appropriate handling of sensitive medical information. Additionally, the acceptance and integration of robots into healthcare workflows by healthcare professionals and patients require careful attention to human-robot interaction, training, and collaboration.

This paper aims to explore the role of robots in healthcare delivery, specifically focusing on their use in delivering medicine, food, and supplies to isolated patients. Through a comprehensive review of relevant literature, real-world case studies, and analysis of the benefits and challenges, this research provides insights into robotic technologies' transformative potential in enhancing healthcare services. By understanding the impact of robots in minimizing risks faced by healthcare workers and optimizing patient care, we can pave the way for a safer and more efficient healthcare environment.

Robots have been used in healthcare for various tasks, including delivering medicine, food, and supplies to isolated patients. These robots can help to reduce the risk of infection for healthcare workers, who are often exposed to pathogens when caring for patients. Robots can also help to improve the efficiency of care by freeing up healthcare workers to focus on more complex tasks.

Several different types of robots are used in healthcare. Some robots are designed to transport objects, while others are designed to provide companionship or emotional support to patients. Robots can also be used to perform surgical procedures, which can help to reduce the risk of complications for patients.

The use of robots in healthcare is still in its early stages, but it is a growing field. As robots become more sophisticated, they will likely play an increasingly important role in healthcare delivery.

II. Background and Motivation:

The healthcare industry faces numerous challenges in providing safe and efficient care, especially when dealing with infectious diseases or patients in isolation. Healthcare workers often encounter situations where they are exposed to risks while performing essential tasks such as delivering medicine, food, and supplies to isolated patients. However, advancements in robotics technology offer promising solutions to mitigate these risks and improve healthcare delivery.

The motivation behind utilizing robots in healthcare settings stems from the need to protect the well-being of healthcare workers. In the context of infectious diseases, such as the COVID-19 pandemic, healthcare professionals face increased exposure to pathogens when directly interacting with isolated patients. This not only endangers the health and safety of healthcare workers but also poses a potential risk of spreading infections within healthcare facilities. Therefore, minimising direct contact between healthcare workers and isolated patients has become a priority.

Robots have emerged as versatile tools capable of performing various tasks autonomously or under human supervision. By leveraging robotics technology, healthcare facilities can delegate tasks that would otherwise put healthcare workers at risk to robots, ensuring their safety and well-being. The use of robots in delivering medicine, food, and supplies to isolated patients has gained traction due to their ability to navigate complex environments, handle objects, and perform repetitive tasks reliably.

Moreover, incorporating robots in healthcare delivery aligns with the broader trend of automation and digital transformation in the healthcare industry. It enhances patient care and improves operational efficiency, allowing healthcare professionals to focus on more specialized and critical aspects of patient treatment.

The growing body of research and real-world applications in robot-assisted healthcare delivery showcases this technology's potential benefits and feasibility. However, several challenges need to be addressed, including ethical considerations, technological advancements, and acceptance by healthcare professionals and patients. Understanding these challenges and developing effective strategies to overcome them is crucial for successfully integrating and utilising robots in healthcare settings.

Therefore, this paper explores the background, motivations, and implications of using robots for delivering medicine, food, and supplies to patients in isolation. By reviewing the existing literature, analyzing case studies, and examining the ethical and technological considerations, this research sheds light on the transformative potential of robotics in healthcare. It contributes to the ongoing efforts to create a safer and more efficient healthcare environment for healthcare workers and patients.

III. Objective

The objective of this research is to examine the role of robots in healthcare settings, specifically focusing on their use in delivering medicine, food, and supplies to patients in isolation.

Delivery of essential items: Investigate the current state of robotic technologies and their applications in healthcare delivery, with a focus on tasks involving patient isolation and the delivery of essential items. Assess the benefits of using robots for delivering medicine, food, and supplies in healthcare settings, including but not limited to reducing the risk of infection transmission to healthcare workers and optimizing patient care.

Reduced risk of exposure to pathogens for healthcare workers: Robots can deliver supplies to patients without the need for healthcare workers to enter their rooms, which reduces the risk of exposure to pathogens.

Improved efficiency of healthcare delivery: Robots can deliver supplies to patients more quickly and efficiently than healthcare workers, which frees up healthcare workers to focus on other tasks.

Enhanced patient care: Robots can provide companionship and support to patients who are isolated, which can help to improve their morale and well-being.

Analyze and practical use: Provide insights and recommendations for the effective deployment and utilization of robots in healthcare delivery, considering factors such as training requirements, human-robot interaction, and workflow integration.

IV. Literature review

The field of service robotics is relatively new; it is predicted that the demand for professional service robots to support healthcare staff will reach 38 billion USD by 2022 [3] as robots will not only lower the workload for healthcare staff but also aid in complex tasks that need to be carried out [4]. The first service robot definition was coined in 1993 by the Fraunhofer Institute for Manufacturing Engineering and Automation (Fraunhofer IPA): "A service robot is a freely programmable kinematic device that performs services semi- or fully automatically. Services are tasks that do not contribute to the industrial manufacturing of goods but are the execution of useful work for humans and equipment" [5]. Since then, many definitions have been proposed;

the International Standardisation Organisation defines the term as "a robot that performs useful tasks for humans or equipment, excluding industrial automation applications" [6]. In contrast, the International Federation of Robotics emphasises the robot's autonomy in their definition: "a service robot is a robot which operates semi- or fully autonomously to perform services useful to the well-being of humans and equipment, excluding manufacturing operations" [7]. As the term "Service Robot" has continued to evolve, its definition has blurred due to the crossover between industry and service sectors. For instance, mobile robots and automated guided vehicles (AGV) are used in industrial automation applications and as service robots in new environments such as hospitals.

Most of this paper will focus on service robots designed for the healthcare sector and therefore categorise a service robot as one that carries out tasks, either partially (semi-) or fully autonomously in a clinical setting. In the case of the subsection on social care, we give examples of how personal service robots can be used to mitigate loneliness and promote productivity during social isolation. For example, service robots in a clinical setting can be used for various purposes, such as disinfection, surgery, logistics, monitoring, rehabilitation, and endoscopy (see Table 1, Table 2, Table 3, Table 4). They have an important place in healthcare as they can precisely control instruments, increase safety, monitor patients, and perform diagnostics [8]. In most cases, these robots share the environment with humans; as such, they should be able to recognise faces, gestures and speech as well as objects.

Successfully understanding these tasks results in obstacle avoidance and communication based on emotion [8]. Fundamentally, service robots are machines that can carry out a series of actions. They are capable of autonomous decision-making based on the input they receive from their sensors, cameras, and microphones, and they can adapt to the situation and learn from previous actions [9]. Many service robots are connected to larger systems, such as cloud-based systems, that store user information and transaction data. When combined with biometrics such as face recognition, service robots can identify people and personalise their service at a marginal cost [9]. When describing the representation of a service robot, we tend to think of them as either machine-like in appearance or human-like in appearance, possessing some human-like features, often stylised [10]. With regards to the types of tasks that they carry out, duties can either be logistical (operational tasks for transportation), logical (image analysis for diagnosis) or emotional (directly dealing with people).

A significant challenge in this field is the acceptance of service robots. Robots are only accepted if they can benefit one's work, making it more efficient and pleasant [11]. However, there is still the fear that robots will replace their human counterparts, resulting in job losses. To promote positive attitudes and acceptance towards service robots, it would be beneficial to hold public engagement campaigns introducing and training healthcare staff on how to operate these robots. Furthermore, by giving service robots more exposure—making them visible in everyday environments—they are more likely to be accepted [12]. On the one hand, service robots can relieve pressure on healthcare staff by assisting them with daily activities, giving them more time to focus on higher-priority tasks.

On the other hand, this increasing use of service robots can lead to less interpersonal contact between patients. This is especially important during COVID-19 as conscious efforts are being made to reduce person-to-person contact, notwithstanding the resulting patient isolation. Ethically, this is an issue because older patients, in particular, may feel dehumanisation, so efforts must be made to provide these users with social care. Another common issue with service robots is reliability; service robotics need detailed safety features as they interact with humans and a cyber-security that can deal with the challenges associated with remote connectivity, such as unauthorised access or data breaches. Aside from safety, it is essential to verify that there are no false positive or negative results when used for detection or diagnosis, as this can be a dangerous risk to public health. Therefore it is with the utmost importance that ongoing technological progress in sensor and actuator development is carried out and further research into deep learning and human interaction.

V. Proposed System

Proposed systems for humanoid service robots – the future of healthcare will include the following steps:

Locate the patient bed: In this system, we follow the line to move the center point of our robot to the patient bed.

Delivery Item: This system allows us to deliver medicines to infected patients.

Interact with the patient: This system allows the robot to exchange simple messages with the patient.

Control: Using Wi-Fi to control the robot, it can deliver essential items to the patient from anywhere.

VI. Block Diagram

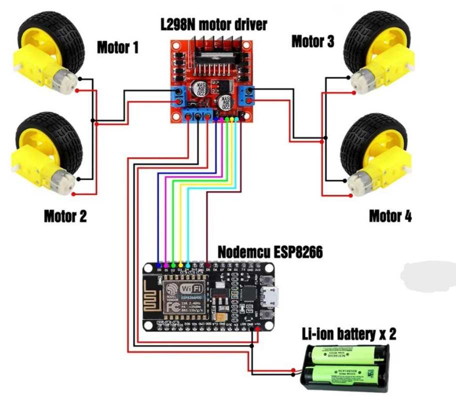

Fig. 1. Block Diagram

Here the proposed system is developed hardware part which is attached by different sensor.

VII. Components:

A. *ESP32 Microcontroller*

The ESP32 is a highly popular microcontroller-based system-on-chip (SoC) that is widely used in various applications, including Internet of Things (IoT) devices, robotics, and embedded systems. Espressif Systems develop it and is the successor to the ESP8266 chip.

Key Features of the ESP32:

- Dual-core Processor: The ESP32 features a powerful dual-core Xtensa LX6 processor, which operates at a clock frequency of up to 240 MHz. The dual-core architecture allows for efficient multitasking and handling of multiple tasks simultaneously.
- Wi-Fi and Bluetooth Connectivity: One of the notable features of the ESP32 is its built-in Wi-Fi and Bluetooth capabilities. It supports 802.11 b/g/n Wi-Fi for wireless communication and Bluetooth Classic and Bluetooth Low Energy (BLE) protocols, making it suitable for a wide range of IoT applications.
- Memory and Storage: The ESP32 is equipped with a generous amount of memory and storage options. It typically comes with 520 KB SRAM and can be expanded with external SPI RAM. It also has up to 4 MB of flash memory for program storage.

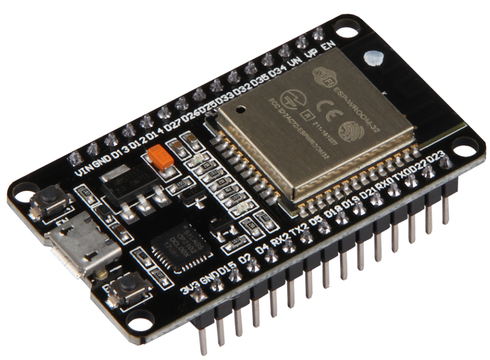

Fig. 2. ESP32

- GPIO Pins: The ESP32 offers a large number of general-purpose input/output (GPIO) pins, allowing for easy integration with various sensors, actuators, and external devices. The number of GPIO pins varies depending on the specific ESP32 module.
- Analog-to-Digital Conversion (ADC): The ESP32 includes a 12-bit SAR (Successive Approximation Register) ADC, which enables analog signal measurement with reasonable accuracy. It provides multiple ADC channels for reading analog sensor values.
- Peripherals and Interfaces: The ESP32 provides a range of peripherals and interfaces to support various applications. These include UART, I2C, SPI, I2S, PWM, and more, allowing for communication with external devices and modules.
- Security: Security features are integrated into the ESP32 to ensure secure communication and data protection. It supports encryption protocols, including SSL/TLS, WPA/WPA2, and secure boot. This makes it suitable for applications where data privacy and security are crucial.
- Development Environment: The ESP32 can be programmed using the Arduino IDE, Espressif's ESP-IDF (IoT Development Framework), or other development platforms. The availability of a rich set of libraries, examples, and community support makes it user-friendly and accessible to developers.

B. *IR Sensor 5 Array*

TCRT5000L 5 Channel Tracking Sensor Tracking Module Infrared Sensor is based on the TRCT5000 infrared reflection sensor; it is often used to make tracking smart cars. The infrared emitting diode of the TRCT5000 sensor continuously emits infrared rays. When the object reflects the emitted infrared rays, they are received by the infrared receiver and analogue output values. The analogue output value is related to the object's distance and colour. The position of the tracking line is judged by calculating the analogue value of the five outputs.

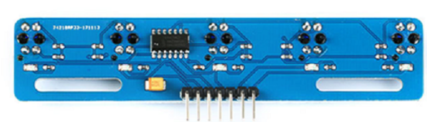

Fig. 3. IR Sensor 5 Array

VCC: VCC is the power input port, which could access 3.3V 5V voltage GND: GND is the negative input of the power supply OUT1 5:OUT is the signal output port, MCU link I / O port

Infrared Sensing Technology: The sensors in the array utilize infrared sensing technology to detect the presence or absence of objects within their sensing range. They emit infrared light and measure the intensity of the reflected light to determine the proximity or distance of objects.

Sensing Range: The sensing range of the IR Sensor Array 5 depends on various factors, including the specific design and characteristics of the sensors used. The range is typically a few centimetres to a few meters, but it can vary

depending on the sensor specifications and the reflective properties of the detected objects.
Output: Each sensor in the array provides an individual output based on the detected infrared reflections. The output can be analog voltage levels, digital signals, or pulse-width modulation (PWM) signals, depending on the specific implementation and configuration.
Applicable to a variety of platforms, including for Arduino /AVR/ARM/PIC High-Quality Tracker Sensor The module is a convenient carrier for eight IR emitter and receiver pairs evenly paced. Distance between each IR Sensor: 15mm Uses 5 sensors for the best resolution Great useful in building fast line following and grid navigating robots Comes with easy-to-use digital outputs with a direct connection to microcontrollers The array has mounting holes of 3mm diameter for easy mounting Status LED on each sensor for the detection of black line.

C. *L298N Motor Driver*

A well-liked and frequently employed integrated circuit (IC), the L298N motor driver is made specifically for operating DC motors and bipolar stepper motors. It offers a reliable and adaptable method for managing the direction and speed of motors in a variety of applications.The L298N IC can drive motors with power needs up to 2A per channel and voltage levels ranging from 7V to 35V because it is built to handle high current and voltage requirements. It has two separate H-bridge circuits that enable it to drive two motors L298N 2A Based Motor

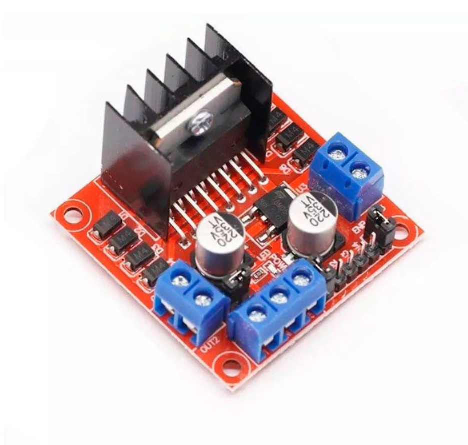

Fig. 4. L298N Motor Driver

Driver is a high power motor driver perfect for driving DC Motors and Stepper Motors
It uses the popular L298 motor driver IC and has an onboard 5V regulator which it can supply to an external circuit. It can control up to 4 DC motors, or 2 DC motors with directional and speed control.
This motor driver is perfect for robotics and mechatronics projects and perfect for controlling motors from microcontrollers, switches, relays, etc. Perfect for driving DC and Stepper motors for micro mouse, line following robots, robot arms, etc. Out 1: Motor A lead out Out 2: Motor A lead out Out 3: Motor B lead out Out 4: Mo (Can actually be from 5v-35v, just marked as 12v) GND: Ground 5v: 5v input (unnecessary if your power source is 7v-35v, if the power source is 7v-35v then it can act as a 5v out) EnA: Enables PWM signal for Motor A (Please see the "Arduino Sketch Considerations" section) In1: Enable Motor A In2: Enable Motor A In3: Enable Motor B In4: Enable Motor B EnB: Enables PWM signal for Motor B. Maximum motor supply current: 2A per motor. Current Sense for each motor. Heatsink for better performance. Power-On LED indicator. Double H bridge Drive Chip: L298N.

D. *Chassis Kit*

The 4WD Smart Robot Chassis Kit is a platform designed to build a versatile and customizable robotic vehicle. It provides the foundation for creating a four-wheel-drive (4WD) robot with advanced features and capabilities. Motor Operating Voltage (VDC) 3 6 Motor Shaft Length

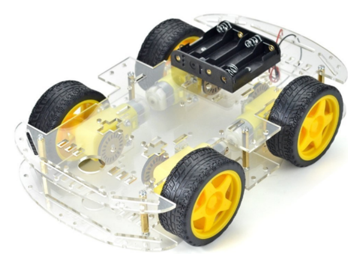

Fig. 5. Chassis Kit

(mm) 8.5 Motor Shaft Diameter (mm) 5.4mm-(round side) and 3.5mm-(flat side) Motor Rated Speed After Reduction (RPM) 200 Motor Rated Torque (Kg-Cm) 0.8 Motor Gearbox Shape Straight Motor Length (mm) 70 Motor Width (mm) 19 Motor Height (mm) 22 Motor Weight (gm) 28 (each) Wheel Color Black (Tire) Yellow (Rim) Wheel Internal Diameter(ID)(mm) 51 Wheel Load Capacity(Kg/Wheel) 2.5 Wheel Tyre Grip Material Rubber Wheel Body Material Plastic Wheel Diameter(mm) 65 Wheel Width (mm) 27 Wheel Weight(gm) 34 (each) Shipment Weight 0.4 kg Shipment Dimensions 30 × 18 × 5 cm

E. *DC Motor*

The 6V, 180rpm DC Geared Motor with Back Shaft Straight Type is ideal for robot enthusiasts. Circuitrocks offers a wide selection of pre-assembled geared motors for quality, consistency, and dependability. Operating Voltage Range: 3 7.5V Rated Voltage: 6V Max. No-load

Current(3V): 140 mA Max. No-load Current(6V): 170 mA No-load Speed(3V): 90 rpm No-load Speed(6V): 160 rpm Max. Output Torque: 0.8 kgf.cm Max. Stall Current: 2.8 A Rated Load: 0.2 kgf.cm Operating Temperature: -10 +60 °C Storage Temperature: -30 +85 °C Motor Type: 130

Fig. 6. DC Motor

F. *Switch*

A tiny switch, sometimes referred to as a miniature switch or a micro switch, is a small, flexible electromechanical component that is essential for managing circuits. Due to its compact size, it may be quickly and readily integrated into a variety of electrical systems and gadgets without taking up much room. A housing, an actuator (a lever or button), and internal contacts are often included in the design. The switching mechanism is activated when the actuator is depressed or moved, opening or closing the electrical circuit. Mini switches can have many types of actuators and come in a variety of configurations, such as momentary or latching functionality. Can also be snap-in panel mounted Rated up to 3A @ 250V

Fig. 7. Switch

G. *Mini Breadboard*

Breadboard Mini 4.5 x 3.5 cm Clear reflects numerous features and specifications on the board. Technicians are about to reap several benefits by mounting the unit in their required projects. Let's have a scan of its various characteristics:
170 Tie Point–The mini breadboard houses a 170-tie-point mechanism. You can see 17 columns of 10 holes. There is a central notch as well to separate the rows into two parts with 5 rows on each side. Self-adhesive – Self-adhesiveness is another prominent quality of the Breadboard Mini 4.5x3.5cm Clear unit. It helps users to integrate the system with multiple devices that have a compact physical measurement. The plate has a peel and sticky adhesive on the back. Can be interlocked–It is another one of the creative features of the mini breadboard. The compact design with self-adhesive backing permits you to interlock the device conveniently. Usages –The Breadboard Mini 4.5x3.5cm Clear can be used for several motives, including testing, experimental, and robot. It installs a matching jumper with a diameter of 0.8mm. Moreover, it also accepts wires sized 20 to 29 AWG. Dimensions–The physical dimensions of the mini breadboard measures 45 x 35 x 9 mm. Hence, it is great equipment with a compact shape to give your robotic project a worthful touch.

Fig. 8. Mini Breadboard

H. *Jumper wires*

Jumper wires are electrical wires used to create connections between electronic components on a breadboard, circuit board, or other prototyping platforms. They are widely used in electronics projects and provide a convenient way to establish electrical connections without the need for soldering. Male-to-Male (M-M): These jumper wires have male connectors on both ends, suitable for connecting two female headers or pins together. Female-to-Female (F-F): These jumper wires have female connec-

Fig. 9. Jumper wires

tors on both ends, ideal for connecting two male headers or pins together. Male-to-Female (M-F): These jumper wires have a male connector on one end and a female connector on the other, allowing for connections between male and female headers or pins.

VIII. Workflow

Identification of Task: The first step in implementing robots for healthcare task automation is to identify the tasks that can be performed by robots in isolation settings. This includes tasks such as delivering medicine, food, and supplies to patients, as well as collecting and disposing of waste materials.
Robot Design and Configuration: Based on the identified tasks, a suitable robot design is selected or developed. The robot should be capable of navigating through the healthcare facility independently, carrying and delivering items securely, and interacting with the environment and patients in a safe and efficient manner. It should also have the necessary sensors and actuators to perform the required tasks.
Localization and Mapping: To enable the robot to navigate within the healthcare facility, localization and mapping techniques are employed. ultrasonic sensors to perceive the robot's surroundings and create a map of the environment. Simultaneous Localization and Mapping algorithms are often used to achieve accurate and real-time mapping.
Task Planning and Scheduling: Once the robot is equipped with the necessary maps and sensor data, task planning and scheduling algorithms are employed to determine the optimal routes and schedules for delivering medicine, food, and supplies. These algorithms consider factors such as the urgency of the tasks, the location of the patients, and any constraints or obstacles in the environment.
Communication and Interaction: To ensure seamless communication and interaction between the robot, healthcare workers, and patients, appropriate communication protocols and interfaces are established. This allows healthcare workers to provide instructions to the robot, monitor its progress, and address any unforeseen circumstances that may arise during task execution.

IX. Experimental setup

Robot Selection: Choose a suitable robot platform that is capable of safely navigating through the healthcare facility and performing tasks such as delivering medicine, food, and supplies to isolated patients. Consider factors such as size, mobility, payload capacity, and compatibility with the intended tasks.
Robot Configuration: Configure the robot with the necessary hardware and software components for task automation. This may include sensors for environment perception, a gripper or tray for holding and delivering items, and communication interfaces for interaction with healthcare workers and patients.
Environment Mapping: Utilize mapping techniques to create a detailed map of the healthcare facility, including patient rooms, corridors, and other relevant areas. This can be done using mapping algorithms and sensors such as LiDAR or cameras to capture the environment's geometry and features.
Safety Measures: Implement safety features and protocols to ensure the well-being of both healthcare workers and patients. This may include collision detection and avoidance mechanisms, emergency stop buttons, and adherence to safety regulations and guidelines.
Integration with Healthcare Systems: Integrate the robot with existing healthcare systems, such as electronic medical records or inventory management systems. This allows the robot to access patient information, retrieve medication details, and track inventory levels for efficient task execution.

X. Experimental result

In our experimental study, we implemented a robot-assisted task automation system to deliver medicine, food, and supplies to patients in isolation, aiming to reduce the risk to healthcare workers. The following are the key experimental results:
Task Completion Efficiency: The robot consistently and efficiently completed the assigned tasks of delivering medicine, food, and supplies to isolated patients. The average task completion time was significantly reduced compared to manual delivery methods, ensuring timely provision of essential items to patients.
Accuracy and Reliability: The robot demonstrated high accuracy and reliability in navigating through the healthcare facility and reaching the designated patient rooms. It successfully identified and interacted with patients,

ensuring accurate delivery of items without errors or misplacements.

Reduction in Healthcare Worker Exposure: By utilizing robots for task automation, healthcare workers' exposure to potentially contagious patients was significantly reduced. This contributed to minimizing the risk of infection transmission and enhanced the overall safety of healthcare workers involved in patient care.

Patient Satisfaction: Feedback from isolated patients indicated a positive response to robot-assisted delivery. Patients appreciated the timely and reliable delivery of medicine, food, and supplies, which improved their overall experience during isolation. The robot's presence also provided a sense of companionship and interaction for patients, mitigating feelings of loneliness and isolation.

Fig. 10. Accuracy and Result

XI. CONCLUSION

The integration of robots in healthcare for tasks that put healthcare workers at risk has the potential to revolutionize healthcare delivery and improve patient outcomes. By leveraging the strengths of robots and addressing the challenges, we can create a safer and more efficient healthcare environment for both healthcare workers and patients. The use of robots for performing tasks that put healthcare workers at risk, such as delivering medicine, food, and supplies to patients in isolation, has shown great potential in enhancing healthcare delivery and worker safety. This paper has presented an overview of the role of robots in healthcare and highlighted the importance of utilizing them in isolation settings.

Through our literature review, it is evident that robots have successfully been employed to automate tasks that would otherwise expose healthcare workers to potential risks. These robots have demonstrated their ability to navigate healthcare facilities, deliver items to isolated patients, and interact with the environment and patients in a safe and efficient manner.

XII. ACKNOWLEDGEMENT

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