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AUTONOMOUS HEALTH MONITORING AND ASSISTANCE ROBOT

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Abstract - This document outlines the design and development of an Autonomous Health Monitoring and Assistance Robot, which aims to transform patient care and enhance overall well-being. The robot incorporates sophisticated sensors, artificial intelligence, and automation technologies to monitor vital signs, deliver real-time health updates, and assist patients with their daily routines. Featuring an intuitive interface, the robot facilitates easy interaction, making it suitable for users of all ages. Its autonomous functions allow it to navigate various environments, identify emergencies, and provide prompt interventions, thereby alleviating the workload of caregivers and improving the standard of care. This research discusses the robot's architecture, operational effectiveness, and potential uses in both healthcare facilities and home care environments, underscoring its significance in enhancing patient outcomes and increasing healthcare accessibility.

***Key Words*: Patient Management, Automation in Healthcare, Support for Home Care, Well-Being of Patients, Innovations in Healthcare Technology, Monitoring of Vital Signs.**

1.INTRODUCTION

The World Health Organization (WHO) officially declared the COVID-19 pandemic a "global emergency" on January 30, 2020, due to its rapid global spread. The pandemic has significantly impacted economies worldwide, resulting in stock market declines in numerous nations. Since the initial cases were reported in Wuhan, China, in December 2019, the virus has swiftly disseminated both within China and internationally, affecting nearly every country except Antarctica.

Despite limited publicly available data, researchers globally have made strides in assessing the pandemic's magnitude, its rate of progression, and various transmission dynamics. Recent clinical findings indicate that a considerable number of COVID-19 patients exhibit mild symptoms during the first four days, highlighting the disease's potential for stealthy transmission.

Experts have concluded that COVID-19 is considerably more transmissible and deadly than the typical influenza virus. As per the WHO's situational report 127, released on May 26, 2020, there have been 5,404,512 confirmed cases globally, with 343,514 fatalities. The mortality rate is notably higher among older individuals compared to younger populations, and male patients are at greater risk than their female counterparts within the same age bracket. Individuals with pre-existing health conditions such as cardiovascular diseases, hypertension, diabetes, cancer, and chronic respiratory illnesses face a higher likelihood of severe complications and death from COVID-19 compared to those without such comorbidities.

The United States, China, Italy, Iran, Brazil, France, the United Kingdom, and Germany are currently among the most affected nations. COVID-19 can be transmitted through pre-symptomatic, symptomatic, or asymptomatic carriers, underscoring the importance of preventive measures such as hand sanitization, wearing face masks, and maintaining social distance to mitigate the risk of infection. artificial intelligence, to develop machines that can perceive their environment, analyze data, and respond accordingly.

2. LITERATURE REVIEW

Kavita Satale and colleagues [1] introduced a design and implementation of a Nursing Robot, utilizing components such as the ATmega2560 microcontroller, L298N motor driver, and DC motors. This system is capable of efficiently and accurately picking and placing medications for the appropriate patients by employing a suitable path planning algorithm. Given that robotics is a rapidly advancing field, it necessitates further research and development. Miran Lee and associates [2] examined the necessity and feasibility of care training assistant robots within care education, employing the Dynamixel XM-430-W350-R and servo motors. The integration of two 6-axis force sensors, PFS303YA301, aims to minimize human errors, reduce labor costs, and enhance output efficiency, which has contributed to the adoption of robotics across various sectors, including assembly lines, agriculture, packaging, and more recently, healthcare. Xi Vincent Wang and his team [3] proposed that robots are anticipated to become increasingly autonomous, flexible, and cooperative in the post-pandemic landscape. They highlighted future research trends and suggested that advancements in underlying technologies should be prioritized to bolster robotics research during and after the pandemic. Shuo Tian and colleagues [4] advocated for Smart Healthcare systems that promote improved health self-management, leveraging technologies such as IoT, mobile internet, cloud computing, big data, 5G, microelectronics, and artificial intelligence. However, the current landscape of smart healthcare is hindered by a lack of overarching guidance and structured documentation, resulting in ambiguous development objectives and potential resource wastage. Erwin Loh and his team [5] explored various medical specialties, addressing both current strengths and challenges. They noted that artificial intelligence has demonstrated effectiveness comparable to that of human practitioners in diagnosing a range of medical conditions, and in certain instances, it has proven to be more effective. AI researchers are actively developing algorithms capable of learning, evolving, and maturing akin to human beings through self-reflection.

Leo Louis et al.[6] proposed an exploration of the operational principles and applications of an Arduino board, which incorporates elements such as Arduino, microcontrollers, hardware, software, open-source platforms, VLSI, and sensors. Arduino serves as an open-source microcontroller that can be programmed, erased, and reprogrammed at any time. Despite its open-source nature and ease of programming, its applications remain somewhat limited. Krishna Chaitanya Kodur et al.[7] introduced a robotic nursing aid that features a 7-DoF robotic arm equipped with a two-finger gripper, an Intel RealSense D435i camera, and laser technology. This robotic system is designed to assist users with mobility and is operated remotely in a straightforward and intuitive manner. An impedance control strategy, combined with model predictive control, is employed to maintain optimal control, ensuring that the robot remains at a specified distance and matches the patient's velocity. Amit Kumar Pandey et al.[8] focused on the development of a social robot utilizing a motor/sensor board, an internal computer, and a communication device. A Class-Ethernet control model is implemented via a universal serial bus cable connecting the tablet to the CPU, allowing for the transfer of programs or modules between robots. However, significant advancements are still required for these general-purpose sociable robots to function in a socially acceptable manner. Meir Nitzan et al.[9] aimed to assess blood oxygen saturation and pulse rate using pulse oximetry and photoplethysmography. This method involves monitoring oxygen saturation over time and providing alerts for dangerously low oxygen levels, particularly in newborns. However, low peripheral perfusion resulting from reduced cardiac output or vasoconstriction can hinder the accurate detection of arterial pulsations. Maria Kyrarini et al.[10] discussed the challenges that healthcare robots encounter in their integration into society, particularly in the context of healthcare, robotics, care robots, nursing robots, hospital robots, and assistive robots. These robots are designed to aid elderly or disabled individuals, yet the high cost of commercially available robots poses a significant barrier to their widespread adoption.

3. METHODOLOGY

This paper aims to present an overview of current nursing robots, detailing their classification, features, and advancements. It examines various products and patents associated with nursing robots, highlighting the structural attributes, distinctions, and applications of typical nursing robots. To design a robot capable of performing tasks traditionally carried out by humans. One such task is the automatic medication dispenser, which is essential for ensuring timely medication delivery to the elderly. This device is specifically tailored for individuals who manage their medications without direct professional oversight, thereby minimizing the risk of administering incorrect medications at inappropriate times. The primary

components of this medication dispenser include a microcontroller connected to an alphanumeric keypad, an LED display, a motor controller, an alarm system, and a multi-compartment pill container and dispenser.

1. Pill dispensers integrate advanced technology with user-friendly design. 2. Medications are loaded into the dispenser, which dispenses each dose according to a predetermined schedule. 3. An audio reminder alerts the patient when it is time to take their medication. 4. These systems can support up to three separate medication times each day, tailored to the patient's requirements.

To develop a wireless-controlled robot, the system utilizes a four-wheel drive robotic vehicle to facilitate smooth navigation. This robot is equipped with arms designed for lifting a tray, a controller box for the circuitry, and a mount for a mobile phone or tablet. The mobile device serves the purpose of conducting live video calls. 1.The Wi-Fi module establishes a connection with the smartphone application via the internet. 2. Upon receiving a command from the smartphone, the robot executes the corresponding movement. 3. The robot is programmed to halt and notify the operator whenever it encounters an obstacle

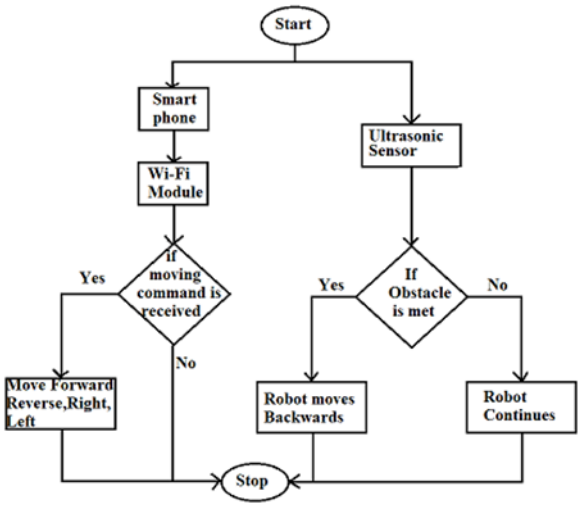

Fig.1. Block Diagram for Proposed System.

4.HARDWARE SETUP

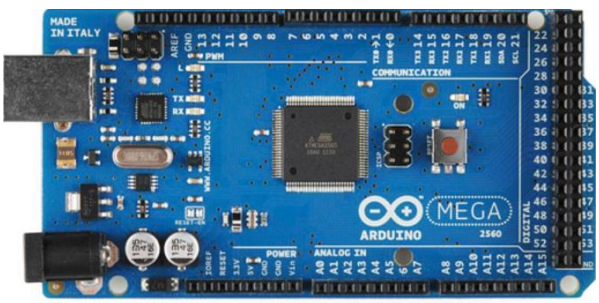

Fig.2. Arduino Mega 2560 for controlling the functions.

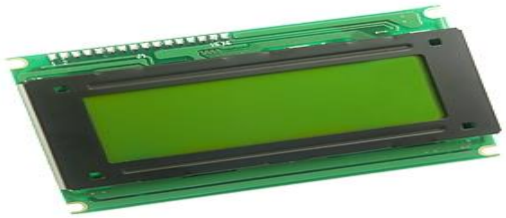

Fig.3. LCD Display to show information.

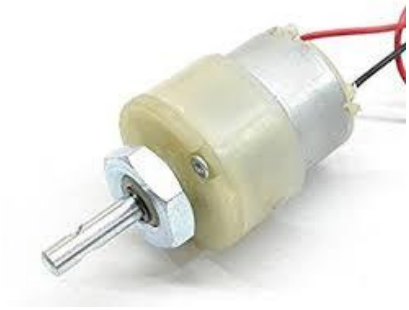

Fig.4. DC Motor to manage the moving parts.

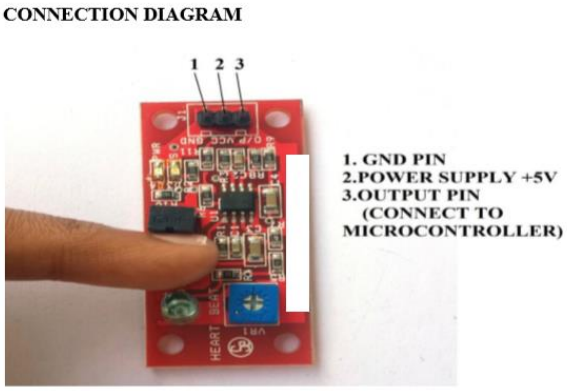

Fig.5. Heartbeat Sensor to check pulse rate

Fig.6.Wifi Module for wireless communication.

5. RESULTS

Fig.7.: Hardware setup of the proposal Model

Fig.8.: Display Pic of Morning Tablet that is to be given

Fig.9.: Display Picture of Morning tablet Dispensary

Fig.10.: Display Picture of Afternoon Tablet Dispensary

Fig.11.: Display Picture of Night Tablet Dispensary

Fig.12.: Heartbeat Sensor Readings

6. CONCLUSION

The Atmega 2560 microcontroller has been selected for the development of the Nursing Robot due to its extensive popularity and adaptability in various robotics applications. Its strong performance and compatibility with numerous sensors and modules render it an excellent choice for constructing sophisticated robotic systems. The Nursing Robot is specifically designed to assist patients by ensuring they adhere to their medication schedules. By following a predetermined timetable, the robot autonomously navigates to designated locations within a hospital or care facility. The robot's movement is facilitated by DC motors, enabling it to maneuver effortlessly in four directions—forward, backward, left, and right—with accuracy and without limitations. This capability ensures effective navigation through various hospital layouts. Additionally, the integration of sensors significantly enhances the robot's functionality, allowing it to monitor environmental conditions, identify obstacles, and prioritize patient safety. These sensors play a crucial role in elevating the quality of care provided to patients. The Nursing Robot reduces the necessity for continuous human intervention, offering timely reminders and assistance to patients regarding their medication schedules. This system can be effectively deployed in hospitals to enhance operational efficiency, alleviate caregiver workload, and improve the overall patient experience. By automating routine tasks, the Nursing Robot signifies a substantial advancement in contemporary healthcare technology.

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