Robotic Nurse

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Abstract — The technology advancements has led to rise in robots in many fields such as we used in healthcare applications. The microcontroller used in this is Arduino in which input pins are the APR33A3 module, SPO2 sensor, pulse rate sensor, temperature sensor, emergency switch for emergency condition, the motor drivers is given for the movement of the robot and dispensing of the medicine. The robot attends every patient in which the instructions is sent from the mobile app through wifi module to Arduino, it stores the health parameters of patient and send it to the doctor through sms. It also helps the patient in taking the medicine in time to time. The model of robotic nurse is to reduce the workload of nurses and doctors and not making them not to get infected, this robotic nurse helps in health care departments like hospitals, emergency wards, isolation wards.

Keywords: Oxygen Sensor, Pulse rate Sensor, Arduino, SPO2 Sensor

I. INTRODUCTION

In today's world we are using robot for other purposes which helps them in finishing their work but to take care of their health and the environmental conditions we go to hospitals for checkup but the doctors and will be not be able to attend each and every patient and some of the patients will be affected with diseases which affects the nurses and doctors as well and there would be lot of stress and too much of work load to reduce all of these the robotic nurse came into being which helps delivering the patients time to time the medicine.

In the past years we have seen a dangerous disease which is called as the covid19 in which many people died this robotic nurse has helped them especially in hospitals, nursing homes and isolation ward as the nurses and doctors are getting affected to get rid them robotic nurse has come up the Arduino which is used in this as the is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

It also helps the doctors and give the health updates and also helps the nurses by not getting infected and reduces their stress and pressure. These robots helps in detecting the patients it detects and it controls through voice command which is called as the APR33A3 module and the controller is Arduino. This controller is used to make gaming devices, fitness gadgets, weather stations, and much more. Among these models, the Arduino boards are able to read This electronic platform contains microcontrollers, connections, LEDs and many more. There are various types of Arduino boards present in the market that includes Arduino UNO, Red Board, LilyPad Arduino, Arduino Mega, Arduino Leonardo.

This robotic nurse will also help in emergency situations especially in covid 19 pandemic these robots has been used for their needs and it also helped the doctors to get their daily of each and every patient health report and it also helped them to not to get affected for them not getting attracted to diseases and it reduced the stress work of nurses and doctors.

[1] Abdelbaset Elghriani, Younis A. Younis, Abdelsalam M. Maatuk, "Assessment of Healthcare Workers' Level of Knowledge and Practices of Using Robotics During Covid-19", 2022 IEEE 2nd International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering (MI-STA), pp.199-203, 2022.

Nursing robots are getting into the people life gradually because of the huge assistance they can provide both to patients and nurses. Human nurses can have peace of mind. Their jobs are secure but a little help has come to the rescue to do most of the boring nursing tasks for them. Robot nurse helps nurses in hospitals. Larger robotic machines can be used to carry-out laborious physical tasks like moving patients, and smaller interactive robots are being used to combat loneliness and inactivity in the elderly population. An increasing elderly population paired with an insufficient amount of healthcare workers able to care for it makes revolutionary inventions like nurse robots incredibly helpful.

[2] John A. Stankovic, Meiyi Ma, Sarah Masud Preum, Homa Alemzadeh, "Challenges and Directions for Ambient Intelligence: A Cyber Physical Systems Perspective", 2021 IEEE Third International Conference on Cognitive Machine Intelligence (CogMI), pp.232-241, 2021.

In this paper, it is that present Hstar Technologies' 2 nd generation Robotic Nursing Assistant (RoNA) systemRoNA. Compared to the 1 st generation RoNA system released in 2011, the RoNA has more powerful arms which can lift up to 500 pounds patient. The RoNA has been equipped with many intelligent sensors that allow nurse easily and intuitively guide it performing the patient lifting. The paper also discusses the design improvement, control system as well as the software architecture of the RoNA system.

Nursing has ranked as one of the top 10 occupations for causing the work-related musculoskeletal injuries in U.S. Constantly and manually lifting and repositioning patients around bed and transferring them from bed to bed have been recognized as the major reasons causing nurses' workrelated musculoskeletal injuries. We believe that advanced robotic technologies can assist nurses in performing the labor intensive tasks and preventing the musculoskeletal injuries among medical workers and nurses.

[3] Hsieh-Yu Li, Lay Siong Ho, Achala Athukorala, Wan Yun Lu, Audelia Dharmawan, Jane Li Feng Guo, Mabel May Leng Tan, Kok Cheong Wong, Nuri Syahida Ng, Maxim Mei Xin Tan, Hong Choon Oh, Daniel Tiang, Wei Wei Hong, Franklin Tan, Gek Kheng Png, Ivan Khoo, Chau Yuen, Pon Poh Hsu, Chen Ee Lee, U-Xuan Tan, "Towards a Manipulator System for Disposal of Waste from Patients Undergoing

Chemotherapy", 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp.2949-2955, 2021.

A persistent-if less glamorous—challenge in hospitals lies in the day-to-day work of moving and lifting patients with impaired mobility. This is a challenge intensified by our burgeoning aging population, the obesity epidemic, and our aging healthcare workforce. During manual patient handling, the predominant risk of staff injury is excessive back and shoulder loading. A mobile robotic nurse assistant (RoNA) is highly desired to enhance the efficacy and quality of care that nurses and their paraprofessional staff can provide.

An assistant could improve a nurse's working conditions by off-loading some of his or her most physically demanding duties, thereby reducing the potential for self-injury or injury to the patient. Hstar Technologies is developing a revolutionary RoNA system that provides physical assistance to nurses in a hospital ward.

The design of RoNA is a safe and robust system that works effectively in a hospital environment under direct and telepresence control by a nurse or physician. RoNA has a humanoid design featuring bimanual dexterous manipulators that employ a series-elastic-actuation (SEA) system. These electric actuators provide manipulator compliance, safety, flexibility and the strength to lift patients weighing up to 300lbs.

RoNA also features an innovative humanoid upper torso, a unique mobile platform with holonomic drive and posture stability enhancement, intelligent navigation control with 3D sensing and perception capability, an intuitive and innovative human-robot interaction control interface, and a highly integrated plan for healthcare system assembly. We anticipate that robotic maneuvering assistants would increase job satisfaction, reduce lifting-related injuries, and extend the years of effective service nurses could render in hospitals. These effects would reduce hospital costs and ameliorate problems posed by the shortage of nursing staff.

[4] J. Mišeikis et al., "Lio-A Personal Robot Assistant for Human- Robot Interaction and Care Applications," in IEEE Robotics and Automation Letters, vol. 5, no. 4, pp. 5339-5346, Oct. 2020, doi: 10.1109/LRA.2020.3007462.

In this paper the robot used here is Lio in which it is personal assistant robot which takes care of the patients needs in which it detects the patients through its arm in which it operates through mobile.

Nurse robots have become more popular by providing the medicines and giving the health updates and in before days there are some types of robots which does assisting the nurses and doctor and it does only limited applications, When the covid19 came up the use of robot came have become more important by updating its applications in which it helps the nurse and doctors which will not affect them in attracting the diseases and they also become advances in applications.

The mobile is controlled through decision procedure in which it tells that in which operation it needs to be done and which all the patients it needs to be visited. In mobile applications the complex algorithms can be done in this robot arm and the height of the robot should not be scared for the patients in which the robotic arm is given as leather for grabbing the objects. In mobile applications it done through python using myP, c++ programming which helps in detecting the patient, the voice interaction is also done in this robot in which it displays the text through voice interactions and custom designed visualisations that is beneficial for the operation of the robot.

Additional robot camera feeds can be visualised in this screen, embedded speakers together with a multidirectional microphone to enable to interact using voice and sound. Lio can understand voice commands as well as generate speech from text or play music.

This problem is not helped in hospitals and also even in homes in which it not only helps the doctor and even to the nurses.

[5] Ilias, Bukhari, R. Nagarajan, M. Murugappan, Khaled Helmy, Awang Sabri Awang Omar, and Muhammad Asyraf Abdul Rahman. "Hospital nurses following robot: hardware development and sensor integration." International Journal of Medical Engineering and Informatics 6, no. 1 (2014): 1-13.

In this paper it tells that the nurses have give to the health updates of the patients and it also has to perform the duties by attending the patients and by carrying the medical needs in a cart in which they have to attend each and every patient it is a tiresome job. To avoid all these a mobile robot is constructed for the nurses so that it follows and carry the medical equipments and at the same time it also performs obstacle avoidance.

In this the obstacle avoidance is done through ultrasonic sensors in which it is attached through microcontroller called as ATO controller in which it detect through pulse rate sensor if the obstacle detects the waves are reflected and it avoids the obstacle and it carries a weight of 20 kg

The motors used in this is dc motors in which it used for the rotation of the robot and the robot is constructed in a circular shape it routes in 360 degrees and also measurement is also done in this system between the patient and the robot in order to avoid the collision.

There are two USB ports in which the USB-5 and USB-8 are used for the detecting the collision the USB-8 is used in this as it has advanced settings in which it helps in identifying the detection and tries to avoid that and it can also be used for navigation in which it helps to go forward and backward.

The trans wheels are used in this robot for the rotation but the vibration is developed for forward and backward of rotation to solve this we are inserting more trans wheels which not only helps in rotation but also in reducing the sound of vibration and it also used to create smoothness when the robot is rotating at 30 degrees. It helps the nurses to not only attend the patient it can also attend other patients also and this robot is controlled through mobile and it goes according to nurse mobile platform and it also avoids obstacles and reduce the stress work of the nurse.

II. METHODOLOGY

The controller used in this is Arduino in which the inputs are given to this are APR33A3 module which is used for voice control and sensors used are SPO2 sensor is used for

detecting the oxygen levels, pulse rate sensor for detecting the heart beat and emergency switch is used for emergency conditions and power supply is used with help of batteries and there are two motors which are the dc motor and motor driver in which the dc motor is used for rotation and motor driver for dispensing of medicine and relays are used in water pump which sprinkles itself through sanitiser.

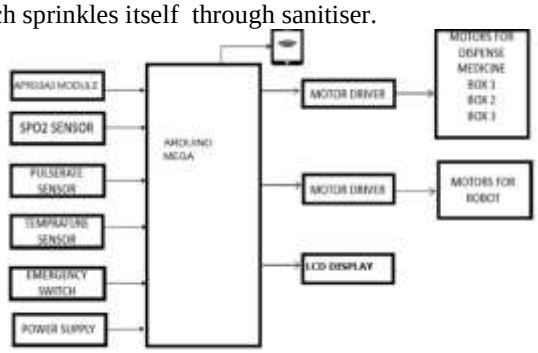

Fig. 1: Block diagram of robotic nurse

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields.

APR33A3 module is a 8 Channel Voice Record & Audio Playback Board integrated with APR33A3 series IC which is a powerful audio processor along with high high-performance audio analog-to-digital converters (ADCs) and digital-to-analog converters (DACs).

ESP8266 module enables microcontrollers to connect to 2.4 GHz Wi-Fi, using IEEE 802.11 bgn. It can be used with ESP-AT firmware to provide Wi-Fi connectivity to external host MCUs, or it can be used as a self-sufficient MCU by running an RTOS-based SDK.

The SPO2 sensors used in this is used for detecting the oxygen levels. The normal oxygen levels should be between 95 to 100. The heartbeat sensor are different for different ages for 3 t 4 years old is between 80 to 120 bpm, for 5 to 6 years old is 75 to 115 bpm, 7 to 9 years is 70 to 110 bpm and for 10 years and older, adults is 60 to 100bpm.

The pulse rate sensor used in this is used for checking the heart beat. Temperature sensor is used for measuring the temperature of patients the normal temperature.

It should be in the range of 97.7 to 99.5 degree Fahrenheit, if it is more than 37.8 degrees the patient is ill.

There are two motor drivers one of motor driver is L293D H-bridge motor is a bidirectional drive currents used for dispensing the medicine and other motor driver is used as dc motors is used for the movement of the robot and the speed is 5000 to 14000 rpm.

The integration of this block diagram is to provide voice module and also rotation of the robot which helps to meet each and every patient and it also gives a remainder to the patients to take their medicines on time. The patients can be detected using Arduino.

The robot takes the health update of a patient and sends to doctor which also helps the doctors and nurses to reduce their stress ans work.

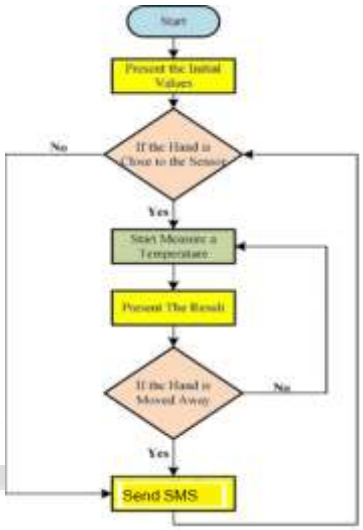

Fig. 2: Flowchart on Temperature sensor

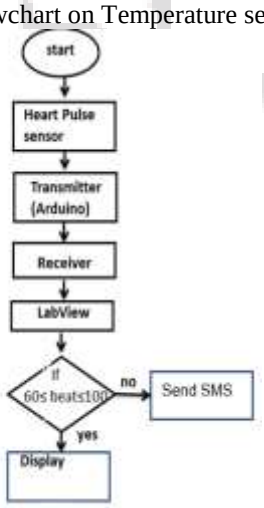

Fig. 3: Flowchart on Heartbeat sensor

The flowchart in this is that in the temperature sensor it starts and it shows the initial room temperature, if the patients hand is closer to the temperature sensor it presents the results, if the hand is moved away it send message to the doctor.

The next flowchart is based on the heartbeat sensor it starts and asks the patients to place their finger on the sensor then transmits through Arduino. If the heartbeat is normal it displays in LCD display but if the beat is exceeded more it send an alert message to doctor through sms.

The temperature sensor uses principle of thermocouple to give accurate reading. SPO2 sensor is to

measure oxygen rate, pulse rate sensor to measure the heart beat if they are in range of threshold the SMS is sent and if they go beyond the threshold the emergency buzzer rings and SMS is also sent to the doctor.

The ESP8266 module is responsible for connecting to the Wi-Fi network and also acting as a server. The mobile app is connected through internet to the on board Wi-Fi module. The Wi-Fi module is connected to the Arduino, the instruction from the app is sent to Arduino through wifi module.

The robot is already given the health parameters of a patient so when it goes to the patient and it helps the patients to take their medicine on time. If the rage is within the parameters it is sent through mobile if they are beyond the parameter range then the emergency buzzer rings and it is sends SMS to the doctor

In this the robot has the object detection, if the robot goes to the patient then it detects it and if it is that patient it dispenses the medicine according to it.

In this flowchart it tells that there are sensors in that controller in which if the emergency switch is pressed it alerts with buzzer and send message to the doctor.

In this robot the pre defined time is given so that the robot attends only that only for some amount of time and it attends another patient and it also moves forward, backward, left and right according to pre defined time.

Fig. 4: Results of robotic nurse

III. Results

The fig above shows that it is connected to Arduino and the sensors are connected to the inputs of the Arduino, the output is shown through LCD display which shows the reading of the sensors in which the heartbeat sensor senses the heart and temperature it detects the temperature and there is also a emergency switch in case the patient is in critical condition and the motor drivers are connected for dispensing the medicine and dc motors are connected for the motion of the robot. The health parameters of a patient are sent to the doctor. It reduces the work load of nurses and doctors. The medicines are given to the patient and the health parameters of the patient is sent to the doctor through SMS and the instructions are given through the mobile app through Wi-Fi module and the doctors commands the robot and it tells the movement of the robot through mobile app and it is also wireless module with the help of wifi module. In this robot it has three boxes which dispenses the medicine after when it recognises the patient it dispenses the medicine box and gives only the required medicines to the patient.

IV. Conclusion

The main aim of this paper is used for health care assistants and dispenses the medicines on time and reduces the stress and workload of a doctor and nurses. It also helps them in not getting affected with disease for doctors and nurses. In this the robot has sensors which detects the patients and updates the health parameters to the doctor through SMS.

V. Future scope

- The robot are also connected through using AI-ML which helps the robot in interaction is done with the patient.
- The robot can be installed the cameras which are used for face recognition for dispensing the medicines.
- The robots can attend for multiple number of patients with higher microcontrollers.
- The robots can also be used for lifting the medicines and the objects for helping the nurses and doctors and it can also help in serving the patients if the medicines are at last box and the patient is unable to lit it the robots help them in giving the medicines.

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