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A Personalised Humanoid Social Robot with Energy Efficient Health Monitoring System

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ABSTRACT: Healthcare sector is the most promising field in today's technology. This involves maintenance of quality physical and mental health by implementing preventive measures and treatment. It includes all the necessary medical aids, tests, examinations, treatments, diagnosis, evaluations and services that ensure the diseasedoes not strike back again. In this paper, an idea to improve the current status of healthcare sector through roboticsand automation. A medical assistant system with monitoring patient health parameters such as blood pressure and blood glucose is provided to enhance the recovery speed of the patient. The new feature included is an UV light infection box which will provide complete hygiene and sanitation while delivering the essentials to the patients.

KEYWORDS: Medical assistant system, Sanitation, Health monitoring, Live camera, UV light disinfection

I. INTRODUCTION

The socially assistive humanoids plays major role in assisting patients in the hospitals. The continuous monitoring of patients health parameters is the most importance task for achieving their satisfaction in the healthcare sector. Another major issues is providing complete sanitation and hygiene in the workplace for eliminating the spreading of contagious diseases. The people's expectations to increase their life span is more with the advancement of technology. So, this will lead to increase in old age population which will require more attention to monitor health parameters to avoid complications.

The lack of proper and quality healthcare will affect the speed of the patient's recovery. This has been one of the major problem in the field medicine. Even though there are thousands of medical centres across the country many of those do not have facilities for proper medical attention during critical situations. This not only increases the mortality rate but also leads to unnecessary suffering and persistent symptoms. Efforts have been made to enhance these conditions with the use of technology and robots to replace medical staffs to reach the patients.

The following are the problems focused that potentially harmful healthcare includes: improper monitoring of patients health parameters, unavailability of timely attention, possible human error, loneliness of patients, lack of data analysis, time consuming. These problems have to be eliminated to multiply the healthcare quality and reduce the carelessness.

II. RELATED WORK

The concept of humanoid machine was first developed by in early 20th century. The conversational affective social robots for ageing and dementia illustrates the study based on how human robot interactions takes place in socially assistive robots. This work features robots with smart speakers to recognise the voice of patients and interact with them to avoid loneliness^[1]. An IOT based sanitization robot using raspberry pi zero W and UV lamp was designed which only focuses on providing sanitation and lack of monitoring health parameters. Due to the usage raspberrypi, the cost of the model is high which is not affordable for the patient^[2].

The smart delivering robot for isolation ward uses pulse oximeter to assess the oxygen level of patients and monitors



the continuously via mobile application [3]. The UV floor sanitization robots implement a UV robot prototype by using ultrasonic sensor and IR sensor providing complete hygiene in hotels, hospitals, workplaces, etc. [4]. The sanitizer robot is also designed using raspberry pi which makes them more costly [5].

UV light installed mobile robot was introduced by Danish base company UVD robot for disinfecting rooms, which could retard the spreading of diseases. These robots can work effectively and the methodology implemented is more efficient than any other technique. Using a mobile array of powerful short-wavelength ultraviolet-C that emit enough energy to shred the DNA or RNA of any microorganisms exposed to them [8]. An autonomous robotto perform bed baths was also proposed in a paper [10].

III. METHODOLOGY

In this proposed system, we monitor the two health parameters namely, blood glucose level and blood pressure. This is being monitored by IR light sensor in the fingertip of the patient and the values are calculated by using MAX30100. The continuous monitoring of the patient movements is achieved by ESP32 cam module where the camera has been fixed in the robot. UV light infection box has been made in the robot’s body which will suppliesthe essentials for the patient and ensure the complete hygiene. The parameters recorded, live monitor of patients and overall control of the robot is achieved by developing a mobile application in IOT platform using Node MCU.

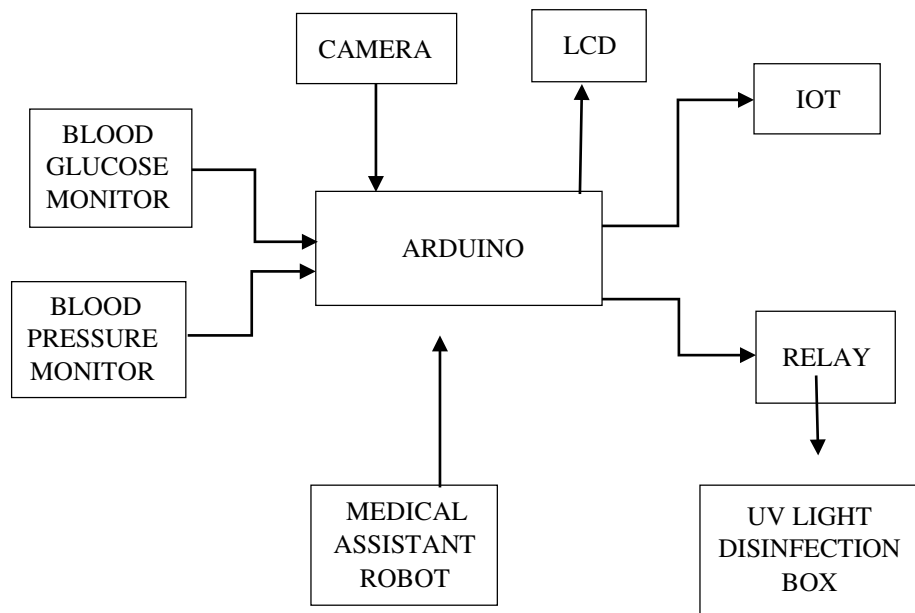


Fig. 1. Block diagram of the proposed system

COMPONENTS:

- **ARDUINO UNO:**

Arduino is a microcontroller board based on ATmega 328P series.it consists of 14 digital I/O pins out of which 6 can be used as pulse width modulated outputs. It also incorporates 6 analog inputs, 16 MHz ceramic resonator, a USB connection, a power jack, An ICSP header and a reset button. It contains everything needed to support the microcontroller.



- **ESP32 CAM MODULE:**

The core of this module is ESP32 chip, which is scalable and adaptive. Two CPU cores can be individually controlled. The clock frequency is adjustable from 80 MHz to 240 MHz and supports RTOS. It is a general purpose Wi-Fi+BT MCU module which integrates traditional Bluetooth, Bluetooth low energy and Wi-Fi.

- **MAX30100:**

The MAX30100 sensor help with measuring the absorption between two light frequencies. It regulates the brightness manually with PWM, filter 50/60 Hz noise out of the signals. The readings will store in a FIFO buffer. It can store up to 16 measurements, where each sample is size of 4 bytes. By changing the sampling rate and pulse width the ADC resolution can also be changed. This sensor is implemented for calculating blood glucose and blood pressure level.

- **LCD DISPLAY:**

A liquid crystal display is a flat panel display or other electronically modulated optical device that uses the light modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly but instead use a backlight or reflector to produce images in colour or monochrome.

- **IOT USING NODE MCU V3:**

The best way to develop an IOT application with less integrated circuits to add is to choose NodeMCU. This is an open source firmware and development kit that plays a vital role in designing a proper IOT product using a few script lines. The module is mainly based on ESP8266 that is low cost Wi-Fi microchip incorporating both a full TCP/IP stack and microcontroller capability.

- **RELAY:**

Relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. It allow one circuit to switch a second circuit which can be completely separate from first. This is used here to operate the UV light disinfection box.

- **UV LIGHT DISINFECTION BOX:**

This box is to provide the essentials and needs of the patient that can be supplied without any spreading of diseases causing pathogens. This box uses ultraviolet germicidal light with 15W power, UVD 189nm for ozone disinfection and sterilisation and 20m² disinfection area. The UVC rays produce at 254 nm which is hundred times stronger than sunshine, they can kill the dust mites immediately.

IV. EXPERIMENTAL RESULTS

A mechanical model of medical assistant robot with UV light disinfection box is obtained. The parameters measured by the sensors are transmitted and recorded by the mobile application developed by using IOT platform. The mobile app is BLYNK which is used to monitor the parameters and live camera. The control of the robot and UV light disinfection box is also done from the receiver side.

V. CONCLUSION

Thus a system for minimising human contact and enhance patient care is designed. This ensures the workplace safety and increased patient satisfaction. The food transport and supply to the patients without spreading infections can be done. Administrative and logistical tasks that are routine and burden the medical staffs can be eliminated. This can help the physicians to examine and treat the patients in the isolation wards. In future, this can be developed to measure more parameters using various sensors.



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