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Automatic Medical Robot

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Abstract: *The COVID-19 is the infectious disease caused by the coronavirus which is a respiratory pathogen. Most people (about 80%) recover from the disease without needing hospital treatment. About 20% of those who get COVID-19 become seriously ill and require oxygen, with 5% becoming critically ill and needing intensive care. Complications leading to death may include respiratory failure, acute respiratory distress syndrome (ARDS), etc. To have a solution on this we are getting treatment from doctors, nurses and they are doing their best. But sometimes this is causing problem as they cannot give attention to each and every patient because of work load. On this situation. To help society, to help people we have a product which we can use as an attendee to the patient. This product can help patient to get his/her medications and syrups on time and majorly helps to the Covid-19 suffering patient to control patient's oxygen level.*

Keywords: Covid-19, Arduino Uno, SpO₂ level, GSM based communication, Medical equipment

I. INTRODUCTION

Most people (about 80%) recover from the disease without needing hospital treatment. About 20% of those who get COVID-19 become seriously ill and require oxygen, with 5% becoming critically ill and needing intensive care. Complications leading to death may include respiratory failure, acute respiratory distress syndrome (ARDS), sepsis and septic shock, thromboembolism, and/or multiorgan failure, including injury of the heart, liver or kidneys. People aged 60 and over, and those with underlying medical problems like high blood pressure, heart and lung problems, diabetes, obesity or cancer, are at higher risk of developing serious illness. This can be avoided by taking some simple precautions, such as physical distancing, wearing a mask, keeping rooms well ventilated, avoiding crowds, cleaning your hands, and coughing into a bent elbow or tissue. Check local advice where you live and work, etc. Our project is one of the leading factor in such situations containing automatic medicine guider, oxygen level controller and most important is GSM system. This automatic medical robot is so planned that he can manage the patient's medicine time, medicine prescription, oxygen level and the GSM system helps doctor and patient to have a bridge between them to get in contact with each other. We planned this robot with specially designed GSM system containing 3 connections which can help the patient and doctor to monitor oxygen level.

II. LITERATURE REVIEW

To make the system efficient and economical there are various devices and systems associated with the medical robot. This literature survey facilitates us to beat various styles and program related enhancements. In "Basic Arduino Programming" T.K. Sethuramalingam and M. Karthighairasan says that 'Arduino is an open hardware platform which is a portion of the automatic control for laboratory sterilization progression. Sterilization is a familiar practice in biological laboratories and it is defined as a development of microbial grown control, concerning the overall annihilation of any microorganism on all objects actions going on in society, and Michael Morgolis says that 'you don't need to have mastered Arduino or programming to get started. Updated for the Arduino 1.0 release, the recipes in this second edition include practical examples and guidance to help you begin, expand, and enhance your projects right away whether you're an artist, designer, hobbyist, student, or engineer. Get up to speed on the Arduino board and essential software concepts quickly. Learn basic techniques for reading digital and analog signals. Use Arduino with a variety of popular input devices and sensors. Drive visual displays, generate sound, and control several types of motors. Learn techniques for handling time delays and time measurement. Apply advanced coding and memory handling techniques'. [1]

Pulse oximeter is one of the most commonly employed monitoring modalities in the critical care setting. This review describes the latest technological advances in the field of pulse oximetry. Accuracy of pulse oximeters and their limitations are critically examined. Finally, the existing data regarding the clinical applications and cost-effectiveness of pulse oximeters are discussed. Mowar W.R. says Prospective study using pulse oximetry to measure oxygen saturation of ED patients at triage. Saturation values were disclosed to physicians only after they completed medical evaluations and were ready to discharge or admit each patient.

We measured changes in medical management initiated after disclosure of pulse oximetry values. Providing physicians with routine triage pulse oximetry measurements resulted in significant changes in medical treatment of these patients. [2]

GSM network is the most worldwide mobile communication network nowadays. Based on the SIEMENS MC35 GSM module, general techniques of communication with GSM network are depicted, including the initialization of terminal equipment, sending and reading short messages (SMS), sending SMS to group users, and the management on phonebook of SIM card, furthermore, a flexible solution on real-time reading SMS is proposed. Finally, application cases are given for GSM module. [3]

The speed of dc motor could be achieved using mechanical or electrical techniques. In the past, speed controls of dc drives is mostly mechanical and required large size hardware to implement. We can utilize the dc motor for various applications by controlling the speed and orientation according to the field of our interest, by S. Semwal. [4]

III. OBJECTIVES OF SYSTEM

As we all know, in pandemic situation like Covid-19 and also in intensive care patients required an external oxygen system or ventilator system that can cause extra workload on doctors and medical staff. Due to that workload it is very hard to attend serious patients in time. So this fully automated system can provide the 24x7 Oxygen control which is required for patient as per there SpO2 level (Oxygen Saturation level in Blood in %). The smart Medicine box is provides a time to time medicines to the patients. And the Emergency switch is provided to the patients to call doctors in case of emergency.

IV. PROPOSED DESIGN

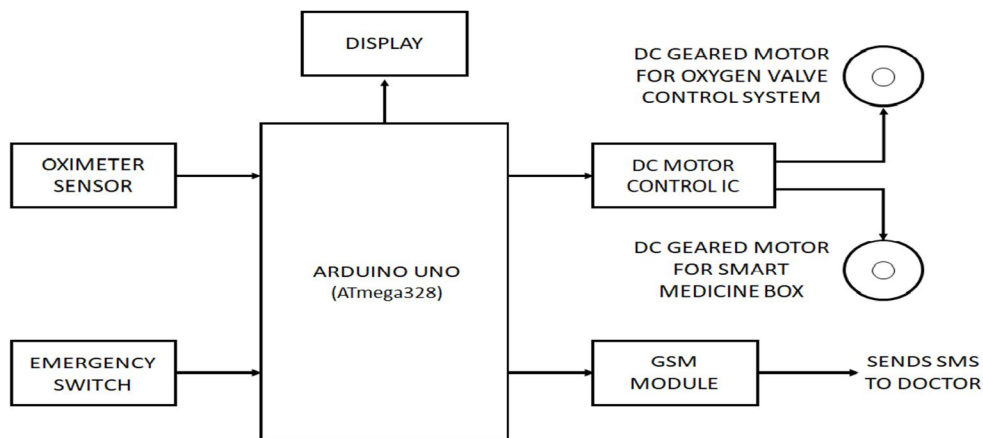


Fig. (1) Block Diagram

The proposed system uses Arduino UNO as the core of the system to which different sensors and modules are interfaced to get the results in various cases.

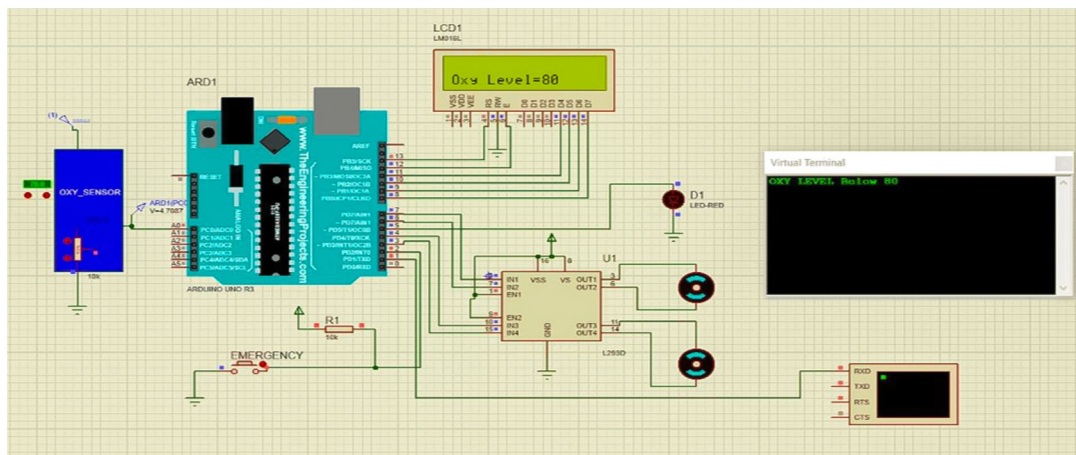


Fig. (2) Simulation Circuit Diagram

V. WORKING OF SYSTEM

In this system, first we can measure the oxygen level and heart rate of patient's body with the help of Oximeter Sensor. Then this data is processed in the microcontroller. The dc geared motor is connected with dc motor driver IC circuit, and the motor shaft is connected with the pressure valve system of oxygen tank or system. When oxygen level of patient is decreasing the motor will rotate clockwise and when oxygen level is get increased then motor rotates anticlockwise to regulate the flow of oxygen. In this system we added the GSM module (Global System for Mobile communication), so we can transmit the SpO₂ levels of patients to the doctor. If the oxygen level falls down at dangerous level the doctor gets message that patient requires an attention. The Smart Medicine Box is using the another dc geared motor to rotate the specially designed medicine box to provide the medicines to the patient in time, and next factor is GSM system which is designed with an emergency switch provided at patient end, so if patient wants to meet doctor, he can push a button provided there to get doctors attention of doctors or medical staff.

VI. RESULTS

In this project, Arduino board which is the processor that controls all the units is attached to it. The Oximeter sensor is attached to the finger of the patient and also an emergency switch is provided at the patient's bed. The dc geared motor is mechanically connected with the oxygen control valve to control the flow of Oxygen LPM (Litres per Minute). Smart Medicine Box provides the specific medicines to the patient in determined time.

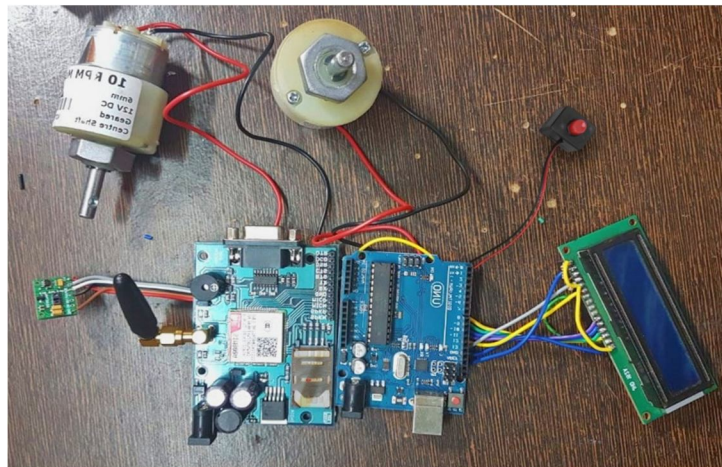


Fig. (3) Photograph of Automatic Medical Robot System

A. Oxygen Control System

In this system the oximeter sensor is attached to the patient's finger, then the level of oxygen (%) and heart rate is counted and processed in the Arduino Uno. Then processor sends processed data to the DC geared motor control IC which rotates the geared motor which is coupled with the oxygen control valve.

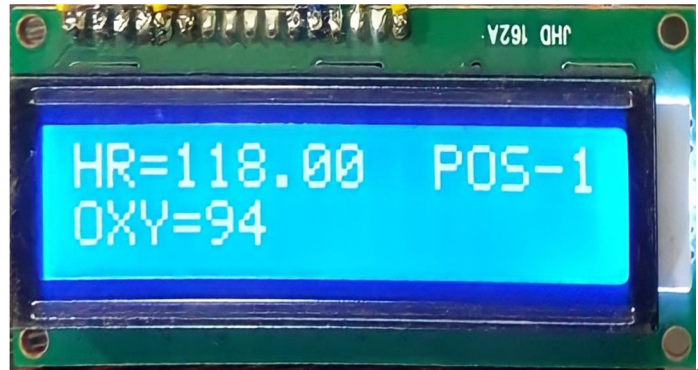
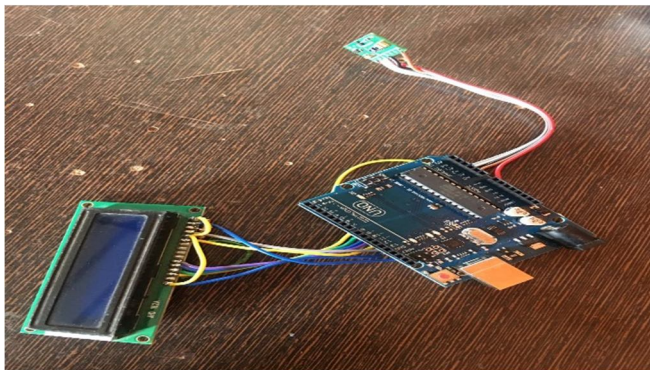


Fig. (4) Oxygen Control System with Display readings of Oxygen level and motor positions (POS)

The positions of geared motor shaft is move position 1 to position 4 according to oxygen level readings to maintain the required flow of Oxygen (O₂) in litres per minute (LPM) to the patient.

SpO ₂ Level (%)	Motor Position (POS)	Oxygen Flow Rate (LPM)
100 – 90	1	1
90 – 80	2	2
80 – 70	3	5
Below 70	4	10

TABLE – I

B. Emergency Button(Switch)

When emergency switch is pressed by a patient then the “BED NO.-1 and PATIENT CALL” message is send on the mobile number which is provided to the concern doctors by using GSM system.

When the patient’s oxygen level goes very low (Below 70%), then system automatically sends the emergency message i.e. “BED NO.-1 and OXYGEN LEVEL LOW” on the concern mobile number.

This messages are shown in the below screenshot.

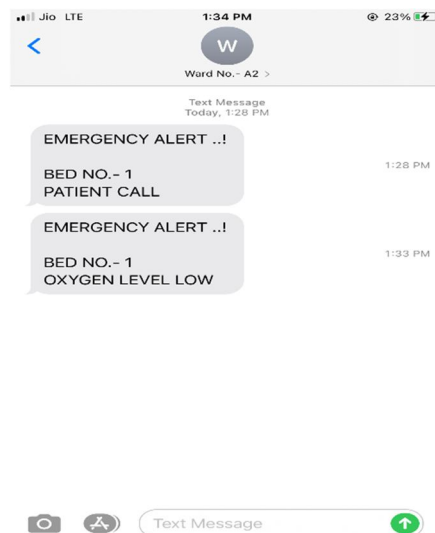


Fig. (5) Emergency Switch Alert Messages

C. Smart Medicine Box

The Smart Medicine Box is used to provide a medicines or tablets to the patients at a specific medicines at specific time i.e. when we set a timer at 8 am to take a tablet at compartment -1 of the box then, at 8 am it automatically open compartment -1 as shown in below figure. There are 6 compartments in box so we can add six timers on this system.



Fig. (6) Smart Medicine Box



VII. CONCLUSION

Thus we conclude that the Automatic Medical Robot with many more features can help a patients, a doctors and serving people working in this critical case to control oxygen and get a notification of patients. Especially to save the time and to attend the patient in time. With the help of modern days technology like Arduino Uno, DC Geared Motor, GSM module, etc we can be properly analyse the patients with proper care, and also with minimum staff or doctors. This system can be reduce stress level of doctors, so doctors can attend more patients when needed.

VIII. FUTURE SCOPE

Further many additions can be made into this system which we thought of but couldn't make as it would increase the overall cost of the system. We can add the temperature sensor to measure the body temperature, blood pressure measurement sensor to measure blood pressure, a storage device that can store all the data regarding patient's medical condition with some time interval. In future this system is very useful for doctors and hospitals.

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