Automated Effective Oxygen Administration and Dialysis Monitoring System

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Abstract

Oxygen is a lifesaving medication that should be offered with an administration to a patient who suffers from oxygen deficiency to avoid toxic effects of excessive oxygen supplement as well as to minimize the exposure to hypoxaemia. This work aims to automate the process of administering oxygen delivery in order to extend the continuous oxygen administration process beyond the IC units, reduce the cost of oxygen administration in terms of well-trained health care providers and equipment, prolong the lifetime of oxygen supplement, and help in the process of weaning patient from oxygen. In this work, model for a Portable Automated Oxygen Delivery and dialysis monitoring System that consists of two subsystems: an Oxygen Reader Subsystem and an Automated Adjustment Oxygen Delivery Subsystem, both communicating wirelessly, has been developed. If the oxygen level is cross below the threshold level, then a SMS will be sent to agency automatically to refill the cylinder. Then a reply SMS will be sending to the hospital about the booking status. In case any fault detection in oxygen distribution line sub system automatically enabled by the controller .The system promises significant benefits in improving the life quality of hypoxaemic patients as well as healthcare service for oxygen delivery administration.

I. INTRODUCTION

The weight of the conventional healthcare system is becoming substantial becauseof the increasing number of aging people combined with the small amount ofhealthcare resources and personnel (doctors, hospital administrators, nurses). In thehealthcare industry, the use of communication apps, things (sensors and devices)for healthcare monitoring are increasing exponentially and have a huge impact onthe patients and healthcare professionals. According to Forbes and Gartner, it isestimated that by 2020, approximately 20 billion smart devices will be connected tothe Internet, while HealthcareIoT market will contribute to$117 billion with anannual increasing rate of 38% during the 6-year period from 2016 to 2022.

According to these assessments, it is predicted that HealthcareIoT can play a centralrole in the healthcare industry. IoT has a significant effect on the healthcare industry,and various technologies, tools, and devices are used for different types of patients(e.g., temperature, pulse, and oxygen in the blood, blood pressure, glucose monitor,GSR, and ECG) to minimize avoidable deaths.

Nowadays, patients have the tools to view their key vitals themselves and help doctors to have immediate access to patient data on-the-go. In a form of wearable devices e.g. Apple watches. However, we note that these devices are quite expensive and it is difficult to find these devices used by poor people, who are facing the biggest part of diseases burden. Moreover, most of the existing medical devices are still need some investigations once it comes to the concept of the Internet of Things. The concept of the IOT entails the use of electronic devices that capture or monitor data and are connected to a private or public cloud, enabling them to automatically trigger certain events. Medical data such as blood pressure and heart rate are collected by sensors on peripheral devices; these data are transmitted to healthcare providers or third parties via wireless telecommunication devices. The data are evaluated for potential problems by a health-care professional and health providers are immediately alerted if a problem is detected. As a result, timely intervention ensures positive patient outcomes. The Two groups of people, who have high-levels of medical-care need, are the elderly and the chronically ill. The World Health Organization (2016) indicates that elderly people, who frequently suffer from chronic disease, require a highly effective and efficient provision of care.

According to the National Broadband Plan (2015) by the Federal Communications Commission (FCC), the use of remote patient monitoring under IOT technology will save the healthcare industry $700 billion over 15 to 20 years. Then it is important to focus on the IOT technology to benefit from the most recent technology. Bluetooth, ZigBee, and Wi-Fi are the common wireless technologies for remote patient monitoring systems. However, their suitability and

usability for this task are widely varying. Therefore, there are significant considerations while selecting a technology for IoT medical devices; you need to be aware of what their characteristics for specific requirements. The proposed system will help patients in remote places (e.g. home healthcare) and that is not just about monitoring a chronic disease state but about helping prevent patients from getting to that state. By implementing this project, it will offer an inexpensive system for remotely patient's health monitoring, which can save their lives by giving emergency alert in real-time.

II. RELATED WORKS

Modern health care system introduces new technologies like wearable devices or cloud of things. It provides flexibility in terms of recording patients monitored data and send it remotely via IOT. For this connection, there is need of secure data transmission .To transmit the data with privacy is the Moto of this paper. The proposed system introduces security of health care and cloud of things .System works in two major parts viz. storage stage and data retrieving stage. In storage stage, data is stored, updated for future use. In data retrieving stage, retrieve data from cloud.

The cloud server can share with authenticated user as per request. A patient with wearable devices continually updates his record every 5 or 10 min. In emergency mode, it updates for every 1min.The wearied device will send results to phone using Bluetooth connection or NFC technology.This can able to give to cloud server using GSM and 3G.

Afef Mdhaffar et al [5] has explained lowpower WAN network to perform analysis ofmonitored datain health caring system. They have established WAN network for communication upto the range of 33m2 at around 12 m altitude. Also they have demonstrated that power consumed by LoRaWAN network is ten times less than the GPRS/3G/4G.The IOT architecture has been given for step wise working for understanding of IOT .The main purpose of LoRaWAN is the energy consumption. The power consumption in idle mode for LoRaWAN is 2.8mA while in GPRS is 20mA.Hardware cost in LoRaWAN is 10doller while in GPRS is 50 dollar. Maximum data rate in LoRaWAN is 50kbps (uplink), 50 kbps downlink while in GPRS is 86.5 kbps(uplink),14kbps(downlink).These results gives the overall efficiency of LoRaWAN in the demonstration of IOT for health monitoring system.

Mohammad M. Masud et al [6] had given the measurement of ECG signals at various intervals and at different situations.They have considered energy aware, limited computing resources and lose network

continuity challenges .For these challenges; mathematical model has been developed to execute each task sequentially. There are three approaches designed to work out the process .One is mobile based monitoring approach, data mining and third is machine learning approach.

Ayush Bansal et al [7] focuses on development of a system which is capable of detecting critical cardiac events. Using an advanced remote monitoring system to detect symptoms which lead to fatal cardiac event.
Ing-Ray Chen et al [8] gives trust based health IOT protocol that considers risk classification, reliability trust, and loss of health probability as design dimensions for decision making. Comparative analysis of trust based protocol and baseline protocols te check feasibility.
Muthuraman et al [9]had introduced for hospital management. It enables automatic electronic medical records in standard. Also discusses with the implemented real world scenario of smart autonomous hospital management with IOT.

III. PROPOSED METHODOLOGY

Supplemental oxygen is one of the most commonly prescribed treatments in medical care. At any given time, up to a quarter of hospitalized patients receive oxygen therapy, and data from the United Kingdom suggest that 34% of all ambulance transports involve the delivery of oxygen. Although guidelines suggest that oxygen is not a treatment for breathlessness in the absence of hypoxaemia,in a Victorian Emergency Department audit, the most common reasons for oxygen administration were shortness of breath, chest pain and hypoxaemia (in that order).
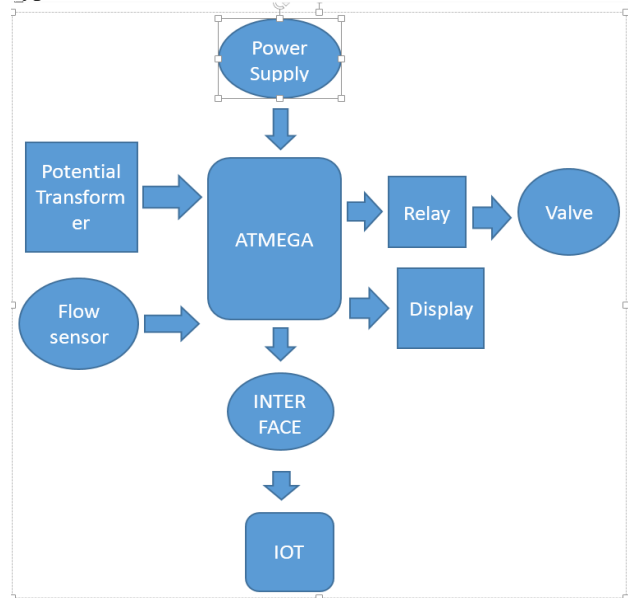

Fig.1ProposedBlock Diagram

In this paper, our main objective is to care the patients health for monitor the oxygen inlet and outlet level to check the respiratory system. It also provides air sub bag system and dialysis rate monitoring system. We are going to implement our work in the CAN bus architecture which makes the system efficient to connect the sensors and the electronic control units(ECU). That helps the intimations about the patients health would be speedy and also gives the precision on the monitoring systems.

In the CAN bus, we are passing the oxygen and monitoring the patients respiratory system whereas the oxygen flow, voltage flow and also the load that are monitoring and the corresponding actions to be taken when these parameter exceeds the limit. It also has the output valve to be controlled with the adjustment by the controller.

IV. HARDWARE SPECFCATION

A. ArduinoController

Arduino is a microcontroller or it can be called as tool for making computers that can sense and control more of the physical and real world than your desktop computer. It's physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects have the tendency to standalone, or they can be helped by the software section running on your computer. The boards can be assembled by hand or purchased preassembled from the market, it is available very easily. The arduino IDE is the software platform which can be downloaded for free. The Arduino programming language is an implementation of Wiring and defining the devices used, a similar physical computing platform, which is based on the Processing multimedia programming environment.

B. Potential Transformer

Potential transformer or voltage transformer gets used in electrical power system for stepping down the system voltage to a safe value which can be fed to low ratings meters and relays. Commercially available relays and meters used for protection and metering, are designed for low voltage. This is a simplest form of potential transformer definition.

C. Load Cell

A load cell is a transducer which converts force into a measurable electrical output. Although there are many varieties of load cells, strain gage based load cells are the most commonly used type. Except for certain laboratories where precision mechanical balances are still used, strain gage load cells dominate the weighing industry. Pneumatic load cells are sometimes used where intrinsic safety and hygiene are desired, and hydraulic load cells are considered in remote locations, as they do not require a power supply.

D. Relay Driver

Relay Driver is used for drive the relay. ULN2003A IC is used as driver.

E. Relay

Relays are switching devices. Switching devices are the heart of industrial electronic systems. When a relay is energized or activated, contacts are made or broken. They are used to control ac or dc power.

F. Global System for mobile Communication (GSM)

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

V. SIMULATION RESULTS

To implement our methodology in the simulation, we are going for the proteus ISIS schematic software tool. The Proteus Isis' circuit was implemented as in the below figures.
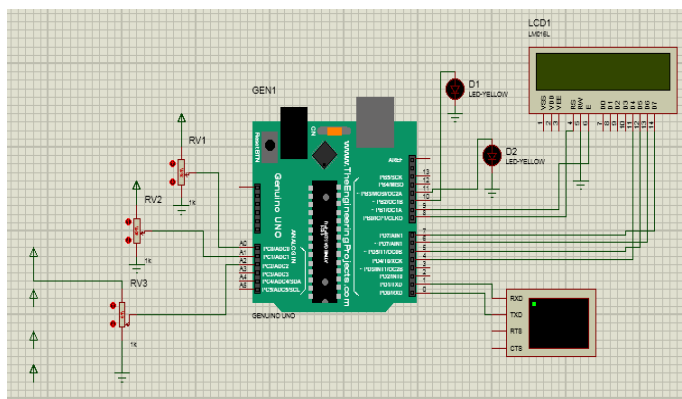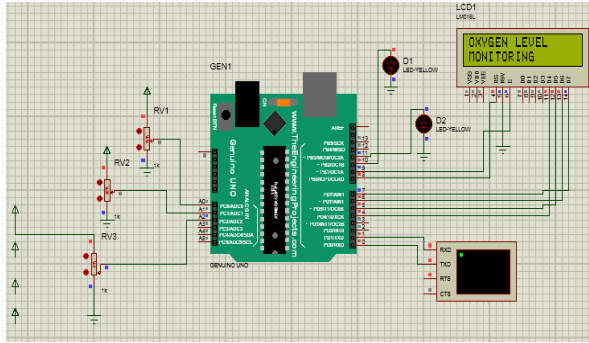

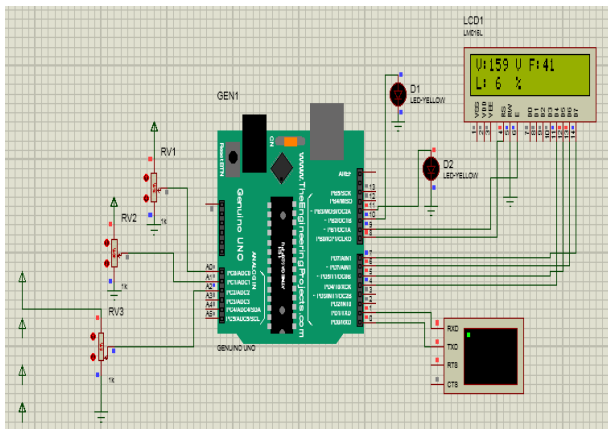
Fig.2 simulation result

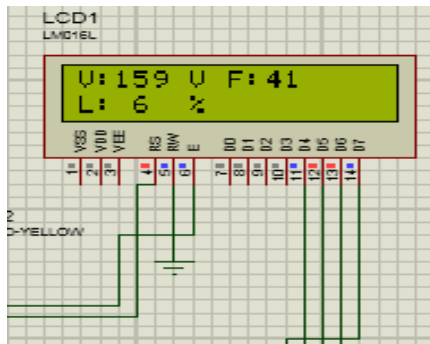**Fig.3 output response**

Fig.4 output

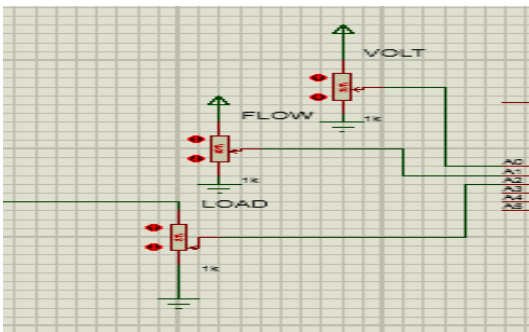**Fig.5 LCD monitoring**

Fig.6 input sensor arrangement

VI. CONCLUSION

This paper was a valuable experience in the design, implementation, and testing of hospital environmental parameters. In general, the design fulfills its intended objective, which is a user friendly, low cost, portable, multifunctional environmental monitoring device. The system consists of four sub-systems: oxygen monitoring system, power off solution, alert system, sub bag oxygen transfer system. Application of the proposed system has the potential to greatly improve oxygen ventilation and dialysis monitoring . Application of the proposed system has great clinical potential to improve the quality of oxygen delivery and some other technical related issues

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