iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: IV Month of publication: April 2023

DOI: https://doi.org/10.22214/ijraset.2023.51340

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

Automatic Anaesthesia Controller Combine with Ventilator

AK. Nivetha[1], B. Mohamed Thahir[2], T. Sudharsan[3], S. Nafees Ahamed[4]
Asst. Professor, Dept. of Biomedical Engineering, Dhanalakshmi Srinivasan Engineering College (Autonomous), Perambular
Final Year, Department of Bio Medical Engineering, Dhanalakshmi Srinivasan Engineering College (Autonomous), Perambalur

Abstract: Before initiating any surgical therapy, the patient is always given anaesthesia.During any procedure, it's essential that the patient be in aesthetically pleasing condition.A patient will not feel any discomfort while under anaesthesia during a medical treatment, and the anaesthetics effects should endure the entire time.It is impossible to inject a large amount in a single shot.The patient must thus get a few centimetres of anaesthesia at regular intervals.If the injection is missed, it could have catastrophic implications.The level of anaesthesia is determined physically, such as heart rate and body temperature.After drinking all of the anaesthesia, the patient's diaphragm develops abnormalities.

I. INTRODUCTION

Anaesthesia is an essential part of contemporary surgical practise because it helps patients endure difficult procedures with little pain. Anaesthesia administration is not without risk, though, since it can have a number of adverse effects, such as postoperative nausea and vomiting, cardiovascular instability, and respiratory depression. Anaesthesiologists frequently provide a finely calibrated combination of medications based on the specific requirements of each patient to reduce these dangers. However, this procedure could be difficult and time-consuming due to the variability of patient reactions and the complexity of administering anaesthesia.

Automatic anaesthesia controllers, which optimise the delivery of anaesthesia during surgery using computer algorithms and patient data, have been created and tested by researchers and physicians as a solution to these problems. By lowering the danger of under- or over-dosing, lowering the frequency of adverse events, and expediting the anaesthetic administration process, these controls have the potential to improve patient outcomes.

This article attempts to give a general overview of the automatic anaesthesia controller, as well as its present status in clinical use and any potential advantages or disadvantages. It will examine the underlying technology, including the application of machine learning, artificial intelligence, and predictive algorithms, as well as the difficulties associated with incorporating these systems into current anaesthetic processes. The paper will also highlight future directions for this developing technology and cover the present research and development status, including clinical studies and regulatory approvals..

II. OBJECTIVES

Depending on the application and setting, the goals of an automatic anaesthesia controller and ventilator combination can change. However, the following are some general goals that an automated anaesthesia controller and ventilator may try to accomplish:

1) To increase patient safety by lowering the possibility of human error when providing mechanical breathing and anaesthetic..
2) To provide more precise and individualised anaesthesia and ventilation based on the patient's state in order to enhance patient outcomes.
3) By lowering the need for manual interventions and freeing up healthcare providers' time, it will be possible to increase the efficiency of the anaesthetic and ventilation process.
4) To reduce the need of cosmetic products and mechanical ventilation, hence lowering the risk of complications and unfavourable outcomes.
5) To enable healthcare professionals to monitor patients' vital signs in real-time and make decisions about their care that are well-informed
6) Standardising the anaesthetic and ventilation procedure in order to improve consistency and reduce variability in care.
7) Delivering a more stable and controlled anaesthetic and breathing environment to increase patient comfort.

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III. EXISTING SYSTEMS

The patient receives anaesthetic in accordance with the stepper motor's rotation. Following anaesthesia administration, vital signs like temperature, exhalation breath temperature, and pulse are simultaneously monitored. The second dose of anaesthetic will be injected if they are in a normal state. A buzzer will alert the doctor when an irregularity arises, and anaesthetic supply will only continue if everything is okay. Additionally, the appropriate sensors check these parameters. The patient's safety is increased because to the integration of monitoring parameters, and anaesthesiologists are at peace.

There are several existing systems for automatic anaesthesia controllers that are currently used in clinical practice. Here are a few examples:

1) *Closed-loop Anaesthesia Delivery Systems:* Closed-loop anaesthesia delivery systems use feedback from patient monitoring devices to adjust the amount of aesthetic agent being delivered to the patient in real-time. These systems are designed to maintain a constant level of anaesthesia throughout the surgical procedure, and can help reduce the risk of under- or over-administration of anaesthesia.
2) *Automated Drug Delivery Systems:* Automated drug delivery systems use pre-programmed infusion pumps to deliver precise amounts of aesthetic agents to the patient. These systems are typically used in combination with patient monitoring devices to ensure that the patient is receiving the appropriate amount of anaesthesia.
3) *Smart Anaesthesia Machines:* Smart anaesthesia machines are advanced systems that use artificial intelligence and machine learning algorithms to adjust anaesthesia delivery based on patient data. These systems can help reduce the amount of manual intervention required by the anaesthesia provider, and may help improve patient outcomes.

Overall, the use of automatic anaesthesia controllers can help improve patient safety and reduce the risk of adverse events during surgery. However, it is important for anaesthesia providers to be familiar with the specific system being used and to be prepared to intervene if necessary to ensure patient safety.

IV. PROPOSED SYSTEM

In the proposed system Arduino uno microcontroller based system is used to inject the predefined number of anaesthesia doses to the patient at regular time intervals. We measure the biomedical parameters such as heart rate , temperature , SPO2 and ECG. since the measurement of medical parameters is a vital process. These parameters determine the overall condition of the patient, only based on these parameters the movement of the servo motor is operated . after the activation of motor anaesthesia drug is inject to the patient through iv line which initiates the unconscious state . During this stage the diaphragm is inactive so we provide the ventilation combined with this automatic anaesthesia machine.

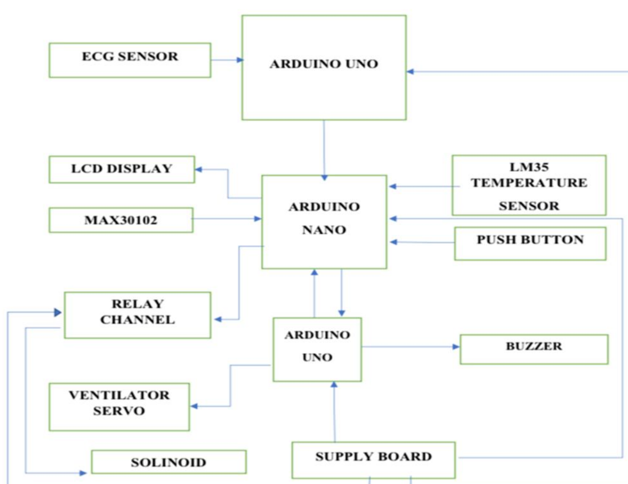

Fig. 1 Block diagram for proposed system

Here are some components and considerations that may be included in such a system:
1) *Vital Sign Monitoring:* The system should be able to monitor vital signs such as heart rate, blood pressure, oxygen saturation, and carbon dioxide levels in the patient's blood.
2) *Anaesthesia delivery System:* The anaesthesia controller must be able to deliver the appropriate amount of aesthetic agent to the patient based on their weight, age, and other factors.
3) *Ventilation Management:* The ventilator must be able to provide mechanical ventilation to the patient to ensure adequate oxygenation and removal of carbon dioxide.
4) *Closed-loop Control:* The system should be able to automatically adjust the anaesthesia and ventilation settings based on the patient's vital signs and other inputs, using closed-loop control algorithms.
5) *User Interface:* The system should have a user-friendly interface for healthcare providers to input patient information, adjust settings, and monitor the patient's progress.
6) *Alarms and Alerts:* The system should be able to generate alarms and alerts when vital signs or other parameters fall outside safe limits, to alert healthcare providers to take appropriate action.
7) *Backup Systems:* The system should have backup systems in place, such as battery backup, to ensure that the system can continue to function in case of power failure or other emergencies.
8) *Safety Features:* The system should include safety features such as fail-safe mechanisms to prevent over-administration of anaesthesia or mechanical ventilation, as well as safety alarms to alert healthcare providers of any potential safety issues.

Overall, the development and implementation of an automatic anaesthesia controller combined with a ventilator require close collaboration between medical professionals and engineers, as well as rigorous testing and validation to ensure safety and efficacy.

V. SOFTWARE AND HARDWARE DETAILS

The autonomous anaesthesia controller and ventilator system is made up of a number of hardware and software elements. The hardware elements include a ventilator, anaesthetic equipment, patient monitoring devices, and a control unit. The ventilator delivers controlled infusions of air or oxygen to the patient's lungs. In addition to administering anaesthetic gases to the patient, the anaesthesia equipment also keeps track of the patient's heart and breathing rates. The patient monitoring devices measure a wide range of physiological parameters, such as blood pressure, heart rate, oxygen saturation, and carbon dioxide levels. The control unit, sometimes known as the system's brain, regulates the ventilator, anaesthetic machine, and patient monitoring apparatus. The algorithms for automatically adjusting anaesthetic and ventilation parameters, the user interface, and the communication protocols between the hardware components are all included in the system's software components. The algorithms use a combination of physiological signals and patient data to change anaesthesia and breathing parameters in real-time. They are based on accepted principles of anaesthetic management. Medical professionals may input patient information, set anaesthetic and breathing parameters, and more thanks to the user interface's straightforward design and ease of use. The communication protocols make sure that the hardware is synchronised and properly collaborating. Overall, the hardware and software specifications of the system's components are essential to its smooth operation. The software components must be made to be dependable, effective, and user-friendly while the hardware components must be carefully built and calibrated to ensure correct measurement and delivery of the anaesthetic and ventilation parameters.

VI. CONCLUSION AND FUTURE SCOPE

Potentially, other monitoring and control systems, such as clinical decision support systems and electronic medical records, could be integrated with the automatic anaesthesia controller and ventilator system. This integration might make it possible for patient data to be automatically transferred to the anaesthetic system, which would enhance the system's capacity to make judgements based on a more thorough patient history. To enable more accurate and coordinated control of anaesthesia and surgical processes, the system might also be connected with other surgical tools, including surgical robots. The autonomous anaesthetic controller and ventilator system has potential uses outside of surgical operations in various fields of medical study and practise. In the intensive care unit, for instance, where precise management of respiratory and cardiovascular parameters is essential, the system might be used to monitor and adjust anaesthesia and ventilation in critically ill patients. In animal research investigations, where precise management of anaesthesia and ventilation is required to assure the safety and welfare of the animals, the system might potentially be utilised to monitor and control ventilation and anaesthetic. In conclusion, the automatic anaesthesia controller and ventilator system may be integrated with other monitoring and control systems and have potential uses in further fields of medical study and practise. In order to improve patient outcomes and lessen the stress on medical professionals, future research and development can concentrate on further optimising the system's algorithms and integrating it with other systems.

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