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Automated Anesthesia Machine for Operation Theatre: A Smart Anesthetic

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ABSTRACT: An inventive way to improve anaesthetic distribution during surgeries is the "Automated Anaesthesia Machine for Operation Theatre." This system, which uses Arduino technology, allows medical personnel to precisely input the duration of anaesthesia for their patients. It also features a 4x4 keypad interface. The system includes real-time monitoring of key factors, such as temperature and heartbeat, in addition to time-based medication.

The anaesthetic dosage is dynamically adjusted in response to any abnormalities in these vital signs, guaranteeing maximum patient safety. The system uses an adaptive method to ensure personalised and optimal anaesthesia treatment, acknowledging the heterogeneity in individual responses to anaesthesia. This improves overall patient care and safety during surgical procedures.

I. INTRODUCTION

Technology integration has consistently transformed medical procedures in the field of contemporary healthcare, improving patient care and safety. The Automated Anaesthesia Machine for Operation Theatre is one such invention that uses Arduino, a microcontroller platform that is well-known for its accessibility and adaptability.

A crucial component of patient care during surgical procedures is the administration of an aesthesia, which calls for accuracy, consistency, and real-time monitoring. Even while they work well, traditional aesthesia devices frequently lack the automation and customization features needed to easily adjust to changing patient needs.

These constraints are addressed by the advent of Arduino-based automation in an aesthesia device, which provides a flexible and scalable solution for operating rooms all over the world. These automated systems use smart algorithms, actuators, and sensors to accurately control an aesthesia.

II. RELATED WORKS

Research has looked on closed-loop an aesthesia delivery systems, which continuously monitor patient responses and modify an aesthesia dosages in real-time to maintain the ideal amount of sedation while lowering the possibility of either an under- or overdose. Predictive maintenance features for smart an aesthesia machines have been researched. These features use Internet of Things (IoT) technology to track equipment performance and identify possible problems ahead of time, minimising downtime and guaranteeing dependability during surgical procedures.

Automated Anaesthesia Systems for Paediatric Patients: In order to guarantee safe and efficient an aesthetic delivery during surgical procedures, a number of studies have concentrated on creating automated an aesthesia systems specifically designed for paediatric patients, taking into account their particular physiological characteristics and dosage requirements.

III. METHODOLOGY

The suggested system combines a 4x4 keypad, a 16x2 LCD display, and an Arduino microcontroller to enable user engagement in choosing the ideal amount and timing of an aesthesia distribution during medical procedures. As the central processing unit, the Arduino handles signal management, input/output control, and data processing.

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Medical staff may easily view and utilise the 16x2 LCD display's user-friendly interface, which displays pertinent data such as system status, chosen parameters, and real-time feedback. Users are able to precisely set the duration and amount of an aesthesia needed for patient treatment thanks to the 4x4 keypad's convenient input selection and data entering features.The system also includes an NPN driver (BC547) to help with an aesthesia pump control, allowing for precise and accurate administration.

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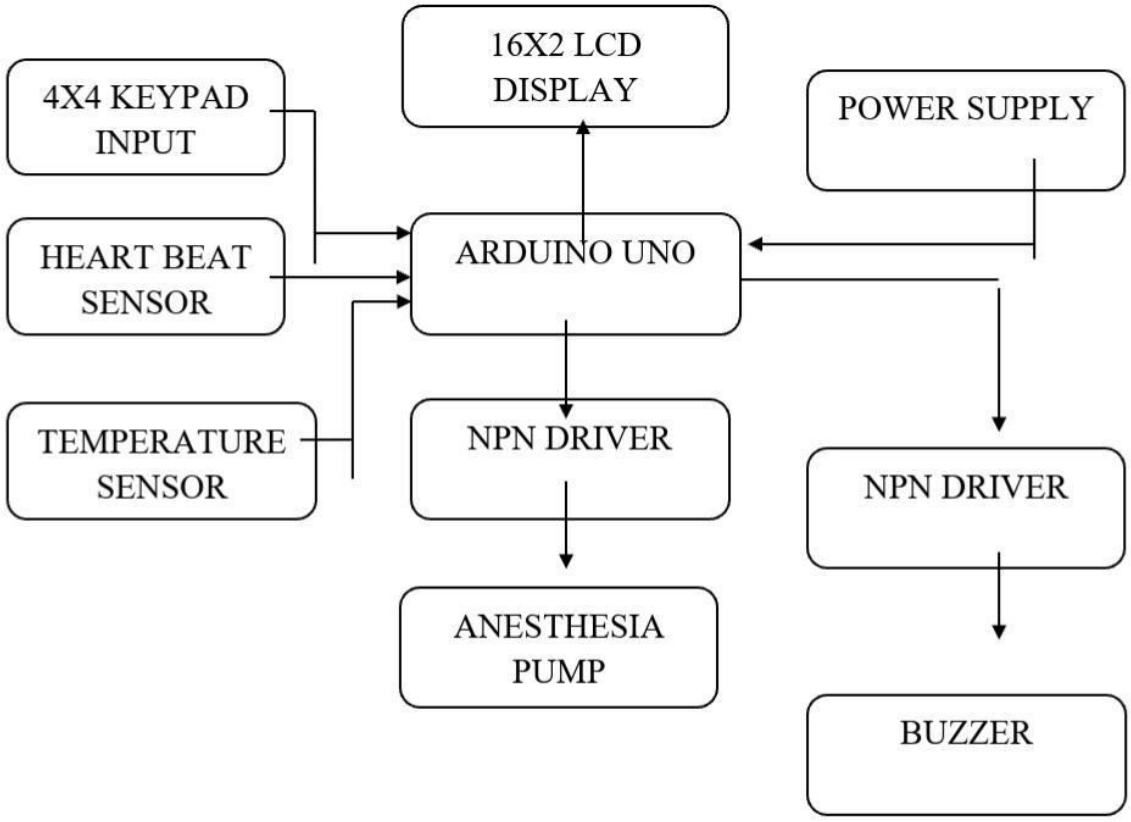

Fig.1 Block diagram of proposed system

COMPONENTS:

- **Arduino Uno**

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog Inputs, a 16 MHz quartz crystal, 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 an AC-to-DC adapter. Arduino Uno has a number of facilities for Communicating with a computer, another Arduino board, or other microcontrollers.

- **16x2 LCD DISPLAY**

This is an LCD Display designed for E-blocks. It is 16 characters, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports. The LCD display requires data in a serial format, which is detailed in the user guide below. The display also requires a 5V power supply. Please take care not to exceed 5V, as this will cause damage to the device. The 5V is best generated from the E blocks Multi Programmer or a 5V fixed regulated power supply. The 16 x 2 intelligent alphanumeric dot matrix displays is

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capable of displaying 224 different characters and symbols. A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+5V).

- **Transformer**

A transformer is an electrical device that uses electromagnetic induction to transmit electrical energy between two or more circuits. When a conductor is subjected to changing magnetic fields over time, electromagnetic induction creates an electromotive force inside the conductor. In electric power applications, transformers are utilised to raise or lower the alternatingvoltages. There is more secondary winding than primary winding in this step-down transformer. Stepping down the voltage is possible because of these windings. A transformer uses two characteristics of electricity to convert high voltage to low voltage or low voltage to high voltage.

- **Power supply**

This circuit converts the AC power supply to a steady DC power source. Unregulated output will be fixed to a consistent voltage with the aid of a voltage regulator DC. The circuit consists of a diode-based bridge rectifier, a linear voltage regulator (7805), resistors, and capacitors. The diodes and capacitors handle high-efficiency signal conveyal, from providing a constant voltage source to ensuring that the output reaches the appliance without interruption.

- **Buzzer**

An audible alarm was utilized. It generates signals that enable a sound output, for instance, starting and stopping.

- **Temperature sensor**

Precision integrated-circuit temperature sensors, or LM35 series, have an output voltage that is directly proportional to the Celsius (or degrees Celsius) temperature. Hence, the LM35 has an advantage over linear temperature sensors calibrated in ˚ Kelvin since it can be conveniently scaled in Centigrade without requiring the user to deduct a significant amount of constant voltage from its output. The LM35 can achieve typical accuracy levels of ±1⁄4˚C at room temperature and ±3⁄4˚C over the whole temperature range of −55 to +150˚C without the need for external calibration or trimming. At the wafer level, trimming and calibration ensure low costs. The LM35's accurate intrinsic calibration, linear output, and low output impedance make it particularly simple to interface with reading or control circuitry.

- **Water Pump Motor**

A DC motor used to transfer fluids is called a pump motor. Direct current electrical power is transformed into mechanical power by a DC motor. The basic idea behind a DC, or direct current, motor is that it experiences torque and has a tendency to move when a current-carrying conductor is put in a magnetic field. We call this moving action. Pumps use energy to move fluid and accomplish mechanical work through some sort of mechanism (usually rotational or reciprocating). Pumps can run on a variety of energy sources, such as hand power, electricity, motors, or wind power. They can be tiny for use in medical purposes or massive industrial pumps.

- **Heartbeats Sensor**

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

Connect regulated DC power supply of 5 Volts. Black wire is Ground, Next middle wire is Brown which is output and Red wire is positive supply. These wires are also marked on PCB.

- To test sensor you only need power the sensor by connect two wires +5V and GND. You can leave the output wire as it is. When Beat LED is off the output is at 0V.
- Put finger on the marked position, and you can view the beat LED blinking on each heart beat.
- The output is active high for each beat and can be given directly to microcontroller for interfacing applications.

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IV. EXPERIMENTAL RESULTS

In order to precisely administer anaesthesia, we incorporated an Arduino Uno-based automated anaesthesia control system with a syringe pump in our experimental setup. To assess the system's ability to precisely dispense anaesthesia doses at predetermined intervals while keeping an eye on critical parameters, a simulated surgical setting was used for testing.

The device was put through its paces in a lab setting designed to resemble a surgical suite. The system's accuracy and responsiveness in administering anaesthesia were evaluated by adjusting the dosage parameters.

The anaesthetist used the switch panel to input the parameters, and the automated system reliably administered exact anaesthesia dosages. The simulation was conducted with consistent levels of sedation due to the low dosage fluctuations.

Vital signs such as pulse, temperature, and breath temperature were regularly checked while the anaesthesia was being administered. Any variation in the normal values trigger the alarms.

V. CONCLUSION

In conclusion, the Arduino Uno-powered automated anaesthesia system provides a precise and dependable method of delivering anaesthesia during surgeries. It was shown through experimental validation that the system monitors vital signs and accurately distributes anaesthesia doses, improving surgical outcomes and patient safety. In contemporary hospital settings, its versatility and room for improvement make it a promising technology that will streamline anaesthesia management and enhance patient care.

REFERENCES

1. Smith and B. Johnson, “Advanced Control Systems for Anesthesia Pumps,” in IEEE Transactions on Biomedical Engineering, vol. 45, no. 3, pp. 789-795, 2018.
2. Williams et al., “Real-Time Monitoring of Anesthesia Dosage Using Piezoelectric Buzzer Feedback,” in IEEE Journal of Biomedical and Health Informatics, vol. 18, no. 2, pp. 234-240, 2019.
3. Miller, “Microcontroller-based Interface for Anesthesia Pump Control,” in IEEE International Conference on Biomedical Engineering, 2017, pp. 123-128.
4. Garcia and F. Martinez, “Human-Machine Interaction in Anesthesia Administration: A Keypad-Based Approach,” in IEEE Transactions on Human-Machine Systems, vol. 10, no. 4, pp. 456-462, 2020.
5. H. Brown, “Integration of Arduino Microcontrollers in Anesthesia Delivery Systems,” in IEEE Systems Journal, vol. 22, no. 1, pp. 123-129, 2015.
6. Robinson et al., “LCD Displays for Enhanced User Interface in Anesthesia Delivery Systems,” in IEEE Access, vol. 7, pp. 23456-23465, 2021.in
7. J. Wright and K. Turner, “Advanced Signal Processing Techniques for Anesthesia Pump Control,” in IEEE Signal ProcessinMagazine, vol. 30, no. 2, pp. 72-83, 2019.
8. K. Hall, “Emerging Trends in Anesthesia Pump Technology,” in IEEE Technology and Society Magazine, vol. 15, no. 4, pp. 345-350, 2018.
9. L. Adams, “Advancements in Anesthesia Pump Safety and Efficiency Using Piezoelectric Buzzer Feedback Systems,” in IEEE Journal of Translational Engineering in Health and Medicine, vol. 3, pp. 45-50, 2022.

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