Microcontroller Anesthetic Injector

[1]Dr. A. Sundar Raj, [2]S. Jim Hawkinson, [3]B. Lakshmi, [4]M. Mohamed Shahidh, [5]S. Rahilah Noor, [6]S. Ajith

[1]Associate Professor, [2]Assistant Professor, [3,4,5,6] UG Student
Department of Biomedical Engineering
E.G.S Pillay Engineering College, Nagapattinam, Tamil Nadu, India.

Abstract: **The objective of this work is to assist an anesthesiologist during a procedure in order to reduce human error in administering the correct dosage of anesthetic to the patient. When a big procedure is conducted at a hospital, the patient must be under anesthesia. A whole dose of anesthetic cannot be given in a single injection if the procedure takes a long period. It might result in the patient's demise. The patient may awaken in the middle of the procedure if less anesthetic is given. The anesthetists give the patient a few milliliters of anesthetic at a predetermined period to avoid this. The patient may become awake if the anesthesiologist fails to give the anesthetic medicine at the right time and in the right dosage, which would be painful for the patient and inconvenient for the surgeon. A micro-controller-based automatic anesthetic system is a viable solution to these risky issues. A microcontroller and a syringe infusion pump are included in this system. With the aid of various sensor results, the anesthetist can choose the degree of anesthesia in millilitres per hour to deliver to the patient. After the microcontroller receives the input from the sensors, it adjusts the signal to the desired level and feeds it into the dc motor to properly operate the infusion pump. The patient receives anesthesia in accordance with the dc motor rotation.**

Keywords: Anesthesia, Microcontroller, Sensors, dc motor, Syringe infusion pump

I.INTRODUCTION

Now-a-days, the medical electronics-sensors (E-sensors) are playing an important role in health care centers. The patient electronics-health (E-health) monitoring is one of the major advancements in research field. Here we use the temperature sensor, heartbeat sensor and ECG sensor to monitor the patient's body temperature, pulse and heart rate respectively. Hence like the use of thermometer in home to check body temperature before doctor's consultation, this proposed model (devices) can be used to check the patient's health condition in home as firstaid information to the concerned patient otherwise nowa- days consulting doctors or going to diagnosis centers become very costly in terms of financial aspect. To minimize this situation, we describe the design of a SST89E516RD2 microcontroller based advanced/high performance integrated health portable monitoring system. Like one parameter say Heart rate of the patient is measured by placing the index finger on IRD (Infra-Red Device) sensor and the pulse rate is then measured and displayed on LCD. The device sends messages when the parameter value exceeds the provided cut-off value. This cut-off value or threshold is given by the programmer during coding of the LPC-2148. The standard heart beat ranges between 60-100 pulses/min and standard temperature ranges between 18°C to 38°C. The Heart Rate, ECG, Brain tumor and the Body Temperature information is then sent to the authorized person through GSM.

II.OBJECTIVE OF THE WORK

The project's primary goal is to assist an anaesthesiologist during a procedure to reduce human error in administering the correct dosage of anaesthetic to the patient. The millilitres (1–1000) of anaesthesia to be supplied to the patient, together with the timing of the injection, are set using a keypad interface. The amount and timing of the drug injection are displayed on an LCD via an interface. The time is tracked using a real-time clock. A consistent flow of anaesthesia is injected at the desired moment via a stepper motor that is mechanically coupled to a syringe infusion pump.

III.METHODOLOGY

3.1 AUTOMATIC ANESTHESIA SYSTEM

Automatic Anaesthesia Injector system is also an application of embedded technologies in which a microcontroller is used to control the entire unit.

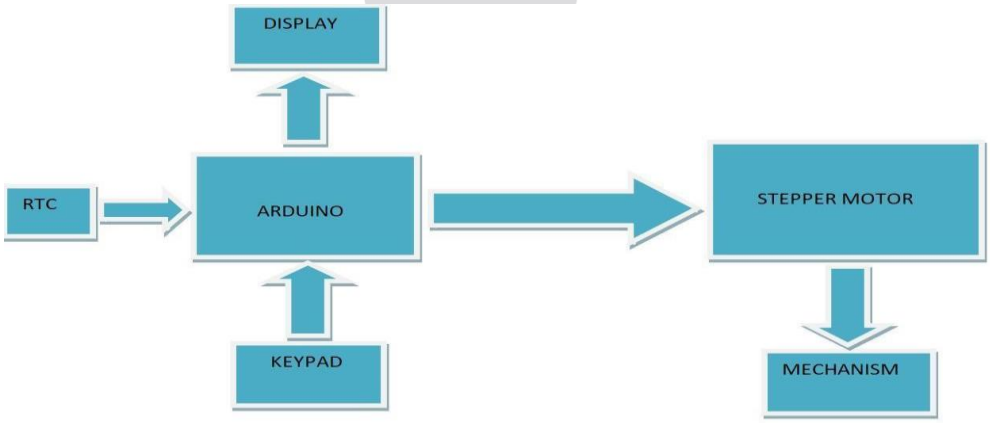

Fig 3.1 BLOCK DIAGRAM OF AAI SYSTEM

3.2 WORKING OF THE SYSTEM

Designed a system that allows the anesthetist to control the level of anesthesia administered to the patient using a keypad, and that uses a stepper motor and infusion pump to deliver the anesthesia to the patient. Stepper motors are often used in medical devices because they provide precise control over the motion of a device. In your case, it sounds like the rotation of the stepper motor is being used to control the movement of the infusion pump, which in turn controls the flow of anesthesia into the patient's body. Again, it's important to emphasize that any medical device or system should be designed, tested, and validated to ensure that it is safe and effective. In addition to consulting with medical professionals and regulatory experts, you may also want to consider conducting thorough testing and validation of your system before using it in a clinical setting. This may include testing the system under a range of conditions, including variations in anaesthesia level and patient physiology, to ensure that it is reliable and safe to use.

3.3 FLOWCHART

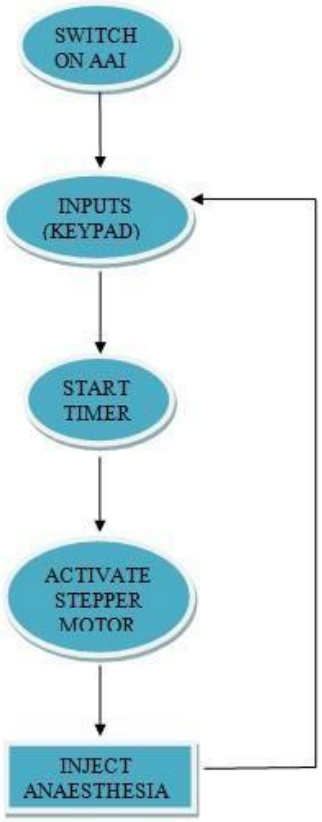

FIG 3.2 FLOWCHART REPRESENTATION OF AAI SYSTEM

IV RESULTS

4.1 INTERFACING LCD WITH ARDUINO

Interfacing LCD to display the quantity of drug to be injected and the time at which drug should be injected.

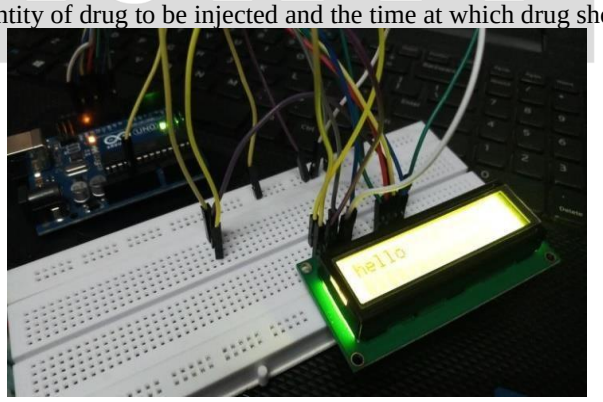

FIG 4.1: INTERFACING LCD WITH ARDUINO

4.2 INTERFACING KEYPAD WITH ARDUINO

Interfacing Keypad to provide the inputs, quantity to be injected and the time at which drug should be injected.

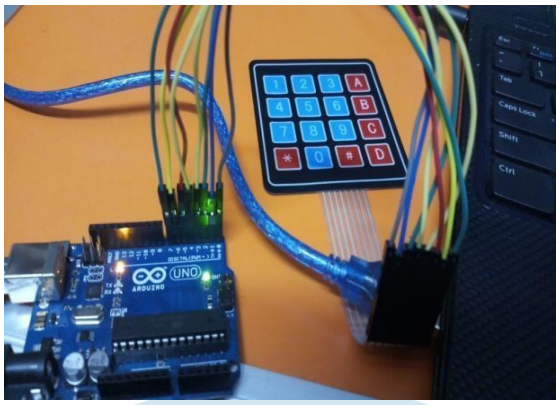

FIG 4.2 INTERFACING KEYPAD WITH ARDUINO

4.3 SYRINGE INFUSION PUMP CONNECTED TO THE MOTOR

The infusion pump is mechanically interfaced to the stepper motor. In Fig.4.3 it can be observed that the piston is at initial position i.e., the stepper motor did not yet start the rotation operation

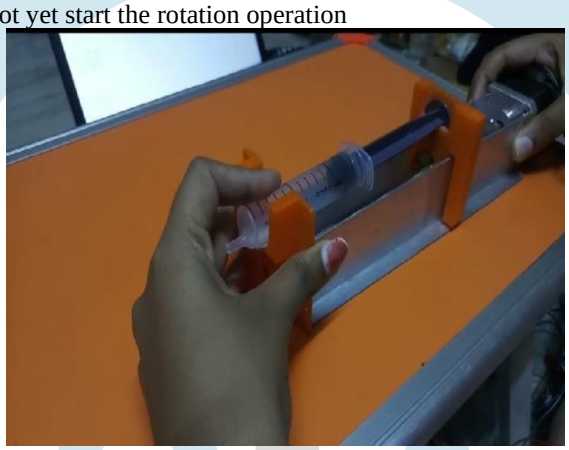

FIG.4.3 SYRINGE INFUSION PUMP CONNECTED TO THE MOTOR

4.4 PISTON OF THE SYRINGE MOVING IN FORWARD DIRECTION

It is observed that the stepper motor starts its rotation after its phases are energised by the pulses of stepper driver which is controlled by the Arduino board. The piston moves in forward direction which helps in injecting anaesthesia drug to the patient.

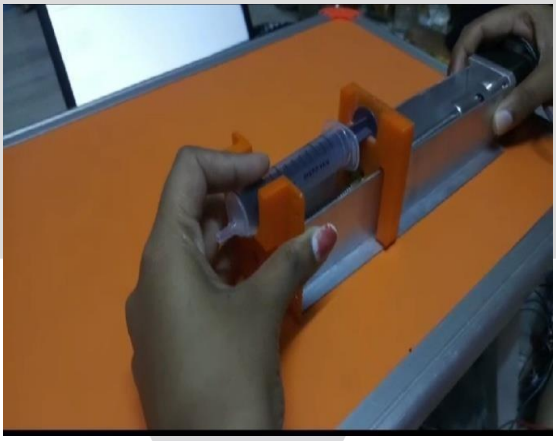

FIG.4.4 PISTON OF THE SYRINGE MOVING IN FORWARD DIRECTION

4.5 PISTON OF THE SYRINGE MOVING IN BACKWARD DIRECTION

It can be observed that the piston is moving in backward direction. This action is performed by controlling the direction pin of stepper driver. This backward motion of piston is helpful for refilling of the syringe with the required anaesthesia drug.

FIG.4.5 PISTON OF THE SYRINGE MOVING IN BACKWARD DIRECTION

V. CONCLUSION

Microcontroller is made use of to perform anaesthesia injecting operation, where the quantity to be injected and the time at which the drug should be injected is provided. The Microcontroller displays the quantity to be injected and the time in the display device. Syringe infusion pump is mechanically connected to the motor. The stepper motor is used to control the forward and backward movement of the piston of the syringe. It is practically calculated that 150 steps of stepper motor rotation are required to inject 1ml of drug when the delay provided to stepper motor between each pulse is 6000 microseconds and the step angle is 1.8 degrees (i.e., full step).

The Syringe Infusion pump injects uniform flow of anaesthesia by precisely driving the plunger of a syringe towards its barrel. Modern technologies have developed using Embedded Systems promoting comfortable and better life. **PREVENTION IS BETTER THAN CURE** and protection is intelligent than prevention and **MICROCONTROLLER BASED ANESTHESIA MACHINE** is one of the efficient protecting systems plays its major role in Biomedical field.

REFERENCES

1. Clara M Ionescu "Computer assisted drug delivery for general anesthesia: Completing the puzzle" SAMI, IEEE 17th World symposium on applied medicinal intelligence and information, 2019
2. Smt. Leela Salim, Abey Thomas, Akshay M, Athul Alias, Muhammed Irshad “Microcontroller based anesthesia injector” June,2019
3. D Hemapriya, K Amrudha Shree, S Deepika, R Karthiyayini "Feedback Control approach in Controlled Sedation for Intensive Care Unit", IEEE international conference on innovations in green energy and healthcare (ICIGEHT), 2017.
4. D Y Pawade, T S Diwase, T R Pawade "Designing and Implementation of Fuzzy Logic Based Automation System to Estimate dose of Anesthesia" Confluence 2013, the next generation information technology summit (4th international conference), 2013.
5. “Monitoring Multiple Biomedical Parameter to Automate Anesthesia Injection using FPGA”, 2nd International Conference on Computer, Communication, and Signal Processing (ICCCSP 2018).