EEG Based Anesthesia Regularization System

S. Madhumathi[1] V. Santhana Lakshmi[2] G. Merlin Christy Rani[3]
[1]Assistant Professor [2,3]Student
[1,2,3]Department Biomedical Engineering
[1,2,3]Adhiyamaan College of Engineering, Hosur

Abstract— Anesthesia is administered to the patients while doing major surgery. The doctors should be very careful in administering the amount of anesthesia. Because if the amount exceeds it may threaten the life of the patient. If the lesser amount is delivered then the patient may feel the pain and also it may cause disturbance during the surgery. To overcome the patient's disturbance an automatic anesthesia regularization system is designed based on the patient's EEG signal. The EEG is the physiologic signal that is very much helpful in monitoring the patient's condition. The patient's awake condition can be easily seen through the EEG signal. If the patient was waked up then there will be some variation in the EEG signal so that it indicates anesthesia should be administered. A syringe pump is used for delivering the anesthesia. A stepper motor is used for the automatic regularization.

Key words: Anesthesia, Stepper motor, Syringe Pump, LCD Display

I. INTRODUCTION

In general the surgery is done by cutting and coagulation. During all the surgeries there will be blood loss and pain. The pain will be completely reduced by the automatic administration of anesthesia using EEG signal and pulse signal. For measuring these biological signals embedded system is used. The PIC microcontroller is used for the automatic delivery. A LCD display is used for displaying the patient details and the amount of anesthesia to be delivered. Zigbee transmitter is used for transmitting the EEG and pulse signal to the PC. The waveform has been wirelessly transmitted to the PC for displaying.

II. LITERATURE SURVEY

One of the current challenges in medicine is monitoring the patient's depth of general anesthesia (dga). Accurate assessment of the depth of anesthesia contributes to tailoring administration to the individual patient, thus preventing awareness or excessive anesthetic depth and improving patient's outcomes. Many surgical procedures would not be possible without the patient entering a state of general anesthesia. The essential features of a successful dga, can be incurred from the patient, are a reversible loss of consciousness with a lack of movement, a lack of awareness, unresponsiveness to painful stimuli and a lack of recall of the surgical intervention [1]. The next proposal is the EEG analysis. For this purpose a new application was developed that enables investigation of parameters derived from EEG signals and provides flexible spectrum evaluation of EEG data. It aims at automatic assessment of anesthetic depth during surgical procedures [2]. All anesthetists would like to be confident that their patients are asleep throughout surgery. Depth of anesthesia monitors may contribute to reducing the perioperative awareness, but they are expensive. EEG is the surface representation of the summed electrical activity of billions of cortical neurons. Typically, when a, hypnotic such as propofol, is applied, the EEG shows a biphasic response with initial bifrontal activation, followed by progressive synchronization and slowing, producing EEG patterns with higher amplitudes and lower frequencies [3].

III. BLOCK DIAGRAM

A. *Patient Section:*

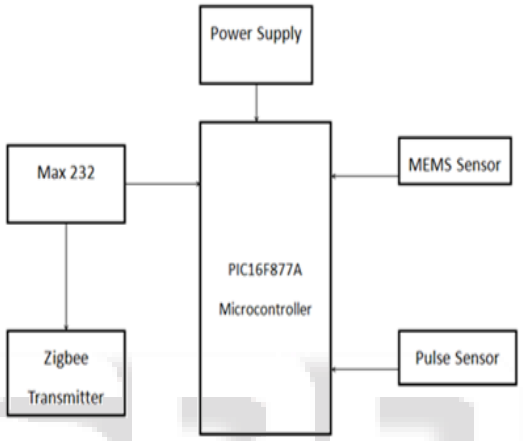

Fig. 1: Patient Section

B. *Monitoring Section:*

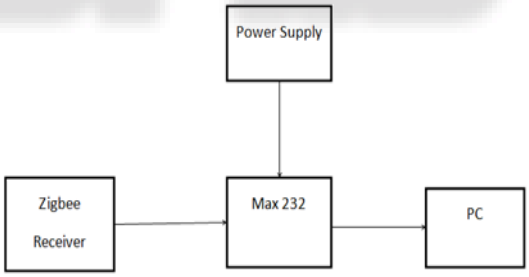

Fig. 2: Monitoring Section

IV. METHODOLOGY

The pulse and MEMS sensors are connected to the patient. The pulse sensor will sense the patients pulse whether it is low or high before and during the surgery. The MEMS sensor will analyze the patient's brain signals. The acquired signal will be displayed on PC through wireless transmission. According to the pattern of EEG that is sensed, the amount of anesthesia will be delivered to the patient. A stepper motor will be attached to the driver circuit which will help in delivering the anesthesia to the patients in a prescribed level. This model will help in removing the disturbance from the patient side during operations and also the continuous administration of anesthesia when it is needed. It is an automatic system.

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V. SYSTEM DESIGN

A. MEMS Sensor:

MMA7361L model was used. It is a low profile capacitive micro-machined accelerometer featuring signal conditioning. It induces a sleep mode that makes it ideal for handheld battery powered electronics.

The advantages over other sensors are High Sensitivity-800mVg, Low Power Consumption-400µA, Low Voltage Operation- 2.2V to 3.6V, Low cost, Fast Turn on time - 0.5ms.

B. Pulse Sensor:

The principal advantage of pulse sensor for medical application is their intrinsic safety since there is no electrical contact between the patient and the equipment. The pulse oximetry is the non-invasive measurement of arterial oxygen saturation in the blood. The technique is now well established and is in regular clinical use during anesthesia and intensive care.

C. Microcontroller:

Microcontroller selected for the EEG recorder is the PIC16F877A from Microchip Technology Inc. It is a 40 pin IC. It has less number of instructions set. It is a low cost 8-bit microcontroller operating at the speed of 4MHz. The microcontroller pins are connected to the ADC, power supply unit, sensors and zigbee transmitter.

D. MAX – 232:

The MAX-232 is used to convert the low range value into acceptable value. The low power consumption of this component makes it possible to be powered by the RTS line of the computer serial port. This part cannot be powered by the battery because it is not isolated from the 240V power line by the opto-isolator.

E. LCD:

The LCD is the 7 segment display which is used to display the patient's details and the amount of anesthesia level that is to be delivered to the patient in a digital format.

F. Stepper Motor:

It is used for converting the electrical pulse into equal incriminatory steps. It works in connection with the switching devices. The electronic switching device is used to control the windings of the stepper motor with particular frequencies.

G. Syringe Pump:

The syringe pump is used to deliver the prescribed amount of medication in a regular period of time. The anesthesia is administered by moving the plunger towards the medicine. The size of the syringe is based on the amount of anesthesia level.

VI. CONCLUSION

This paper is very much helpful for the doctors to treat the patients without any disturbance using the patient's EEG signal for the administration of anesthesia during surgical procedures. This system is automatic and cheap.

REFERENCES

[1] Bojan musizza and samo ribaric, Monitoring of DGA Sensors 2010, 10, 10896-10935.
[2] M. Vande Velde, EEG analysis for monitoring of anaesthetic depth (EUT report, ISSN 0167-9708; 91-E-254).
[3] Sneyd JR, Depth of Anaesthesia Monitoring, South Afr J Anaesth Analg 2012; 18(1).
[4] Alkire, M.T., Hudetz, A.G.; Tononi, G. Consciouness and anesthesia. Science 2008, 322, 876-880.
[5] Ghoneim, M.M.; Block, R.I. Learning and memory during General Anesthesia, and update. Anesthesiology 1997, 87,387.
[6] Basar, E. (1980) EEG- Brain Dynamics: Relation between EEG and brain Evoked potentials. Amsterdam: Elsevier, 1980.
[7] Faulconer, A. and R.G.Bickford (1960) Electroencephlography in anesthesiology Spring Field, ILL.: Charles C. Thomas, 1960.
[8] Kishimoto T, Kadoya C, Sneyd R, et a;. Topographic encephalogram of propofol-induced conscious sedation. Clin Pharmacol Ther. 1995; 58(6):666-674.
[9] On being aware. Br J Anesth. 1979; 51(8):711-712.

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