

Design and Development of Microcontroller based Anaesthesia System for Biomedical Applications

M. Firdouse Ali Khan¹ Md Aasif Sheriff² H. Ijaz Ahamed³ S. Aravind⁴

¹Research Scholar ^{2,3,4}Student

^{1,2,3,4}Danish Ahmed College of Engineering

Abstract— The 21st century is the era of Embedded Systems with its increasing applications in various fields of biomedical engineering. One such application of embedded systems in biomedical field is Microcontroller based Anaesthesia System. This is an autonomous system that helps in giving the anaesthesia to the patient continuously till the end of operation in appropriate dosage, thereby reducing manual efforts for giving anaesthesia to patients more than once whenever required. And also it may reduce over and insufficient dosage of anaesthesia to the patient.

Key words: Microcontroller, Anaesthesia, Biomedical

I. INTRODUCTION

In present scenarios of the world embedded systems are more popular due to their manual less operations. Due to this the demand for embedded systems in every field increases. They are also preferred for automated control systems. Especially in the field of biomedical engineering, embedded systems are playing vital role.

In the present scenario of operation being carried out on the patient, giving anesthesia is important to carryout painless operation. The anesthesia is given before starting of operation. Sometimes the patient may take longer time for recovery after operation due to over dosage or may recover early during operation itself due to insufficient dosage (which may require an anesthesia for the second time during operation). The possible way is to give anesthesia in proper small dosage continuously avoiding the above mentioned issues.

To address this Microcontroller based Anesthesia System plays an important role. This system gives anesthesia in small dosage continuously to avoid over and insufficient dosage. This system consists of Keypad for entering the speed of dosage, LCD to display the status, stepper motor connected to injection mechanism, status led and buzzer to indicate the refilling of injection if required.

The block diagram of anesthesia system is as shown in Fig. 1.

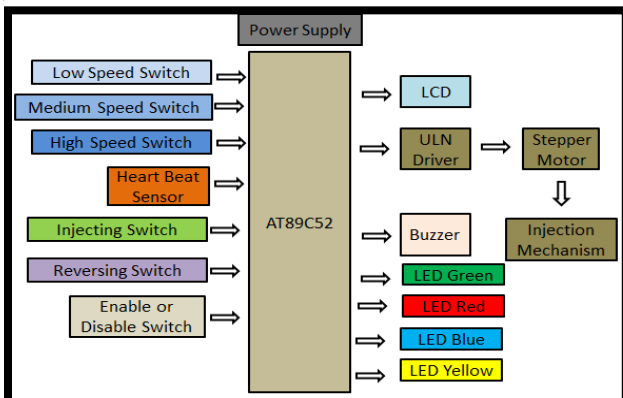


Fig. 1: Microcontroller based Anaesthesia System

The system consists of AT89c52 microcontroller, Heart beat sensor for detecting the patient heart beat

whether it is high or low to take the decision of injecting, Speed Switches to inject anaesthesia slower or at medium speed or faster, apart from this an injection switch to inject, and reversing switch to reverse back the injection to its initial position or start position, enable or disable switch to enable or disable system, LCD to display status whether it is injecting or reversing, stepper motor attached to injection mechanism, buzzer to be on when injection reaches its final point, Green LED when injection or reversing is going on, Red LED to indicate injection is empty or reached its final point, Blue LED to indicate that system is injecting, Yellow LED to indicate system is reversing injection.

The process discussed above can be better understood by Fig.2, which gives an overview of how this system works.

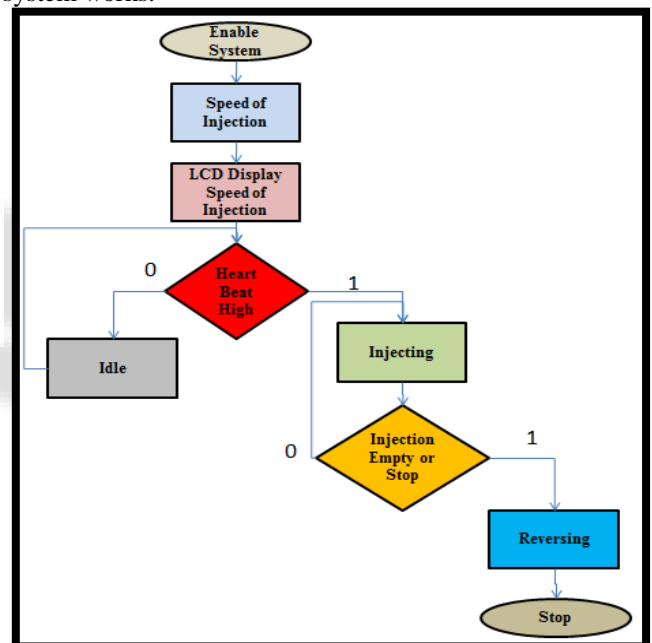


Fig. 2: Microcontroller based anesthesia system process flow

From Fig.2 it is our assumption that the speed of injection is set by the doctor. The injection or reversing process is selected. The heart beat sensor detects the heartbeat, to decide whether to inject or not. If doctor stops injection process then the system stops injecting process. Not only this, the system even stopped when injection is empty or when injection has reached its final point. The injection mechanism can be reversed by selecting appropriate switch in order to bring back injection to its initial position. The system even buzzers whenever injection reaches its final point.

II. SOFTWARE DESIGN

Based on the above assumption the flow chart as shown in Fig. 3 is considered for software designing.

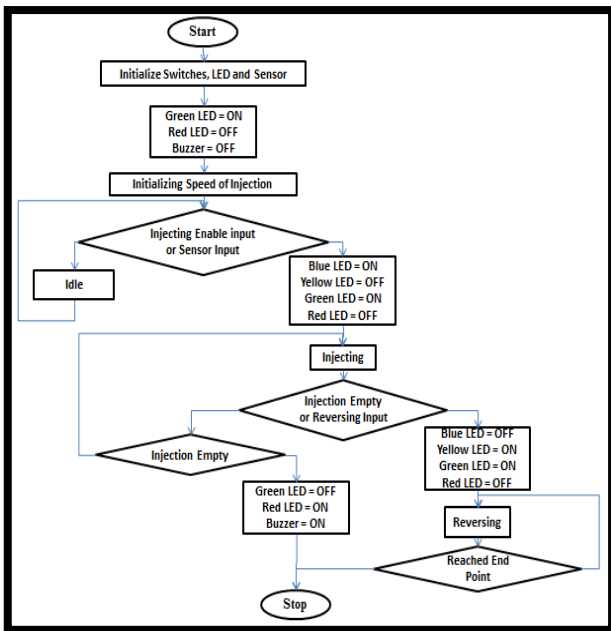


Fig. 3: Microcontroller based anesthesia system flow chart

From the flow chart it is understood that we would like to consider few things, like, initializing switches, LEDs, Buzzer and also initializing the speed of Injection. Making Green LED ON whenever injecting or reversing, Red LED ON whenever injection reached its final point, in case of injecting Blue LED will be glowing and in case of reversing Yellow LED will be glowing. The LCD is used to display status like INJECTING or REVERSING.

III. HARDWARE DESIGN

As far as concerned with the hardware design, simulation software like proteus is used to implement the above concept before implementing it on actual hardware. In proteus software AT89C52 microcontroller is used, three switches for giving the input for speed by the doctor, as heart beat sensor is not available in proteus library the logic state is used as an input assuming logic 1 for high heart beat and logic 0 for low heartbeat, LCD connected to Port0, Stepper motor via driver connected to Port2 and LED's and Buzzer connected to Port3. There is also switch for selecting injecting or reversing mechanism as shown in Fig. 4.

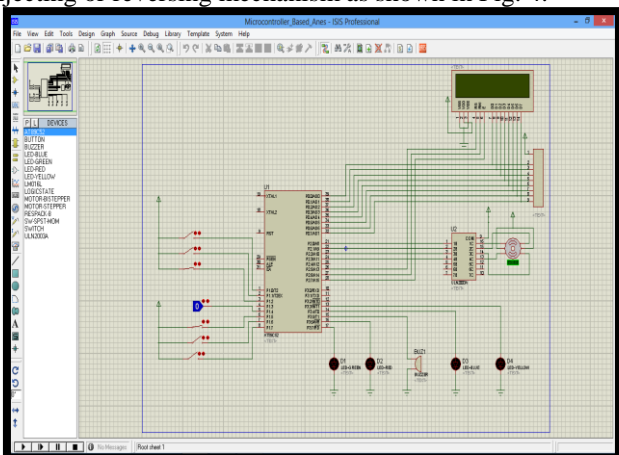


Fig. 4: Microcontroller based anesthesia system proteus diagram

IV. HARDWARE SOFTWARE CO-DESIGN

To simulate the hardware design shown in Fig.4, the code for AT89C52 is written in Keil as per the flow chart shown in Fig. 3. The hex file is generated and is being linked to proteus AT89C52. The simulation is run and it is observed that when inputs are given to the system, system is injecting displaying the same on the LCD, and, when injection reaches its final point its indicating the same through Red LED and Buzzer as shown in Fig. 5.

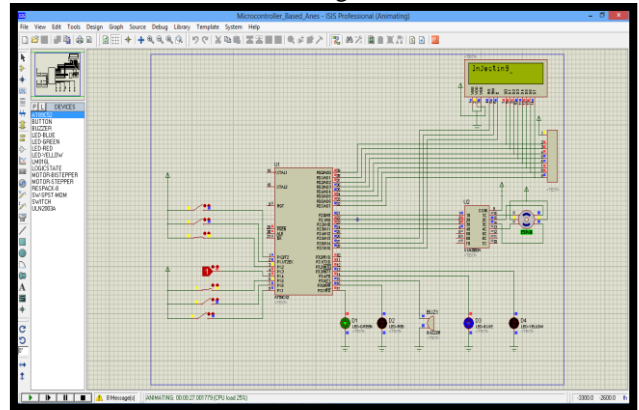


Fig. 5: Microcontroller based anesthesia system proteus output

V. CONCLUSION AND FUTURE SCOPE

As it is the era of embedded systems, every field is expecting to have some sort of embedded technology in it for making themselves autonomous. One among such field is biomedical field. And the anaesthesia injection system is one among them. It helps the doctors to carrying out their most important work of operation rather than taking care of anaesthesia if required in between process of operation. It can be consider as manual less mechanism for injecting. This work can be extended in future by making injection mechanism more and more interactive for doctors.

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