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Annexure I

1. Project Title: Automatic Anaesthesia Injector using Arm Controller

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1. Abstract & Objective

1.1 Abstract

Major operations are performed to remove or reconstruct the infected parts in the human body. These operations will lead to blood loss and pain. Therefore it is necessary to arrest the pain and the blood loss. Anesthesia plays an important role in the part of painkilling .AAI can be defined as "Automatic administration of anesthesia based on the biomedical parameters of the patient, eliminating future side effects and the need for an anesthetist. "Anesthesia is very essential in performing painless surgery and so an Automatic administration of Anesthesia is needed for a successful surgery.

1.2 Motivation

Embedded systems are used in many applications in medical field for controlling various biomedical parameters, and monitoring biomedical signals. In this design, a ARM processor is used for controlling the anesthesia machine automatically, depending upon the various biomedical parameters such as body temperature, heart rate etc., Major operations are performed to remove or reconstruct the infected parts in the human body. These operations lead to blood loss and pain. Therefore it is necessary to arrest the pain and the blood loss. Anesthesia plays important role in the part of painkilling. Hence, anesthesia is very essential in performing painless surgery.

- The need for an anesthetist is eliminated.
- Level of anesthesia is not varied, so the future side effects are eliminated.
- IR detector is also included in the system for monitoring the total anesthesia level for the entire period of the surgery time.

1.3 Objective

The main aim of this project is "Automatic administration of anesthesia based on the biomedical parameters of the patient, eliminating future side effects and the need for an anesthetist. "Anesthesia is very essential in performing painless surgery and so an Automatic administration of Anesthesia is needed for a successful surgery.

2. Block Diagram & Technical Specifications

2.1 Block Diagram and Working:

2.1.1. Block Diagram:

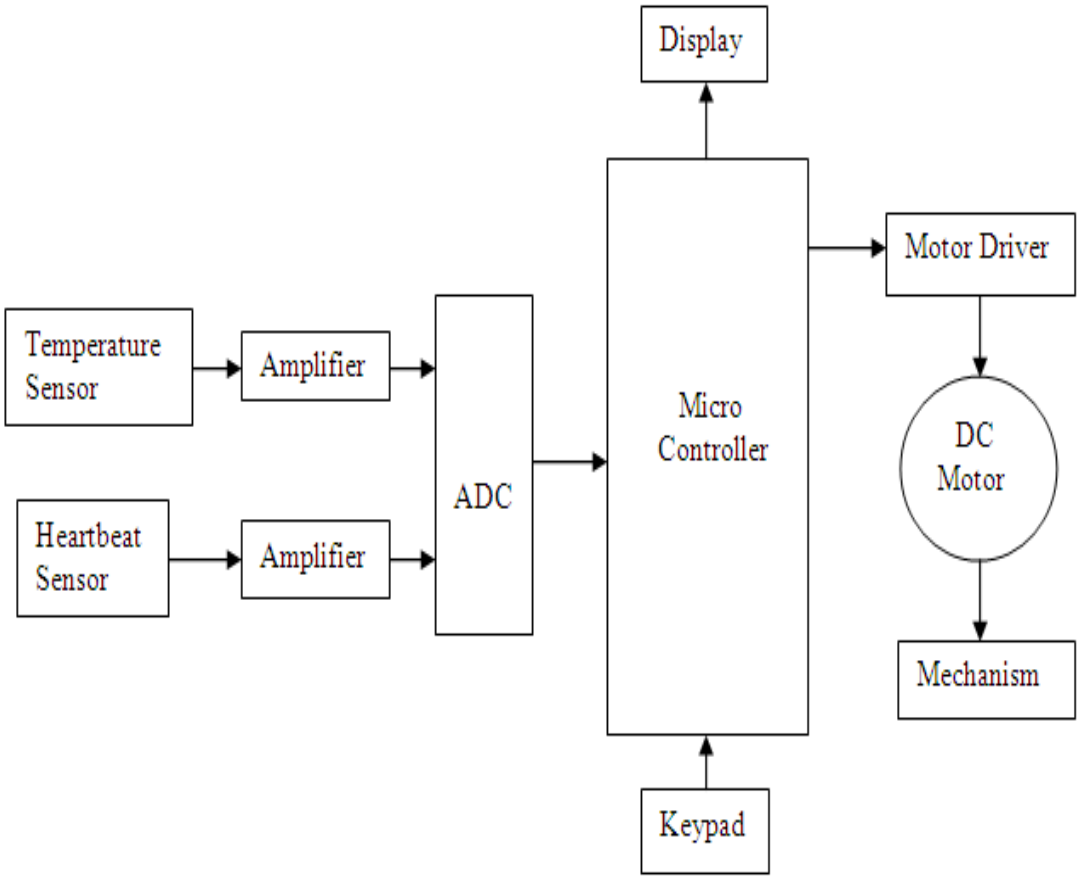


Figure 3.1: Block Diagram

2.1.2. Working:

The block diagram consists of controller, temperature sensor, heart beat sensor, motor, motor driver, display, keypad, syringe. The Microcontroller is used to control the all the devices connected to the system. The most commonly used type of all the sensors are those which detect **temperature** or heat. These types of temperature sensor vary from simple ON/OFF thermostatic devices which control a domestic hot water heating system to highly sensitive semiconductor types that can control complex process control furnace plants.

We remember from our school science classes that the movement of molecules and atoms produces heat (kinetic energy) and the greater the movement, the more heat that is generated. **Temperature Sensors** measure the amount of heat energy or even coldness that is generated by an object or system, allowing us to "sense" or detect any physical change to that temperature producing either an analogue or digital output. Heart Beat can be measured based on optical power variation as light is scattered or absorbed during its path through the blood as the heart beat changes. The heartbeat sensor is based on the principle of photo phlethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses. DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

2.2 Technical Specifications:

2.2.1. MICROCONTROLLER

A ARM7 based LPC2148 is used as the microcontroller to implement this project. It is based on reduced instruction set computer, commonly known as RISC. This result in a high instruction throughput and impressive real time interrupt response from a small and cost effective chip.

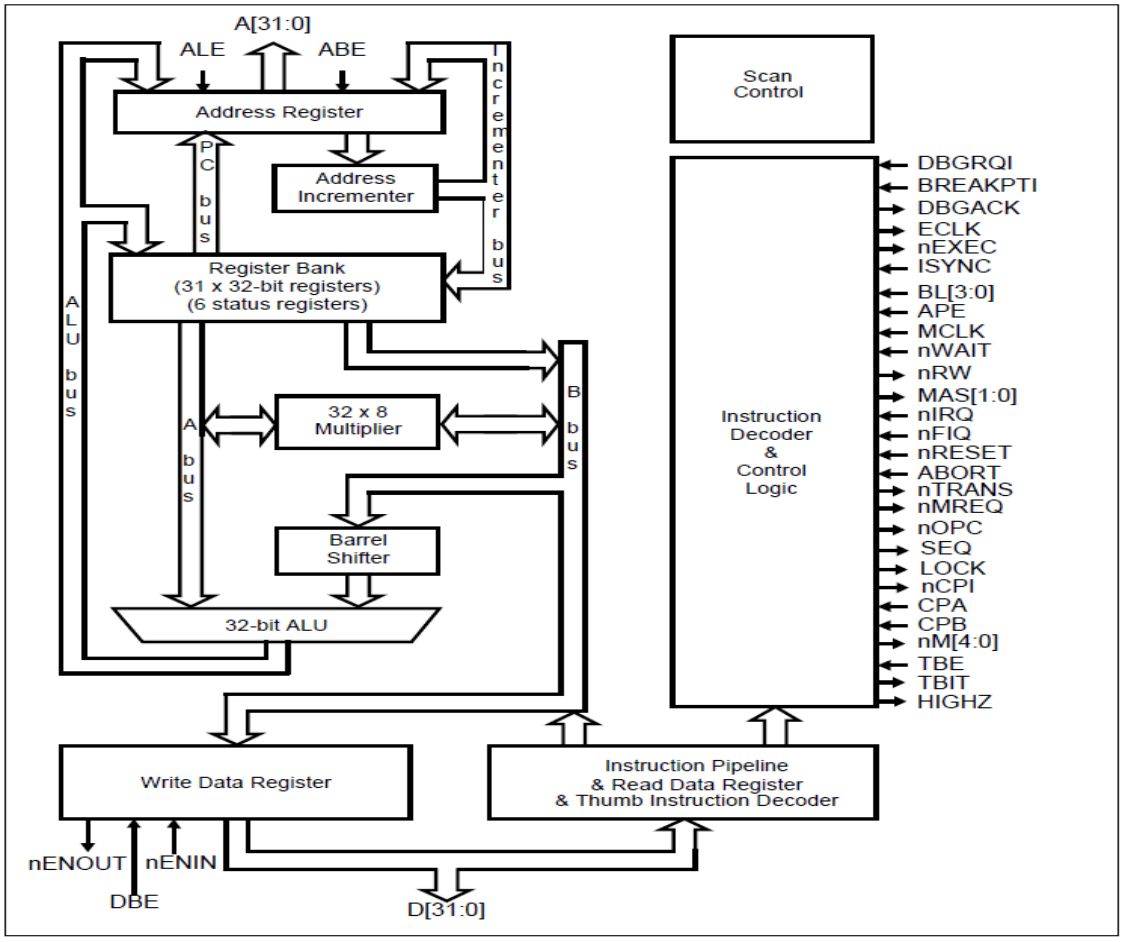


Figure 4.1:ARM7TDMI Core Diagram

4.1.2 The Major Features

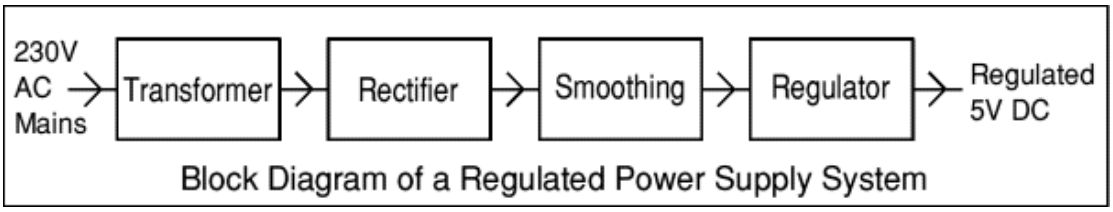
- 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 8 KB to 40 KB of on-chip static RAM and 32 KB to 512 KB of on-chip flash memory.128-bit wide interface/accelerator enables high-speed 60 MHz operation.
- In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot
- loader software, single flash sector or full chip erase in 400 ms and programming of 256 B in 1 msec. Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution.
- USB 2.0 Full-speed compliant device controller with 2 KB of endpoint RAM. In addition, the LPC2148 provides 8 KB of on-chip RAM accessible to USB by DMA.
- One or two (LPC2141/42 Vs, LPC2144/46/48) 10-bit ADCs provide a total of

6/14 analog inputs, with conversion times as low as 2.44 ms per channel.

- Single 10-bit DAC provides variable analog output (LPC2148 only)
- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input

2.2.2. POWER SUPPLY

There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function.

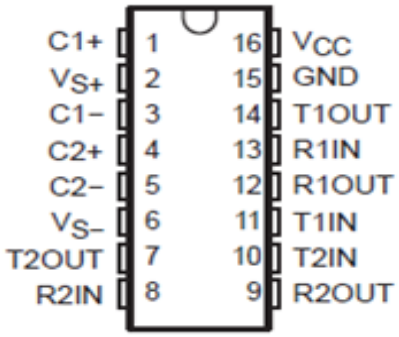


Block Diagram of a Regulated Power Supply System

- Transformer - steps down high voltage AC mains to low voltage AC.
- Rectifier - converts AC to DC, but the DC output is varying.
- Smoothing - smooth's the DC from varying greatly to a small ripple.

2.2.3. MAX-232

RS232 is not compatible with today's Microprocessor and Microcontroller, we need a line driver (voltage converter) to convert the RS232 signal to TTL voltage levels that will be acceptable to the 8051's TxD and Rxd pins.The information from micro controller is sent to system through serial communication by using MAX-232 IC in between micro controller and RS232(DB9 connector). This MAX-232 acts as voltage level translator i.e., the TTL logic voltage level is to be transformed to RS232 DB9 connector voltage level of the system.



2.2.4. DB9 CONNECTOR

DTR (Data terminal ready)

When the terminal is turned on, after going through a self test, it sends out signal DTR to indicate that it is ready for communication. If there is something wrong with the COM port, this signal will not be activated. This is an active low signal and can be used to inform the modem that the computer is alive and kicking. This is an output pin from DTE and an input to the modem.

DSR (Data set ready)

When DCE is turned on and has gone through the self test, it asserts DSR to indicate that it is ready to communicate. Thus it is an output from the modem and input to the PC. This is an active low signal. If for any reason the modem cannot make a connection to the telephone, this signal remains in active, indicating to the PC that it cannot accept or send data.

RTS (request to send)

When the DTE device has a byte to transmit, it asserts RTS to signal the modem that it has a byte of data to transmit. RTS is an active low output from the DTE and an input to the modem.

CTS (clear to send)

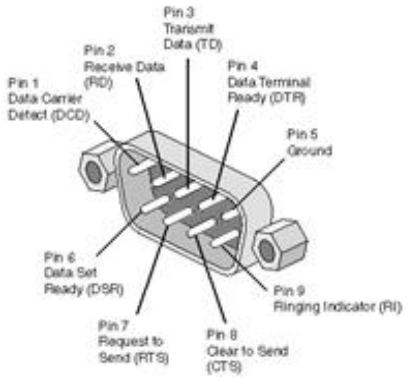
In response to RTS ,when the modem has room for storing the data it is receive,it sends out signal CTS to the DTE to indicate that it can receive the data now. This input signal to the DTE is used by the DTE to start transmission.

DCD (data carrier detect)

The modem asserts signal DCD to inform the DTE that a valid carrier has been detected and that contact between it and the other modem is established. Therefore .DCD is an output from the modem and an input the PC (DTE).

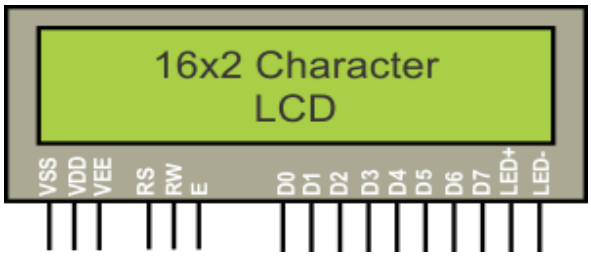
RI (ring indicator)

An output from the modem (DCE) and an input to a PC (DTE) indicate that the telephone is ringing .It does on or off in synchronization with the ringing sound .Of the 6 handshake signals ,this is the least often used, due to the fact that modem take care of answering the phone . However, if in a given system PC is in charge of answering the phone, this signal is used.



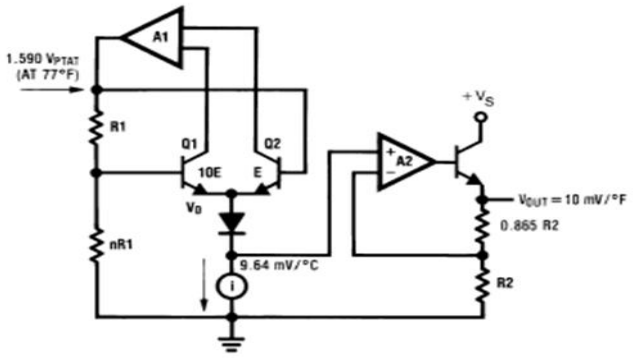
2.2.5. LIQUID CRYSTAL DISPLAY (LCD)

LCD is a type of display used in digital watches and many portable computers.LCDdisplays utilize to sheets of polarizing material with a liquid crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them.



2.2.6. TEMPERATURE SENSOR LM35

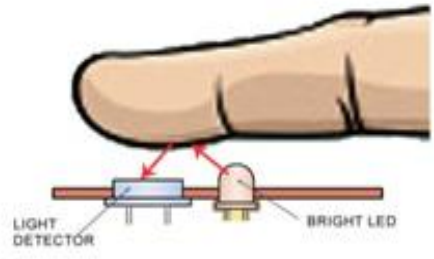
The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range.Low cost is assured by trimming and calibration at the wafer level. The LM35's lowoutput impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range.



2.2.7. HEART BEAT 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. A simple heart -beat transducer can be made from an infrared LED and an infrared phototransistor. It works because skin acts as a reflective surface for infrared light. The IR reflectivity of skin depends on the density of blood in it. Blood density rises and falls with the pumping action of the heart. So the intensity of infrared reflected by the skin (and thus transmitted to the phototransistor) rises and falls with each heartbeat.

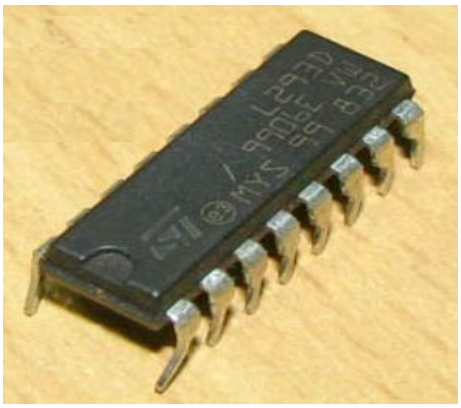


2.2.8. MOTOR DRIVER (L293D)

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

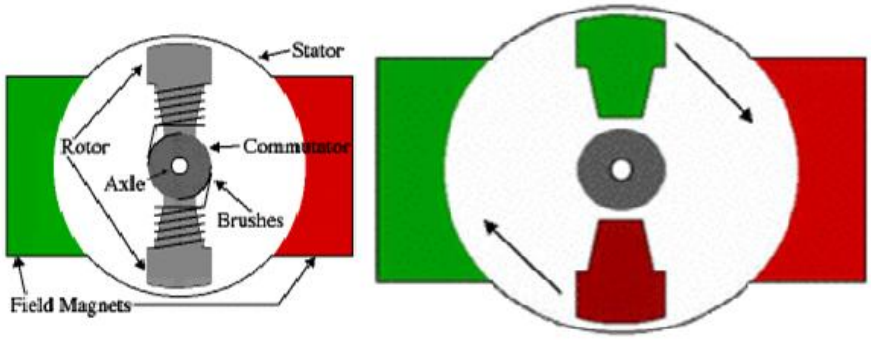
L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

2.2.9. DC MOTOR



A DC motor is an electric motor that runs on direct current (DC) electricity. In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware

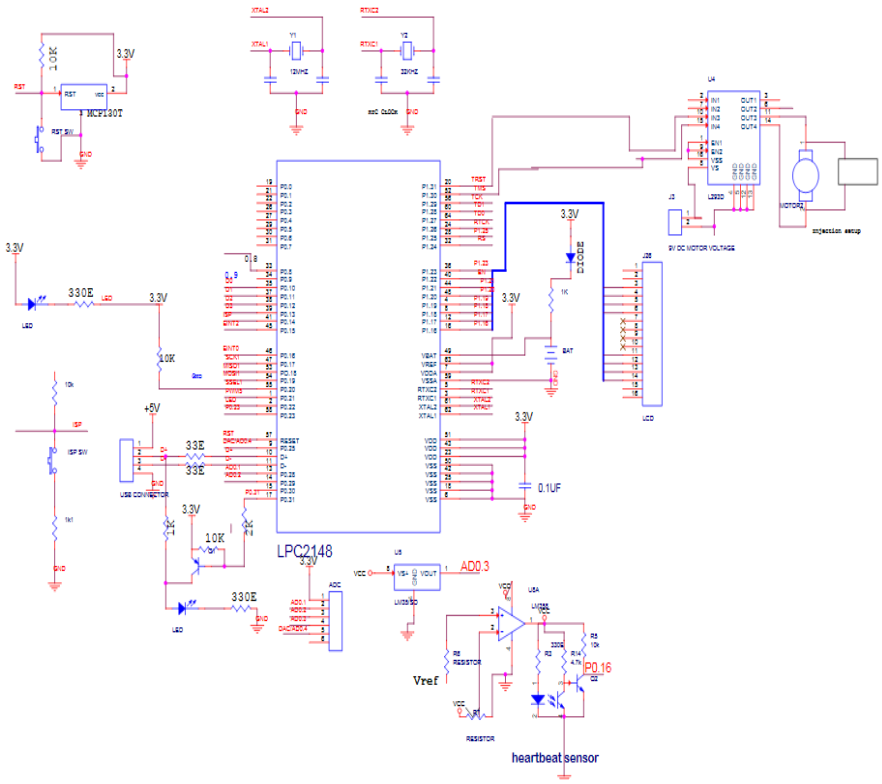
of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.



2.2.10. SYRINGE

A syringe is a simple pump consisting of a plunger that fits tightly in a tube. The plunger can be pulled and pushed along inside a cylindrical tube (called a barrel), allowing the syringe to take in and expel a liquid or gas through an orifice at the open end of the tube. The open end of the syringe may be fitted with a hypodermic needle, a nozzle, or tubing to help direct the flow into and out of the barrel. Syringes are often used to administer injections, insert intravenous drugs into the bloodstream, apply compounds such as glue or lubricant, and measure liquids.

2.2.11.Schematic Diagrams



2.3. Results & Analysis

Click on the flash magic icon which is on the desktop of the personal computer .

- Then the flash magic window is opened as shown in fig5.1.In that we have chosen the device which is used in implementation (LPC2148).
- Check whether the COM Port as COM 1, baud rate is 9600 and interface is choosenasnone(ISP).

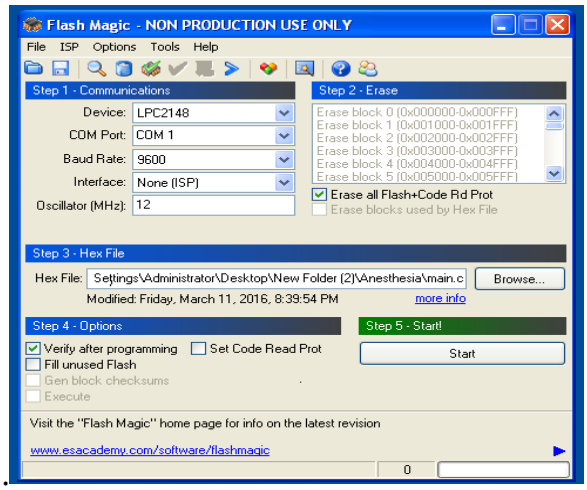


Figure 5.1: Flash magic window

- Click on the Tools in menu bar.In that select terminal tool, the terminal settings window is opened as shown in **Fig 5.2**then click on OK.

- Click on start button

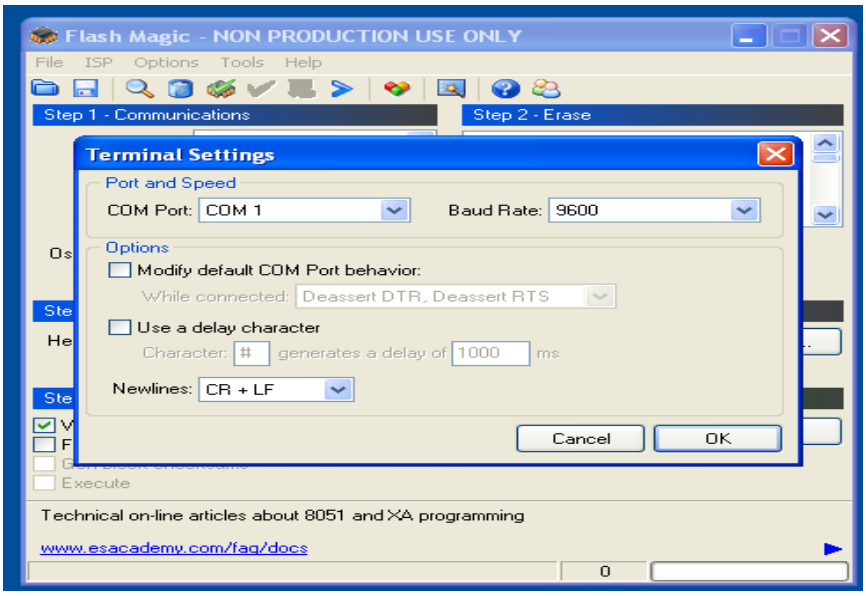


Figure 5.2: Terminal Settings window

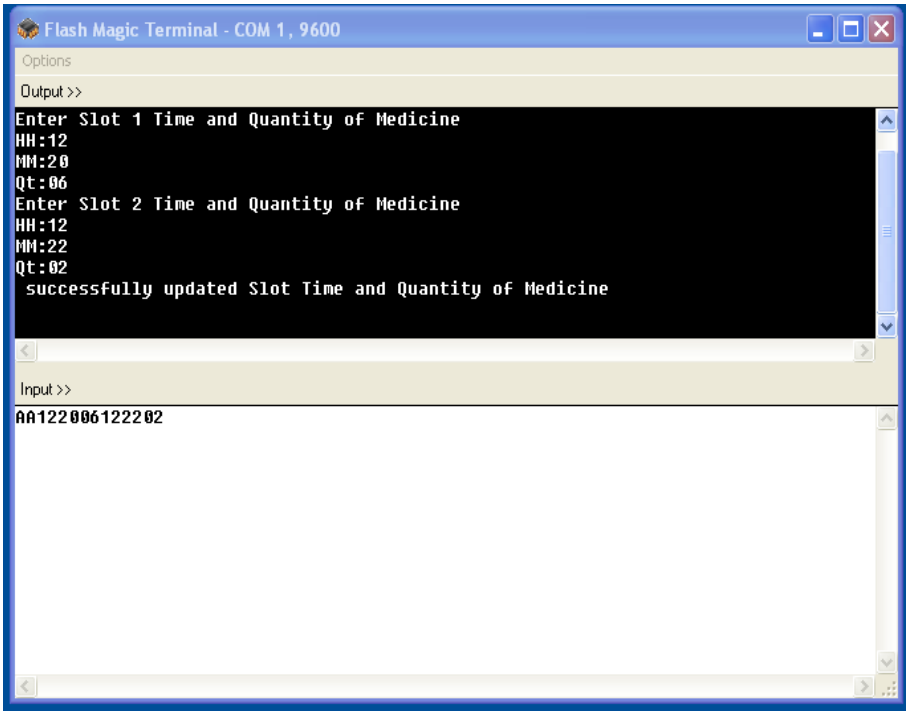


Figure 5.3: Flash Magic Terminal Window

- Then the flash magic window is opened for entering the output time slots and quantity of medicine.
- Now enter the AA in the input section.So,in the output section it displays to enter slot 1 time and quantity of medicine.(we have to enter preferred time and quantity in slot1).
- Next in the same way slot2 is repeated.

- The result of the machine as shown in **Fig5.4** will be occurred according to the time slots.

PHYSICAL VIEW WITH EXPLANATION

In this section the **Fig 5.4**shows the results obtained on LCD.Here the LCD displays date and time, time slots along with quantity of medicine, temperature and heart rate of the human body.

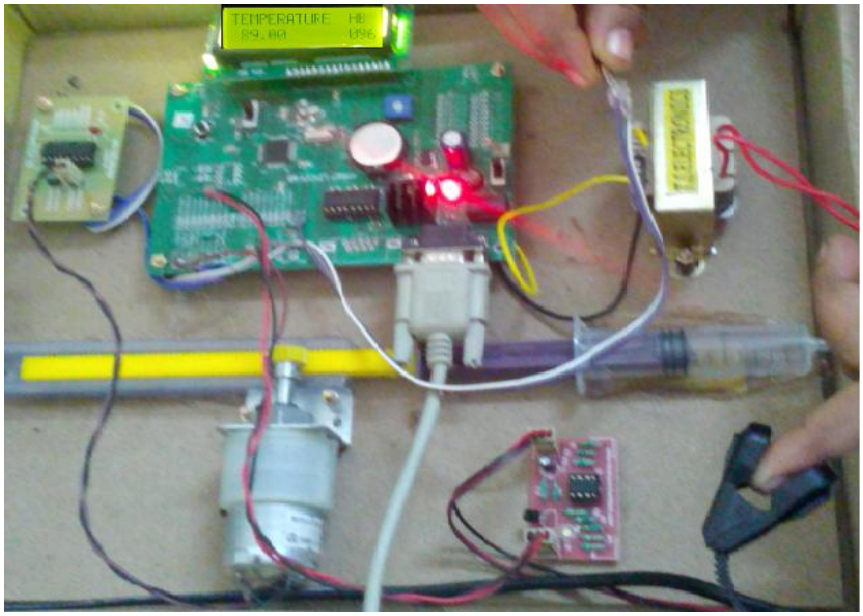


Figure 5.4: Physical View of Automatic Anaesthesia Injector using Arm Controller

3. Conclusion

3.0. Conclusion

The Automatic Anesthesia injector using arm controller was designed and implemented for safety purpose of the patient and reduce man power (anesthetist). By using various electrical circuits the bio-medical parameters can be found. The output of the circuits is amplified by means of an amplifier and fed into an A/D converter. The digitized signal is then fed into the input port of the microcontroller. The microcontroller displays the parameters in digital value in the display device. when we enter the value through the keypad then the DC motor rotates so teeth rack push the plunger of the syringe attached to it

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