Low Power Embedded System For development of Portable Insulin Injection Pump

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***Abstract*- The field of Bio-Medical Engineering has been serving the humanity since ages by developing the equipment's which are user friendly and highly competitive in rates. As we have already seen portable biomedical instruments such as Therapeutic Instruments e.g. Automated External Defibrillator (AED), Insulin delivery systems. as well as diagnostic instruments e.g. Thermometer, Blood Glucose Meter (BGM), Cholesterol meters, Electrocardiogram (ECG), Heart rate monitor, Pulseoximeter. In today's world there is no age limit for diabetes from a child 2 months old to an age old person any one can have it. In this scenario we have tried to implement through this paper the various ways of delivering the insulin in human body, the main aim is to inject timely the amount of insulin in human body and to help in this we have used the 8259 with the help of steeper motor.**

***Index Terms*- Microcontroller, 8259, Diabetes, Insulin.**

I.INTRODUCTION

Infusion Pumps are used to deliver very small quantities of drugs over long periods of time. They are also commonly called Syringe Pumps. Infusion is a method of delivering fluids, medication or nutrients into a patient's Circulatory system, generally used intravenously, although subcutaneous, arterial and epidural infusions are occasionally used. Infusion pumps are typically found in hospitals and other point of care environments.

Here in this paper the Injection pumps can administer fluids in ways that would be impractically expensive or unreliable if performed manually by nursing staff. For example, they can administer as little as 0.1 ml per hour injections (too small for a drip), injections every minute, injections with repeated boluses requested by the patient, up to maximum number per hour, or fluids whose volumes vary by the time of day. As they can produce high but controlled pressures, they can inject controlled amounts of fluids subcutaneously (beneath the skin), or epidural (just within the surface of the central nervous system).

In olden days injection pumps are used manually. It is difficult to deliver the liquid in small quantities for us. When we use manually, it may be small decrement or increment in dosage. Exact value is not possible by using manual operation. So to over come these draw backs infusion pumps are used. And exact our required value of dosage will delivered by infusion pump.

II. BLOCK DIAGRAM

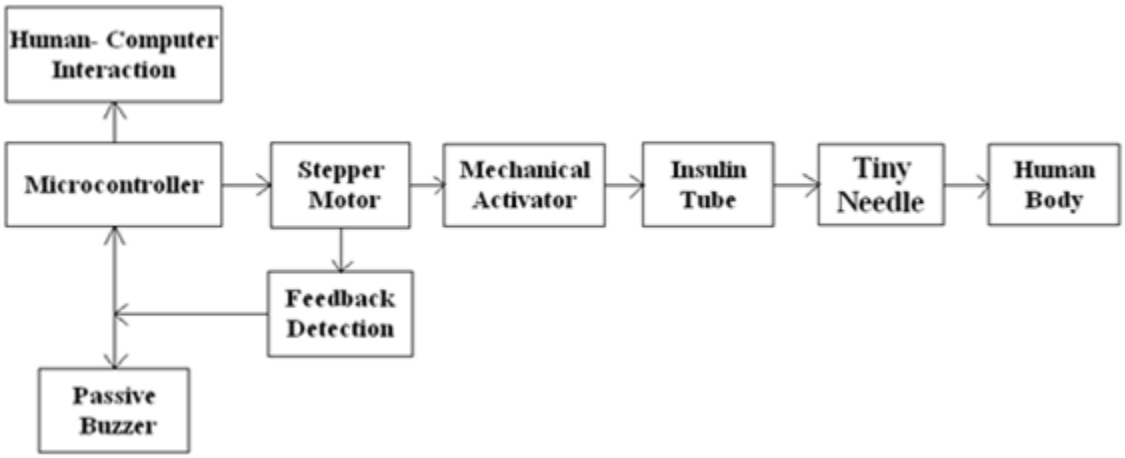


Fig 1: BLOCK DIAGRAM OF INJECTION PUMP

III.WORKING PROCESS

An injection pump is a device to which a syringe is fitted which is filled with a liquid, in particular with a medicine solution. This mechanism is connected to the microcontroller through DC motor. Here DC motor is used to control the motion of the piston of the syringe pump.

Limit switch is provided to bring the piston in starting position. It means syringe pump is empty. According to range of the medicine required we have to set the rotations of the Dc motor. To inject 1ml of liquid in 1hour we have to use more time delay for moving the steps in the dc motor.

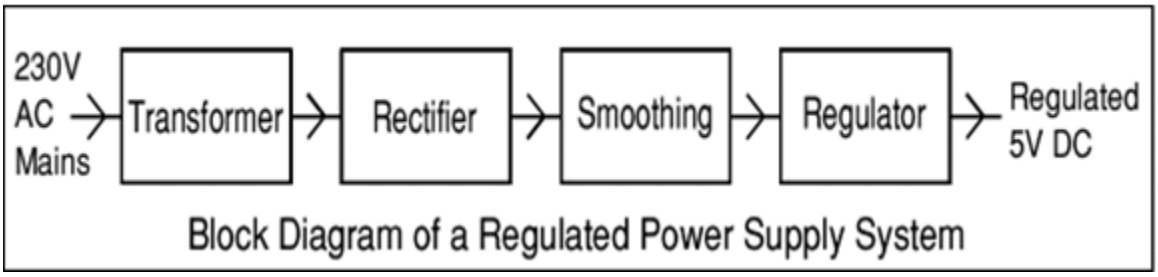
The rotations of the dc motor are controlled by the controller. The volume of the liquid is entered with the help of the keypad and it can be displayed on LCD with the help of the controller. The buzzer is used to identify that the liquid in the syringe is coming to the end point.

The second limit switch is used to notice the controller that the syringe is filled with excess of liquid as that the piston touches the limit switch. The injection pump is mainly used in the researches where the chemicals are used in small quantities.

1. Power Module

The power supply unit is used to provide a constant 5V of DC supply from a 230V of AC supply. These 5V DC will acts as power to different standard circuits. It mainly uses 3 devices

(i). Bridge wave rectifier
(ii). Voltage regulator



2. The Controller

The P89V51RD2 is also In-Application Programmable (IAP), allowing the Flash program memory to be reconfigured even while the application is running.

3. **DC Motor**

Brushless DC motors are commonly used where precise speed control is necessary, computer disk drives or in video cassette recorders the spindles within CD, CD-ROM (etc.) drives, and mechanisms within office products such as fans, laser printers and photocopiers. They have several advantages over conventional motors.

4. Mechanical Activator

It is require to push insulin from insulin tube forward.

5. Insulin Tube

It consists of insulin which is to be injected into an human body.

6. Tiny Needle

The insulin passes through the needle into veins of human body.

7. Passive Buzzer

The buzzer is use which can change its tone and volume by adjusting the duty ratio of the PWM wave.

8. Human –Computer Interaction Unit

Human computer interaction unit s composed of two parts: the stroke segment LCD screen and the membrane switches. The stroke segment LCD has the advantage of low cost and a clear displaying content over its dot-array counterpart, thus it is very suitable for the elder patients to read.

PROPOSED MODEL

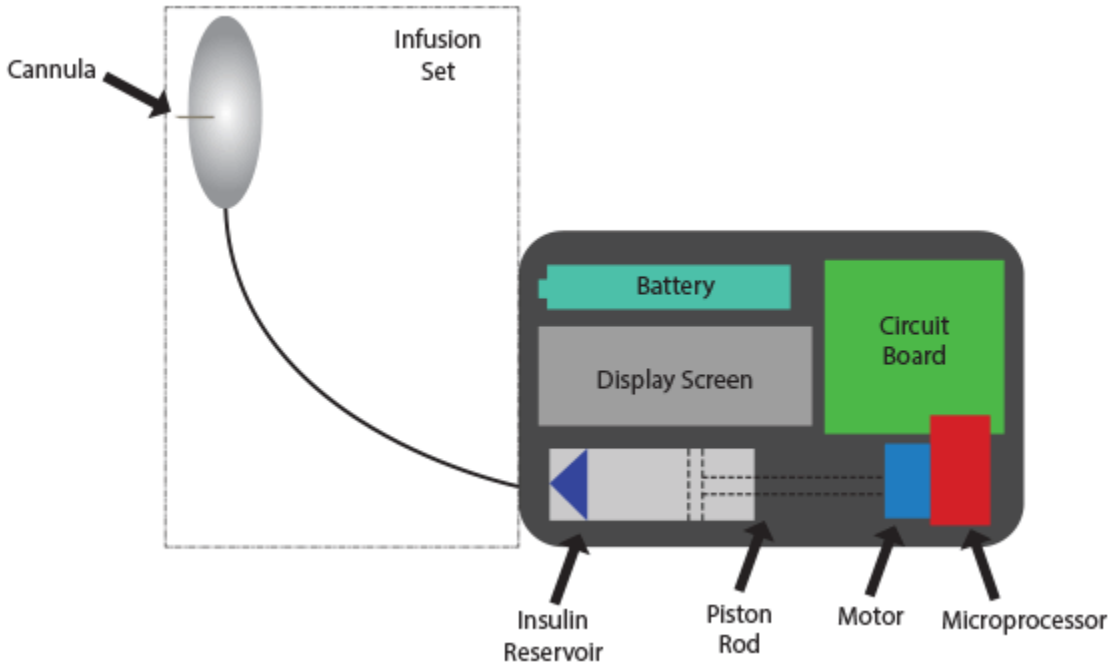


FIG 2: SNAPSHOT OF MODEL

IV. SOFTWARE MODULE SOFTWARE DEVELOPMENT TOOLS

It is possible to create the source files in a text editor such as Notepad, run the Compiler on each C source file, specifying a list of controls, run the Assembler on each Assembler source file, specifying another list of controls, run either the Library Manager or Linker (again specifying a list of controls) and finally running the Object-HEX Converter to convert the Linker output file to an Intel Hex File. Once that has been completed the Hex File can be downloaded to the target hardware and debugged. Alternatively KEIL can be used to create source files; automatically compile, link and covert using options set with an easy to use user interface and finally simulate or perform debugging on the hardware with access to C variables and memory. Unless you have to use the tolls on the command line, the choice is clear. KEIL Greatly simplifies the process of creating and testing an embedded application.

The Keil Software 8051 development tools listed below are the programs you use to compile your C code, assemble your assembler source files, link your program together, create HEX files, and debug your target program. µVision2 for Windows™ Integrated Development Environment: combines Project Management, Source Code Editing, and Program Debugging in one powerful environment.

- C51 ANSI Optimizing C Cross Compiler: creates re-locatable object modules from your C source code,
- A51 Macro Assembler: creates re-locatable object modules from your 8051 assembler source code,
- BL51 Linker/Locator: combines re-locatable object modules created by the compiler and assembler into the final absolute object module,
- LIB51 Library Manager: combines object modules into a library, which may be used by the linker,
- OH51 Object-HEX Converter: creates Intel HEX files from absolute object modules.

V. HARDWARE MODULE

DC motors are fairly simple to understand. They are also simple to make and only require a battery or dc supply to make them run.

The brushed DC motor will generate torque directly from DC power applied to the motor leads. Brushed DC motors require a significant amount of maintenance to work properly. This involves replacing the brushes and springs which carry the electric current as well as cleaning or replacing the commutator.

Many of the limitations of the classic commutator DC motor are due to the need for brushes to press against the commutator. This creates friction. At higher speeds, brushes have increasing difficulty in maintaining contact. Brushes may bounce off the irregularities in the commutator surface, creating sparks. This limits the maximum speed of the machine. The current density per unit area of the brushes limits the output of the motor. Brushes eventually wear out and require replacement, and the commutator itself is subject to wear and maintenance. The commutator assembly on a large machine is a costly element, requiring precision assembly of many parts.

FIG 3: BRUSHLESS DC MOTOR

FEATURES BRUSHLESS DC MOTOR

- Long life span and no maintenance
- High efficiency(85-90)
- High reliability
- Noise reduction and elimination of commutator losses
- High cost
- Complexity of motor speed control
- Require external communication like controller to generate torque
- Transferring of power from driver to rotor is easy
- It consists of permanent magnets external to rotor
- 3-phase driving coils

- One or more hall effect sensor
- Uses where exact speed control is necessary

DC MOTOR DRIVER UNIT

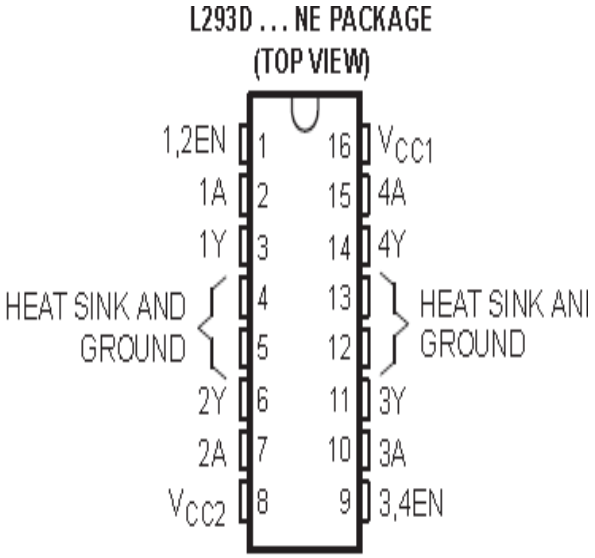


FIG 4: PIN DIAGRAM OF DC DRIVER

FEATURES OF L293D

- **Used has Dc motor driver**
- **Supply voltage range 4.5V to 36V**
- **High current half H drivers**
- **High noise immunity input**
- **Out put current of 600mA per channel**
- **Out put peak current of 1.2mA per channel**
- **Thermal shut down**
- **Output clamp diodes for inductive transient suppression**
- **Input circuit are TTL compatible**
- **Output circuit are totem pole with Darlington transistor pair**
- **Maximum input voltage is 7V**
- **Output voltage range is -3V to 39V**

schematics of inputs and outputs (L293D)

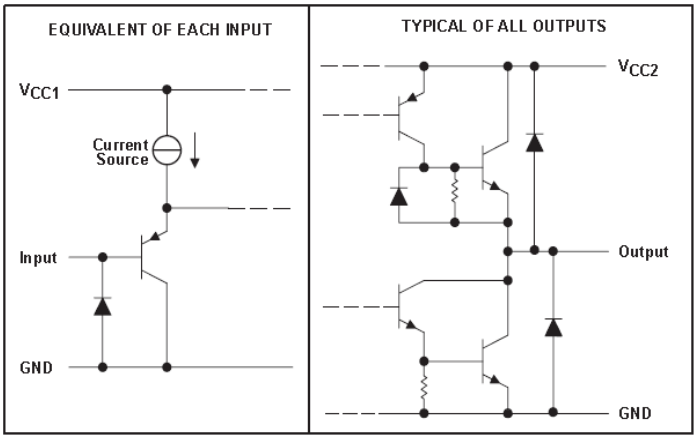


FIG 5: INPUT AND OUTPUT COMPATIBLES

VI. SCHEMATIC DIAGRAM & WORKING PROCESS

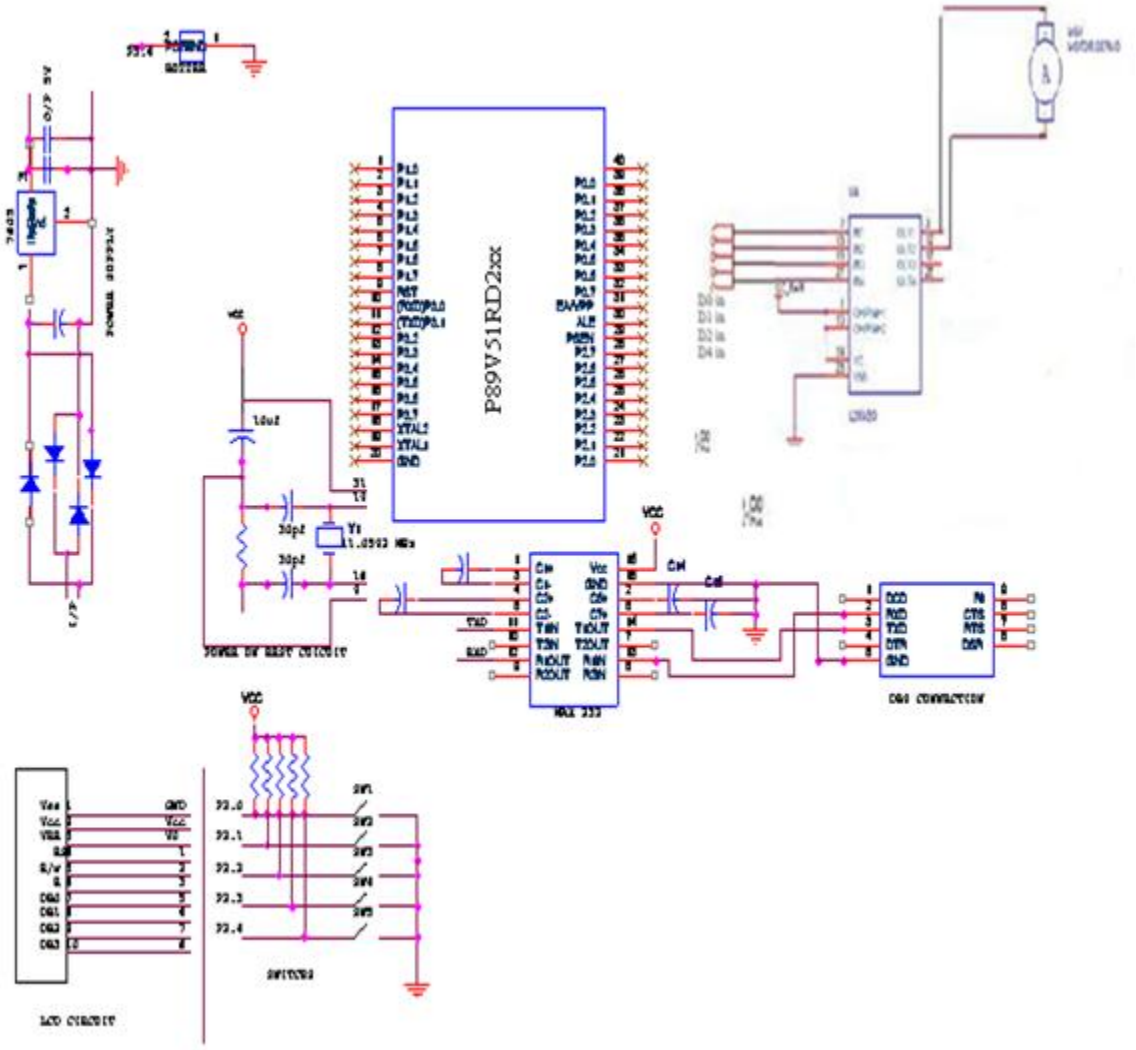


Fig 6: SCHEMATIC DIAGRAM

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VII. ADVANTAGES AND APPLICATIONS

ADVANTAGES

- Fully Programmable ,
- Quick set up and installation
- Accurate
- Affordable
- Sophisticated dispensing
- Flow control
- Wide variety of syringes from 10 µl to 140 ml
- Quick fluid filling
- Power reduction mode

APPLICATIONS

- Continuous delivery of fluid
- In Industrial plant reactors
- Dispensing Viscous Fluids

where the flow should be controlled and constant.

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