A Design of Biomeditronics Analysis Bed Parameter using Atmega 16 Microcontroller

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Abstract — *Biomedical field does not have anyboundation as the technology is developing and the patients are increasing day by day. After working in the practical exposure with the surroundings, we found that sensors are very valuable.It is reasonable at both the ends. It has proved its need till now and is showing its abilities incessantly. This technology has the ability to shape the future of biomedical. The main aim of paper is to understand the technology better on the practical basis. It perfectly helps an engineer to get an overlook of society. We get technical exposure to every old and new instrument and technical advances. A step-by-step approach in designing the Atmega-16 microcontroller based system for measurement and control of the essential parameters. The results obtained from the measurement have shown that the system performance is quite illusive and accurate. The system has successfully overcome quite a few disadvantages of the existing systems by minimizing the power consumption, maintenance and complexity, at the same time providing a complete form of fulfillment to the health trades. The continuously decreasing costs of hardware and software, create a wider acceptance of electronic systems in different fields, and an emerging control system industry in several areas of inclusive production, will result in reliable control systems that will address several aspects of variable qualities of production. Further corrections will be made as quite reliable and primitively expensive and more useful as sensors are developed for use in medical science .Although the enhancements mentioned in the paper may seem far in the future, the required technology and components are present, many such sensors have been independently developed, or are at least tested at a prototype level. Also, differentiation of all these technologies is not a big task and can also be successfully carried out.*

Index Terms— *Biomedical, sensors, load sensor, temperature sensor, heart-beat sensor.*

I. INTRODUCTION

Advancement in the competitive phase of technology day by day has quite dramatically brought a sparkle change in the field of engineering and medical science and quite generously it has also widely opened the window for increasingly sophisticated sensors to be used in medical research.This technology of biomedical parameter analysis bed is mainly a biomedical project added with sensors to provide fast database for the emergency-based patients. In this paper, we have given preference to mainly the load sensor, temperature-sensorand heart-beat sensor for the assimilation of the project.As Doctor and patients interaction is too important for the treatment and analysis of any visual health problems. If this process would be fast and data analysis will be accurate and flexible, then that will be the best treatment of any patient and it will make more comfortable feeling for the doctor too. In today's time, one of the most important requirement will be fulfilled by this project and hence this is one of the most important aim of this paper. As we know that doctor needs analysis of some basic parameters to convey a health status of the patient. As some of the visualisation is not captured by human eyes. So, it will be much easy and preferable with the use of sensors.

Through the used technology, the human body scanning system could be made more simple and evaluating by incorporating load and ECG sensors. The analog channel inputs AN4 and AN7 can be used and the Port B can be programmed as an input port. An additional ADC chip in the external circuit as an input port in analog channel. The Hospitable wide wireless capability would allow doctor to allow the patients database using their word held computers. The entire medical data readings could be made wireless and wearable. Such a package of demand would contain the circuiting for inputs from ECG sensors, EEG sensors, pressure measurement and pulse rate transducers. The wearable module can transmit the data continuously over a fibre optic link or through an internet digital radio. The received data can be stored in separate memory and be processed by a microcontroller. Health status of a human being can be traced down very fast. The wide wireless capability would allow doctor to occur the patients database using their word held computers. Driver circuits and alarms may be used on a large scale modification of this project. It will reduce much to the risk of diseases like heart attack and many more. It will reduce the human dependency on doctors. Robotic doctors will be named inplace of human doctors. This enhancement will enable monitoring of patients to be more flexible and strain-free.

II. BLOCK DIAGRAM

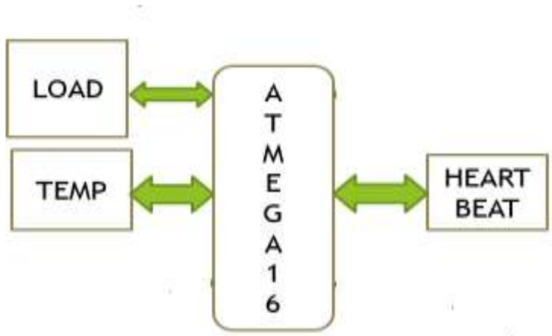

Fig.1 Block Diagram of Biomeditronics Analysis Parameter Bed

The main aim of this paper is to improve the quality and capability doctors to look after the patients in a quite successive seconds of time only through the help of these sensors (load sensor, temperature sensor, heart-beat sensor) pulled on a ATMEGA16 Microcontroller. The block diagram shows the reasonable view of its working. In this, all sensor takes analog data from body and fed it into the microcontroller to further process to get desired output.

III. INSTRUMENTAL SENSORS

Load Sensor

A load cell is a transducer that is used to transform a force into electrical signal. The recognize use of this sensor is in weighing machine. Normally, each and every weighing machine which shows weight has a load cell as sensing element present in it.This conversion is indirect and happens in two stages. The first one is through a mechanical linkage, the force being sensed first and then it leads to deformation in a strain gauge.

Fig. 2. Load Sensor

The strain gauge measures the deformation (strain) as an electrical signal, as the strain shifts the effective electrical resistance of the wire. A load cell mainly consists of four strain gauges in a Wheatstone bridge configuration. Load cells of one strain gauge (quarter bridge) or two strain gauges (half bridge) are also available.The electrical signal output is typically in the order of a few millivolts and requires amplification by an instrumentation amplifier before it can be used. The output of the transducer is plugged into a series route to calculate the force applied to the transducer. Load cells are used in several applications of measuring instruments such as weighing scales, universal testing machines.

Table 1: Specifictions of Load Sensor

S.L. NO.	PARAMETER	VALUE
1.	Type	Single Point Load Cell
2.	Material	Alluminium Alloy
3.	Surface	Anodized Treatment
4.	Excitation Voltage	5-12 V DC
5.	Non-linearity	0.017% Full Scale
6.	Hysteresis	0.02% Full Scale
7.	Input Resistance	405 +/- 6 Ohm

Temperature Sensor

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.

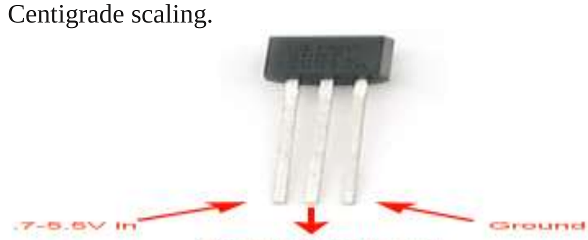

Fig.3. Temperature Sensor

The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°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 low output 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 LM35D is rated to operate over a 0° to +100°C temperature range. It has certain features:- 1.)Calibrated directly in Celsius (Centigrade) 2.)Linear + 10.0 mV/ C scale factor 3.)0.5 C accuracy guaranteeable (at +25 C)4.)Rated for full -55 to +150 C range 5.)Suitable for remote applications 6.)Low cost due to wafer-level trimming. 7.)Operates from 4 to 30 volts. 8.)Less than 60 A current drain9.)Low self-heating, 0.08 C in still air 10.)Nonlinearity only 1/4 C typical 11.)Low impedance output, 0.1 W for 1 mA load

Heart-Beat Sensor

Fig. 4. 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. It has certain features:- 1.)Microcontroller based SMD design. 2.)Heat beat indication by LED 3.)Instant output digital signal for directly connecting to microcontroller. 4.)Compact Size 5.)Working Voltage +5V DC.Various Applications of Heart-Beat Sensor:- 1.)Digital Heart Rate monitor 2.)Patient Monitoring System 3.)Bio-Feedback control of robotics and applications. Output checking on scope for reference below. The output is digital level at around 5V supply. The duration between pulses are used to calculate the heart beat.

Fig. 5. Putting the middle finger to detect the heart-beat pulse

III. ATMEGA 16 MICROCONTROLLER

An ATmega16 is a low-power consuming CMOS 8-bit microcontroller which is based on the AVR enhanced RISC architecture. Through the execution of the herculean set-up in a single clock cycle, the ATmega16 gains the through puts that signals to the 1 MIPS per MHz which permits the system designed to reduce power consumption versus processing speed up to a limit. The AVR core adds up a higher instruction set with 32 general purpose work on registers. All the 32 registers are directly attached to the Arithmetic Logic Unit (ALU), permitting two independent registers to be work out in one single instruction executed in per clock cycle. The analyzed architecture is more code versatile but gaining throughputs up to ten times quicker than normal CISC microcontrollers. The best mode block the CPU but permits the USART, Two-wire interface, Analog to Digital Converter, Static-RAM, Timer or Counters, SPI port, and basic interrupt system to regulate the working. The Power-down mode preserve the register datas but condenses the Oscillator, block all other chip functions till the upcoming External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer carry on to run, permitting the user to maintain a timer base but the left of the device keeps on rest. The Analog to Digital Converter Noise Reduction mode blocks the CPU and all Input-output modules leaving Asynchronous Timer and Analog to Digital Converter, to reduce the switching noise during Analog to Digital conversions. In working mode, the crystal/resonator Oscillator is working but the rest of the device keeps on a rest. This permits very quick start-up combined with low-power consumptionThe device is manufactured using Atmel's extensive density non-volatile memory technology. The On chip ISP Flash allows the program memory to be redefined in-system through an SPI serial interface, by a normal process of non-volatile memory programmer, or by an On-chip Boot program working on the AVR core. It will permits to work while the Application Flash section keeps on refreshing, providing accurate Read-While-Write operation. By placing an 8-bit RISC CPU with In-System Self-Programmable Flash on a single chip, the Atmel ATmega16 is a powerful generative microcontroller that allows a highly-flexible and expensive price solution to many embedded control applications. The ATmega16 AVR is linked with a full suite of program and system development tools.

IV. BIOMEDICAL SIGNAL PROCESSING

The processing of biomedical signals mainly constitutesof maximum four stages:- 1.)Interpretation or classification of the signals 2.) Computation of signal parameters that are mostly useful. 3.)Measurement and the desirable observation, that is, called as signals acquisition.4.)Transformation and minimization of the signals. Acquisition of Biomedical signals for existence-time acquisition of facts are directly from the source by direct electrical joints to devices which avoids the necessity for people to detect, encode, and validate the data manually. Sensors attached to a patient changes biological signals, like pulse rate, mechanical movementinto electrical signals, which are transferred to the computer. The signals are sampled accordingly and are changed to digital representation for storage and processing. Automated data-acquisition and signal-processing steps are particularly useful in patient monitoring settings [2]. Digitization of Bio-signals as by Sampling and Quantization are most naturally occurring signals are analogsignals, i.e., signals that varies simultaneously. Before processing is allowable, analog signals must be changed to discrete units. The changing process is called analog-to-digital conversion (ADC). Two parameters finds how nearby the digital data catches the real analog signal: the accuracy with which the signal is recorded and the frequency with which the signal is sampled. It is determined by the number of bits (quantisation) quantized and are used to dictate a signal and their absoluteness; the more bits, the higher the number of levels that can be differentiated. Precision also is fixed by the accuracy of the device that changes and transfers the signal. Ranging and calibration of the instruments, either manually or automatically, is required for signals to be framed with as much precision as defined.

Inadequate ranging will responses in information lacking. For example, a conversion in a signal that differs between 0.1 and 0.2 volts will be unfindable if the device has been set to record changes between 0.0 and 1.0, in 0.25-volt parts. The sampling rate (sampling frequency) is the second frame that effects the correspondence between an analog signal and its digital deployment. A sampling rate that is too less in comparison to the rate at which a signal changes value will generate a badrepresentation [3]. On the opposite site, oversampling ascends the expense of processing and storing the data [4]. As a general rule, we need to sample more than twice as fastly as the highest-frequency component required from a signal. For instance, looking at an ECG, we determine that the normal repetition frequency is up to at most a few per second, while on the other phase QRS complex have necessary frequency datas on the order of 150Hz [5]. Therefore, the data sampling rate should be approximately greater than 300 measurements per second. This rate of sampling is normally known as Nyquist frequency. Another aspect of signal quality determination is the receivingof noise in the signal – the device of the acquired data that is not due to the specific result being measured. A basic way of noise is the electrical or magnetic signals generated by the nearby devices and power lines. However, certain miserrors or either the imperfections in the sensors, poor surface contact between sensor and the source (patient), and variations from signals generated by physiological processes other than the one being studied (e.g., breathing interjects with the recording of ECG) are other common sources of noise.

A feature of noise is its relatively random show in mainly cases. Filtering the steps can be needed to minimize the influence of noise [6]. Continuously Repetitive signals, such as an ECG, can be differentiated over many cycles, thus minimizes the effects of at present noise. When the noise pattern varies from the signal pattern, Fourier analysis can be provided to filter the signal in the frequency domain.

V. RESULTS

The field of biomedical signal processing seems to hold a very promising future. The field is still in its early stages and extensive research is being held in many institutions around the globe. Advanced uses of technology has designed a quite versatile impact in the medical research field. With this use of sensors, the dependency on the man-power will be reduced to quite an extent. These sensors provide a fast reading and help the doctors to operate fastly to a patient.The human body scanning system could be made more sophisticated by incorporating load, heart beat and temperature sensors.It will be quite helpful in keeping the clinical information database of all data regarding the patients in electronic form. The patient call switches help emergency situations to be handled quickly. The future enhancements can be easily implemented. The education of the wired number, length and weight through the use of load sensors. The use of ATMEGA16 microcontroller is also quite handful.

VI. CONCLUSION

In biomedical signal processing, the aim is to extract clinically, biochemically or pharmaceutically relevant information in order to enable an improved medical diagnosis. All living things, from cells to organism, deliver signals of biological origin. Such signals can be electric, mechanical, or chemical. All such signals can be of interest for diagnosis, for patient monitoring and biomedical research. This paper has cover the instruments and senors related to the patient handful operations. It is a rapidly expanding field with a wide range of applications. ix. Health status of a human being can be traced down very fast. The wide wireless capability would allow doctor to occur the patients database using their word held computers. Driver circuits and alarms may be used on a large scale modification of this project. It will reduce much to the risk of diseases like heart attack and many more. It will reduce the human dependency on doctors. Robotic doctors will be named inspite of human doctors. This enhancement will enable monitoring of patients to be more flexible and strain-free.

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