Thermistor based Apnoea Monitor

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Abstract- *We have designed an apnoea monitor for low resource environments. The device calculates a patient's breathing rate by detecting changes in temperature when the patient breathes through a mask. Features of the device include an alarm that is basically a piezoelectric speaker which goes on at abnormal condition. This portable device can be used anywhere to give an alert when a patient stops breathing.*

Key words: Apnoea, breathing, rate, temperature, piezoelectric, speaker

1.INTRODUCTION

The respiration rate is the number of breaths that a patient takes each minute. The rate is usually measured when a person is at rest and simply involves counting the number of breaths for one minute by counting how many times the chest rises. Respiration rates may increase with fever, illness and with other medical conditions. Normal respiration rates for an adult person is 12 to 20 breaths per minute. Recent studies suggest that an accurate recording of respiratory rate is very important in predicting serious medical events. Both an increased and decreased respiratory rate can be a sign that something is amiss in the body. An abnormal rate is fairly nonspecific, meaning there are many causes of both a rapid and a slow rate. It's important again to note that the normal ranges are for people at rest.

1.1 Block diagram explanation

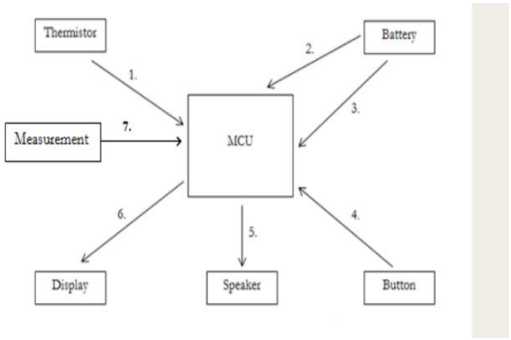

Fig-1: Block diagram of Apnoea monitor

1. Thermistor:

We used thermistor based measuring system to measure the breathing rate of the patients. The thermistor used is LM35 temperature sensor which is mounted inside a mask which is worn by the patient. The respiratory rate count from respiratory system by using LM35 i.e. the no. of time sensor sense the breathing temperature in one minute is counted and that is nothing but the respiratory rate count in one minute .

2. Mask:

An oxygen mask provides a method to transfer breathingoxygen_gas from a storage tank to the lungs. Oxygen masks may cover the nose and mouth (oral nasal mask) or the entire face (full-face mask). They may be made of plastic, silicone, or rubber.

Mask cover the nose and mouth that's why we use this mask here for taking a temperature from respiration and given to the sensor .

3. Power supply:

Our device can be powered through standard AC power supply using adapter with12VDC.

4. Speaker:

There are alarm for device generated by a piezoelectric speaker. The device gives alarm if there is an abnormal condition .

5. Respiration Rate Display:

Breathing rate is measured and displayed in breaths/min with waveform on LCD and GLCD. This allows whoever is monitoring the patient to see if the patient is breathing too fast or too slowly.

Fig-2: A LCD of 16 columns and 2 rows

2.HARDWARE DESIGN AND IMPLEMENTATION

The hardware of our project has following components

- LM35 temperature sensor
- LCD Display
- GLCD Display
- Power Supply
- PIC Microcontroller

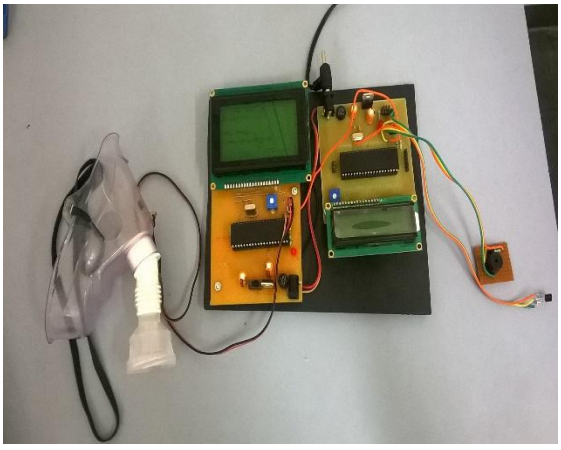

Fig-3: Hardware of the apnoea monitor

1.LM35 temperature sensor:

We have used a thermistor based measuring system to measure the breathing rate of the patients. The mask is a standard nebulizer mask that is used by asthma patients .The LM35 is mounted inside the mask so that it is directly in front of the patient's mouth. As the patient breaths the difference between inhalation and exhalation temperature is plotted as the graph of breathing rate. The environmental temperature is also measured using another LM35 for reference. We used this sensor because its output voltage is linearly proportional to the temperature(deg celsius). Its accuracy is 0.5 deg Celsius.

2. LCD and GLCD:

LCD/GLCD(Graphical/Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16*2 LCD display is very basic module and is a very commonly used in various devices and circuits.

3. Power Supply:

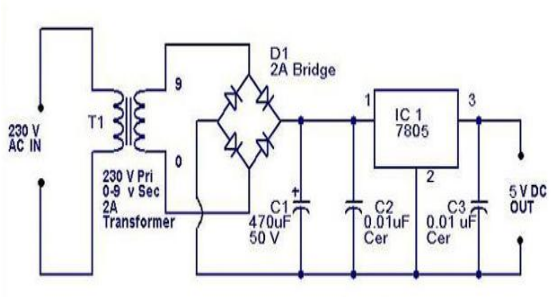

Fig-4: circuit diagram of power supply

The power supply section consist of step down centre tap transformer of 230V primary to 9V and 12V to secondary voltage for the +5V and +12V power supply respectively. The step down voltage is then rectified by diode. The high value of capacitor are used to remove the noise. The power supply gives constant regulated supply i.e. +5V by using 7805 regulated IC. This IC filters the high frequency spikes.

4. PIC microcontroller:

The PIC microcontroller we have used in the project is PIC16F877A. Only 35 single-word instructions to learn. All single-cycle instructions except for program branches, which are two-cycle Operating speed: DC 20 MHz clock input DC 200 ns instruction cycle. Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes

of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory. Pin out compatible to other 28-pin or 40/44-pin PIC16CXXX and PIC16FXXX microcontrollers. Self-reprogrammable under software control. Programmable code protection. Power saving Sleep mode, Selectable oscillator options, In-Circuit Debug (ICD) via two pins.

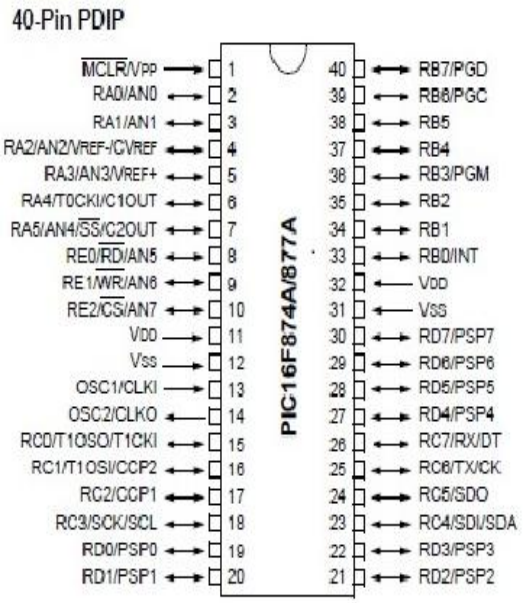

Fig-5: pin diagram of PIC16F877A

3.RESULT AND CONCLUSION

Our project has the following results and conclusion-

- It measures respiratory rate with an error less than 10%.
- The start up time is less about 30 seconds.
- It displays the condition and waveform of respiration of the patient.
- The indication of an abnormal condition is done by the piezoelectric speaker going on.

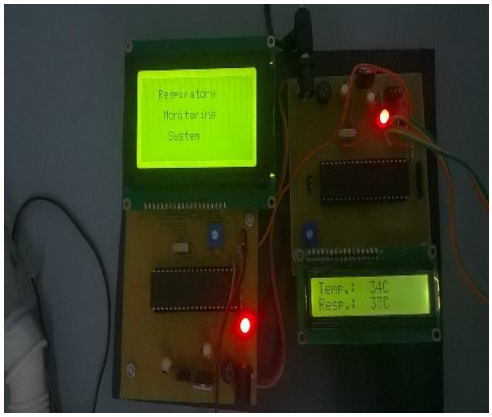

Fig-6: final outcome of Apnoea monitor

Therefore we have developed a portable and accurate monitor that counts the respiration rate per minute and helps in indentifying the condition of apnoea in a person. Because of the components used in making the monitor it is a low cost device.

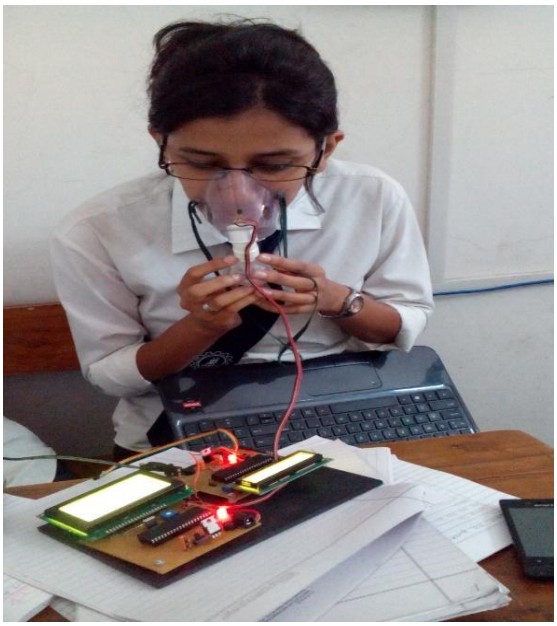

Fig-7: Example of a person using Apnoea monitor

4.ADVANTAGES

- The designing of our project and the components used make it a very cost effective product to use.
- Simplicity of design makes the device very easy to use. Any person in the house can use it with ease.

- The best advantage of our project is the compact design which makes it portable. Hence it can be used while travelling as well.

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