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LOW COST PATIENT CONDITION INDICATOR SYSTEM FOR HOSPITAL USING RF COMMUNICATION

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ABSTRACT

The project low cost patient indicator system was developed to assist doctors who handle many patients. The amount of patients is increasing day by day but doctors are not increasing in that rate then one doctor has to handle many patients. When patients are in critical condition, doctors should always have to pay their attention. When handling multiple patients they have to work hard and always keep in touch with patients. This is not an easy task therefore low cost patient condition indicator system is introduced. It consists of two parameters of the patient condition, heartbeat rate and the oxygen saturation of the blood. A clip is fixed to patient's finger and it consists of heartbeat sensor and oxygen saturation sensor. The reading taken to microcontroller and transmit the data and receiving part consists of the doctor's room. Patient condition can be monitored through the display. An alarm will generate if a patient condition is in critical then the doctor can treat that patient. This is the basis of this project. The heartbeat sensor and pulse oximeter sensor generate the pulse with noises and this system is removed the unwanted noises and amplify the proper signal then the signal drives to microcontroller circuit. The calculations of the heartbeat and oxygen saturation level per minutes are done by the microcontroller and pass that value to doctor's room through Radio Frequency. As a result of the system doctor can see the patient condition in every 10 seconds.

Keywords: SpO_2, Heartbeat Measuring, RF Communication, Encoding and Decoding, Instrumentation Amplifier

1 INTRODUCTION

The heart is one of the most vital organs within the human body. It acts as a pump that circulates oxygen and nutrient carrying blood around the body in order to keep it functioning. The circulated blood also removes waste products generated from the body to the kidneys.

When the body is exerted the rate at which the heart beats will vary proportional to the amount of effort being exerted. By detecting the voltage created by the beating of the heart, its rate can be easily observed and used for a number of health purposes. The optimal oxygen saturation of the blood lies between 95 and 98 percent. This value corresponds to the percentage of hemoglobin molecules which transport oxygen in proportion to the total number of hemoglobin molecules.

On one side, the clip contains a strong light source, which shines through the finger. On the other side, a sensor measures what proportion of the light penetrated through the finger and what was absorbed[1]. Different proportions of light penetrate the finger according to the level of saturation of the blood. From this, the oxygen saturation figure is calculated[4].

The values of the heart rate and the oxygen saturation values are taken to the filter circuit because noises are affected to the output pulses. Second order low pass filter is used having approximately 200Hz. These values are read by microcontroller ATmega32 and transmit the signal to receiving end. HT12E is used in transmitting section and HT12D is used at the receiving end then values are read by microcontroller they display the values in LCD display. An alarm will generate when an abnormal condition of the patient then doctor can pay his attention to the patient[2].

2 METHODOLOGY

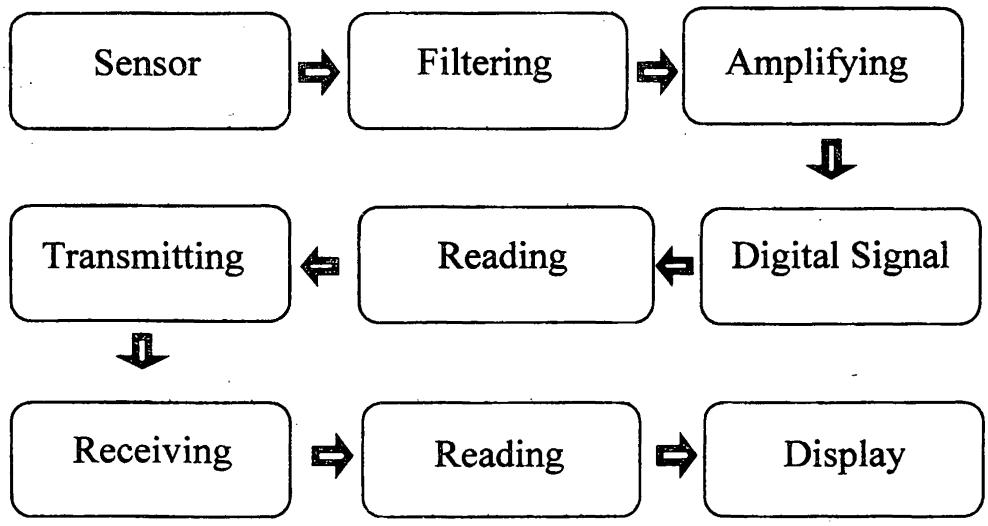

Figure 1: Block Diagram of the System

2.1 Low pass filter circuit

The heartbeat pulse and oxygen saturation pulse are detecting by the sensor with distortion so we use low pass filter circuit to remove noises.

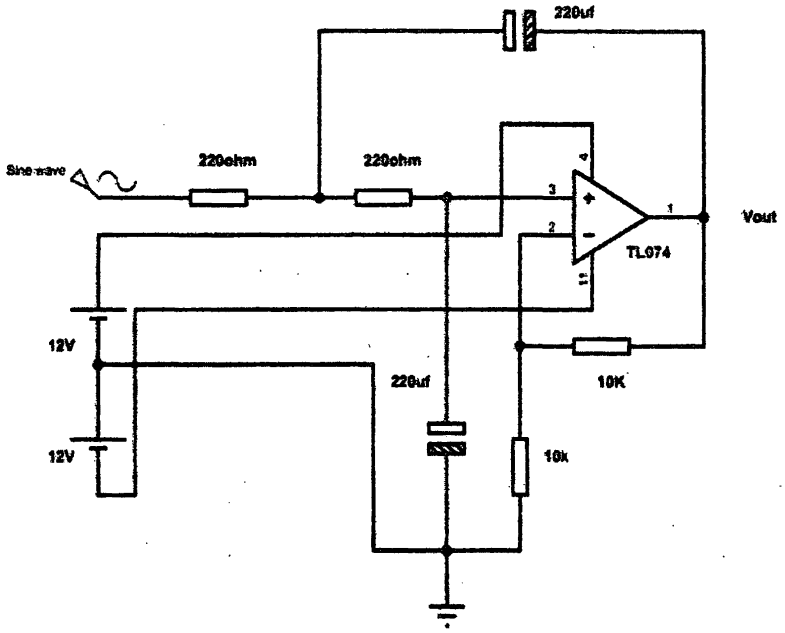

Figure 2: Low pass filter circuit

$$f_c = \frac{1}{2\pi\sqrt{R_1 R_2 C_1 C_2}} \quad (1)$$

$$f_c = \frac{1}{2*\frac{22}{7}\sqrt{220*220*1*220*10^{-6}*220*10^{-6}}}$$

$$f_c = 3.287Hz$$

Where R_1,R_2 are resistors, C_1,C_2 are capacitors, f_c is cut off frequency.

The f_c is 3.28Hz per second so the maximum heart rate per minute is 196.8 Bpm[3].

2.2 Process of the System

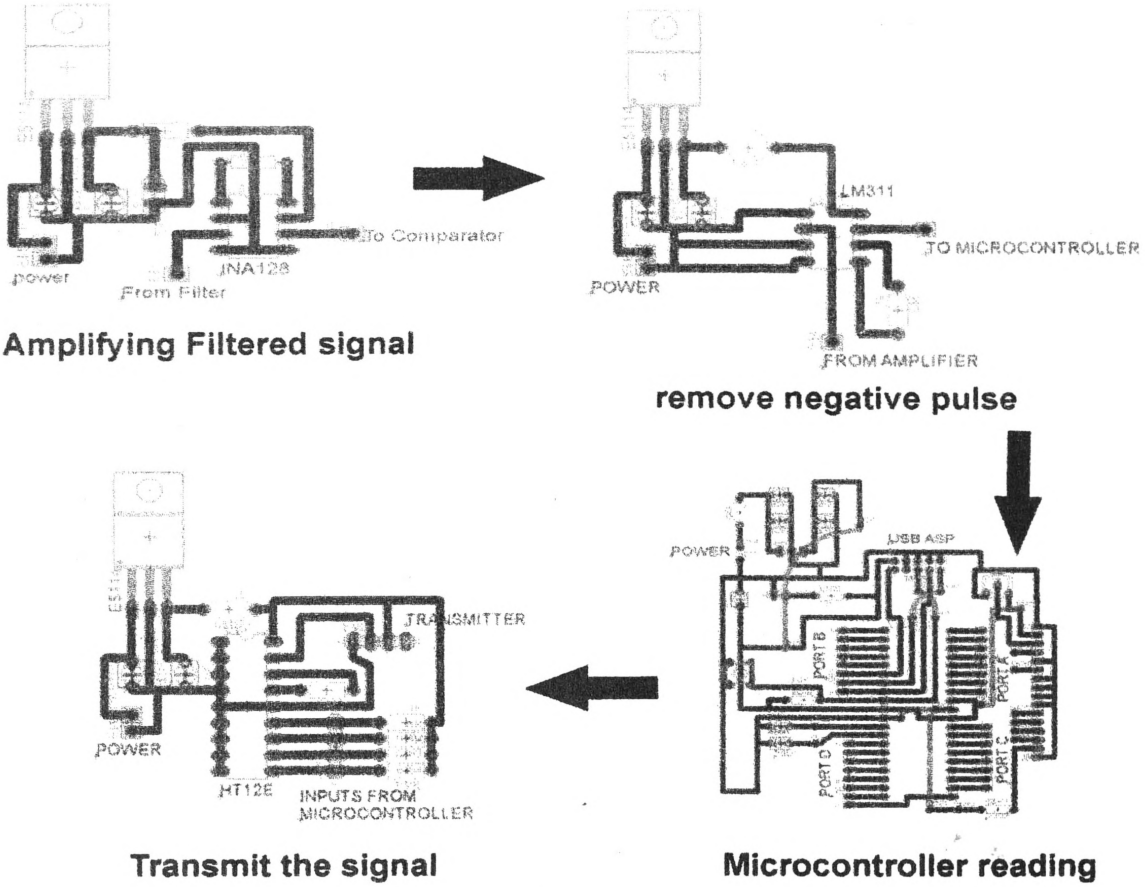

Figure 3: Process of the System

To amplify the original value, INA128 instrumentation amplifier is used. This amplifier can remove unwanted signal. A comparator circuit compares two voltages and outputs either a 1 (the voltage at the plus side) or a 0 (the voltage at the negative side) to indicate which is larger. The negative voltage is grounded in comparator circuit therefore always positive voltages are generating and voltage difference is always positive then the output of the comparator circuit indicate positive pulses only. These pulses are passed to the microcontroller and do its process and calculations then values taken from the microcontroller pass to the encoder. A wireless radio frequency (RF) transmitter can be easily made using HT12E Encoder and ASK RF Module.

2.3 Receiving Process

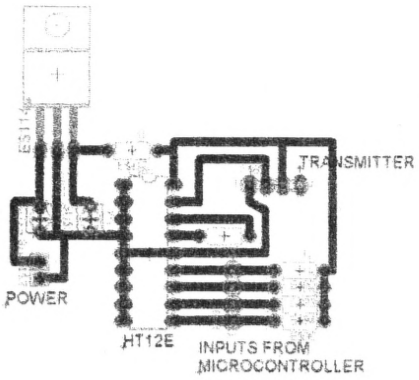

Figure 4: Receiving Circuit

ASK RF Receiver receives the data transmitted using ASK RF Transmitter. HT12D decoder will convert the received serial data to 4 bit parallel data and microcontroller will read the data values and display on the screen[1].

3 RESULTS AND DISCUSSION

When the clip is set to the finger and make power buttons ON, after 10 seconds the LED display show the heart rate per minute and the oxygen saturation as well.

Figure 5: Final result of the System

This system is low cost implementation. Totally budget is around Three thousand rupees. This system can be used at the home then parent can check their kid's health condition when they got sick. Main purpose of this system is introducing an easy way to doctors checking their patients. They can consult multiple patients simultaneously.

4 CONCLUSION

It was a challenging task to complete this kind of system with a limited amount of time, by studying all the patient monitoring systems in the market. Analyzing the requirements, collecting the data, studying existing technologies to implement this system, gathering ideas from resourceful authorities and conducting literature reviews were done in order to achieve the objectives of the system. Those are good experiences that could be very valuable to us in future. Therefore confidence was built on completing any tough task within a given period. By conducting literature reviews different methodologies that were used for the same problem were discussed. Therefore self-learning was improved with this study and learnt how to face challenges and overcome them.

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