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Blood Pressure Measurement using ARDUINO

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Abstract: ***The blood pressure is commonly measured using mercury sphygmomanometer and nowadays it is used with LED sphygmomanometer. The height of the mercury column reflects the blood flow for calculating blood pressure. The blood pressure value is generally measured in millimeter of mercury (mmHg). For each heartbeat systolic and diastolic blood pressure varies. The systole pressure is the maximum pressure at arteries which occurs at the end of the cardiac cycle when the ventricles contracts. The diastole pressure is the minimum pressure at arteries which occurs the start time of the cardiac cycle when the ventricles are filled. In my proposed methodology, the above disadvantages are overcome. The heart rate sensor will be connected to the processor. The heart rate sensor senses the heart rate of the person and date will be fed to the processor. The processor calculates the heart rate, cardiac output, stroke volume, resistance value and finally displays the blood pressure value in the LCD display.***

Index Terms: Arduino UNO, heart rate sensor, LCD

I. INTRODUCTION

The blood pressure is commonly measured using sphygmomanometer. The height of the mercury column reflects the circulating pressure. The blood pressure value is generally measured in millimeter of mercury (mmHg). For each heartbeat systolic and diastolic blood pressure varies. The systole pressure is the maximum pressure at arteries which occurs at the end of the cardiac cycle when the ventricles contracts.

The diastole pressure is the minimum pressure at arteries which occurs the start time of the cardiac cycle when the ventricles are filled. Systolic and diastolic blood pressure are not static it varies from one heartbeat to another. The blood pressure changes its response to stress, diseases, drugs, exercise etc. sometime the variation may be large. The invasive blood pressure measurement is restricted in hospitals because it causes harm to human beings. The non-invasive measurement is simple and quicker when compared to invasive measurement.

The non-invasive measurement is less accurate and there will be some difference in numerical result. It's mainly used for continuous examination and monitoring. The non-invasive blood pressure is measured in many ways some of them are Palpation, Auscultatory, Oscillometric, Continuous noninvasive techniques, Pulse wave velocity, Ambulatory and home monitoring, White-coat hypertension etc. The invasive blood pressure measurement is measured accurately but it affects the human being. By placing the cannulae needle in the arterial line the blood pressure is measured directly and accurately. The cannulae are inserted by palpation or with the use of ultrasound guidance.

The cannulae will be connected to a sterile which is connected to an electronic pressure transducer. The blood pressure is constantly monitored beat-by-beat and a waveform can be displayed. A variety of invasive vascular pressure monitors for trauma, critical care, and operating room etc. These include single pressure, dual pressure, and multi-parameter (pressure and temperature). Blood pressure is the pressure circulating blood around the walls of blood vessels.

The blood pressure is measured in 2 numbers. The first number, systolic blood pressure. It measures the pressure in the blood vessels when our heart beats.

The second number, diastolic blood pressure. It measures the pressure in the blood vessels when our heart rests between beats. The blood pressure is classified as low pressure, high pressure, and normal. In case of normal pressure, the value will be less than 120/80. If the person is having high pressure the blood pressure will be displayed as 120/90. If the blood pressure is in between 120/80 and 120/90 the patient health will be at risk and which may be lead to high pressure.

II. OBJECTIVE

The main objective of our project is to measure the blood pressure using the heart rate sensor.

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III. PROPOSED MODEL

A. Block Diagram Explanation

Blood pressure measurement is commonly measured using sphygmomanometer. Based on the systole and diastole value the blood pressure was calculated. In sphygmomanometer method using of mercury causes hazardous and the accuracy cannot be obtained. The proposed project is developed to measure the blood pressure.

Fig 3.1 is the block diagram of proposed methodology which explains about the blood measuring instrument. Initially the power supply given to Arduino. The driver circuit consists of 9V step down transformer. The basic function of step down transformer is to step down 230V AC to 9V AC to avoid overflow of current to the circuit. From transformer the current passes to bridge rectifier, which covert AC to DC. Further it has 120µF capacitor which smooths the current to perform the next operation. 5V voltage regulator allows single for the microcontroller operation as long as capacity needed for the circuit.

The blood flow sensor is connected to heart rate IR transmitter. In the IR transmitter there is a LED interfaced which show how a person's heart beat is beating at present. The IR transmitter is the heart rate sensor which calculated the heart rate per minute. After that cardiac output, resistance and blood pressure are calculated.

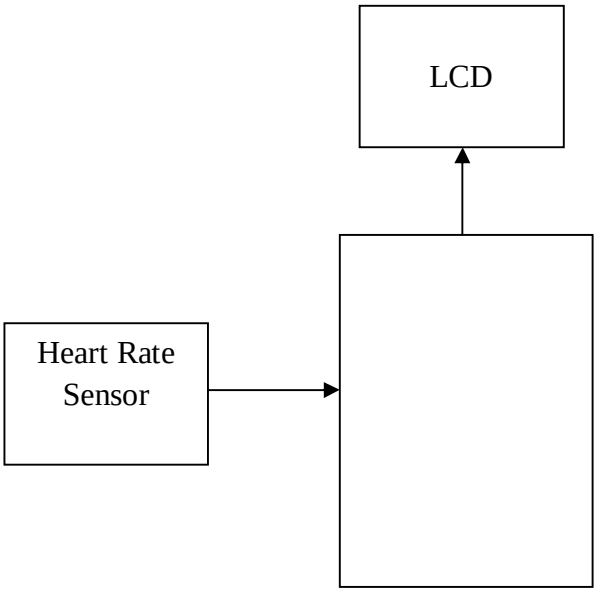

Fig 3.1 Block Diagram of Blood Pressure Measurement

Initially the blood flow is measured and it is fed to heart rate sensor (IR transmitter). From this the heart rate is calculated per minute, this value is fed to the Arduino UNO microcontroller. The cardiac output is measured by multiplying the stroke volume and heart rate. When the resistance is calculated the blood pressure is measured directly. The blood pressure is the product of cardiac output and resistance.

B. Formula

1) Stroke Volume = π * (LVOT dia)^2/ 2 *LVOT VTI
2) Heart rate = Beat/min
3) Cardiac output = Stroke volume * Heart rate
4) Resistance = MAP * 80/Cardiac output
5) Blood pressure = Cardiac Output * Resistance

C. Algorithm & Explanation

This is process flow algorithm for our proposed project.

1) Initially the blood flow will be sensed using the blood flow sensor.
2) After this the heart rate will be calculated.
3) When the heart rate is calculated, the calculation of stroke volume, cardiac output, resistance.
4) Finally the blood pressure is calculated.

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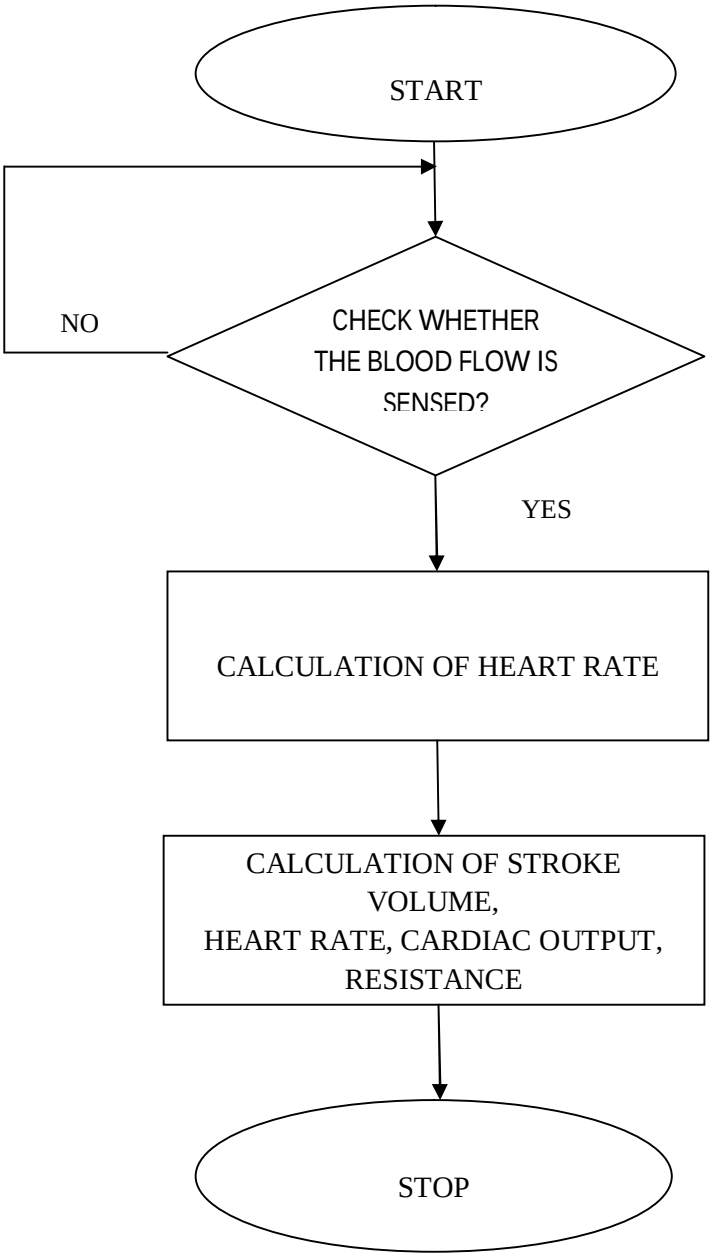

IV. CONCLUSION

Implementation of blood pressure measurement using Arduino UNO, heart rate sensor and LCD display. The project gives solution for mercury used sphygmomanometer and LED used sphygmomanometer. This method gives the accurate measurement of blood pressure. In our proposed methodology the mercury, LED sphygmomanometer problems are overcome. In this the blood pressure is calculated using the formulas of stroke volume, heart rate, cardiac output, resistance and finally blood pressure is calculated.

V. RESULT & ANALYSIS

A. The following Result is Obtained in Our Proposed Methodology

1) Blood flow is sensed.
2) Heart rate is calculated per minute.
3) Data is transmitted to processor for calculation of stroke volume, cardiac output, and resistance.
4) Finally with all these values, the blood pressure is calculated.

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When blood flow is sensed the heart rate is calculated per minute. After this the values are sent to Arduino UNO microcontroller and in this processor the stroke volume, cardiac output, resistance are calculated. Finally blood pressure is calculated.

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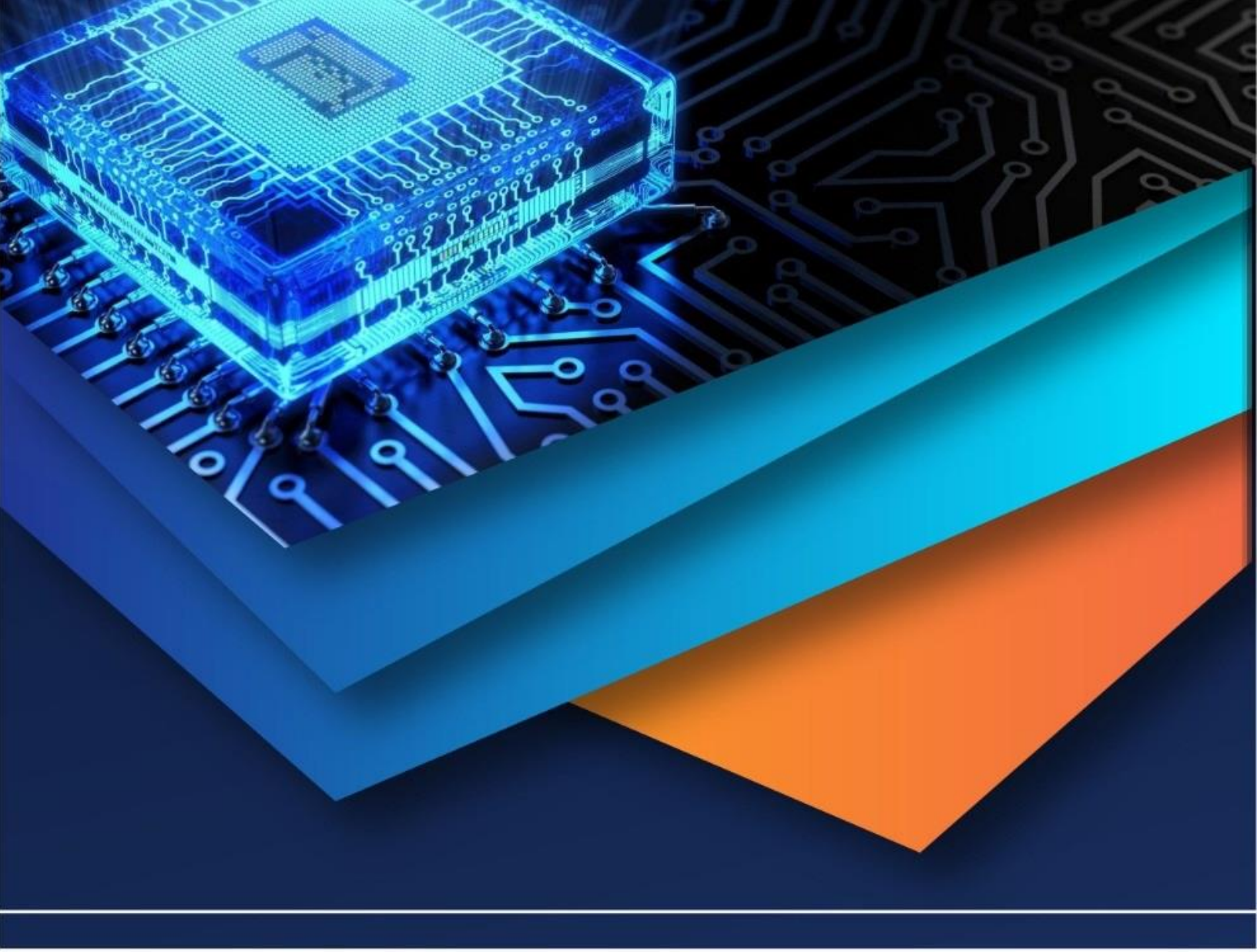

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