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Portable Device for Measuring Heart Rate of Pregnant Women Based on IP Address With BPM Graph Display

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ABSTRACT

Checking the pregnant woman's womb during pregnancy is very important and should be done regularly. In the examination, the calculation of the number of heartbeats in a certain time interval is called beats per minute. The matrix of a person's heart condition is Beats Per Minute (BPM). This research is related to making a prototype of a pregnant woman's heart rate device using a fingerprint sensor. The tool can be used for health experts, namely midwives. The test results of abnormal heart rate of pregnant women are 1 person. This tool is very easy to use because it is portable (easy to carry everywhere) and its use by attaching the fingerprints of pregnant women to the max30100 sensor for 10-15 seconds using the index finger, the sensor will process the data read by the NodeMCU receiving data and the data transmission process is displayed on the IP Addres in the form of BPM. NodeMCU must be connected via wifi / hotspot with one Ip address and must have an account to be able to access on the internet platform, namely google chrome or mozila firefox so that it can be accessed via smartphone or personal computer.

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1. INTRODUCTION

Pregnancy is a series of events that begins with conception and will develop until it becomes an aterm fetus and ends with the process of childbirth [1]. Health for a pregnant woman is very important. This is so that pregnant women can give special attention and care to their pregnancy [2]. Pregnancy has been known to cause hemodynamic stress on the heart and this can result in maternal and fetal complications [3]. Pregnant women are very vulnerable to various health problems that can endanger their lives and their children. One of them is pressure on the heart and circulation system [4]. The results showed that there were 59 cases (66%) of pregnant women with heart disease accompanied by heart failure [5]. In the health examination of pregnant women, the doctor checks the heartbeat of the pregnant mother or fetus which is a parameter for checking the health of the fetus [6]. Fetal well-being monitoring (FWM) is very important as fetal surveillance during antenatal care and during labor [7]. The heart is one of the vital organs in the human body [8]. The role of the heart is very important to pump blood throughout the body [9]. The fetal heart rate (DJJ) is considered a factor to measure the well-being of the fetus in utero [10]. In the examination, the number of heartbeats that occur in a certain time interval is counted, called beats per minute [11]. Fetal Heart Rate is a standard of fetal heart health from a mutually agreed unit in determining whether the fetus being examined is normal or not [12].

The development of electrical engineering is progressing rapidly and extends to the field of medical electronics. Monitoring tools for calculating pulse rate are available, both conventional and digital [13]. Diagnostic tools are used to retrieve information from patient records. Medical records and present the data through display media [14]. Pulse oximetry is usually performed in a rapid response and rapid implementation intensive care unit or room [15].

A device called a probe consists of a light source, a light detector and a microprocessor that can calculate the difference between oxygen-rich hemoglobin and oxygen-deficient hemoglobin [16]. Infrared light is absorbed more by hemoglobin that contains more oxygen than red light absorbed by hemoglobin that has less oxygen [16]. The probe's microprocessor calculates variations in oxygen levels and converts the data into digital values [17]. Between the two lungs in the center of the chest, the heart is a hollow muscle with four rooms. The inner part of the heart, which is to the left of the midline of the chest, is covered and protected by the mediastinum. The heart is about the size of the owner's palm, shaped like a blunt cone, with the upper end sticking out towards the right shoulder and the lower end connecting to the left hip [18]. When blood is pushed out of the heart, the wave felt in the arteries is called a pulse [19]. This pulse, a pressure wave directed from the aortic artery and traveling faster, can be felt in the radial artery and dorsalis pedis artery [20]. Occupation, diet, emotions, lifestyle and age all have an impact on the speed at which the heart beats in good health [21]. This research is a development of research conducted by Y Wahyuni [12] however, in the research developed, this tool can display numeric and graphical variables along with a database or data backup on a web.

2. RESEARCH METHOD

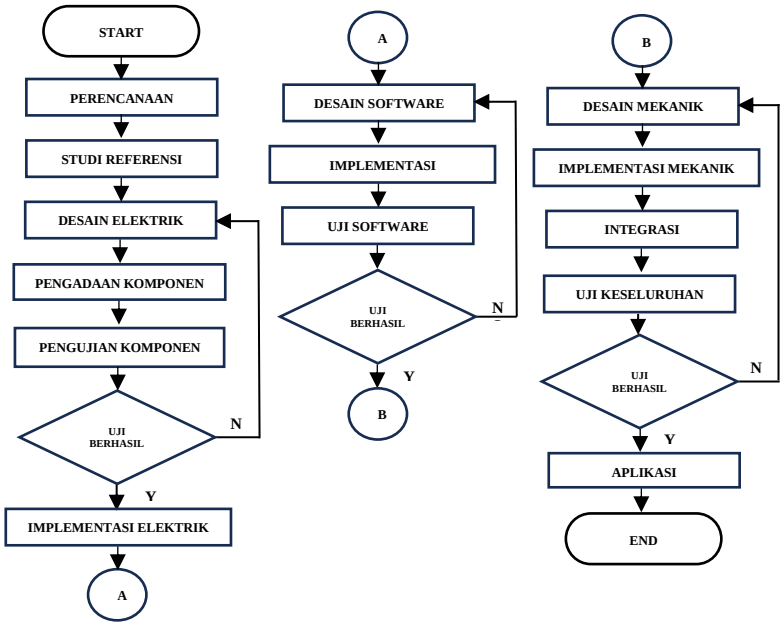

Figure 1. Hardware Programming Research Method

The method used in this research is hardware programming shown in stages: research project planning in the form of preparing the number of tools and supporting needs needed, budget projections and funds as well as the implementation or application of the intended application; Research in the form of preparation of initial research of the application to be made, starting from the selection and testing of components (tools and materials); Component testing (Part.Testing), among others, by performing component work functions based on the needs of the application to be designed; Mechanical System Design (Mechanical. Design, namely by determining the shape and size of the tool, resistance and flexibility to the size of both fingers, placement of electronic modules and testing of the designed mechanical system; Model Design in the form of making a prototype design of a heart rate measuring device for pregnant women based on IoT microcontroller NodeMCU, the entire circuit to be made as minimal as possible so that the tool can work optimally; Electrical System Design (Electrical Design) is made to demonstrate how the components are connected to the circuit; Design Software (Design Software) is made in the form of a flowchart; Functional Test is related to the electrical system and software designed to be integrated during functional testing; Integration or Assembly in the form of software on the controller and electrical module both have been integrated in the mechanical structure that has been made; Overall Functional Testing is carried out by testing carried out from the entire research system; System Optimization is the stage of the entire tool that has been assembled according to the provisions and will maximize performance in this stage.

3. RESULTS AND ANALYSIS

The result of making the tool portable is easy to carry everywhere and this tool has a fairly simple appearance.

Figure 2. Picture of Pregnant Women's Heart Rate Device

BPM Tool specification is that blood oxygen saturation is closely related to lung health. Blood oxygen saturation (SpO2) refers to the concentration of oxygen in human blood, which is a key index for measuring human health. The specifications of the SpO2 tool are 5cm long, 7.5cm wide, 3.5cm thick, the required supply voltage: 220 VAC, NodeMCU ESP8266, Oxymeter sensor used is Max30100 type and LED Indicator.

To get the appropriate results, performance testing of the system as a whole is carried out for each system that is not suitable, it must be checked again if the system is still not in accordance with the objectives. Here are some tests that have been done:

3.1. Component Testing

Table 1. Component Testing

Component		Connect With	Description
NodeMCU ESP8266	Sensor 30100	Pin A0, VCC, GND	Connect
Sensor Max30100	NodeMCU	Pin (+), Pin (-)	Connect

From structural testing for testing components to be properly connected, the NodeMCU A0 component is connected to the Max30100 sensor, the NodeMCU VCC is connected to the VCC pin, and the NodeMCU GND pin is connected to the Max30100 sensor.

ThingSpeak

```
#include <ESP8266WiFi.h>;
#include <WiFiClient.h>;
#include <ThingSpeak.h>;

const char* ssid = "Wifi Keluarga"; //Your Network SSID
const char* password = "sokgratis"; //Your Network Password
int val;
int PulseSensorpin = A0; //Pulse Sensor Pin Connected at A0 Pin
WiFiClient client;

unsigned long myChannelNumber = 1815782 ; //Your Channel Number (Without Brackets)
const char * myWriteAPIKey = "009F8GM9ZIWB7UKU"; //Your Write API Key

void setup()
{
 Serial.begin(9600);
 delay(10);
  // Connect to WiFi network
  WiFi.begin(ssid, password);
  ThingSpeak.begin(client);
}

void loop()
{
  val = analogRead(PulseSensorpin); //Read Analog values and Store in val variable
  Serial.println("Pulse Sensorvalue=  "); // Start Printing on Pulse sensor value on LCD
  Serial.println(val); // Start Printing on Pulse sensor value on LCD
  delay(10);
  ThingSpeak.writeField(myChannelNumber, 1,val, myWriteAPIKey); //Update in ThingSpeak
```

Figure 3. NodeMCU ESP8266 Program Testing

For NodeMCU ESP8266 testing, it is carried out by providing a program by uploading the command program, after which the results of the command execution can be seen through the Arduino serial number shown in Figure 3.

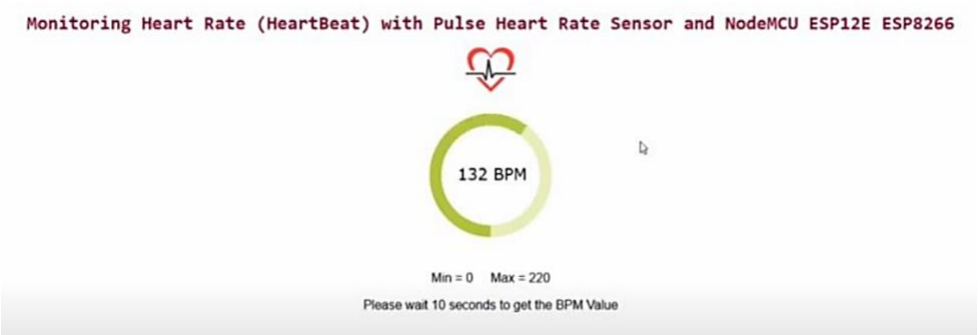

Figure 4. Testing Heart Rate Monitoring Using IP Address

How to use the IP Address is by opening the IP Address page found on the Mcu Esp 8266 Node then for ten seconds place a finger on the sensor using the index finger making sure the tip of the finger is not damp or exposed to water so that the sensor reading can be accurate and wait for ten seconds then the graph display will display the results of the heart rate BPM reading.
Tabel 2. Pengujian Pengujian Pengukuran BPM

3.2. Validation Testing

At this stage, testing the Max30100 sensor against fingerprints or finger prints, testing the transfer of NodeMCU ESP8266 data values to the IP Address, and testing the transfer value of the data retrieval process from the IP Address. The following is the Max30100 sensor test.

Table 2. BPM measurement in pregnant women

No	Name	Age	Category	Trimester			Description
				I	II	III	
1	Ajeng K	28	Adults	90	102	110	Normal
2	St. Fatimah	27	Adults	95	98	97	Normal
3	Sulastri	25	Adults	91	93	100	Normal
4	Siti Aisyah	29	Adults	90	88	92	Normal
5	Indah S	26	Adults	90	95	101	Normal
6	Riska P.S	28	Adults	92	94	97	Normal
7	Kartika P	37	Adults	101	107	110	Abnormal
8	Suci Indah	32	Adults	89	92	95	Normal
9	Vinna D	31	Adults	91	93	95	Normal
10	Iim Rohimah	40	Adults	94	98	103	Normal

In table 2 above, it is explained that the data collection of pregnant women patients ranges in age from 25-40 years, it is clear that the above only displays the results of the patient's heart rate because here the author takes the conclusion of the heart rate relationship to summarize the existing results because if the patient's heart rate condition is normal then we can see that there are abnormal pregnant women.

4. CONCLUSION

This tool can be intended for health experts, especially in obstetric services, this tool has been successfully tested to determine the heart rate of pregnant women in BPM which is displayed through monitoring on the IP Address where the sensor detects by attaching a fingerprint as data input connected to the internet, the index finger is attached with a time of 10-15 seconds. Furthermore, the results of testing this tool obtained an abnormal heart rate of pregnant women there is 1 person. this tool is very easy to use because it does not require too many devices and this tool is easy to store or carry everywhere. For how NodeMCU works, it must be connected to wifi or hotspot with one Ip address and must have an account and the internet platform used is google chrome or mozila firefox.

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