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Smart Identification of Heart Rate in Pregnant Women

Yuli Wahyuni[1*], Asep Denih[2], Irfan Maulana[3]

[1,2]*Department of Computer Engineering, Faculty of Vocational School, Pakuan University, Jl. Ciheuleut Pakuan PO Box 452 Bogor 16143 West Java, Indonesia*

[3]*Department of Technology Computer, Faculty of Math and Science, Pakuan University, Jl. Ciheuleut Pakuan PO Box 452 Bogor 16143 West Java, Indonesia*

**Corresponding author email: yuli_wahyuni@unpak.id*

Abstract

One of the human people who play a role in living one's life is the heart. The workings of the heart is to work in a reflex way. Normal human heart rate in general is between 60 to 100 beats per minute, during sleep the human heart rate can decrease between 10 to 30 beats per minute when asleep (Almajani, 2016). In pregnant women, the heart rate needs to be controlled so as to facilitate the delivery process, the purpose of this monitoring is also to detect early changes in heart rate patterns during pregnancy. At Posyandu Kemuning 1A, Sukamakmur Village, Ciomas, the data collection is still conventional and has not been databased, recorded in the form of a book which is usually reported monthly to the village. From these problems, a website is needed to record data whose data will be stored in the database and can be viewed, edited on the website page or stored in pdf form. In this study, the identification of the heart rate of pregnant women using an android-based pulse sensor. Some of the components used are using the Pulse sensor as input, then the Wemos D1 R1 Microcontroller as the process and the Blynk application and database as the output. The tool that is made serves to detect the heartbeat and the website system that is created functions as a database-based storage medium. The conclusions obtained from the website system that has been created can assist Posyandu officers in monitoring the patient's heart rate and inputting data into the database.

Keywords: Heart Rate, Intelligent, Pregnant Women, Identification

1. Introduction

The heart is an important organ in the human body that acts as the last defense for human life. Humans cannot regulate how fast or how much the heart beats because the heart rate works reflexively. (Rozie, 2016). Normal human heart rate in general is between 60 to 100 beats per minute, during sleep the human heart rate can decrease between 10 to 30 beats per minute when asleep. (Almajani, 2016).

So far, data collection is still in conventional form in the form of monthly reports that are submitted in the village so that a computer-based system is needed where data can be accessed directly anywhere and anytime, namely a website-based system for recording data whose data will be stored in the database and can be viewed, edited on the page. website or saved in pdf form and keep up with the times of technological developments.

Fachrul Rozie (2016) carried out research on pulse monitoring using Arduino Uno and his own application using the Java and XML programming languages in Eclipse with the ADT Plug-in. Mardiansyah (2019) carried out research using a telemetry system and using a pulse sensor as input and the nRF24L01+ transreceiver as a data sender on the patient's heart rate condition to the doctor's room and using an alarm. Then Leni Pratiwi Kardini (2016), carried out research on remote heart rate monitoring using the Blynk application and the Global Positioning System (GPS). Billy Mulia Wibisono (2018), carried out research. A heart rate monitoring system that can carry out continuous monitoring is needed using a pulse sensor and Arduino Uno.

Currently, there are tools for monitoring heart rate, both conventional and digital. However, there are not many tools available that can display a graph of the pulse count on a smartphone and can also send the results to a database. This tool will be designed using a pulse sensor as a means of calculating the pulse, then the blynk application on a smartphone to display a graph of the pulse, and the results of the calculation can also be stored in the database.

The heart rate calculation process is carried out using a pulse sensor as input and the output can be a beat per minute (BPM) display on the LCD or also on an application on a Smartphone. You can also calculate your pulse manually by gently pressing your wrist for 15 seconds. After that multiply the results of the pulse count by 4 to get the number of pulses per minute.

Based on the description above and the results of observations in previous studies, a study entitled "Intelligent Identification of Heartbeats in Pregnant Women was made." Some of the components used are using the Pulse sensor as input, then the Wemos D1 R1 Microcontroller as the process and the Blynk application and database as the output. The tool created serves to detect heart rate and the website system created functions as a database-based storage medium.

2. Literature Review

A. Heart

The heart is a hollow organ that has four chambers. The heart is located between the two lungs in the middle of the thoracic cavity. Two thirds of the heart lies to the left of the midsternal (inner) line and is protected by the mediastinum. The heart is the size of the fist of its owner, shaped like a blunt cone, the upper end extends towards the right shoulder, while the lower end leads to the left pelvis (Syaifuddin, 2009).

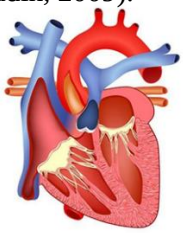


Figure 1: Heart
Source https://www.sehatq.com/article/menilik-more-far-heart-anatomy-and-how it works

At rest the heart can beat 70 times per minute. When there is a lot of movement, the heart rate can increase to 150 beats per minute with a pumping power of 20-25 liters per minute (Syaifuddin, 2006). Quoted from the Mangasa A. S. Manulang Thesis report, according to the book Health Assessment By Patricia A. Potter RN, MSN, the human heart rate is based on age and in a state of sedentary movement, it can be seen in table 1.

Table 1: Human heart rate

Kategori	Umur	Frekuensi
Bayi	Baru Lahir	100–180 denyut per menit
Bayi	1 Minggu–3 Bulan	100–200 denyut per menit
Bayi	3 Bulan–2 Tahun	80–150 denyut per menit
Anak	2–10 Tahun	70–110 denyut per menit
Remaja	10–20 Tahun	60–90 denyut per menit
Dewasa	21 dan lebih	60–100 denyut per menit

B. Wemos D1 R1

In the design, this tool also uses Wemos D1 R1 which is used as a microcontroller. The Wemos D1 R1 display can be seen in Figure 2 below.

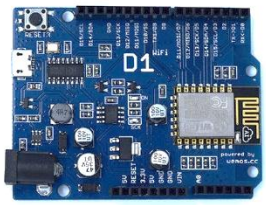


Figure 2: Wemos D1 R1
Source: https://embeddednesia.com/v1/wemos-d1-board-esp8266 -arduino-compatible/

Wemos is one of the board modules that can function with Arduino, especially for projects that contain the concept of IoT. ESP 8266 is a chip that features Wi-Fi and supports the TCP/IP stack. This small module allows a microcontroller to connect to a Wi-Fi network and establish a TCP/IP connection using just a simple command. With a clock of 80 MHz, this chip is equipped with 4MB of external RAM and supports the IEEE 802.11 b/g/n format so it doesn't cause interference to others (Dian Mustika Putri, 2017).

C. Pulse Sensor

Pulsesensor (Gitman, 2013) is a heart rate sensor designed for Arduino. This sensor can be used to facilitate the incorporation of heart rate measurements with data applications into its development. Pulsesensor includes an open source monitoring application.

Figure 3: Pulse sensor
Source: https://www.indiamart.com/proddetail/ pulse-rate-sensor-heartbeat-heart-rate-detector-module-for-arduino-22944740891.html

The pulse sensor is used as an input device to detect the heart rate, the results of which will be displayed in the Blynk application. Heart rate readings using a pulse sensor are carried out with a period of 3 to 7 seconds.

Heart rate readings are carried out in real time with unit readings per second (bpm). The way this sensor works is based on the reflection of the LED light that is affixed to the skin surface of the finger. When the heart beats pumping blood, the blood will flow through the arteries from large to small like the tips of the fingers. (Wibisono 2018).

D. Blynk

Blynk is an application platform on Android and iOS smartphones as a control for the Arduino module, Raspberry Pi. ESP8266 and similar devices via the internet (Agus Faudin, 2017). This application is used for media receiving notifications on smartphones. The Blynk application is used to monitor the results of the pulse count on the smartphone used.

Figure 4: Blynk
Source: https://github.com/blynkkk

E. XAMPP

Sandi stated that XAMPP is a small and lightweight Apache distribution that contains technology in the form of the most common web development from one package (in Nurhayati, 2018). Then Nugroho also stated that XAMPP is a complete web program package that can be used to learn web programming, especially PHP and MySQL, this package can be downloaded for free and legally (in Nurhayati, 2018).

Figure 5: XAMPP
Source: https://github.com/blynkkk

F. Androit

Android is a modified Linux-based operating system for mobile devices consisting of an operating system, middleware, and other main applications. Android is developed by Android Inc. then this company was bought by Google in 2005. Then the Android operating system was launched in 2007 along with the formation of the Open Handset Alliance organization (Huda, 2019).

Figure 6: Android
Source: https://logos-world.net/android-logo/

3. Materials and Methods

3.1. Materials

In this study, there are several objects carried out by researchers, namely objects in reading heart rate values by the Pulse Sensor, making tools for posyandu, output tools in the form of graphics that can be displayed on smartphones, websites for data input while data storage is stored in a database. The research location is at the Nusa Indah Posyandu located in Taman Lestari Housing and on the Pakuan University Bogor. The data used in the form of input data, namely the patient's name, age, address, gender, and BPM. for output data in the form of serial number, name, age, address, gender, and BPM, time of visit and configuration with edit and delete notifications. While the tools used during research related to technology are: Laptop, Intel(R) Processor, Core(TM) I5-5200 2.20 GHz, Windows 10 Pro operating system, 12 GB RAM memory, NVIDIA GeForce 930M. Tools in the form of mechanics, namely: screwdrivers, plastic boxes, double-sided tape. The materials used during the research are: Wemos D1 R1, Pulse Sensor and Jumper Cable.

3.2. Methods

The research phase used in this study uses the System Development Life Cycle method. There are 6 stages in this research method, the research stages can be seen in Figure 7.

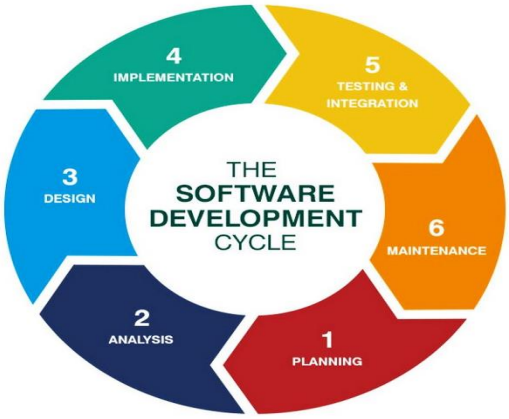


Figure 7: Software development life cycle research stages

4. Results and Discussion

A. Result

Making this tool is made using a Pulse Sensor as an input sensor, then the Wemos D1 R1 microcontroller as a process to connect the sensor with the Blynk application and Sensor with the website. Then the chisel is placed in a plastic project box with a length of 18cm, width 11cm and height 6cm, the overall appearance of the tool can be seen from Figure 8.

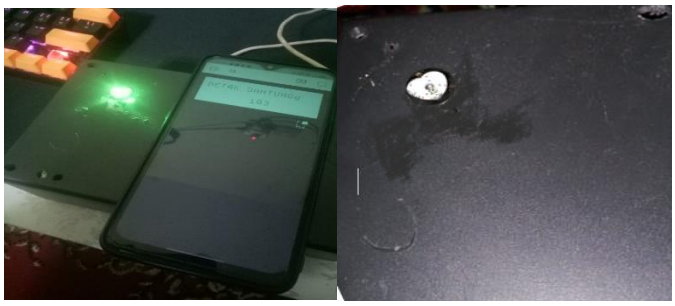


Figure 8: Overall view of the tool

Web creation is done using Visual Studio Code. The initial stage of making a web is to create a form to input data, then the inputted data can be displayed in tables and existing data can be deleted or updated.

1. Login Display

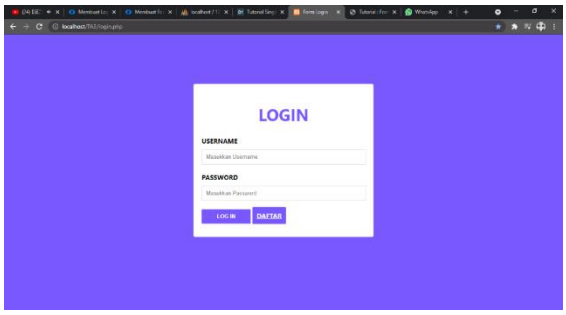


Figure 9: Login Display

2. Display Login Error Notification

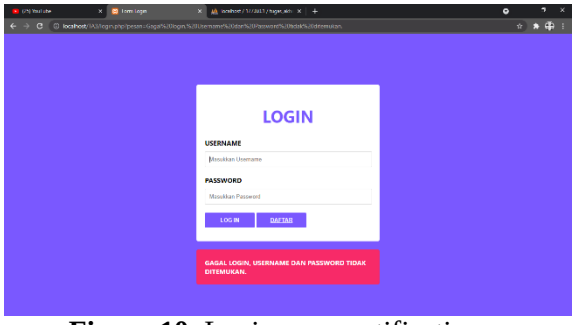


Figure 10: Login error notification

3. Logout Display

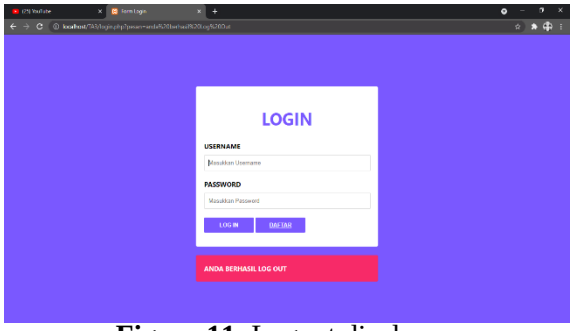


Figure 11: Logout display

4. Account List View

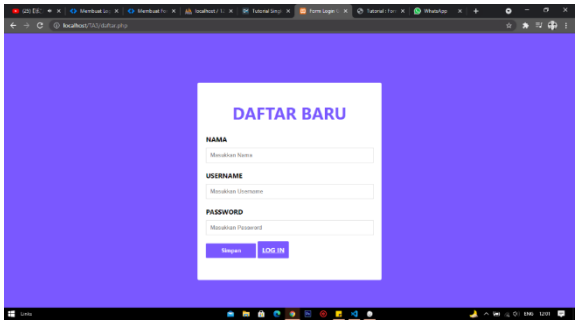


Figure 12: Account list view

5. Display Data Input

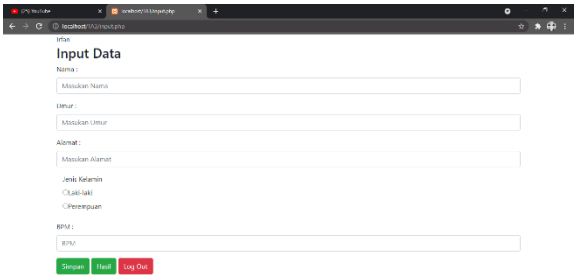


Figure 13: Display data input

6. Notification notification for filling in the empty form

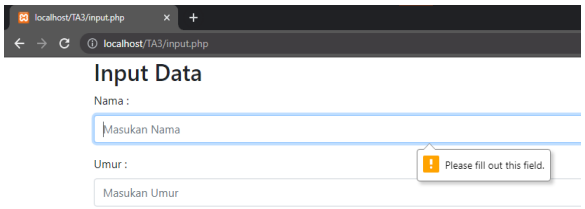


Figure 14: Display notification notification for filling in the empty form

7. Data Results in the form of Tables

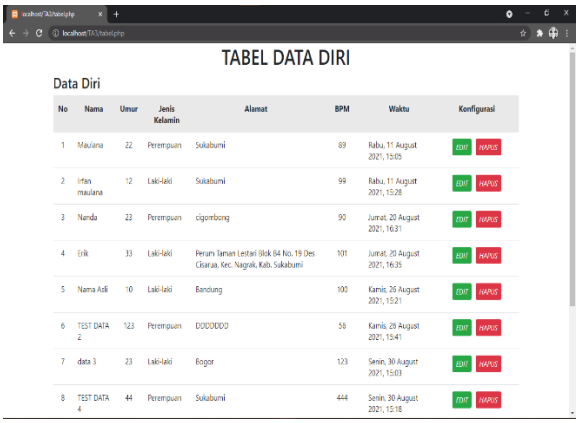


Figure 15: Results table

8. Edit Data Page

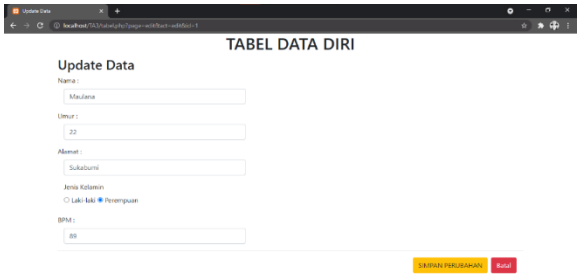


Figure 16: Results table

B. Discussion

After the results of the hardware and software are obtained, then we will discuss how the tool works and also the connection between the web and the database. Starting from input then it will be processed into output that can be displayed on web pages and databases. The system will work if it has been given a 5V voltage on the microcontroller. There are 3 ways to apply voltage to the device circuit, namely:

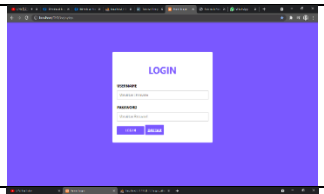
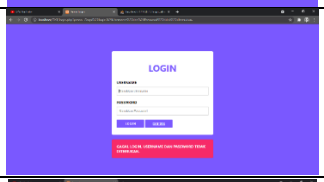
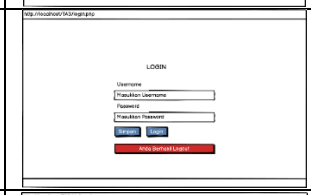
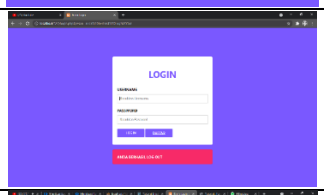
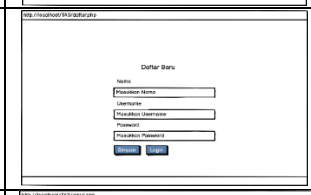
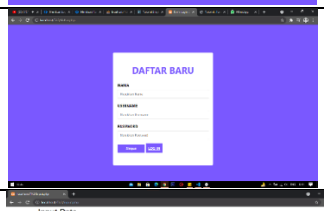
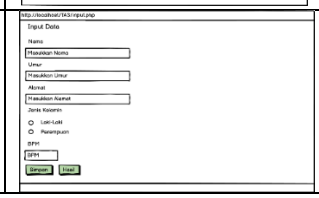
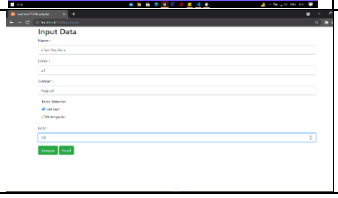
1. By using a USB cable that is connected to one of the ports on your Laptop or computer
2. By using an adapter cable with a voltage of 5V which is connected directly to the microcontroller
3. By using a USB cable that is connected to the Powerbank.

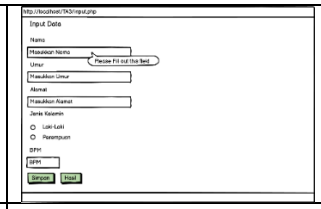
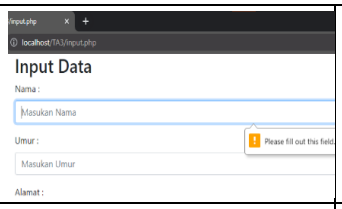
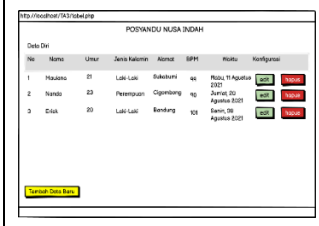
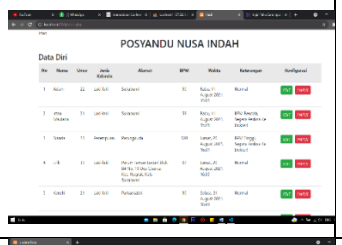
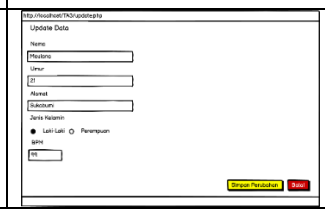
After the tool is powered, the pulsesensor will work and to get the BPM count, place your fingertip on the pulsesensor light to get the BPM count. Wait a while to get a stable count result. The calculation results can be seen in the Blynk application on a pre-configured smartphone. After getting stable results, open the web page to enter the data that has been obtained so that it can be stored in the database that has been created. If the bpm count is more than 120 and less than 60, a notification will appear telling you if the abpm is high or low.

The website system that has been created has one user, namely the admin who is required to login first before being able to input, edit, and delete data in the form of name, address, gender, age, and bpm.

a. Structural Trial

Table 2: Website structural trial stage

No.	Design	Interface	Description
1.			In accordance
2.			In accordance
3.			In accordance
4.			In accordance
6.			In accordance

7.			In accordance
8.			In accordance
9.			In accordance

b. Functional Trial

Table 3: Website structural trial stage

No	Form	*Command Button*	Hasil
1.	Login	1. Log in 2. List	Succeed
2.	List	1. Save 2. Log in	Succeed
3.	Input	1. Save 2. Result	Succeed
4.	Hasil	1. Add new data 2. Edit 3. Dalate 4. Print	Succeed
5.	Edit	1. Save changes 2. Batal	Succeed

c. Validation Trial

Validation trials are carried out to find out the data that has been inputted into the system. This trial phase was carried out in several stages, including tool validation trials and Web validation trials.

1. Tool Validation Trial

This testing stage is done by placing the fingertip on the sensor lamp. Then the calculation results will appear on the smartphone and serial monitor in bpm form, and on ThingSpeak and Serial Plotter in graphic form.

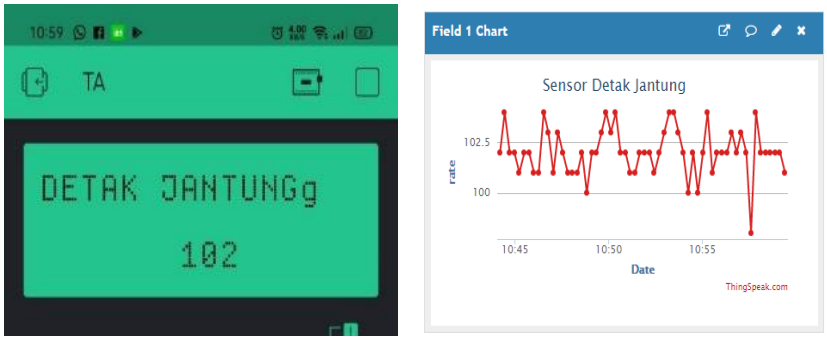


Figure 17: BPM and Graphics Display

2. Website Validation Trial

This testing phase is carried out to find out the data inputted from the web page can enter the database and can also be viewed on the website page. When accessing the website, you are required to login first, then immediately fill in your personal data in the form provided, then the data that has been inputted will enter the database.

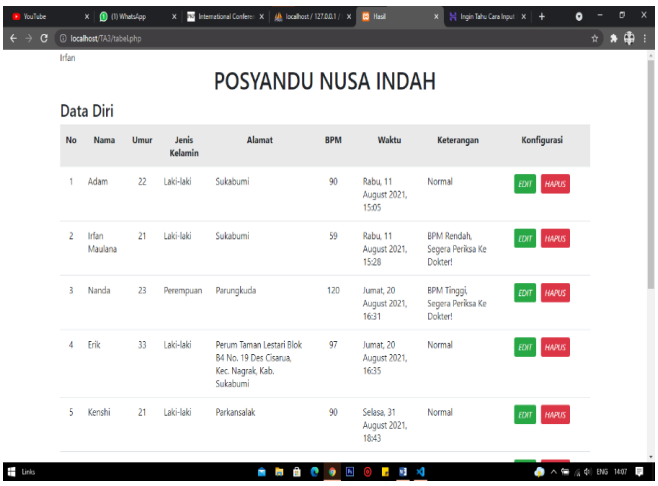


Figure 18: Result Display

Table 4: Website Validation Trial

No	Step	Expected results	Conclusion
1.	Fill out the new personal data form	Data added successfully	Succeed
2	If one of the forms is not filled in	Data Not Saved	Succeed
3.	Pressing the Edit button	Go to Edit page	Succeed
4.	Pressing the Delete button	Data will be deleted	Succeed
5.	Press the add New Data button	Go to Homepage	Succeed
6.	Login with new account	User enters the website page	Succeed
7.	Register new account	Go to the account register page	Succeed

5. Conclussion

The design and manufacture of this Android-Based Heart Rate Identification system uses a box project as a container for a tool that contains a microcontroller and its sensors. Then the output is in the form of a BPM display on a Smartphone using the Blynk application and graphics using Thing speak and storage media using a database. The test results of this system start with the Wemos D1 R1 connected to power and then connected to Wi-Fi. Then the microcontroller connects with the Blynk application that has been configured with the Wemos D1 R1. Then place your fingertip on the sensor light to get the results in the form of bpm which can be seen on the Blynk application display and the Thing speak website. If the results of the count have been obtained, they can be directly entered into the website that has been created. To access the website, you are required to login first, after that you can directly enter data in the form provided. The results can be seen on the website that has been created and can also be saved in pdf file format and can be printed. With the tools and website systems that have been created, it is hoped that it can help Posyandu officers in monitoring the patient's heart rate and inputting data into the database.

Acknowledgments

Thank you to the research team for completing this research well.

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