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Design a Visually Impaired Walker Using an Internet of Thing -Based Smart Bracelet

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ABSTRACT

The eyes are one of the most important senses in the human body. They are used to understanding the surrounding situation so people can understand what is around them. Visual impairment is divided into two types, total blindness and low vision, depending on the degree of disability. A standard walker is a stick that helps you assess the condition of the road and the obstacles in front of you. The developing electric mobility aids are not only walking sticks. A glove-shaped walker was developed to detect objects before the tent and provide information from beeps and vibrations. Produce a walker using a visually impaired smart bracelet using sensor technology to help the blind's vigilance and mobility capable of detecting objects at a predetermined distance. The tool successfully outputs information in human voices recorded in DFPlayer Mini according to the conditions of ultrasonic sensor readings and monitoring of smart bracelets through the blynk application. Operation There are buttons used to turn the system on and off. All sensor inputs and outputs will be processed using the ESP-8266 NodeMCU. From the test results of the entire system, it can be concluded that the smart bracelet runs optimally according to the block diagram the author has compiled. Write down the conclusions of your paper and further research suggestions in the form of narratives and not in bullet or numeral form.

Keywords: *Visually impaired, Walker*, *Internet of things,*

Introduction

The eyes are one of the most important senses in the human body. They are used to understand the surrounding situation so that people can understand what is around them [1][2][3]. The leisure part of society and have the same obligations and rights as citizens, as much as the Almighty's created human beings. Visual impairment is divided into two types, total blindness and low vision, depending on the degree of disability. Not everyone has a normal eye condition, and some people are born with poor eyesight. People with poor eyesight are sometimes called blind[4][5][6]. People with visual impairments often need the help of tools to facilitate their activities, but it can still be done. Therefore, a walker is required for the visually impaired standard

A common walker is a stick that helps you assess the condition of the road and the obstacles in front of you. Various innovations have been developed using electronic technology to provide accurate information about road conditions and obstacles[12]. The developing electric mobility aids are not only walking sticks[13]–[18]. A glove-shaped walker was developed to detect objects in front of the tent and provide information through beeps and vibrationsThe[22].

From the research of Eko Didik Widianto, M. Ikhsan, and Agung Budi Prasetijo in 2021, who made "Information Provider Vests for Blind People Using Multisensor HC-SR04" This research is designed to help and facilitate the visually impaired in activities. Then research from [23]–[26] made "Visually Impaired Walkers Using Microcontroller-Based Ultrasonic Sensors." This research is designed to help the visually impaired in their activities and make it easier for families to monitor the location of the blind because it has been equipped with GPS sensors[21]–[23], [27].

Research Methods

Planning Tools

The planning process for making this tool includes all stages related to the series, namely Hardware and Software planning (programming language), for example, the selection and preparation of each component, PCB manufacturing, installation of parts, and testing of tools[12]–[15].

Hardware Planning

Hardware Planning is a tool that begins with creating a block diagram of the design as a whole. This planning includes the selection of components to be used, the manufacture of a series of schematics and component layouts, the installation of parts, and the last stage, namely finishing.

Designing Tools

At the design stage, this tool has the aim that during the process of making the tool can run well according to what is expected until the end until the device can be used ideally as desired. What is being done now is to create a tool design that aims to determine the layout of components so that components can be installed correctly and regularly.

Tool Installation Process

The process of installing the components of a Visually Impaired Walker Using an IoT-Based Smart Bracelet is shown in figure 1.

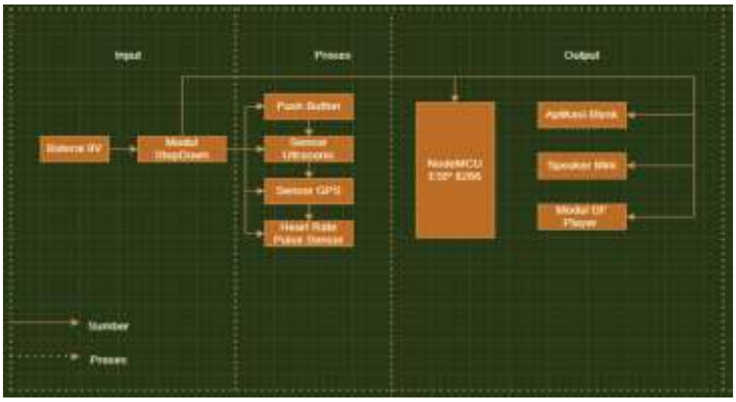

Figure 1 Planning tools

Results and Discussion

The system testing process is carried out to ensure that the design of the blind walker system and remote monitoring for families using the Internet Of Things-Based NodeMCU ESP8266 can run well. To test each component used to determine whether the component can work properly. This stage begins with testing supporting equipment parts such as sensor circuits and monitoring circuits. This test can form a blind walker system through smart bracelets and monitoring for families using the Internet of Thing-based ESP8266 through the blynk application.

Results of Designing a Smart Wristband System and Monitoring System

The results of the design of the smart bracelet using ultrasonic sensors (HC-SR04) and a monitoring system for the family using ESP8266 based on the Internet of Things, in this study where the innovative bracelet user monitoring system in the form of the user's location when traveling outside the house and the user's pulse whether it is at a regular pulse, the average pulse itself is in the range of 60 to 100bpm (beat per minute) if the user's pulse is above average then the ESP8266 will automatically send notifications on the blynk app. The results of the design are shown in figure 2.

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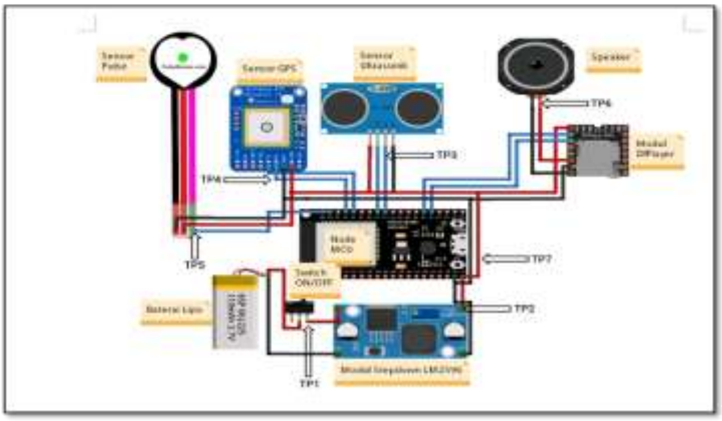

Figure 2 Design of a blind walker

Smart Wristband Weight Measurement

Measurement of the weight of the smart bracelet is carried out to determine the importance of the smart bracelet box itself and ensure that users are comfortable using it. Here are the results of weight measurements from the smart bracelet box.

Figure 3 Wristband weight measurement

Radiation Measurement

Exposure to radiation absorbed by the body is called SAR (Specific Absorption Radiation). Radiation exposure is also influenced by the magnitude of broad unity power (power density). WHO sets the SAR radiation limit at 1.6 W/Kg, and the radiation power density limit is 4.5 watts/m2 for a frequency of 900 MHz. and 9 watts/m2 for a frequency of 1800 MHz. Measurements of radiation results are shown in Figure 4 and Table 1.

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Figure 4 Radiation Measurement

Table 1 Radiation measurement results

No	Radiation Value	Maximum Radiation	Result
1	0.00 MilliSievert	2 millisieverts/year	In Range
2	0.00 MilliSievert	2 millisieverts/year	In Range
3	0.00 MilliSievert	2 millisieverts/year	In Range

In table 1, radiation measurements are carried out on visually impaired walkers using radiation measuring devices three times. The safe limit of radiation exposure in an electronic item is 50 microsieverts. It can be seen in the table above that the blind walker itself gets a value of 0.00 Microsievert on radiation measurements, and it can be stated that the blind walker is safe for daily use.

Component Measurement

Measurements are carried out three (3) times to determine the optimal indigo and consist of several measurement points (TP), namely:

TP1 is a power supply useful for supplying electric current in smart bracelets. TP2 is a step-down module useful as a dc voltage lowering from a 9V battery to 5V. TP3 is an HC-SR04 sensor that uses a smart bracelet as a proximity sensor on visually impaired walkers. TP4 is a Neo 6M GPS sensor that functions as a sensor that detects the location of the smart bracelet user when he is out of the house. TP5 Heart Rate Pulse Sensor (Pulse Sensor) sensor, which monitors the pulse of the smart bracelet user, is at a regular pulse or not. TP6 The mini speaker serves as a notification to the user of the smart bracelet juxtaposed with the HC-SR04 if there is an obstacle or object in front of or on the left side of the user as far as 80 cm. TP7 (NodeMCU ESP-8266) is the central brain for controlling sensors and connections to the internet.

Table 2 Component Measurements

No	Position Measurement	Point Measurement	Unit		Many Measurements					X
					1	**2**	**3**	**4**	**5**	
1	9V Battery	TP 1 (Battery Output)	(Early)	V_{DC}	8,7	8,5	8,3	8,7	8,5	8,54
				I_{DC} (Ma)	150	147	148	145	148	147,6
				V_{DC}	8,5	8,3	8,1	8,5	8,3	8,34

			1/2 Hour	I_{DC} (Ma)	145	143	144	142	144	143,6
			1 Hour	V_{DC}	8,3	8,1	8	8,3	8,1	8,16
				I_{DC} (Ma)	144	142	142	141	143	142,4
2	Step Module Down	TP2 (Output Step Module Down)	(Early)	V_{DC}	4,7	4,8	4,7	4,9	4,9	4,8
				I_{DC} (Ma)	130	128	130	130	127	129
			1/2 Hour	V_{DC}	4,5	4,5	4,3	4,4	4,5	4,44
				I_{DC} (Ma)	128	127	128	127	127	127,4
			1 Hour	V_{DC}	4,5	4,4	4,3	4,5	4,4	4,42
				I_{DC} (Ma)	127	127	127	125	125	126,2
3	HC-SR 04 Sensor	TP3 (Output Hc-sr Input Esp-8266)		V_{DC}	3,37	3,33	3,3	3,36	3,33	3,33
				I_{DC} (Ma)	1,8	1,8	1,8	1,7	1,8	1,78
4	Gps Neo 6 M	TP4 Neo 6M GPS Output to ESP-8266		V_{DC}	3,35	3,32	3,32	3,34	3,32	3,33
5	Heart Rate Pulse Sensor	TP5 Heart Rate Pulse Sensor output to ESP-8266		V_{DC}	3,5	3,3	3,3	3,3	3,3	3,3
6	Mini Speakers	Mini Speaker Output		V_{DC}	3,5	3,3	3,3	3,3	3,4	3,36
7	ESP 8266 MCU nodes	Output ESP-8266		V_{DC}	4,7	5	5	4,7	4,9	4,86

Table 2 above is the value on each component when measured, for the HC-SR04 sensor, GPS Neo 6M, and Heart Rate Pulse sensor, which has an output voltage below 5 VDC by looking at the reference on the sensor datasheet, namely 3 VDC to 5 VDC. For the HC-SR04 sensor, GPS Neo 6M and Heart Rate Pulse Sensor will run properly.

Sensor Testing

Sensor testing is carried out to find out the work and results on the sensor to be used, determine whether the sensor is suitable for use or not, and determine the sensor's accuracy. The sensors to be tested are as follows.

HC-SR04 Sensor Testing

The HC-SR04 sensor is tested to determine the sensor's accuracy in detecting the distance used on the smart bracelet as a notification to the user if there are objects or obstacles in front of and beside the user. Here are the results of testing the HC-SR04 sensor on the smart bracelet. Test Results are shown in the figure

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Figure 5 Hc-Sr04 Sensor Testing

Table 3 HC-SR04 Sensor test results

NO	Measurement distance	Distance Detected	Percentage of error
1	80 cm	78 cm	2,5 %
2	80 cm	77 cm	3,75 %
3	80 cm	78 cm	2,5%
4	80 cm	76 cm	5 %
5	80 cm	77 cm	3,75 %

In table 3, you can see the measurement results of the distance sensor measurement applied to the smart bracelet. On this sensor, it is explained that when in front of the smart bracelet user there is an object or obstacle with a distance of 80 cm in front of it, the proximity sensor (HC-SR04) will detect the object and trigger the life of the speaker as a notification to the smart bracelet user.

Monitoring Objects Around Smart Bracelet Users
In the picture above, testing has been carried out on the HC-SR04 sensor monitoring system through the Blynk application. It can be seen in the picture given a red box that on the left side of the smart bracelet user, there is an object detected as far as 29 cm, while in front of the smart bracelet user, there is an object with a detected distance of 13 cm.

Figure 6 Hc-Sr04 sensor display on the Blynk app

Heart Rate Pulse Sensor Testing

The heart rate pulse sensor test results, which are carried out three times to determine the pulse rate response, can then be displayed on the blynk android smartphone application. In three tests, the user's pulse was declared safe because the vibration was in the safe range of between 60-100 BPM (Beat Pe Minute). The Heart Rate Pulse Sensor Test results are shown in figure 7 and table 4.

Figure 7 Pulse sensor testing

Table 4 Pulse test results

NO	Pulse Rate Safe Limit	Pulse Detected	Result
1	60-100 BPM	91 BPM	In Range
2	60-100 BPM	87 BPM	In Range
3	60-100 BPM	90 BPM	In Range
4	60-100 BPM	83 BPM	In Range
5	60-100 BPM	88 BPM	In Range

Conclusion

After the design, testing, and analysis of the system. So it can be concluded that several things can be used for further development improvements: Overall, the tool has worked as it should and is running well. Measurements at each component point have obtained results, and the error percentage is no more than the maximum error. This research has resulted in a walker using a visually impaired smart bracelet using sensor technology to aid the alertness and mobility of the visually impaired capable of detecting objects at a predetermined distance. The tool successfully outputs information in human voices recorded in DFPlayer Mini according to the conditions of ultrasonic sensor readings and monitoring of smart bracelets through the blynk application. The blynk application can monitor all sensors on the smart bracelet, including:

a.Hc-Sr04 sensor (Distance Monitoring)
b.Gps Neo 6 m (Real-Time Surveillance Location)
c.Heart Rate Pulse Sensor (Pulse Monitoring)

Operation There are buttons used to turn the system on and off. All sensor inputs and outputs will be processed using the ESP-8266 NodeMCU. From the test results of the entire system, it can be concluded that the smart bracelet runs optimally according to the block diagram the author has compiled. Write down the conclusions of your paper and further research suggestions in the form of narratives and not in *bullet* or *numeral form.*

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