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Design An Infant Warmer With Android-Based Temperature Monitoring

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Abstract

Infant Warmer design testing or calibration with Android-based Temperature Monitoring is highly dependent on infant warmer modeling equipped with a microcontroller-based APGAR timer using 2 modes (water mode and skin mode) the timer can be activated by sound. The purpose of this research is to design an infant warmer tool with an Android-based temperature monitoring system using a research method consisting of several stages including the required voltage supply of AC 220V and dc voltage supply required by 5V, temperature setting in this Infant Warmer Design tool using temperature settings 36 - 37 °C , an effective distance of 8 meters of temperature monitoring, and a display on LCD devices and android apps. The result of this research is an infant warmer design module with Android-based monitoring and temperature monitoring with the application can work according to its function. The correction value measured in the temperature test was 33 °C at 0.16 °C, the temperature was 35 °C at 0.085 °C, the temperature was 37 °C at 0.1 °C, so the prototype could still be used. The relative percentage of errors is 0.2 % - 0.4% .from the comparison between kalibtor incu analyzer tools.

Keywords: *Infant Warmer, Monitoring Temperature, Android-based*

I. INTRODUCTION

INFANT warmer is an electromedic device used to provide comfort and warmth to newborns. In newborns with a gestational age of 37 weeks to 42 weeks, weighing 2500 grams born 4000 grams is the most critical period of intrauterine life transition to extrauterine life, on the basis of the findings of a baby who can not regulate their body temperature so that they experience stress with changes in the environment[2] it takes a

place that can provide a warm feeling as it is still in the womb. Neonate temperature should be monitored periodically every 4 hours to maintain a body temperature of around 36.5°C – 37.5°C[3].

Fig. 1. Infant warmer device

Previous research has been conducted in the infant warmer team using a microcontroller consisting of 2 modes namely water mode and skin mode and APGAR TIMER settings using sound signals. Infant warmer is a tool to warm the baby. This tool is functioned as a baby sanctuary for those born early or post-caesarean section. Infant warmers are also a temporary shelter to stabilize the body temperature of babies born with hypothermia shown in Fig. 1.

The main components of infant warmer are heater and temperature control. Warmers in infant warmers use dry elements whose temperature can be adjusted as needed. Heat radiation that hits the baby temperature between 35 C - 37 C. Electrical Heating Element (electric heating element) is widely used in daily life, both in the household and industrial equipment and machinery. The shape and type of Electrical Heating Element is variously adapted to the function, installation place and media to be heated. The heat generated by this electric heating element is derived from wires or high electrical resistance tape (Resistance Wire)[6]. 2 main types of electric heating elements are:

1) Basic Shape Electric Heating Element consists of Resistance Wire coated by an electrical insulator. Variations in the shape of heating elements are Ceramik Heater, Silica and Quartz Heater, Bank Channel heater, Black Body Ceramik Heater.

2) Advanced Shape Electric Heating Element is a heating element coated by pipes or sheet metal plates for the purpose of adjusting to the use of such heating elements. Metal materials commonly used are: mild stell, stainless stell, copper and brass. Heaters included in this type are Tubular Heater, Catridge Heater, Band, Nozzle &Stripe Heater.

The Arduino is a board containing microcontrollers and other supporting components along with an input/output (I/O) port[7] which can be seen in Fig. 2.

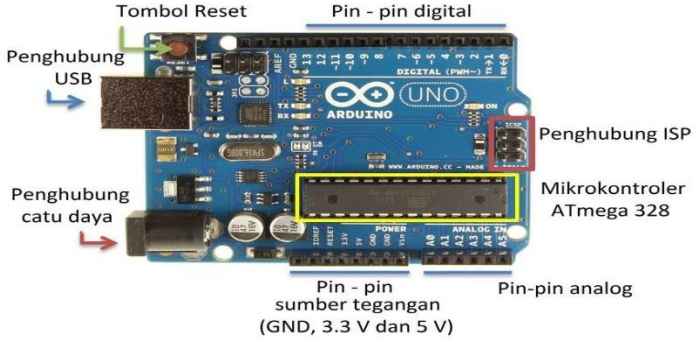

Fig. 2. Arduino Uno

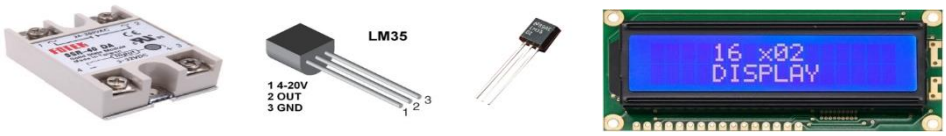

Fig. 3. Solid state relay (left) ; LM35 sensor (middle) ; LCD display (right)

Liquid Cristal Display (LCD) is a component that serves as a data viewer in the form of characters, letters, numbers or graphics [8]. The LM35 is a temperature sensor component that indicates the linearity between the resulting output voltage temperatures. The LM35 requires a current of 60 μA this means that the LM35 has the ability to generate heat (self-heating) from the sensor which can cause a low misreading of less than 0.5 ºC at 25ºC. Solid State Relay is the main component used in the currently designed prototype which functions as a low power circuit interface with a series of high-power equipment[10] shown in Fig. 3.

PWM on the arduino works at a frequency of 500Hz, meaning 500 cycles/beats in one second. For each cycle, we can rate it from 0 to 255. When we give the number 0, it means that the pin will never be worth 0 volts or the equivalent of GND. Whereas if we give a value of 255, then the entire cycle will be worth 5 volts.

II. METHOD

The tools and materials needed to design an infant warmer with android-based temperature monitoring can be seen in Table 1.

TABLE I
SPECIFICATIONS OF SUBSTRATES USED

Description	**Information**
Prototype's Name	Design An Infant Warmer With Android-Based Temperature Monitoring
Voltage	Electricity Supply PLN AC 220V
	Supply Tegangan DC Power Supply 5V
Temperature	Temperature setting at 36 – 37 °C
Distance	Maximum distance of effective tool temperature monitoring at 8 meters

Fig. 4. is a design of the infant warmer diagram block with the way it works is pln voltage into the power supply and heater driver circuit, the power supply converts the AC voltage to DC. power supply provides voltage to the arduino and various components that require the DC middle on the tool, pushbutton serves as input printah to the tool that is as a regulator setting temperature raises and lowers the temperature, then after the tool in the temperature settings then arduino will work printah to various blocks that is there a driver block in charge of controlling the heater in accordance with the settings and monitored by the sensor block that is LM35 as data for feedback in comparing data te mperature. Fig. 5. shows the wiring scheme diagram and flow chart can be seen in Fig 6.

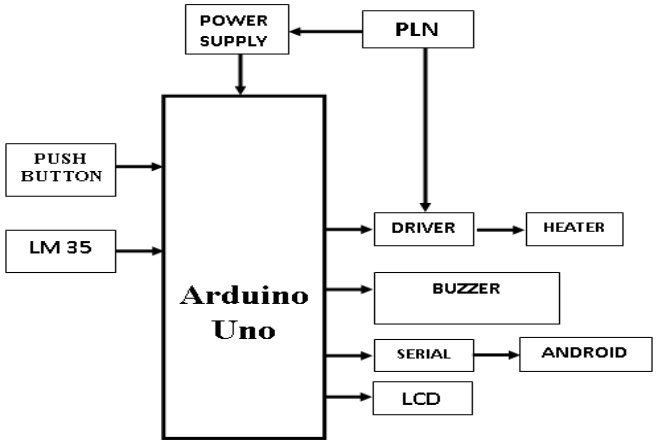

Fig. 4. Block diagram infant warmer

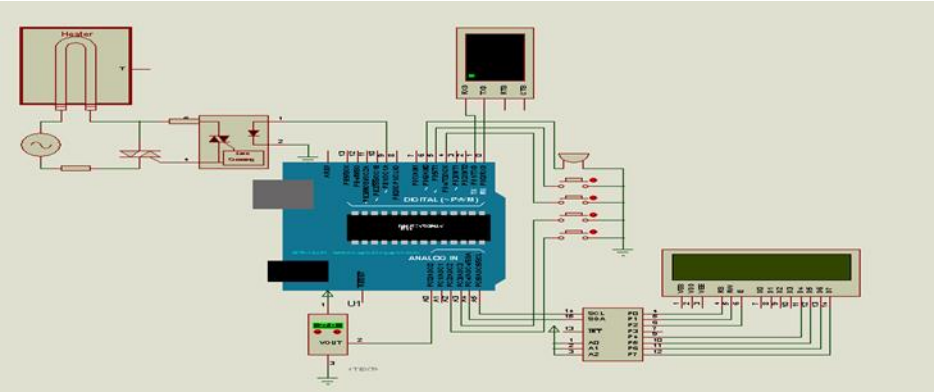

Fig. 5. Wiring design diagram

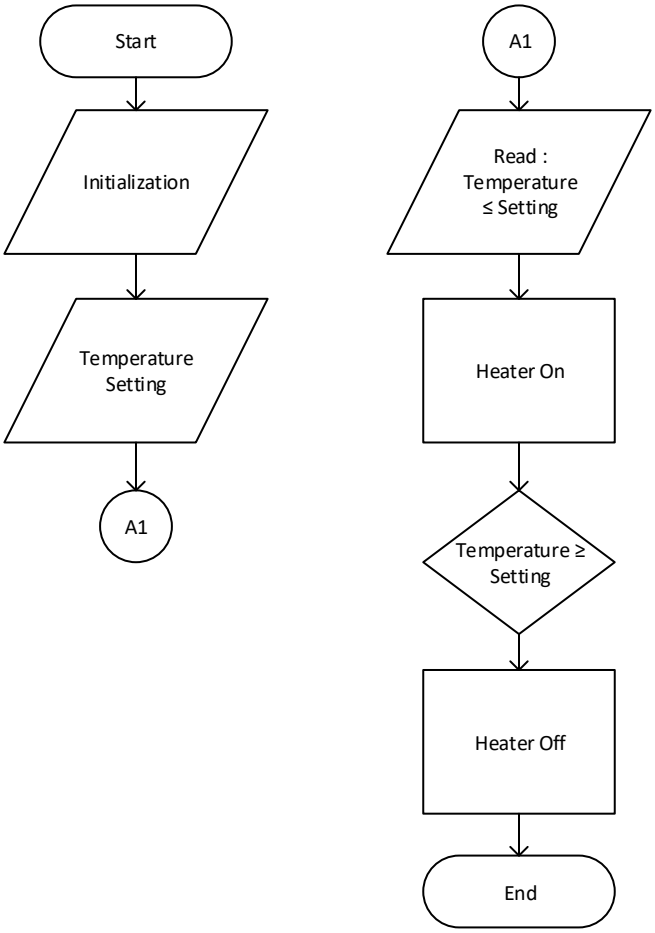

Fig. 6. Flowchart system

III. RESULTS AND DISCUSSION

A. *Design Result*

Fig. 7. shows the design of the prototype. Fig. 8. shows an application called Serial Monitor which is a serial data reader application submitted by Arduino in the following design the application is used as a temperature monitoring application.

Fig. 7. Rear view (left) ; Front view (right) of prototype design

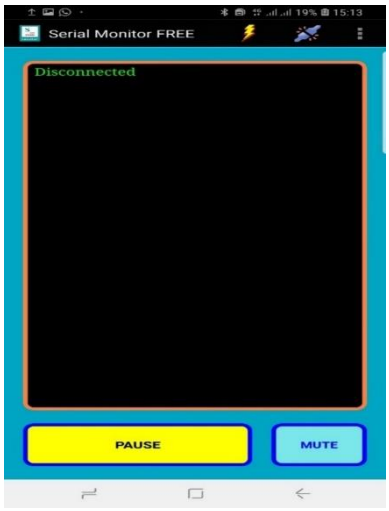

Fig. 8. Serial monitor application design

B. *Function Testing*

The function test aims to ensure parts of the module are functioning properly. The steps that must be done are checking the power cord, all control buttons, visually and audible function tests of alarms, and sensor function tests shown in Table 2.

TABLE II
COMPONENT FUNCTION TEST RESULTS

No	Information	Function
1	AC power cord	Good
2	ON/OFF switch	Good
3	UP Button	Good
4	DOWN Button	Good
5	OK Button	Good
6	Seting Button	Good
7	Buzzer	Good
8	LCD	Good
9	Heater	Good
10	Bluetooth	Good

C. *System Analysis*

Infant warmer temperature measurement, testing is done by comparing the temperature of the tool with the temperature of the Incu Analyzer. Table 3 shows the tests that have been done every 1 minute as many as 6 tests.

TABLE III
INFANT WARMER TEMPERATURE MEASUREMENT AND TESTING RESULTS

Description	Temperature Setting (ºC)	Result and Testing (ºC)					
		I	II	III	IV	V	VI
Calibrator Temperature	33 ºC	33.7	33.68	33.68	33.69	33.69	33.69
	35 ºC	35.64	35.63	35.62	35.61	35.60	35.59
	37 ºC	37.26	37.15	37.13	37.12	37.11	37.11
Temperature Display	33 ºC	33.7	33.7	33.7	33.2	33.7	33.2
	35 ºC	35.7	35.7	35.7	35.7	35.2	35.2
	37 ºC	37.1	37.0	36.9	37.1	37.1	37.1

Power Supply Output Voltage Testing shown in Table 4 using the voltage method already directed by the power supply

TABLE IV
TESTING OUTPUT VOLTAGE

No	Temperature	Output Voltage Sensor	Refference Voltage	Electric Voltage AC
1	30 ºC	300mV	5V	210V
2	31 ºC	310mV	5V	210V
3	32 ºC	315mV	4.9V	210V
4	33 ºC	330mV	5V	210V
5	34 ºC	340mV	5V	210V
6	35 ºC	350mV	5V	210V
7	36 ºC	360mV	5V	210V
8	37 ºC	370mV	5V	210V

Temperature Measurement of infant warmer module with android app shown in Table 5. Temperature readings in the application are conducted indoors with a measurement distance of between 1 to 10 meters.

TABLE V
TEMPERATURE READINGS WITHIN 1 TO 10 METERS

No	Read temperature in the application	Distance	Status
1	35.2 ºC	1 meter	Connected
2	35.2 ºC	2 meter	Connected
3	35.2 ºC	3 meter	Connected
4	35.2 ºC	4 meter	Connected
5	35.2 ºC	5 meter	Connected
6	35.2 ºC	6 meter	Connected
7	35.2 ºC	7 meter	Connected
8	35.2 ºC	8 meter	Connected
9	35.2 ºC	9 meter	Disconnected
10	35.2 ºC	10 meter	Disconnected

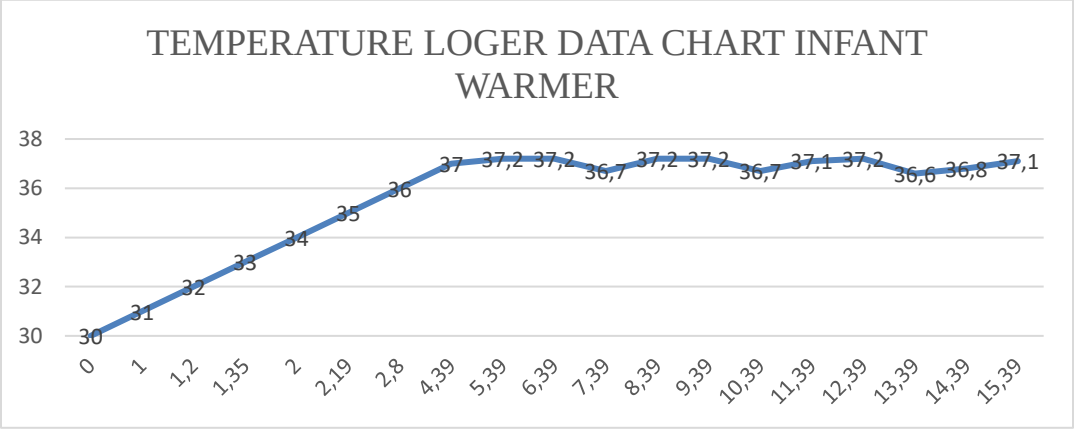

Fig. 9. Temperature testing graph

Figure 9 describes the time it takes for the device to reach a stable temperature or steady state temperature with temperature testing from 30 °C to 37 °C in a stable temperature that takes 6.39 minutes.

IV. CONCLUSION

From the results of research on the design of infant warmer prototypes with Android-based temperature monitoring can be concluded that 1). Prototype can work according to its function, 2). When recording and analyzing the temperature there are deviations and accuracy in the module. Correction value that has been deducted this tool has a correction value that occurs in temperature testing 33 °C of 0.16 °C, temperature 35 °C of 0.085 °C, temperature of 37 °C of 0.1 °C for which this tool can still be used. but the tool module tool has a percentage And has a relative error of 0.2 % - 0.4% .from the comparison between the tool calibtor incu analyzer

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REFERENCES

[1] Qurrahman, Bima Alif. Rancangan Bangun Infant Warmer Dengan Monitoring Suhu Berbasis Android, 2018
[2] Ekawati, Heny.Pengaruh Inisiasi Menyusu Dini (Imd) Terhadap Perubahan Suhu Tubuh Pada Bayi Baru Lahir Di Klinik Bersalin Mitra Husada Desa Pangean Kecamatan Maduran Kabupaten Lamongan,Vol.7 No 1, 2015
[3] Rusiana, Risa.Asuhan Kebidanan Pada Bayi Baru Lahir Dengan Hipotermia Sedang Di Ruang Gayatri Rsu Dr.Wahidin Sudiro Husodo Kota Mojokerto. Laporan Penelitian, 2015
[4] Raiz, Muhamad Lutfi. pemodelan infant warmer dilengkapi dengan APGAR timer berbasis mikrokontroller , 2017
[5] Kadir, Abdul. From Zero to A Pro Arduino .Hal 2, 2015
[6] Kadir, Abdul.Panduan Praktis Mempelajari Aplikasi Mikrokontroler danPemrogramannya menggunakan Arduino.Hal 196, 2013
[7] Nurhayati.Rancang Bangun Alat Pengontrol Suhu Berbasis Mikrokontroler Pada Pembuatan Bioetanol Berbahan Baku Kulit Pisang,"vol. JTE. Volume 01 Nomor 02, pp.1-7, 2012
[8] Hilal, H.,Badaruddin, Yanto,B.H.Switch Peralatan Ac Phase Satu Dengan Menggunakan Solid State Rela.JURNAL SINERGI, Vol. III No. 1, 2007
[9] M. Asvial, S. Budiyanto and D. Gunawan, "An intelligent load balancing and offloading in 3G — WiFi offload network using hybrid and distance vector algorithm," *2014 IEEE Symposium on Wireless Technology and Applications (ISWTA)*, 2014, pp. 36-40, doi: 10.1109/ISWTA.2014.6981191.
[10] Silaban, F. A., Budiyanto, S., & Raharja, W. K. (2020). Stepper motor movement design based on FPGA. *International Journal of Electrical and Computer Engineering*, *10*(1), 151.
[11] Budiyanto, S., Nugroho, A., Nugraha, B., & Sirait, F. (2017). Ip over radio: a performance evaluation for internet of things system with various data transmission technique. *Advanced Science Letters*, *23*(6), 5581-5583.
[12] Ramadhan, E., Firdausi, A., & Budiyanto, S. (2017, November). Design and analysis QoS VoIP using routing Border Gateway Protocol (BGP). In *2017 International Conference on Broadband Communication, Wireless Sensors and Powering (BCWSP)* (pp. 1-4). IEEE.
[13] Silalahi, L. M., Budiyanto, S., Silaban, F. A., & Hakim, A. R. (2021). Design a Monitoring and Control in Irrigation Systems using Arduino Wemos with the Internet of Things. *Journal of Integrated and Advanced Engineering (JIAE)*, *1*(1), 53-64.