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Induction Cookers Use a Hybrid System Powered by Recycled Batteries

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ABSTRACT

Traditional stoves cause fires due to problems and accidents. Induction stoves mitigate this concern by reducing the likelihood of flames and the risk of fire. Induction cookers do not produce flames. The power supply, combined with a recycled 12V 16850 Lithium-Ion battery and a bridge diode, constitutes the primary voltage source that provides 200W of power to activate the ZVS module. Then, connect the ACS712 sensor as a current sensor. The ATMega328 microcontroller controls the system, which is programmed to read and respond to sensor inputs. The sensor results are displayed on the I2C LCD as soon as the ZVS module is powered, when a load is placed on the coil. The results obtained from the first to third minutes of the study showed a water temperature ranging from 32.6°C to 64.9°C with a stable current of 17.5 A. From the fourth to the eighteenth minute, the current decreased drastically to 8A, resulting in an excessively long water heating duration of up to eighteen minutes to reach a temperature of 100°C. This occurs because the ZVS module's working system is not functioning correctly. For further research, consider using a power supply and a higher-voltage lithium-ion battery to accelerate the heating process.

Keywords: Zero voltage switching, Recycled 16850 batteries, Bridge diode, Induction stoves.

ABSTRAK

Penggunaan kompor konvensional seringkali menimbulkan kebakaran yang diakibatkan oleh kebakaran kompor, sehingga untuk membatasi fenomena tersebut kompor induksi dapat menjadi alternatif, karena dengan menggunakan kompor induksi, risiko kebakaran akibat kebakaran kompor dapat dihilangkan. Ini terjadi karena kompor induksi tidak menghasilkan nyala api. Suplai powersupply dan baterai Lithium-Ion 16850 daur ulang 12V digabungkan oleh dioda bridge merupakan sumber tegangan utama yang akan memberikan daya 200W untuk mengaktifkan modul ZVS. Kemudian, dihubungkan sensor ACS712 sebagai sensor arus. Mikrokontroler ATMega328 sebagai kendali seluruh sistem yang diprogram untuk membaca dan merespon masukan sensor. Setelah itu, hasil dari sensor ditampilkan ke LCD I2C berupa daya modul ZVS saat diletakkan beban di kumparan. Hasil penelitian didapatkan pada menit di awal sampai menit ke-3 menunjukkan suhu air 32,6°C sampai 64,9°C dengan arus stabil sebesar 17,5A di menit ke 4 sampai ke 18 terjadi penurunan arus sangat drastis menunjukkan angka sebesar 8A sehingga durasi pemanasan airnya terlalu lama hingga 18 menit untuk mencapai 100°C. Hal tersebut disebabkan sistem pada modul ZVS tidak bekerja dengan baik. Untuk penelitian selanjutnya dapat menggunakan power supply dan baterai lithium-ion dengan tegangan dan ampere yang lebih tinggi agar pemanasannya lebih cepat.

Kata kunci: Zero Voltage Switching, Baterai daur ulang 16850, Dioda bridge, kompor induksi.

1. Introduction

Contemporary technological advancements have a profound influence on society, affecting everyday living and domestic environments. Stoves are used in household appliances to prepare various items that satisfy fundamental necessities [1-4]. Many Indonesians predominantly utilize LPG stoves, particularly following the government's successful transition from kerosene to liquid petroleum gas as a fossil fuel alternative. As time advances and the demand for energy usage escalates, the necessity for energy will likewise intensify. Fossil fuels, including petroleum, coal, and natural gas, fulfill most of our energy requirements. Nevertheless, energy production is presently diminishing. An energy crisis is inevitable if we do not promptly resolve this issue [6]. The use of traditional stoves often leads to fires or workplace accidents due to stove-related mishaps. Induction stoves reduce this concern by lowering the chances of flames and workplace risks associated with traditional stove fires. This is attributable to the lack of flames in induction stoves. Ferromagnetic metal pans are implements employed for culinary purposes. The robust glass heating base remains temperate during cooking, assuring user safety [7-8]. The operational principle of an induction cooker relies on induction heating. A copper wire coil is situated beneath a ferromagnetic pan. Induction cookers do not generate heat autonomously. High-frequency current passes via the induction coil, producing an alternating electromagnetic field [9-10]. The alternating current provided to the induction coil generates a magnetic field in its surroundings. The strength of the magnetic field depends on the current provided to the induction coil, the coil's configuration, and its distance from the coil. The magnetic field induces an eddy current that subsequently heats the pan and the food [11].

Electric induction cookers can be a viable choice in energy transition efforts, reducing reliance on LPG gas as a fuel source, with electricity derived from non-fossil energy alternatives. Initiatives are underway to enhance power plants with innovative and sustainable energy sources. Researchers seek to create battery-powered induction cookers to reduce dependence on fossil fuels, particularly LPG gas. Household battery storage is expected to grow significantly, surpassing 500,000 units by 2025 [12]. The 2019 Global E-waste Monitor report reveals that Indonesia produces more than 1.6 million tonnes of electronic waste annually, establishing it as a major contributor to e-waste in Southeast Asia [13]. According to a 2016 estimate, around 80% of employed batteries are lithium-ion. Ordoñez's research [14] reveals that inside 4,000 tonnes of consumed lithium-ion batteries, there were 1,100 tonnes of heavy metals and 200 tonnes of toxic electrolytes. The principal concern about battery consumption is their disposal and management. Heavy metals and toxic electrolytes jeopardize ecosystems and human health. This waste contains dangerous materials, including heavy metals, which, if mismanaged, can pollute the environment and endanger human health. Furthermore, electronic waste contains valuable elements, such as precious metals and functional components, which are often overlooked and underutilized. Utilized laptop batteries constitute a significant portion of electronic waste [15]. Ironically, unused laptop batteries are often considered worthless, despite studies showing that most cells within these batteries stay functional. Approximately 60-90% of the cells in discarded laptop batteries remain functional for alternative uses, such as power sources for electric motorbikes and backup power solutions for lights and household electrical devices [16]. This practice reduces electronic waste and decreases the demand for new raw materials, endorsing the principle of a circular economy while providing an alternative energy source to meet Indonesia's increasing electrical needs. Given the increasing quantity of electronic waste and computers in circulation within society, this offers substantial opportunities for Indonesia. Employing used batteries for induction cookers can reduce manufacturing costs, improving the affordability and accessibility of this technology for the general populace.

PLN Director Darmawan Prasodjo stated that the shift to induction cookers was initiated to reduce dependence on increasingly expensive LPG imports. Accordingly, PLN promoted public engagement to support and ensure the success of the government's program to migrate from LPG stoves to induction cookers. Consequently, PLN is transitioning from imported energy to indigenous energy by reducing LPG imports. [17-18]. The research centers on designing and constructing an induction cooker that uses a 12 V recycled 16850 Lithium-Ion battery to augment electricity for PLN energy users with a 450 VA power demand. Induction cookers equipped with 16850 Lithium-Ion batteries function during power outages. The rechargeable Lithium-Ion 16850 battery is more environmentally sustainable, in accordance with Indonesia's Sustainable Development Goals: Goal 7 (clean and affordable energy), Goal 13 (climate action), Goal 14 (protection of marine ecosystems), and Goal 15 (protection of terrestrial ecosystems). This research promotes integrating renewable energy by maximizing the incorporation of various renewable sources to improve efficiency and dependability [19]. This study utilizes a bridge diode and a Zero Voltage Switching (ZVS) module to address emergency electrical problems, enabling swift electricity conservation. This research aims to help government policy by promoting the use of induction cookers to reduce LPG gas imports, specifically on energy efficiency and emissions analysis. Evaluate the benefits in real-world contexts and compare them with conventional approaches. An induction stove is engineered to employ electromagnetic energy for residential heating applications. This advancement allows for the transformation of up to 90% of energy into thermal energy, compared to roughly 74% for conventional electric systems and 40% for gas systems [21].

2. Methods

2.1. Tools and Materials

The following tools were used: LCD, ZVS Module, 40-ampere BMS, ACS712 Sensor, ATMEGA328 Microcontroller, Bridge Diode, Relay, and Power Supply.

2.2. Device Assembly

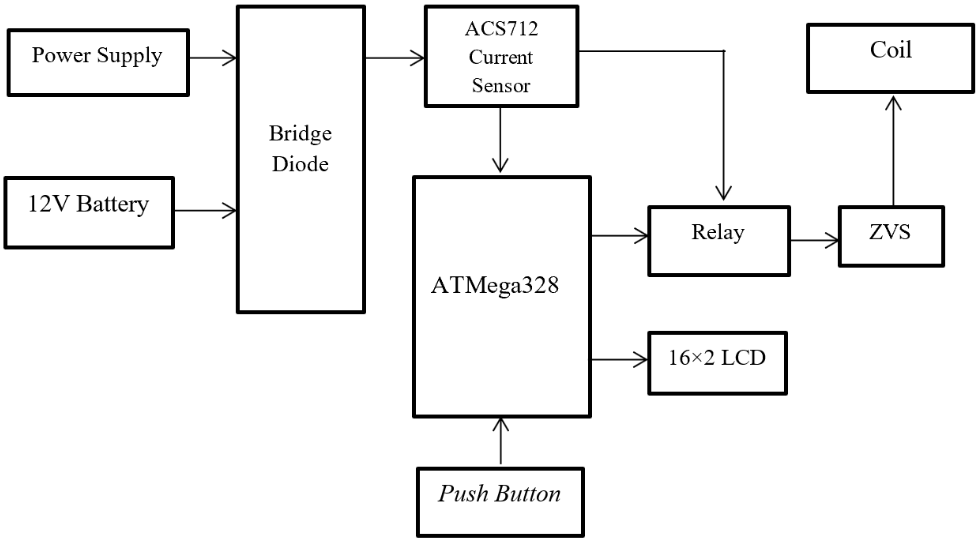

Figure 1. Block diagram of the device

Figure 1 is a block diagram of a hybrid induction cooker system that uses a rechargeable battery. The power supply is the voltage source that will supply the necessary voltage to turn on every component in the circuit. When two voltages are blended into one, the bridge diode functions as a hybrid. After combining the voltages from the power supply and the 12V battery, the bridge diode output is connected to the ACS712 current sensor. The ACS712 current sensor can measure the current, and the ATMega328 microcontroller processes and controls the system. The diagram shows the functions of each block. The power supply provides voltage to the microcontroller, sensors, and the circuit. The circuit features a 12V output stabilized by an LM7812 IC. The 12V battery, made from recycled lithium-ion batteries, serves two purposes: powering the stove and saving current. The bridge diode connects the power supply and battery voltages. The ACS712 current sensor measures the current or voltage generated by the induction cooker when heating an object. The ATMega328 microcontroller processes data for display on the 16x2 LCD. Relays are used to control and distribute electricity. Push buttons are used to make a circuit on or off.

2.3. 12V Power Supply Circuit and Bridge Diode

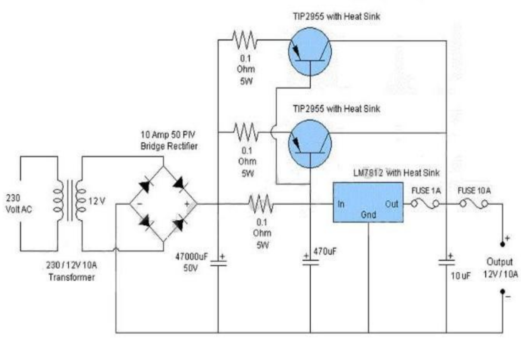

Figure 2. 12V Power Supply Circuit and Bridge Diode.

A power supply is hardware that can convert a 220VAC/50Hz PLN power source to other electrical voltages. The power supply transforms alternating current (AC) into direct current (DC), which is rectified using a diode. This rectifier uses a bridge diode as a full-wave rectifier. The 47000µF capacitor is the first DC filter or screen of the waveform produced by the full-wave diode bridge rectifier. The power supply provides direct current to electronic equipment. The figure above shows a power supply circuit that can provide a stable 12-volt DC output with a maximum current of 10 amps. This circuit uses an LM7812 IC voltage regulator and a TIP2955 transistor current amplifier. The power regulator consists of a parallel circuit of two TIP2955 transistors that increase the current-carrying capacity of the 12-volt LM7812 IC.

2.4. Design Induction Stove

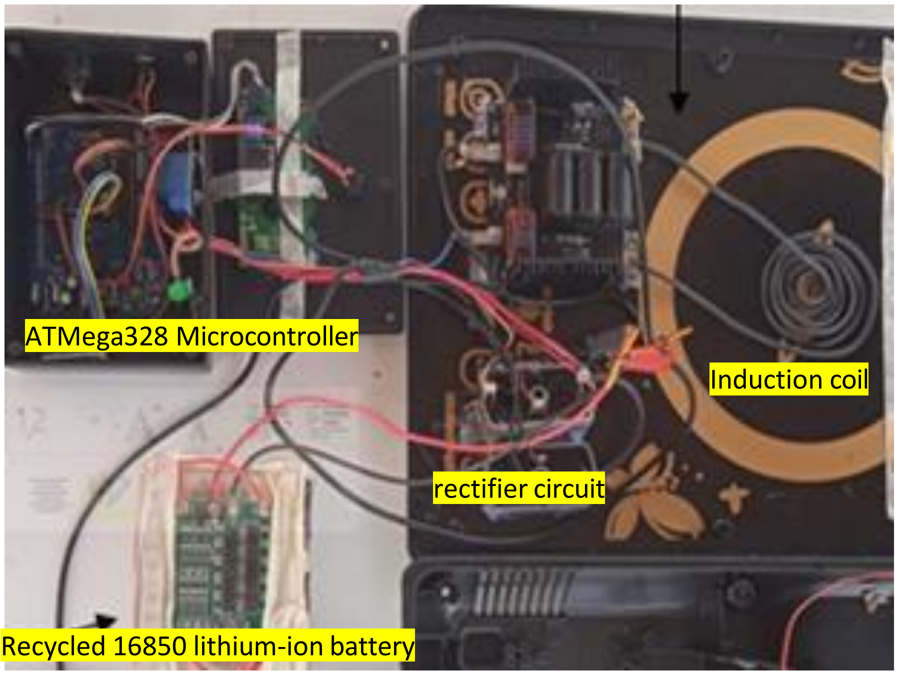

Figure 3. Design Induction Stove

Figure 3 shows the design induction stove. The induction stove uses a hybrid electrical energy system from the State Electricity Company (PLN) and a series of used, recycled 16850 lithium-ion batteries. This system consists of electric current rectifiers, an ATMega328 microcontroller, a used battery circuit, and an induction heating circuit. One unit channels electrical energy from the PLN, and the recycled 16850 lithium-ion battery is used in the induction heating circuit after it passes through the rectification process in the rectifier circuit and the control process in the microcontroller.

2.5. Research Flow Chart

The research flowchart is shown in Figure 4. The process begins with a start, followed by initialisation, which uses the preparation symbol to prepare data storage. The microcontroller then processes the entered values. The push button controls the on and off states of a circuit. If the circuit is off, the process returns to the start. If the circuit is on, the process continues to the next step. The power transistor in the inverter operates the resonance circuit using the zero-voltage switching principle. The ACS712 sensor reads the input and converts it to a current value displayed on the LCD. This process repeats until completion.

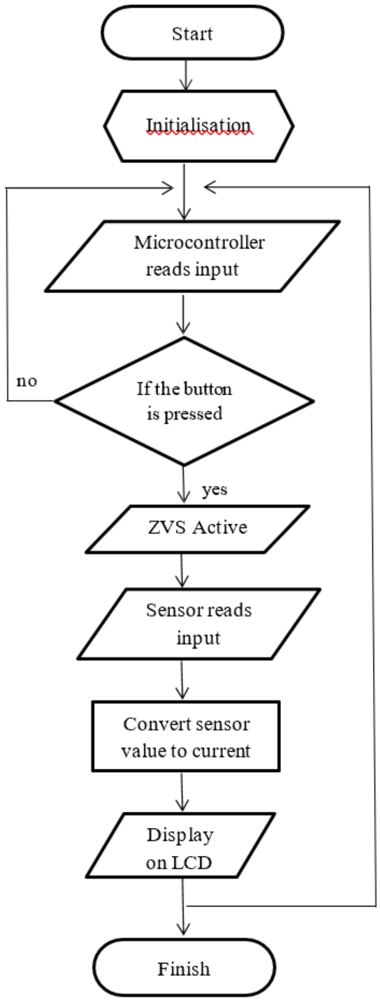

Figure 4. Flowchart of the device

3. Results and Discussions

3.1. Measurements and Measurement Results of the System

The hybrid induction cooker, which uses repurposed batteries, is now complete. This device was manufactured after undergoing multiple testing phases. Figure 5 illustrates the physical appearance of the device.

Figure 5. Physical appearance of the Device

3.2. Testing and Discussion of the Device

3.2.1. Testing the Power Supply Circuit

Table 1 presents the test results of the regulator circuit. Even when the input voltage fluctuates, this regulator circuit maintains voltage stability. This circuit's output is tuned to the microcontroller's specifications, which require a minimum current of 10A and 12V. Measure the input and output of the regulator circuit to test it and prevent damage to the microcontroller and other supporting components, such as sensors, resistors, and transistors. When supplied, the input and output voltage data the regulator generates are as follows, guaranteeing that the output voltage stays at 12V.

Table 1. Regulator Circuit Test Results

No	Test	Input (VAC)	Output (VDC)
1	First time	220.5	12.36
2	Second time	221.7	12.58
3	Third time	221.7	12.58

3.2.2. ACS712 Sensor Testing

Table 2 shows test results for the ACS712 sensor circuit. As is well known, the ACS712 current sensor's job in this situation is to separate the applied load from the current. The ACS712 sensor is fitted in series with the load heating method. Since the ACS712 current sensor has an analog output, the voltage output will be near 2.5 VDC if no current is detected. Depending on the circuit developed, the sensor output will be larger or smaller if a change in current is detected. The Hall effect method, which measures the strength of the magnetic field, is the sensor is operational principle. To test this sensor, the microcontroller is programmed to read the IC and ADC1115 attached to pin A0 on the ADS1115. The purpose of the ADS1115 is to increase the ADC value to acquire precise measurements. The ACS712 sensor outputs data that will be gathered gradually and processed to calibrate later using the multimeter's current values.

Table 2. Test Results for the ACS712 Sensor Circuit

No	Ammeter (A)	Instrument (A)
1	0.11	0.12
2	0.15	0.16
3	0.41	0.43
4	0.57	0.57
5	1.12	1.16

3.2.3. Testing for Zero Voltage Switching (ZVS)

Table 2 shows test results for ZVS. The switch may function when the voltage is zero, thanks to a zero-voltage switching mechanism called ZVS (Zero Voltage Switching). In addition to lowering switching losses, this switching strategy increases the back converter's efficiency as a direct current motor power source. To perform the ZVS (Zero Voltage Switching) test, the voltage and current in the ZVS were measured both when it was loaded during cooking and when it was unloaded.

Table 3. Data from ZVS Testing

Load	Current (A)	Voltage (V)
Load During Cooking	17.58	12.63
No load	0.27	12.63

3.2.4. Testing for Battery

Table 4 shows the results of battery tests. The battery was produced using the type lithium-ion 16850 batteries. Their voltage is checked before they are put together in parallel and series. Batteries connected in parallel and series will make a total voltage of 12 volts. These batteries are also examined to determine the voltage they produce under both load and no-load conditions.

Table 4. Results of Battery Tests

Load	Test	Voltage (V)	Current (A)
No load	First	11.08	0.44
	2nd	11.07	0.57
	3rd	11.08	0.44
Cooking Load	First	12.63	6.23
	2nd	12.63	5.78
	3rd	12.63	5.78

3.2.5. Testing for Bridge Diode

Table 5 shows the bridge diode testing results. The diode comprises four diodes packaged in a four-pin component device, along with a bridge circuit design. The other two terminals—the positive (+) and negative (-) output terminals—are output terminals, and the other two branches serve as voltage/current (AC) inputs. The aim of testing this diode is to determine the input value from the battery, the input from the supply, and the output when there is a load during cooking and when there is not.

Table 5. Bridge Diode Testing Results

Load	Battery Input (V)	Supply Input (V)	Output (V)
Cooking Load	12.23	12.23	12.23
No load	12.35	12.21	13.31

3.3 Examination of Samples

As part of the sample testing procedure, 250 milliliters of water were boiled by Aisyah et al. [22], who studied the energy efficiency of boiling water using several stoves: an induction unit, an electric unit, and a halogen unit. A thermometer was used to measure the temperature, and a stopwatch was used to record the time. Between 0 and 18 minutes, the air temperature reached 94.3^{0}C at the 15th minute. "Moh.W. Aminullah, et al. in [23] reported that the water temperature reached 87^{0}C at the 15th minute. Aisyah S. et al. in [22] claimed that the water temperature reached 90^{0}C at the 18th minute using power from a 300W induction cooker. With the help of a 200W induction cooker, the water temperature in this study reached 101.3^{0}C at the eighteenth minute.

Table 6. Checking the Current Used to Bring Water to a Boil

No	Time (Minutes)	The Device's Current (A)	The Temperature (°C)
1	0	17.27	32.6
2	1	17.36	48.4
3	2	17.74	56.8
4	3	17.81	64.9
5	4	8.07	68.2
6	5	8.15	70.5
7	6	8.22	72.7
8	7	8.07	74.2
9	8	8.22	77.4
10	9	8.07	79.9
11	10	8.15	82.8
12	11	8.07	85.4
13	12	8.22	87.6
14	13	8.22	90.2
15	14	8.07	91.9
16	15	8.15	94.3
17	16	8.07	96.0
18	17	8.22	99.1
19	18	8.22	101.3

This test was carried out to assess the temperature and current that the ZVS module produced and the amount of time it took to boil 250 ml of water, based on the previously mentioned data. According to Table 3.6, the water temperature varied between 32.6°C and 64.9°C from boiling until the third minute, while the steady current was 17.5 A. This test aimed to evaluate the temperature and current produced by the ZVS module and to measure the time it took to boil 250 ml of water, as referenced in the previously mentioned data. According to Table 3.6, the water temperature fluctuated between 32.6°C and 64.9°C from the beginning of boiling until the third minute, while the current remained steady at 17.5 A. The water's heating time was excessively long to reach 100°C due to a sharp drop in current between the 4th and 18th minutes of boiling, which registered a value of 8.3A. This decrease was caused by a malfunctioning ZVS module system and possibly insufficient windings in the coil. The results are given in Table 6 and Figure 6.

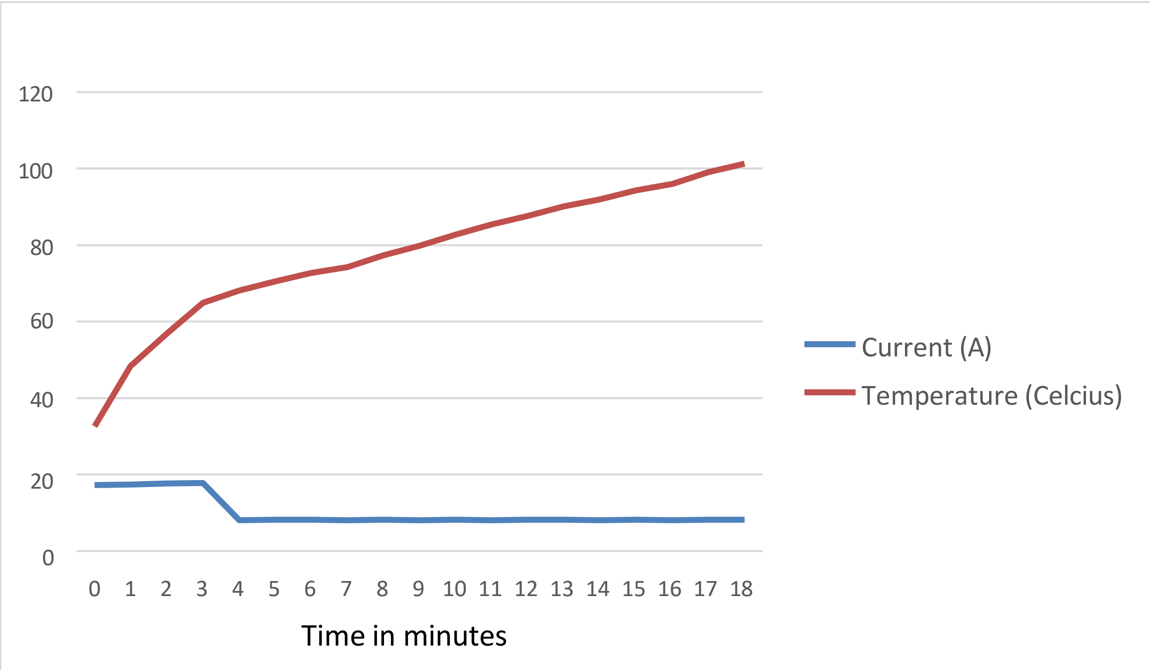

Figure 6. Graph of Testing Induction Cooker Samples with ZVS Modules

Figure 6 depicts the test by quantifying the temperature and current generated by the ZVS module and the duration of water boiling. During the initial three minutes, the water temperature rose from 32.6°C to 64.9°C, while the average current at ZVS was already subjected to a load of 17.5 A. The ZVS module significantly reduced its current to 8.07A after 4 minutes of boiling water at a temperature of 68.2°C. Consequently, the time required for the water to reach 100°C extended to 18 minutes. This investigation determined that the water boiling time was merely 18 minutes to achieve 100°C, which is more rapid than the findings of Aisyah et al. [22] and Moh.W. Aminullah et al. in [23].

4. Conclusion

A bridge diode connects the power supply and a recycled 12V 16850 lithium-ion battery, which serves as the primary voltage source, supplying 200W of power to activate the ZVS module. Integrate the ACS712 sensor as a current sensor to measure the wattage generated by the induction cooker when linked to the load in the coil. The entire system is managed by the ATMega328 microcontroller, which is configured to read and react to sensor inputs. The sensor results are displayed on the I2C LCD as the ZVS module is powered when a load is placed on the coil. From Table 3.6, during the initial three minutes, the water temperature rose from 32.6°C to 64.9°C, while the average current at ZVS was already subjected to a load of 17.5 A. The ZVS module significantly reduced its current to 8.07A after 4 minutes of boiling water at a temperature of 68.2°C. Consequently, the time required for the water to reach 100°C extended to 18 minutes. The ZVS module's operating system malfunctions due to insufficient coil windings. The design needs enhancement to function optimally. Proposals for further development include using a power supply and a recycled 16850 lithium-ion battery with increased voltage and amperage for expedited heating and implementing an improved mechanical design for the ZVS module, such as a protective casing for the induction coil.

References

[1] M. F. Kharis, "Desain perancangan dan pengembangan produk kompor biomassa dengan metode quality function deployment," *MEKANIKA*, vol. 2, no. 2, pp. –, Apr. 2021. P-ISSN 1555-2465, E-ISSN 2746-3788.

[2] M. A. Wicaksana *et al.*, "Kontribusi transisi energi pada sektor rumah tangga untuk mencapai target netral karbon di Indonesia," *Jurnal Rekayasa Teknologi Nusa Putra*, vol. 10, no. 1, pp. 31–37, Feb. 2024. P-ISSN 2407-8301, E-ISSN 2776-0197. https://rekayasa.nusaputra.ac.id/index

[3] R. W. Damayanti, H. Setiadi, P. W. Laksono, D. L. Rizky, and N. A. E. Entifar, "Factors affecting technological readiness and acceptance of induction stoves: A pilot project," *Emerging Science Journal*, vol. 7, no. 6, pp. 1892–1923, 2024. https://doi.org/10.28991/ESJ-2023-07-06-04

[4] S. Azzahra, "Uji performa kompor induksi dan kompor gas terhadap pemakaian energi dan aspek ekonomisnya," *Energi dan Kelistrikan: Jurnal Ilmiah*, vol. 12, no. 2, 2020. P-ISSN 1979-0783, E-ISSN 2655-5042. https://doi.org/10.33322/energi.v12i2.1009

[5] R. T. Lestari *et al.*, "Rancang bangun kompor induksi menggunakan zero voltage switching low power," *Journal of Mechanical and Electrical Technology*, vol. 4, no. 1, Jan. 2025. E-ISSN 2809-9605, P-ISSN 2827-8097.

[6] I. G. B. S. Dhanu, "Perancangan pembangkit listrik tenaga surya sebagai supply daya untuk kompor induksi 550 W," *Tugas Akhir Jurusan Teknik Elektro, Program Studi D3 Teknik Listrik, Politeknik Negeri Bali*, 2023.

[7] L. B. Setyawan *et al.*, "Pemanas listrik menggunakan prinsip induksi elektromagnetik," *Techné Jurnal Ilmiah Elektroteknika*, vol. 14, no. 2, 2015. https://doi.org/10.31358/techne.v14i02.127

[8] B. Sudiarto, J. D. Nugroho, F. Husnayain, and A. R. Utomo, "Influence of input voltage variation on the energy efficiency of induction cookers," *Jurnal Nasional Teknik Elektro dan Teknologi Informasi (JNTETI)*, vol. 12, no. 2, pp. 101–109, May 2023. https://doi.org/10.22146/jnteti.v12i2.6784

[9] S. Kurniati, S. Syam, and F. L. Bantoruan, "Sistem pemanas induksi dengan menggunakan solenoid coil dan mikrokontroler," *Jurnal Media Elektro*, vol. 10, no. 1, pp. 44–52, 2021. https://doi.org/10.35508/jme.v0i0.3902

[10] F. Kurniawan, A. Syakur, and A. Warsito, "Perancangan inverter frekuensi tinggi sebagai suplai pemanas induksi pada oven listrik hemat energi," *Transient Jurnal Ilmiah Teknik Elektro*, vol. 7, no. 4, pp. 861–867, 2019. https://doi.org/10.14710/transient.7.4.861-867

[11] A. K. Fadhillah and A. Wisaksono, "Design and construction of water heater with induction method with Arduino Uno monitoring," *Procedia of Engineering and Life Science*, vol. 2, no. 2, 2022.

[12] Frost & Sullivan, *Global Residential Battery Energy Storage Market, Forecast to 2022*, 2019.

[13] D. N. Perkins, M. N. Brune Drisse, T. Nxele, and P. D. Sly, "E-waste: A global hazard," *Annals of Global Health*, vol. 80, no. 4, pp. 286–295, 2019. https://doi.org/10.1016/j.aogh.2014.10.001

[14] J. Ordoñez, E. J. Gago, and A. Girard, "Processes and technologies for the recycling and recovery of spent lithium-ion batteries," *Renewable and Sustainable Energy Reviews*, vol. 60, pp. 195–205, 2016. https://doi.org/10.1016/j.rser.2015.12.363

[15] B. Abimanyu, I. I. M. Gusti, and K. K. A. Rahmah, "Pemanfaatan limbah baterai bekas laptop lithium-ion 18650 sebagai energi listrik alternatif berkelanjutan pada sepeda motor listrik," *Politeknik Astra*, Jakarta, 2024. https://repository.polytechnic.astra.ac.id/files/original/c7f062891bec150b6e891949a6b8e810a366b37d.pdf

[16] F. Fitriono, G. H. Saputra, and A. Ancolo, "Studi pemanfaatan baterai lithium 18650 bekas sebagai penyimpan energi listrik untuk penerangan," *Jurnal Ilmiah Teknik Elektro*, vol. 4, no. 1, pp. 13–17, 2022. https://doi.org/10.36269/jtr.v4i1.987

[17] Kementerian ESDM RI, "Dorong konversi ke kompor induksi, pemerintah kurangi ketergantungan kepada liquefied petroleum gas," 2022. https://ekon.go.id/publikasi/detail/4365/dorong-konversi-ke-kompor-induksi-pemerintah-kurangi-ketergantungan-kepada-liquefied-petroleum-gas

[18] International Energy Agency (IEA), *An Energy Sector Roadmap to Net Zero Emissions in Indonesia*, IEA Publications, 2022.

[19] S. Ahmad, L. J. A. Jamilatul, S. M. N. Hasan, A. Saha, M. S. A. Mohd, A. Syafiq, and L. Wang, "Quasi resonant topology based highly efficient solar-powered induction cooker," *Bulletin of Electrical Engineering and Informatics*, vol. 13, no. 6, pp. 4506–4521, 2024.

[20] D. A. Hasibuan and I. M. A. Nrartha, "Perbandingan ekonomis penggunaan kompor listrik induksi dan kompor gas LPG dari sisi penggunaan di rumah tangga," *VOCATECH: Vocational Education and*

Technology Journal, vol. 5, no. 1, pp. 11–21, 2023. ISSN 2716-5183 (online), ISSN 2686-4770 (print). http://ojs.aknacehbarat.ac.id/index.php/vocatech/index

[21] R. J. Singh and M. Kumar, "A hybrid model of induction stove," *International Journal of Power Technology and Future Innovations*, 2016. Corpus ID: 219107824.

[22] S. Aisyah, M. Triani, and R. Rasgianti, "Energy efficiency analysis for various type of electric cooker," *Journal of Physics: Conference Series*, vol. 1869, 012175, 2021. https://doi.org/10.1088/1742-6596/1869/1/012175

[23] M. W. Aminullah, Haryadi, and D. Fitria, "Perancangan kompor listrik berbasis panel surya terhadap pengaruh panjang coil," *JTE UNIBA*, vol. 6, no. 2, pp. 200–205, Apr. 2022. E-ISSN 2549-0842, P-ISSN 2528-6498.