Communication in Physical Sciences, 2025, 12(7):1988-2006

Automation of electric power source changeover switches deploying artificial intelligence

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Received: 17 August 2025/Accepted 02 October 2025/Published online: 17 October 2025

https://dx.doi.org/10.4314/cps.v12i7.2

Abstract: *Unstable, unreliable, and expensive electric power supply systems have created a need for multiple alternative power sources to manage power failures and cost. Manually controlled changeover switches are limited by human cognitive ability and availability of personnel to operate the device, making them inefficient and expensive to maintain. This paper proposes an automated electric power changeover switch that deploys artificial intelligence to process real-time generated data such as solar availability, grid stability, and fuel level in fossil fuel power generators, using forecasting and optimization techniques to accurately select preferred shared active power sources during operation. After each power changeover, the device sends a short message service (SMS) to enrolled users on the electric power status and also allows the remote control of the device. The obtained trial test results validated its operational efficiency. The developed device is targeted at low-income countries of Sub-Saharan Africa where electric supply is highly unstable.*

Key words: *Artificial intelligence, Automated Power supply, Changeover control switch, Electric Power Control, Power supply system*

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1.0 Introduction

Automatic changeover switch systems have greatly enabled the uninterrupted power supply through the automatic seamless switchover between different power sources such as the national grid, fossil fuel power generators, solar power, etc. according to (Kume & Swamy, 2004). The national power grid in most parts of the Sub-Saharan Africa is unstable, unreliable, and expensive creating a compelling need for alternative power sources. The automation of the power changeover switch to achieve the automatic selection of available reliable cost effective power sources in a safe manner will mitigate the problem of the unstable national power grid as shown by (Oduah & Okwah, 2019).

In Nigeria and most parts of Sub-Saharan Africa, power outages can last for several hours daily, disrupting industrial productivity, household comfort, and essential services. This chronic instability highlights the urgent need for automated systems capable of ensuring continuous and safe power delivery. Since the early days, these systems have been mostly mechanical or manual operations whereby a person would manually initiate switching power sources according to (Shomefun & Diagi, 2018). Mechanical wear, latency in response time, and minimal feedback for the users were some of the majorly reported limitations and hence inefficiency of the device leading to a possible blow to the electrical appliances at the point of transition of power sources according to (Andrew, 2005), and (Singh, 2016). There is a growing need for more advanced, reliable, safe, and responsive power changeover systems paving way to the emergence of automatic changeover switches with microcontrollers marking a significant leap towards solving the problem.

Recent developments in microcontroller-based and GSM-enabled systems have marked a shift toward semi-intelligent changeover switches. These systems introduced faster switching and limited remote control, yet they remain largely reactive and lack predictive decision-making capabilities. There is a rapid rise in the cost of electric power supply in Africa especially Nigeria leading to most users resorting to alternative shared power sources like for instance, implementing solar power and national grid as shown by (Ezema, Peter & Harris, 2012). Part of the loads are isolated from the national grid and connected to solar power source to reduce the power consumption and heavy bills charged on the national grid. So, two power sources are adopted simultaneously in order to reduce cost. The power changeover systems needs to be intelligent and automated to select the most cost effective and efficient, available power sources during changeover. The systems with microcontrollers achieved faster switching time and eliminated much human error as reported by (Cuthrell, 2025), and (Ehiabhili, Ezeh & Orji, 2018).

Yet, many existing designs have remained constrained by the limitations of being unable to be controlled remotely; some cannot appropriately manage user preferences, while some are prone to voltage spikes during the transition between the various available power sources. Despite these advances, no existing system provides an integrated solution that combines real-time monitoring, user-defined control, and AI-based optimization for cost, stability, and safety in a single automated changeover device. Part of the deficiencies of the existing variants of power changeover switches includes the inability to monitor power consumption in real-time and the lack of provision of a way to intelligently prioritize power sources based on availability, cost and customer needs.

In recent literature, researchers have proposed some solutions to tackle these challenges. For example, GSM-based systems were introduced to send SMS alert to users during every transition, thereby providing a remote notification to the users according to (Pandey, *et al*. 2020). Systems of Smart Grids introduced a platform where users interact with their power management setups through smartphone applications or other connected devices. Most of such solutions do not provide compatibility with smart home technologies, and are also devoid of AI-driven optimization that would allow much more personalized and effective power management as reported by (Yan, 2024). Another key consideration in power changeover switches is the ability of the device to provide protection against power surge. Only twenty percent of the available power changeover switches included basic surge protection according to (Ekanayake, *et al.* 2012), and one percent included intelligent surge protection mechanisms, while the rest seventy nine percent did not incorporate surge protectors in their operations (Herath, *et al*, 2020).

First of all, the user interaction options that the available power changeover systems possess are very meager. Users can hardly make any preferences related to choosing the power source or customization of preferences of alternative power sources. Secondly, the systems are reactive, they switch the power sources depending on the real-time conditions, and there is no forecasting or optimization involved as previously reported by (Alhamrouni, *et al.* 2024). Also, very few of the existing designs addressed voltage protection at source transitions, which leaves connected devices open to potential damage during power surge according to (Boateng, *et al*. (2022).

To address these identified shortcomings and enhance power reliability, the aim of this study is to automate electric power changeover switches deploying artificial intelligence enabling the device to automatically prioritize the available input power sources based on their cost effectiveness, stability, and the power transition achieved in a seamlessly timely and safe manner. This paper presents a developed prototype of an improved automated electric power changeover switch system that overcomes many of these limitations of existing systems by including features that enhance cost management, the user interaction, optimize performance, and improved safety all achieved via Ai. The three predominantly used electric power sources in Africa are the national grid dominated by hydroelectric power; fossil fuel power generators; and solar power as presented in Fig. 1. The three dominant electric power sources are implemented as alternative power sources in the development of this automated power changeover switch solution. The approach is to adopt Ai in making decisions on the active power phases to be connected during power changeover with the objective of optimizing efficiency, safety, and minimizing total cost of power in the entire operation. In order to reduce cost of the electricity, two different power sources are sometimes active the same time allowing the different load-lines to be distributed between the active power sources according to (Ijewere, 2011).

The significance of this study lies in its potential to provide a cost-effective, intelligent, and reliable power management solution suitable for regions with unstable electricity supply. By incorporating artificial intelligence into changeover switch design, this work contributes to advancing smart-energy technology, reducing operational costs, and improving power reliability for domestic and industrial users.

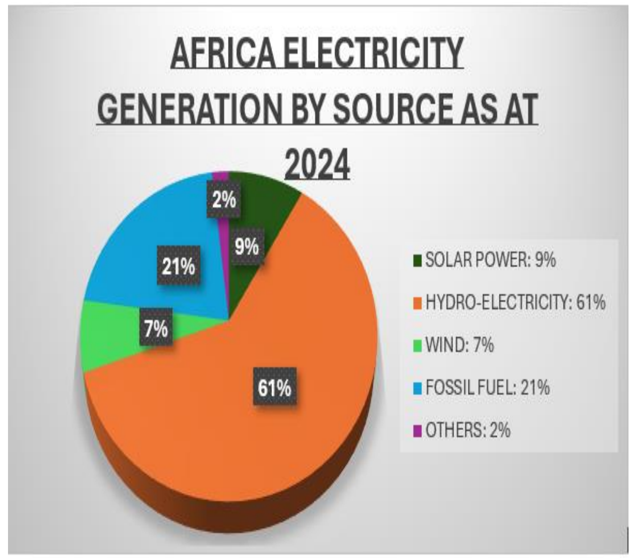

Fig. 1. Estimated Africa Electricity Generation by source as at 2024 (Olanrele, & Fuinhas, 2024).

2.0 Materials and Methods

This session covers the design and development, deployed components, implementation, testing, and validation of the novel automated electric power changeover switch system. The input power sources used in this automated changeover switch are the national grid, solar power, and the fossil fuel power generator plant.

2.1 Ethical and Practical Considerations in This Study

In this study, all ethical and practical considerations were carefully addressed throughout the design, implementation, and testing of the AI-based automated power changeover switch.

The device was developed and tested in compliance with institutional research ethics and international electrical safety standards (IEC and IEEE) to ensure safe operation, user protection, and environmental sustainability.

All data used by the system—such as grid voltage levels, fuel status, and solar power readings—were generated from controlled experimental setups and not from identifiable individuals, ensuring full data privacy and confidentiality. The programmable logic controller (PLC) was configured to process only non-personal operational parameters, and all logged data were securely stored and used exclusively for system optimization.

Practically, the design prioritized affordability, accessibility, and sustainability. Components were sourced locally to minimize cost (totaling USD 249.02) and promote replicability in developing regions like Sub-Saharan Africa. Energy-efficient and recyclable materials were used where possible to reduce environmental impact. The system's architecture also incorporated built-in surge protection, safe transition mechanisms, and user alerts via SMS to enhance reliability and prevent electrical hazards.

Informed by ethical engineering principles, the research maintained transparency in reporting, avoided fabrication or manipulation of data, and ensured all co-authors contributed significantly to the work. The device was tested in a controlled environment to prevent harm to users and equipment.

2.2 The System Architecture and Components

The system incorporates both hardware and software modules to achieve efficient management of the power sources, safety measures, and user-friendly interactive communication with all the enrolled users. The operation of the automated power changeover switch is presented in the Block diagram in Fig. 2.

The flowchart of the operation of the automated power changeover switch is as shown in Fig. 3.

2.3 Selection procedure of the available power source inputs during changeover of power

The availability of power in any of the input power sources activates the power indicator light connected to the line to switch ON and then trigger the microcontroller to scan and receive power through the input relay switch. Priority is given to the national grid which is referred to as the primary source of power. This is followed by the solar power source. A comparator analyzes the voltage levels at the input power source and remotely switches on the power generator if the national grid source is below the fixed threshold. In this architecture, the fuel generator backs up the national grid immediately the voltage drops below a fixed limit. The output power is delivered to the load-lines via the output relay.

Based on the power requirement of the household appliances, for instance 15kW appliance load is allowed on a standard 6mm^2 radial wire; different loads are placed on different phases and are powered by different power sources according to (Team, 2024). Usually, heavy appliances of about 30 A to 32 A are placed on the national grid, while lower power appliances are put on solar power. In this order, the total load and power consumption and cost on the national grid will be reduced significantly deploying the strategy as noted by (Babatunde, *et al*. 2020).

The activities of the automated changeover switch can be described in four modes. Mode one: the national grid source is available and the solar power source is also available. Part of the load is placed on the national grid while the lighter load is placed on the solar power source. Mode two; when there is power failure on the national grid, the fuel power generator automatically switches ON to supply to the phase. The solar power supply will continue to function on its assigned phase. Mode three; if the voltage supply from the solar power source drops below a predetermined threshold, the whole loads will be put on the fuel power generator source. Mode four; if the national grid is available and the solar power falls below a predetermined threshold the entire loads will be put on the national grid. The entire system automatically toggles and resets to mode one once power are restored on the national grid and the solar power inputs. If the unit cost of electric power for the national grid exceeds the input cost of fossil fuel either, Premium motor spirit (PMS) or automotive gas oil (AGO), then the device will automatically overwrite and switch to module two. The switching of the changeover switch is described in Table 1.

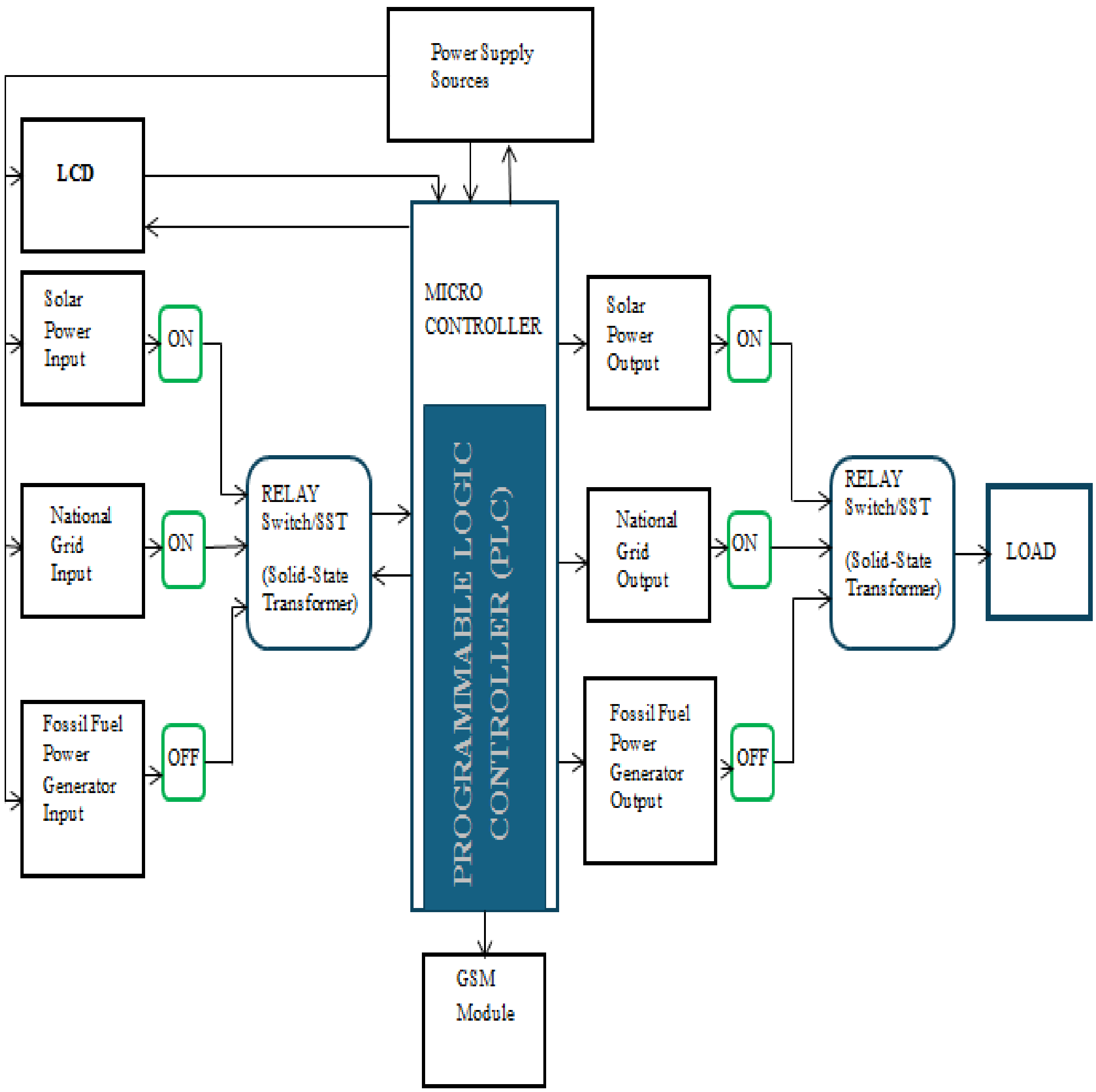

Fig. 2. Block Diagram of the automated power changeover switch

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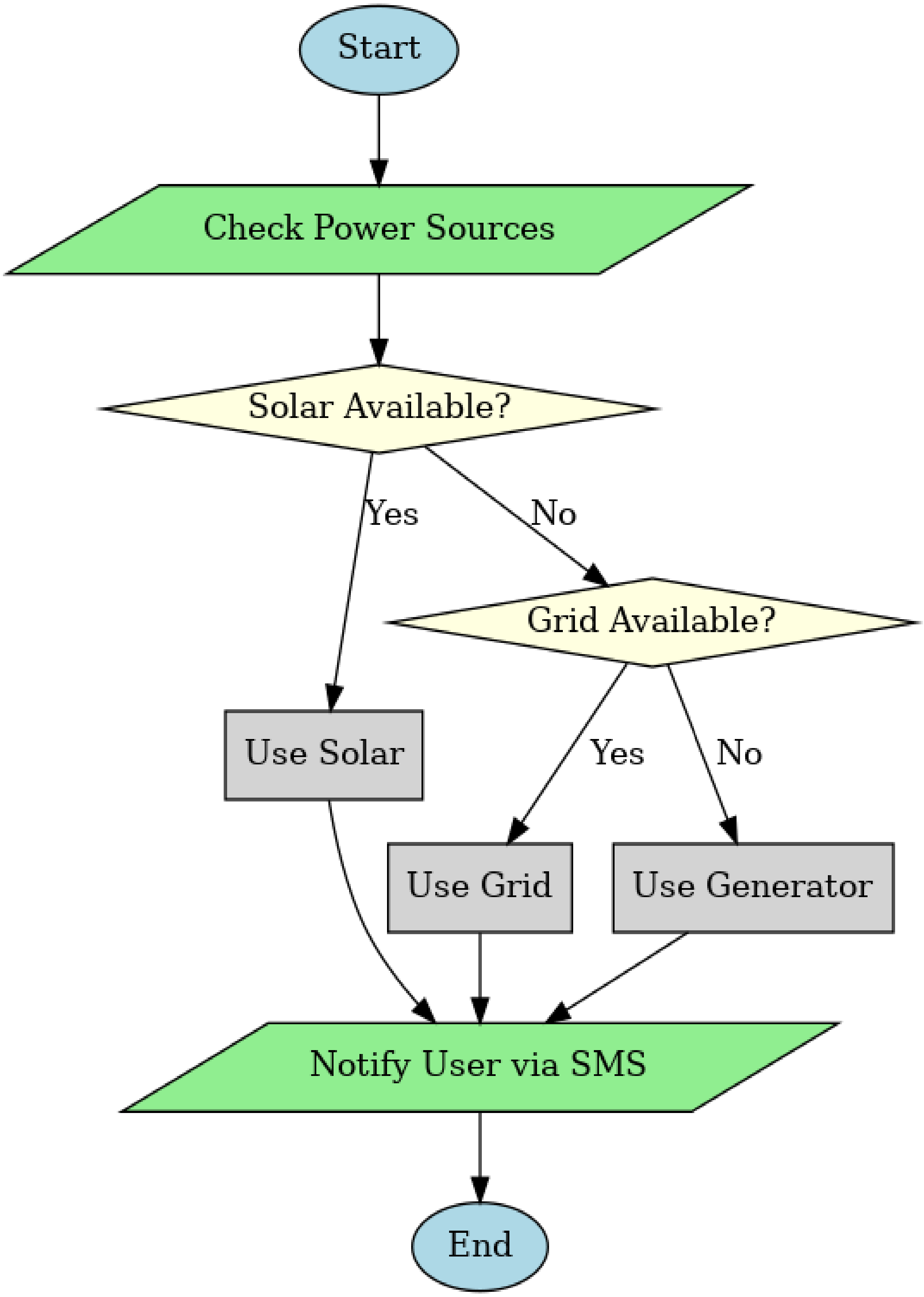

Fig. 3. Flowchart describing the basic operations of the automated power changeover switch

Table 1: The switching modes of the automated power changeover switch

MODE	National Grid	Solar Power Source	Fossil Fuel Power Generator	Comments
One	On	On	Off	The fuel power generator is Off.
Two	Off	On	On	The power generator is automatically switched On.
Three	Off	Off	On	The entire load is put on the power generator.
Four	On	Off	Off	The entire load is put on the national grid.

The All-In-One Programmable Logic Controller (PLC) is the central brain of the automated changeover switch that controls the selection of the active input power sources. The PLC has input and output module for interface that enables it to communicate data and interact with the entire system according to (Obasi, *et al.* (2015). It has a central processing unit and a memory for the storage of generated data deployed for making forecasted predictions. Artificial intelligence is implemented in training the PLC in making decisions that will be cost effective and power efficient during the selection of active power sources as demonstrated by (Kabir, *et al.* 2021).

The fuel level sensor in the fossil fuel tank of the power generator is connected to the PLC enabling it to monitor the fuel level and to alert the users immediately it drops below a predetermined threshold as shown by (Biswas, *et al*. 2024). Also, the output of the maximum power point tracker (MPPT) on the solar power module is connected to the input of the PLC for the monitoring of the solar power source operation. In this design, the PLC communicates with the connected sensors, and receives data via the input devices, processes the data at the central processing unit, and triggers output based on the pre-programmed parameters using Ladder Logic according to (Gupta, Singh, & Mitra, 2022).

The human machine interface (HMI) of the PLC enables the manual input of data on market values of PMS/AGO per liter and also the current tariff on the national grid power via a graphical user interface (GUI). So, the system is able to evaluate and compare which of the two power sources is more cost effective to switch to at any period. Provided that there is adequate fuel in the fossil fuel generator tank, the device can remain in mode two for 6 hours uninterrupted based on cost considerations. However, the device will switch back to mode one after 6 hours of running on mode two based on cost efficiency. This is to allow the power generator to cool down and to restore the viscosity of the lubricant. The liquid crystal display (LCD) screen is presented in Fig. 4.

The remote communication with the automated power changeover switch is implemented through the GSM module. The system allows the user to register or delete contacts through the SMS module; in this way, the users` access list can be modified and updated by the admin without the need for a technician. It also enables integration with smart home systems for voice-based control, which will allow the users to check current power sources as well as issue coordinated commands to overwrite default settings via the PLC as demonstrated by (Budrin, *et al.* 2020). The sensors installed on the MPPT in the solar power solution and the fuel level monitor in the generator tank enables the device to analyze grid stability, and real-time power generator fuel levels, and then

selects the most efficient sources of power. In turn, the system
will send users weekly reports on their energy consumption to give better visibility on electricity usage, especially with the national grid as shown by (Trindade, *et al.* 2017).

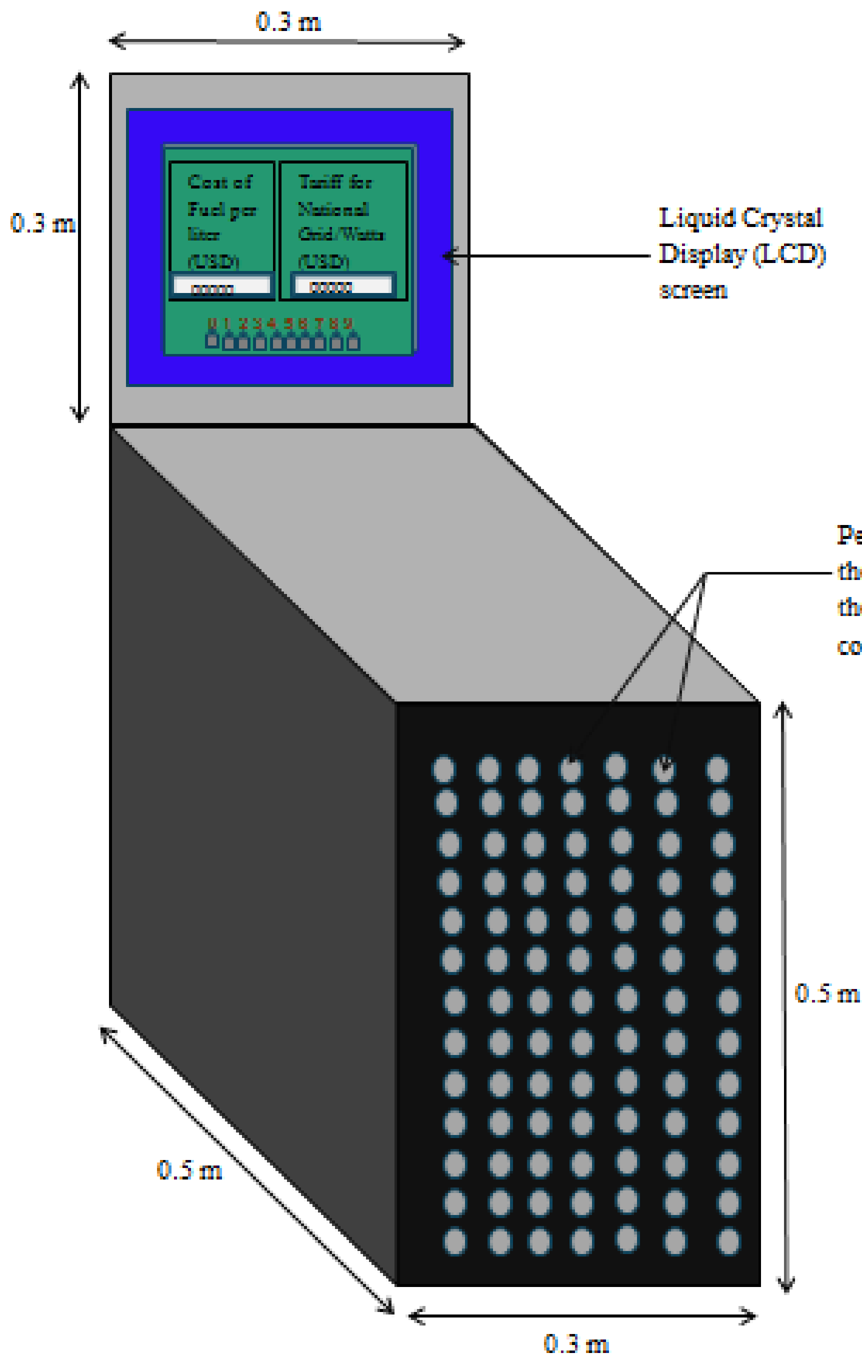

Fig. 4. Automated electric power source changeover switch showing the LCD screen

Furthermore, automatic surge protection for connected devices against voltage surges during transitions provides advanced safety and reliability in the developed device. Here we deploy a solid state transformer (SST) which is a power converter that integrates modular converter structure for input and output stages. This achieves power factor correction, voltage control, and a stable interconnection of the distributed supplies as reported by (Zhang, *et al*. 2005). The contactors of the relay switch in the input and output power source points also protect the system against any power surge.

The microcontroller continuously checks grid power, fossil fuel power generators, and solar power sources every two minutes. During the operation of the PLC, it undergoes the following cycles starting from the input scan. At the input scan, the PLC detects the state of the input power sources. The next is the program scan. The PLC determines what needs to be done based on the available input power sources. This is followed by the Execute Program Logic. At this stage the PLC implements what the programmed rules state considering the feedback from the various sensors. Next are the Update outputs of the PLC. This drives the output sources. Then the final stage is the housekeeping. At this stage, the PLC implements self-diagnostics, all communications and external reporting according to (Saxena, Jabbar, & Fezaa, 2023). The switching modes of the device are presented in Table 1.

2.4 Training process of AI for the power changeover predictions

The AI in the automatic changeover switch system is trained to choose the best power sources by analyzing real-time data and forecasting availability as reported by (Dhameliya, 2023). Here, a supervised learning approach using neural networks was adopted. The training process starts with data collection where the system gathers solar grid voltage and frequency from the MPPT sensor and generator fuel levels information. Data preprocessing is where the collected data is cleaned and normalized to remove inconsistencies and enable better decision-making at the PLC according to (Rodriguez, Dhameliya, & Patel, 2024). Voltage stability data, load demand, and power quality indicators are generated and analyzed by the programmable logic controller. The model selection and training phase uses machine learning algorithms trained on historical and real-time power source data to predict the best sources at any given time as reported by (Körösi, *et al*. 2024). The trained AI model goes through validation and testing under monitored conditions to evaluate its accuracy in choosing the best sources while minimizing switching delays and voltage fluctuations. Finally, the deployment and optimization phase integrates the trained AI model into the microcontroller where it learns from new data and dynamically optimizes power selection for better efficiency and reliability as previously reported by (Körösi, & Paulusová, 2014). The developed system combines machine learning techniques with a robust data sampling and collection technique to achieve power reliability and efficiency.

2.5 Power Sources

A combination of three power sources is simulated to be read by this test system: solar, fossil fuel power generator, and national grid. The combination and selection of the power sources based on availability is described in Table 1.

2.6 GSM Module

A module of this type enables the system to send real-time SMS alerts to users on transitions of power sources and initialization in system status. The GSM module SIM800L was deployed in the developed device. It is a miniature cellular module which allows sending and receiving SMS with the advantages of low cost and small footprint and quad band frequency support ideal for long range connectivity. It also enables a user to control the system remotely by sending commands through SMS messages as demonstrated by (Anirban, *et al*. 2017).

2.7 The Sensor Technology

The system uses voltage and frequency sensors attached to the MPPT to monitor grid stability, solar irradiance for solar availability, and fuel level sensors to assess generator runtime. A microcontroller and PLC processes these inputs in real-time, while AI-based predictive analytics optimize power source selection for efficiency and reliability as reported by (Paul, *et al*. 2025).

The circuit diagram of the automated power changeover switch is presented in Figure 5. The diagram shows the various input power sources J_1,J_2,J_3,J_4 probes, the PLC, and the LCD graphical user interphase.

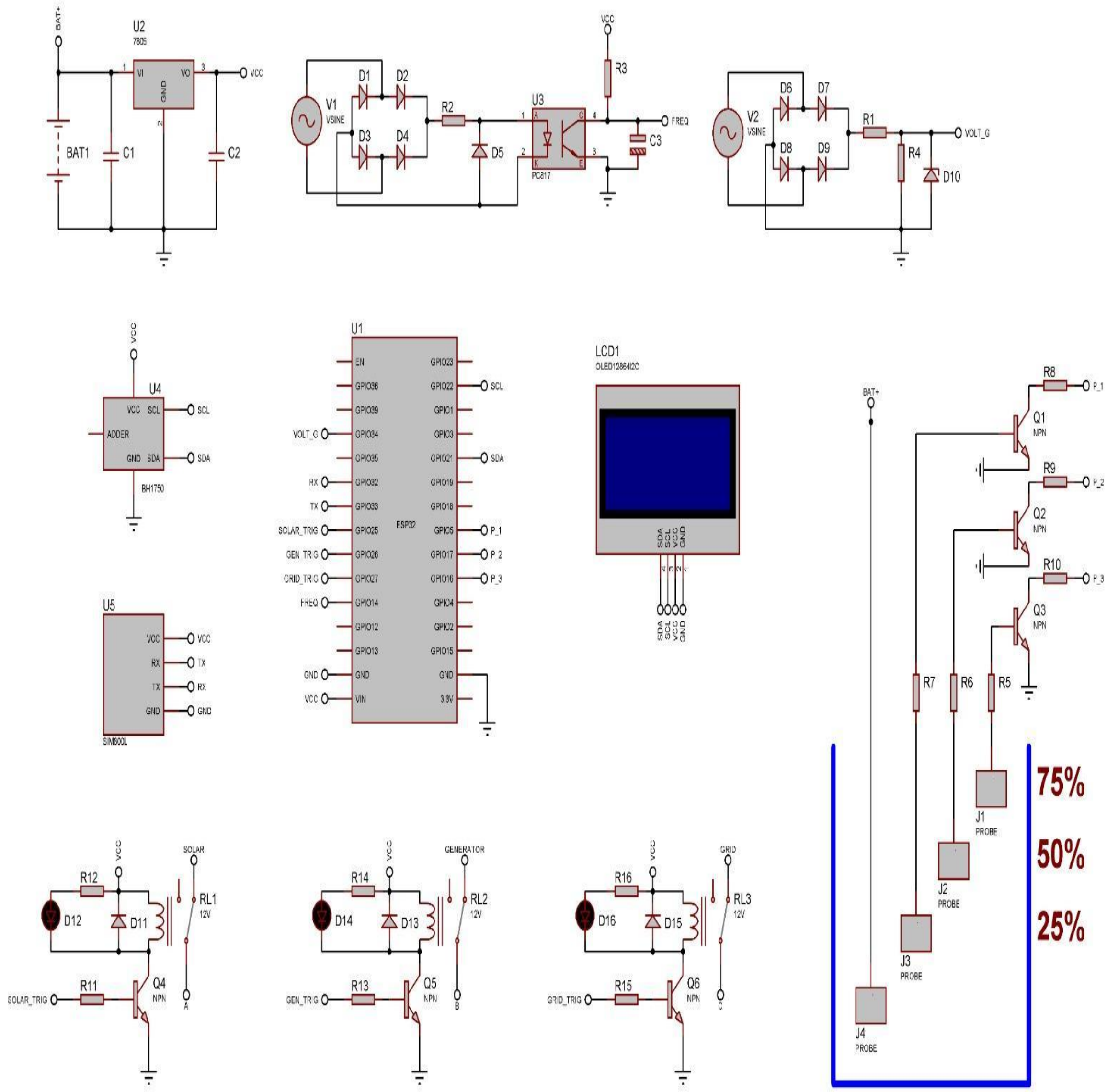

Fig. 5. The complete circuit diagram of the automated electric power source changeover switch.

2.8 *Cost of the developed Automated Power Changeover Switch*

In this study, all the components deployed in the construction of the developed device were procured locally in Lagos, Nigeria. The cost of the developed device is presented in Table 2. The electronic components were procured from Lagos, Nigeria. The developed device is cheap at USD 249.02.

Table 2: Costing of the develop Automated Power Changeover Switch

Item	Quantity	Unit cost ($) USD	Cost ($) USD
PIC16F876A Microcontroller (China)	1	24.13	24.13
GSM Module - SIM800L (China)	1	5.86	5.86
Solid State Transformer Modules (24V – 380V Module 3) China	2	3.55	7.10
Relays (60A, 240V) China	2	55.00	110.00
12V Battery	1	3.59	3.59
Programmable Logic Controller - modular (China)	1	65.00	65.00
Wires (China)	1 roll	2.32	2.32
LCD screen – 10.2 inches (China)	1	2.55	2.55
Casing		5.48	5.48
Liquid level sensor (China)	1	2.99	2.99
AI Training and Research	-		20.00
Total			**$249.02**

3.0 Results and Discussion

3.1 Results

The developed automated power changeover switch was tested for switching accuracy, response time, voltage stability, and AI prediction reliability, ensuring seamless transitions between power sources while preventing downtime and appliance damage. Also, SMS notification efficiency and energy consumption reporting were validated, confirming real-time user notifications and optimized power management. The outcome of the field test is presented in Table 3.

After each changeover of power source, SMS was delivered to the enrolled users on the active power sources in use and the status of all the input power sources. On the average, under a stable telecommunication network, it took 5 minutes for the SMS to be delivered to the users. Logged data of all the available power sources provides detailed reliable records for further research on the power sources.

Table 3: Field test validation of the developed Automated Power Changeover Switch

Power source conditions	**Switching accuracy/ Selected mode**	**Response Time**	**Comments**
National Grid ON at tariff USD 0.14 per kilowatt – hour (kWh); Solar Power source ON; Fuel level in fossil fuel generator full. Price of PMS per liter USD 0.59.	Mode one; Phase 1 with heavy appliances load on National Grid while Phase 2 with lighter load is on Solar Power source. Fossil fuel generator is OFF.	Scan time for selection is 10 seconds.	The National Grid voltage was stable. The tariff was uniform for Band "A" in Nigeria. It was cheaper to run on National Grid than the fuel generator. The selected mode is cost effective.

National Grid OFF; Solar Power ON; Fuel level in fossil fuel generator full. Price of PMS per liter USD 0.59.	Mode two; Phase 1 with heavy appliances load on Fossil fuel generator while Phase 2 with lighter load is on Solar Power source. National Grid is OFF.	Scan time for selection is 8 seconds.	National Grid OFF. The device scans every two minutes to detect any change in conditions to reset.
National Grid still OFF; Solar Module power OFF as battery drained/no sun; Fuel level in fossil fuel generator 80% full. Price of PMS per liter USD 0.59. Generator ON.	Mode three; Both Phase 1 and Phase 2 are connected to Fossil fuel generator.	Scan time for selection is 9 seconds.	National Grid and Solar power OFF. The device scans every two minutes to detect any change in conditions while monitoring the fuel levels in the fossil fuel tank.
National Grid ON; Solar Power OFF; Fuel generator OFF. No fuel in generator fuel tank.	Mode four; Both Phase 1 and Phase 2 are connected to National Grid.	Scan time for selection is 10 seconds.	Fossil fuel generator and Solar power OFF. The device scans every two minutes to detect any change in conditions while monitoring the solar module conditions. The phase 2 is transferred immediately power is restored on the solar power supply.

3.2 Discussion

The developed power changeover switch performed well as shown in Table 3, making the best cost effective and reliable selections from the various active modes. It is important to note that although the device has the capability to amplify the voltage applying the solid state transformer it does not generate its power source. So, if there is no power in all the input power sources, there will not be any power output. But by monitoring the national grid supply, the fossil fuel tank levels and the solar module power conditions, the users are informed of the real time status of the power sources to enable them plan to prevent a total power collapse.

A comparison of the different technologies of power changeover switches is shown on Table 4. This confirms that the developed device is cost effective and demonstrates superiority to the existing technologies.

Table 4: Comparison of existing power changeover switches technologies.

S/N	Changeover Device	Features	Cost ($)	Limitations
1	Manual Changeover	Required human intervention,	Between $120 to $300	It`s very uneasy to switch and

	Switch, reported by Maverick (2024).	although it has a very simple design, but there is no automation		also very slow in switching
2	Automatic Transfer Switch, reported by Dev *et al*. (2020).	It is fully automated, fast switching	Between \$550 to \$2,500	It is very expensive and it requires professional installation
3	Static Transfer Switch (STS), reported by Maverick (2024)	It uses solid state electronics, it has no moving part	Between \$1,500 to \$5,000	It is very expensive and it requires a stable power input
4	Relay-Based Changeover, reported by Abdulkareem *et al*. (2021).	It uses electromagnetic relays, it has a relatively medium switching speed	Between \$350 to \$500	Its relays wear out over time, and its mechanical failure risk is high
5	Contactor-Based Changeover, reported by Agbetuyi *et al*. (2011).	It uses power contactors, and it is more robust than relay-based systems	Between \$500 to \$1,500	Overtime, it experiences arc flash during switching

3.2.1 Electric wire construction materials and their effect on power changeover switch

In power changeover systems, electric cables play a critical role in power transmission between solar, grid, and generator sources as well as efficiency and durability according to (Helmenstine, 2019). The various materials used for the making of wires are presented in Table 5.

Table 5: Materials used for electric wires implemented for power changeover switches

Material	Resistivity	Durability	Conductivity	Cost per Length	Sectional Area	Resistivity ($\Omega \cdot m$)	Conductivity (S/m)
Copper	Low resistance	High flexibility and resilience to corrosion	High conductivity, guarantees minimal loss and seamless power changes	Moderate cost	Standard size suitable for most applications	1.68×10^{-8}	5.96×10^{7}

Aluminum	Higher than copper	Requires larger wire diameters, oxidation susceptibility	Less conductive than copper, may cause voltage dips	More affordable than copper	Requires a larger diameter for the same conductivity	2.82×10^{-8}	3.5×10^{7},
Silver (doped)	Lowest resistance	Durable but not commonly used due to cost	Best conductivity among all materials	Very expensive	Used in specialized applications	1.59×10^{-8}	6.30×10^{7}
Tinned Copper	Low resistance	Highly durable, treated with tin to stop corrosion	Similar to copper	Higher cost than plain copper	Used in long-term installations	$\sim 1.68 \times 10^{-8}$	$\sim 5.96 \times 10^{7}$

3.2.3 The novelty in the developed Automated Power Changeover Switch

The novelty of the automated power changeover switch is in its ability to deploy artificial intelligence to automatically select the cost effective power sources from the available power supply inputs during power changeover. The device implements advanced technologies such as solid-state transformers and programmable logic controllers to enhance its efficiency and reliability. It is comparatively cheap at USD 249.02.

The implemented sensor technologies in the solar module and fossil fuel tank level monitoring are very reliable, durable, and demonstrate excellent response time. The generated power source logged data will create a foundation for other research involving the various power sources supplies. The device is suitable in smart cities, hospitals, and industries where a stable power supply is essential according to (Sărăcin *et al.*, 2013).

3..2.4 The limitations of this research

The scope of this work does not cover the generation of electric power but is limited to the switching of alternative power sources. It also discusses the application of the relevant solid-state components without indebt to the fabrication process of the components. The study does not include the evaluation of the dynamic costs of electric power sources across Africa. This will be part of the next stage of this research as it will guide the redesign of the graphical user interphase of the LCD to make it more robust in capturing cost effective power sources in countries of Sub-Saharan Africa.

3.2.5 The applications in the industry

Automated power changeover switch is a very important device in the industry to maintain an uninterrupted supply of electric power at an optimal cost as previously reported by (Durrani, *et al*. 2018). The developing countries of Sub-Saharan Africa are usually exposed to the incessant power failures of the national grid according to (Husák, *et al*. 2019). Deploying multiple sources of electric power will require prioritization of the available choices with respect to cost, stability and strength. The developed automated power changeover switch implements artificial intelligence to provide a seamless power transition to any of the available power sources during operation. Another very important aspect of the developed device is the generation of logged power source data for any related research.

2.0 4.0 Conclusion

The electric power changeover switches is a critical infrastructure in most Sub-Saharan Africa where power is scarce, unavailable, and expensive as reported by (Oluwatoyin, Odunola, & Alabi, 2015). It is essential to have multiple electric power sources to mitigate the menace of power outage on the national grid. An automated power changeover switch deploying artificial intelligence provides the solution by ensuring that cost effective and reliable power source is implemented at all times in a safely manner to protect the appliances.

Although power changeover switches are available in the market, they are limited in their operations by their dependence on the choice of the admin personnel controls making them manual in their operations according to (Narasimha & Salkuti, 2018). The automation of the power changeover device has made it an excellent power supply manager in the most cost effective and efficient manner as demonstrated in this research study.

The available variants of the power changeover switches in the Africa landscape are not affordable and are not conditioned to function in locations where electricity is shared in different phases making them unattractive for most remote areas of Africa. There is a rapidly growing market for power changeover switches as research reveals its tremendous benefits to the economy in providing a more stable and reliable power for production as reported by (Future Market Insights, 2025). Investing in the commercialization of the developed innovative product will create excellent return on investment for all the stakeholders considering the enormous market in Africa and the comparatively low cost of the developed device.

The short term impact of this developed automated power changeover switch is that it will pave way for a more stable, reliable, and cost effective electric power supply thereby catalyzing manufacturing businesses especially in Africa. The cases of power surge and damaged electric appliances linked with power changeovers will be averted leading to a safer environment according to (Onah, Kpochi, & Goodman, 2020). The long term impact will mean that the real-time generated data of the available power sources provided by the automated power changeover switch will be deliberately and intentionally used in the improvement of the national grid performance and other electric power sources making them more reliable and efficient. (Somefun, *et al*. 2020) previously reported that power changeover switches is suitable in smart cities, hospitals, and industries where a stable power supply is essential.

This study proposes a mandatory regulatory submission of all data generated by the developed automated power changeover switch for onward deposition to a repository designated for scientific research on the improvement of electric power sources stability in Africa.

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Funding sources

No funding

Competing Financial Interests Statement:

There are no competing financial interests in this research work.

Data availability

The microcontroller source code and any other information can be obtained from the corresponding author via email.