

# Improved Design on Automatic Single Phase Changeover Using Bluetooth Trigger

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**Abstract-** *Improved Design on Automatic Single Phase Changeover Using Bluetooth Trigger is a smart system built to solve the hassle and stress of manually changing over phase either to generator of the national grid. This project contains a detailed design of how the smart system of using Bluetooth to changeover phases can be actualized. This project used a Bluetooth module, a relay switch, a micro controller (Arduino), a multimeter. The purpose of this work is to solve the stress of manually changing over phases by introducing a smarter way that is the use of Bluetooth device.*

**Indexed Terms-** *Automatic changeover system, Bluetooth module, Micro controller (Arduino)*

## I. INTRODUCTION

The changeover switch is a device used to switch off a power supply and subsequently switch on another power supply. Basically, it is aimed at switching on a more convenient power supply to the load. Since it switches on power to the load, precautions have to be taken while choosing the type of changeover switch, while selecting the appropriate size, the control of arching has to be put into consideration. This project has been improved on the existing Electromechanical devices that have been in use over the years. In the course designing this project, different kinds of problems were encountered and they include; Difficulty in troubleshooting with circuit without the circuit diagram, Difficulty in connecting the output without short-circuiting, until a multiplexing circuit was gotten, Difficult in wiring because of strong wiring the project required. The objective of this work is; To design an automatic switching device which can be controlled using Bluetooth which will change to alternative power supply and back to the main supply when restored, Reduce/eliminate the stress of using manual changeover, to make use of a Bluetooth device to switch/transfer power from one source to another,

Determine the voltage carrying capacity that would trigger the transfer of power supply from one source to another. This project covers only a single-phase Bluetooth trigger automatic changeover which can only be used for providing a means of switching from single phase of AC mains to the generator in the case of power failure in public utility or private homes. According to [2], uninterrupted continuous power supply is essential to the industrial sector, university operations, and residential sector. These standby power supply systems are used to supply power to several types of loads such as: Essential Loads particularly in industrial processes where they require high restarting times or high shut down times. So the automatic transfer from the main supplies to the standby generator must be available, Critical Loads such as elevators, or lighting in the buildings where the automatic changeover is very important especially in hospitals, malls, and public places, Sensitive Loads such as computers, equipment and appliances in hospitals, microprocessor, controlled industrial machines, and the monitoring system where it is costly to shut them down and may be required to use of Uninterrupted Power Supply.

A Bluetooth trigger automatic changeover system allows a smooth and automatic transfer of electrical current between multiple sources of power to loads. The automatic changeover system would ensure that all power sources synchronized before connecting the loads with any source to prevent any feedback current from any source to the load when any one of them takes over [4]. The changeover would sense the interruption if the main supply remains as unavailable the changeover is sensitive to the fluctuations as voltage drops below a particular level within a specified time in the main power supply line. In this case the automatic changeover would switch on the generator and starts feeding the load through a relay that switches the battery voltage to the ignition of the generator. In a few seconds the generator starts

producing full power. During this time, the relays would disconnect the load from the other power supplies simultaneously and connect it to the generator. The changeover senses the main power supply continuously. If it is restored, the changeover would return back the connection between the load and the main supply because of its priority. Then, the generator would shut down after a few seconds.

The automatic changeover switches with a Bluetooth module that is being designed would be a complete system with various subsystems and components arranged and linked to function primarily as a means of manipulating the supply of electrical power to any desired load using a Bluetooth device.

## II. MATERIALS AND METHODS

The methodology of this work involves the design, development and incorporation of an Automatic Changeover Switch. The incorporation of the Automatic Changeover Switch involves the use of automatic switching between the phases of the mains supply and automatic switching between the generator/backup power supply. Industrial and commercial processes are dependent on electric power supply. Electricity supply instability in developing countries creates a need for alternative sources of power (to back up the utility supply) and the automation of electrical power generation [1]. The limitations of this approach are more or less the same thing with automatic changeover system with electromechanical relays [6]. Recently, electromechanical relays (EMRs) have been used with another component to implement automatic changeover [5].

## III. RESULTS AND DISCUSSION

In this section of the work, the various objectives were actualized. A workable system was designed in which a changeover system can be triggered ON/OFF using Bluetooth and can also be switched over to the generator using Bluetooth. Also, the stress of manually changing over switches was eliminated because a smart system has been used instead of the manual process. The Bluetooth application was used to send commands to enable the relay switch the phases. The voltage carrying capacity that would trigger s the

changeover was determined. The design of an automatic changeover using Bluetooth trigger lets the user control or switch ON/OFF his changeover device using his android smartphone. In the smartphone application, the user can select actions on what should happen with electrical/electronic devices in the network.

Mobile phone is a revolutionary invention of the century. It was designed to make and receive calls and text messages, but it has become more relevant after the smartphone was introduced. In this project I'm designing an automation system where one can switch his changeover using the Bluetooth based smartphone by sending command via Bluetooth from a pre-programmed application.

Below is a diagram showing a connected Bluetooth with the Arduino module;

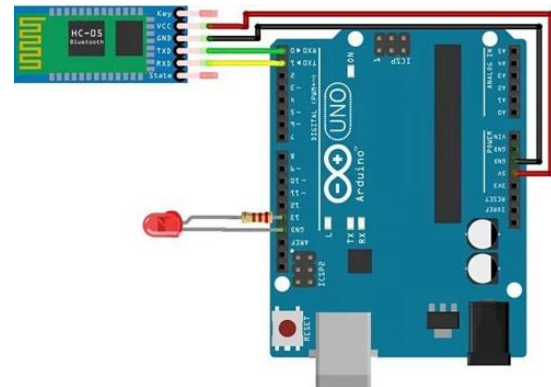


Figure 1: Bluetooth with the Arduino module

This diagram shows the connection of the Bluetooth module with the Arduino micro controller. The four steps taken to do this connection are;

Arduino	Pins		Bluetooth	Pins
RX	(Pin 0)	→	TX	
TX	(Pin 1)	→	RX	
5V		→	VCC	
GND		→	GND	

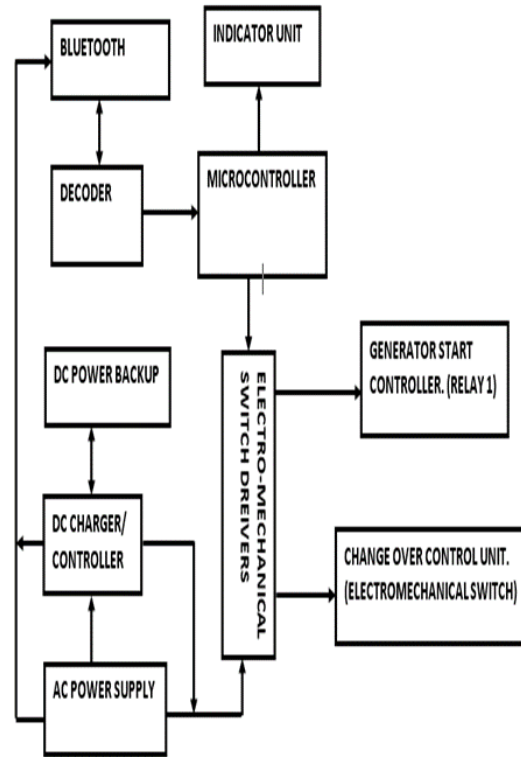
This work does not cover Android app development.

- Pair your device with the HC 05/06 Bluetooth module:
- Turn ON the HC 05/06 Bluetooth module by powering the Arduino.

- Scan your smartphone for available devices. 3. Pair your smartphone to the HC 05/06 by entering default password 1234 OR 0000.
- . Press "paired devices"
- Select your Bluetooth module from the list (HC-05/06)
- Disconnect the button to disconnect the Bluetooth module



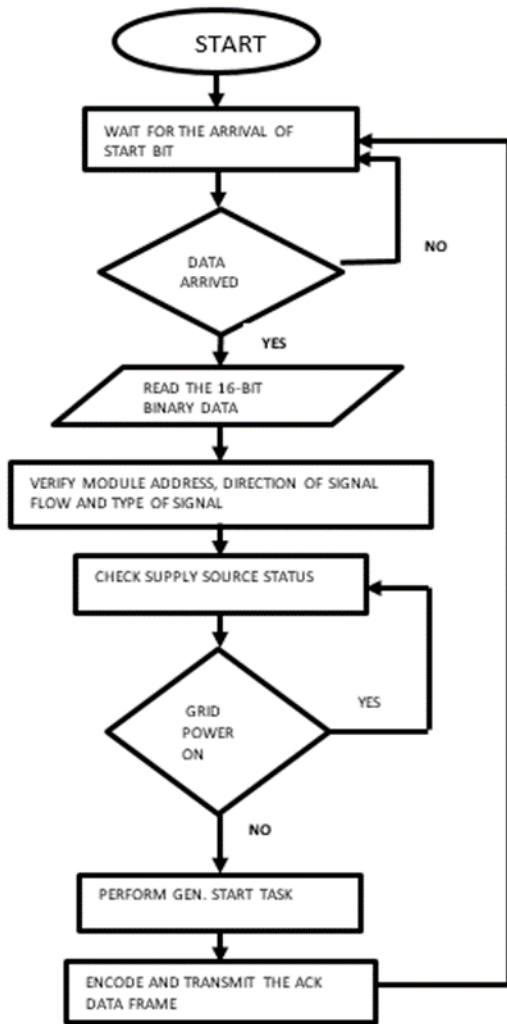
The figure 2: the connected device with the Bluetooth module.



The figure 3: comprehensive block diagram of the system.

This design contains a Bluetooth module connected to a decoder. This decoder then connects to the microcontroller which decodes the signal or commands being sent by the end user. The microcontroller then sends this signal to the electrochemical switching device (Relay). Now the relay being a switching device triggers the changeover to either generator or the national grid (Port Harcourt Electricity Distribution) PHED)).

Now for the microcontroller to work, a minimum off 5V is sent to the switching device which in turn triggers the relay to either changeover to either generator or the national grid (PHED). To switch OFF the device, the microcontroller passes a 0V or logic low to its digital pin.



The figure 4: the programmed application and a flow chart of how the system operates

The flow chart contains programmed language that the Bluetooth sends out to the microcontroller which in turn interprets the message and carries out the desired task which was sent from the user.

Here ATMEGA328p microcontroller is used. It is an 8 bits microcontroller and it requires supply voltage of 5V DC. We can use 9V DC battery or 12V, 1A adapter to provide the power supply.

Bluetooth module TX and RX pins are connected to the RXD and TXD pins of the controller. Vcc pin is connected to the 5V and GND pin is connected to ground.

• Connection Process

Step 1: Connecting Bluetooth

The Bluetooth module Tx is connected to arduino Rx (digital pin 0) and the module Rx to arduino Tx (digital pin 1) 5v and GND of the module is connected to the arduino's 5V and GND.

Step 2: Connecting Relay Driver

The relay driver chip consists of total 16 pins (8 pins both sides) where pin 1 to 7 are input from digital pins of Arduino and pin 10 to 16 are for the output to the relay switches. The pin 8 is connected to the ground and pin 9 to +12v supply. In this project, the digital pin 7 and 8 (pin 13 and 14 of Atmel328) is connected to the pin 1 and 2 of the relay driver.

Step 3: Connecting Relay Switches

The relay used is SPDT. It has 5 pins on the underside. The pin 1 is connected to the pin 16 and 3 is connected to arduino GND. Pin 2 is the common contact in the relay to which you have to connect the power source (AC 230V), and 4 is the pin to which you have to connect the controller wire.

Controller communicates with Bluetooth module using serial communication (UART protocol) band rate 9600 to communicate with the Bluetooth. To change the Bluetooth name and password, the Bluetooth AT commands is used.

Below are few Bluetooth AT commands:

- AT- Responds OK. (Used to test the Bluetooth module)
- AT+RESET – Responds OK. (Used to reset the module)
- AT+NAME? – Responds with the module name.
- AT+NAME= <name> - Responds OK. Name should be less than or equal to 20 characters.
- AT+PSWD? – Responds with the existing password.
- AT+PSWD= <password> - Sets module pairing password.

The changeover switches are connected through the relays. Here the relays are used to switch to either the generator or national grid or used to switch off the system depending on the need.

Step 4: Loading the Arduino Software

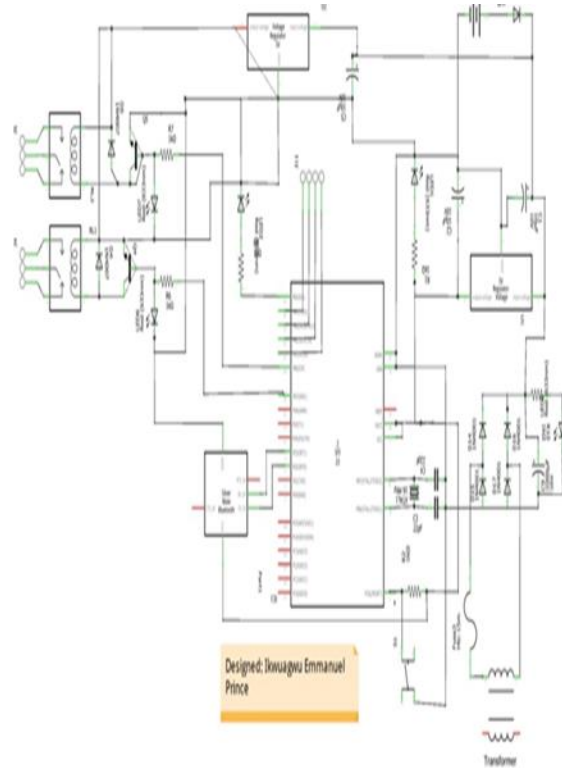
Here, it checks the incoming Bluetooth signal via the Bluetooth module and the compares (ASCII values) using an “if” statement with previously defined values. If it matches the value, the relay is activated using digital write (pin, HIGH) command, which passes 5V to the arduino digital pin.

Step 5: Downloading the android application and setting up Bluetooth

There are several applications available in Google play store for home automation. Any of them can be installed and used. Once installed, it will have to be paired with the Bluetooth module. For this to occur the arduino and Bluetooth will have to be powered and then the Bluetooth on your smartphone will be turned ON to make it visible to other devices. After that, search for new devices in the Bluetooth, select the Bluetooth module from the list, and enter the pairing code when prompted usually 1234 or 0000.

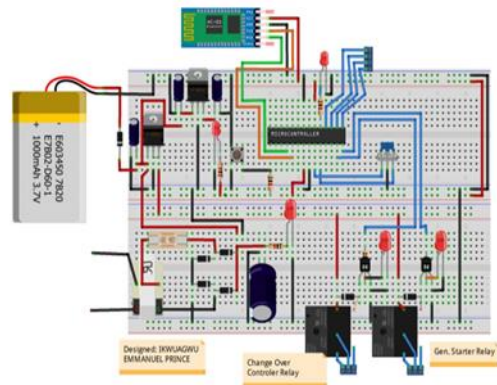
After pairing with the system, go to the application and enter the name of the Bluetooth module and click “OK”. After that the phone will get connected to your system and clicking the respective button, the appliance turns ON/OFF.

- The Circuit Diagram:



The figure 5: The circuit diagram of the system.

- Breadboard Design:



The figure 6: The breadboard design where the comprehensive complete components were connected.

### CONCLUSION

An automatic power changeover switch using Bluetooth trigger has been designed. The prototype of the automatic power changeover switch worked according to the specification and quite satisfactorily. The device is quite cheap, reliable and easy to operate.

Whenever there is power outage, it reduces stress for manpower changeover. The automatic changeover system has immense advantage in every area where uninterrupted power is required. Whenever the reliability of electrical supply from the utilities is low and wherever continuity of supply is necessary, the automatic changeover system using Bluetooth trigger switches to an alternative source from main supply and vice versa. This paper designed a low-cost automatic changeover system using Bluetooth trigger that can be used mainly in residential building; this system can be used and the specifications adhered to, the materials used if the project is to be implemented should be of high quality.

#### REFERENCE

- [1] Ahmed, M. S, A.S.Mohammed “Development of a single phase Automatic Changeover Switch”, Department of Electrical and Computer Engineering, Federal University of Technology, Minna, Nigeria. July, 2006
- [2] Oladokun (2013), “Design and Construction of an Automatic Mains and Phase Changer”.Book entitled by “Maintaining Mission Critical Systems in a 24/ Environment”, Publisher: Wiley-IEEE Press, Pages: 89 -111, Subject Categories: Power, Energy, & Industry Applications.
- [3] J. G. Kolo, “Design and Construction of a Single Phase Automatic Change-Over Switch”,DepartmentofElectrical and Computer Engineering, Federal University of Technology Minna, Nigeria, 2007.
- [4] R.Silva,“How automatic transfer switches work”,retrieved online from [http://www.articlesbase.com/tool\\_and equipments](http://www.articlesbase.com/tool_and equipments). November, 2009
- [5] Agbetuyi, A. F., Adewale, A. A., Ogunluyi, J. O. & Ogunleye, D. S., 2010. Design and Construction of an Automatic Transfer Switch for a Single-Phase Power Generator. 192 Journal of Electrical Engineering, pages1-2
- [6] Osaretin C.A.; Ibadode E.I.; Igbinovia S.O. (2016) Design and Implementation of Automatic Changeover Switch (With Step Loading) for Renewable Energy Systems. Int. J. Renew. Energ & Environ Vol.2, pp179-192