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ELECTRIC POWER GENERATION FROM MIXED WASTE

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[1,2,3]Bachelor's of Engineering,[4]Project Guide
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Abstract: **Electricity generation by burning waste materials, is a process that involves generating electricity from waste material by burning the waste materials inside the firebox. This process cuts down landfill waste and generates renewable energy. This process involves the collection of waste materials, segregation, burning of waste inside the firebox, pollution control, and production of energy. The electricity generated can be used to glow LED bulbs in homes, offices, and other commercial apartments. This electricity generation process is used to reduce non-biodegradable waste substances, such as plastics, paper, etc. Overall, electricity generation by burning waste materials is a favorable solution for waste management and renewable energy production. However, it is important to take into consideration the advantages as well as disadvantages of this method to reduce any hazards to the environment.**

IndexTerms **- Led Bulbs, Firebox, Electricity, Non-biodegradable Waste.**

I. INTRODUCTION

This project has been designed for the generation of electricity from waste material that involves the conversion of various types of waste into usable energy. This process is often referred to as waste-to-energy, and it offers several benefits including reducing waste in landfills, reducing greenhouse gas emissions, and providing a source of renewable energy. The process of generating electricity from waste materials involves the use of thermal or biological processes. The basic idea is demonstrated in the block diagram shown in Figure 1. This diagram illustrates the segregation of waste. The block diagram in Figure 2 shows the electronic components used and the process for waste segregation. Block Diagram 3 shows that the waste materials are burned to generate heat, heating panels are used to convert heat energy into electricity, powering LED bulbs and charging batteries. Smoke is then filtered before entering the water tank.[1]-[5]

This system consists of different components like Heating panels, LED bulbs, Zaar box, IN4007, Battery 4.5V, Resistors, and capacitors. Also, by using a pollution control system the smoke is directed towards the water tank and filter system for pollution control, utilizing a water-cooling system.[6]-[7]

The paper further outlines the system description, experimental procedures and concludes with hardware output.

II. LITERATURE SURVEY

A. Energy Generation from Bio-Waste Using Normal and Chemical Decomposition Techniques to Meet Power Demand in Urban Areas [2]

Abstract: To convert chemical energy present in the organic waste into electrical energy through the catalytic reaction of the microorganisms that are internally present in the food waste. In the Microbial Fuel Cell, the decomposition of food generates microbes present in the container and oxidizes the organic fuel which generates a proton and passes through the Proton Exchange Membrane (PEM) from anode to cathode. This leads to the production of electricity.

B. Generating Electricity by Non-Biodegradable Waste[3]

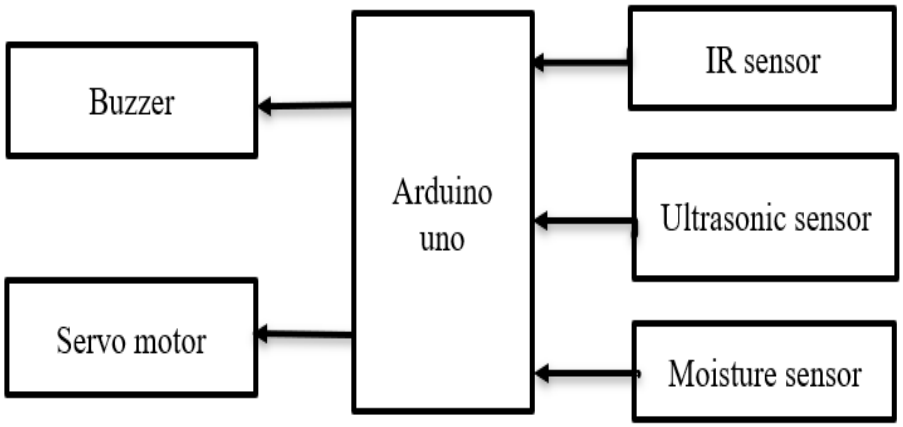
Abstract: To reduce the amount of greenhouse gases like CO2, CO, SO2, NO2, and heavy metals like mercury being released into the atmosphere, waste-to-energy plants are used. The waste is burned in the firebox. After that, the heating panel converts the heat energy into electric energy. This energy is then stored in the battery, and a heating sensor turns on the output to deliver this energy to the LED bulb, causing it to light up.

C. Waste to Energy as an Alternative Energy Source and Waste Management Solution[4]

Abstract: A review of WTE technology as a solution to the MSW problem and providing an alternative source of energy. WTE technologies mean utilizing waste to generate energy or converting garbage to be alternative energy source.

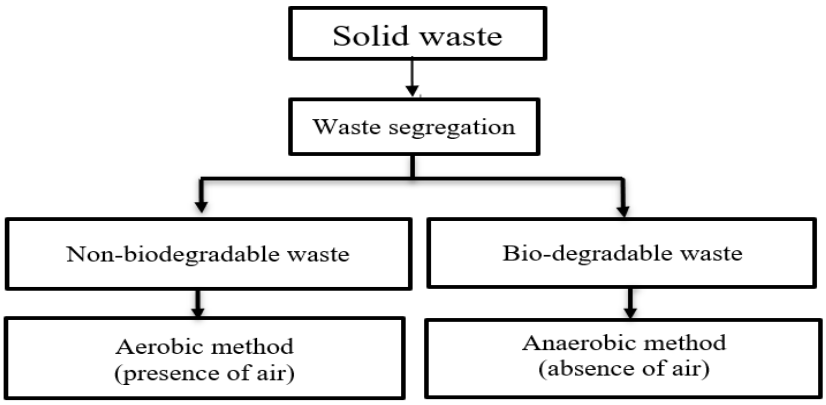
Other literatures [5]-[34] helped to get motivated in this field and also technical information has helped in this project.

III. BLOCK DIAGRAM



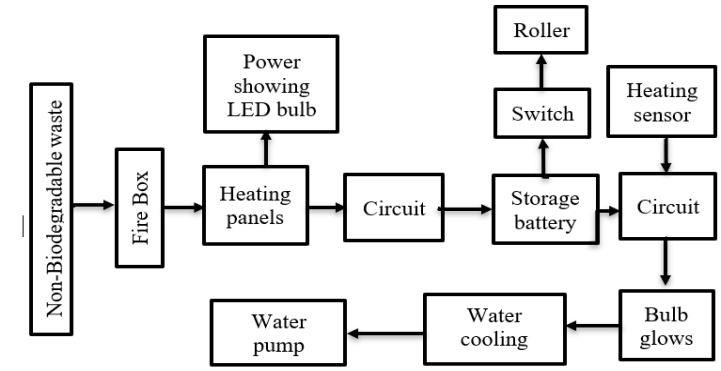
[fig 1. Block Diagram of the main configuration of the project]

The block diagram (fig 1) shows the waste segregation process. An Arduino Uno ATmega328P is used as the controller. An IR sensor is used to detect objects when placed, while ultrasonic sensors use sound waves to measure garbage levels and approximate the volume in bins. Also, a moisture sensor is used to classify the waste as wet or dry waste.



[fig 2. Block Diagram of Waste Segregation]

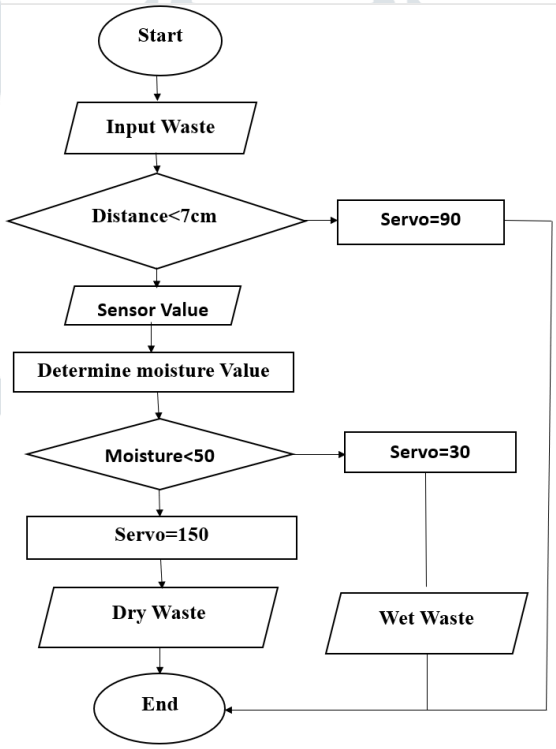
As shown in Fig 2, we utilize a segregation technique to sort waste and differentiate between biodegradable and non-biodegradable waste. Non-biodegradable waste is used to make electricity through aerobic respiration. By using anaerobic methods we can produce biogas from biodegradable waste. This method not only solves the issue of waste management but also produces energy from the process, contributing to a more eco-friendly system.



[fig 3. Block Diagram of Electricity Generation from non-biodegradable waste]

In this block diagram(fig 3), we can observe that when waste materials are burnt in the firebox, heat is generated, activating the heating panel to convert it into electricity. Subsequently, this electricity powers the LED bulb, which illuminates. The electricity then flows into the circuit and is stored in the battery. Once electricity is stored in the battery, the heating sensor activates the output power supply, causing the LED bulb to glow again. Simultaneously, smoke is directed to the water tank, where the filter system begins controlling pollution.

IV. FLOW CHART



[fig 4. Flow chart for waste segregation code]

This Arduino code appears to control a servo motor and ultrasonic sensor to categorize waste as either wet or dry based on moisture levels and detect the presence of a hand using the ultrasonic sensor. Here's a summarized flowchart explanation:

1] Setup:
Set up pins for an ultrasonic sensor (trigPin, echoPin), a buzzer (buzz), and a servo motor (servo).
Initialize variables and objects.

2]Loop:
Set the servo to a default position (90 degrees).
Read analog value from moisture sensor (value).
If the moisture level (value) is above a threshold (500):
Move the servo to a position indicating wet waste (30 degrees).
Print "wet waste" to Serial.
If the moisture level is below the threshold:

Move the servo to a position indicating dry waste (150 degrees).
Print "dry waste" to Serial.

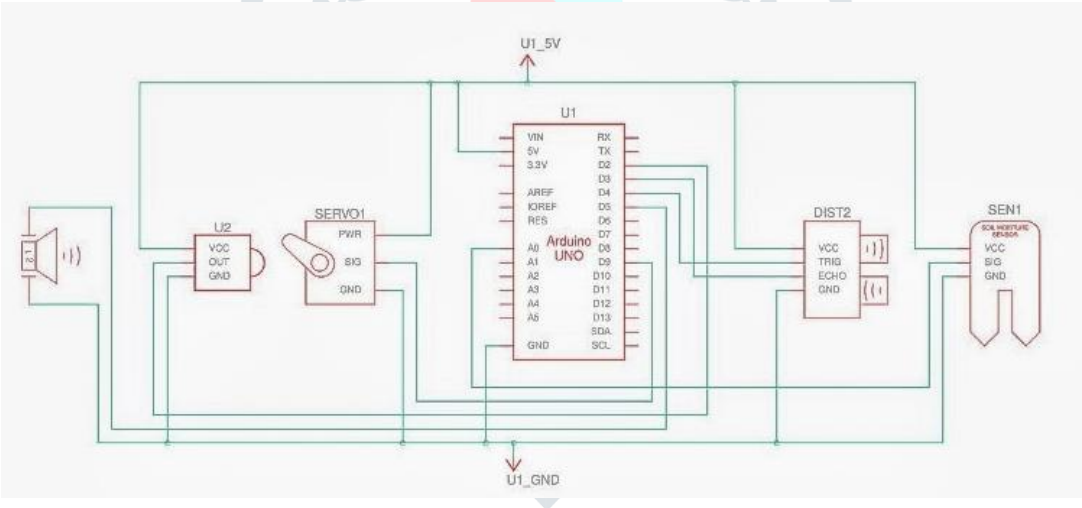
3]Ultrasonic Sensor:
Trigger the ultrasonic sensor and measure the duration of the echo.
Convert the duration to distance in inches and centimeters.
If the detected distance is less than 3 inches:
Activate the buzzer.
If the distance is greater than or equal to 3 inches:
Deactivate the buzzer.

4]Delay:
Introduce delays for proper functioning and to avoid rapid sensor readings.

5]Conversion Functions:
microsecondsToInches and microsecondsToCentimeters are functions to convert microseconds to distance in inches and centimeters, respectively.
This code integrates both the moisture sensor and ultrasonic sensor to make waste categorization decisions and detect the presence of a hand.
The servo motor is used to visually represent the waste category, and the buzzer provides an audible indication when a hand is detected.

V. CIRCUIT DIAGRAM

1] Waste segregation:

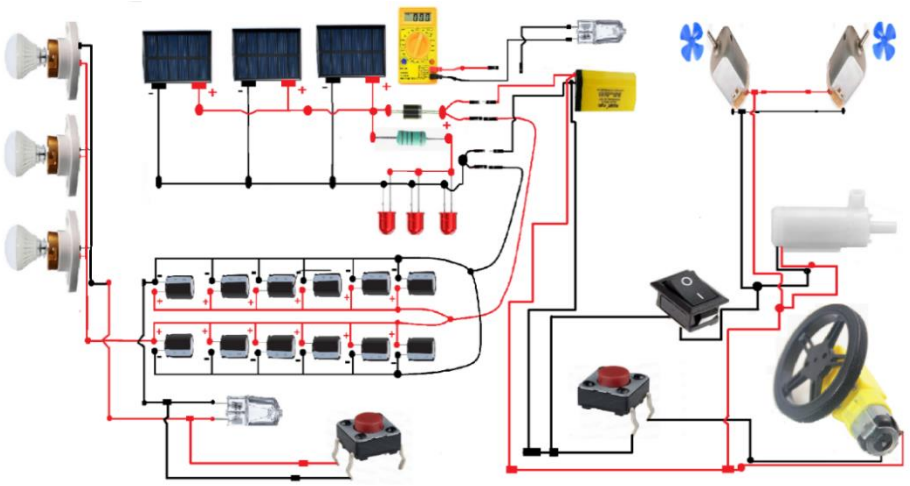


[fig 5. Circuit diagram of waste segregation] [Tinkercad Software]

a)Design Steps:-

1. Select an Arduino Uno, designed to operate efficiently with a 5V input power.
2. Connect the IR Sensor to Pin 2 of the Arduino for Precise sensor integration.
3. Connect the Ultrasonic Sensor's echo pin to pin 3 and the trig pin to pin 4 of the Arduino, ensuring seamless communication.
4. Integrate a servo motor and a buzzer into your system by connecting them pins to 9 and 5 of the Arduino respectively, for dynamic functionality.
5. Validate your circuit design by simulating it, ensuring a meticulous check of each component's functionality.

2]Circuit diagram for electricity production:



[fig 6. Circuit Diagram of Electricity Production]

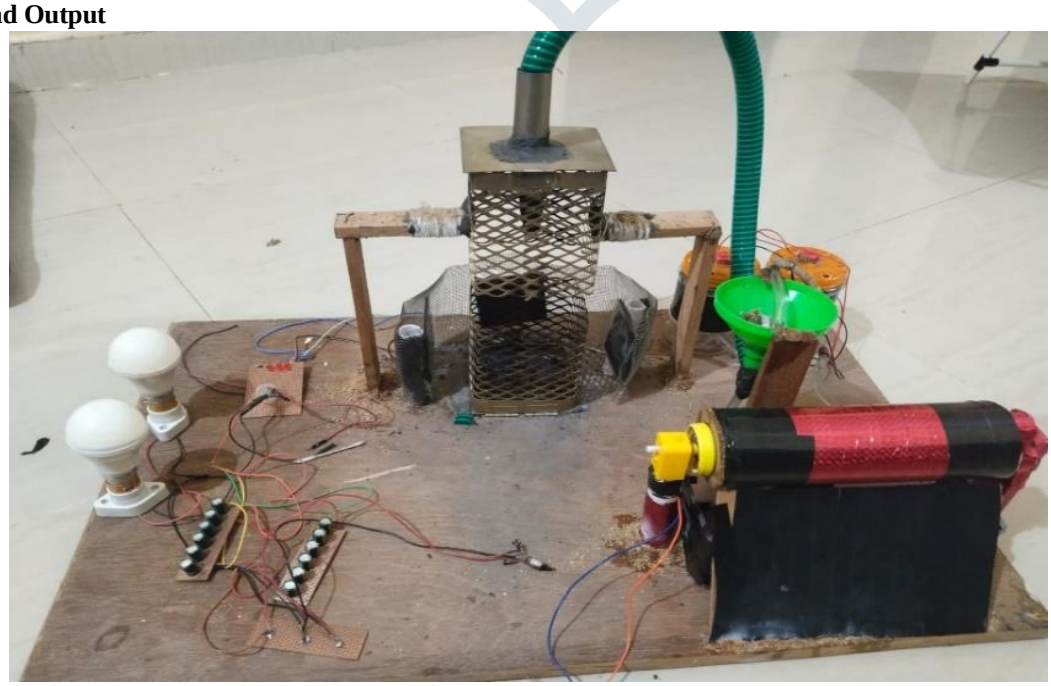
b)Design Steps:-

1. Connect all heating panels to the battery through diodes.
2. Connect a power-indicating LED to the solar panels through a resistor.
3. Connect capacitors to preserve the battery's life and health.
4. Connect the heating sensor to the battery using a switch.
5. Connect the DC water pump through the same switch.
6. Simulate for results.

VI.EXPERIMENTAL PROCEDURE

The initial step involves segregating waste using Arduino technology. We employ a segregation technique to sort solid waste, distinguishing between biodegradable and non-biodegradable components. Through aerobic respiration, we harnessed the potential of non-biodegradable waste to generate electric power. Simultaneously, employing anaerobic methods enabled the production of biogas from biodegradable waste. This sustainable approach not only addressed waste management but also harnessed energy from the process, contributing to a more environmentally friendly and efficient system. When we burned waste materials in the firebox, heat was generated, and the heating panel started converting heat into electricity, as observed through the glowing LED bulb. The generated electricity flowed through a circuit, charging a battery for power storage. When electricity was stored in the battery, the heating sensor activated the output power supply, causing the LED bulb to glow. Simultaneously, smoke was directed to the water tank, and the filter system started controlling pollution.[8]-[12]

VII.Images and Output



[Fig7. Project Setup]

In this Fig7, shows the project setup, which consists of the following components: LED bulbs, capacitor, firebox, battery, pipeand carbon collector plate.

[Fig 8. Production of Electricity from waste]

Fig 8 shows waste burning in the firebox, converting heat to electricity via a heating panel. This powers an LED bulb, with excess stored in a battery. When the battery is charged, the heating sensor activates the power supply, reigniting the LED. Smoke is filtered in a water tank.

VIII.CONCLUSION:

From this project, we conclude a successful integration of Arduino-assisted waste segregation, energy harvesting, and pollution control. The technology showcased efficient waste management, emphasizing sustainability. Harnessing energy through aerobic and anaerobic processes demonstrated a commitment to eco-friendly power generation. The live demonstration highlighted the conversion of waste heat into electricity, offering practical solutions for a more sustainable future.

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