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"IoT-BASED WASTE MATERIAL SOLAR COOKER"

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ABSTRACT

Energy demand is increasing rapidly while conventional energy sources are depleting and causing environmental pollution. Solar energy is one of the most abundant renewable energy sources available on Earth. A solar cooker is an eco-friendly device that utilizes solar energy for cooking food without using fossil fuels. However, traditional solar cookers lack monitoring and efficiency optimization. In this research, an IoT-based solar cooker developed using waste materials is proposed. The system integrates temperature sensors, a microcontroller, and IoT connectivity to monitor and control the cooking process remotely. Waste materials such as discarded aluminum sheets, cardboard boxes, and glass are used to construct the cooker, making it cost-effective and sustainable. The temperature data is transmitted to a mobile application through Wi-Fi, allowing users to monitor cooking conditions in real time. The proposed system promotes renewable energy usage, reduces waste, and provides a low-cost smart cooking solution suitable for rural and urban areas..

Key Words: *IoT, Solar Cooker, Renewable Energy, Waste Materials, Temperature Monitoring, Arduino, Smart Cooking*.

I. INTRODUCTION

With the growing population and rapid industrialization, energy consumption has increased significantly. Traditional cooking methods rely heavily on fossil fuels such as LPG, coal, and firewood, which contribute to environmental pollution and deforestation. Solar cooking is an alternative and sustainable method that utilizes sunlight as a clean energy source.

Solar cookers convert solar radiation into heat energy, which is then used for cooking food. These cookers are widely used in rural and remote areas where access to electricity or gas is limited. However, traditional solar cookers do not provide information about cooking temperature or efficiency. The Internet of Things (IoT) has introduced smart monitoring and automation in various fields. By integrating IoT with solar cooking systems, it becomes possible to monitor temperature, cooking time, and performance remotely. This project proposes an IoT-based solar cooker built using waste materials, making it economical, environmentally friendly, and suitable for sustainable development.

II. REVIEW OF LITERATURE

Various researchers have worked on solar cooking technologies and IoT-based monitoring systems.

Kumar et al. (2018) proposed a solar box cooker that improves heat retention using insulated materials. Their work focused on increasing the efficiency of solar cookers in rural environments.

Aggarwal and Pangasa (2019) studied the integration of smart technologies in automated systems and demonstrated how IoT can enhance monitoring and control processes in modern applications.

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Subudhi and Ponnalagu (2019) discussed intelligent monitoring systems using microcontrollers and wireless communication. Their research showed the effectiveness of real-time data monitoring.

Chikankar et al. (2016) developed a wireless sensor network system for environmental monitoring using ZigBee communication. The research highlighted the importance of sensor-based monitoring systems.

From the literature review, it is observed that combining IoT technology with renewable energy devices can significantly improve efficiency, monitoring capability, and user convenience.

III. Problem Identification

Although solar cookers provide an eco-friendly cooking solution, several limitations exist:
Traditional solar cookers lack temperature monitoring systems.
Users cannot determine the cooking status remotely.
Many solar cookers are expensive due to specialized materials.
Lack of smart monitoring reduces user convenience and efficiency.
Waste materials are often discarded instead of being reused for useful applications.
These challenges highlight the need for a low-cost, smart, and sustainable solar cooking system.

IV. Solution

To overcome these issues, an IoT-based solar cooker using waste materials is proposed.
The system includes:

1. Solar cooker constructed using waste materials such as cardboard, aluminum foil, and glass.
2. A temperature sensor to measure internal cooking temperature.
3. A microcontroller (Arduino/ESP8266) to process sensor data.Wi-Fi module for IoT connectivity.
4. Mobile or web interface for remote monitoring.

The system allows users to monitor temperature and cooking progress in real time through the internet

V. Proposed Methodology

The proposed system consists of several components integrated into a smart solar cooking system.

Components Used

1. Solar reflector made from waste aluminum sheets
2. Insulated cooking box using cardboard and glass
3. Arduino/ESP8266 microcontroller
4. Temperature sensor (LM35 or DS18B20)
5. Wi-Fi module
6. Mobile monitoring interface

Working Principle

1. Solar radiation is reflected by the reflective surface into the cooking chamber.
2. Heat energy is trapped inside the insulated box using the greenhouse effect.
3. The temperature sensor continuously measures the internal temperature.
4. The microcontroller processes the temperature data.
5. Data is transmitted to the cloud via Wi-Fi.
6. The user can monitor cooking conditions through a smartphone

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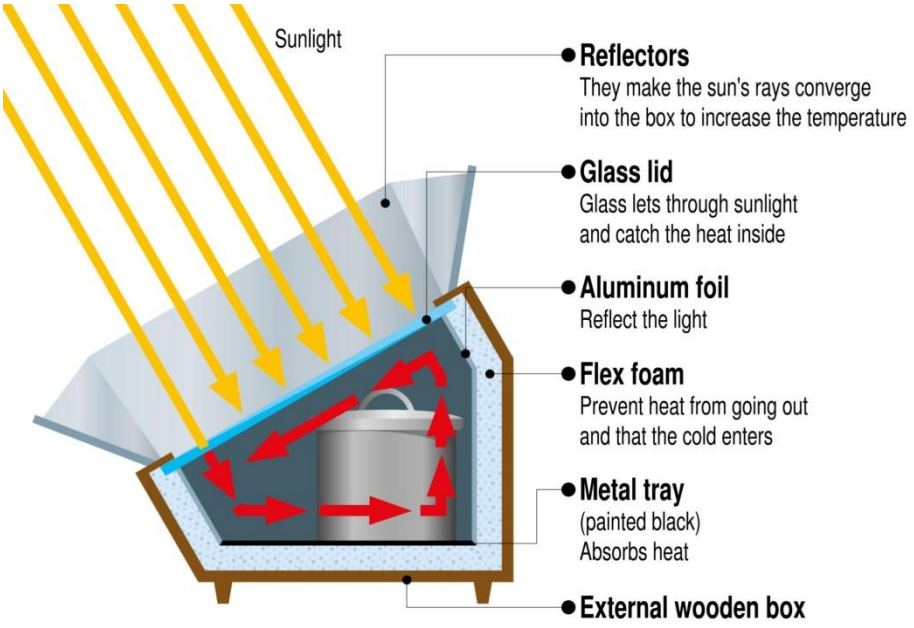

Figure1: Working of Solar Cooker

Block Diagram:

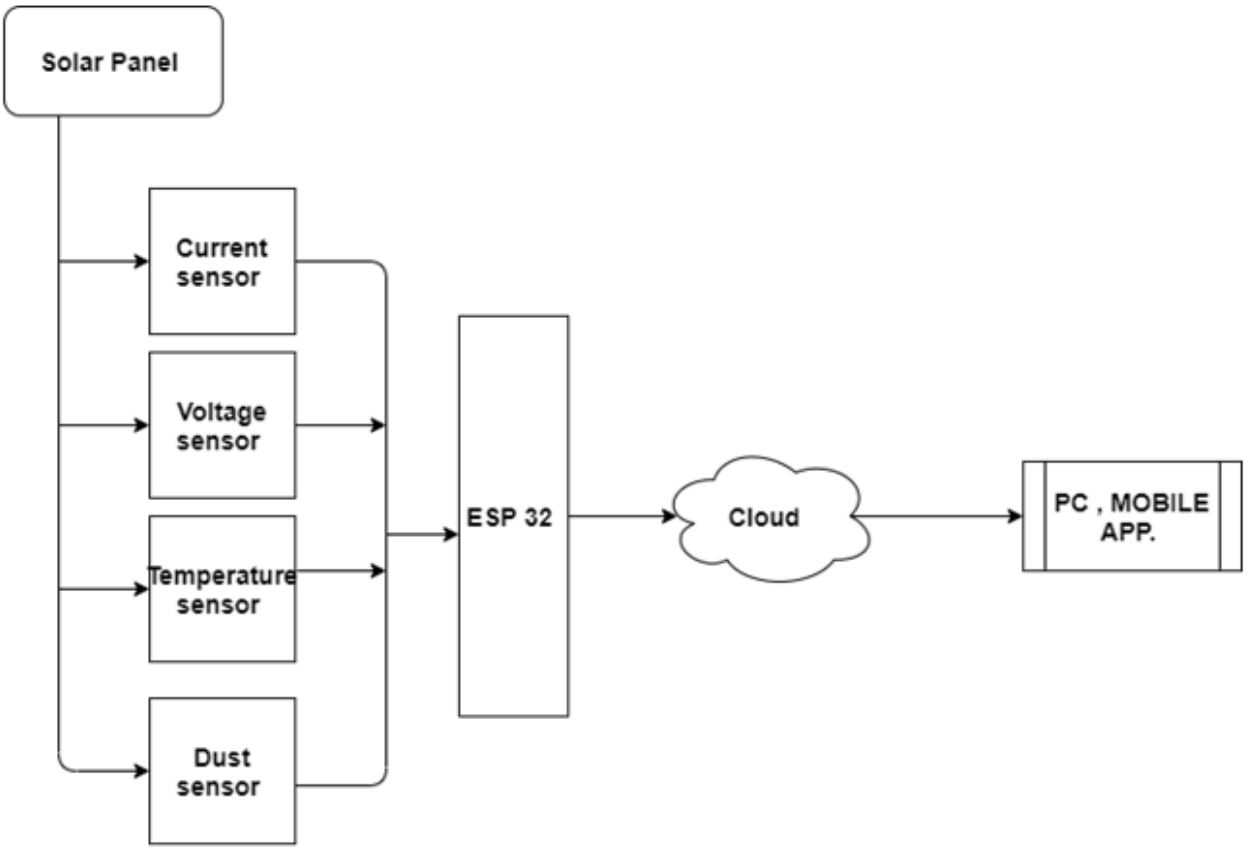

Figure2:Block diagram of 8 components

ALGORITHM

Step 1: Start the system
Step 2: Initialize microcontroller and sensors
Step 3: Measure temperature using temperature sensor
Step 4: Send temperature data to microcontroller
Step 5: Transmit data through Wi-Fi to cloud server
Step 6: Display temperature and cooking status on mobile application
Step 7: Repeat monitoring until cooking is completed
Step 8: Stop the system

VI. RESULT

The developed IoT-based solar cooker successfully demonstrates the use of solar energy for cooking while allowing real-time monitoring. The temperature sensor accurately measures the internal temperature of the cooker and sends the data to the IoT platform. Experimental results show that the cooker can reach temperatures between **80°C and 120°C**, which is sufficient for cooking food items such as rice, vegetables, and boiling water. The use of waste materials significantly reduces the cost of construction. The IoT monitoring system provides real-time temperature updates, improving usability and efficiency.

VII. CONCLUSION

The IoT-based waste material solar cooker provides a sustainable and cost-effective solution for eco-friendly cooking. By integrating IoT technology with solar cooking systems, users can monitor cooking conditions remotely, improving efficiency and convenience. The use of waste materials reduces environmental impact and promotes recycling. This system is especially beneficial for rural areas where electricity and fuel resources are limited. Future improvements may include automated solar tracking systems, improved insulation techniques, and mobile applications for advanced monitoring and control.

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