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CARBON SHIELD – ADVANCE CARBON CAPTURE DEVICE FOR SUSTAINABLE FUTURE

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Abstract : The solar-powered thermal power plant air carbon collector system is an innovative project designed to reduce carbon emissions from industrial exhaust by using renewable energy sources. This system integrates a solar thermal power plant, which provides the necessary energy to run the carbon collection process, and an air carbon collector that captures carbon dioxide (CO_2) from the exhaust gases of thermal plants. The ATmega32 microcontroller is used for monitoring and controlling various components of the system, including the solar energy input, sensors, and actuators involved in the carbon collection process. The collected CO_2 can then be stored or processed further for reuse or safe disposal, contributing to a greener and more sustainable environment.

Keyword – *Solar Panel, ATmega32 microcontroller, Air Quality Sensor, Carbon Collector, Display, IOT Integration and Automation*

1. INTRODUCTION : -

In this project we are deciding to over come from to present, many environmental problems caused by excessive carbon emissions are threatening the living habitat of mankind, such as global warming and sea level rise. Above from this, the rapid development of the city consumes a large amount of energy, and the sequent carbon dioxide emissions accelerate the process. As the main source of development of human society, fossil energy has creates about serious environmental pollution problems while promoting the development of the world economy .fossil fuel combustion and cement production have produce carbon dioxide. (CO_2) is the most important a greenhouse gas (GHG) contributing to global warming India as a developing country cannot afford to invest in emission control, yet India is developing policies that will control carbon emissions.

Throughout this we are making the project as solution for reduce carbon in environment. It focuses on the reduction of specific carbon emissions in india.In addition to developing clean energy and adjusting the energy structure, the carbon emission reduction space of thermal power generation should be explored in depth to reduce carbon emissions in the power industry.

2. NEED OF PROJECT : -

As global concern about climate change intensifies, reducing atmospheric CO_2 levels has become a critical challenge. Industrial processes, power plants, and other major sources emit large quantities of CO_2, contributing significantly to global warming and climate disruption.

Current methods for capturing and storing CO2 are often inefficient, expensive, or not scalable enough to meet the necessary reduction targets.The problem is to develop an effective, cost-efficient, and scalable carbon capture device that can significantly reduce CO2 emissions from industrial sources and other major emitters. This device should ideally integrate with existing infrastructure, offer high capture efficiency, and provide a viable method for storing or utilizing the captured carbon.This statement outlines the broader issue (climate change and CO2 emissions), the specific challenge (inefficiency, high cost, and scalability of current methods), and the goal (developing an improved carbon capture device).

3. METHODOLOGY : -

- Set up the solar power system, ensuring stable voltage levels for the microcontroller and sensor. Interface the air quality sensor with the ATmega32. Connect the LCD display for real-time data output.
- Integrate the ESP8266 module for IoT connectivity.
- Write the code to read sensor data and display it on the LCD. Develop the communication protocol to send data to the Thingspeak server via ESP8266. Implement power-saving features and automation based on air quality readings.
- Test the air quality sensor in various environments to ensure accurate data. Calibrate the sensor and filtering system for optimal carbon collection.
- Install the system in a location with sufficient sunlight for solar power. Monitor the air quality data remotely and make necessary adjustments to the system.
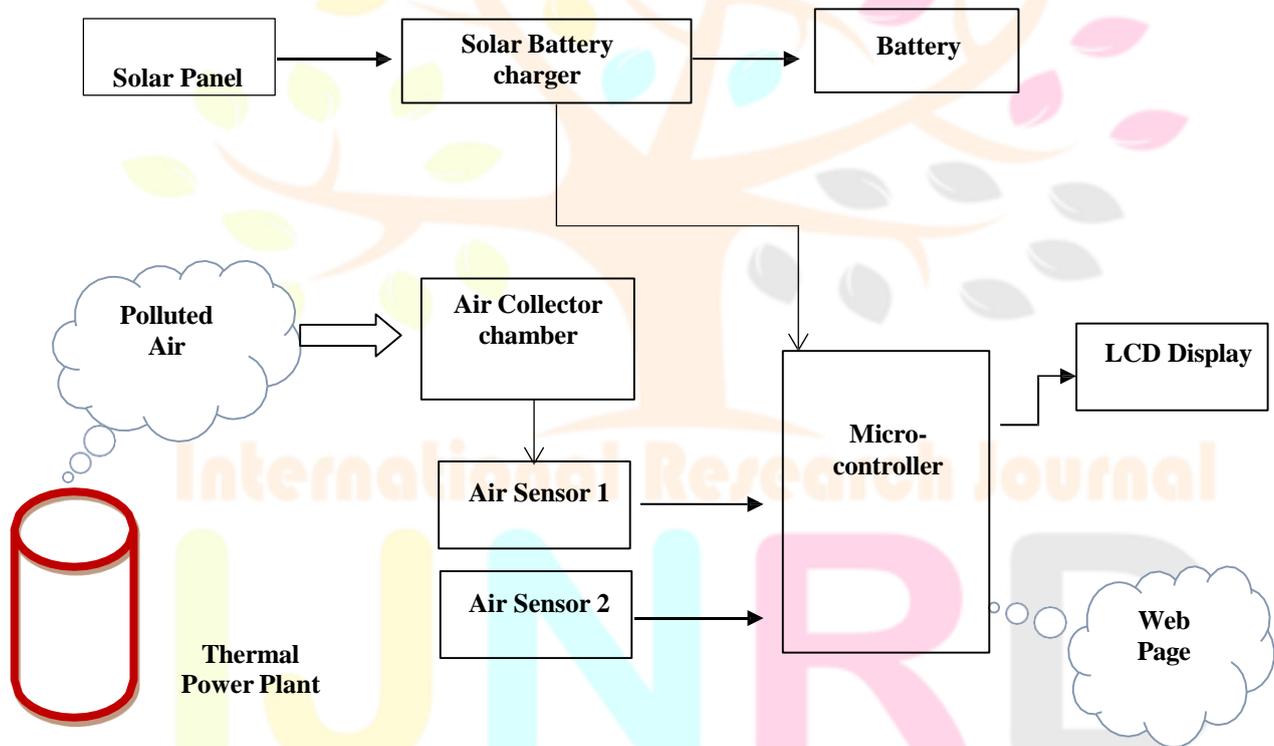
4. BLOCK DIAGRAM : -

fig – 1: functional block diagram
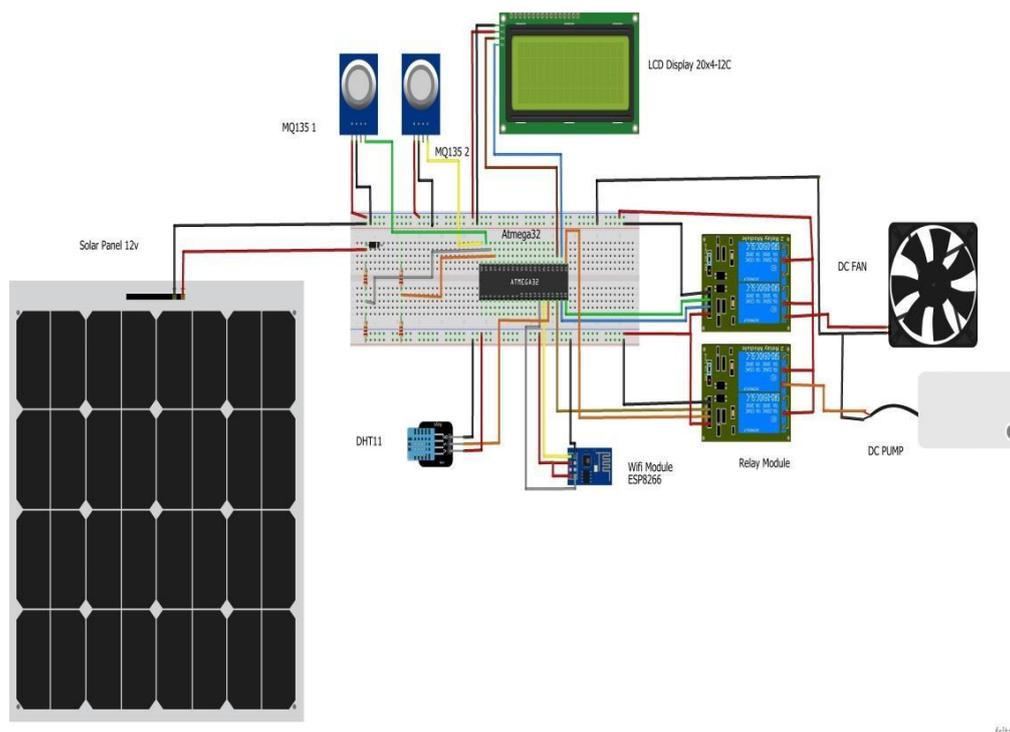
3.1 CIRCUIT DIAGRAM : -

fig – 2: circuit diagram

3.2 HARDWARE RESULTS : -

Carbon Shield System using solar energy. It continuously monitors environmental parameters such as temperature, humidity, smoke level, air quality, and battery voltage, and displays the data on an LCD. Additionally, it uses a Wi-Fi module (ESP8266) to send data to ThingSpeak for remote monitoring.

Code Features:

1. **Temperature & Humidity Monitoring:**
   DHT11 sensor is used to measure temperature and humidity.
   Based on the values, the pump and fan are activated to manage the environment.

2. **Smoke & Air Quality Detection:**
   MQ and MQ135 sensors are used to monitor smoke and air quality.
   The fan is controlled to manage the air quality based on the gas levels.

3. **Battery Monitoring:**
   Analog inputs (A0 and A1) are used to read the battery and solar panel voltages.
   Relay control is used to turn charging on/off depending on battery voltage.

4. **Wi-Fi Connectivity:**
   The system connects to a Wi-Fi network using AT commands for ESP8266.
   Data is sent to ThingSpeak periodically for remote visualization.

5. **LCD Display:**
   A 20x4 LCD display is used to show real-time data. The Carbon Shield System using solar energy was successfully implemented. It continuously monitors temperature, humidity, smoke levels, air quality, and battery voltage. The system performs the following key functions:

- **Environmental Monitoring:**
  The DHT11 sensor accurately measures temperature and humidity, and the system controls the fan and water pump accordingly to maintain optimal environmental conditions.

- **Air Quality Control:**
  MQ and MQ135 sensors detect smoke and harmful gases. If gas levels exceed the set threshold, the fan is activated to ensure air circulation and reduce pollution.

- **Battery Management:**
  The system monitors the solar panel voltage and battery level using a voltage divider circuit. A relay is used to manage battery charging based on predefined voltage limits.

- **IoT Integration:**
  Data is sent to ThingSpeak periodically using an ESP8266 module, enabling real-time remote monitoring of environmental parameters.

- **User Interaction:**
  A 20x4 LCD display provides real-time feedback to the user about temperature, humidity, gas levels, and battery status.
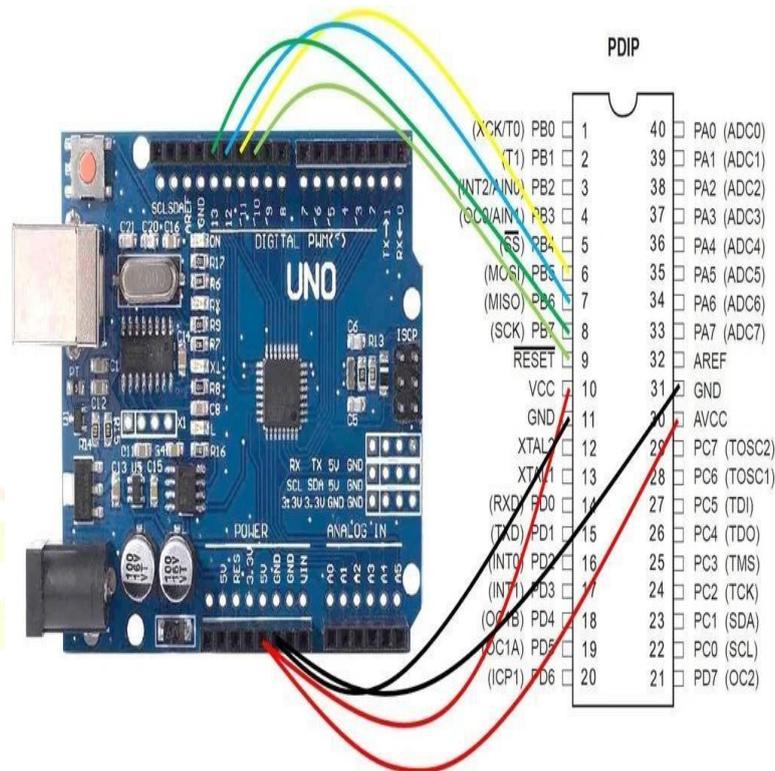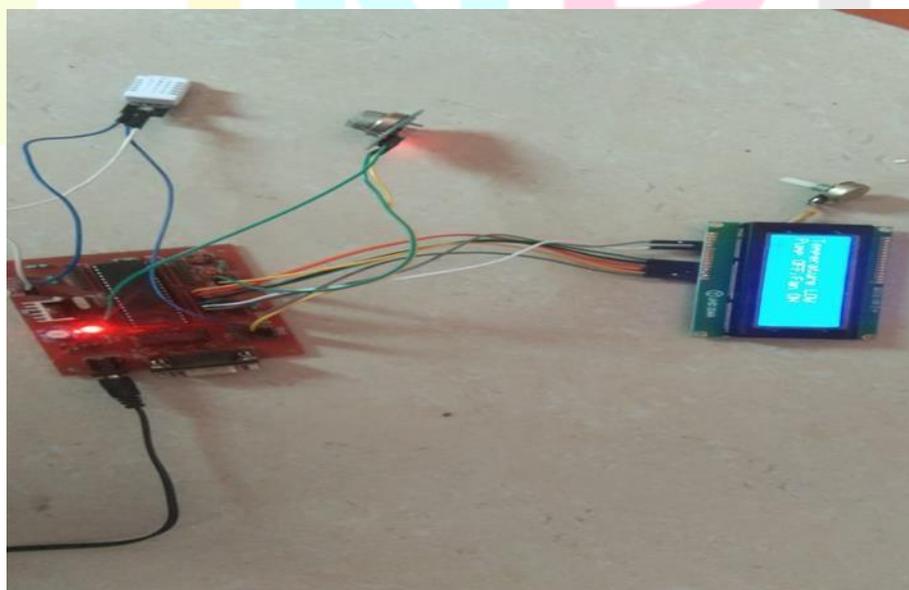

fig – 3: connection diagram

fig – 4: result diagram

3.3 ADVANTAGES : -

- Environmental Impact Reduction
- Renewable Energy Utilization
- Cost-Effective
- Autonomous Control System
- Energy-Efficient Carbon Capture

3.4 FUTURE ENHANCEMENTS : -

- Add machine learning algorithms for predictive analysis of air quality data.
- Introduce multiple sensors for a broader range of pollutant detection (e.g., NOx, SO2).
- Implement a mobile app for real-time notifications and remote control.

4. CONCLUSION : -

The project demonstrates a low-cost, efficient, and sustainable solution for air quality management using solar energy. With further optimization and scaling, this system can be deployed in various industrial and residential environments to enhance air quality and monitor key environmental parameters remotely.

5. ACKNOWLEDGEMENT : -

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