

Solar power Portable Body Incubator Using Raspberry Pi

The Portable Body Incubator is a health-focused device designed to regulate environmental conditions for medical purposes, specifically for maintaining the optimal temperature and humidity for patients, such as newborns or individuals requiring temperature-controlled care. This system uses a Raspberry Pi as the central controller to monitor and adjust various parameters such as temperature, humidity, and UV exposure within the incubator.

Key sensors and modules integrated into the incubator include the MAX30100, which measures heart rate and oxygen saturation levels, the DHT11 for temperature and humidity measurements and which are interfaced to the Arduino NANO. Here we are using Arduino NANO as a serial converter. Relays for controlling devices such as the exhaust fan and heater to maintain desired temperature levels. The UV lamp is also controlled via a relay to maintain optimal humidity by preventing fungal growth and infections.

To enhance portability and energy efficiency, the system is powered by a solar panel, ensuring continuous operation even in off-grid locations or areas with limited electricity access. This renewable energy source makes the incubator more sustainable and suitable for use in remote or disaster-affected regions.

Data from the sensors is displayed in real-time on an LCD screen for local monitoring and adjustments. For remote monitoring, an ESP32 is used for live streaming to a web interface, allowing health professionals or caretakers to monitor conditions from any location. Additionally, an ESP8266 is connected to ThingSpeak, a cloud platform for IoT data visualization, providing remote access to sensor data and helping to track trends over time.

This portable body incubator system allows caregivers to provide continuous, data-driven care, with automation, remote access, and solar-powered operation for better patient monitoring and comfort.

Major features of this project:

Temperature and Humidity Control: To maintain optimal temperature and humidity levels using sensors and automated control of the heater, fan, and UV lamp.

Health Monitoring: To monitor vital signs such as heart rate and oxygen levels using the MAX30100 sensor.

Real-Time Data Display: To display real-time sensor data on an LCD screen for immediate monitoring.

Remote Monitoring: To enable remote access and live streaming of data using ESP32 for continuous monitoring.

Cloud Data Storage: To upload sensor data to ThingSpeak using ESP8266 for long-term tracking and analysis.

Portable Design: To create a compact and mobile incubator that can be used in various healthcare settings.

Renewable Energy Source (Solar-Powered Operation): Integrated solar panel ensures continuous operation in off-grid areas. Enhances portability and sustainability, making it ideal for remote regions.

Major blocks present in this system:

1. Rechargeable Battery.
2. Solar panel.
3. Raspberry pi pico.
4. Arduino Nano.
5. Max30100 sensor.
6. DHT11 sensor.
7. LCD display.

8. LM2596 Voltage regulator.
9. Relays.
10. UV Lamp.
11. Heater.
12. Exhaust fan.
13. Esp32 Camera.
14. ESP8266 WI-FI module.
15. Buzzer.

Software's used:

1. THONNY PYTHON IDE programmer.
2. Python language.
3. Express SCH for Circuit Design.
4. EMBEDDE C and ARDUINO IDE for ESP32CAM

Block Diagram

