NANOSATELLITE TEMPERATURE & HUMIDITY SENSOR

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- ***Abstract—***

Nanotechnology, the science and engineering of materials and devices which has become an increasingly important field in recent years, with numerous potential applications in fields ranging from medicine to electronics to energy. By studying materials at this scale, researchers are able to uncover unique properties and behaviour's that can be harnessed for innovative solutions to real-world problems.

Nanotechnology is an area of active research and development, with ongoing efforts to explore its possibilities and address its challenges. This paper will provide an overview of nanotechnology, its applications, and its current state of development. In the past two decades, a silent revolution has taken place in the space domain, leading to what today is known as "New Space." We have passed from a selected group of countries, space agencies, and big industries building, launching, and operating satellites and other spacecrafts, of a scenario in which many universities and research institutes can do it.

Nanosatellites, or CubeSats, are small and cost-effective satellites that have revolutionized space exploration. With their small size and low cost, nanosatellites have enabled new approaches to space missions and have facilitated creative solutions to space-related challenges.

And We Know: "Success is not the result of spontaneous combustion. You must set yourself on fire." - Arnold H. Glasow

Nanosatellites have been used for Earth observation, climate monitoring, and scientific research, and have shown potential for commercial applications such as space-based logistics and internet coverage. The use of sensors in nanosatellites has enabled them to collect valuable data and monitor their environments, contributing to their effectiveness in space. Overall, nanosatellites have opened up new opportunities for space exploration, scientific research, and commercial space activities.

• Introduction

Sensors play a crucial role in the functionality of nanosatellites.

"Sensors are the bridge between the physical and digital world." - Oren Eytan

With their small size and weight, nanosatellites require sensors that are compact, low-power, and capable of withstanding the harsh conditions of space. Some of the sensors commonly used in nanosatellites include cameras for Earth observation and communication purpose, GPS sensors for navigation, and magnetometers for attitude determination.

Additionally, nanosatellites often use temperature, pressure, and radiation sensors to monitor their environment and ensure that the satellite is operating within safe parameters. Overall, sensors are essential components of nanosatellites that enable them to perform their missions and gather valuable data.

Nanosatellites are loosely defined as any satellite weighing less than 10 kilograms. CubeSats must also comply with a series of specific criteria that control factors such as their shape, size and weight.

Nanosatellite development based on CubeSat standards guarantees ongoing and relatively inexpensive access to space, as well as a wide range of launch and space rocket options.

In today's generation space technology has tended to become increasingly large and sophisticated, accessible only to the space agencies of the world's most developed countries or at the service of major corporations. New Space is based on a philosophy of creating less expensive satellites in shorter periods of time

A nanosatellite is any satellite that weighs between 1 and 10 kilograms. Initially, nanosatellites were only ever used in low Earth orbit for communications and remote sensing, however, recent advancements have led to their application in interplanetary missions. CubeSat has played a significant part in the proliferation of nanosatellite missions.

- **METHODOLOGY & BLOCK DIAGRAM**

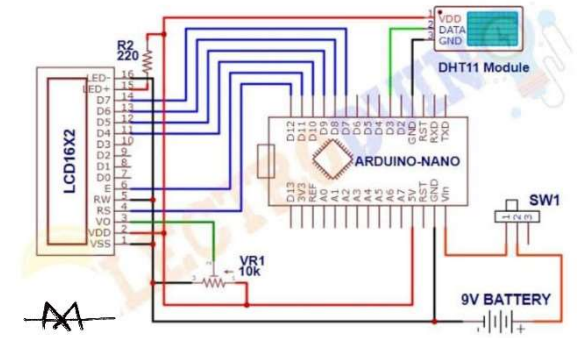

FIGURE – 1.01

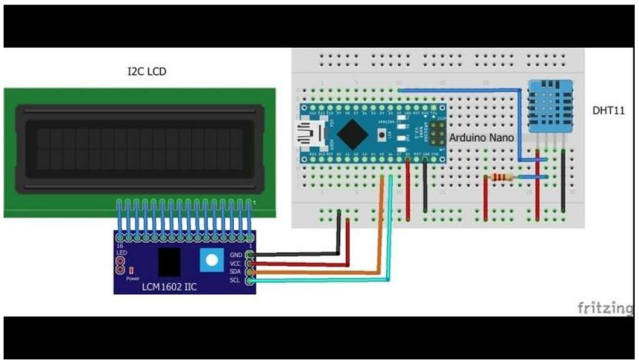

FIGURE – 1.02

- **COMPONENTS OF SYSTEM:**

As mentioned in above figure 1.01 and 1.02 respectively, this project involves the components mainly like Arduino Nano, DHT-11 is used to determine the temperature and the humidity of the atmosphere or the given specified region, jumper cables, LCD display (16*2) with i2c connection and for power source we here in this model have taken 9-volt battery as a power source.

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- **METHODOLOGY:**

1) DHT11: It is a sensor which is the part of the satellite which helps in measuring the temperature and humidity. It has parts made up of Nano materials and therefore the technology it uses comes under nanotechnology.

2) Arduino Nano: It is a small, complete, flexible and breadboard-friendly, microcontroller board, based on ATmega328p, developed by Arduino.cc in Italy in 2008 and contains 30 male I/O headers, configured in a DIP30 style.

3) BATTERY: It is a part of the satellite which provides power so that the sensor can measure the temperature and humidity and provide the readings shown on the led display.

4) LCD (Liquid Crystal Display) DISPLAY (16*2): It is the part of the satellite which shows the determined temperature and humidity. The led display is connected i2c by soldering the pins.

5) JUMPER CABLES: Here the cables used are female to female and help in connecting the different parts of the satellite through the pins.

6) NANOTECHNOLOGY USAGE: Here the components such as the Arduino Nano(microcontroller), dht11 and made up of nanomaterials which makes the satellite smaller, more efficient, light weight, helps in easier communication and also easier to launch the satellite into the space. Since there are nanoparticles therefore the technology used here is nanotechnology.

The system integration of this nanosatellite temperature and humidity sensor involves the process of assembling and integrating all the subsystems and components of the satellite to ensure that they work together seamlessly and give us the accurate readings of temperature and humidity of a particular area. Launching a Nano satellite typically involves mission planning and design, assembly and testing, launch vehicle selection, integration with the launch vehicle, launch and deployment, operations and data analysis.

- **RESULTS:**

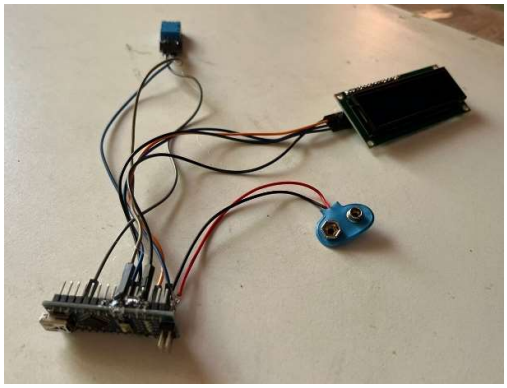


FIGURE – 1.03

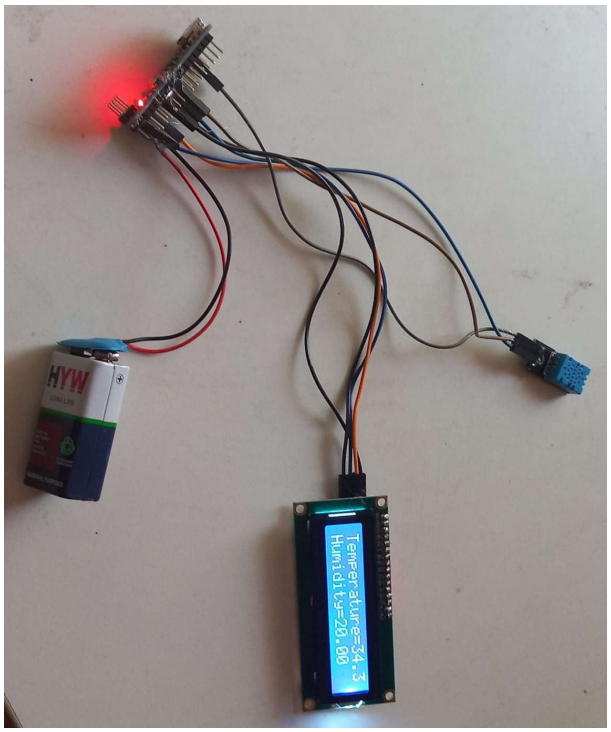


FIGURE – 1.04

- **FIGURE – 1.03 :** BEFORE CONNECTING TO POWER SOURCE
- **FIGURE – 1.04 :** AFTER CONNECTING TO POWER SOURCE

The Out come of this project are recorded in the satellite are as follows :

- **TEMPERATURE :** This project accurately displays the temperature levels of a particular specified area.

- **HUMIDITY :** It also determines the humidity levels of a particular region.

❖ ADVANTAGES & APPLICATIONS:

- Temperature and humidity sensors have a wide range of applications in various industries, including:

1. **HVAC (heating, ventilation, and air conditioning) systems -** Temperature and humidity sensors are used to regulate indoor air quality and ensure occupant comfort.
2. **Food and beverage industry** - Temperature and humidity sensors are used to monitor and control food storage and processing conditions to prevent spoilage and ensure food safety.
3. **Agriculture -** Temperature and humidity sensors are used to monitor crop and soil conditions to optimize yield and reduce water usage.
5. **Pharmaceutical industry** - Temperature and humidity sensors are used to monitor and control the storage and transportation of drugs and vaccines to maintain their effectiveness.

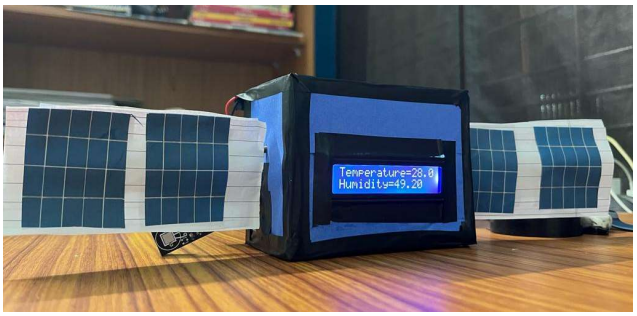
6. **Environmental monitoring -** Temperature and humidity sensors are used to monitor and predict weather conditions, track climate change, and assess air and water quality.

- The advantages of temperature and humidity sensors include:

  - **Accuracy -** Temperature and humidity sensors provide precise and reliable measurements, which are critical for many applications.
  - **Versatility -** Temperature and humidity sensors are available in a wide range of types and formats, including digital and analog, wired and wireless, and with different measurement ranges and resolutions.
  - **Cost-effectiveness -** Temperature and humidity sensors are relatively inexpensive and can be easily integrated into existing systems.
  - **Convenience** - Temperature and humidity sensors can be remotely monitored and controlled, allowing for real-time data analysis and adjustments.
  - **Safety -** Temperature and humidity sensors are often used to monitor and control critical systems and processes, such as in the food and pharmaceutical industries, to ensure safety and prevent damage or loss.

Overall, temperature and humidity sensors play a critical role in many industries and offer numerous advantages in terms of accuracy, versatility, cost-effectiveness, convenience, and safety. Enhanced data accuracy through networks with high redundancy. Quicker development times compared to larger satellites.

Nanosatellites will also be useful in helping humanity prepare for things like natural disasters, for instance, nanosatellites have been developed to predict impending hurricanes. These low-cost, low-flying devices have played a pivotal role in the development of the Internet of Things, helping intelligent devices connect to the internet, as well as each other. Current wireless communications technologies, such as 3G, 4G and Wi-Fi, are not able to cover an entire country. However, nanosatellites can, and are opening up the possibility for widespread, effective data communication unfettered by the limitations of their Earthly counterparts. It is no surprise that the increased usage of nanosatellites across the board is being termed the ‘nanosat boom’.



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