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Digitization Of Hotel Load Capacity Testing Device

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Abstract: *In the current dynamic technological environment, there is a growing need for precise and dependable sensors and measurement instruments. These sensors are crucial across multiple sectors such as automotive, railways, healthcare, and manufacturing, where obtaining accurate data is essential for maintaining safety, enhancing efficiency, and ensuring product quality. Addressing these demands involves the crucial task of developing and calibrating sensors to deliver precise and consistent output. In this project, a hotel load capacity test bench is introduced for the Indian Railway at Diesel Loco Shade Central Railway. Its purpose is to do extensive testing on designated equipment and provide thorough findings. The system uses a number of metrics to guarantee correctness, and reports are easily accessible on the screen. The ThingSpeak platform securely stores the data gathered during testing in cloud storage, enabling effective data management and analysis.The digitization of the hotel load capacity testing device improved efficiency and passenger capacity, and also reduced the overall cost of transportation*

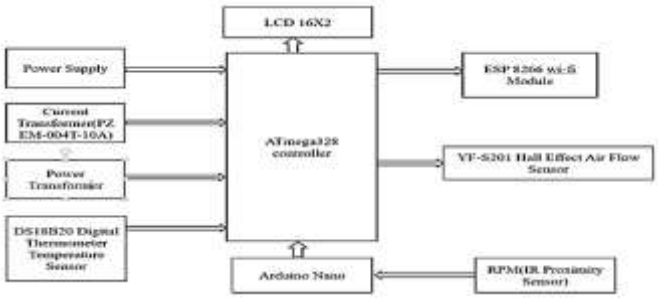
Keywords: *Temperature sensor, enhanced efficiency, accurate data, dependable sensors, quality.*

INTRODUCTION

Digitization of the hotel load capacity testing device, which checks the hotel load from the loco. The hotel load is generated from the transformers of the loco. Previously, in coaches of loco, the power supply was generated and supplied to the Coaches using the power car loads. The power car load uses approx. 5000 liters of diesel for generating the energy, which is not beneficial for the railways. Due to this, the coaches' capacity was less in number, and the passenger capacity is also reduced [8]. So to overcome this, the Indian railways used a transformer inside the loco, which powered the coaches. The digitization of hotel load capacity testing devices should be able to display accurate output on an LCD screen, and data will be stored in cloud storage using the ThingSpeak platform [3]. Digitization of the hotel load capacity testing device has been developed for measuring and displaying the various parameters associated with the device, viz. Pressure Sensor, Temperature Sensor, RPM Sensor, Current Measuring Device, and Voltage Measuring Device, and store all the data of the device in the cloud[4]. This project specification serves as automation of the hotel load capacity testing device, with a focus on precision, user-friendliness, and safety

METHODOLOGY

Figure 1: Block diagram of Digitization of Hotel Load Capacity Testing Device



In the digitization of the hotel load capacity testing device shown in [Figure 1], all the sensors are placed, including the Pressure Sensor, Temperature Sensor, RPM Sensor, Current Measuring Device, and Voltage Measuring Device, over the device with the connectivity of the controller [5]. Also Wi-Fi module and LCD are connected to the controller, and a power supply is given to it. Then, initiate the I/O ports and Wi-Fi module [7]. The controller will read the sensor data, then it checks the internet connection. If the internet connection is ON, then data will be sent to the cloud using the Thing Speak platform [2] as well as displayed on the LCD. If the internet connection is OFF, then data will only be displayed on the LCD; it can't be sent to the cloud. In this project, Sensors viz. current, voltage, temperature, and pressure are connected to the ATmega328 controller and RPM sensor to the Arduino Nano [3, 4] Power Transformer: First parameter is the voltage transformer which is we use to step down the main power supply and simultaneously data will be transmitted to the controller using serial communication. RPM Sensor: The second parameter is used to measure the RPM of the device, where we use an Infrared (IR) sensor. To measure and transmit data from this RPM sensor [1], we use a separate Arduino Nano, which simultaneously transmits data from the sensor to the controller using UART (serial communication protocol). Current Transformer: The third parameter is used to measure the current supply to the device using the current transformer, and data will be transmitted to the controller using serial communication. Temperature sensor: The fourth parameter of the device will measure the temperature [4] of the surroundings of the device, having a range from -55°C to +125°C. We use this sensor because it can send accurate readings of temperature without the need for an analog-to-digital converter using digital protocol. Pressure sensor (Air): The last parameter will measure the airflow pressure, where we use a Hall Effect air flow meter/sensor.

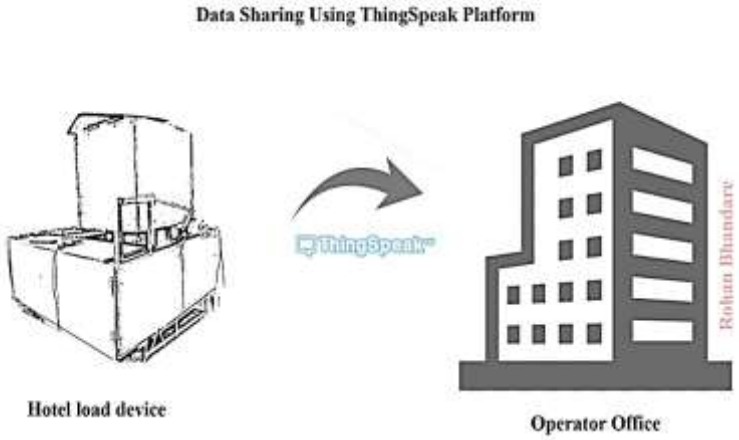
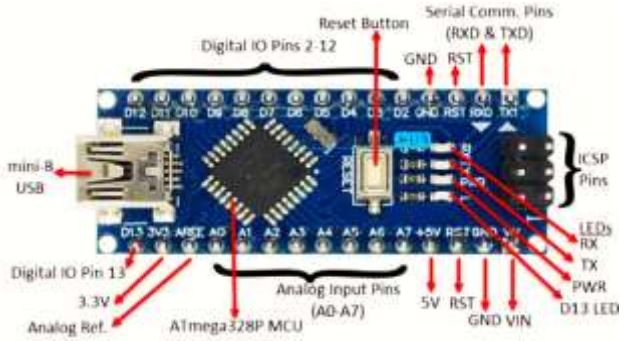


Figure 2: Data Sharing Using the ThingSpeak Platform

HARDWARE

Figure 3: Arduino Nano



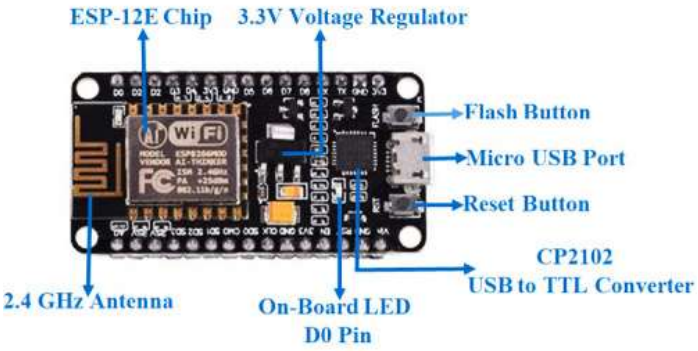


Figure 4: Node MCU ESP2866

The Arduino Nano shown in [Figure 3] stands as a widely acclaimed and cost-effective digital control module globally. It is compact, comprehensive, and designed for breadboard compatibility, featuring the ATmega328P microcontroller. This device functions as a diminutive computing unit, capable of interfacing with an ATmega328 Controller. Furthermore, it integrates various sensors, such as a Pressure Sensor, Temperature Sensor, RPM Sensor, Current Measuring Device, and Voltage Measuring Device, facilitating seamless connectivity with the controller [11]. Subsequently, all data is transmitted to the cloud via NodeMcu shown in [Figure 4] . as an internet connection is ON, data will be passed to the cloud, and if the internet connection is OFF, data will not be passed to the cloud but displayed on the LCD shown in [Figure 5 and 6].

SPECIFICATION

ATMega328

High performance, low power AVR® 8-bit microcontroller

Advanced RISC architecture

131 powerful instructions – most single clock cycle execution

32 x 8 general-purpose working registers

Arduino Nano

Microcontroller: Microchip ATmega328P:

Operating Voltage: 5V

ALGORITHM

Start

Activate all the sensors

Read the data from all the sensors

Check the internet connection.

If the connection is ON, the data is sent to the cloud and displayed on the LCD.

If the connection is OFF, then data will not be sent to the cloud and directly displayed on the LCD

Send Data to the cloud.

Stop

The digitization of hotel load capacity testing devices mainly focuses on the real-time values of the various parameters used in the device. This project comprises various components such as a temperature sensor, a voltage and current sensor, an rpm sensor, and an airflow sensor [9].

We have used 2 controllers, ATmega328p and Arduino Nano, for calculating and storing the real-time data. As the device is constantly in an ON State, the components will act accordingly and will capture the latest value of the device, and accordingly, the data is sent to the controller.

Then, from the controller using the Wi-Fi module, we send the actual real-time data to the ThingSpeak platform shown in [Figure 2] for storing and analyzing the working of the device [11]

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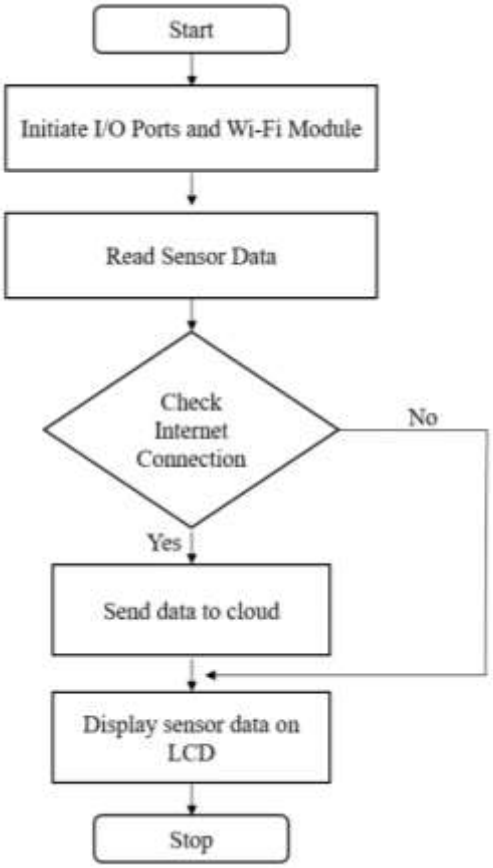
FLOWCHART
RESULT



In this project, it was confirmed that the sensor interfaces connected to the IC ATMega328 and Arduino nano, as shown in [Figure 3] of the system, provide precise results. It shows the actual readings of all parameters. due to this, we can check the actual efficiency of the parameters, also we can check the result on the cloud platform. The cloud platform is ThingSpeak, and it is also used to store data up to 25 to 30 days. The data displayed on this platform is in a graph format shown in [Figures7.8,9.and 10]. All of this is beneficial for analyzing the work efficiency and reliability of all sensors

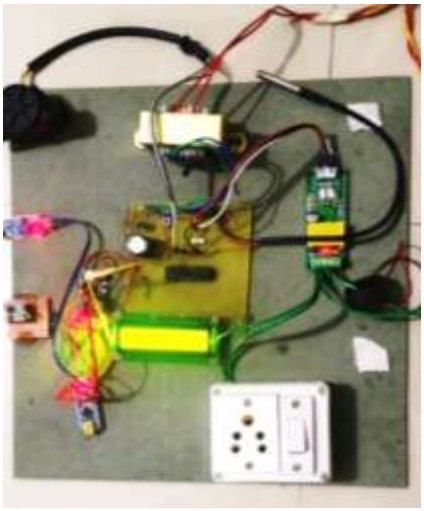


Figure 5: Prototype of the working of all sensors.

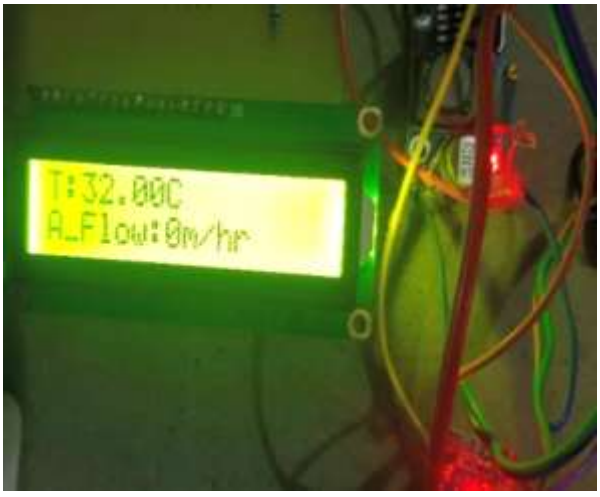


Figure 6: Digital representation of data

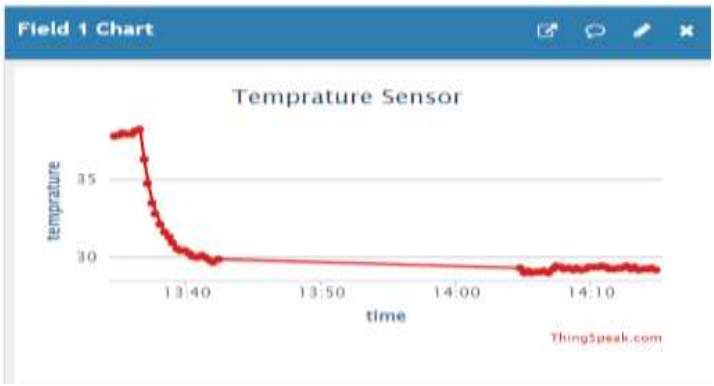


Figure 7: Temperature vs Time Ratio

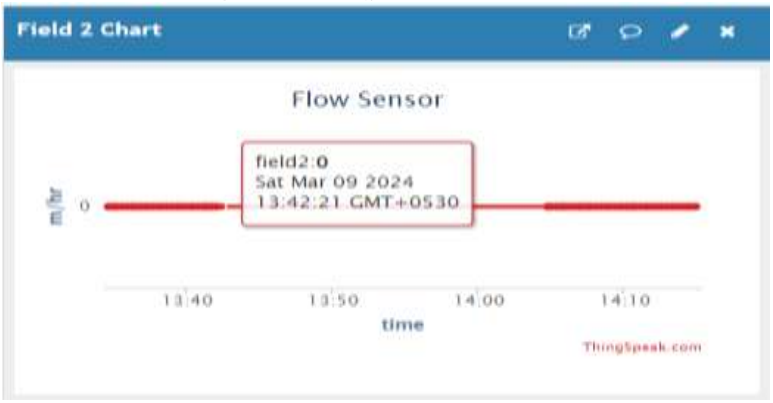


Figure 8: Air flow vs Time Ratio

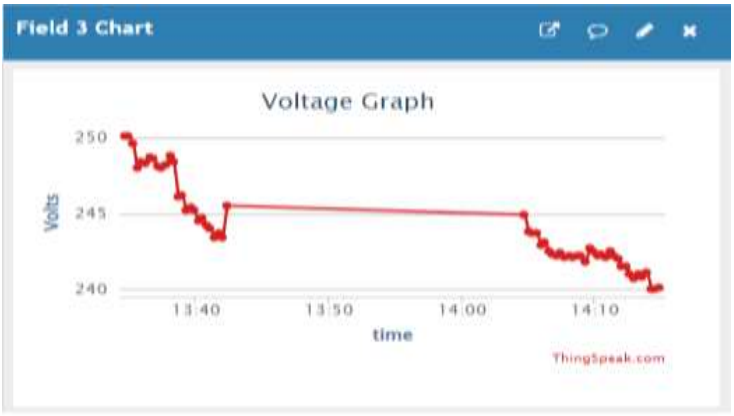


Figure 9: Voltage vs Time Ratio

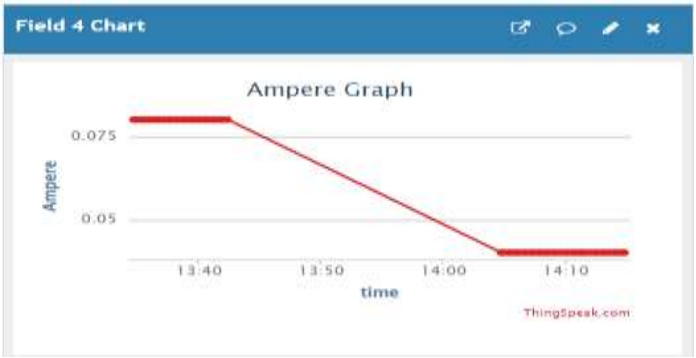


Figure 10: Ampere vs Time Ratio

It is a cutting-edge, extensively utilized cloud platform for gathering, displaying, and analyzing real-time data streams. Following a number of steps, the data is plotted graphically and a comma-separated values (.csv) file is produced. The above result shows as compared to conventional analog devices, digital devices are capable of producing load capacity readings that are more precise and dependable. This is due to the fact that digital equipment are easier to calibrate and are less prone to noise and interference. This can free up employees' time so they can concentrate on other duties like equipment upkeep and maintenance. Manual transmission of this data to a mobile application allows for output monitoring. A smartphone software called SmartAgro was created specifically for this project.

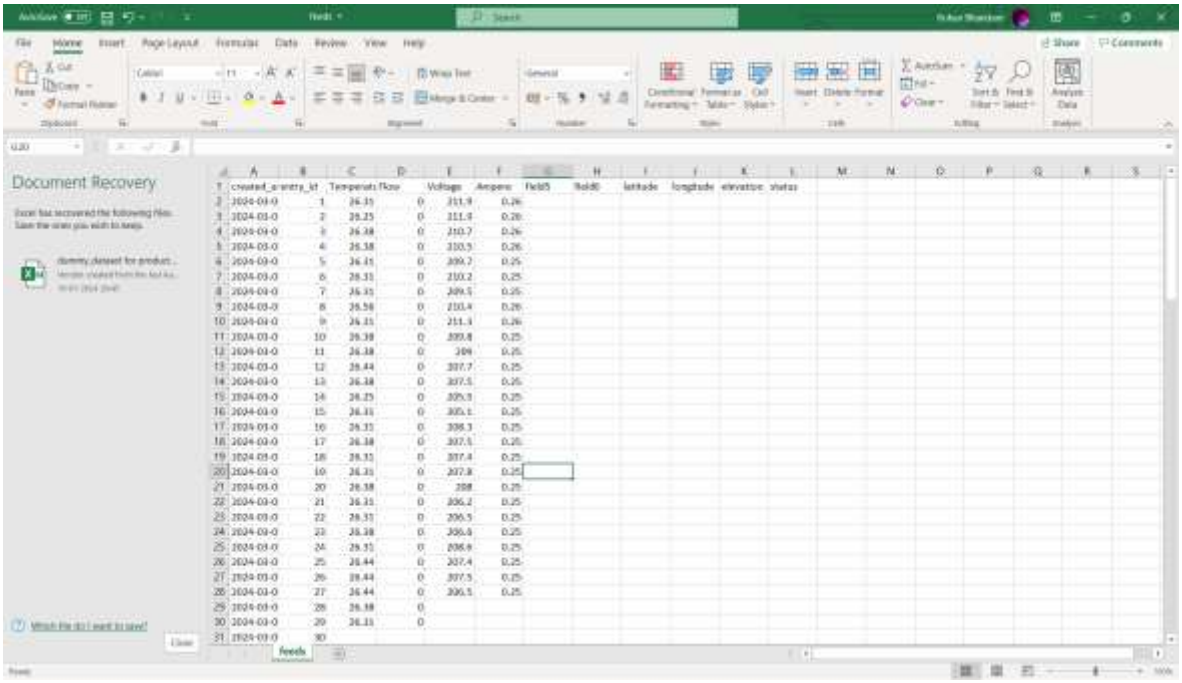


Figure 11: Result in CSV Format

A significant step toward resolving the difficulties the Indian Railways face in effectively regulating coach power supply is the digitization of the hotel load capacity testing system. The device allows for real-time monitoring and analysis of vital factors, including pressure, temperature, RPM, current, and voltage, by integrating a number of sensors with cloud storage technologies. The real-time installed digitization of Hotel Load Capacity testing devices shown in [Figure 12]

Figure 12: Real-Time Hotel Load Capacity Testing Device

CONCLUSION

The implemented project represents the final prototype model of a fully automated system, eliminating the need for human intervention in sending output directly to the cloud Platform and can be accessed from anywhere. The hotel load capacity check test device makes proper digitization of the parameters that

we measured. shown in [Figure 11]. Due to this project, all the data related to this becomes easier to access and is stored. The digitization of Hotel Load Capacity testing devices is a major step forward in the hospitality industry. This technology has the potential to improve the accuracy, efficiency, and cost-effectiveness of hotel load capacity testing.

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