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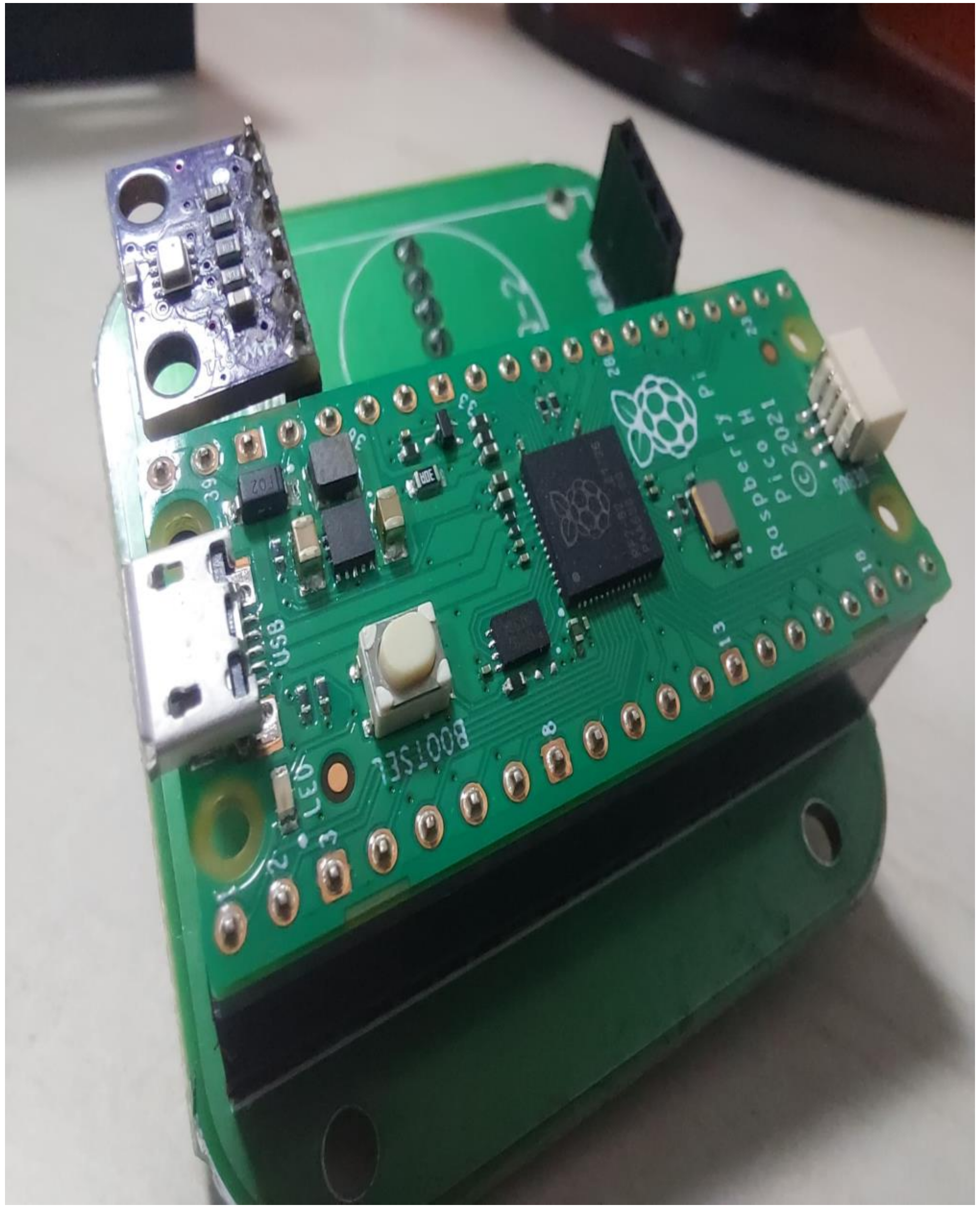
CHENNAI INSTITUTE OF TECHNOLOGY
(Autonomous)

PICOSAT: THE DEMOCRATIZATION OF WEATHER MONITORING THROUGH AFFORDABLE PICO SATELLITE TECHNOLOGY

Problem Definition



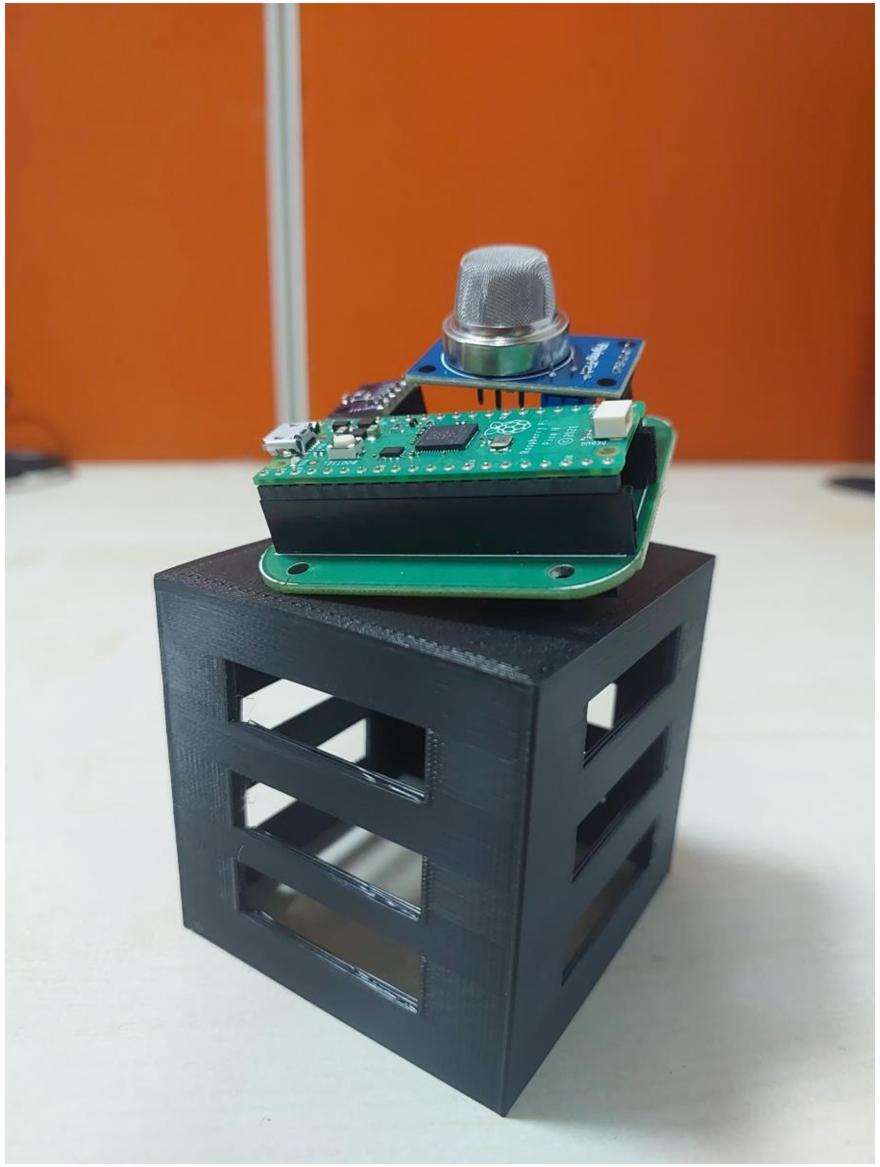
- Accurate localized weather data is lacking, especially in rural and remote areas, hampering critical decision-making in agriculture, disaster management, and community planning.

- Deploying and maintaining comprehensive weather monitoring infrastructure is cost-prohibitive, making it inaccessible to many communities, small organizations, and individuals.

- Existing systems rely on outdated data collection methods, causing delays in acquisition and analysis, while lacking automated processes hinders timely insights extraction using MQTT protocol for efficient data transmission.

- Limited interoperability and data sharing across different weather monitoring systems and data sources lead to fragmented and inconsistent information for stakeholders.

Proposed Solution



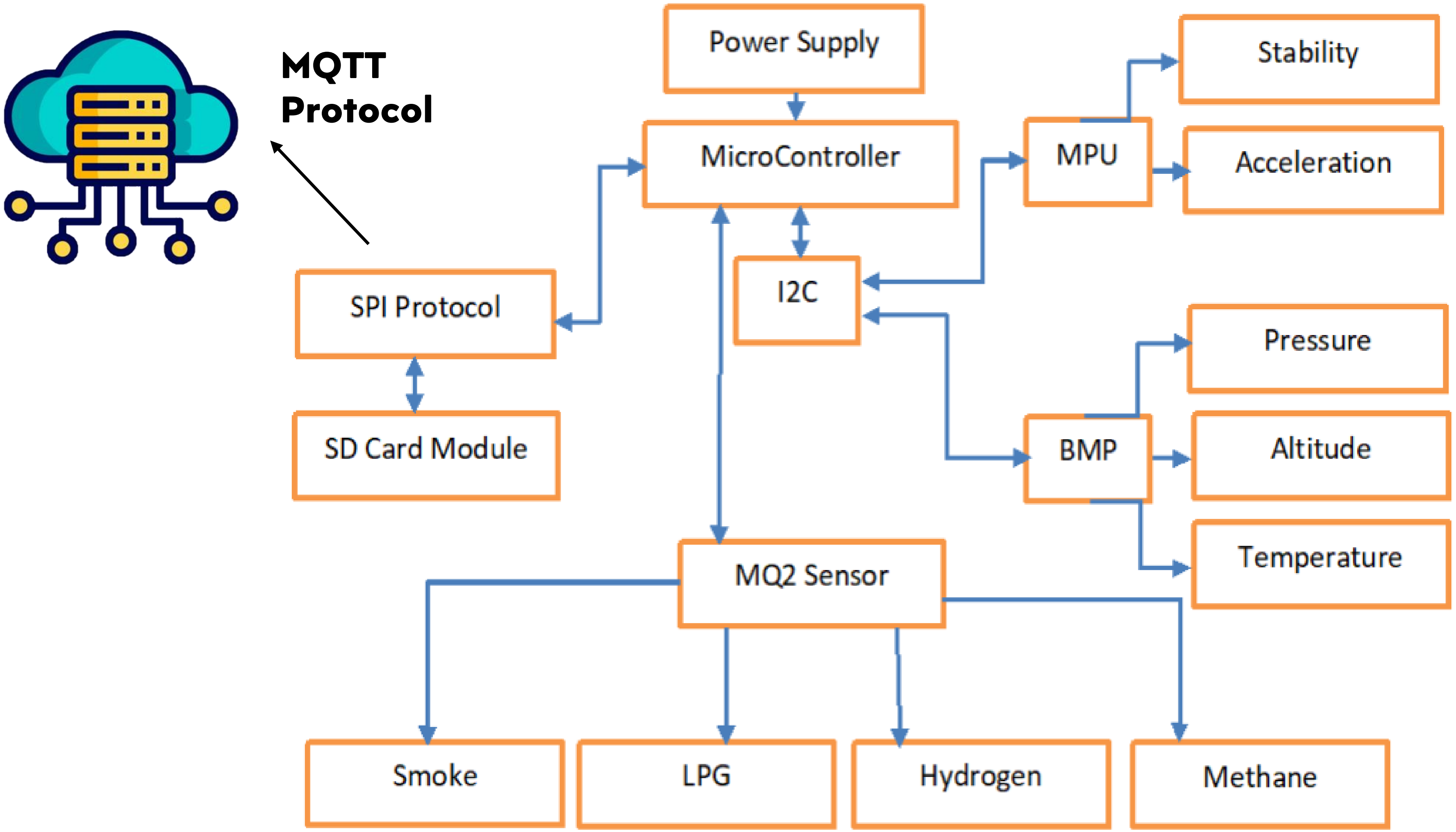
- A CubeSat equipped with remote sensing capabilities and wireless data acquisition enables localized weather monitoring, even in remote areas.

- Leveraging the Raspberry Pi Pico microcontroller and **MQTT Protocol** ensures a cheap and efficient system for data transmission and analysis.

- The integrated solution allows research institutions and communities to access affordable weather monitoring infrastructure for critical decision-making.

- Interoperability through the MQTT Protocol facilitates data sharing and collaboration, overcoming fragmented weather information silos.

Block Diagram



Specific Metrics

Measure the precision of temperature, humidity, and rainfall data collected by AgroSat against ground-based weather stations. Utilize statistical methods such as mean absolute error and root mean square error to quantify the accuracy of atmospheric measurements.

Assess the storage capacity utilization of AgroSat's onboard memory for storing meteorological data. Evaluate the compression techniques employed to maximize data storage efficiency while ensuring minimal loss of information crucial for weather analysis and crop yield prediction.

Evaluate the reliability of MQTT-based communication between AgroSat and ground stations for transmitting real-time weather data to cloud servers. Analyze factors such as message delivery latency, packet loss, and network stability to ensure consistent and timely dissemination of meteorological information.

Assess the accuracy of crop yield predictions generated from AgroSat's weather data and historical agricultural data. Utilize machine learning algorithms such as regression analysis and neural networks to validate the predictive models, comparing forecasted yields to determine the precision of predictions.

Measurable Metrics

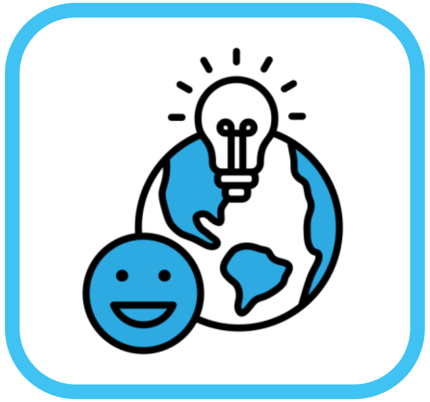
Accuracy of Atmospheric Measurements: Evaluate the precision of AgroSat's data collection capabilities, encompassing air pollution and global warming indicators, against established environmental monitoring standards. Employ statistical analysis to gauge the accuracy of atmospheric parameter readings, ensuring reliable data for assessing environmental conditions and trends with respect to air quality and climate change dynamics.

Real-Time Data Transmission Reliability: Evaluate the robustness of MQTT-based communication between AgroSat and ground stations for transmitting real-time atmospheric data to cloud servers. Ensure consistent and dependable transmission of air pollution and global warming measurements, minimizing latency and packet loss to facilitate timely environmental monitoring and decision-making processes.

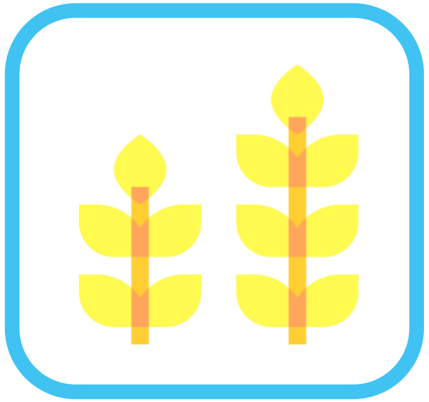
Environmental Impact Assessment: Analyze the correlation between air pollution, global warming trends, and their impact on agricultural ecosystems. Utilize AgroSat's data to assess the environmental implications of atmospheric changes, informing policymakers and stakeholders about potential interventions to mitigate the effects of climate change on crop yields, soil health, and overall agricultural sustainability.

Realistic Utility

Improving Air Quality with AgroSat Monitoring



Advancing Climate Understanding Through Data



Maximizing Crop Yield with AgroSat Insights

Enabling Seamless Remote Monitoring Using MQTT

Early Warning for Weather Hazards

Attainability

Ensuring the attainability of wireless charging stations with integrated solar panels necessitates a multifaceted approach. This involves leveraging existing technological capabilities while advancing research in energy storage, wireless power transfer, and smart grid management. Practical solutions must address real-world challenges such as the intermittency of solar power, alignment issues in wireless charging, and regulatory frameworks. Achieving attainability requires collaboration between stakeholders including governments, industries, and research institutions to develop scalable, cost-effective, and environmentally sustainable solutions.

Scalability

- In wireless charging stations with integrated solar panels hinges on adaptable design, standardized protocols, and infrastructure readiness.
- Ensuring scalability involves engineering solutions that accommodate varying power demands, geographical locations, and technological advancements.
- This includes developing modular components, standardized interfaces, and interoperable systems to facilitate seamless integration and expansion. Additionally, scalability requires robust infrastructure planning, incorporating considerations for grid connectivity, power distribution, and regulatory compliance.
- By prioritizing scalability in design and deployment strategies, wireless charging stations can effectively scale to meet growing energy demands while remaining cost-efficient and accessible. Collaboration between industry stakeholders, policymakers, and technology innovators is essential to foster a scalable ecosystem for wireless charging with solar integration, driving widespread adoption and sustainable energy transition.

COMPETITORS

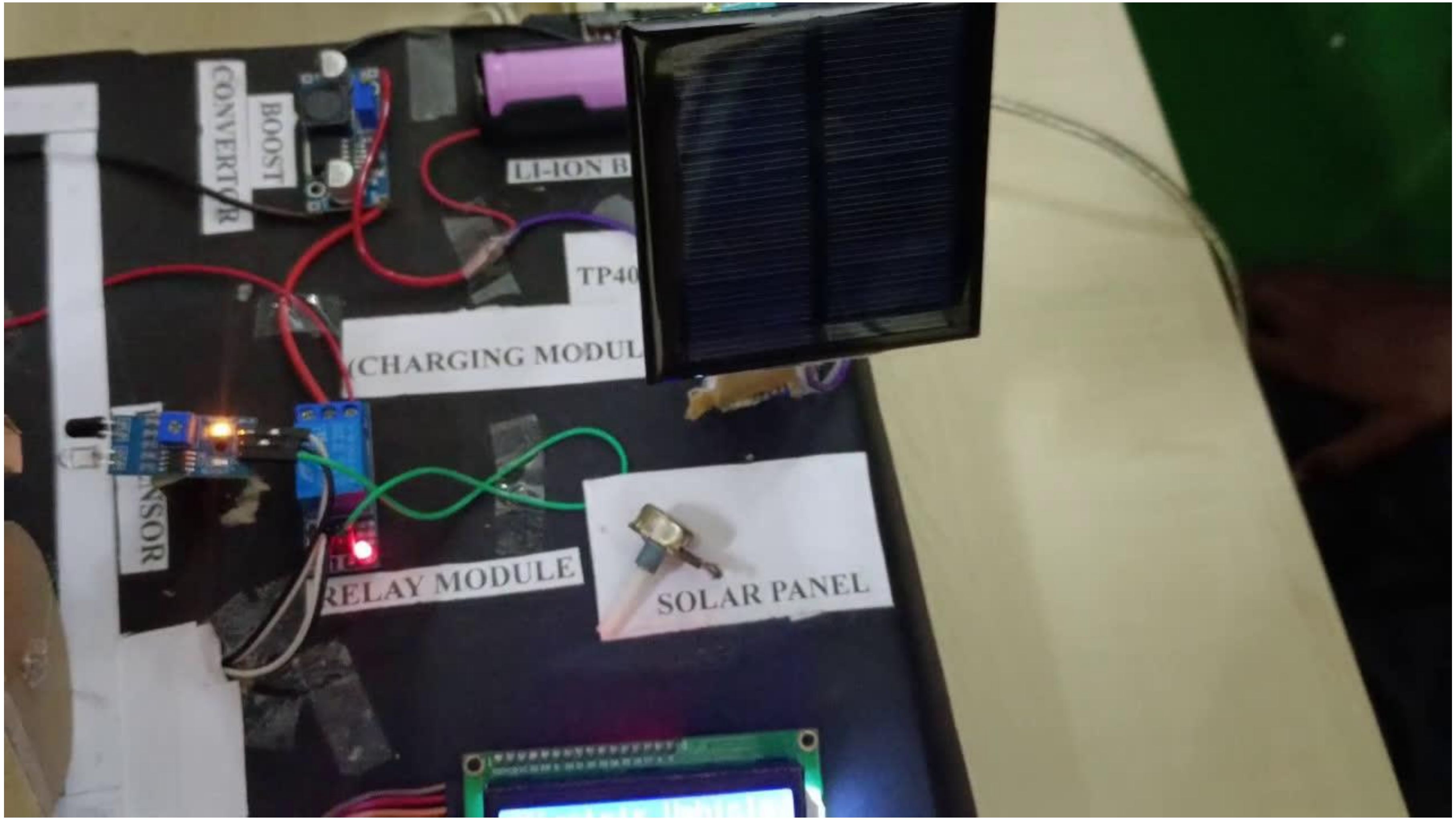
Qualcomm Inc

The BCU consists of a ground-based pad that can be surface mounted or buried a few centimetres under the ground. The BCU pad is connected to a remote AC power source with associated control and communications electronics. The BCU pad can be manufactured to various sizes depending on the power rating but is **typically 766mm x 575mm x 28mm (30x23x1 inch) and weighs 20kg (44 lbs). The VCU consists of the VCU pad and on-board control electronics.** The VCU pad is smaller and lighter than the BCU pad, typically 350mm x 220mm x 22mm (14x8.5x0.87 inch) and 7kg (15.4 lbs) in weight.

Continental AG

The fully automatic charging solution comprises two components one unit in the underbody of the vehicle and another on the garage floor. As soon as the car is parked, the two components connect automatically via a smart system, which among other options is controlled via ultra-broadband – a radio-based communication technology for short-range data transmission.

Video Prototype



Video Link : https://youtu.be/CFFz4jHICRg

THANK YOU

emphasizing the importance of continued innovation and collaboration in advancing wireless charging technology for sustainable energy solutions.