Solar Panel Maintenance System

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Introduction

Renewable energy sources such as solar panels have gained significant attention in recent years as a clean and sustainable alternative to traditional energy sources. However, the maintenance of solar panels is crucial to ensure their efficiency and longevity. The current manual maintenance approach is time-consuming, costly, and prone to errors, leading to reduced energy output and downtime.

The proposed AI-powered solar panel maintenance system aims to reduce the cost and time of solar panel maintenance and increase their efficiency and lifespan, ultimately contributing to the promotion of renewable energy sources as a sustainable and viable alternative to traditional energy sources. In conclusion, it has the potential to significantly enhance the performance and longevity of solar panels and reduce maintenance costs.

Literature Review

- Nasib (2019) [1] proposed a cleaning robot with a rotating brush and water stream jets which can move on the rails mounted besides the solar panel array. The system cleans the solar panel array on a programmed time interval on its own.

- Milan (2019) [2] created a simple solar panel cleaning system which consists of a viper and a water jet stream to clean the solar panel. The System can be triggered through an application.

- Manju (2018) [3] proposed a similar solution to Nasib (2019) [1] which consists of a brush and a water jet stream to clean the solar panels.

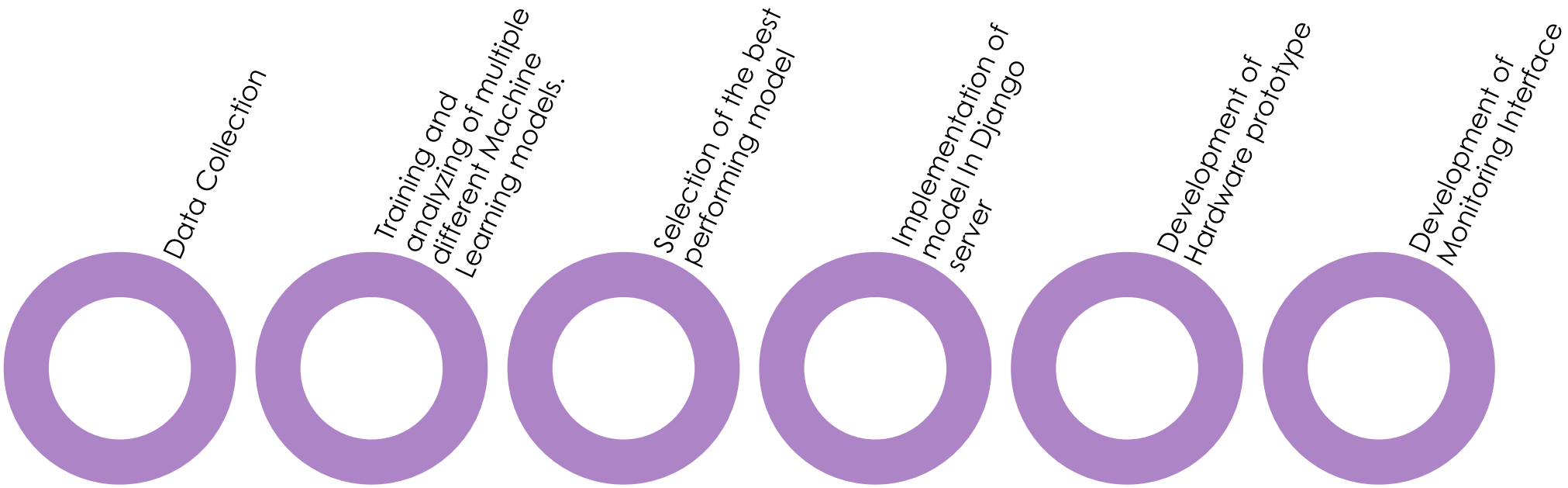
- Piotr (2013) [4] talks about the possibility of creating a system to clean the dust from solar panel surface through ultrasonic vibrations. The ultrasonic beams will hit the dust particles, which will make them vibrate and fall off the solar panels.

- Xiaolong (2019) [5] talks about a cleaning robot which works on the basis of a piezoelectric actuator. The wiper on the robot will move based on the information received through a piezo electric actuator.

Objectives

- Detect faults and abnormalities in solar panels accurately and efficiently.
- Predict potential problems before they occur and take necessary action to prevent them.
- Schedule maintenance activities based on data collected from the solar panels to minimize downtime.
- Optimize the performance of the solar panels by analyzing and adjusting their settings based on environmental and usage data.
- Provide real-time monitoring of the solar panels and alert maintenance personnel of any issues.
- Reduce the cost of solar panel maintenance and increase their efficiency and lifespan.

Methodology



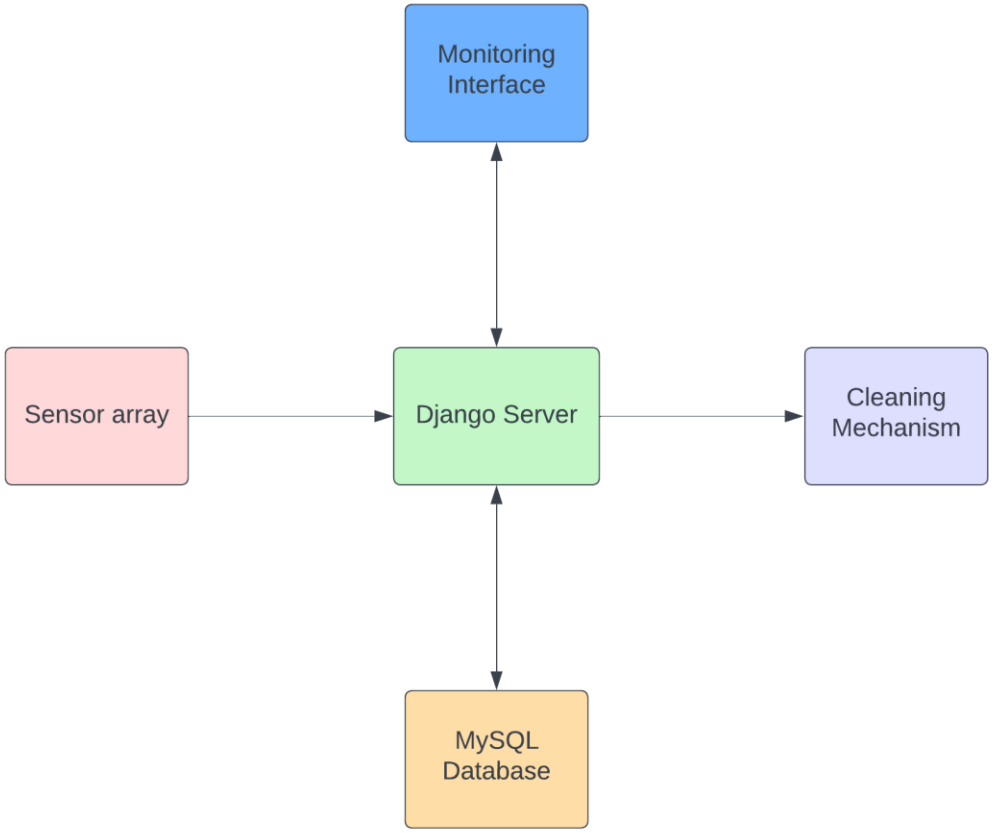
Data

- Collected our own data.
- Collected between 31st Jan to 2nd March.
- Data collected at Stanza hostel Kandoli.
- A sensors used:
  - Photoresistor
  - Thermister
  - Barometer
  - Anemometer
  - Hygrometer

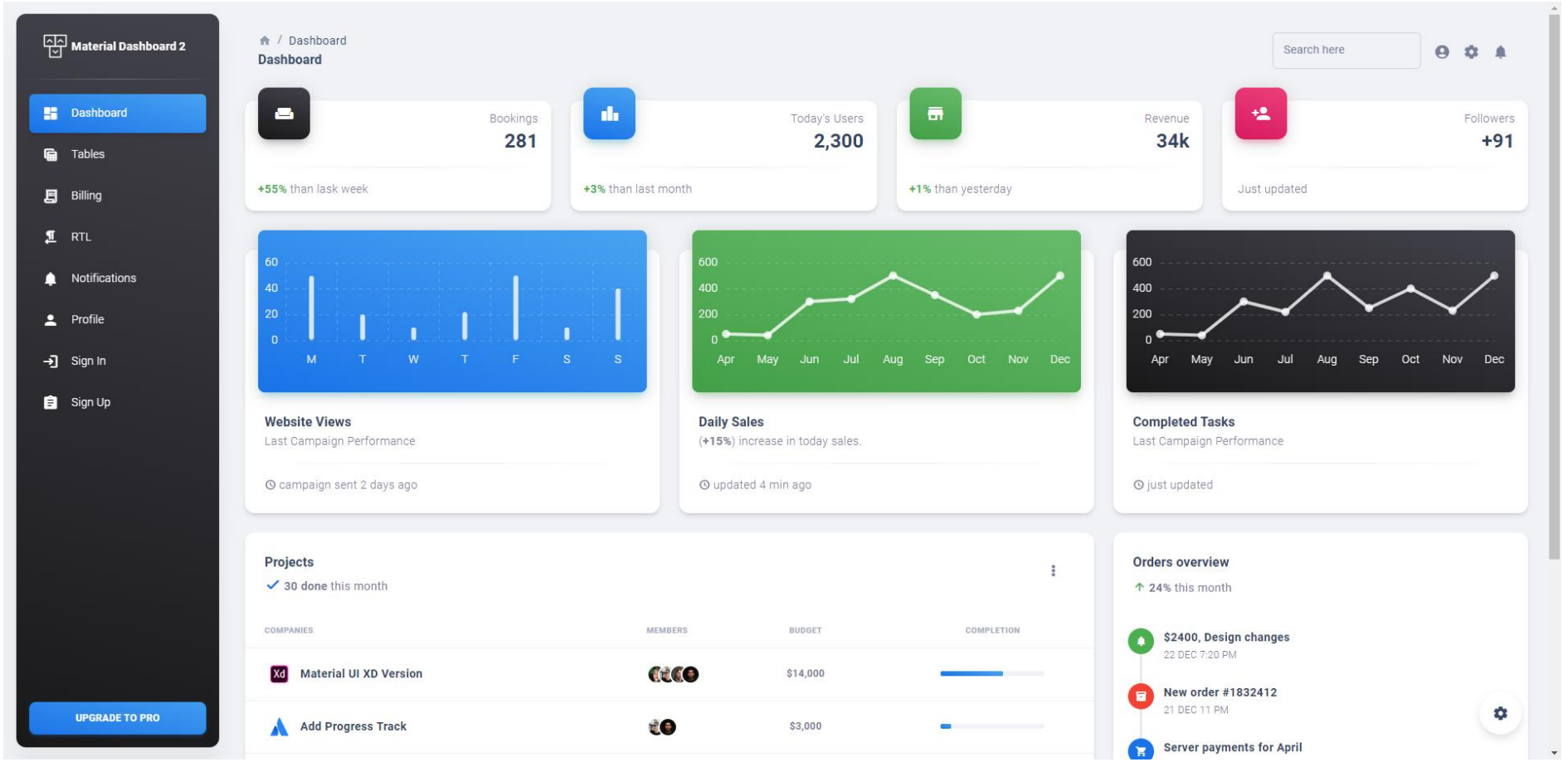
Dataset Columns

- AirTemp (Recorded via Thermister)
- CloudOpacity (Recorded via Solcast API)
- DewpointTemp (Mathematically calculated)
- Ghi (Recorded via Photoresistor)
- PrecipitableWater (Mathematically calculated)
- RelativeHumidity (Recorded via Hygrometer)
- SurfacePressure (Recorded via Barometer)
- WindDirection10m (Recorded via Anemometer)
- WindSpeed10m (Recorded via Anemometer)

System Architecture



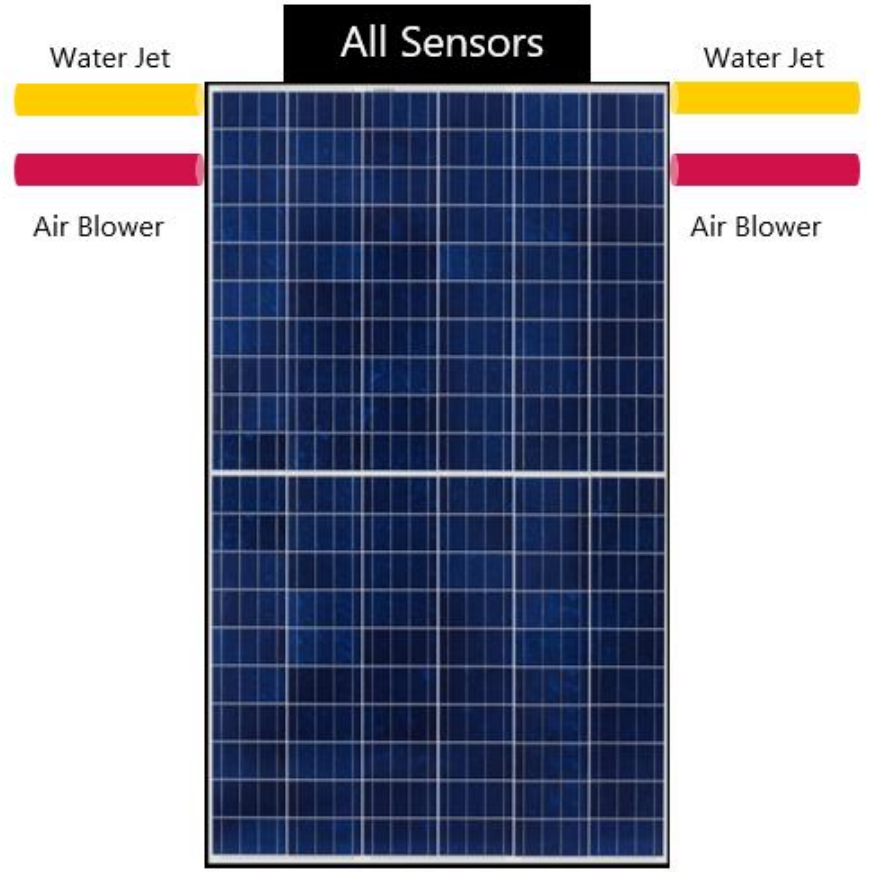
User Interface



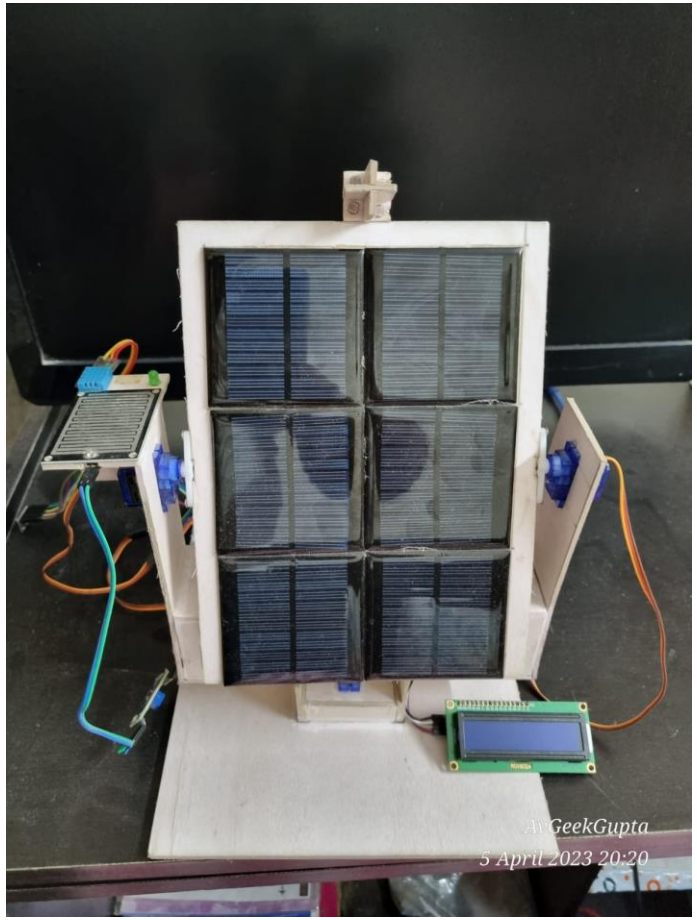
Hardware Design

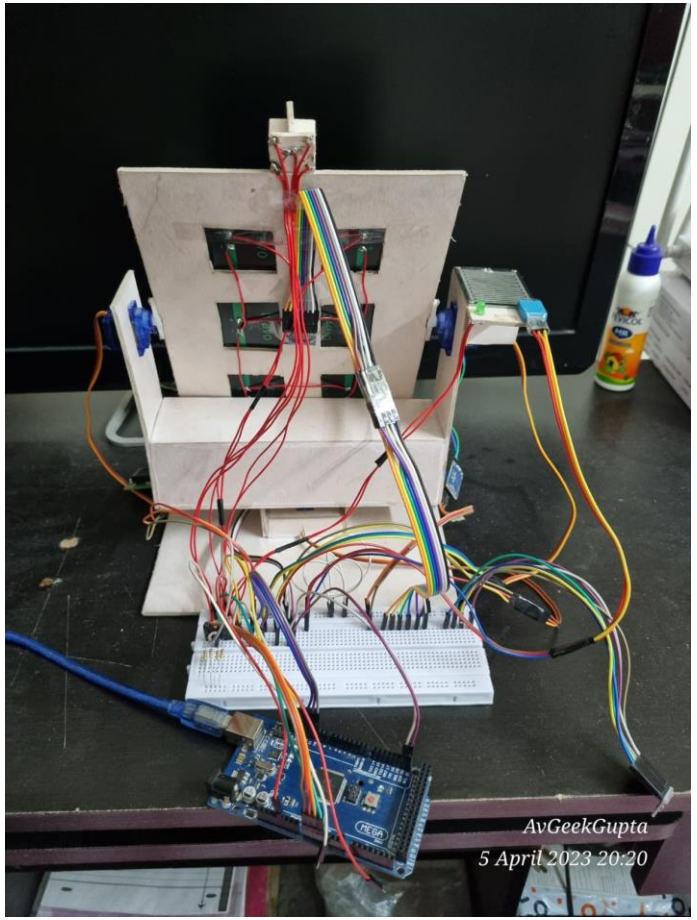
- All the sensors will be kept in a box properly and will be mounted at the top of the solar panel in order to collect most accurate real time data.

- Water jets and air blower will be mounted at upper corners of the solar panel so that it can reach every corner of solar panel for cleaning.



Constructed Hardware

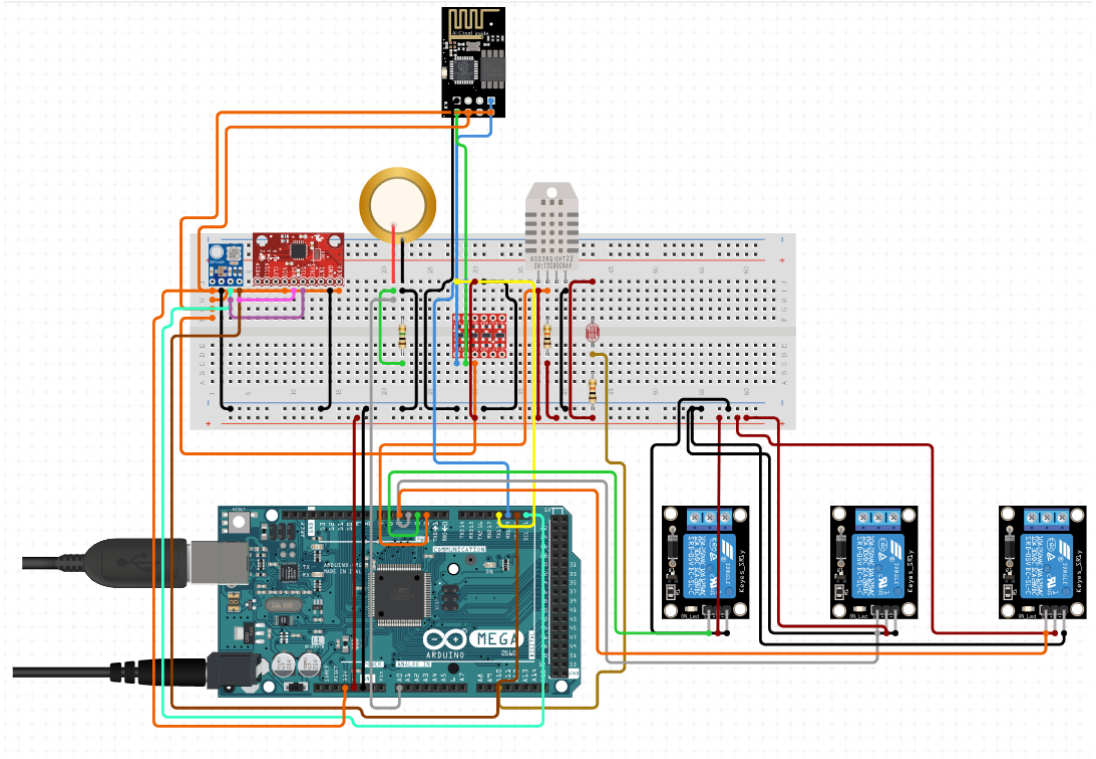




Circuit Diagram

- Sensor module consist of ->

1. Microcontroller (Arduino Mega)
2. Wi-Fi Module
3. Gyroscope
4. Humidity Sensor
5. Photo Sensors
6. Rain Sensor
7. Barometer
8. Anemometer
9. Water Jet
10. Air Blower



References

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Thank You