The University of Texas at Dallas
Department of Computer Engineering

Microprocessor Systems Final Project report on

Sun tracking solar panel system using TIVA TM4C1294XL ARM Cortex board with local troubleshooter.

Submitted by

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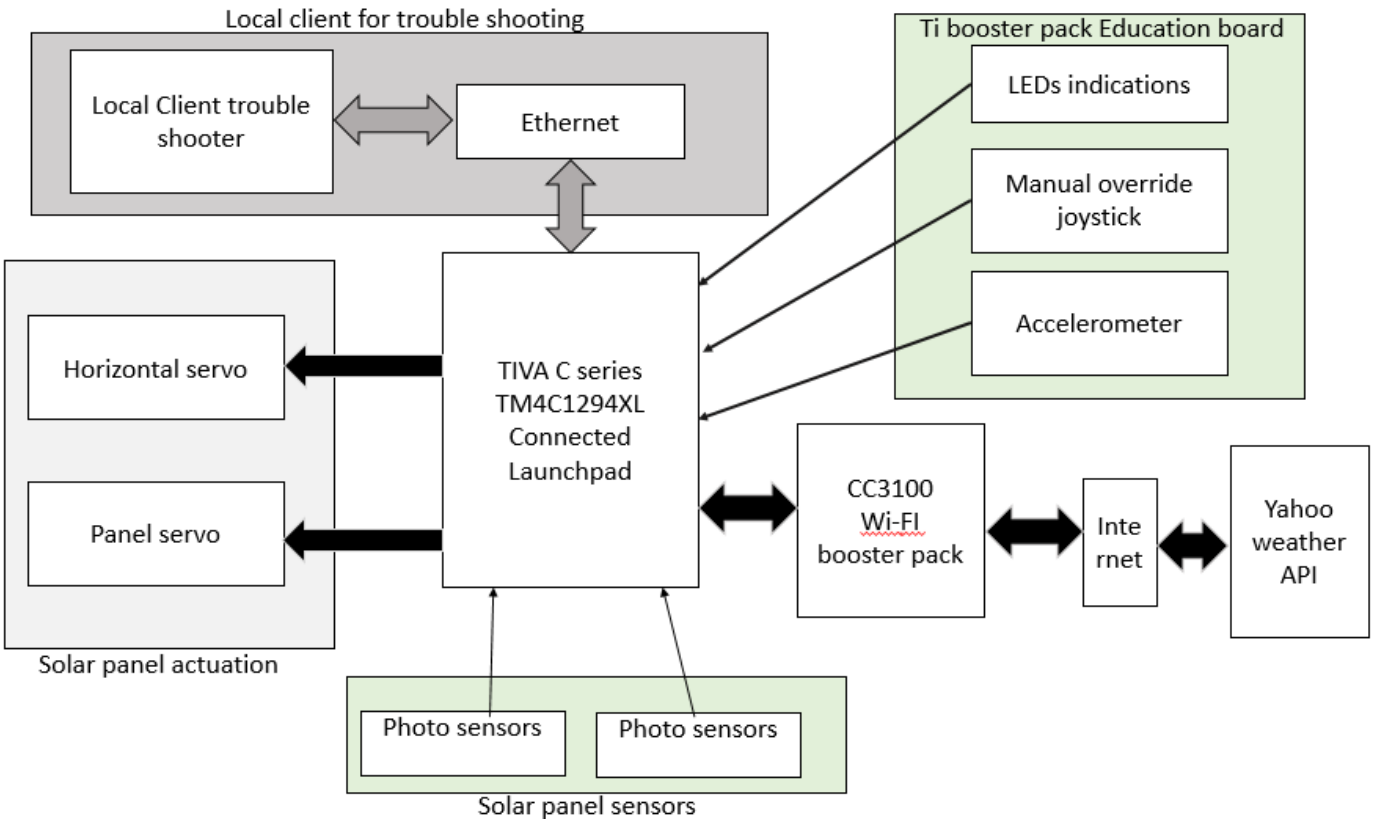
Introduction / Problem trying to solve:

Basic idea of project is to make system which will change the orientation of the solar panel according to the location of sun so that there will be maximum utilization of solar power. Presently available solar panel have limited predefined rotation in only 0 to 180 degrees rotation. I am trying to make a system which will function more than solar panel. But I will not be working on solar panel but the system which will let the solar rotate through every direction leading to maximum utilization.

But here the system is not limited only to track sun presence and changing the orientation of solar panels according to it, the system is also checking for weather information such as sunny or cloudy condition of atmosphere and also the temperature of the surrounding. Also it will take decision such as whether the atmosphere is cold or warm. Depending on the decision it will notify user at some point that what he needs for his whole day.

Block Diagram:



Solution:

I am using the Light dependent sensors to determine which direction to rotate depending on the value got from sensor. The sensors were interfaced to processor through ADC. The main code will determine which direction to rotate the panel using the servo. This will cause the solar panel to generate maximum power output leading to full utilization of the solar energy. But in the same sense the orientation feedback of solar panel was needed. This was done by interfacing the accelerometer on ti educational boosterpack board mkII.

Mainly the tilt sensor output was suitable for the second solution which includes the calculation of the solar panel orientation depending on the GPS location, sunrise time, sunset time the respective servo values will be calculated so the photo sensor feedback will not be needed to track sun or light difference. Due to the requirement of high mathematical computations requirement for this idea, this idea was left out in middle till the getting the GPS coordinate from google maps API. This solution was overcoming the problem arising from improper functionalities of the photo sensors connected to solar panel.

The joystick was interfaced based on the direction of pots connected in it which will rotate the panel according to it. This was working as the manual override incase the automatic system stops working due to sensor fault. So currently the automatic system failed to improper connection od the LDRs to panel as they were supposed to give change in outputs when change in light occurs but they had not sufficient sensitivity due to which the difference was not distinguishable.

For the same case I have made local trouble shooter for this system in which the user may able to orient the panel using local client on his computer where functionalities with some buttons are listed. By using the buttons one will be able to test individual function of each part. This idea will be helpful to determine whether any part of hardware was having any problems. By pressing the button one can see changes real time in system. Then there were some enhancement done introducing IoT based solar panel which will be more than just a solar panel. Using the wifi some weather data was retrieved using yahoo weather API. Also based on the weather data the system will be able to take decision on telling the user about the extreme weather condition through SMS notification.

What I’ve learned

I got introduced to new great field of IoT in embedded systems, it was different experience to work on it. Even though I have worked on servos and some photo sensors but using them in combination to generate some decision making system that too in IoT based Launchpad. I got to learn connecting to client through the Ethernet and creating server in html stored in Launchpad. I also learned ways to retrieve the weather and environment data from yahoo API and sending the message notification just by using the wifi module without any need of GSM module.

Problems faced

As I was new to interfacing with Ti products that too in IoT base. As the algorithm for determining the solar panel orientation values for servo using sensors feedback was changed to determining the values from GPS location based equation. But getting the required data from internet took lot of time and other sensor started showing some faults. So feedback based system has some more corrections to do. Also getting all sensors and hardware was difficult. But as we got Launchpad from the lab work got little bit simpler. Also code composer was not able to work on laptops so other IDEs were required to find which were compatible to code. So I used Energia IDE to code and get output. But same code can be used in code composer studio by including some required files.

Future enhancement

This system can be enhanced to a large number of solar panels connected in same place. As the idea of providing weather report to user based on internet connection can be developed to great extent in home automation systems. Also by using internet one can get data like sun rise and sunset and also about the condition of atmosphere. So the system can be enhanced more to detect such condition start rotating based on some calculations without any feedback. One more important thing which will be most crucial part of the system is trouble shooter which will remotely control the function of the panels at the same time in case the automatic system fails.