**Nonfunctional Requirements:**

1. **Usability:**

The EMSS should be easy to understand and easy to learn about its functionality and usage. It should take less than 1 hour to get familiar with the handling of the system.

1. **Reliability:**

The EMSS should work all the time (24/7). As this is related to the power connection of the house, it should not interrupt the energy supply to the house.

1. **Performance:**

The EMSS should be very responsive.

All the activities should get performed within less than 1 second.

It should not take much time to navigate through the system. All the navigation should happen in less than 1 second as well.

1. **Supportability:**

The EMSS should provide the user with all required documentation related to the system which will help user to understand the entire functionality of it, help user to maintain the system in good condition.

The EMSS should provide required instructions in case of minor errors or issues.

1. **Correctness:**

The EMSS should perform all the tasks properly wherever the computation of data is involved. It should perform appropriate activity based on the past data and the data collected from the attached components.

1. **Durability:**

The system should not fail very frequently (Not before 1 year). Once the setup or upgrade is done the EMSS should continue to work for longer time without any issue/error.

1. **Appearance:**

The data displayed to the user should be in easily readable format. It should make user to take longer to interpret the information provided on monitor.

1. **Safety:**

The EMSS should not cause any event which is harmful or which will damage the entire system installation. It should not cause any human damage as well.

1. **Efficiency:**

The EMSS should work with great efficiency when it has to switch between the power supply sources (From solar energy to main power supply).

1. **Integrity:**

To preserve the data in case of failures the EMSS should have the efficient data backup system.

1. **Usefulness:**

The EMSS should provide all the functionalities required by the user. E.g. Shor information about different components, switch between the energy sources, monitor the power consumption by house etc.)

1. **Legal:**

The EMSS should comply with the requirements of the main power source company.

1. **Modifiability:**

The EMSS should not take much efforts in case of system upgradation/updating.

**Architectural patterns:**

**Model View Controller:**

We are using MVC as it provide the flexibility in case of modifying any part of the system ( view, model or controller) without worrying about the other part.

If we add extra appliance in the house, there will be change in DB to accommodate attributes of this new appliance. We can do that without worrying about the view. Moreover if the data gets updated there will be change in its representation on view as well.

E.g. User asks for battery information from view, controller gets the data from model, does the processing on it ( db will return the how much the battery is charged currently. Controller will do further analysis like how long battery will work based on the requirement of the house )and present back the result on view.

* MVC pattern perfectly fits for the applications where the part of the system which processes the data, view which shows the system data to user and the controller which handles/manages the interaction between model and view are separate from each other. In EMSS the monitor (the hardware component integrated with EMSS components) acts as both view to show the user all the information related to the entire system for example, battery info, power generation, error status and much more and also as controller as it is the part of application which allows the user to interact with the system and initiates the required actions. Data related to all the components of EMSS like battery, inverter, solar panels, acts as model in our system.
* The major benefit of the MVC pattern is, it provides separation between view and the model. In EMSS, we just want to provide the user with the information of all attached components and the energy flow without letting the user know about the complexity involved in processing all the inputs collected from different components.
* It is beneficial for our project as it is abstract architecture, hides all the working details from user, only interacts with help of an interactive view, and this separation of responsibilities into three parts provides flexibility. Works faster as all the work is divided between subsystems.

1. This pattern provide advantages to the EMSS system, as it sectioned the system to three strata it provided an efficient modularity. It separated the business logic than the presentation logic. Where the user in EMSS is only interacting with the monitor as a view and controller.
2. Easy management of complexity by dividing the whole system to three sections. It is easier to manage the performance of the model , view , and controller separately.
3. Each of these strata acts as an independent component, each of them is responsible about only one thing , which makes it easy to enhance or replace the components without worrying about affecting the other component. So, in case of major error occurrence it will be clear which component that has been damaged, and in which logic, there won't be a need to go through the whole system to discover where the damage is.

**Event Driven and Observe and react:**

For the functionality which controls the amount of voltage flow to house there are 2 alternatives:

1) User will manually put the voltage value

System keeps sending the same amount of voltage to house unless user puts any manual voltage value. When the event of putting required voltage value occurs, system changes the amount of energy flow. In this case we want the system to respond in less amount of time and event driven architectural pattern provides the feature of great responsiveness. In addition, it provides high performance in case of such important events with fast processing. It also helps in managing real time events.

2) System will keep monitoring the power consumption by house and will redirect the energy accordingly

In the case where user is not interacting with the system, EMSS will keep monitoring the power consumption by the house and will change the amount of energy flow accordingly. If there is significant change in power usage by the house system will display the same to user and will react by initiating the activity of changing the amount of voltage flow.

For this functionality the Observe and react pattern is suitable as it brings the benefits of detecting the situation which is not usual, provide its information to the user and react on it by taking the required action.

**Observe and react:**

For the functionality of EMSS which controls the energy flow to house either from solar panel or from main power grid, observe and react pattern is suitable.

- when the power is not getting generated as sun is not there and battery is also empty then in this case the system will automatically switch to the on-grid power supply without affecting any other component.

- We want the EMSS to detect this exceptional condition of no power supply from primary source of energy (Solar panels and battery), and react by connecting the house to main power supply.