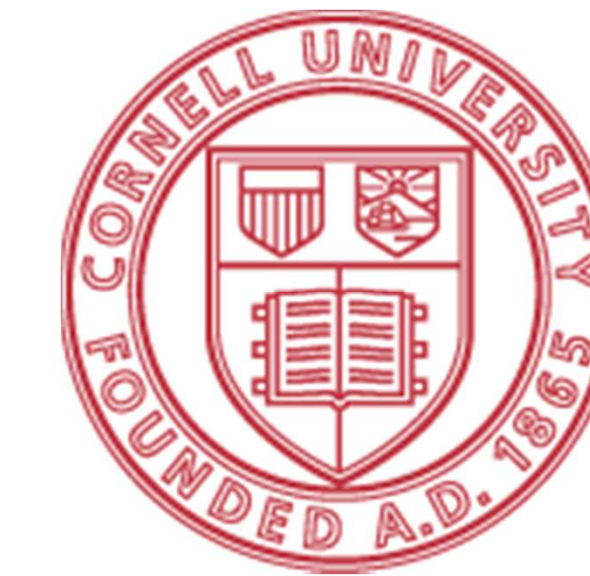


SOLAR HOT WATER NET ENERGY MONITOR



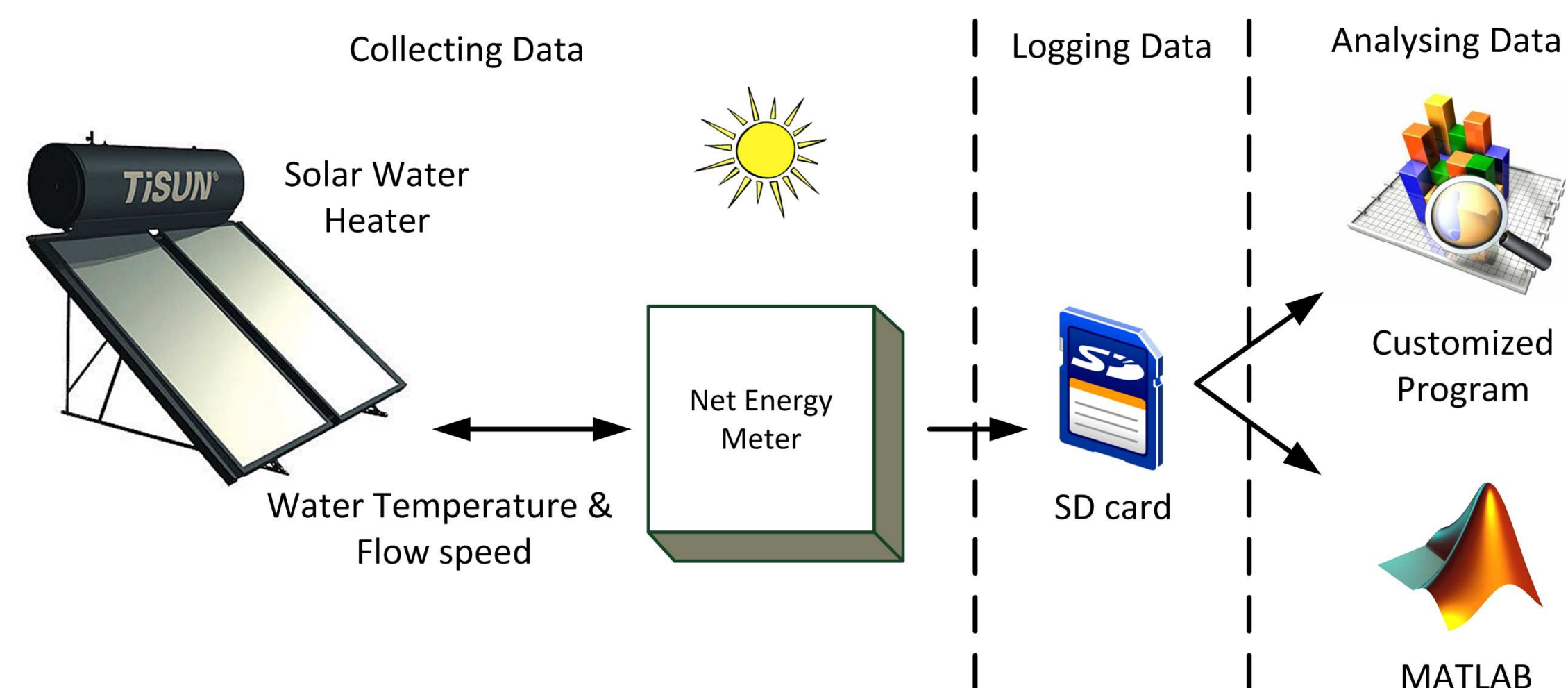
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PROJECT OVERVIEW

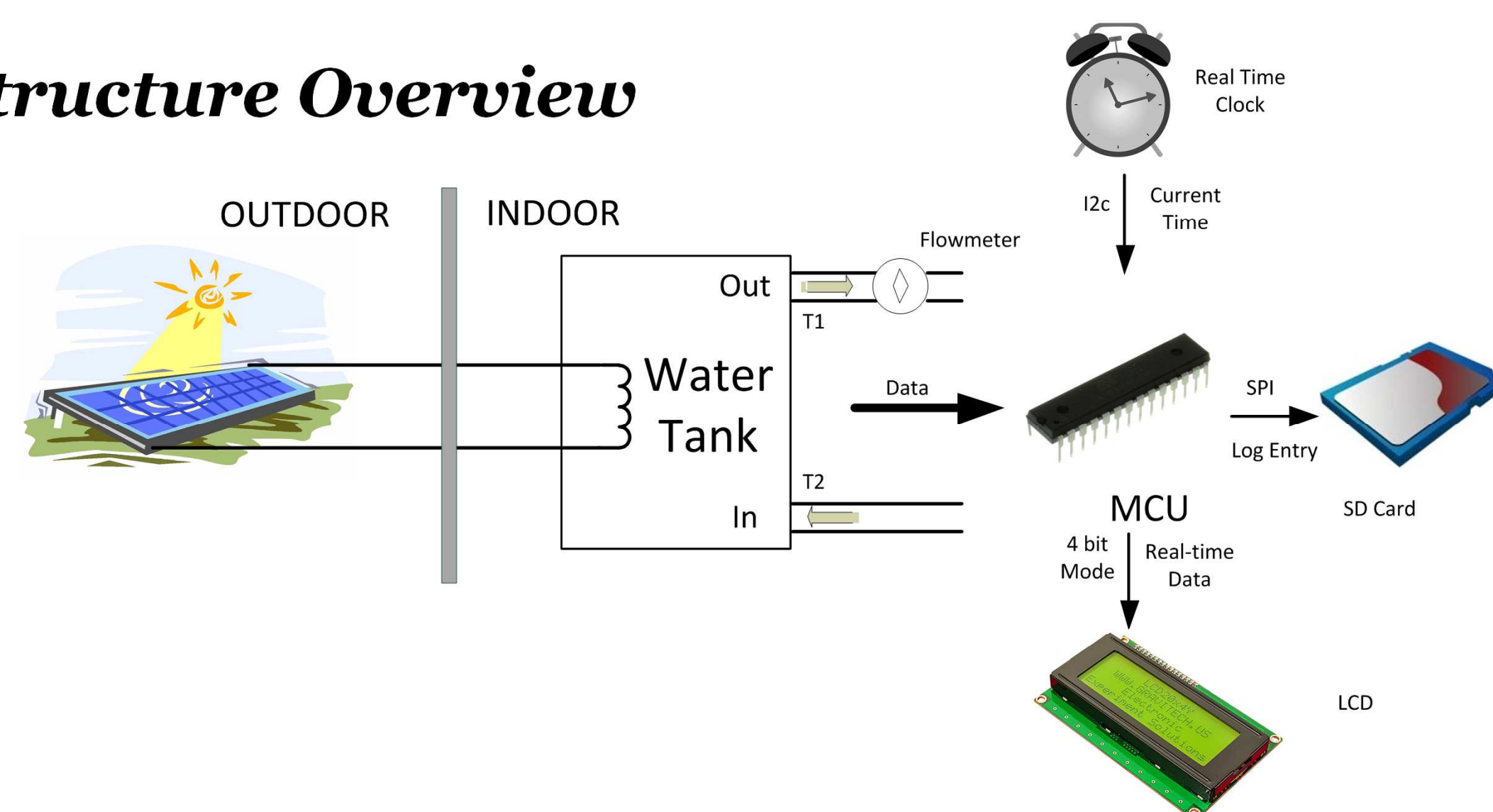
“An intuitive visual interface of a solar heater which helps users to understand how solar energy has been utilized”



Abstract

The project is to build a digital instrument to measure the net energy delivery of the hot water in a home-use solar hot water heater. To provide an intuitive and visual interface to the users, data can be viewed in real-time on a LCD screen and logged to a SD card. The logged data can be further analyzed in the MATLAB or customized program to obtain more specific understanding of the solar heater. In addition, since the energy monitor is up running all the time, the users can have a complete set of historical data of how they consume the energy on the hot water.

Structure Overview



Why we care about the net energy?

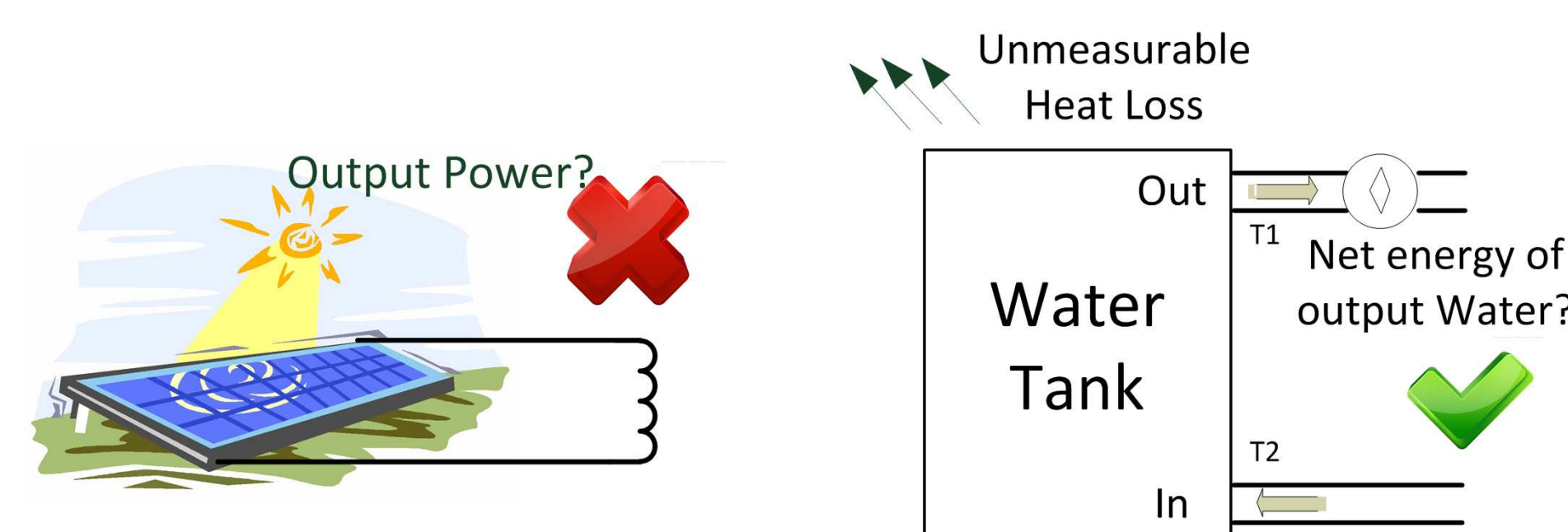


Net Energy tells the actual energy harvest from a source which is the solar energy in this case. It is the most meaningful and critical measure for a user to understand how well the solar heater performs and how much usable energy it generates over time.

How to measure the net energy?



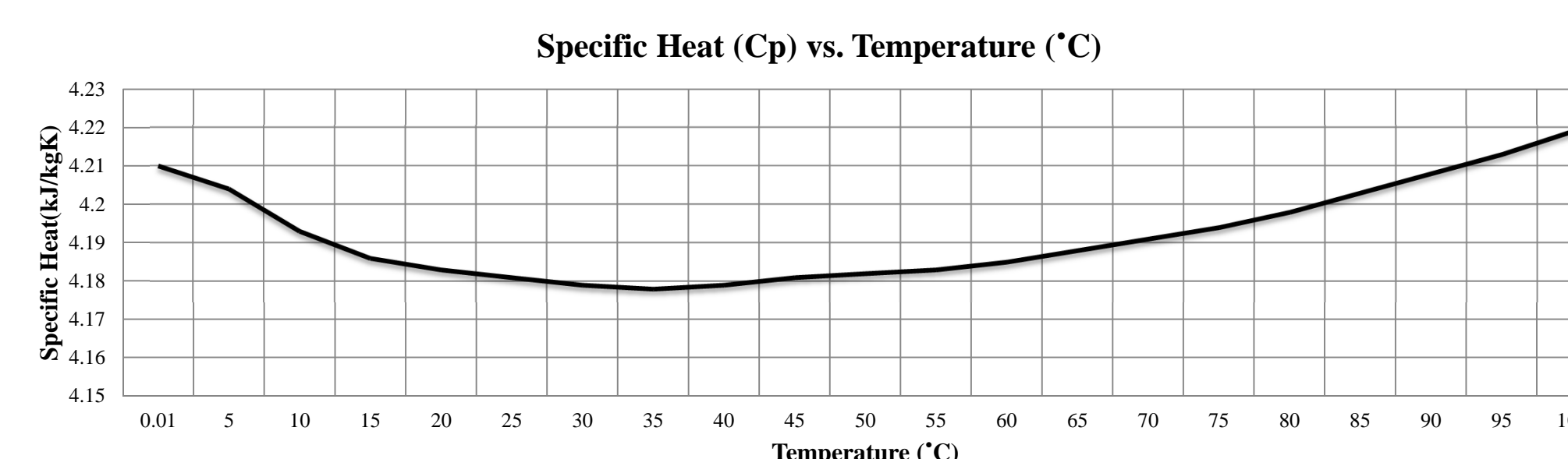
It is inaccurate and overestimated to measure the net energy of the solar hot water by checking the output power of the solar heater, because output power changes along with the sunlight intensity all the time and there is a huge amount of heat loss when water is stored in the tank.



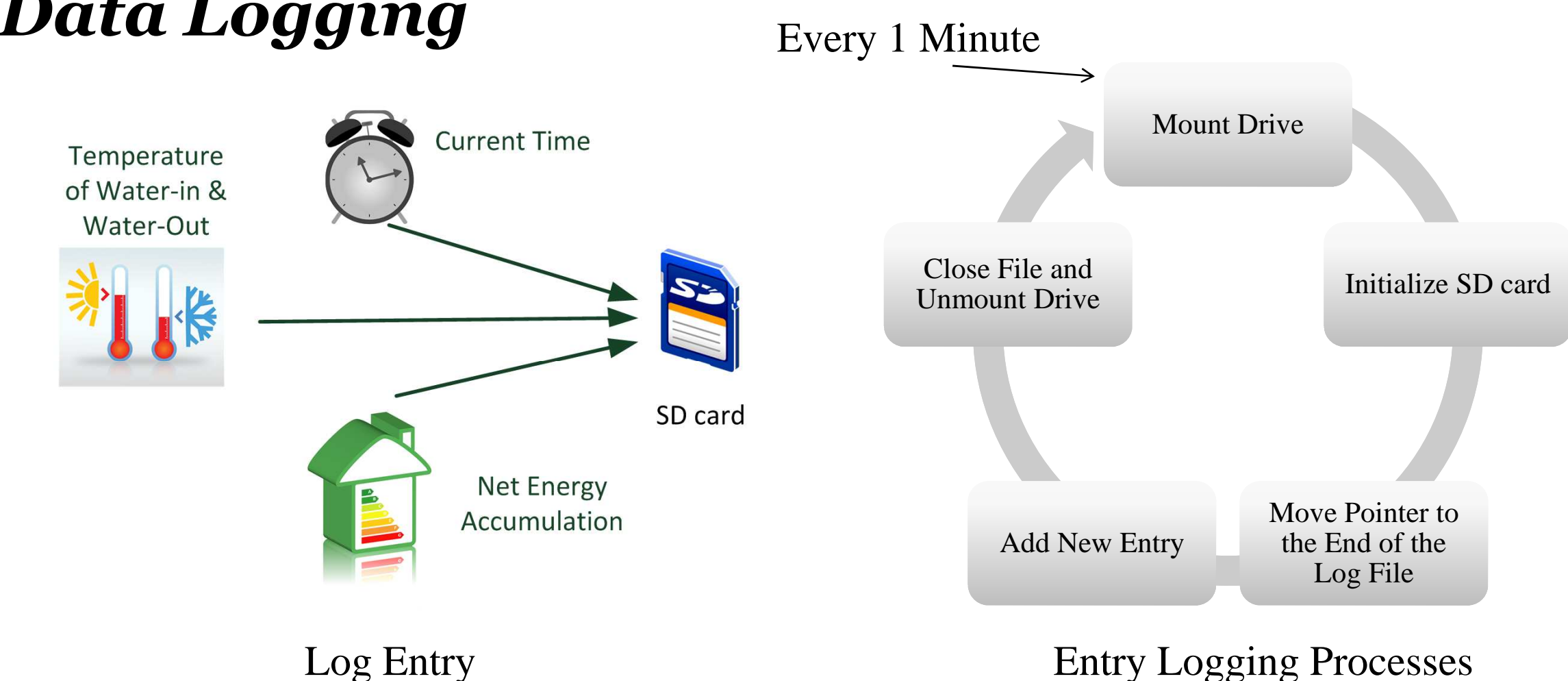
$$H = \int_0^t Cp * (T1 - T2) * \Delta m * dt$$

Net Energy Calculation Formula

The net energy is accumulated for a period of 24 hours and then it will reset when another day starts. The specific heat of the water at a given temperature (show as Cp in the formula) is found out by the following chart.

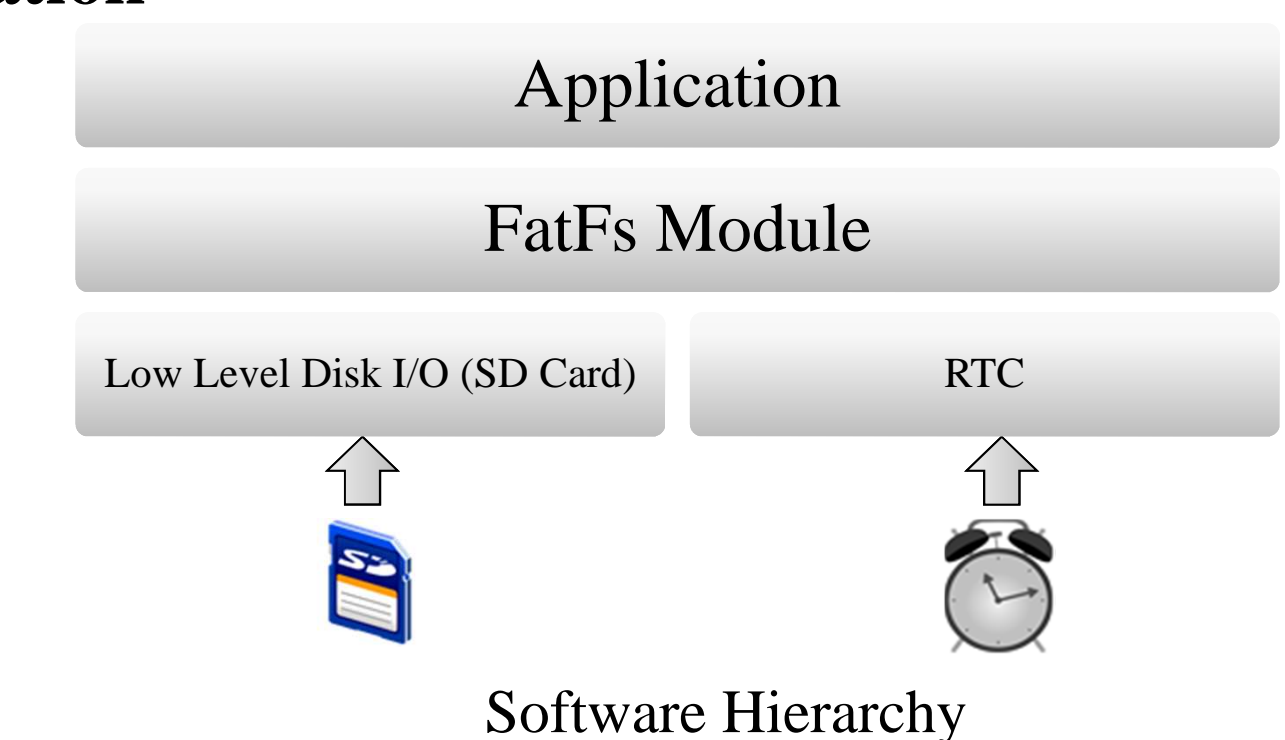


Data Logging

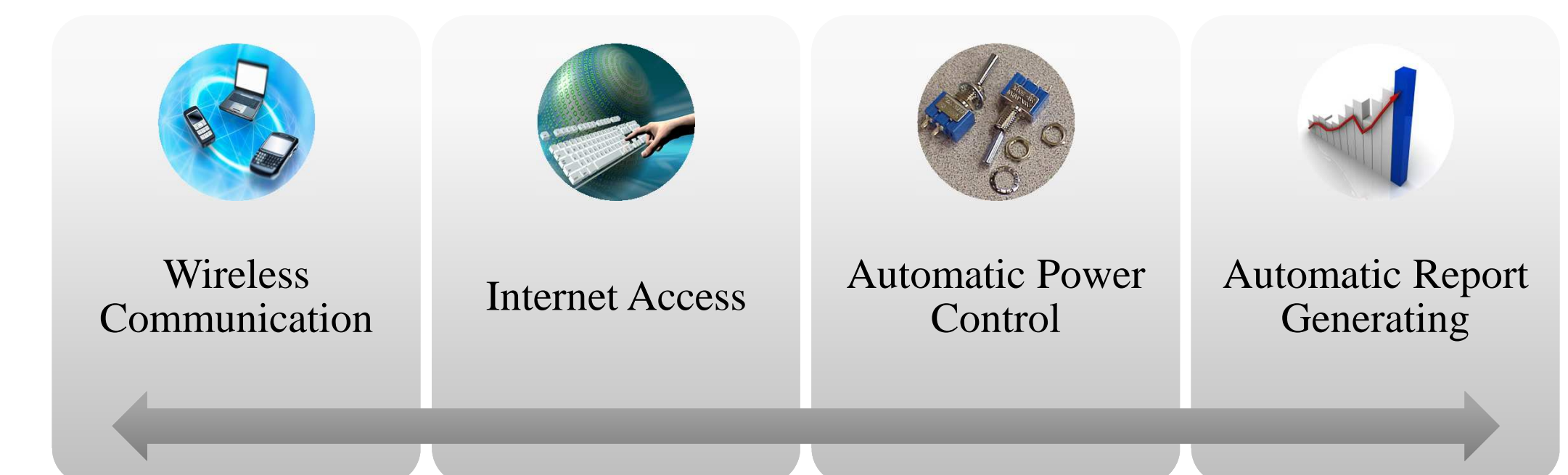


Fat File System Implementation

In order to make the log file recognizable to PC systems, Fat file system must be implemented on the SD card.



Further Improvements



Conclusion

The project offers an easy-to-install solution for solar heaters' users to measure the machines' performance and daily energy usage in a convenient, intuitive and visual way which enables them to take better advantage of the energy, save the world.

