Self Sustained Solar Grid for charging Society Electric Vehicles

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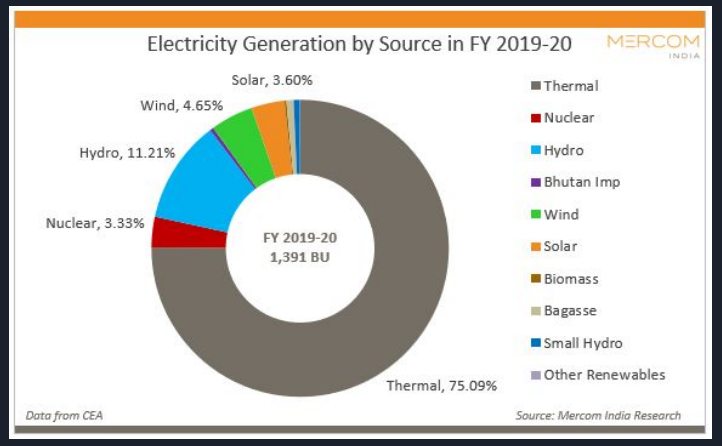
Problem statement



Current energy systems are getting

- Extinct - less availability in long run
- Higher expenses
- Pollution

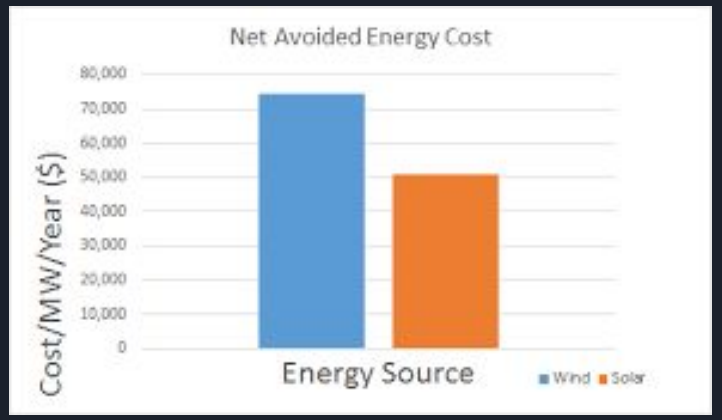
Current renewable energy solutions at individual level are not efficient

Do not give economies of scale for local installations

Tall Buildings Solar panels are the most popular source of renewable energy but they need a lot of space to generate electricity in an optimum amount which is not available in developed cities.

Why using solar energy ?

SOLAR PANELS - India is one of the leading generator of solar energy in the world owing to its ideal geographical location. India receives tropical sunlight and clear sky for upto 300 years in a year - The Economics Times

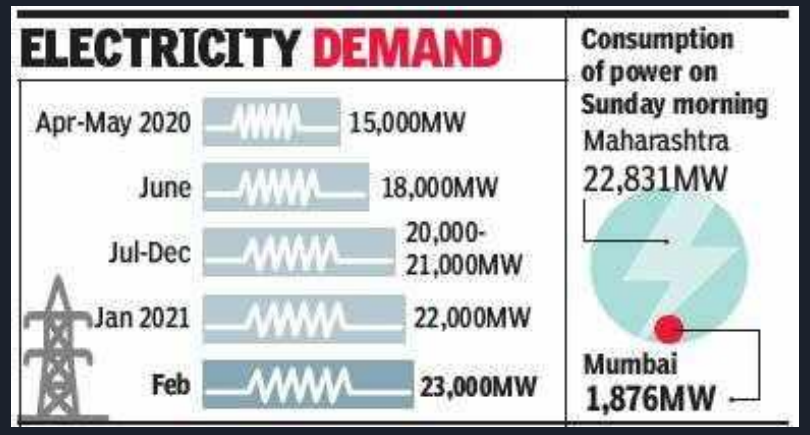


Closer look at the community - Our Mumbai city

Secretary of Gulmohar society Mr. Somnath Saini told us that they always look for solutions that can make use of the unused space of the building like Rooftop, balcony shades and window-shades.

- Tall buildings make the skyline of Mumbai
- Average of 5 flats per floor
- Every flat in the building has ROOFS on Balconies, Kitchen windows, Bathroom windows
- Proven research on Increased efficiency of 42% at higher altitudes

Total electricity consumption of flats by building in Mumbai city



Total amount spent to generate this much energy

The cost of producing one megawatt-hour of electricity — a standard way to measure electricity production — is now **around $50 for solar power**, according to Lazard's math. The cost of producing one megawatt-hour of electricity from coal, by comparison, is $102 — more than double the cost of solar.

Solution – Self Sustained Solar Grid

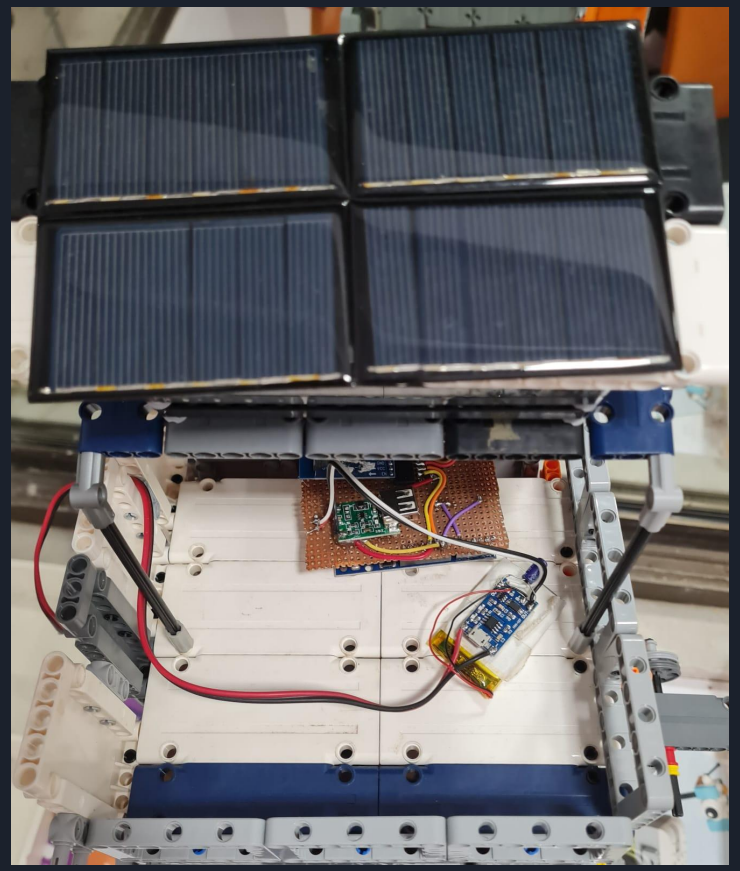
Our Solution is to implement a network of small solar microgrids to generate electricity using the unused premises of the pre-existing buildings (roof tops, balconies sheds, window sheds) and putting solar panels on them.

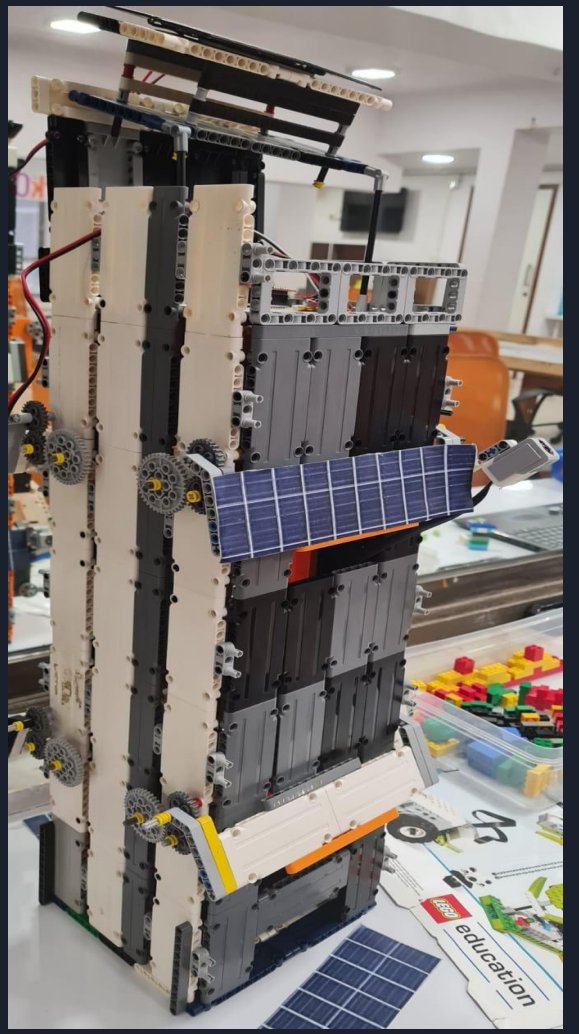
- We target the roof area of each flat
- Surface area of each roof of windows, kitchens, bathrooms and balconies ranges from 2ft*3ft X 5 = 30 square feet
- Regular building facade contains approximately 16 window sheds and 16 balcony sheds
- the solar panels to get their best performance, a **steep angle of 60°** is best. During the spring the best angle is 45°, and during the summer when the sun is high in the sky, it's best to have a low tilt at 20°!
- The best angle for solar panels to work is between 50 to 55 degrees
- Solar panels work the most efficient between 11am to 4pm.

Our prototype

We have made a small lego model of a building with solar microgrid.

- It has solar auto-adjusting solar panels on the roof, balconies and windows.
- Panels angle is controlled by EV3 and motors using light sensor according to the sun position
- It has a smart arduino circuit which connects the grid to the cloud network
- Full information about the total batteries charged and electricity generated goes to the cloud network





Our prototype

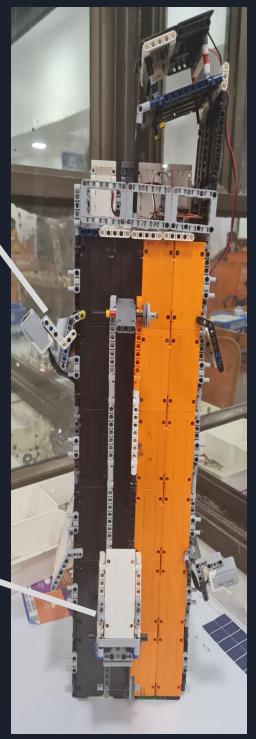
Rooftop stationary solar panel.

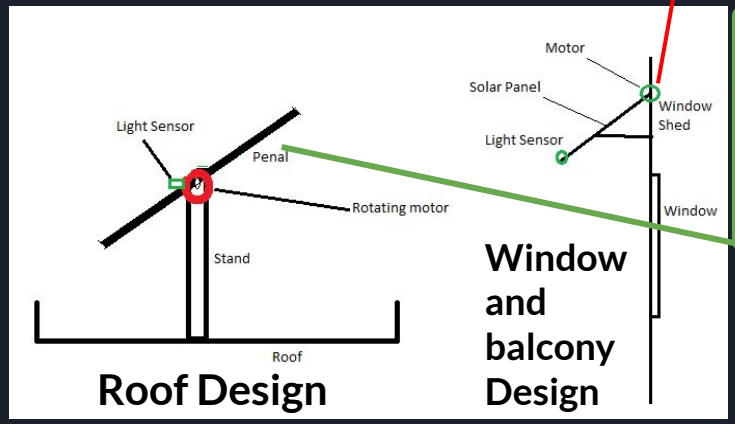
Colour sensor detecting ambient light intensity

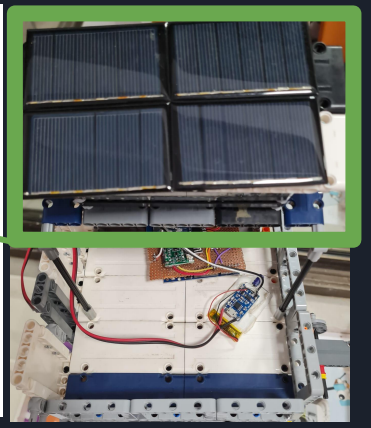
Battery charging circuit.

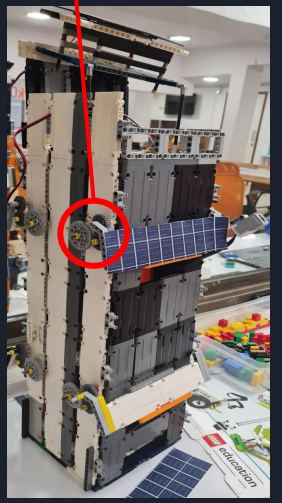
Lift

Adjusting window sheds for optimum absorption.









Working of solution

- There are 2 main parts of the solution

Solar power generation in microgrids

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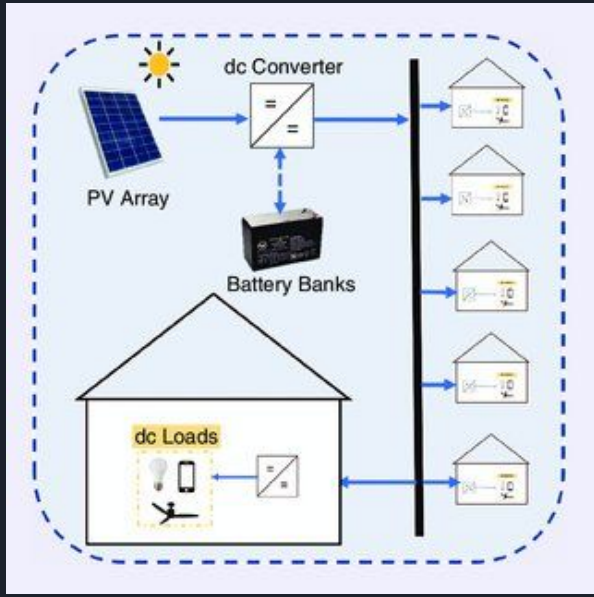
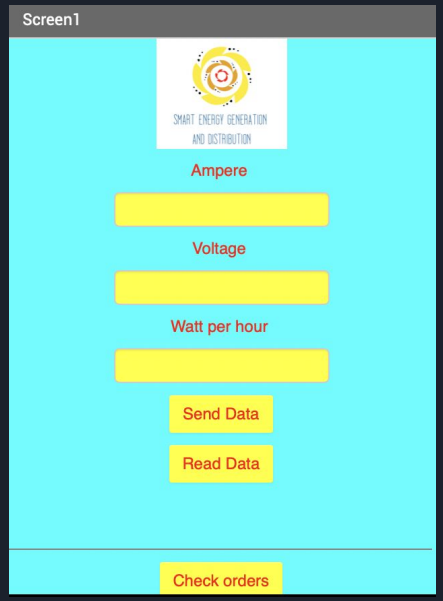
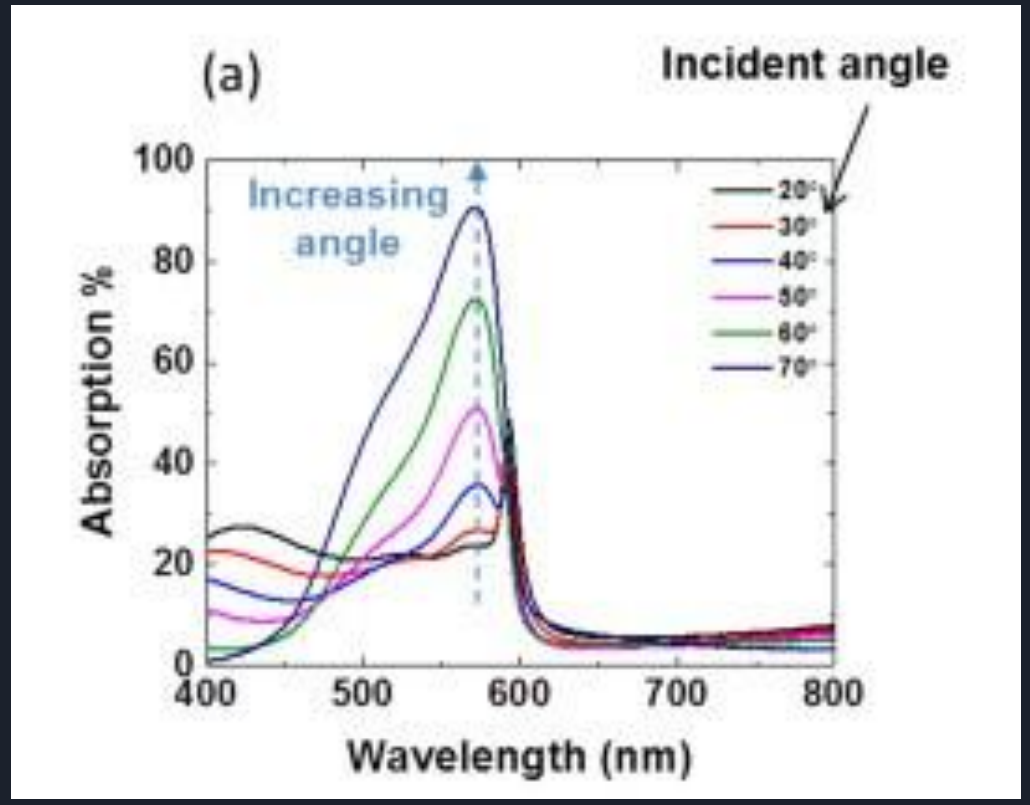
Smart Power Distribution System

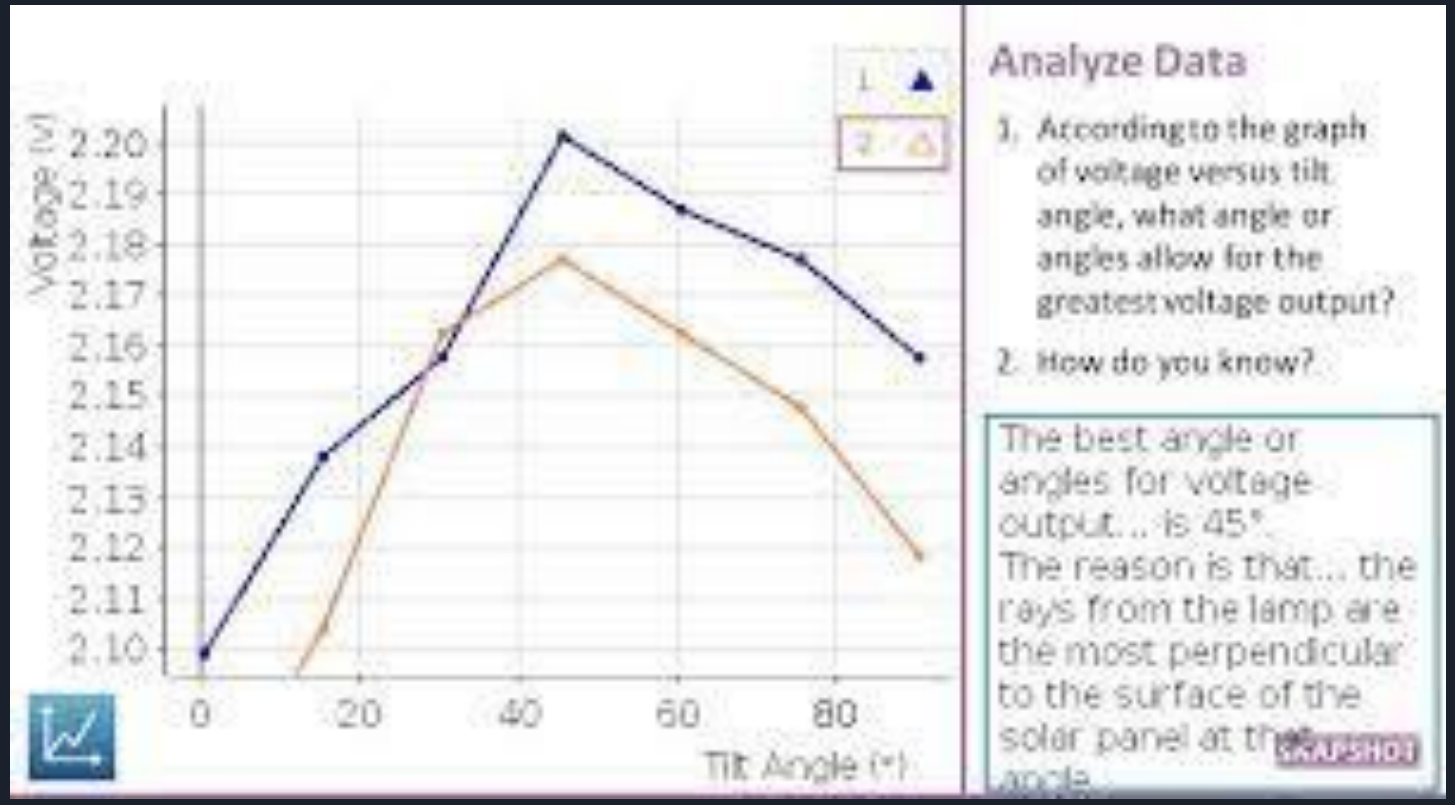




Technology used

How does tilt of the solar panel affect the efficiency at which it absorbs energy?





We can conclude that the best rate of absorption takes place at the angles 45-60 degrees where most amount of voltage is gathered. The reason may be that rays from the sun are the most perpendicular to the surface as cited in the graphs above.

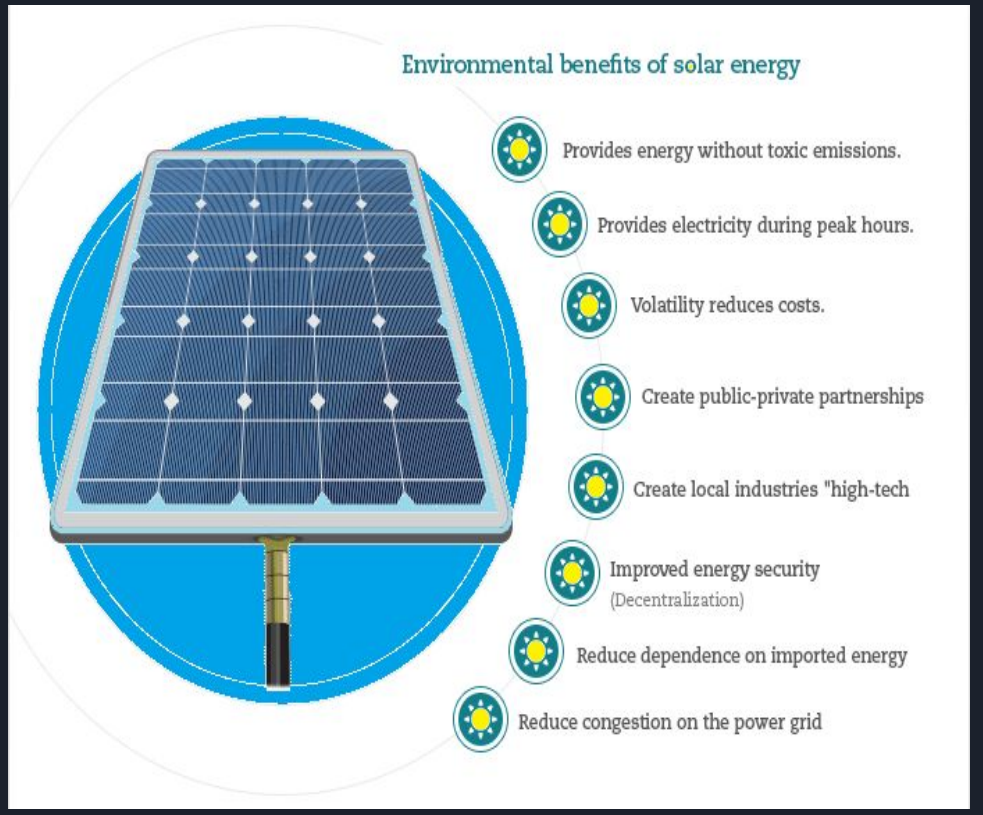
Solar Microgrid -

Solar microgrid is a network of small solar power plants on the residential building which generates electricity and store it in the batteries

Benefits:

- Easy to implement in the cities
- Carbon neutral energy source
- Source of income for residential societies
- Utilise the unused area

Idea is to create a network of batteries charging using solar microgrids and then distributing them. Fully charged batteries will go to customers and empty batteries will be brought back for charging.



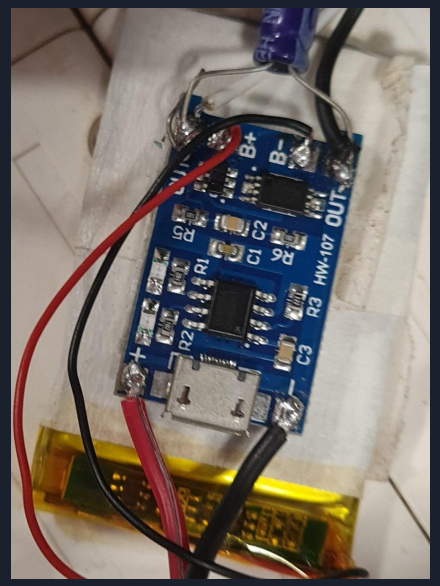
Calculations -

- Average area of the roof of 4 apartment building - 60X60 feet
- 40X60 is available roof area - 20 panels
- Panels on windows(12 windows) - 12
- Panels on balconies(12 balconies)-24, Total panels - 56
- Total panels Working at a time - 40 (average)

- Total energy generation - 40X300=12KW
- Battery voltage - 12v, Current - 1KAmp
- It can charge 5 - 200 Ah batteries in one hour it its peak time
- So on an average if it charges for 8 hours a day
- One building can provide 40 fully charged batteries in day

To Sum it up one building can provide 40 fully charged batteries in a day with 3 floors and roof setup and 8 batteries extra per floor for additional floor

Circuit



TP 4056 Charging circuit

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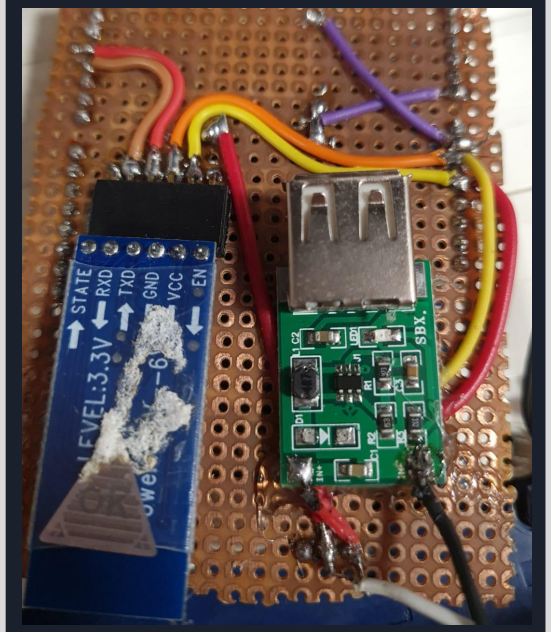

HC05 Bluetooth module and boost circuit

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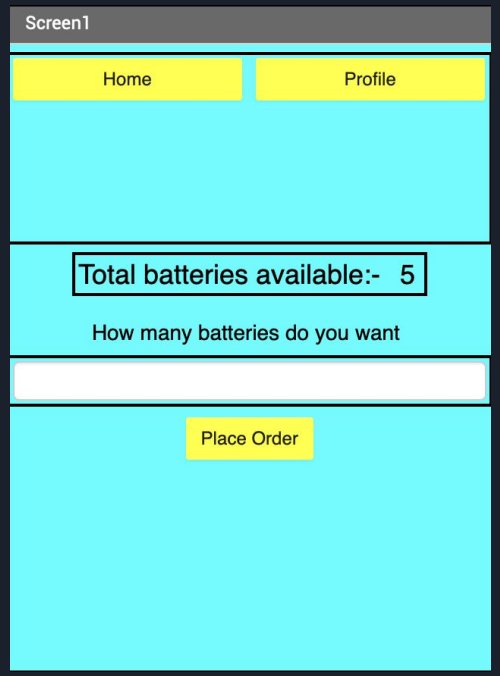
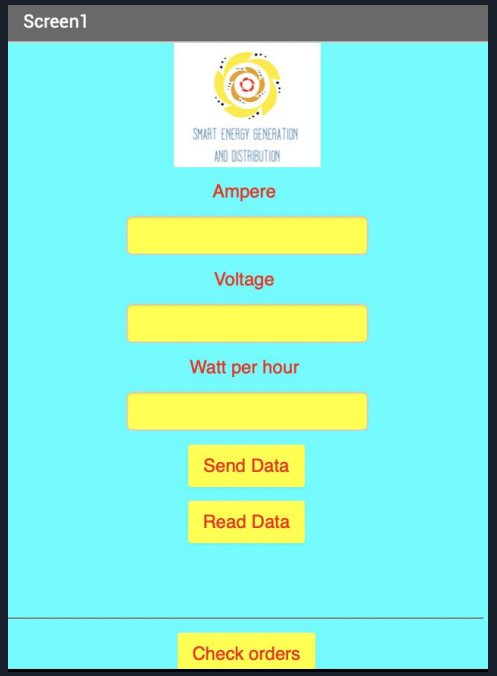
Arduino Controller and Solar panels

Our App

We have used MIT App Inventor to make our app. We have 2 apps a customer app and a management app. The customer app is for all our customers who want to purchase batteries and our management app is for the staff of the power station to know how much voltage or current is being generated from the solar panels. We will dive into more detail in the next few slides.



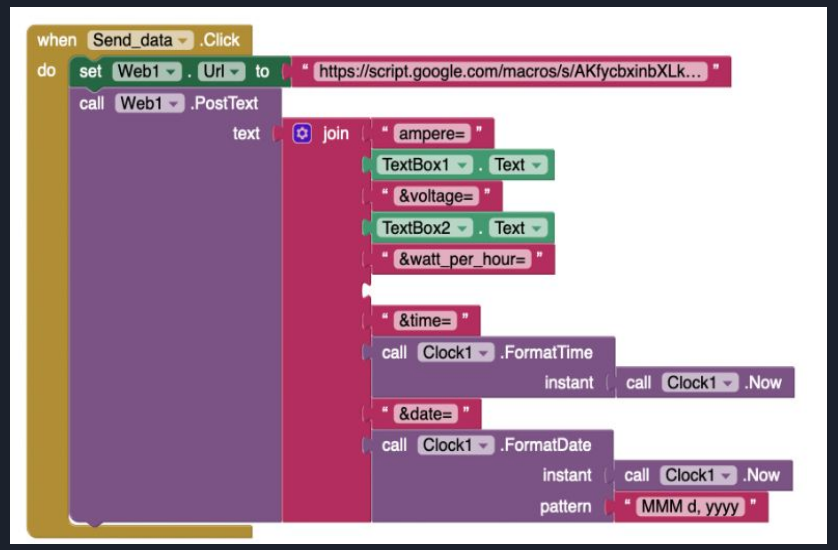
Customer App

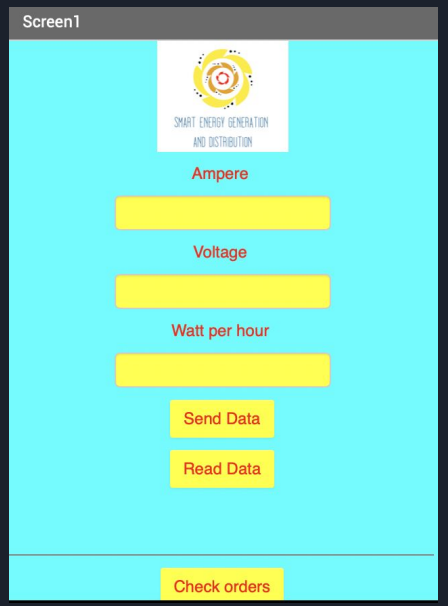


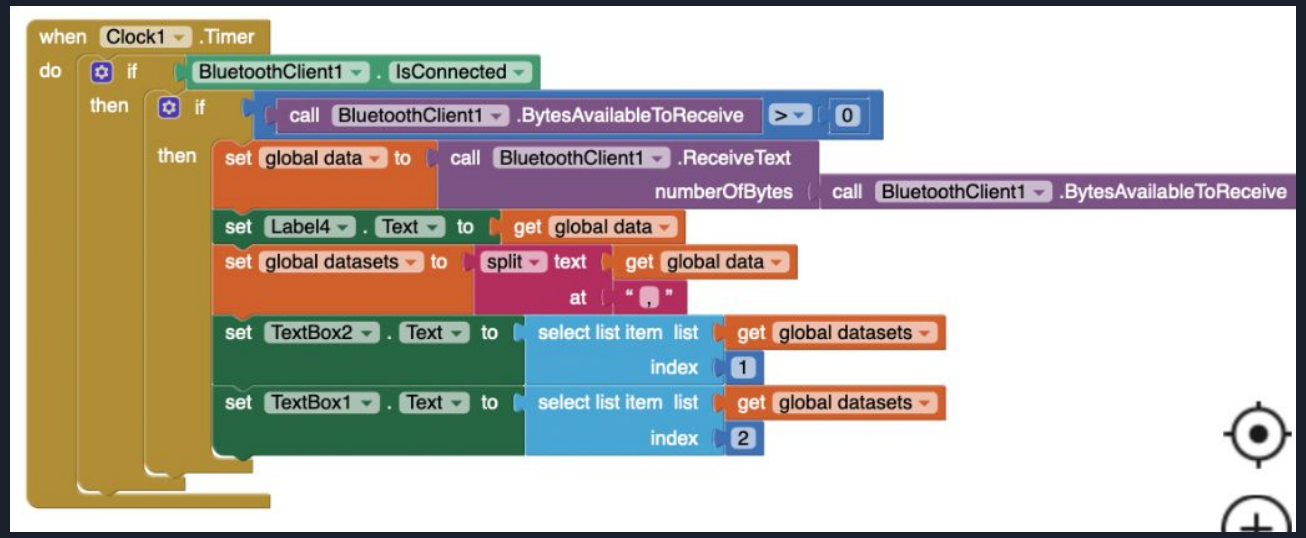
Management App

Management App

The management app is only accessible by the staff. In the app the staff members can see how much current we are getting from the solar panels, how much voltage we are getting from the solar panels and also how many watts are generated per hour. The staff can also see the number of orders which have been made, the name of person who ordered it and also the number of batteries they ordered. The staff can also input the values of the solar panels.

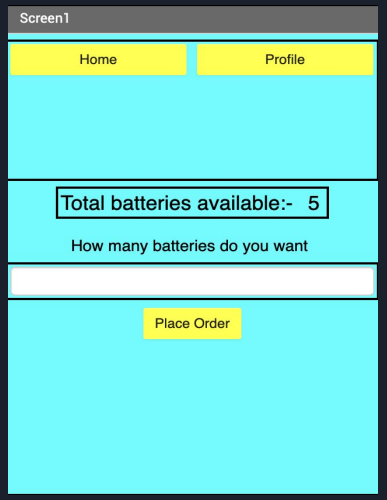


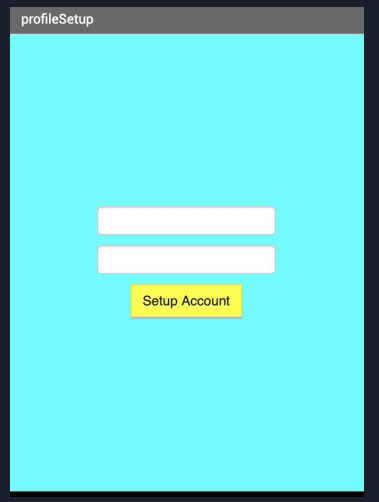


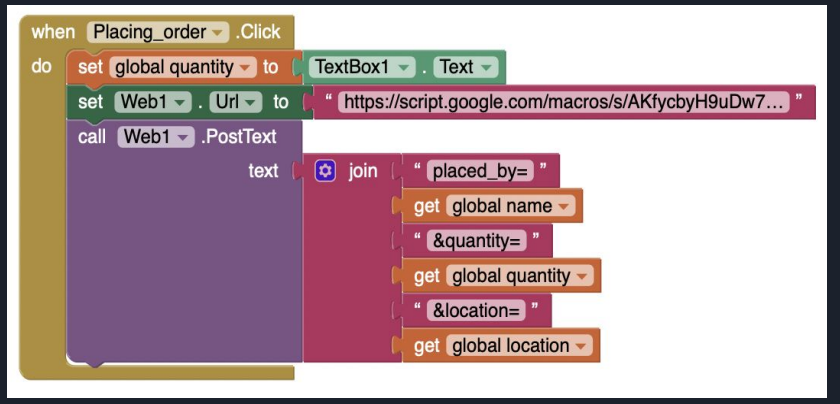


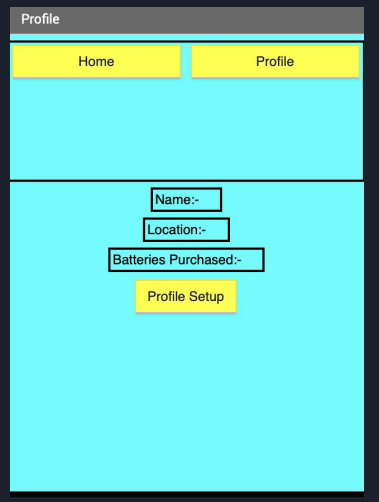
Customer App

In the customer app the customer can see how many total batteries are available. They have an option to purchase batteries. They can purchase batteries only if they have an account. There are buttons which help them to navigate from the profile screen to the ordering screen. Once they click the profile screen if they have a profile they can see their name, location and how many total batteries they have purchased. If they don't have a profile they can click the button to setup a profile and they will be taken to a profile setup screen









Impact of solution

- This solution is directed towards people of the working class who earn through driving trucks, buses, auto rickshaws and trucks.
- It will provide easy availability of batteries to the peoples with EVs
- This solution will integrate a power generation network system which will help the cities to become self sufficient and self sustained