Smart Bus Shade

Green Technology based Cost Effective Prototype Structure for Smart Bus Shade for Rural Communities

Caleb Benijon
Electrical and Electronics Department
Karunya University
Coimbatore, INDIA
samcaleb95@gmail.com

A Antony Kishore
Electrical and Electronics Department
Karunya University
Coimbatore, INDIA
kishorebalan567@gmail.com

Abstract: The existing bus shades are not completely utilized because of safety and maintenance issues. The bus shades is an electrical burden for the energy production. Improvising the utility and safety of the bus shades will produce revenue for its maintenance.

Initially a smart IOT based system is developed to control the power supply system automatically. The bus shade is equipped with LED lights, CCTV Camera, USB Charging ports, LCD Monitor and Audio system. All the systems are designed to run by DC power supply.

The recording of the CCTV Camera and Lighting is controlled by PIR sensor. The IOT is programed to log the usage statistics and report every hour through google drive. The bus shade is equipped with atmospheric temperature sensor, Light Intensity sensor and Wind Speed and Direction indicator. The data from the sensors is logged to google drive every hour.

The Bus shade is fitted with a smart filter system to recharge ground water through bore hole method. The power requirements is satisfied by Solar Panels.

The Audio system and the LCD are used for advertisement purpose which will generate revenue for the maintenance of the Bus Shade. In such provisions the Bus Shade will be Smart and Safe for the public usage. The logged data will provide us new research node where it is practically impossible to collect data from. The above mentioned data can be manipulated with GIS. We hope to build Smart and Stay Smart.

Keyword: Solar panels, Bus shade, IOT based, DC power supply, PIR Sensor, Wind speed indicator, Battery, GIS.

I. Introduction

This is a concept of electrically smart bus stop. The concept is conceived from hybrid power systems and multiple other smart energy buildings. The background for this project is basically improving the existing bus stop (or new bus stop design) in terms of safety, technology and utility. The general problems in existing bus stop are insufficient lighting, information and so on. This project addresses most of the existing problems.

The bus stop is designed in such a way that all the resources near the bus stop to electrify. Solar panels are deployed to harvest the energy from the sun. Wind turbines will also be incorporated in suitable regions. The power generated by the panels and the wind turbine will serve for the electricity requirements of the bus stop. Rain water harvesting through bore hole method.

The bus stop facilitates LCD display to display bus timings and Advertisement (AD) shows. This brings the revenue for the maintenances of the bus stop. The Bus stop will have mobile charging ports. All the amenities inside the bus stop are in DC. Henceforth, invertor is not required. CCTV surveillance is also possible. Thus this project can be a boon to the economy.

Objectives:

This Project will focus on the following objectives

- To ensure public safety

Providing enough luminance in the bus shade during evening and night. Providing information on bus routes and timings through a display. Installing voice assistance to announce the bus arrivals.

- To utilize green energy

Installing solar panels to harvest sunlight. Installing wind turbine to harness wind energy. Incorporating PIR Sensor control for the display and speaker systems to reduce power consumption.

- To produce revenue for the maintenance of the bus stop through advertisements.

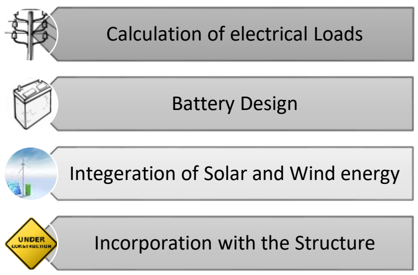
Selling advertisements to public and private concerns to produce revenue for the operation and maintenance of the bus shade.

- To improve ground water recharge

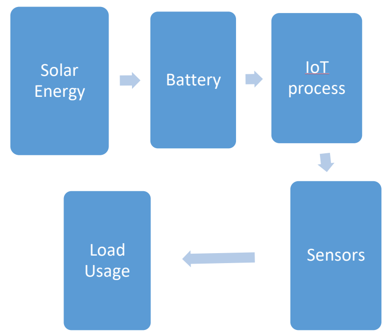
A bore hole is provided to collect rain water from the roof top of the bus shade.

Methodology:

Electrical Component



Block Diagram:



SOLAR PANEL SPECIFICATION P/N:

SW0.4M Maximum power voltage:4.0V

Maximum power current: 100.0mA

Dimension: 70*65*3.2mm

1. Outline View:

2. Technical characteristics:

(STC Standard Testing Condition: 1000W/M2 AM1.5, 25℃.) Description of Goods Technical Spec. Open Circuit Voltage(Voc) 4.6V±8% Short Circuit Current (Isc) 105mA±8% Maximum Power Voltage(Vmp) 4.0V±8% Maximum Power Current(Imp) 100.0mA±8% Maximum Power(Ppm) 0.4W±8%

3. Mechanical Characteristics:

① Monocrystalline Silicon solar cells

② Encapsulated: PC film lamination 4. Quality Assurance

① 3-year limited, work temperature: -10℃-50℃ 5.

Notes:

① This product couldn't be contacted directly with strong corrosive substances.

② To be avoid to scratch the surface.

③ This product couldn't be born bending force during transportation & assembling.

Outline Dimensions

L 70±0.2mm

W 65±0.2mm

H 3.2±0.3mm

Battery Design:

Battery Basics • Cell, modules, and packs – Hybrid and electric vehicles have a high voltage battery pack that consists of individual modules and cells organized in series and parallel.

• Battery Classifications – Not all batteries are created equal, even batteries of the same chemistry. The main trade-off in battery development is between power and energy: batteries can be either high-power or high-energy, but not both. Often manufacturers will classify batteries using these categories

• C- and E- rates – In describing batteries, discharge current is often expressed as a C-rate in order to normalize against battery capacity, which is often very different between batteries.

• Secondary and Primary Cells – Although it may not sound like it, batteries for hybrid, plug-in, and electric vehicles are all secondary batteries. A primary battery is one that can not be recharged.

• Depth of Discharge (DOD) (%) – The percentage of battery capacity that has been discharged expressed as a percentage of maximum capacity. A discharge to at least 80 % DOD is referred to as a deep discharge.

• Terminal Voltage (V) – The voltage between the battery terminals with load applied. Terminal voltage varies with SOC and discharge/charge current.

• Open-circuit voltage (V) – The voltage between the battery terminals with no load applied.

• Internal Resistance – The resistance within the battery, generally different for charging and discharging, also dependent on the battery state of charge.

• Nominal Voltage (V) – The reported or reference voltage of the battery, also sometimes thought of as the "normal" voltage of the battery.

• Cut-off Voltage – The minimum allowable voltage. It is this voltage that generally defines the "empty" state of the battery.

• Capacity or Nominal Capacity (Ah for a specific C-rate) – The coulometric capacity, the total Amp-hours available when the battery is discharged at a certain discharge current (specified as a C-rate) from 100 percent state-of-charge to the cut-off voltage.

• Energy or Nominal Energy (Wh (for a specific C-rate)) – The "energy capacity" of the battery, the total Watt-hours available when the battery is discharged at a certain discharge current (specified as a C-rate) from 100 percent state-of-charge to the cut-off voltage.

• Charge Voltage – The voltage that the battery is charged to when charged to full capacity. Charging schemes generally consist of a constant current charging until the battery voltage reaching the charge voltage, then constant voltage charging, allowing the charge current to taper until it is very small.

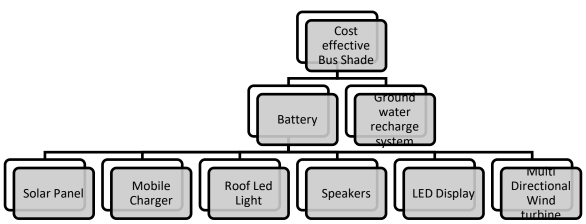
• Float Voltage – The voltage at which the battery is maintained after being charge to 100 percent SOC to maintain that capacity by compensating for self-discharge of the battery.

• (Recommended) Charge Current – The ideal current at which the battery is initially charged (to roughly 70 percent SOC) under constant charging scheme before transitioning into constant voltage charging.

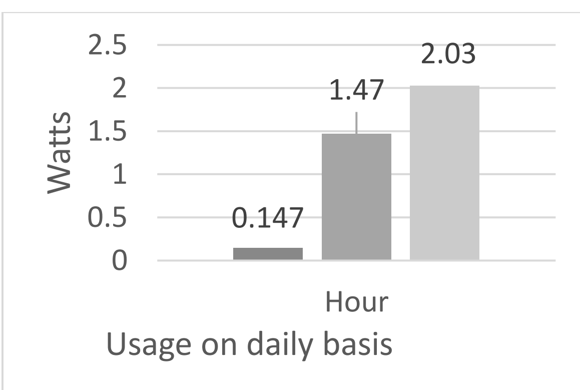
• (Maximum) Internal Resistance – The resistance within the battery, generally different for charging and discharging.

Type	Specification	Remarks
Voltage collection range	0~5V	
Voltage collection accuracy	±5mV	
Accuracy of total voltage	0.1%	
Current collection accuracy	±1%	500A current sensor
Error of SOC estimation	≤5%	
Temperature collection accuracy	±1℃	
Temperature collection range	-40~125℃	
Balance current	300mA	3 channels of balance can be switched on at the same time
Power consumption of BMU operation	0.5W	One BMU module
Power consumption of BCU operation	≤2.8W	
3.5" display screen	3W	Power consumption of sleep mode: 0.24W
Working input voltage	DC 12/24V	
Storage temperature	-45~125℃	
Weight	BCU:480g BMU:640g	Weight of one Battery monitor unit and one Battery cluster-management unit
Charging control mode	CAN communication, active/passive output	Depend on actual conditions
Discharging control mode	CAN communication, active/passive output	Depend on actual conditions

Schematic Diagram of the whole project:



Load Calculations:



Formula:

For Load Calculation:

kVA = V x I x √3 ÷ 1000

Where: V = Volts generated

I = Amps available

P.F. - Power factor of load

For Solar Calculation:

E = A * r * H * PR

E = Energy (kWh)
A = Total solar panel Area (m²)
r = solar panel yield or efficiency(%)
H = Annual average solar radiation on tilted panels (shadings not included)
PR = Performance ratio, coefficient for losses (range between 0.5 and 0.9, default value = 0.75)

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