

Operating Scenario:

- 7AM to 7PM (12 operating hours)
- At least 5 total hours of sunlight
 - based on local solar radiation data at UTP, Perak ([Reference](#))
- Assume solar power unit efficiency at 65%
- All component runs at 5V*

Component Operating Characteristics for bus unit:

RASPBERRY PI 4:

- Always active
- Estimated current: 1A

A7670E:

- TX every 10 seconds, assume TX takes 1 secs
- Estimated current:
 - Idle: mA for 9 secs
 - Active: 500mA for 1 secs
 - Rare case: 2A, handle by 2200μ 25V capacitor
 - Average: 77mA
- [Reference \(Section 5.4\)](#)

NodeMCU ESP-32:

- Always active
- Estimated current: 53mA
- [Reference \(Section 5.4\)](#)

Xiaomi Redmi Monitor RMMNT215NF:

- Always active
- current: 2A
- Voltage: 12A
- [Reference \(Similar product\)](#)

SFM-27 BUZZER:

- Active during bus stop, assume 2 minutes every 5 minutes, 4 pieces
- Always active
- Estimated current: 6mA
- [Reference \(Product description\)](#)

NEO-6m:

- Always active
- Estimated current: 70mA
- [Reference \(Section 3.3\)](#)

MAX485:

- Always active
- Estimated current: 1.6mA

MH-ET LIVE Scanner v3.0:

- Always active
- Estimated current: 20mA

LED light:

- Active during bus stop, assume 2 minutes every 5 minutes, 4 pieces
- Estimated current:
 - Active: 80mA ($4 \times 20\text{mA}$) for 2 minutes
 - Average: 32mA
- [Reference \(Product description\)](#)

ToF sensor VL53L0XV2:

- Active during bus stop, assume 2 minutes every 5 minutes, 4 pieces (seat)+ 1 at door
- Estimated current:
 - Active: 675mA ($45 \times 15\text{ mA}$)
 - Average: 270mA

Component Operating Characteristics for bus stop unit:

RASPBERRY PI 4:

- Always active
- Estimated current: 1A

A7670E:

- TX every 10 seconds, assume TX takes 1 secs
- Estimated current:
 - Idle: mA for 9 secs
 - Active: 500mA for 1 secs
 - Rare case: 2A, handle by 2200 μ 25V capacitor
 - Average: 77mA
- [Reference \(Section 5.4\)](#)

Xiaomi Redmi Monitor RMMNT215NF:

- Always active
- current: 2A
- Voltage: 12A
- [Reference \(Similar product\)](#)

Daily Energy Consumption Estimate:

Module	Avg Current (mA)	Voltage (V)	Daily Runtime (h)	Energy (Wh/Day)
Bus Stop Unit	3077	5	12	184.6
Bus Unit	3291	5	12	197.3
Total	6368	5	12	381.9

Solar Power System Feasibility:

Solar Panel:

- Maximum Power: 100W
- Voltage at Maximum Power: 18V
- Current at Max power: 5.56A
- [Reference \(Product description\)](#)

Estimated Daily Energy Harvest:

At 65% efficiency:

$$100W \times \frac{65}{100} \times 5h = 325Wh/day$$

Battery:

- Bus unit:
 - Total capacity: 15Ah 12 V nominal
- Bus stop unit
 - Total capacity: 15mAh 12 V nominal

System Analysis Conclusion:

Module	Daily energy need	Solar daily harvest	Daily Surplus	Battery capacity	Backup runtime (battery only)
Bus Unit	197.3 Wh	325 Wh	+127.7 Wh	180 Wh	0.91 days
Bus Stop Unit	184.6 Wh	325 Wh	+140.4 Wh	180 Wh	0.98 days