# Cost-Benefit Analysis

## Battery Form Factors

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Form Factor** | **Initial Cost** | **Safety** | **Durability** | **Longevity** | **Efficiency** | **Compactness** |
| Cylindrical  Batteries | typical price range is 0.50$ - few dollars, highly affordable | durable outer casing protects them against punctures and physical damage | robust design and excellent heat dissipation | average longevity of 5 years | moderately energy efficient, with stable and high power output | larger in size (not suitable for devices where compactness is a critical factor) |
| Pouch  Batteries | 50$ or more depending on the brand | poor due to soft-packing and lower resistance to heat dissipation | moderate durability, their soft packing makes them susceptible to external pressure | average longevity of 4 years | moderate energy density and not suitable high power systems | space efficient |
| Prismatic  Batteries | high initial cost compared to other battery form factors | Moderate, the pouch cells are housed in rigid and rectangular casing | Moderate, due to their rigid casing which renders them less resistant to physical damage | average longevity of 6 years | High energy densities and capable of providing stable power output | More space efficient |

## Summary

Each project will require a different battery form factor based on considerations including affordability, safety, longevity, efficiency, and compactness.

Cylindrical form factors, despite their lack of compactness which makes them not suitable for application in devices where compactness is a critical factor. They are still known for their robust design and excellent heat dissipation capability. Additionally their durable casing protects them from damage and this improves safety.

Pouch form factors, although ideal for applications that require space efficiency and design flexibility. It is the absence of hard exterior casing which impacts safety and durability negatively. Also their poor resistance to heat dissipation which curtails the overall efficiency.

Prismatic form factors, their strength lies in their compact design, allowing for higher energy densities to be achieved. However, their rigid casing renders them less resistant to physical damage which in turn impacts safety and durability.

All these form factors have low initial cost ranging from a few dollars although prismatic being slightly expensive. Ultimately, the cost of any battery form factor increases with its capacity.

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## LiDAR Sensors

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| --- | --- | --- | --- | --- | --- |
| **Sensor Type** | **Initial Cost** | **Durability** | **Resolution** | **Scanning Speed** | **Power Consumption** |
| Solid-state | $1000 to >= $100 000 | enhanced durability, due to the absence of moving parts | high | high | low |
| Mechanical | $1 000 to  $10, 000 per unit. | moderate | high | low | high |
| Hybrid | $5,000 to $50,000 per unit. | moderate | high resolution | fast data acquisition | low |

## Summary

Each type of LiDAR sensor exhibits distinct attributes that render them suitable for different applications:

* Mechanical scanning LiDAR sensors, with their lower initial cost, are ideal for applications that prioritize detailed environmental mapping and navigation over long distances but do not require high-speed scanning. However, their moderate durability and relatively high-power consumption might limit their suitability in dynamic and fast-paced environments.
* Solid-state LiDAR sensors, despite their higher cost, offer enhanced durability, high-speed scanning capabilities, and lower power consumption, making them a preferred choice for applications that demand reliable and precise data acquisition in dynamic and energy-conscious settings. However, they work best for short-range sensing.
* Hybrid LiDAR sensors strike a balance between the two, offering a blend of long-range sensing, high resolution, and fast data acquisition at a moderate cost. They are well-suited for applications that require comprehensive 3D perception while maintaining a reasonable budget.