RETROFIT KIT FOR BOOK TROLLEY
(MARK IV KIT VERSION)

**retro-fit (retrő-fit)**
Verb - add a (component or accessory) to something that did not have it when manufactured.
Noun - an act of adding a component or accessory to something that did not have it when manufactured.

**INNOVATION PRODUCT**

**GREEN PRODUCT**
Quiet and Energy Efficient
Pollution free

**PERFORMANCE**
- Improvement in total medical leave due to back pain per year
  - Before: 10 minutes
  - After: 5 minutes
  - Physical exertion:
    - Before: Strenuous
    - After: Effortless

**NOVEL RETROFIT FRAME**
Incorporating power assist in a regular book trolley by retrofitting it with an electrical drive unit.

Retrofitting an existing trolley, rather than buying a new bespoke motorized trolley meant that the existing trolley could be used, keeping costs down significantly.

**MOTIVATION**
- Health benefits
  - reduced occupational hazard, fatigue, and injury risk.
  - i.e. musculoskeletal injuries
- A positive work environment
  - happy work place equals happy workforce.

Safety in operation using twist throttle
Easy to read battery indicator
High performance motor controller

High grade steel frame with retrofit design to suit any book trolley.
High capacities battery up to 3 days operation (Optional Lithium Battery)
Low noise electric motor with high capability to move load up to 250 kg

**COMMERCIALIZATION**

<table>
<thead>
<tr>
<th>TARGET MARK IV</th>
<th>RM 500</th>
<th>RM 3,000</th>
<th>RM 9,048</th>
<th>RM 9,889</th>
<th>RM 11,851</th>
<th>RM 19,920</th>
</tr>
</thead>
</table>

An extremely high potential for commercialization, as the cost of incorporating power assist in a trolley by retrofitting, is a great cost savings compared to buying a commercial unit, which cost up more than 300%.

**Team Member**
Fimaris Bt Mohd Ariff, IRC UTP
Siti Nurhayati Bt Abdul Karim, IRC UTP
Dr Mark Ovosis, EPIC UTP
Nor Shahrul B Abu Bakar, EPIC UTP
Aziz Jammos B Jamali, EPIC UTP

Universiti Teknologi Petronas
32610 Seri Iskandar
Perak Darul Ridzuan
MALAYSIA
Tel: 6093688174
Fax: 6093654068
www.upt.edu.my