EE2111A - Design Project

Design a robotic vacuum cleaner that meets given specifications

Specifications

- In a single charge, the robot vacuum cleaner should be able to vacuum an area of 1000 sq ft (approximately equal to the area of a 3-bedroom HDB flat)
- Minimum suction power of 20 kPa (kiloPascal)
- Charging time: not exceeding 3 hours to fully charge the batteries

Design

- Brainstorm to identify what the product must do in order to be competitive in the market, and prepare a **requirement document** that clearly outlines these ideas.
- Identify different sub-systems of the hardware and the software needed to realize the design ideas.
- Use proper calculations to determine the specifications of the components needed, and source the components from recognized vendors.
- Software: show using flowchart or pseudocode how the system will work.

Post-design evaluation

1. Estimate how long will the vacuum cleaner take to clean the specified area of 1000 sq ft.
2. Show using appropriate calculations that the specification for charging is met.
3. Estimate the cost (material) of the vacuum cleaner: The cost must be calculated using the cost of components to be obtained from either RS

Components (rs-online.com) or Element14 (sg.element14.com). Do not use components from any other vendor.

- For materials that are not available in the above mentioned catalogues, *e.g.*, materials for casing, use an authentic source and cite its URL.

Product brochure

Prepare a product brochure of the robotic vacuum cleaner designed by you. It should include at the least the following:

- Physical dimensions
- Weight
- Cleaning capacity
- Battery specifications
  - Type
  - Ampere-hour rating
  - Voltage rating
  - C-rate (charging and discharging)
  - Charging time
- Input power
- Run time
- Cost

You can include any other features that you think will make the product attractive to customers.

Deliverables

A concise but comprehensive report that includes

1. Cover page giving project title and the names & matriculation numbers of all members in the team
2. Table of contents
3. The main body of the report
4. Product brochure (specifications)

The main body of the report must include at the least the following:

- Selling point: state clearly how your product is competitive in the market.

- High level design:
  a. Design goals and objectives
  b. Morphological overview of the design concept
  c. Functional block diagram
  d. Brief description on how the system works
  e. List of components required
- Detailed design:
  a. Morphology: 3D sketch showing the shape of the robot and component placement
  b. Component level calculations and the specifications for the chosen components
  c. Bill of materials: for each component include vendor's name, unit price, number of units required, and cost
  1. Schematic drawing of electrical and electronic system
  d. Flowchart or pseudocode of the software
  e. Post-design evaluation: estimate
     (i) The time required for cleaning the specified area
     (ii) The time required to fully charge the batteries
     (iii) Residual energy in the battery after cleaning the specified area (assuming that cleaning started with fully charged battery)
     (iv) The charging time after cleaning the specified area
- Conclusions
- Reference