

MAE94 Project: Solar Powered Minicar: Concept Proposal

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Abstract

The MAE94 Summer 2020 class was tasked with utilizing learned Design Tools to design, prototype, and realize a mechanical device for the design project. This report includes hand sketches of three different design concepts for the MAE94 Design Project, which is defined to be building a solar powered minicar from sketch. The candidate design concept was a regular four-wheel car with rear-wheel drive. Further study of this design will be made during the process of prototyping and realizing.

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1. Introduction

The class of Summer 2020 MAE 94 (Introduction to Computer-Aided Design and Drafting) was tasked with creating a minicar that used a solar panel, a motor, bevel gears, an axle, screws, together with a panel mount to travel on a flat surface based on specified Design Requirements, which will be introduced in the following sections. In addition, in this report, three candidate design concepts are also presented and best one is selected.

2. Design Requirements

The Design Requirements (DRs) consists of the following:

- (1) The device must reach maximum speed within 30 feet of travel on a flat surface.
- (2) Device dimensions are not to exceed $0.20 \times 0.20 \times 0.30 \text{ m}^3$
- (3) The device must utilize a 2''x 2'' solar panel and the DC motor – no other power source or means of transportation can be used.
- (4) Use of the bevel gears is optional – own gears can be designed
- (5) Metal fasteners, such as rods or pins made of metal are allowed, but are limited to a diameter of 1-mm.
- (6) Power transmission components (motor, gears, axles, ...) should be mounted/attached using supplied screws (use as many M2x6 screws as needed).
- (7) All structural components must be either laser-cut from a single 24''x 24'' Acrylic Sheet – 1/8'' thick (3.175mm) or 3D-printed (ABS).
- (8) Structural components may be assembled with or without adhesive (Gorilla Glue).

Every attempt will be made to adhere to these DRs in order to deliver the product as requested by the customer.

3. Design Concepts

We were tasked to develop three different (not variations), but fundamentally different mini-car concepts based on given DRs. The sketches for these three concepts together with some description of the fundamental features of the concepts are presented in the following pages.

Concept-1: Below is the hand-sketch of the first concept. This is a rather simple concept. As can be seen in the sketch, it is a three-wheel car and it is rear-wheel drive. The motor and the gears are placed in the rear and the solar panel and the panel mount is place in the front to balance the weight. Besides the essential parts, other materials are used as fewer as possible to lower the entire weight of the car to reach the speed as soon as possible.

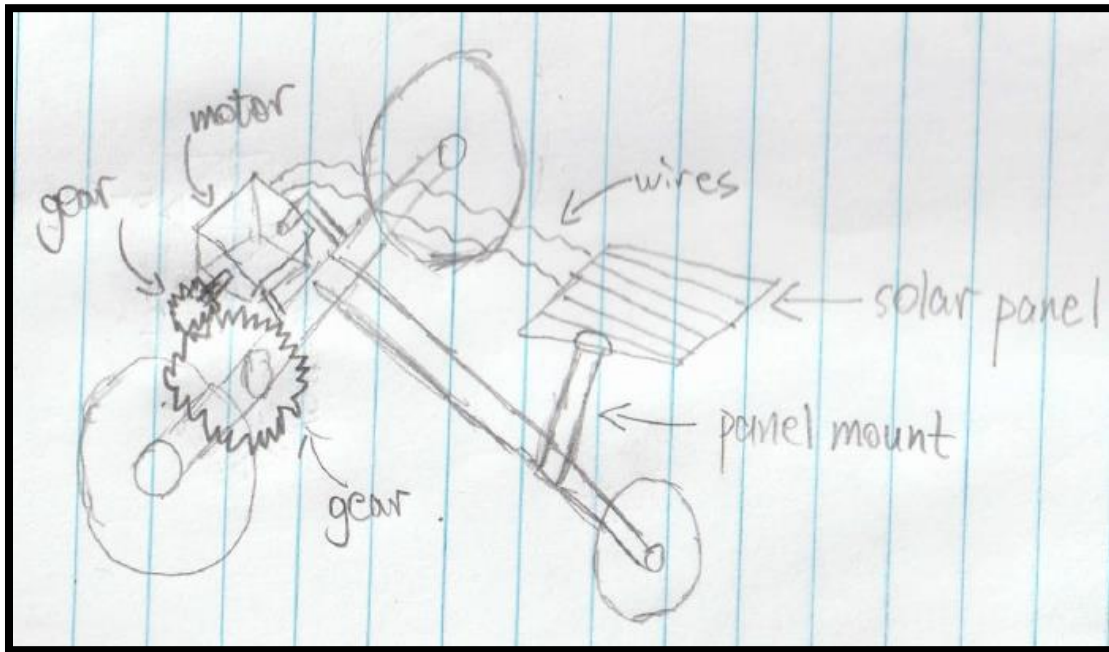


Figure 1: Mini-car concept 1

Concept-2: Below is the hand-sketch of the second concept. In this concept, we can see that it is a four-wheel car with rear-wheel drive. There is a base (chassis) and the motor together with the solar panel are placed on the base with no panel mount used. The use of chassis and fewer links as possible is to make the entire structure stable.

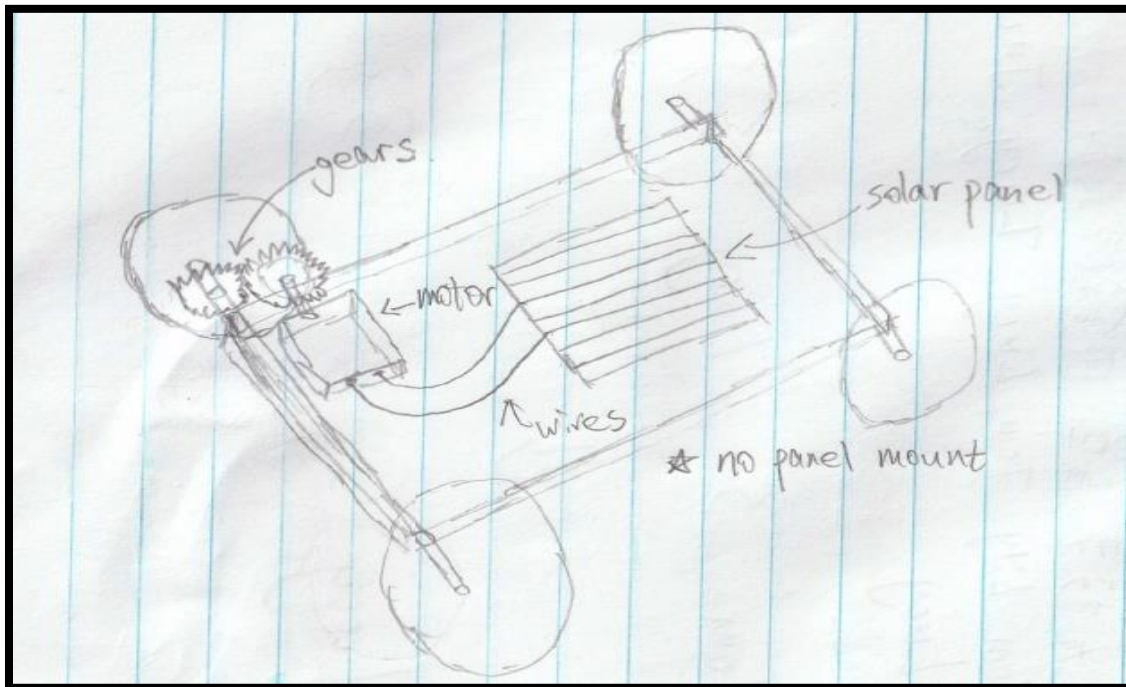


Figure 2: Mini-car concept 2

Concept-3: Below is the hand-sketch of the third concept. We can see that it is a two-wheel car. Two support links are used, one for the motor and one for the solar panel. This design must be the lowest weight, however the issue needs to be solved is the length of each link so that the entire car can be balanced, which can be really hard.

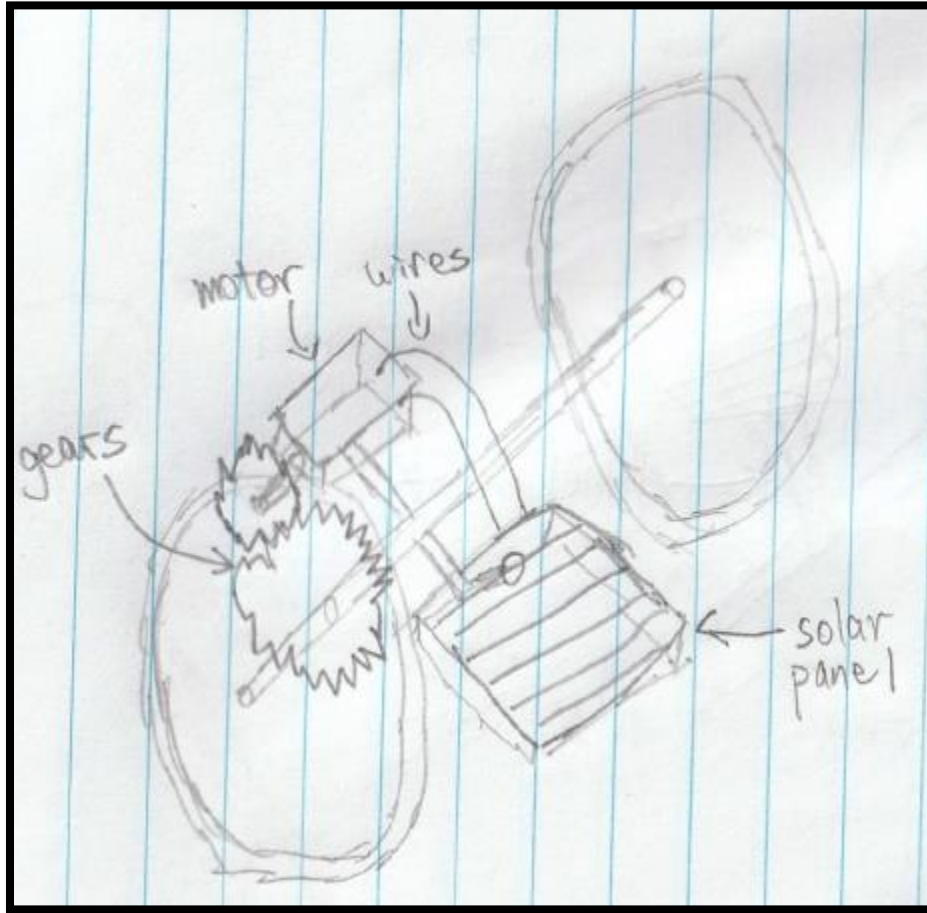


Figure 3: Mini-car concept 3

4. Design Concept Selection

The primary candidate will be the second concept. Compare to the first and third concept, although it uses more materials, it is easier to achieve stability (balance) and it is easier to assemble. Although I think the first one is also a potential candidate, to find the balance may need some extra works. For the third concept, it is the simplest concept, however, as mentioned above, finding the balance can be really hard. Thus, to ensure we will have a deliverable that meets the Design Requirements, the second concept is the best choice.

5. Conclusions

In this concept proposal report, we first introduced the Design Requirements for this project, then three design concepts are presented with some descriptions. Throughout the whole design process, two things are primarily considered, one is the total weight of the car, i.e. use as less material as possible, and one is the stability of the car, i.e. the car need to balance during the run. Thus, given this fact, the second design is chosen to be the primary candidate. More details will be studied in the future during the process of prototyping and realizing.