Eco-Kart

Prototype cart partially assembled
The Team

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Our Purpose and Mission

- **Purpose:** To learn about engineering through designing and building an electric plug-in go-kart. Also to gain experience in marketing and business affairs.
- **Mission:** To design a go-kart that runs on batteries and can be charged in a standard household outlet. We want the go-kart to be cost-efficient and suitable for an average consumer.
Our Sponsors

- **Utica Community Schools**
  - Providing us with metal
  - Place to build
  - Tools and machinery
  - Students helping us build

- **Formula K**
  - Helped determine motor and motor controller set up
  - Large part supplier for electric go kart parts
  - Cost discount

- **BatterySpec.com**
  - Gave us a battery discount
Wanted to create a low-cost, electric, plug-in go kart.
Wanted anyone to have the ability to drive it (fit all body types)
Wanted it to be safe, street worthy, and a product a consumer would want to purchase
We wanted a go kart with a suspension and that could travel about 30 mph
Timeline

- Go-kart kit assembled by end of November
- Design for our kart done by end of December
- Parts ordered for our kart by January 1st
- Go-kart fully functional by mid-March
- Testing completed by April 1st
Team Accomplishments

- Create a nearly complete CAD model of the desired go-kart
- Engineered suspension components as well as overcoming design challenges
- Researched parts, power requirements, steering, suspension, etc.
- A complete battery trade study
- Ordered parts, metal, and supplies to initiate the building of our prototype
Left: An overall view of the frame design, the batteries will be in the rear, the motor mounts on the rear suspension arm.

Below: A close up of the front independent suspension.
Roadblocks

- Remaining within a $5000 budget
- Customization of specific parts
  - Suspension system had to be designed and built
- Transportation/size restraints
  - Must fit through doors and fit inside a bus for transportation
- Chargers that fit our budget, and maximize battery performance and life.
- Time constraints
- Must be easily moved from place to place by hand if necessary
Solutions

- Build the frame from aluminum to reduce weight
- Engineer the frame to be narrow (32 inches wide) to fit through doors
- Look for sponsorship and discounts to remain in budget
- Request information from companies on what charger would be best for our purposes
- Work at a steady pace and stay on schedule to avoid time issues
The battery charger we chose. Each battery is charged individually and charged with a three stage smart charger. It is also waterproof and safe.
Students utilized skills learned in physics class to help predict our requirements for weight, battery type, and motors.

\[ P = \tau \cdot \omega \]
\[ \tau = F \cdot l \]

\[ F = m \cdot a = 318\text{kg} \cdot \frac{894\text{m}}{2} (0 - 30\text{mph in 15s}) = 284.5\text{N} \]

\[ \omega = \frac{30\text{Mi} \cdot 5280\text{ft} \cdot 12\text{in} \cdot 1\text{rotation} \cdot 2\pi\text{rad}}{\text{Hr} \cdot \text{Mi} \cdot \text{ft} \cdot 2\pi \cdot 5.7\text{in}(r) \cdot \text{rotation} \cdot \text{s}} = 92.4\text{rad} \]

\[ \tau = 284.5\text{N} \cdot .145\text{m}(5.7\text{in}_\text{radius tire}) = 41.3\text{Nm} \]

\[ P = 41.3\text{Nm} \cdot \frac{92.4\text{rad}}{\text{s}} = 3816\text{watts} \]

Students learned to interact with companies as prospective buyers.
Program that students learned to utilize
- Autodesk Inventor

Students became more knowledgeable about battery technology, motors, and motor controllers.
- Various types of batteries: lead acid, lithium ion, lithium iron phosphate, nickel cadmium.
- Brushed and brushless motors, and regenerative braking.
- Components of motor vehicles: steering, drive train, suspension systems, safety systems.
Future Plans

- Create a working prototype
  - Build the designed frame
    - Finish engineering the rear axle
    - Cut and weld metal for frame
    - Assemble components
  - Perform tests and evaluate
  - Write an operational manual for the go kart
  - Write a safety manual for the go kart
Marketing

- Approached companies parts were purchased from for discounts and sponsorships.

- Approached BAE Systems for possible presentation of work along with sponsorship, one presentation idea was suggested.

- Plans to contact the new Sterling Heights incubator program for constructive criticism.