Low-Tech Design for Bike Machines
PrachtSmoothie Bike

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Motivation

Our project's scope was to develop a Low-Tech designed smoothie bike focused on community engagement and sustainability.

Community Engagement

- **Community Gardening**: Prachttomate is the name of our partner community garden in Berlin.

Environmental Conservation

- **Recycling:** Repurpose old and/or broken bike parts to create a new smoothie bike.
- **Human Powered Generation**: The ability to produce a mechanical process without the use of electricity.

Figure 1. Prachttomate Smoothie Bike

Introduction

Smoothie Bike (Figure 1): This bike machine uses the bikes mechanical rotational motion to spin a blender.

Project Phases

- **Interview**: Our team met with two members of the Prachttomate Community Garden to discuss their needs and expectations for their smoothie bike.
- **Drive Shaft Development:** The creation of the smoothie platform and driveshaft.
- **Bike and Stand Modifications:** The additional bike modifications, as well as the manufacturing process of the bike stand from recycled bike forks and scrap metal.
- **Delivery and Reception**: The final delivery and reception of the smoothie bike to Prachttomate.

Theory

Before diving into the construction of the smoothie bike; efficiency, emissions, and gear ratios were researched. The efficiency and emissions were also compared to a small electric motor.

- **Efficiency**: Bike efficiency is 15-22% while an electric motor is 20-32% efficient.
- **Emissions:** 18,000 joules of energy produced by a bike creates 0 g of CO_2 while electricity will cost 2.5-3.0 g.
- **Bike Gear Ratio:** Greater than 6:1.
- **Bike Wheel to Friction Drive Ratio:** 223.43 (wheel circumference in cm) to 12.57 (friction drive wheel circumference in cm). This reduces to 17.77:1.
- **Total Gear Ratio:** 106.65:1.
- **Optimal bike rpm:** 60 to 90 rpm.

Interview

On July 27th our team interviewed two members of the Prachttomate Community Garden. During the interview our team of seven was split into different roles: 2 interviewers, 3 scribes, and 3 observers. Our team's questions were focused on finding information about our interviewees experience in the garden and expectations about the smoothie bike.

Community Needs

- **Mobility:** Transportation of the smoothie bike to events in Berlin.
- **Accessibility:** Accessibility for all ages, ranging from kids to adults.
- **Utility:** The ability to carry, keep necessary smoothie ingredients cold, and have a cutting board.

Figure 2. Prachttomate sign

Figure 3. The interview table

Figure 4. Completed smoothie stand and drive shaft

Drive Shaft Development

The drive shaft consists of two parts, the smoothie platform and the mechanical drive.

Smoothie Platform

The smoothie platform is a secure platform that holds the physical blender and the mechanical drive together. This platform is made out of three pieces of hardwood. The main platform has an axil hole with two routed ½ cm deep circles to fit the blender and the bike hub.

Figure 5. Smoothie platform

Mechanical Drive

The mechanical drive is a threaded axil though a recycled bike hub. The threaded rod has a screw welded to the top of it that will engage with the blender. Energy is transferred from the wheel via a friction drive wheel.

Figure 6. Mechanical Drive

Bike and Stand Modifications

The additional bike modifications and improvements to turn it into a smoothie bike.

Bike Modifications

- **Painted** the bike pink and turquoise.
- **Brakes and chain** were fixed and replaced.
- **Front basket and cutting board** were added.

Figure 7. The original bicycle

Figure 8. Finished Smoothie Bike

Building of the Stand

The mobile bicycle stand was created by welding recycled front forks together with other pieces of scrap metal using MAG welding. The stand is permanently attached to the back pegs of the bike and will swing into the proper position.

Figure 9. Andrew grinding metal

Figure 10. Finished bike stand

Community Response

On Friday August 10th we delivered our smoothie bike to the Prachttomate Community Garden in Kreuzberg. We were greeted by two of the gardens members and presented the bike. We demonstrated how to assemble the bike, practice maintenance, and how to make smoothies. The members of the community were extremely pleased with the bike. The garden plans to use the bike for upcoming events, even as soon as the weekend after delivery.

Figure 11. A photo of all our team members and recipients of the bike at the Prachttomate Community Garden

Conclusions

Overall the smoothie bike is a recycled material Low-Tech design that uses bikes mechanics to blend a smoothie. Bikes like these are adding to the community garden culture in Berlin, Germany and empowering students in creativity, design, and workshop skills.

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