

Chapter 13

Bicycle Speedometer Plus

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ABSTRACT

The European Project Semester program at the University of Applied Science Osnabrück deals mainly with engineering projects in different engineering domains. Developing a product based on complex technical requirements and economic concerns, such as cost-sensible development and marketing and environmentally-friendly design, are goals of a successful project during the one-semester internship at Osnabrück for a multicultural project team. In 2018, a team of four students received the task of developing a speedometer for bicycles with a brake light to enhance the rider's safety, especially in an urban environment. Besides the technical challenges, the team developed a marketing plan for the product. To the students, it was an excellent opportunity to understand the benefits and risks of working in a multicultural team and the necessity of following strict project management guidelines to finish a project as a team successfully.

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INTRODUCTION

The Osnabrück University of Applied Sciences (OUAS) offers the European Project Semester (EPS) since 2015. EPS projects address scientific and technical problems related to local laboratories and companies. In this context, technological projects like smart objects are attractive to engineering students, fostering autonomous research and learning.

The objective of this chapter is then twofold: (i) present a smart object developed by a team of EPS students at OUAS; and (ii) illustrate the type of EPS projects conducted at OUAS. In this case study, the team was challenged to develop a smart bicycle speedometer enhanced with a light, data storage and a Bluetooth communication interface.

This chapter has four additional sections dedicated to: project research and requirement analysis; market research of competitors; implementation of the smart speedometer; and conclusion.

PROJECT CHARTER AND REQUIREMENT ANALYSIS

The objective of the project was the development of a speedometer for a bicycle with some enhanced features such as a bike light, and the preparation of a Bluetooth connection with mobile devices so that navigational information could be displayed on the speedometer. The researchers (student team) were tasked with the challenge of integrating the results of a previous project into their conceptual design of the speedometer. The basic requirements given to the team at the beginning of the project are listed in Table 1.

Table 1. Specific requirements of the project

Feature	Explanation
General features	
Subject	To develop a speedometer for a bicycle with some enhanced features
Team	The members of the Speedometer Plus team
Timeframe	Four months
Location	Osnabrück University of Applied Sciences
Specific features	
Energy supply	A hub dynamo delivers the energy for the product. When it stops, an energy buffer must be able to provide energy to display data for 5 minutes without using any kind of battery.
Test bench	A test bench has to be developed, which allows the usage of a hub dynamo during the development phase of the speedometer in the lab.
Electrical characteristics	All required distinguishing characteristics of a hub dynamo, such as voltage over speed, voltage overload, etc., must be measured and documented.
Protection	The speedometer must be protected against overvoltage under every operating condition. The protection circuit shall be a standalone circuit and permanently fixed to the bicycle. As the dynamo provides dynamic voltage, the speedometer should work under every condition, and it should be protected against overloading.
Sensor	The accelerating voltage of the hub dynamo shall be used to determine the speed and acceleration of the bicycle by detecting the frequency. No additional sensors shall be used.
Configuration	The user must (at the least) be able to configure the wheel diameter, the number of pole pairs of the hub dynamo, and the unit of speed (mph or km/h) and distance (miles or km). The configuration of the odometer and trip counters is optional.

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