| | |
|---|---|
| **Project title:** | Design Requirements Gathering using Obsolescence Forecasting |
| **Research team:** | Janis Terpenny, Dazhong Wu, Connor Jennings (Penn State) |
| **Industry collaborators:** | |
| **Thrust area:** | Enabling Information Infrastructure |
| **Current TRL:** | 4 |
| **Final TRL:** | 6 |
| **Project type:** | Proposed |
| **Start date:** | 7/1/16 |
| **Completion date:** | 7/1/17 |
| **Percent complete:** | 0% |
| **Budget:** | $50,000 |
| **IAB funding:** | $0 |

### Industrial Relevance

Decisions made in the design phase impact 60 to 70% of the cost over a product's lifecycle. This makes decision making in the design stage one of the most important factors in reducing costs over a product's production life. Designers and their organizations need accurate information on not only the products, but the design trends in the overall market to make informed decisions and lower cost in the long run.
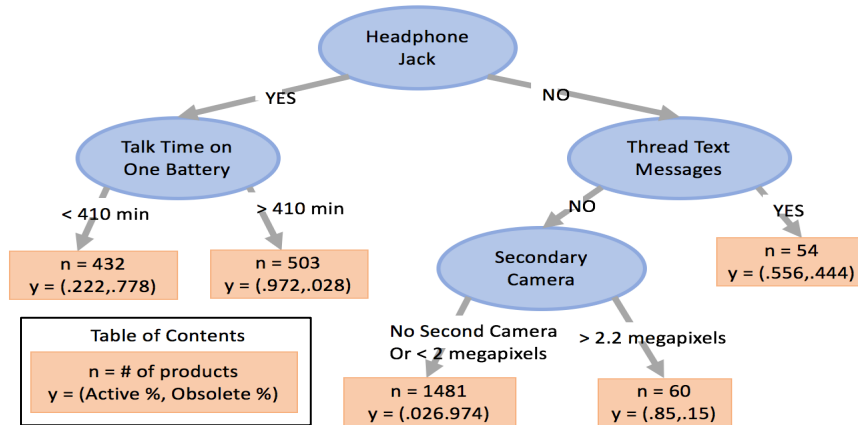
However, organizations with too many stand-alone systems and processes to gather information can become bogged down with maintenance and the value gained from the information becomes less than the cost of maintaining the system. The goal of this research is to use pre-existing obsolescence forecasting systems to extract product feature requirements and trends to aid early stage designers in the decision making process.

### Problem Statement

Since decisions made in the early stages of product design have large cost implications, developing tools and methods for designers to enable more informed decision making can reduce costs throughout a product's lifecycle. The method developed in this project will allow designers to rank the importance of product features and help make decisions about features that will reduce the risk of the new product becoming obsolete.

### Approach and Method

The approach will include using obsolescence forecasting decision trees and observing how higher nodes, which represent features, are more important in determining if a product is obsolete or actively in production. Below is an obsolescence forecasting decision tree for the cellphone market. The highest node is "headphone jack", meaning the best feature to indicate obsolescence in the cellphone market is if the cellphone has a headphone jack.

Decision tree diagram:
- **Headphone Jack**
  - YES → **Talk Time on One Battery**
    - < 410 min → n = 432, y = (.222,.778)
    - > 410 min → n = 503, y = (.972,.028)
  - NO → **Thread Text Messages**
    - NO → **Secondary Camera**
      - No Second Camera Or < 2 megapixels → n = 1481, y = (.026.974)
      - > 2.2 megapixels → n = 60, y = (.85,.15)
    - YES → n = 54, y = (.556,.444)

Table of Contents
n = # of products
y = (Active %, Obsolete %)

Designers must take special care when selecting the specifications of these features with high obsolescence sensitivity. Once a designer knows the feature "a headphone jack" has a high obsolescence sensitivity, the designer must analyze the potential specifications of the feature to select a specification that will minimize the risk of product obsolescence. A tool will be developed to visually display market specifications with-in these features based on historical data.

**Deliverables and Benefits**

This project will create a methodology to rank the importance of product features to prevent product obsolescence over the product's lifecycle using a data driven approach. A visualization tool will be developed to observe historical design trends in the market to help designers select specifications for each feature.

**Potential application areas**

The methods outlined in this project will have large application areas in large complex markets like cellphones and digital cameras because of the intense competition and innovation in these markets. Markets with few products might find this method unnecessary because a human being can find market trends in small markets.

**Project Plan and progress**

- Review current literature and experimental findings on design requirement gathering (1 mo.)
- Develop preliminary case study in the commercial electronic industry (3 mo.)
- Conduct a market analysis to understand the trends of each design features. (3 mo.)
- Develop a second case study in the commercial electronic industry (3 mo.)

|  | July | Aug | Sept | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Review Literature | ▓ |  |  |  |  |  |  |  |  |  |  |  |
| Develop  Preliminary Case Study |  | ▓ | ▓ | ▓ |  |  |  |  |  |  |  |  |
| Conduct Market Analysis |  |  |  |  | ▓ | ▓ | ▓ |  |  |  |  |  |
| Develop Second Case Study |  |  |  |  |  |  |  | ▓ | ▓ | ▓ |  |  |
| Document and Present Recommendations |  |  |  |  |  |  |  |  |  |  | ▓ | ▓ |

- Document and present results and recommendations (2 mo.)

**How Ours is Different**

Our method uses a data driven approach to observe feature trends in a market and distills the information for decision making in the design stage. Additionally, the method proposed in this research will not be a stand-alone system but rather extract information from preexisting obsolescence forecasting systems.