BRUSH

Bristle Recognition Unit for Sorting and Handling

EIH ENGINEERING INNOVATION IN HEALTH

PHILIPS

THE NEED

- Philips' inspection methods fail to identify **brush head bristle length defects** that fall outside the **±1.5mm tolerance** of the designed specification.
- Defective brush heads are discovered using **manual inspection after the final assembly**, leading to a **more material per defective product.**
- **Stakeholders:** Philips Quality Assurance, Manufacturing Engineers, management teams, and Consumers.
- Since Philips Sonicare began, over **50 million brush heads** have been sold to customers.

NEED STATEMENT

A way to address the current shortcomings of the long bristle detection process in toothbrushes for Philips' Quality Assurance and Manufacturing teams so that product waste is reduced and consistent quality is ensured.

CORE FUNCTIONS

1. Detect defects from **Philips toothbrush** accurately
2. Detect long-bristle defects **more efficiently** than current methods
3. Integrate with **adaptability to current system**

Existing Solutions

Current Solutions / Core Functions	Manual Inspection	CMM: Coordinate Measuring Machine	Flat Contrast-Based Visual Inspection
Accurately detect long-bristle defects	✗	✓	✗
Maintain efficient inspection rate	✓	✗	✓
Integrate with adaptability to current process	✓	✗	✓

Figure 1: Comparing Existing Solutions

THE MARKET

- Electric toothbrushes are a very competitive and **growing market**
- **$1.17 billion** market in North America
- In order to stay competitive **brand image is integral**

DESIGN

- Conveyer belt setup equipped with **trucks to hold** and **ramps to line up brush heads**
- **Keyence LJ-S8000 series** 3D laser profiler and software
- Developed **detection software**
- **Pneumatic system** to rid defective product

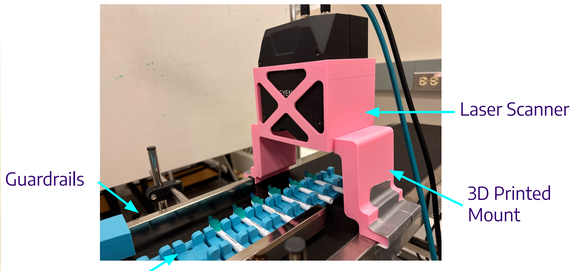

Figure 2: Belt Setup

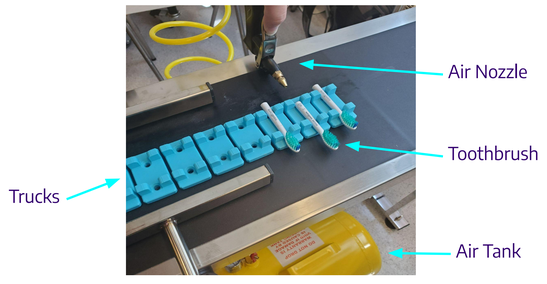

Figure 3: Pneumatic System

BIGGEST TECHNICAL CHALLENGES

- Setting up laser camera within **moving conveyor context**
- Converting camera data to **usable form**
- **Training program** with good dataset and minimizing noise

TESTING

- Data is **collected from the camera** and uploaded to the computer, then **cleaned and processed**
- Pass-fail criteria based on **comparing scanned brush with set bristle ranges**
- Program sends a signal to **downstream mechanical separator**

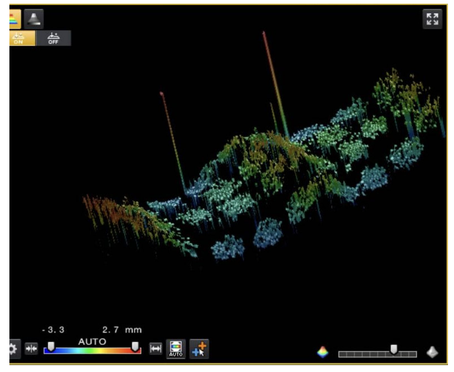

Figure 4: LJ-X8080 Brush Head Scan

FUTURE WORK

- **Philips** will forward our materials and collected data to **Team Tech and Zahoransky (Philips' manufacturers)**
- System will be implemented at **Philips manufacturing** sites

Acknowledgements

EIH Instruction Team: Per Reinhall, Shawn Swanson, and Michael Malone

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