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Barber National Institute Project: Kit Assembly Machine for Mentally Handicapped Employees

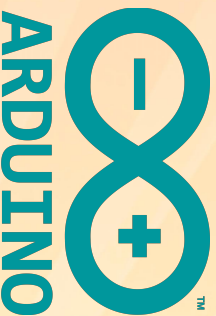
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Introduction

In the past five semesters, the SEECs class of 2015 engineering students worked cooperatively with the Barber National Institute, a local organization, to develop a machine to help mentally handicapped workers assemble bags of parts quickly and accurately. The bags of parts resemble those found in consumer furniture: clear plastic bags with 10 to 20 nuts and bolts used for assembly of the furniture. The workers must assemble part kits with the correct quantity of each part, which is a repetitive and accuracy intensive process.

During the design process, the team took into account ease of use and safety of users. The project was truly interdisciplinary: each team member's skills were utilized in the process. All team members were useful in basic assembly and construction. The Barber National Institute project completed by the SEECs class of 2015 is an ideal example of how multiple disciplines can collaborate to solve a community-centered problem.



Design and Build Process

After visiting the workers and their supervisors and viewing the process that was then in use, the team spent two semesters on design. The design consists of the following major components:

- Arduino (computer) - programmed to light signal LEDs
- Signal Lights (LEDs) - tells the mentally handicapped workers which part to put in the bag, until a kit is completed
- Funnel w/ Switch - controls part flow & indicates part retrieval
- Cart w/ Bin Shelving - provides mobility & bin organization

Blueprint layouts of the assembly were created by the Mechanical Engineers while the Electrical Engineers programmed & wired the electronics. Upon final assembly, all members participated in the overall build of the device.



Supervisor programs device using PC, uploads program to Arduino



Program commences by powering on the device



Button is pressed to restart

Part is placed through the flap



LED signals which part to grab



Final Product and Implementation

The final design contains an Arduino microcontroller which controls the LED signal sequence. The handicapped employee selects parts from the proper bin corresponding to the current LED signal and places them through the flap. The flap triggers a switch which continues the LED sequence. Once the kit is complete, the LEDs flash on and off until the reset button is pressed. After it is pressed, the sequence may begin again.

After testing was completed, the project was deployed on February 14, 2014 to the Barber National Institute in Erie, PA. The device operation was demonstrated to the Barber National Institute supervisors. The team is currently awaiting the report of the device use in employee trial runs.

Acknowledgement

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Stakeholders and Design Requirements

The following stakeholders were identified early in the design process:

1. Barber National Institute (Administration & Staff)
2. Mentally Handicapped Employees
3. SEECs Class of 2015

The design requirements for the device were determined by the needs of each stakeholder. Essential overall needs were:

Safety Simplicity Cost Effectiveness Improved Productivity

With these requirements, the team took great care to devise a solution that would be easy for the mentally handicapped workers to use safely and for their supervisors to oversee. Simplicity and productivity were implemented on the idea that individual part selection should be clear & direct with the user. Cost effectiveness was determined through material analysis.

