

Ryan Alberti, Brandon Joel, Terrence Meekins, Benjamin Stoll, Carly Tronolone, Nicholas Piotrowski  
 Dr. Kevin W Lu  
 EE/CPE 322-A: Engineering Design VI  
 25 March 2023

I pledge my Honor that I have abided by the Stevens Honor System.

### Synthesizing Success

Revisit the design goals in Assignment 4 (Solution Development) and develop a morphological chart to combine ideas for achieving desired goals or functions of the proposed design

Desired Goals / Functions	The Circuit X-Ray Partial concepts and means to achieve this goal		
Calibration	Buttons on the side of machine	Press & hold the associated button for 2 seconds twice	Calibration Knobs
Stability	Weighted floor	Space in the bottom for equipment.	Only the head moves up and down on fixed axis at fixed increments
Adjustable head	Clicks into one of a set of equidistant intervals.	Each interval has a corresponding button to flash a light to take a picture using the camera.	Telescopic poles to adjust height
High Sensitivity	Only one mode is engaged at a time so that there is no interference. Evaluation board is far beneath the measured device beneath the insulative display tray to minimize interference.	Data is measured semi continuously to create a more accurate view of what is wrong. Logs are exported to an SD card for later analysis.	Able to be calibrated when necessary.
Longevity / Modular	Each set of sensors on their own board that clicks into the head.	Easy access to the cabinet to replace individual MUX boards to debug.	Uses prepackaged designs that have already been tested and have existing support portals

Cost Effective	Prepacked, stationary designs that do not require much maintenance	Minimalistic design without unnecessary components	
Safety	Weighted bottom	Latch that closes door	
User Friendly	Few human input options, all are clearly labeled.	Logs output for later analysis.	
Two 'displays' saturation and direction	Hall Effect sensor matrix	Prebuild magnetic field direction matrix	

### 1. Idea Chart 1

- a. The required design shall have the buttons each do a designated task lining up with the desire to have a menu to show different features of our product and allowing it to be calibrated easily.
- b. The design shall have an adjustable head that moves in increments to allow the circuits placed underneath to be under maximum resolution possible.
- c. When the head hits a specific interval, the head shall automatically take a picture of the circuit and focus.
- d. The buttons allow the product to be calibrated at any time.
- e. Prepackaged designs allow our product to be easier to produce and ship to our consumers.
- f. The prepacked stationary designs also afford ease of use in terms of maintenance. An increase in ready made parts allows the servicer to replace pieces easier.
- g. Having both a weighted bottom and limited human inputs, increases safety and reduces the amount of human error in this machine.
- h. Lastly the prebuilt magnetic field direction matrix helps with ease of use for the consumer. It shall allow easier replacement of the part and ease of mind for the servicer.

Desired Goals / Functions	The Circuit X-Ray Partial concepts and means to achieve this goal		
Calibration	Buttons on the side of machine	Press & hold the associated button for 2 seconds twice	Calibration Knobs
Stability	Weighted floor	Space in the bottom for equipment.	Only the head moves up and down on fixed axis at fixed increments
Adjustable head	Clicks into one of a set of equidistant intervals.	Each interval has a corresponding button to flash a light to take a picture using the camera.	Telescopic poles to adjust height
High Sensitivity	Only one mode is engaged at a time so that there is no interference. Evaluation board is far beneath the measured device beneath the insulative display tray to minimize interference.	Data is measured semi continuously to create a more accurate view of what is wrong. Logs are exported to an SD card for later analysis.	Able to be calibrated when necessary.
Longevity / Modular	Each set of sensors on their own board that clicks into the head.	Easy access to the cabinet to replace individual MUX boards to debug.	Uses prepackaged designs that have already been tested and have existing support portals
Cost Effective	Prepacked, stationary designs that do not require much maintenance	Minimalistic design without unnecessary components	
Safety	Weighted bottom	Latch that closes door	
User Friendly	Few human input options, all are clearly labeled.	Logs output for later analysis.	
Two 'displays' saturation and direction	Hall Effect sensor matrix	Prebuild magnetic field direction matrix	

## 2. Morphological Chart 2

- a. Physical calibration knobs - a mechanical option - shall minimize points of failure
- b. Minimizing moving parts and only allowing the head to move up and down shall prevent hazards - such as tipping hazards if the Circuit X-Ray had horizontally moving parts
- c. The head shall have set adjustable intervals with separate buttons for each interval so that camera focus is incorporated into the design rather than being a user concern
- d. Sensitivity of device shall be ensured through mitigating as much interference as possible
- e. Modularity shall be ensured through using prepackaged designs that have been tried and tested. If a single component fails, the user shall have the ability to replace the singular component and have support portals to troubleshoot the failing component.
- f. Choosing designs that require less maintenance makes the product accessible to more people, reduces downtime, and reduces maintenance costs.
- g. A weighted bottom shall counteract the weight of the sensors, camera, and other components on the top of the product. This shall ensure user safety by reducing tipping hazards.
- h. Fewer human inputs and all inputs being clearly labeled shall translate into less training required to use the product. This design choice shall make the product more straightforward to use, and thusly more user friendly
- i. Both displays - the Hall Effect sensor matrix and the Magnetic Field direction matrix - shall be included for more extensive analysis to be possible
- j. Overall
  - i. Multiple partial concepts in singular desired goals categories shall be combined together - such as safety latches and a weighted bottom and log outputs being combined with fewer human inputs - though this morphological chart flows into the main focus points of the design concept.

### Program Outcome 2: (Design)

2.5 (Technical design) Students will be able to develop the design for a project using a hierarchical approach (top-down) and to apply successive refinement to their design, incorporating new information and insights into your design while adjusting the overall design for necessary changes.