ENGINERING DESIGN PROJECT

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RICE EMERGING SCHOLARS PROGRAM

- An academic bridge program tailored for incoming first-year STEM students at Rice
- Offers a six-week summer experience with rigorous coursework and insightful projects
- Website: https://success.rice.edu/rice-emerging-scholars-program-0

BACKGROUND

In rural Mexico, the farmers there continue to use ancient Aztec agricultural methods.

CURRENT METHOD

After preparing the bed, farmers lean over and press pockets with their thumbs to plant seeds

PROBLEM

The process takes time and causes back pain for the farmers

PROJECT GOAL

Produce a simplistic device that will optimize the process of imprinting uniform pockets **while respecting established agricultural traditions** and operating without a power source.

THE FOLLOWING IS THE PROCESS TAKEN FROM BEGINNING TO END

DESIGN CRITERIA

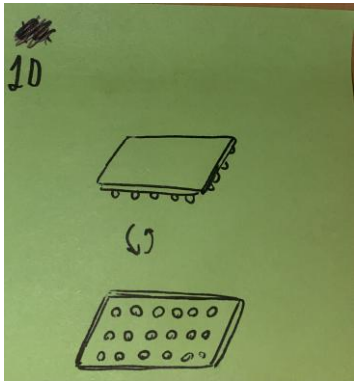
DESIGN CRITERIA	REQUIRED VALUE	JUSTIFICATION
Longevity - Objective	≥ 5 years	Must withstand consistent use.
Manufacturability - Objective	≤ 2 hours	Should be constructed within a reasonable time frame.
Affordability - Objective	≤ 10 USD	Must be financially feasible for the client.
Consistency - Objective	1.5 in spacing between holes, 0.5 in - 1.5 in depth	Lodo beds are organized into arrays with uniform spacing.
Efficiency - Objective	Complete 2 m x 12 m bed ≤ 30 mins	Needs to produce holes faster than traditional thumbs.
Cultural Respectability - Constraint	Expert Opinion - Does the device fit the cultural identity of the Chinampas agricultural method?	Must be respectful and maintain the cultural values of the community.
Bodily Stress - Objective	User-Defined Scale ≥ 3.5	Must reduce back pain.

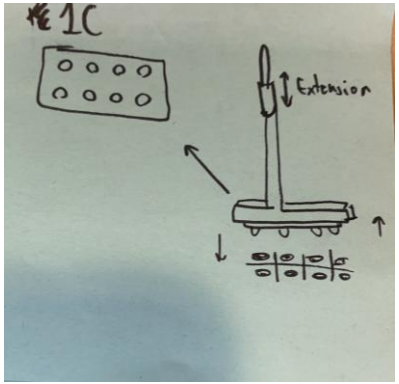
USER-DEFINED SCALE

Value	Definition
5	I would feel much more comfortable using the tool and would experience no pain with frequent usage.
4	I would feel more comfortable using the tool but might experience some discomfort with frequent usage.
3	I would rather use the tool but would experience pain with frequent usage.
2	I would likely feel pain while using the tool.
1	I would feel just as much pain as manually imprinting each hole into the “lodo” for long periods of time.

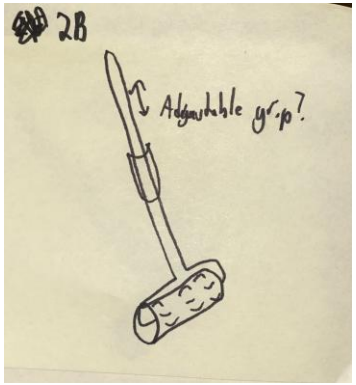
BRAINSTORMED IDEAS

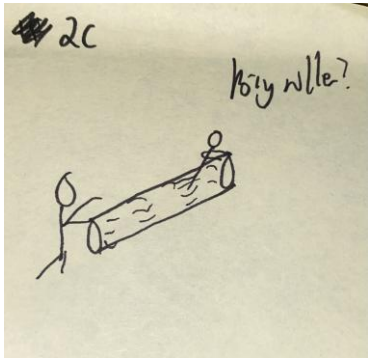
DEVICE WITH PRESS



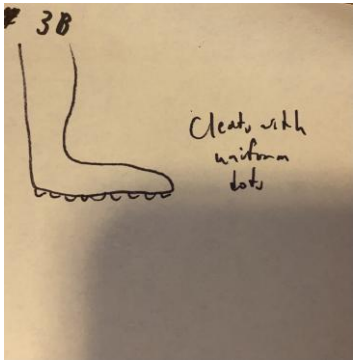


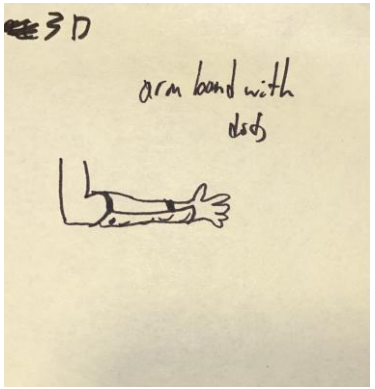
DEVICE WITH ROLLER





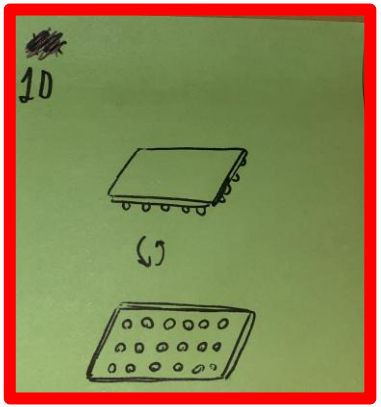
ATTACHABLE DEVICE

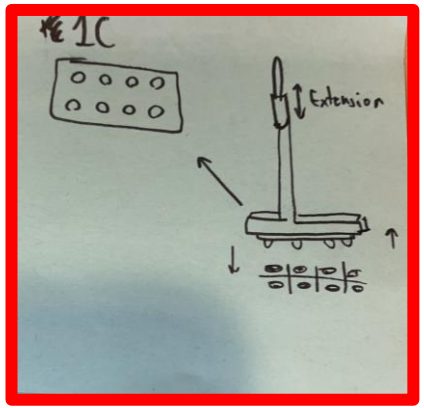




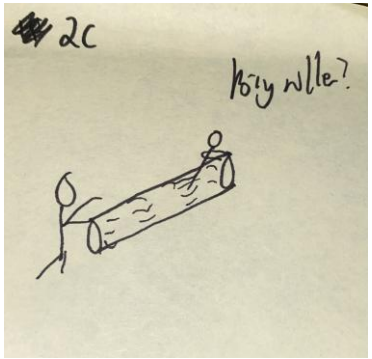
PROJECT DESIGN CANDIDATES

DEVICE WITH PRESS





DEVICE WITH ROLLER



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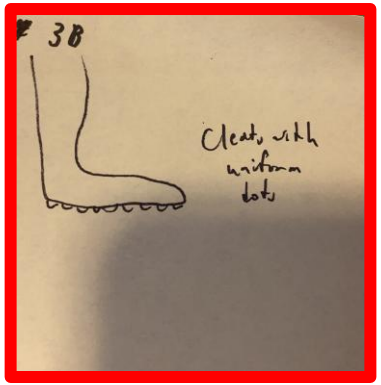
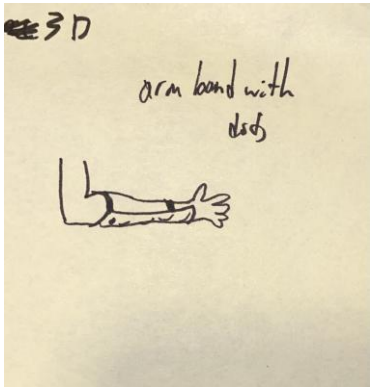


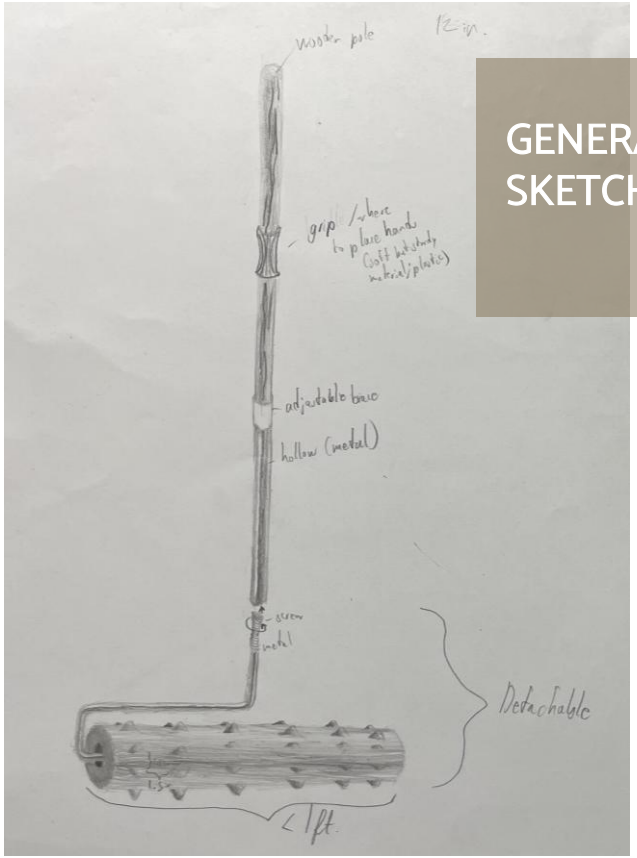


PUGH SCREENING MATRIX

Design Criteria	Press with Extension (Standard) (1C)	Large Stamp (1D)	Roller with Extension (2B)	Boot with Protrusions (3B)
Durability				
Manufacturability				
Affordability				
Consistency				
Efficiency				
Sum				
Rank				

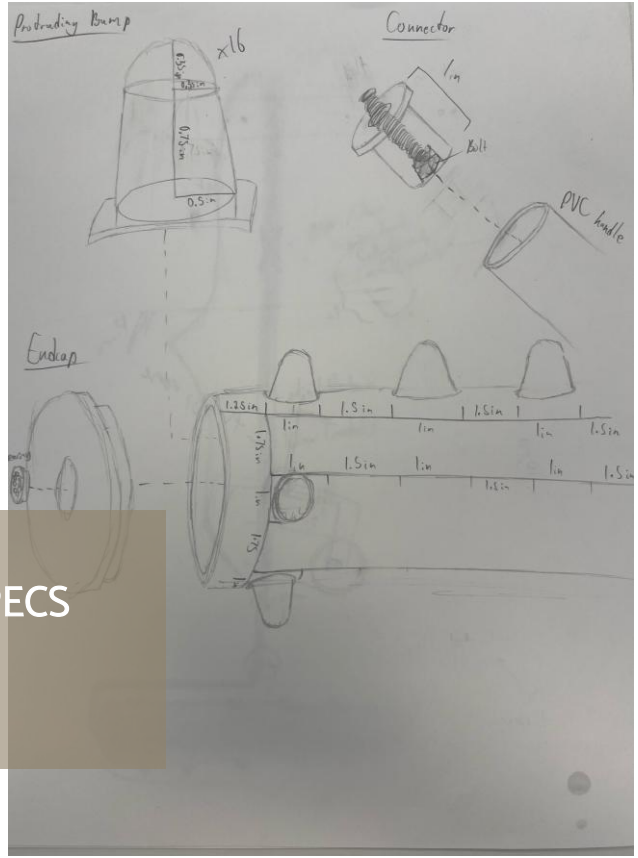
FINAL PROJECT DESIGN

Design Criteria	Press with Extension (Standard) (1C)	Large Stamp (1D)	Roller with Extension (2B)	Boot with Protrusions (3B)
Durability	0	(-)	0	(-)
Manufacturability	0	(-)	0	(+)
Affordability	0	(-)	(+)	(-)
Consistency	0	(+)	(-)	(-)
Efficiency	0	(+)	(+)	(-)
Sum	0	-1	1	-3
Rank	**2**	**3**	**1**	**4**



GENERAL SKETCH

SPECS



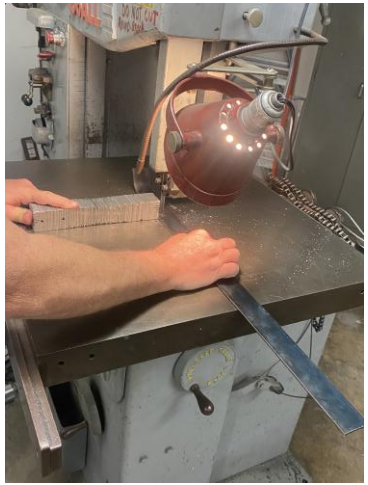
LOW-FIDELITY PROTOTYPES

TRISTEN

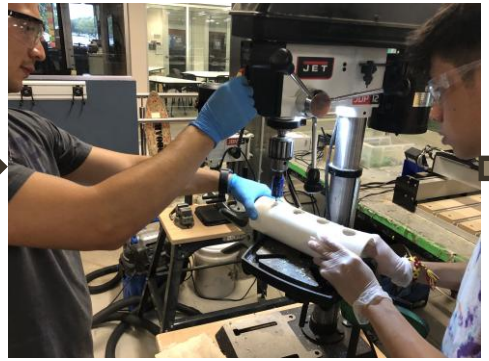
DAVID

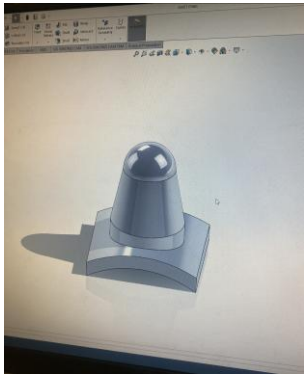
BRYAN

HANDLE



ROLLING COMPONENT





FINAL PRODUCT

01

LONG HANDLE

This is to reduce the need to lean down, minimizing back pain

02

ROLLING COMPONENT

This will be attached to the handle of the device.

03

PROTRUDING BUMPS

These will be along the curved surface and act as thumbs.

TESTING ON SAND

RESULTS

SUCCESSES

Constructed a device operates without a power source and thus respects traditions

LIMITATIONS

3D printers are not readily available for the Xochimilco farmers

Device is simple enough for quick fabrication without needing special tools

Due to time contraints, the device is not fully tested for functionality

FUTURE WORK

1. Run multiple tests on the device to see if it meets the design criteria

2. Improve measurements of the rolling component and bumps to make consistent pockets

3. Use materials that are more accessible to the farmers (no 3D printing)

ACKNOWLEDGMENTS

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RICE | OEDK
Oshman Engineering Design Kitchen