E2.04: NASA Lunar Concrete Mixer

TEXAS STATE
INGRAM SCHOOL OF ENGINEERING

Executive Summary

Lunar Concrete Mixer engineered for the Designed for **geopolymer concrete 'moon brick' production** using **lunar regolith simulant**.

Our **electrical team** has **redesigned the Arduino-based control system** to improve integration with **sensors, switches, and motors.**

Operator Flow Code

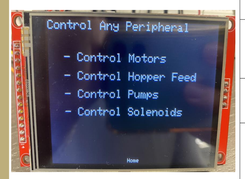
Subsystem Purpose

Processes user inputs into automated sequences, executing tasks in the defined order for efficient system control.

- **User Interface**
  - Reads in operator inputs such as operation sequence, runtime specifications, and motor/activator RPM settings.
- **Operation Sequencing**
  - Manages processes to ensure efficient operation within predefined tolerances by organizing tasks in a logical order.
- **Data Logging**
  - Records sensor data and operational actions every second to an SD card for monitoring and analysis.

User Interface

The touch screen User Interface gives users an easy way to **control and monitor peripherals** on the lunar mixer.
Allows users to test various **"recipes"** by adjusting **cure times, mixing speeds, and material quantities** such as water and activator.



USER SATISFACTION TEST RESULTS:

Tester Name	Tester Comments	Satisfied?	Pass/Fail
Luke Scarpato	"Works well and is responsive"	yes	PASS
Nadia Al-Shewear	"fun screen that covers use of all the peripherals on the machine"	yes	PASS
Jamal Close	"this is cool, easy to understand with minimal instruction"	yes	PASS
Vikas Somayajula	"to the point UI. Hit boxes could be larger for some of the smaller selections"	yes	PASS
Renee Aguliar	"easy to use and stylus is a good addition"	yes	PASS

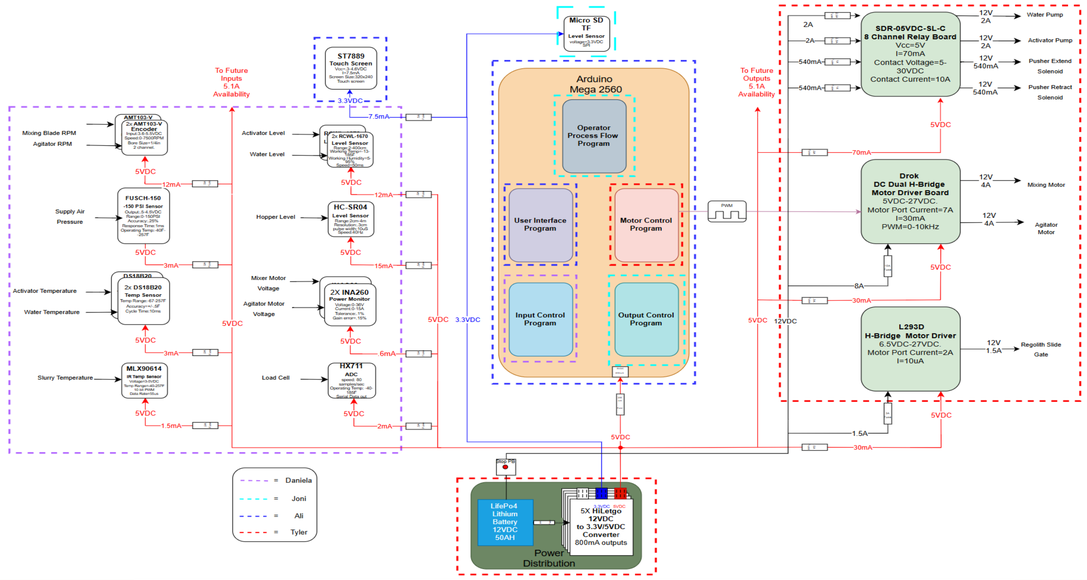
Budget

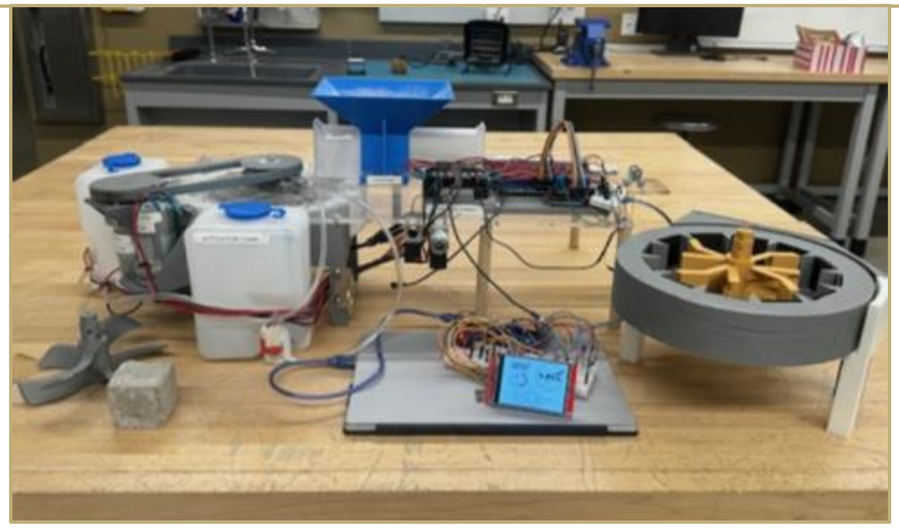
Bill of Materials

Component	Quantity	Price Each	Subtotal Cost
Mix and Agitator Motors	2	$40	$80
Input Sensors	10	$3-$10	$45
Outputs	3	$5-$15	$20
Power Supply Components	6	$3-$93	$251
Other Hardware	2	$15	$30
		Total Unit Cost	$426

Original Unit Cost Requirement: $500.00/unit

Main Block Diagram

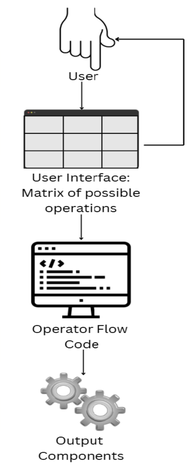




Lunar Concrete Mixer at the Start of Senior Design I

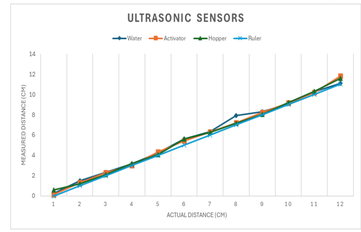
Steps for Automated Control:

- **Step 1** • The user sets up the operation sequence through the interface, specifying hopper feed, pump runtime, and motor RPM.
- **Step 2** • The user can press **Back** to modify steps or **Clear** to reset the process.
- **Step 3** • The **Operator Flow Code** executes the steps in the specified order.
- **Step 4** • Sensor data and operations are logged every second to an SD card once the process starts.
- **Step 5** • The user can press **Stop** anytime to halt the process.
- **Step 6** • The process stops automatically after all steps are completed, and logged data is available for review.



Left to Right: Joni McCawley, Daniela Salazar, Tyler Nuckols, Ali Kobeissi

Material Monitoring

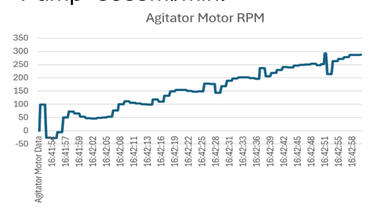


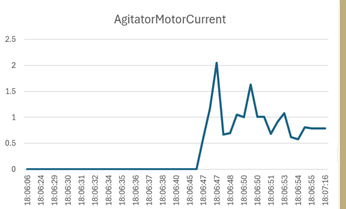
Deviation Sensor Chart (30 Trials)			
Sensor	**Desired Measurement**	**Average Measurement**	**Result**
Ultrasonics	10 cm	10.25 cm	PASS
Pressure Sensor	50 PSI	49.78 PSI	PASS
Temperature Probes	64 F	64.51 F	PASS

Motor Control

Subsystem Purpose:

- Regulates speed of the mixer and agitator motors at a current less than the FLA of 4 amps.
- Enables a flow of water an activator pumps at a flow rate >793ml/min. Water Pump=1395ml/min, Activator Pump=3835ml/min.





Power Management

Subsystem Purpose:

- The purpose of this subsystem is to adequately power the devices used to monitor and provide functionality to the mixer, as well as provide safety integration to the equipment.

Capabilities:

•Capable of 5 hours and 20 minutes of runtime, with a 4-hour 11-minute charge time.
•Provides overcurrent protection for mixer devices at 500mA per device.