

1 What is tile?

"A modular, programmable, smart tile.

It can of **sense pressure**, **emit controllable light**, and **communicate with neighboring tiles** and **remote devices**."

Open Platform

Similar to Arduino, extensible and generalized.

Designed for any environment

Commercial, industrial, and private use.

2 Mechanical

Material Choices

Our main structural components include a **polycarbonate cover piece**, and **structural blocks made of resin**, which transfer load to **strain gauges embedded in the tile base**.

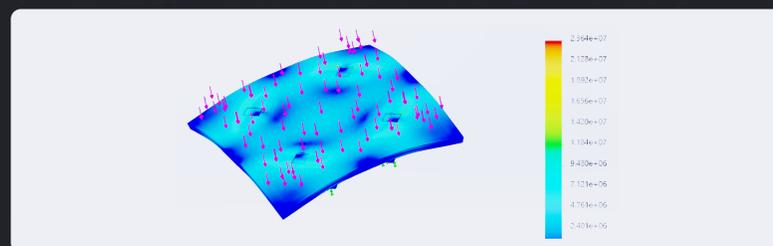
Additional components include **strain gauge seats made of resin** and the **tile base made of PLA**.

In a mass-produced product, potential materials may include injection molded plastic for the tile base, and aluminum for the structural blocks

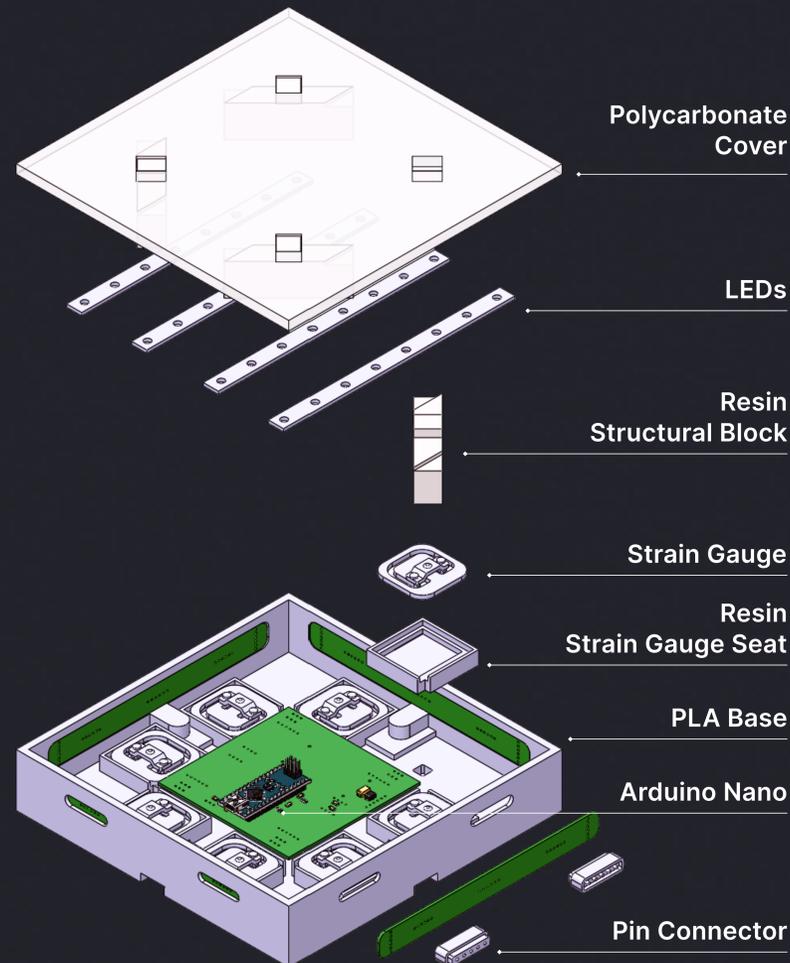
Structural Performance

When a pressure of **77 kPa** (243 kg) is applied to the full area tile cover, a minimum **safety factor of 1.7** is observed, with a **maximum edge deflection of 1.42 mm**.

The pressure applied corresponds to a 120 kg weight applied over an area equal to a US Women's Size 5 foot.



The Programmable Smart Tile



3 Electrical

Load Sensing

Each tile uses **8 center-tap strain gauges** to sense the magnitude and position of load on the tile surface.

Each load cell has a **sensing range of up to 50kg**, with the two cells in each corner forming a **4-element wheatstone bridge**.

Control & Communication

At the heart of each tile is an **Arduino Nano**, communicating with the central **ESP32 microcontroller over I2C**.

Upon connection, tiles **automatically determine their location and orientation** within the network and report it to the central controller

4 Software

Web Application

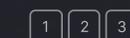
The **React + Typescript Frontend** has 3 modes of operation.

1. **Data Mode** — For viewing and reception of data.
2. **Draw Mode** — To draw patterns on the detected tile grid
3. **Program Mode** — For simple programming logic

WebSocket Communication

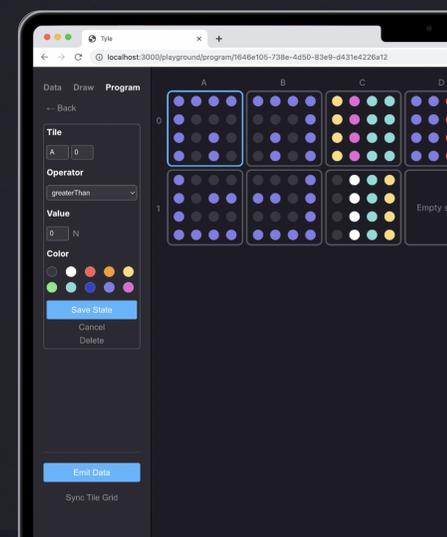
The web application communicates with the ESP32 via a **NodeJS WebSocket server**, which also serves to encode and decode messages between these two clients.

ACTUAL SHAPE

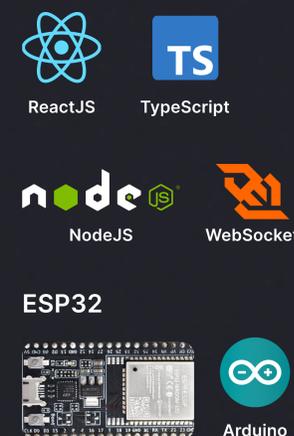


m03000031200 -> decodeTileShape() -> [1][2][3]

Web Application



Software Stack



5 Applications

Aside from drawing simple patterns and programming using simple states, the Data mode exposes its stream of data, allowing an infinite number of applications. Some ideas:

- Floor Piano Keys
- Data Collection on Consumer Pathways
- Responsive Floor Lighting
- Interactive Art Installations
- Foot Traffic Data Viz
- Dance Dance Revolution
- ... etc!



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