Trio Security - SmartSafe

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Introduction: Smart Safe: Overview and Implementation

Overview:
- Create a smart, personal safe with multi-factor authentication
- Detect tampering of safe with notification through text

Implementation:
- Auth 1: Enter user's passcode on keypad
- Auth 2: Scan user's fingerprint to verify identity
- Auth 3: Generate random code, text code to user, and enter code on keypad

Purpose

- Provide additional functionality that most safes do not provide
  - Multiple authentication steps
  - Updates and warnings via text
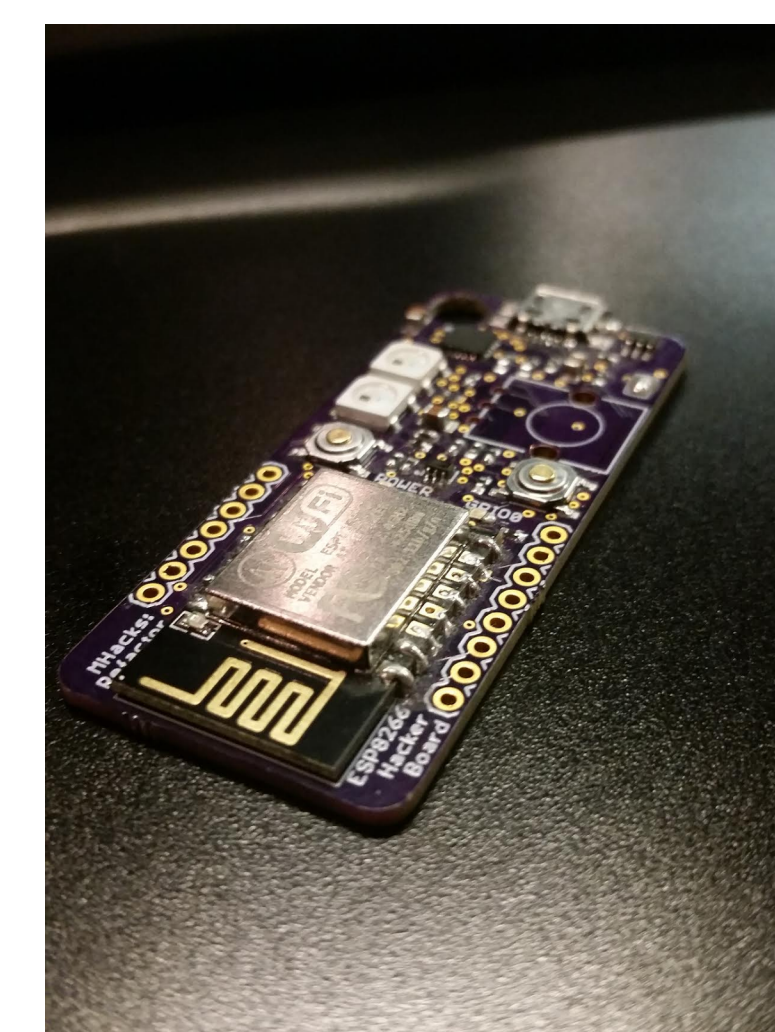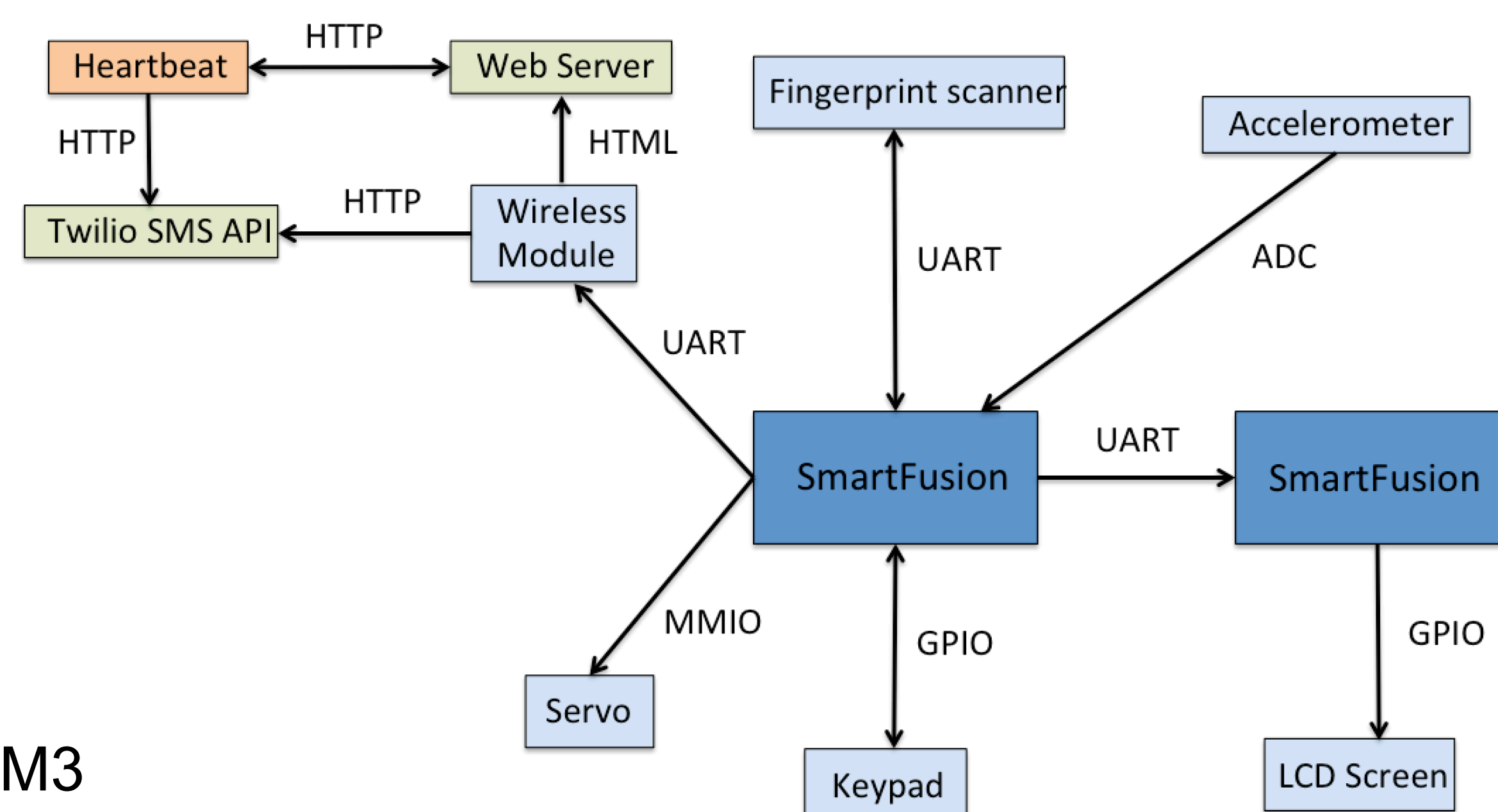- Give users peace of mind by providing information about the state of their safe

System Components

SmartFusion Evaluation Kit
- Consists of an ARM Cortex-M3 processor and an FPGA
- Is responsible for creating hardware and running software to communicate with the other system components

Accelerometer
- Sends safe orientation info to the Smartfusion, which sends a text message if it is being moved

GT-511C1R Fingerprint Scanner
- Is programmed with valid fingerprints to compare against
- Detects when a finger is pressed
- Compares the pressed finger to the set of valid fingerprints
- Transmits packet to either verify or refute fingerprint scan

ESP8266 Wi-Fi Module
- Receives instructions from the ARM Cortex-M3 to send text messages to the user
- Uses a Twilio API to send the text messages over the internet
- Hosts a local web server which saves and displays the time of recent opens
- Is pinged by a heartbeat python script, which sends a text when the module goes offline (due to power loss or Wi-Fi disconnection)

Safe Frame
- Is a wooden box hand-carved to perfection
- Uses a servo to unlock to the safe for five seconds after authentication

LCD Screen
- Displays instructions and messages to the user based on GPIO communication

Keypad
- Is used to enter:
  - User's passcode for Auth 1
  - Randomly generated code for Auth 3
- Has each column sampled every 25 ms to detect user input
- Uses software to de-bounce button presses and filter input noise