

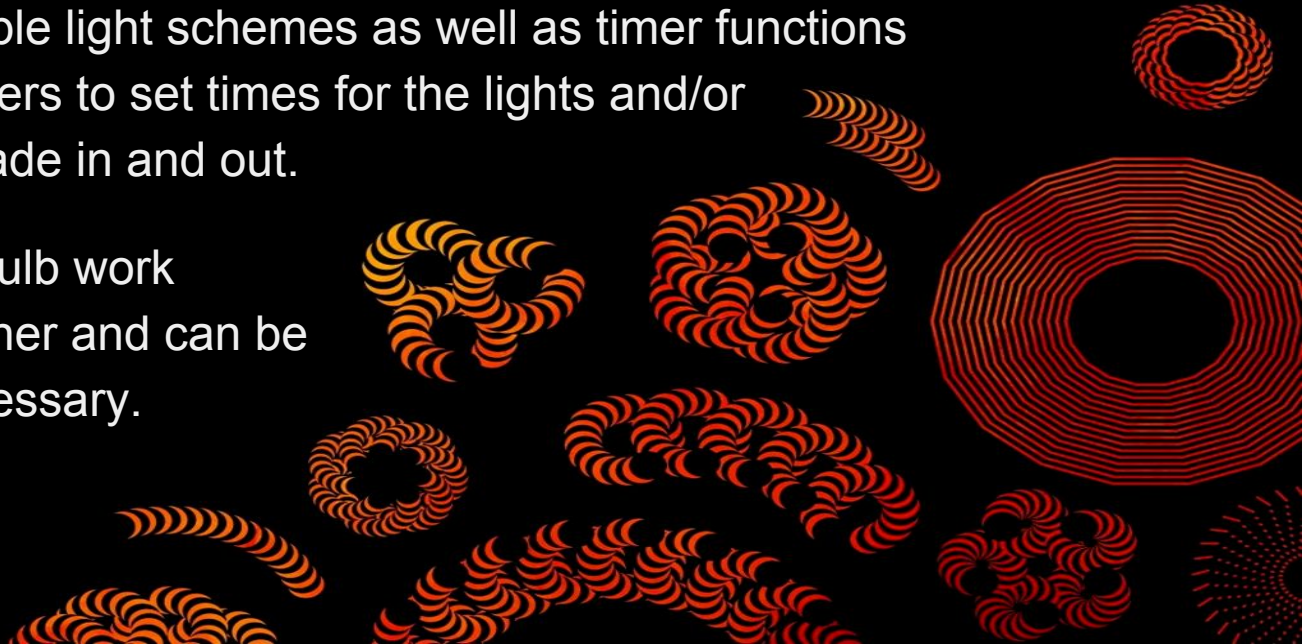
Critical Design Review



Nicolas Soberanes, Eric Jin, Randall Picchini,
Jose Maun, Zaira Tomayeva

Project Description

- A light bulb speaker that screws directly into a 6-inch recessed light fixture and is connected to WiFi for audio control and Bluetooth for lighting control.
- BULB comes with multiple light schemes as well as timer functions (alarm/sleep) allowing users to set times for the lights and/or music to turn on, off, or fade in and out.
- The speaker and light bulb work independently of each other and can be used one at a time if necessary.



Application

For music enthusiasts looking for a discreet way to enjoy both a musical and lighting experience.

For owners of SONOS devices that wish to expand their home audio system.

For homeowners that wish to employ the Internet of Things in various rooms of their homes, including the bathroom.



Subsystem Responsibilities

Nicolas Soberanes (Fearless Leader) - Lead on PCB layout, Firmware Support

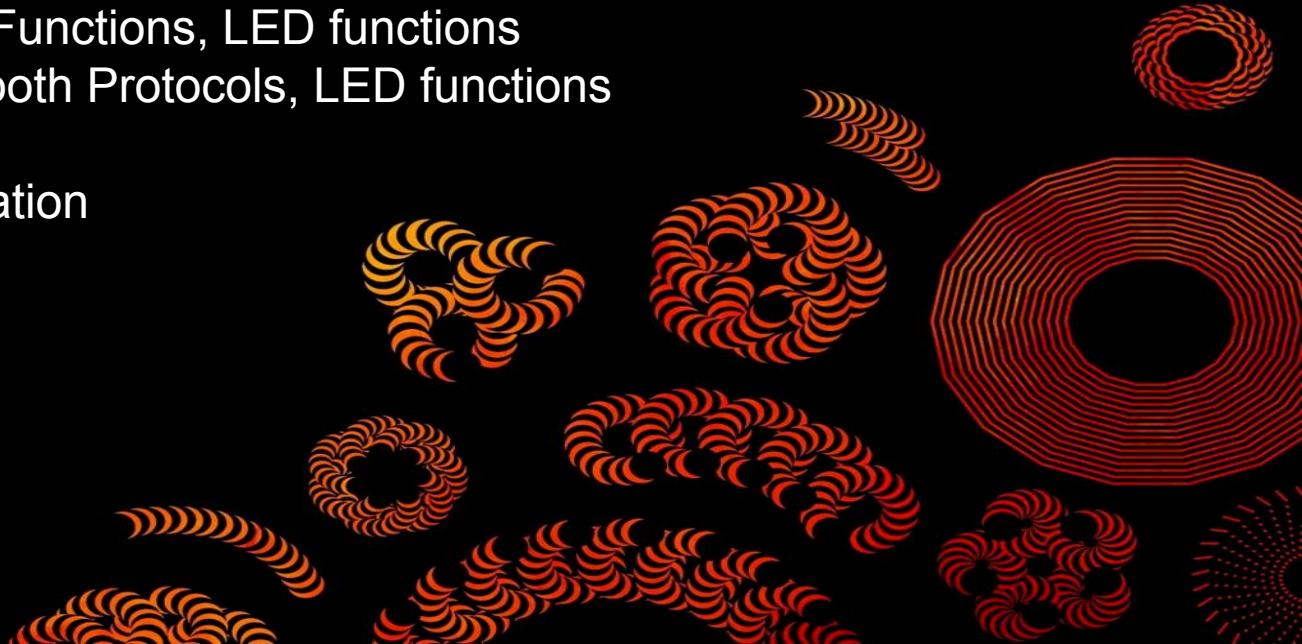
Eric Jin - Software/Firmware Integration

Jose Maun Jr. - Software/Firmware Integration

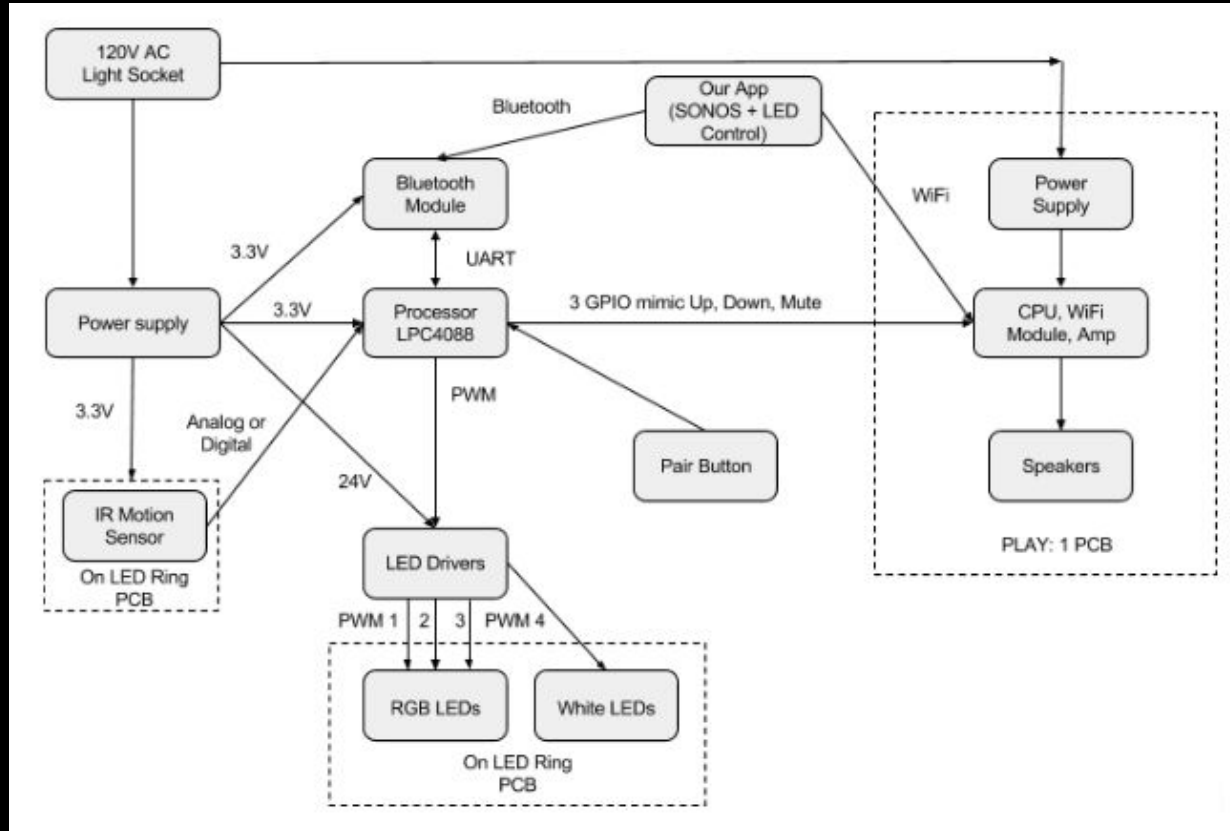
Randy Picchini - Timer Functions, LED functions

Zaira Tomayeva - Bluetooth Protocols, LED functions

All - PCB Layout, Verification



Hardware Block Diagram



Parts: Processor

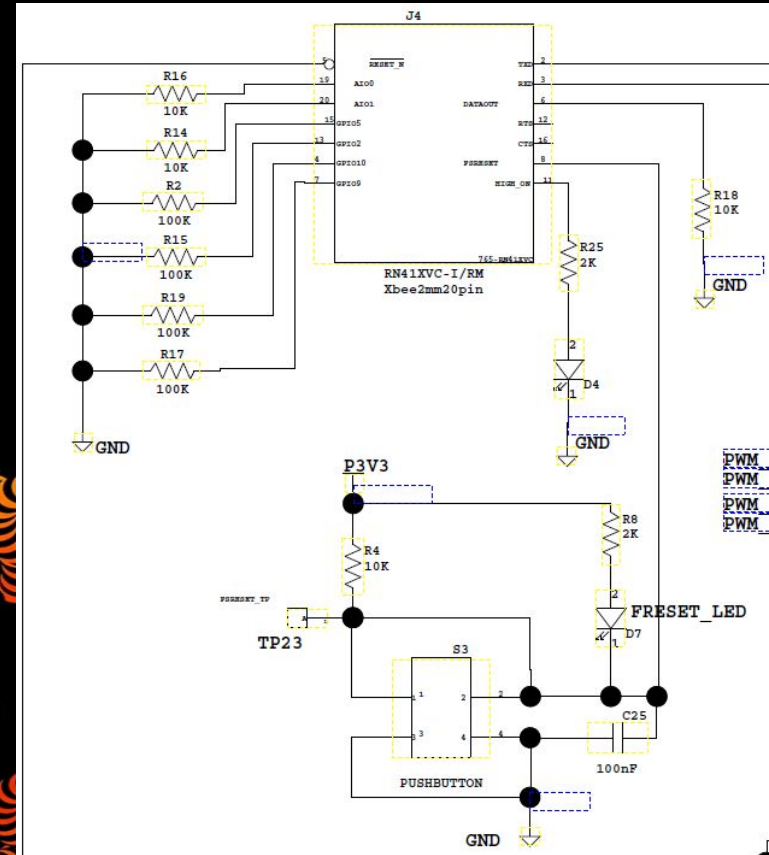
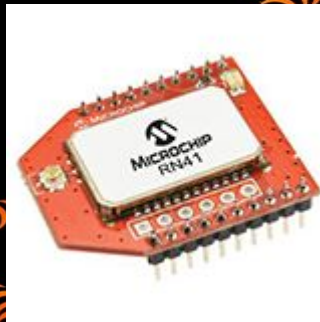
- NXP LPC4088

- Operating speed: 120MHz
- Power supply: 3.3V
- Internal Memory: 512kB Flash,
96kB RAM,
4kB EEPROM
- Serial interfaces: I2S, I2C, SPI,
UART, USB, CAN,
Ethernet interfaces



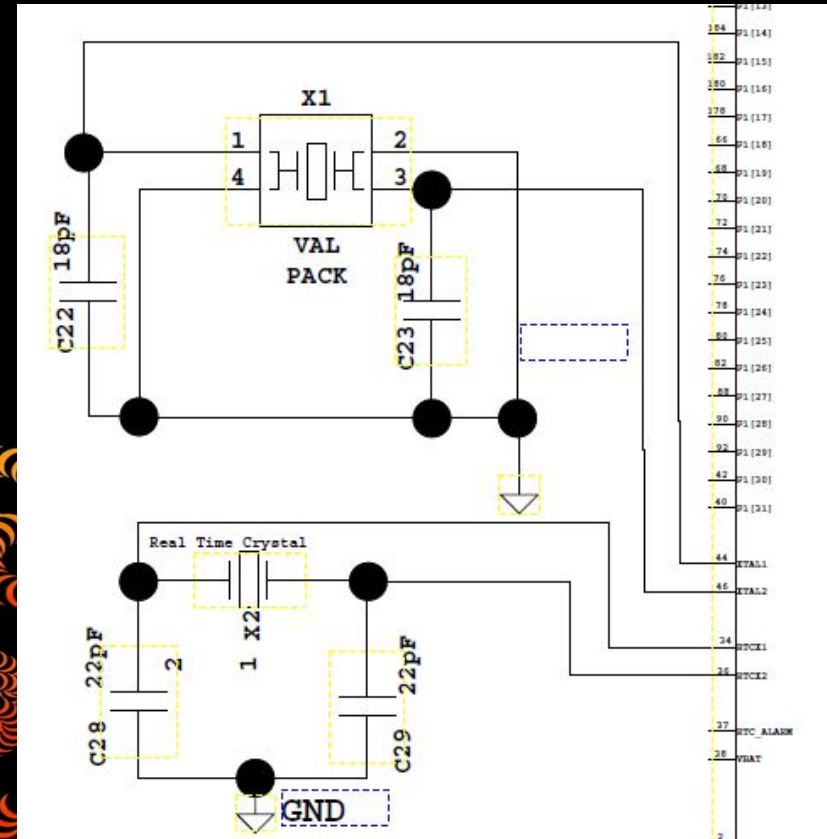
Bluetooth (RN41XVU)

- Serve as main communication from App to LED Control Board.
- Bluetooth version 2.1 backwards compatible with 2.0, 1.2, 1.1
- UART Data Connection Interface
- Embedded Bluetooth stack profiles:
 - SSP, HID, GAP, SDP, RFCOMM, L2CAP
- Range up to 100 meters
- U.FL Antenna Compatible



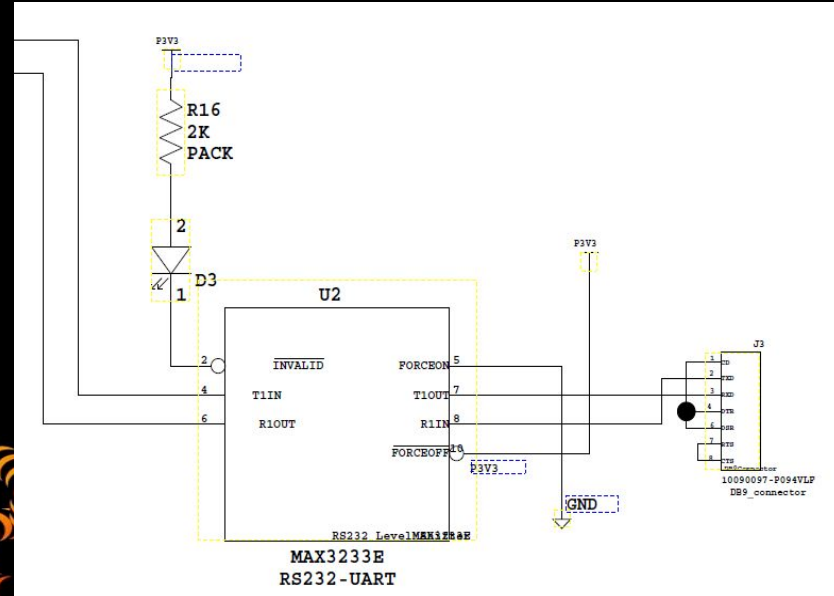
Crystals (Oscillators)

- Main Oscillator (X1 Crystal)
 - 20MHz.
 - Used as reference for CLK.
- Real Time Clock (X2 Crystal)
 - 32.768kHz
 - Used for Timer functions such as sleep and alarm



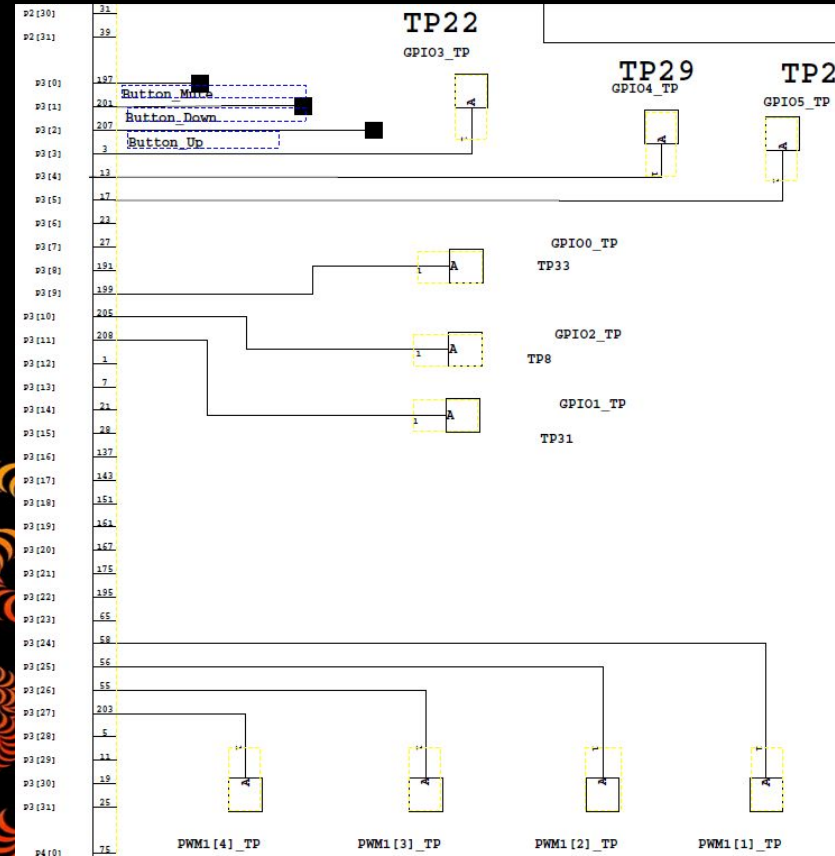
Level Shifter/DB9 Connector

- Used for downloading software to μ processor.
- Level shifter used for proper voltage levels.
- JTAG connector also included in PCB to provide redundancy for downloading software to μ processor.

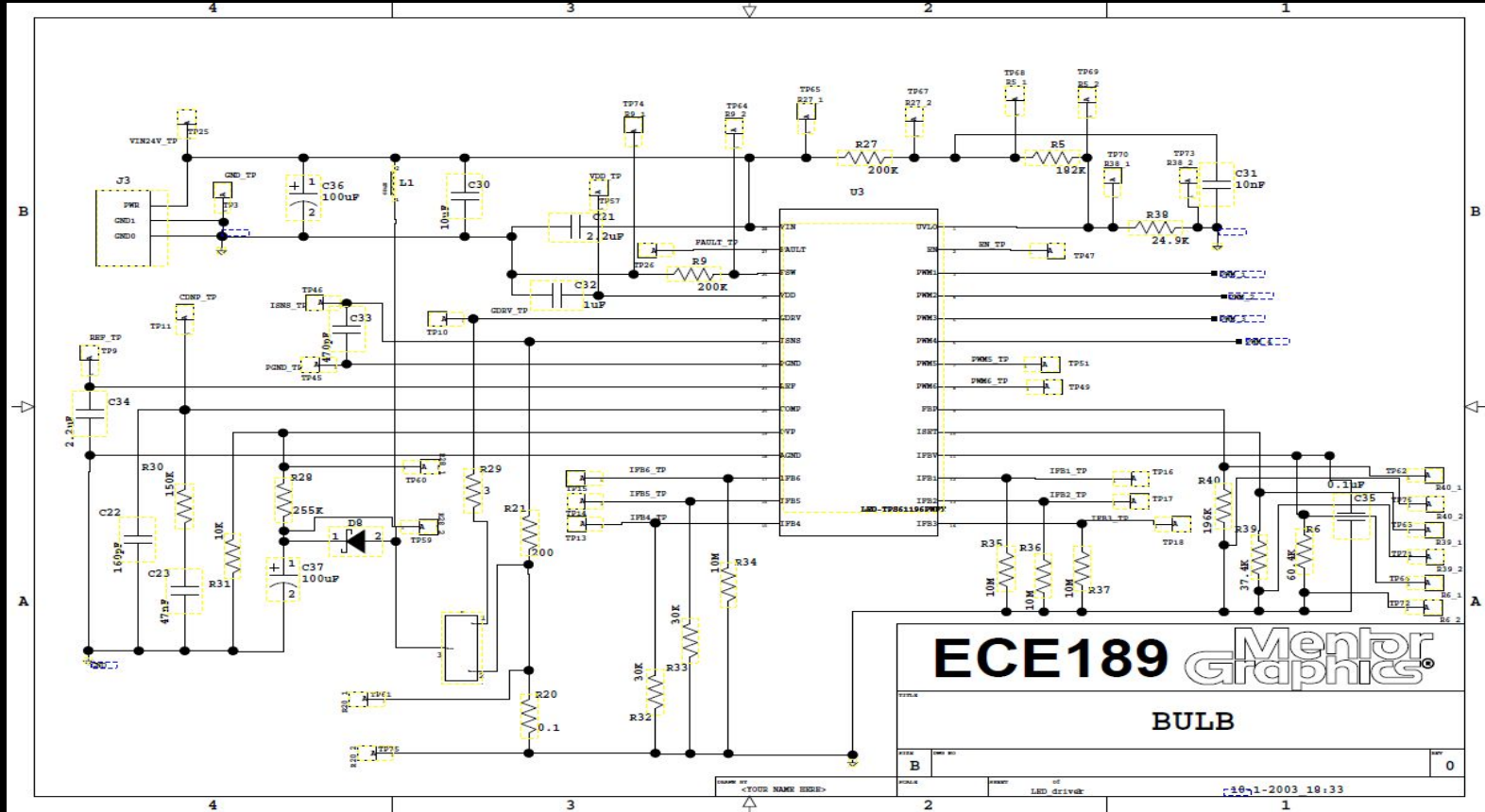


Test Pins, LEDs, and Push Buttons

- Added numerous headers to serve as test points or to expand on the functionality of the board.
 - 6 GPIO Ports
 - 6 PWM ports (4 PWM1, 1 PWM5, 1 PWM6)
- LEDs were added to provide visual status of critical nodes in our circuit.
- Push Buttons were added to control system and modular resets.
- Push Button was also used to place the μ processor in ISP mode.



LED Driver



Layout

