Functional Decomposition for THUNDER BUDDIES

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Team #4

Team Members:

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Block Diagrams:

Level 0:

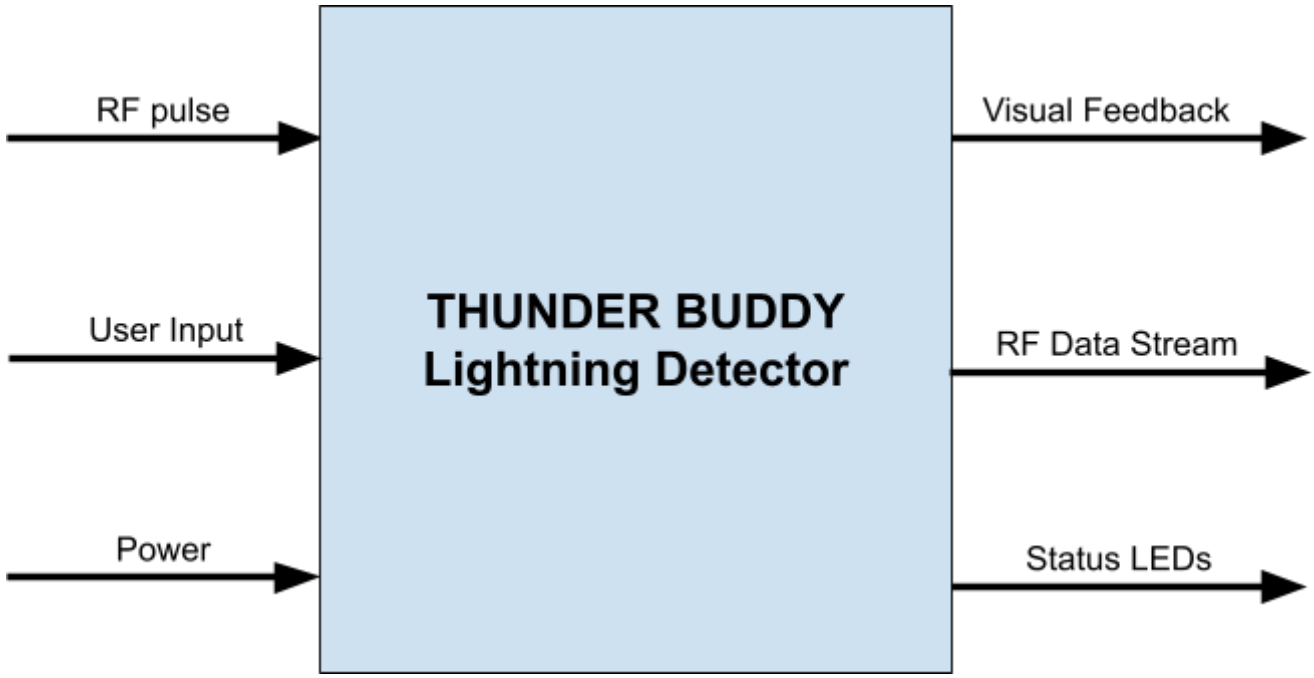

Figure 1: Block Box diagram; level 0 functional decomposition

Module	THUNDER BUDDY Lightning Detector
Inputs	**RF Pulse:** Peak Between 5-10 kHz for lightning **User Input:** Buttons, 2 potentiometers **Power:** 5V-12V DC
Outputs	**Visual Feedback:** TFT LCD **RF Data Stream:** 431-478 MHz; serial data for device ID **Status LEDs:** Power and Status; Red and Green
Functionality	Notify the user of detected RF pulse representative of a lightning strike near the device. RF data stream configuration can adjust transmission frequency, and the device will transmit its ID tag to a master receiver.

Level 1:

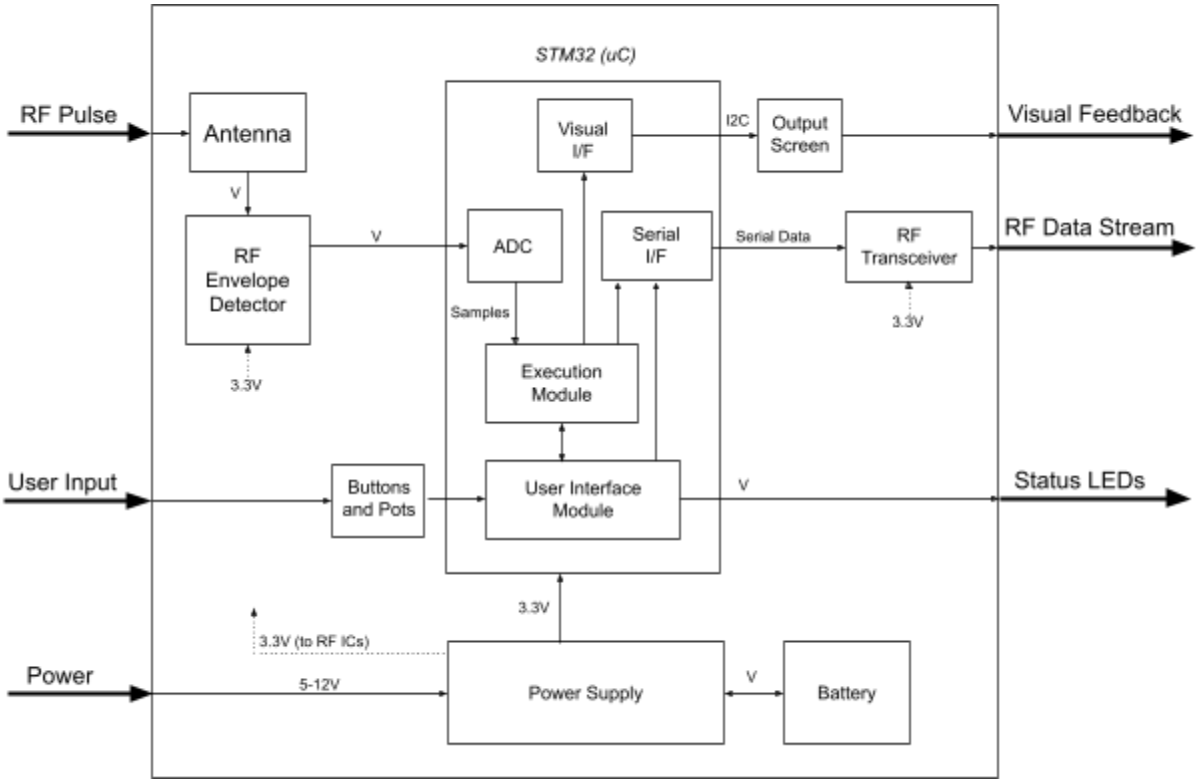

Figure 2: Block Box diagram; level 1 functional decomposition

Module	Antenna
Inputs	**RF Pulse:** Peak Between 5kHz-10kHz for lightning
Outputs	**Voltage:** Max peak of 3.6V
Functionality	Receives RF signal and passes voltage to RF detector chip.

Module	RF Envelope Detector (LMH2121)
Inputs	**Voltage:** Max peak of 3.6V
Outputs	**Voltage:** 20mV-2.7V
Functionality	Converts RF signal to linear DC output. When correctly calibrated, should only respond to lighting strikes and ignore other sources of RF noise.

Module	ADC
Inputs	**Voltage:** 20mV-2.7V
Outputs	**Samples:** 12 bit resolution
Functionality	Converts analog voltage reading to digital value.

Module	Execution Module
Inputs	**Samples:** 12 bit resolution **Data:** Configuration details from UI module
Outputs	**Data:** Status information to UI module Function calls to visual I/F Function calls to serial I/F
Functionality	Waits for RF interrupt to check if ADC sample is in line with expected lightning strike values. If lightning is detected, it communicates with the other software modules.

Modules	User Interface Module
Inputs	**Voltage:** 0V-3.3V **Data:** Status information from Execution Module
Outputs	**Voltage:** 2V for red LED; 3V for green LED **Data:** Configuration info to serial out I/F
I/F Module	Buttons and Pots
Inputs	**User Input:** Button presses, potentiometer rotation
Outputs	**Voltage:** 0V-3.3V
Functionality	Allows the User to turn on the device through a button press, as well as to calibrate and adjust RF input sensitivity and RF output frequency band through the two potentiometers. This module is also responsible for outputting to the two status LEDs.

Module	Output Screen
Inputs	**I2C:** Display data
Outputs	**Visual F/B:** Image indicating detected strike
I/F Module	Visual I/F
Inputs	**Data:** Lightning detected function call
Outputs	**I2C:** Display data
Functionality	Reacts to detected strike by displaying predetermined notification of lightning strike.

Module	RF Transceiver (ADF7020)
Inputs	**Serial Data:** Identification ID, Configuration data
Outputs	**RF Data Stream:** 431-478 MHz; serial data for device ID
I/F Module	Serial I/F
Inputs	**Data:** Lightning detected or Configure function call
Outputs	**Serial Data:** Identification ID, Configuration data
Functionality	Reacts to detected strike by transmitting device identification tag on our calibrated frequency band. Also reacts to configuration (on initialization as well) to change chosen frequency band or device ID.

Module	Power Supply
Inputs	**Power:** External 5-12V DC **Voltage:** 3.3V from battery
Outputs	**Voltage:** 3.3V to battery, RF ICs, and STM32
Functionality	Takes in external power to charge internal battery; also responsible for regulating battery power and feeding it to the other circuit elements.

Module	Battery
Inputs	**Voltage:** 3.3V from power supply
Outputs	**Voltage:** 3.3V to power supply
Functionality	Stores power from external source to allow device to operate wirelessly in the field.