Personal Thunderstorm and Lightning Detector

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Overview

- Introduction
- Purpose
- Theory
- Functions
- Conclusions
- Future Research
- Acknowledgements

Introduction

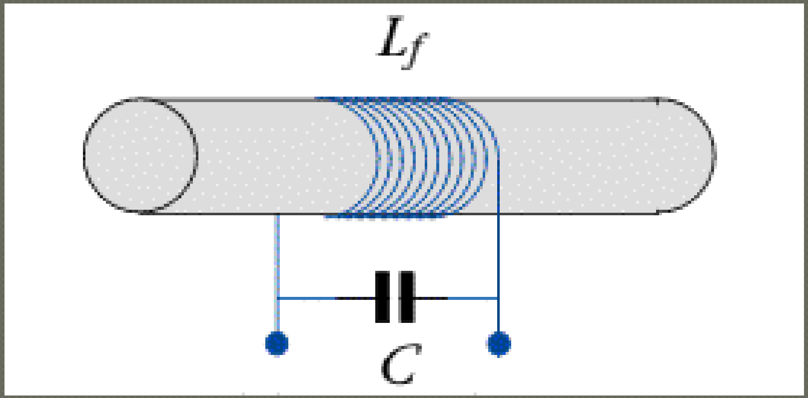
- Lightning Kills 500 people per year
- Typical audible signal is 5 miles
  - Strike can occur up to 20 miles from source
- Pair lightning detection with thunderstorm warning system
- Need for something portable without sensitivity loss

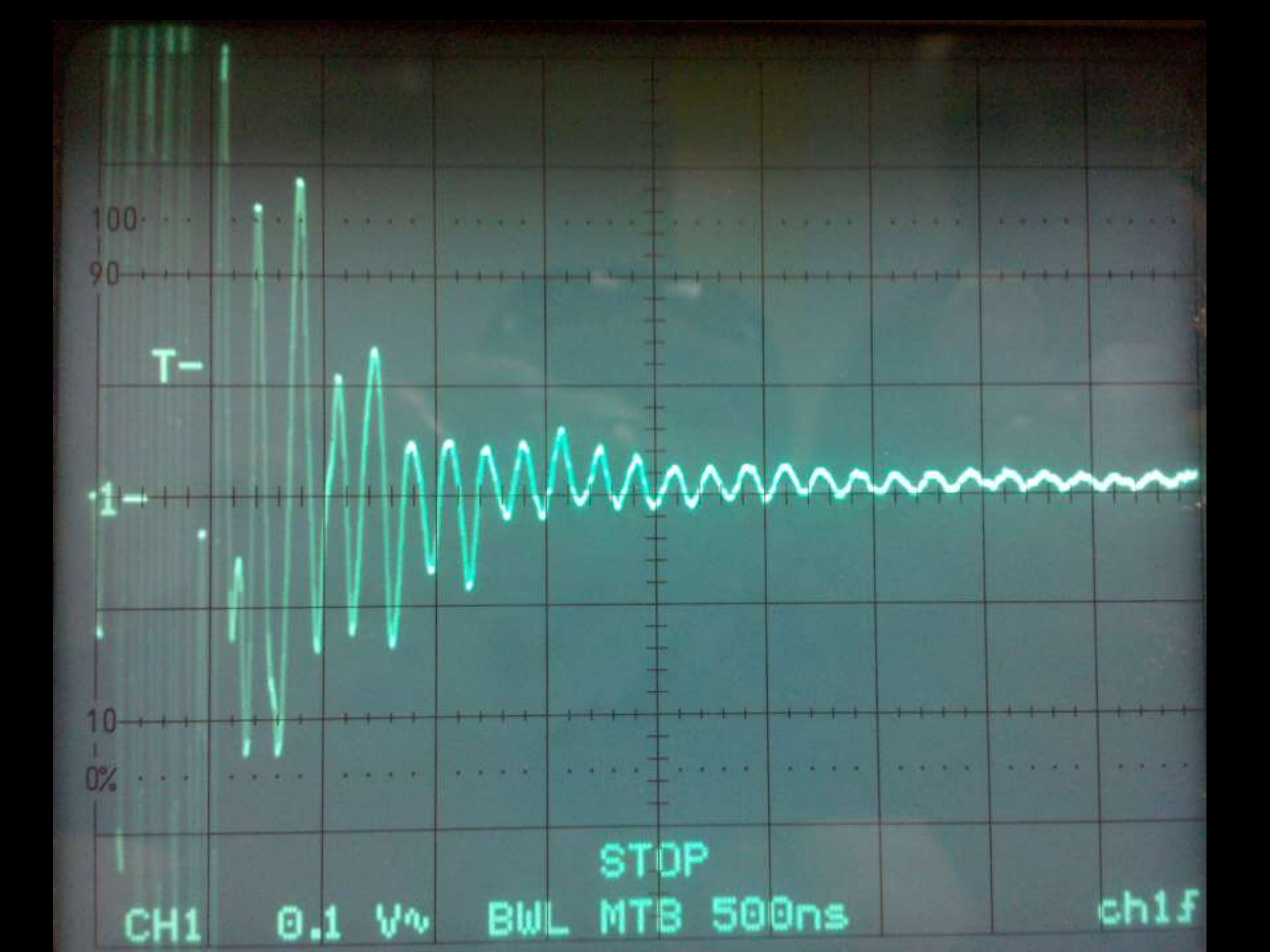
Purpose

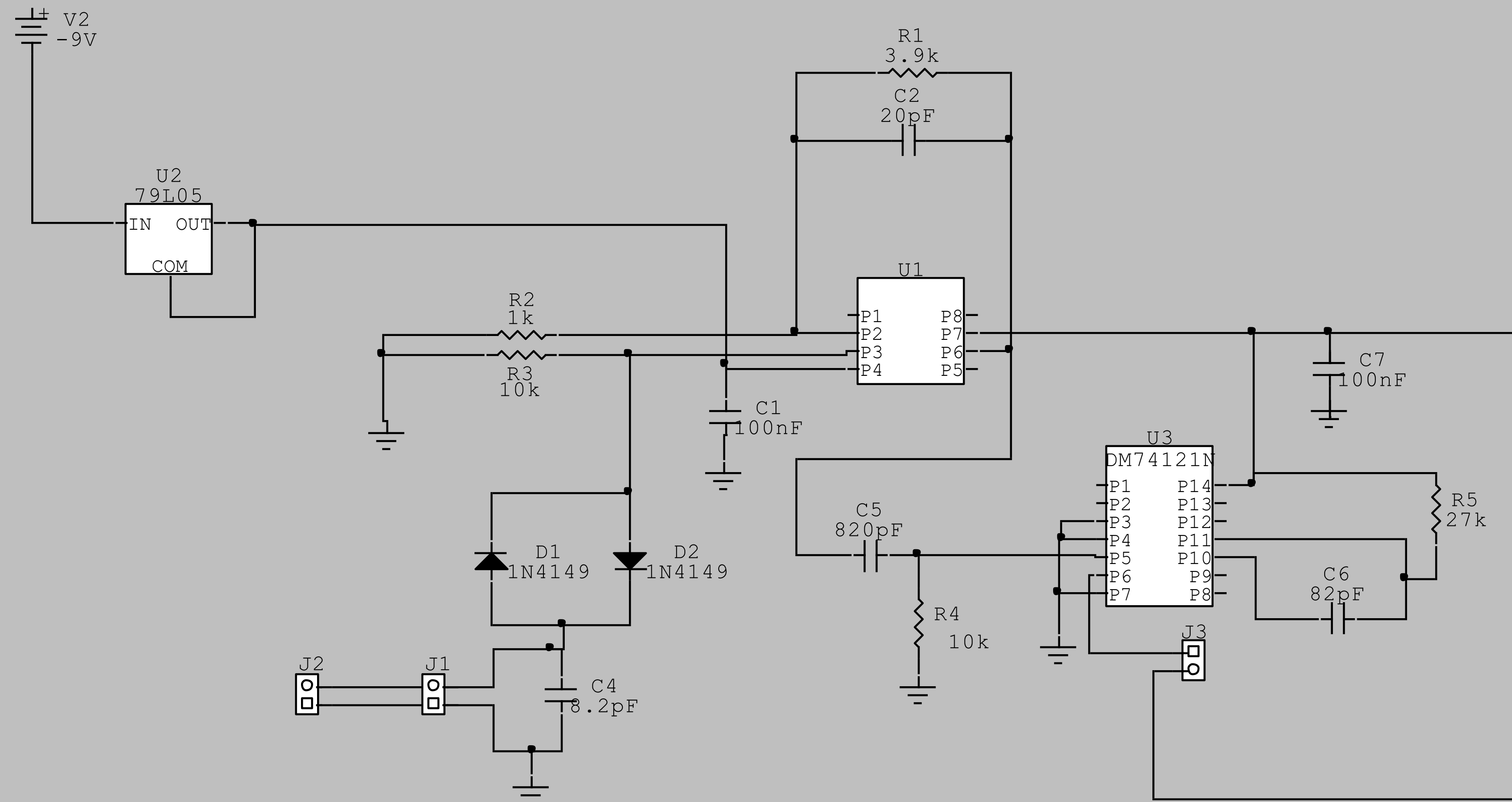
- To develop a lightning detector with:
  - Visual text readout for temperature and pressure
  - LED Warning lights to display current threat
  - Audible warnings for high threat situations
  - Lightning detection up to 25 miles

Theory

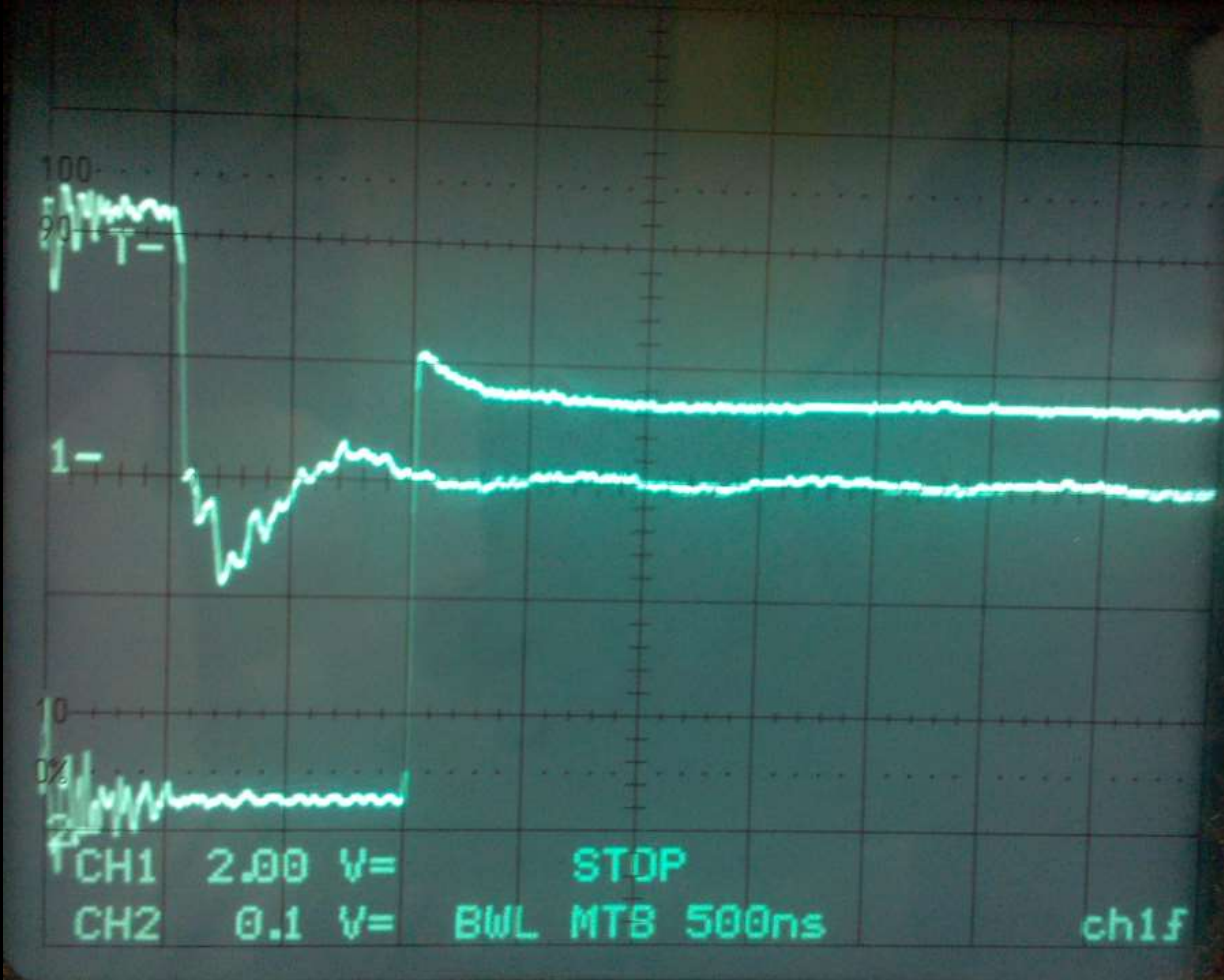
- How it works…
  - Lightning emits electromagnetic signals
  - Ferrite rod "compresses" signal
  - Current induced in windings
  - Parallel capacitor gives resonant circuit – 6 MHz




100
90
T-
1-
10
0%
STOP
CH1
0.1 V∿
BWL MTB 500ns
ch1∫



V2
-9V
U2
79L05
IN
OUT
COM
R1
3.9k
C2
20pF
U1
P1
P2
P3
P4
P8
P7
P6
P5
R2
1k
R3
10k
C1
100nF
C7
100nF
U3
DM74121N
P1
P2
P3
P4
P5
P6
P7
P14
P13
P12
P11
P10
P9
P8
R5
27k
C5
820pF
R4
10k
C6
82pF
J3
D1
1N4149
D2
1N4149
J2
J1
C4
8.2pF


100
90
1
10
0%
CH1 2.00 V=
STOP
CH2 0.1 V=
BWL MTB 500ns
ch1

Functions

- Three main functions
  - LED and LCD Displays
  - Temperature and Barometric Pressure trends
  - Lightning Detection System

Functions

- LED and LCD Displays
  - 2x16 LCD gives user requested threat level, temperature, and pressure
  - Gives meaning to beeps and system reactions to user
  - LED display stays lit for different threats

Functions

- Temperature and Barometric Pressure
  - 30 minute visibility/resolution
    - Use falling quickly or falling slowly scaled for 30 minutes
    - Changes in temperature (2 to 4 degrees F)

Definition of Pressure Tendency Terms	
Term	**Pressure Tendency Over 3 Hours**
Steady	Less than 0.1 mb
Rising or falling slowly	0.1 to 1.5 mb
Rising or falling	1.6 to 3.5 mb
Rising or falling quickly	3.6 to 6.0 mb
Rising or falling very rapidly	More than 6.0 mb

Functions

- Lightning Detection System
  - Automatic highest threat level (5^{th} level)
  - Received in interrupt to microcontroller
  - Alerts until user clears – requires attention
  - Stays at that threat level for 15 minutes past last strike
  - User can clear everything (i.e reset device w/o loosing history)

Conclusions

- Lightning detection is difficult
  - Unpredictable signal, not much research
  - Dangerous to test full scale
  - Causes components to lose stability
  - No real “lightning frequency”
  - Knowing if it is lightning or interference
  - Repeatability – to fast to catch

Future Research

- Personal Computer integration
  - Induced currents kill computers
- Design a system that can differentiate distance
- Smaller ferrite rods = smaller design
- More robust temperature and pressure system

Acknowledgements

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Questions

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