CHAPTER 6

CONCLUSIONS AND FURTHER IMPROVEMENTS

The expectation of this project is to have a low cost lightning warning system to reduce the amount of human deaths and other property damages. In the same time, the system should be reliable.

After taking several field measurements, the aim was to develop a warning system using both environmental static electric field variation and radio frequency emissions due to lightning strokes.

The transient detector, which detects radio frequency emissions, costs about 2500 Sri Lankan rupees and with that unit only, a warning can be released 25 minutes before a close by thunderstorm with 95% level of confidence.

The static field detector measures the environmental vertical static electric field. Output of the static field detector deviates from the rest value by large values when a close by thunderstorm is there. The third unit, which derives the final warnings, detects whether the static field goes to extremes and/or whether transients are detected and releases the warnings accordingly. The static field detection further increases accuracy and reliability of the warning system.

The entire warning system has met with the requirements and aims of the project as the cost is only about 5000 Sri Lankan rupees and in the same time it can release a more reliable warning.

The time between the detectable cloud flashes and ground flashes obeys a distribution given by:

$$y = \frac{16.57t^2 + 4511t - 2.301\times10^4}{t^3 - 37.4t^2 + 134.2t + 1.108\times10^4}$$

where, t – time between cloud flashes and ground flashes

y – number of events, with the maximum at 27.52 minutes.

The distribution of the time between cloud flashes and ground flashes is shown in

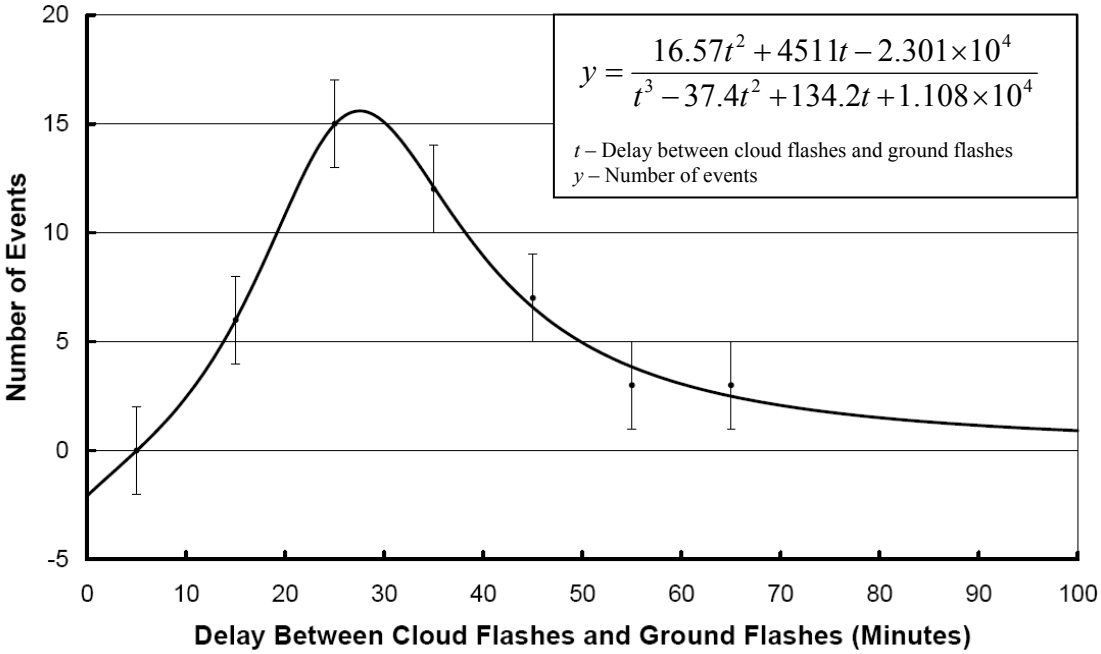

Figure 6.1 – Distribution of time between cloud flashes and ground flashes

As the aim of the project was to develop a low cost lightning warning system, the design was restricted to a simple circuitry. To improve the reliability of the system further, a microcontroller or a microprocessor based system can be designed. That is one of the future improvements that can be introduced to the system.

Another development which can be made to the system is to develop a USB based system which can be integrated with a personal computer or a laptop with software to determine warnings and log the data so that it can be used for research purposes as well. A system like that can be extended to an internet based lightning warning system.

There can be a lot more alternatives to a lightning warning system, but those will deviate from the scope of having a low cost product as a result. The alternative discussed above will be higher in cost when compared to the result of the project discussed in this thesis, but will definitely increase the level of accuracy and reliability. Keeping the cost of the final product as less as possible should be the key aim of such project.

The immediate next extension of this work is to develop a low cost, microcontroller based hand held lightning warning system.

CHAPTER 7

LIST OF PUBLICATIONS

1. K.N. Abhayasinghe and D.A.I. Munindradasa, "Low Cost Lightning Warning System", IX SIPDA (International Symposium on Lightning Protection), to be held from 26th – 30th November 2007 in Brazil.

   Status: Abstract accepted, full paper under review.

2. K.N. Abhayasinghe and G.A.C. Gomes, "On the Correlation Between Cloud Flashes and Ground Flashes of a Thundercloud System in Colombo", To be submitted to the 3rd Environmental Physics Conference, to be held from 19th – 23th Feb. 2008, Aswan, Egypt.

   Status: In preperation