6. CONCLUSION AND FUTURE WORK

The work described in this thesis addresses the problem of the indexing and retrieval of nearest neighbours point data which, although well-known, has no generally agreed optimum solution. The main achievement and contribution of our work has been to explore and develop the application of space filling curves in solving this problem. This approach has been suggested in the literature but little work, other than mostly of a theoretical nature, has previously been carried out in its pursuit. Furthermore, previous work has generally been used in digital image processing for storage. The approach regards spatial data as points lying on a space filling curve passing through every point. Each point lies a unique distance along the curve from its origin and can, therefore, be mapped to a one-dimensional value, and stored in a simple one-dimensional storage structure. Our HCQT framework has entailed the design and practical implementation of an application for the storage and retrieval of data.

The implementation makes use of two other alternative methods in mappings between spatial data to one dimension and thereby enables comparisons to be made of their characteristics and relative suitability for the purpose. The development of our implementation required us to address and resolve two important subsidiary problems:

- How to perform mappings between transportation network data to one dimension.
- How to execute queries on data mapped to a space filling curve.

The development of the transformation approach for performing mappings was useful for a number of reasons. Most importantly, the simplicity of the technique enabled us to focus on the development of querying algorithms. It also provided us with insights which enabled us to improve Butz’ existing calculation-based technique for the Hilbert curve.

The existence of mapping techniques is of little value in the absence of an effective means of querying spatial data mapped to one dimension. The lack of reports of the
practical application of space filling curves in the literature led us to speculate that the concept was awed because no algorithms could be discovered to execute Nearest Neighbour query effectively. Dispelling this notion was thus the preoccupation of the early part of our research.

Having developed an understanding of space filling curves by representing them as trees, we developed 'tree-descent' algorithms for querying the Hilbert curve. A broadly similar approach has been adopted previously but only for the H-order curve by Lawder [LK07] for Indexing data.

In developing a fully-functioning data storage implementation a number of peripheral, though important, matters of detail were addressed, particularly in relation to what is stored on a page and in what order. These matters were also discussed in relation to prominent alternatives to our design. Moreover, the data set can be processed and stored independently of query processing. So answering queries on different dataset can be added to software easily.

**Future Work**

Probably the most important area for further work is the testing of our implementation using data collected from Indian context and makes it application oriented structure. It motivates us to pursue further the application of our implementation to Big data and cloud computing.

Most analysis of the clustering properties of space filling curves has been theoretical and confined to data-spaces of limited size and in 2 or 3dimensions. Our implementation provides the opportunity to carry out further work of an analytical nature, and in a higher number of dimensions.

Since our software is experimental and intended to explore the suitability of mapping spatial data to one dimension, features such as concurrency control and recovery have not been included in the implementation. Nevertheless, there appears to be no reason to believe that these issues need be dealt with in a novel manner as a result of the application of space filling curves.