

**APPLICATION OF GIS TECHNOLOGIES IN MODELING OPTIMAL  
ROUTES OF WATER UTILITIES TO SPUR DEVELOPMENT**

**A CASE STUDY OF MUMONI DISTRICT**

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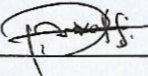
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## DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

Signature:  Date: 27.1.2016

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This thesis has been submitted for examination with our approval as the university supervisors.

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## **ABSTRACT**

Mumoni District lies in the semi-arid zone and the erratic and unreliable rainfall has worsened the situations. The women and girls walk an average distance of 10-15 km in search of water. There is lack of adequate access to basic education and also poor performance in schools. Though the global demand for water is projected to grow rapidly, in the developing countries, the demand will be much higher to a tune of 93%. The objectives of this study was to carry out assessment and develop optimal route model of water utilities to spur development in Mumoni District, Kitui County. This is in line with the Kenya vision 2030 i.e. to become a middle income country; accelerated by working towards MDG's and SDG's such as to reduce poverty, improve literacy, adequate access to basic needs and improved maternal health.

The study employed the GIS and Remote sensing technologies to develop a geodatabase of the various dataset (roads, rivers, rainfall, temperature, waterlines, soils, land use, markets, population and slope) . An assessment of the water utilities in Mumoni was done to show the water distribution. modeling of the optimal routes ( water networks) connecting all the schools. AHP, an MCDM method was used to generate judgment matrix based on the opinions of experts' qualitative measurements for various factors considered in the study as documented in the questionnaires. Respective Weights for each factor (raster dataset) obtained from the expert's judgment matrix were used in carrying out weighted overlay using ArcGIS software.

A cost surface raster layer was generated by combining (weighted overlay) the various datasets which was then used to model the Optimal routes (least cost path) by setting the reservoirs (existing water tanks) as the source layer and the schools locations as the destination layer. From the research, it was established that the existing water line serves the lower region only and the storage tanks are located approximately over 10km apart. Finally, this research has established that AHP and GIS technologies are more convenient and cost effective tools in modeling optimal routes, further it can be used in efficient and effective management of water supply systems.

### **Keywords**

GIS, Network analysis, modeling, spatial analysis, AHP, Classification