



Village Information System Using GIS: A case study of Chilkur village, Moinabad mandal Telangana

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ABSTRACT

Chilkoor village of Moinabad mandal in, Ranga Reddy district is 28 km away from Hyderabad city, nestled in the arm of the beautiful Osman sagar lake which is the source of drinking water to the people of twin cities of Hyderabad and Secunderabad since a long time. Apart from scenic, this village has an ancient temple spot located by the side of lake and known as holy village. Horticulture as well as Agriculture are predominant in this village but because of proximity to the city and due to massive movement of tourists to this village has created pollution which has disturbed the natural flow of the streams and found most of the streams have been dried up and many commercial activities are coming up by disturbing the agriculture, hence in order to have proper planning of land and water management in this village it is important to have proper data of this village, where an attempt has made to develop multi-layered geo database using Arc-GIS server, which will help in analyzing the information and take better decisions, better planning in this village. The present project work titled “Village Information System Using GIS: A case study of Chilkur village, Moinabad mandal Telangana” has been taken up to find a solution to the problems faced by the villagers of Chilkoor, (located at Moinabad, Rangareddy District) such as, basic village facilities, education, health and safety, agriculture, literacy, social welfare, transportation etc., focusing mainly on water management and land Management system using GIS.

Keywords: Horticulture, predominant, proximity, commercial activities, geo database, land Management system.

OBJECTIVE

The main objectives of this project are as follows:

1. Increasing the crop productivity by recharging the dried up bore wells (farmer managed), hence eradicating extreme poverty and hunger.

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2. To identify the soil properties and the crop pattern of the Chilkoor village there by suggesting the farmers of the village, how better the unused lands can be used for cultivation of potential crops.
3. To identify the economic condition of the village and help to uplift the village economy through an effective management of the village information system.
4. To create a sustainable development model for the Chilkoor village by designing an effective water and land management system using geographical information system.

STUDY AREA

Chilkoor village of Moinabad mandal , in Ranga reddy district is 28 km away from Hyderabad city , located N-78-15'-50"to 78 -18'-47"N and 17-19'-20"E to 17-22'-38"E.. Chilkoor village has lot of potential as we see important ancient Temple of Lord Balaji located on excellent spot by the side of Osmansagar lake and devotees are attracted, to this scenic beauty. and every year there is an increase of flow of devotees to this place hence , it becomes important to have proper management for better Tourism and this data -base will help in giving information and development activities can be carried out in this village.

METHODOLOGY

The methods adopted to create a database of the entire Chilkoor village using surveys, GPS, DGPS and other mapping software tools are also discussed in detail. Realizing the importance of agriculture in our country in order to design effective water management and land management ,this kind of database is helpful for farmers as well as planners for better planning .Database for this village is done by using modern technological tools like G.P.S ,D.G.P.S., and G.I.S

A survey was carried out using DGPS equipment along the boundry of Chilkoor village to find out the area of the village the area was determined as 4263 acres repectively. Revenue map from mandal office was obtained and digitized using Map info software tool and then was placed on Topographical map and geo referenced to check the correctness of the map. The entire village details were created to



several layers such as roads vegetation settlements, unused land , land plantation water bodies etc. Topo sheet of scale 1;25,000 and sheet No 56K/7/SW were obtained from survey of India

INTRODUCTION:

The process of development begins from the bottom and moves to the top. The roots of our nation lie in rural india so the development of our society and our country must begin from the rural areas. Realizing the importance of developing agriculture in the villages of our country, the present project “**Village Information System Using GIS**” was taken up to enhance the land productivity by applying modern technological tools like GIS, GPS, DGPS and related software’s The population is continuously increasing and good quality land and water resources are simultaneously declining. Under the optimal land and water allocation, the groundwater utilization will increase, which in turn increase yield of the crops. The proper land and water management practices can develop a reliable decision aid for taking the farm and regional level decisions to solve the problems of irrigated agriculture. The development and application of using GIS the land use planning and water management which is presented here are simple and can be used in any part of the area for maximizing the net agricultural return.

The national push for the introduction of sustainable development has had an impact on land use planning and natural resource management. There is urgent need for widespread changes to land use, and the introduction of sustainable land management practices, to help arrest natural resource degradation and loss of biodiversity. At present there have not been widespread changes to land use due to limitations in the institutional, statutory, and policy frameworks and the political, cultural and community attitudes to large-scale land use change at the direction of government.

The land use planning provides a means of legal control over changes in land use and provides an opportunity to allocate land use to areas best suited to that activity. However, because land use planning is not retrospective and essentially only deals with proposals to change land use, it relies on owners or land managers to initiate such changes. The practice of land use planning involves achieving a balance between the community’s environmental, social and economic needs and demands.

About two hundred years ago, Indian Agricultural productivity was highest in the world. But now if we compare to other countries the current per acre production is quite low. And we need



proper planning to increase the productivity. Chilkoor village has many tanks apart from the lake which has better potential for agriculture, but it was observed that agriculture is slowly decreasing in recent years. And since the Agriculture is the main activity in villages of our country. This G.I.S. Database will help the villagers to solve many problems as well as it will help to manage the existing agriculture regions.

REVENUE MAPS:

Revenue maps also known as land record maps were obtained from Survey Bhavan, Narayanguda, and Hyderabad. Which consists land records of entire Chilkoor village? This revenue map was scanned and then digitized using MAP INFO software tool and then georeferenced. Those map (georeferenced and digitized) enabled us to know the land area under each survey numbers. The unused lands among the survey numbers were Identified, the plantations, cultivated land, crop areas in each survey numbers were identified. GPS coordinates of the bore wells in the entire Chilkoor village obtained from the handled GPS survey were placed on the digitized revenue map which enabled us to identify the survey number with dry bore wells.

SOIL MAPS:

Soil maps were obtained from Survey of India and a detailed study was made how to identify types of soils and soil pattern in satellite imagery , this enabled us to identify the soil pattern of the Chilkoor village Mainly two types of soil patterns were observed in the Chilkoor village those were black cotton soil and red soil. The area covered with black cotton soil was observed to be 823.6 acres and the area covered with red soil was observed to be 3440 acres.



Source: Mandal office Chilkur



APPLYING TECHNOLOGY AT THE FIELD

Differential GPS (DGPS) uses a GPS receiver at a fixed point whose position is known with sub meter accuracy. This is the control unit. The receiver collects data from all visible satellites and computes predicted satellite ranges, which are compared with actual ranges. The difference is the satellite range error, which is then converted to correction signals for use by a roving receiver. The roving receiver would be to one on the system user's boat.

It is assumed that this correction will be the same for other GPS receivers that in the same area and are using the same satellites for positioning. If the correction is communicated to other receivers in the area, usually by a beacon on the same site, the range error can be removed from satellite signals and precise fixes calculated by these receivers. It should be noted that not all data errors can be corrected in this way. Errors that are caused by receiver noise (which is inherent in any GPS receiver) and multipath problems cannot be eliminated with differential equipment. Multipath errors Occur when the receiver's antenna "sees" the reflections of signals that have bounced off of surrounding objects.

Using DGPS to eliminate the effects of correctable errors requires that the user's GPS receiver be connected to a compatible Differential Beacon Receiver (DBR) and be within range of the broadcasting beacon. The DBR accepts and demodulates the broadcast corrections, which are then relayed to the GPS receiver. The GPS receiver applies the corrections to the navigation data it uses to compute a position solution, and then displays differentially corrected data. Care must be taken to ensure that the DGPS receiver and the GPS receiver are compatible for this procedure to be successful.

Differential GPS, or DGPS, has been developed to improve GPS accuracy to within a few meters. Originally initiated by the U.S. Coast Guard, DGPS adds a land based reference receiver, located at an accurately surveyed site.

Since this non-moving DGPS reference station knows where the satellites are located in space at any given moment, as well as its own exact location, the station can compute theoretical distance and signal travel times between itself and each satellite. When those theoretical measurements are compared to actual satellite transmissions, any differences represent the error in the satellite's signal. All the DGPS reference station has to do is transmit the error factors to your DGPS receiver, which



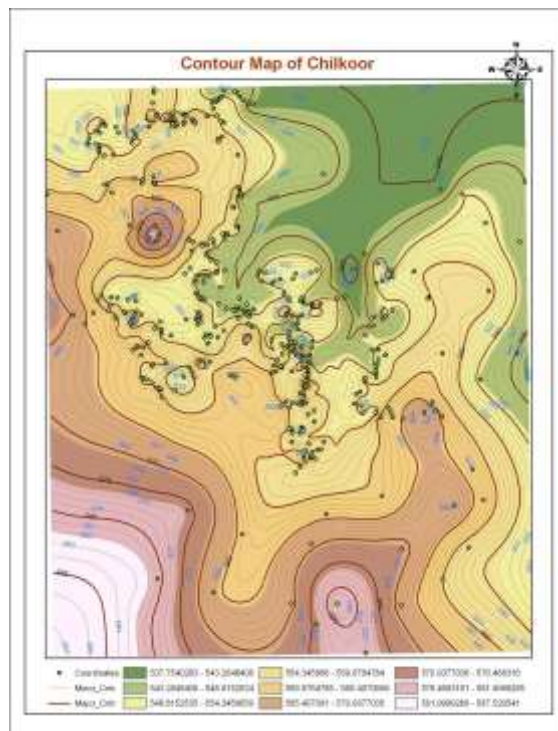
gives the information to the GPS receiver so it can use the data to correct its own measurements and calculations.

A survey was carried out using DGPS equipment along the boundary of the Chilkoor village which also include two hamlet villages Appojiguda and Devalvenkatapuram. The boundary of these villages was surveyed using DGPS and coordinates were taken along the boundary to find out the area of the village. The area of the village determined from the survey was found to be about 4263 acres.

Coordinates of the entire village were taken to create a contour map of the village. A contour map is a map illustrated with contour lines, for example a topographic map, which thus shows valleys and hills, and the steepness of slopes. A contour map of 1metre interval was created using those coordinates. The DGPS coordinates were considered and the elevation of the ground control points (GCP's) was known using the coordinates. Contour map and a slope map were generated from these elevations.



Source: Mandal office Chilkur



Source: Mandal office Chilkur

Utilizing these elevation levels generated from the DGPS survey and using the contour map generated from these elevations a slope map of the village was generated to know the slopes and direction of stream flow in the village.

HAND HELD GPS SURVEY

GPS has become a mainstay of transportation systems worldwide, providing navigation for aviation, ground, and maritime operations. Disaster relief and emergency services depend upon GPS for location and timing capabilities in their life-saving missions. The accurate timing that GPS provides facilitates everyday activities such as banking, mobile phone operations, and even the control of power grids. Farmers, surveyors, geologists and countless others perform their work more efficiently, safely, economically, and accurately using the free and open GPS signals.

A survey was taken up using handheld GPS instrument. Survey was performed to take the bore well coordinates in the village. The coordinates obtained from the handheld GPS survey were utilized to identify the functioning of the bore wells in the fields.

Bore well coordinates using hand held GPS were taken considering 3-factors they were:



1. Dry Bore wells
2. Partially Dry Bore wells
3. Functioning Bore wells

These factors were divided according to the functioning levels of the bore wells in the fields as dry, partially dry and functioning bore wells i...e running borewells. The dry bore wells are the bore wells which have been dried since months, partially dry bore wells are those which are becoming dry due to the seasonal impacts and the functioning or the running bore wells are those which are functioning properly in the fields presently. The, coordinates of the bore wells in the village were taken and were classified accordingly into those three categories.

The observations made during the handheld GPS survey were, the count of dry bore wells and partially dry bore wells were high in Chilkoor and Deval venkatapuram when compared to the other hamlet village Appojiguda. The bore wells laid in the fields were on an average at 200ft depth, some even more. One of the important observations was that the reason for drying out of the bore wells was due to transformation of streams into plots and cultivation lands.

DIGITAL ELEVATION MODEL (DEM)

A digital elevation model (DEM) is a digital representation of ground surface topography or terrain. It is also widely known as a digital terrain model (DTM). A DEM can be represented as a raster (a grid of squares) or as a triangular irregular network. DEMs are commonly built using remote sensing techniques, but they may also be built from land surveying. DEMs are used often in geographic information systems, and are the most common basis for digitally-produced relief maps. Digital elevation models may be prepared in a number of ways, but they are frequently obtained by remote sensing rather than direct survey. One powerful technique for generating digital elevation models is interferometric synthetic aperture radar: two passes of a radar satellite (such as RADARSAT-1 or TerraSAR-X), or a single pass if the satellite is equipped with two antennas (like the SRTM instrumentation), suffice to generate a digital elevation map tens of kilometers on a side with a resolution of around ten meters. Alternatively, other kinds of stereoscopic pairs can be employed using the digital image correlation method, where two optical images acquired with different angles taken from the same pass of an airplane or an Earth Observation Satellite (such as the HRS instrument of SPOT5 or the VNIR band of ASTER).

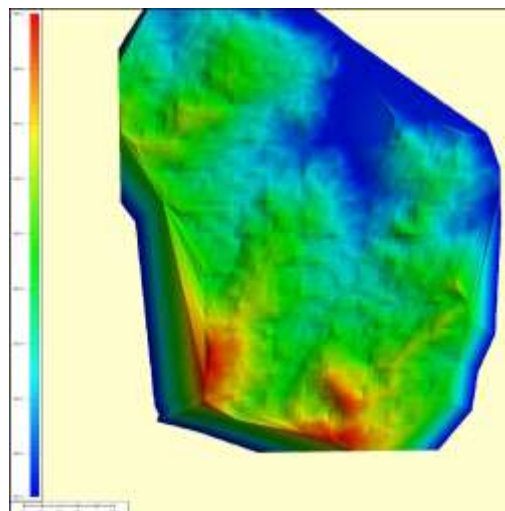


In 1986, the SPOT 1 satellite provided the first usable elevation data for a sizeable portion of the planet's landmass, using two-pass stereoscopic correlation. Later, further data were provided by the European Remote-Sensing Satellite (ERS) using the same method, the Shuttle Radar Topography Mission using single-pass SAR and the ASTER instrumentation on the Terra satellite using double-pass stereo pairs. Older methods of generating DEMs often involve interpolating digital contour maps that may have been produced by direct survey of the land surface; this method is still used in mountain areas, where interferometry is not always satisfactory. Note that the contour line data or any other sampled elevation datasets (by GPS or ground survey) are not DEMs, but may be considered digital terrain models. A DEM implies that elevation is available continuously at each location in the study area. The quality of a DEM is a measure of how accurate elevation is at each pixel (absolute accuracy) and how accurately is the morphology presented (relative accuracy). Several factors play an important role for quality of

DEM-derived products:

- □ terrain roughness;
- □ sampling density (elevation data collection method);
- □ grid resolution or pixel size;
- □ interpolation algorithm;
- □ vertical resolution;
- □ terrain analysis algorithm

DEM OF CHILKOOOR VILLAGE



Source: Mandal office Chilkur



DISCUSSION

A database has been created using GIS of the entire Chilkoor village, utilizing this database the following development activities can be carried out in the village.

1. The streams which were transformed into cultivable land and plots can be restored using the water shed map which indicates the natural path of streams restoring these streams would substantially increase the ground water levels around the streams resulting in recharge of dry bores.
2. The cultivable lands, plantations can be increased by effective watershed management system using the data which we have created.
3. Our GIS database which also includes household information of the village can be effectively utilized to improve their economic conditions.
4. Using this GIS database a development model for the village can be prepared which include laying of roads, sewerage lines, rechargeable zones etc.

RESULTS:

1. An effective watershed management model was designed by identifying dry bores in the entire village thus finding water harvesting and ground water rechargeable zones.
2. Unused land area was identified in the village and suggestions are proposed for productive usage of the land.
3. Population densities, literacy levels, occupation structure of the villagers were identified from the household information data to improve their economic conditions.
4. A sustainable development model for the Chilkoor village was designed by effective water and land management system using GIS database.

CONCLUSION:

The process of development moves from the bottom towards the top. Rural societies are the root of our nation. That is why our development process should begin from rural areas hence the following project was taken up emphasizing on the development of rural Bharat by creating a model village by applying available technology to justify this simple quote

“Model villages are not something which are dreamt



.....but made”

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