CARRYING DGPS SURVEY AND PREPARATION OF DIGITAL ELEVATION MODEL

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Abstract

This work presents a report on carrying a DGPS survey and digital elevation model also comparison between GPS and DGPS data of Sitamarhi area, Bihar India.

Keywords: Wireless sensor network, Mobile computing, Human computer interaction, Multimedia information process, Computational intelligence

I. INTRODUCTION

Differential global positioning system (DGPS) is an enhancement to global positioning system that provides improved location accuracy, from the 15- metre nominal GPS accuracy to about 10cm in case of the best implementations. DGPS uses one or several (network) fixed ground based reference stations in known locations.

The base station compares its own known location, to that computed from a GPS receiver. Any difference is then broadcast as a correction to the user. Correction signals can be broadcast either from ground stations or via additional satellites. These services are privately owned and usually requires a user subscription.

	LADGPS	CDGPS	WADGPS
Method	Code-base	Carrier-base	Code/carrier-base
Accuracy	Meter	Centimeter	Meter
Coverage	~200km	20~30km	~1000km
Reference data	RTCM 1/9	RTCM 18~21 RTCM 3 raw data	Error correction vector
Techniques	DGPS IDGPS	Kinematic (RTK/semi static)	WAAS
Applications	Navigation	Survey	Aviation
Reference type	Single reference		Multi-reference

The classification according to a DGPS system

II. THEORY.

Differential GPS technology is one in which two GPS receivers are usually used to track a single satellite simultaneously. There is usually the control of reference receiver usually located at a known position. The reference receiver at the known control point measures the errors in the GPS signals and transmits the corrections to the rover receivers. The corrections can be real time or can be computed later on during post processing.
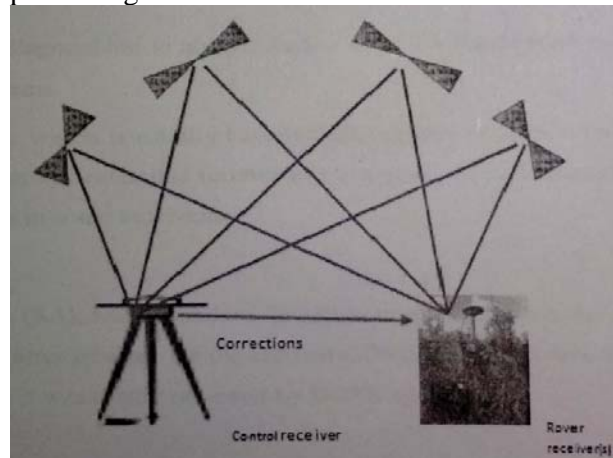

Fig 1. Geometry of DGPS

The DGPS technology is usually capable of improving the accuracy of GPS measurements as it models the ionospheric errors.

Need of DGPS – by using DGPS we can improve our positional accuracy from around 1.5m with standard GPS to around 40cm with DGPS, without the need for post processing

RTK- real time kinematic is an advanced form of DGPS which uses the satellites carrier wave to compare 2 observations from different receivers within the system, to fine tune the satellite and receiver clock errors, thus improving positional accuracy. The GPS signal is made up of 3 distinct

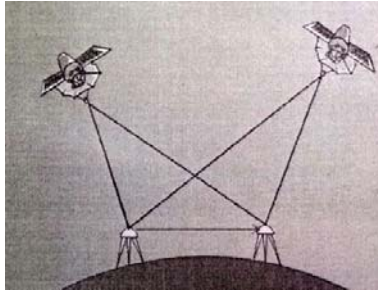components:- 1) carrierwave 2) GPScode 3) Navigation message

Fig2. RTK

III. STUDY AREA

The study area is located between co-ordinates of 26.6°N 85.48°E.it has an average elevation of 56 metres 183 feet. Sitamarhi is drained by rivers such as Baghmati, Aghwara, Lakhandei, Manusmara and few other minor streams
AREA DETAIL

S.NO.	Compartment details	Area in hectare
01	Sitamarhi Area	2,294 Km2

Table –base station points

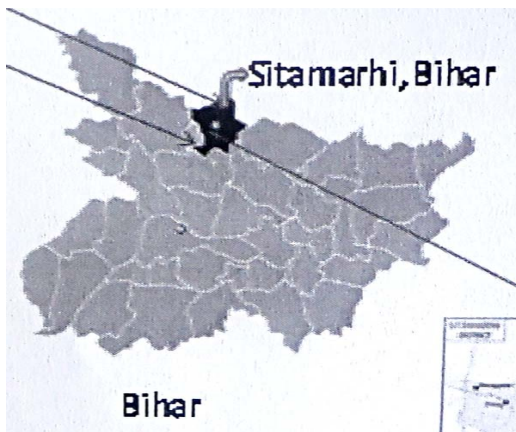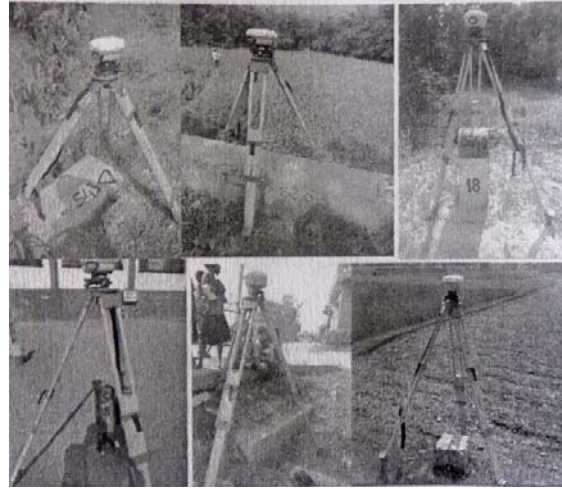| s.no.	Base station	Northing	Southing	Orth. Height	Coordinate quality
1	Sonbasra	2970021.577	358708.8315	79.84	0
2	Bajpatti	2930022.761	362601.4215	60.035	0
3	Majorganj	2960409.493	344824.7671	70.61	0
4	sitamari	2942685.893	350771.5849	63.595	0

BASE STATION POINTS

Fig 3. Sitamarhi map

IV. METHODOLOGY

The data and materials required for the planning and implementation of the research were as follow-
Data- a preliminarily index diagram of base station registration section from the survey of sitamarhi, Bihar.
Equipment's-1)Single frequency differential GPS receivers, 2)Handheld GPS receiver 3)Computer 4)Compact disc 5)Tape measure 6)Tripod stand

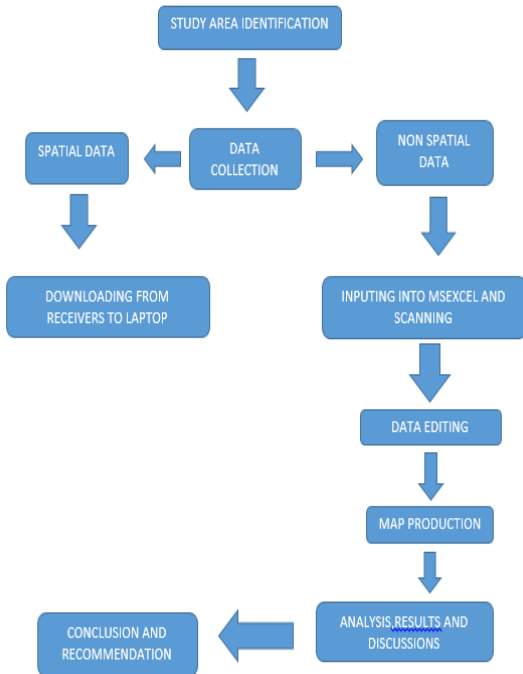

Fig 4. field survey DGPS data collection

Fig 5. Flow chart for DGPS Data Collection and Processing

Processing-all data collected and stored in the receiver relate to the world geodetic system of 1984 (WGS 84) reference ellpipsoid.it is recommended that the data be processed on WGS 84 and converted to the local datum once processing has been completed. The differential correction process was conceptually divided into following steps:-
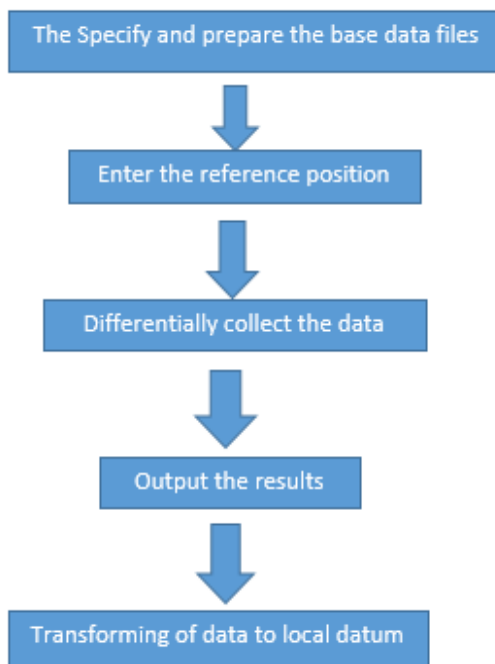
These were executed as functions within the GIS data pro software and are discussed in more detail as follows:-

1). The base data file containing all data collected for the observing session was entered.
2). The reference position of the base station entered related to the WGS-84 ellipsoid there was thus no need for position transformation.
3). When executing the differential correction procedures two files were created. The first was the difference file, which contained the actual correction values for the satellite measurements on an epoch by epoch basis.This file was used to differentially correct the rover file collected during the same time period.The second file was the correction file,which contained the differentially contained rover positions.
4). The differentially corrected rover positions were then exported from GIS data pro software in an usable format. The software automatically averaged all positions collected for each of the parcel corner.
5). The final result were then transformed to the local datum in this case arc 1960 for the georeferencing of the land parcels.
MAP production- The data collected and processed as described above are of little value to the property and land registration system unless they are prescribe in graphical format. This formatting represents the final step and one of the most critical in the DGPS survey technique, since it ensures that the GPS data are compatible with the traditional measurement process currently utilized for parcel mapping in Sitamarhi Bihar.
The collection process was also simultaneously done using handheld GPS receiver where it involved ensuring that the PDOP value was good enough and then picking of the point coordinates.
GEO REFERENCING AND DIGITIZING IN ARC GIS- Georeferencing a raster dataset by definition means to define its location in terms of map projections or coordinates systems. The following steps were my basis for georeferencing the PID as well as the google earth image-
1). A new blank arc map opened and the raster image (pid.jpg) added, this can also be added from arc catalog.
2). Making sure that pid.jpeg was selected layer in the georeferencing toolbar
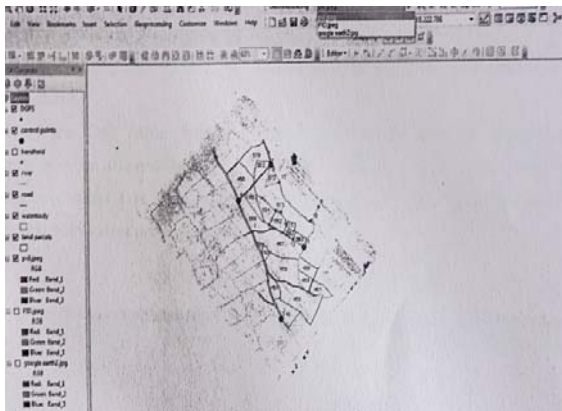
Fig 6. jpg image from georeferencing toolbar

3) Georeferencing –fit to display was selected to bring the pid.jpg image into extent of data view.
4) Add control points tool from georeferencing toolbar was clicked on. Starting at the first selected point of the pid.jpg image, the first control was created by clicking on the center of the intersection of the first point the right clicking and selecting input XY data,typing in the coordinates and finally clicking ok.
DIGITIZING-This refer to the process of converting raster data to vector data. The guidelines that follow were the ones utilized in the creation of the various features which included: line, polygon, and point features.
1) Creating an empty shape file. Arc catalog was opened and the location of your .mxd file browsed to new shape file was created by right clicking on the folder then going new shape file and opening the create new shape file window.
2) Adding a new field in the attribute table.
3) Digitizing land parcels and entering tabular data.
4) To begin editing the editor menu then start editing was clicked on. On being promoted to choose the folder that contained the land parcel shape file I did so and then click Ok. The polygon images were then created by choosing the polygon tool and tracing over the land parcels.
For the point and line features the above steps were repeated but now the point and polyline tools respectively were chosen instead of polygon tool.

V. RESULT ANALYSIS

Fig 7. processing of base station Lat/Long.in Leica geo office software
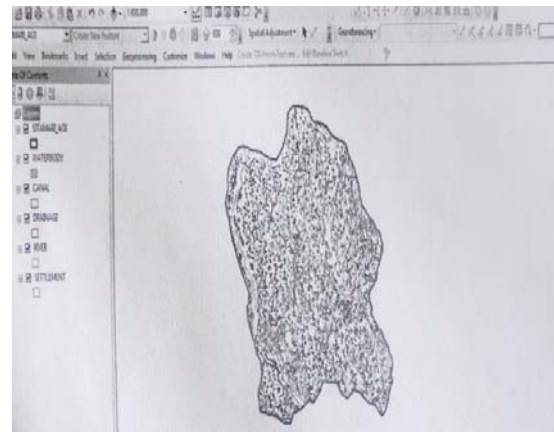

Fig 8. Processing of survey data in Arc GIS showing water body, canal, drainage, river, settlement area in sitamarhi, Bihar
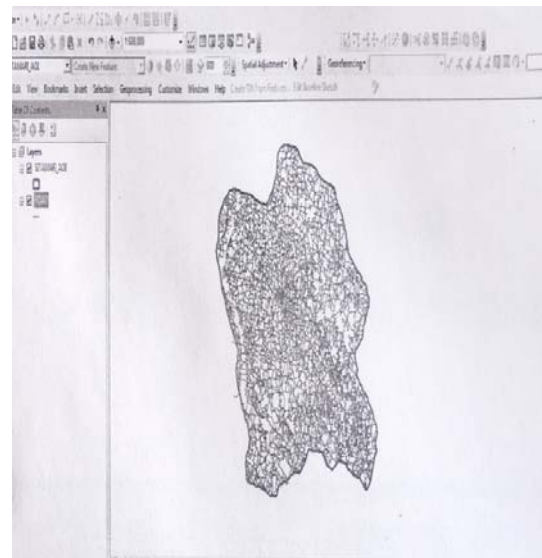

Fig 9. processing of survey data in ARC GIS showing all roads in Sitamarhi, Bihar
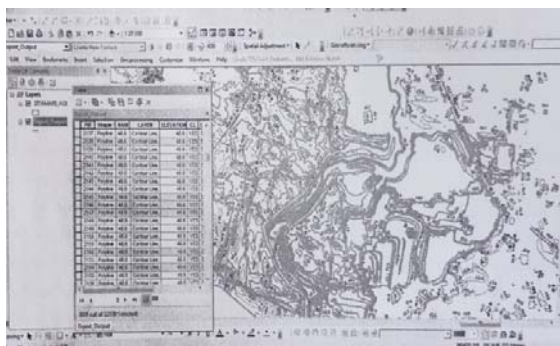
Fig 10. ARC map

VI. CONCLUSIONS

The application area using DGPS has proven it to be a useful tool for general boundary georeferncing and fixation if the needed precautions are adhered. The DGPS technique employed in the determination of the 3-D coordinates of the parcel corners yielded acceptable results. The handheld results were not accurate enough.

From the analysis carried out, the following results were obtained, a percentage mean difference of -10.93% and 15.4% in the eastings and northings respectively, for the DGPS and handheld coordinates.

The northings showed a much higher difference compared to the Eastings. The two sets of coordinates did show strong correlation but their position difference proved the difference between them to be significant.from the calculated position difference between positions obtained using the DGPS and those using handheld values as high as 8m were obtained. Among the 13 positions only two positions which were less than 3m which is usually the survey accuracy for the general boundary surveys.

This helps conclude that the handheld coordinates do not meet the desired boundry tolerance distance for the fixation of the general boundaries. Handheld GPS is cheaper compared to the DGPS receivers but their use would not yield acceptable results.DGPS receivers are therefore the most efficient and effective.

VII. ACKNOWLEDGMENT

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