Ultra Resolution UAV based Geo-ICT enabled

PROPERTY TAX MANAGEMENT
for Municipal Council Bhiwani (MCB)

Applied in ‘Category 6 - Excellence in Adopting Emerging Technologies

Date: 27.02.2019

District Administration and Municipal Council of Bhiwani

Haryana Space Applications Centre
WHY UAV? THE JOURNEY DURING LAST FOUR YEARS

- Our efforts on standardizing UAV flights for governance applications
  - The property tax assessment: Importance and problems
  - Addressing solution

- The spin-offs and other applications from our efforts
  - Mining, Agriculture, Industry (Cluster devpt)
PROBLEM

70 square kilometres
60,000+ known properties
21.75% avg tax collection
struggling with property tax assessment
many properties not assessed
huge revenue losses
Problems of addresses
CAUSES

- Lack of legacy data of properties incl. dimensions
- Rampant corruption & rent seeking during survey
- Faulty assessment & addresses leading to arrear accumulation
- No system available to penalize defaulting owners
- Manual preparation of demand notices & bills
- Manipulation of records, tampering & omissions in sending demand notices.
MUNICIPAL COUNCIL OF BHIWANI IS NOT THE ONLY ONE FACING THESE PROBLEMS....
ULTRA RESOLUTION UAV BASED GEO-ICT ENABLED PROPERTY TAX MANAGEMENT SYSTEM

OBJECTIVES:

- Cost-effective UAV based Aerial Mapping
- Geo-ICT enabled fresh Property Tax Survey
- Real-time Tax Collection / Payment Status
- Monitoring Tax Collection ward wise on a Dashboard
- Payment Gateway implementation as at citizen centric service
- Implementation of Grievance Redressal System
Acquisition of ortho-rectified images from a 42-MP camera on a hybrid vertical takeoff & landing drone.

The outputs of the process:

- 5 cm ultra-high res 3-band true colour orthomosaic
- 5 cm High resolution digital surface model
- 5 cm High resolution digital terrain model
- Contours with 50 cm interval
METHODOLOGY

• A smartphone-based solution from ESRI named Collector for ArcGIS was used for the survey purposes.

• A feature access service with sync enabled technique to work in offline mode was deployed using cloud technology.

• An ArcSDE based geodatabase was created with the necessary domains and fields to facilitate the survey team to allow them to collect the data with minimum entry efforts.
Yield: Coverage of 90 Km2 in two days

Accuracy:

Horizontal: +/- 10 cm  Vertical: +/- 26 cm

Endurance: +90 minutes

Wind Resistance: 8 m/s (~ 29 Kmph)

COST: Rs. 11,000 per Sq.Km.
• HARSAC along with Science & Technology Park, Pune (DST, GOI) have evolved the process of UAV data capturing, processing and handling.

• Efforts to standardize the UAV protocol started in 2015 with 200 ha’s of coverage per flight to 2000 ha’s of coverage in 2017-18.
2015

- Fixed wing UAVs Project
  UDAN - Gurugram

- Low endurance, RTK Based,
  24 MP Sensor

- Electro-magnetic Fields from
  High Tension Wires

- Accuracy Depends
  on Line of Sight

Rs. 35,000/km
200Ha/flight

Take-off and Landing
STAGE-1 UAV SURVEY OCT-NOV 2017

UAV INNOVATION 2015

Fixed wing UAVs Project UDAN - Gurugram

HIGH CRASH RATE
2016
Dual Propeller
UAV

Low endurance, RTK Based, 24 MP Sensor
To avoid EMF from High Tension Wires
Accuracy Depends on Line of Sight
Rs. 18,000/km
400Ha/flight

STAGE-1
UAV SURVEY
OCT-NOV 2017
UAV INNOVATION

TAKE-OFF

Take-off and Landing
UAV INNOVATION

2017 Hybrid VTOL

- Substantially increase safety
- Hybrid Vertical Take Off and Landing
- Stabilized 42 Megapixel Sensor
- On board Post Processing Kinematics (PPK)

Rs. 11,000/km
2000Ha/flight
2017
Hybrid VTOL

UAV

High endurance, 42 MP Sensor
PPK - Provide 10 cm & better accuracy without dependency of line of sight

Safety: Vertical take off and landing – practically operate from 10 x 10 meters site
Superior image quality due to 42 MP stabilised sensor
PPK substantially reduces the need for high number of Ground Control Points (GCPs) – reduces time and costs
Easy of Operation

Rs. 11,000/km
2000Ha/flight
UAV INNOVATION

STAGE-1 UAV SURVEY
OCT-NOV 2017

2017 Hybrid VTOL UAV

High endurance, 42 MP Sensor

PPK - Provide 10 cm & better accuracy without dependency of line of sight

Rs. 11,000/km 2000Ha/flight

Take-off

Landing
PPK TECHNOLOGY

GPS

GNSS
Base Receiver

GPS

Rover Receiver

Receiver estimates position, carrier phase ambiguities and other errors

A PPK Algorithm Filter removes all errors between the two sources

Satellite orbit and clock corrections are estimated based upon reference network data
3D- POINT CLOUD
STAGE-1 UAV SURVEY  
OCT-NOV  
2017

UAV INNOVATION

2015
Fixed wing UAVs Project
UDAN - Gurugram

Low endurance, RTK Based, 24 MP Sensor
Electro-magnetic Fields from High Tension Wires
Accuracy Depends on Line of Sight

Rs. 35,000/km  
200Ha/flight

2016
UAV
Dual Propeller

Low endurance, RTK Based, 24 MP Sensor
To avoid EMF from High Tension Wires
Accuracy Depends on Line of Sight

Rs. 18,000/km  
400Ha/flight

2017
UAV
Hybrid VTOL

High endurance, 42 MP Sensor
PPK - Provide 10 cm & better accuracy without dependency of line of sight

Rs. 11,000/km  
2000Ha/flight
STAGE-1 UAV SURVEY OCT-NOV 2017

UAV INNOVATION

IMPROVED RESOLUTION
STAGE-1 UAV SURVEY OCT-NOV 2017 UAV INNOVATION
STAGE-2
UAV DATA
PROCESS

Property Location & its Info

Geotagged Field Photograph

Ownership details

<table>
<thead>
<tr>
<th>Ownership Details (1 features, 0 selected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership Type</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Individual</td>
</tr>
</tbody>
</table>

Floor Details

<table>
<thead>
<tr>
<th>Floor Details (2 features, 0 selected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor Type</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>First Floor</td>
</tr>
<tr>
<td>Ground Floor</td>
</tr>
</tbody>
</table>
STAGE-3
GEO SPATIAL DATABASE

JAN 2018
STAGE-4 WEB PORTAL

GRIEVANCE REDRESSAL SYSTEM

FEB-JUNE 2018

Grievance reporting - Online

Grievance Registration

Document Checklist for Grievance reporting

1. Rectification of Plot Area
   a) Application
      b) Sale/Deed/Consent/Demand Letter of SPIN or SPIDD
      c) Consent/No objection from the owner of the land

2. Rectification of Carpet Area
   a) Application
      b) Sale/Deed/Consent/Demand Letter of SPIN or SPIDD
      c) Consent/No objection from the owner of the land

3. Rectification of Category - (Building Use)
   a) Application
      b) Occupation Certificate
      c) Site Inspection Report showing actual use of land
      d) Sale/Deed/Consent/Demand Letter of SPIN or SPIDD

4. Rectification of Property - Usage from Rent to Self
   a) Application
      b) Income Tax Return
      c) Site Inspection Report showing actual use of land

5. Change of Property Address
   a) Application
      b) Property Ownership Documents

6. Rectification of Category - (Building Use from Commercial to IT)
   a) Application
      b) Occupation Certificate

7. Rectification of Property: Usage from Residential to IT
   a) Application
      b) Occupation Certificate
      c) Site Inspection Report showing actual use of land
      d) Property Ownership Documents with complete details of building area

OTP verification

Verify Mobile Number

Enter your mobile no.: [ ]

Generate OTP

Type of Grievances

- Rectification of Plot Area
- Rectification of Category - Building Use
- Rectification of Carpet Area
- Rectification of Property Usage from Rent to Self
- Change of Property Address
- Rectification of Category - (Building Use from Commercial to IT)
- Rectification of Property: Usage from Residential to IT
- Property Ownership Documents
## Grievance Assignment

### Zone 2

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Date Submitted</th>
<th>Grievance No.</th>
<th>Property ID</th>
<th>Owner Name</th>
<th>Subject</th>
<th>Responsible User</th>
<th>Assign</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2019-01-16</td>
<td>GRI-641</td>
<td>71C495U17</td>
<td>Jai Pal Katari</td>
<td>1: Rectification of Plot Area 2; 2: Correction in Name; 3: Change of Property Address</td>
<td>ZTO</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2019-01-16</td>
<td>GRI-639</td>
<td>74C381U163</td>
<td>Sudesh Kumari</td>
<td>1: Rectification of Plot Area 2; 2: Correction in Name</td>
<td>ZTO</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2019-01-16</td>
<td>GRI-643</td>
<td>49C13U3</td>
<td>Prem Motors Private Limited</td>
<td>1: Correction in Name</td>
<td>ZTO</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2019-01-15</td>
<td>GRI-635</td>
<td>80C164U15B</td>
<td>Shelly Mittal</td>
<td>1: Rectification of Plot Area 2; 2: Rectification of Category(Building Use) 3: Correction in Name</td>
<td>ZTO</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2019-01-15</td>
<td>GRI-636</td>
<td>36C1645U136G</td>
<td>PATASO DEVI</td>
<td>1: Correction in Name</td>
<td>ZTO</td>
<td></td>
</tr>
</tbody>
</table>

Showing 1 to 5 of 5 entries

[Dashboard](#)  [Pending Grievance](#)  [Waiting For Approval](#)  [In Objection State](#)  [Grievance Report](#)  [Reassign](#)  [Find Grievance](#)  [Add New Sub ID](#)  [Correction Module](#)  [Delete ID](#)  [Users Management](#)

**STAGE-4 WEB PORTAL**

**FEB-JUNE 2018**

**GRIEVANCE CORRECTION MODULE**
## Grievance Report/Status

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Date Submitted</th>
<th>Date Assigned</th>
<th>Grievance No.</th>
<th>Property ID</th>
<th>Name</th>
<th>Subject</th>
<th>Responsible User</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2018-11-28</td>
<td>2019-01-10</td>
<td>GRI-284</td>
<td>59C919U194</td>
<td>Rajesh</td>
<td>1: Rectification of Plot Area 2: Correction in Name</td>
<td>USER</td>
<td>REJECTED</td>
</tr>
<tr>
<td>2</td>
<td>2019-01-07</td>
<td>2019-01-10</td>
<td>GRI-557</td>
<td>42C353U61</td>
<td>Rakesh</td>
<td>1: Rectification of Plot Area</td>
<td>CLERK 6</td>
<td>IN PROGRESS</td>
</tr>
<tr>
<td>3</td>
<td>2018-12-18</td>
<td>2019-01-02</td>
<td>GRI-405</td>
<td>74C381U163</td>
<td>NIDHI BANSAL WIFE OF BHARAT BANSAL</td>
<td>USER</td>
<td>REJECTED</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2018-11-20</td>
<td>2018-11-30</td>
<td>GRI-228</td>
<td>78C1029U99</td>
<td>Sanjeev Kumar</td>
<td>1: Rectification of Plot Area</td>
<td>USER</td>
<td>REJECTED</td>
</tr>
<tr>
<td>6</td>
<td>2018-12-20</td>
<td>2019-01-10</td>
<td>GRI-420</td>
<td>14C1007U544</td>
<td>NEERJA WADHWAN</td>
<td>1: Rectification of Plot Area 2: Correction in Name</td>
<td>USER</td>
<td>REJECTED</td>
</tr>
<tr>
<td>7</td>
<td>2018-12-27</td>
<td>2019-01-12</td>
<td>GRI-476</td>
<td>14C337U238</td>
<td>Col. J.K.V Singh and Surender Mahindru</td>
<td>1: Correction in Name</td>
<td>OWNER</td>
<td>APPROVED</td>
</tr>
</tbody>
</table>
## Grievance Report/Status

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>Date Submitted</th>
<th>Date Assigned</th>
<th>Grievance No.</th>
<th>Property ID</th>
<th>Name</th>
<th>Subject</th>
<th>Responsible User</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2018-11-28</td>
<td>2019-01-10</td>
<td>GRI-284</td>
<td>59C919U194</td>
<td>Rajesh</td>
<td>1: Rectification of Plot Area 2: Correction in Name</td>
<td>USER</td>
<td>REJECTED</td>
</tr>
<tr>
<td>2</td>
<td>2019-01-07</td>
<td>2019-01-10</td>
<td>GRI-557</td>
<td>42C353U61</td>
<td>Rakesh</td>
<td>1: Rectification of Plot Area</td>
<td>CLERK 6</td>
<td>IN PROGRESS</td>
</tr>
<tr>
<td>3</td>
<td>2019-12-10</td>
<td>2019-01-02</td>
<td>GRI-405</td>
<td>74C381U163</td>
<td>NIDHI BANSAL WIFE OF BHARAT BANSAL</td>
<td>1: Rectification of Plot Area 2: Correction in Name</td>
<td>USER</td>
<td>REJECTED</td>
</tr>
<tr>
<td>4</td>
<td>2019-01-09</td>
<td>2019-01-16</td>
<td>GRI-587</td>
<td>26C569U302P178</td>
<td>Dale Ram</td>
<td>1: Rectification of Plot Area</td>
<td>TI</td>
<td>OBJECTION</td>
</tr>
<tr>
<td>5</td>
<td>2018-11-20</td>
<td>2018-11-30</td>
<td>GRI-228</td>
<td>78C1029U99</td>
<td>Sanjeev Kumar</td>
<td>1: Rectification of Plot Area</td>
<td>USER</td>
<td>REJECTED</td>
</tr>
<tr>
<td>6</td>
<td>2018-12-20</td>
<td>2019-01-10</td>
<td>GRI-420</td>
<td>14C1007U544</td>
<td>NEERJA WADHAWAN</td>
<td>1: Rectification of Plot Area 2: Correction in Name</td>
<td>USER</td>
<td>REJECTED</td>
</tr>
<tr>
<td>7</td>
<td>2018-12-27</td>
<td>2019-01-12</td>
<td>GRI-476</td>
<td>14C3375U238</td>
<td>Col. J.K.V Singh and Surender Mahindru</td>
<td>1: Correction in Name</td>
<td>OWNER</td>
<td>APPROVED</td>
</tr>
</tbody>
</table>
### GRIEVANCE CORRECTION MODULE

**STAGE-4 WEB PORTAL**

**FEB-JUNE 2018**

<table>
<thead>
<tr>
<th>No.</th>
<th>Date Submit</th>
<th>Gri No</th>
<th>Property ID</th>
<th>Owner Name</th>
<th>Mobile No</th>
<th>Locality</th>
<th>Subject</th>
<th>Responsible User</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2016-11-28</td>
<td>GRI-284</td>
<td>9C919U194</td>
<td>Rajesh</td>
<td>9699941099</td>
<td>Rajeov Nagar</td>
<td>1: Rectification of Plot Area 2: Correction in Name</td>
<td>USER</td>
<td>REJECTED</td>
</tr>
<tr>
<td>2</td>
<td>2016-11-28</td>
<td>GRI-285</td>
<td>9C919U194</td>
<td>Rajesh</td>
<td>9699941099</td>
<td>Rajeov Nagar</td>
<td>1: Rectification of Plot Area 2: Correction in Name</td>
<td>CLERK 6</td>
<td>OBJECTION</td>
</tr>
</tbody>
</table>

Showing 1 to 2 of 2 entries

---

**Enter Grievance Number/Property ID/Mobile No/Responsible User**

**Search:** 9C919U194
STAGE-4 WEB PORTAL

FEB-JUNE 2018

Correction Form

1. Ownership Related
- Owner Name: Rajesh
- Gender: M
- Relation Type: null
- Relation Name: null
- Mobile Number: null
- Email Id: null

Last Updated on: N/A

2. Building Details
- Floor Type: GF
- Property Type: House
- Property Uses Type: R
- Property Tax: 1400
- Floor wise Covered/Carpet Area(Sq. Ft.): 975
- Total Annual Property Tax: 1400

Last Updated on: N/A

3. Arrear Details
- Property Tax: 28317
- Fire Tax: 0
- Interest on arrear up to 31-03-2017: 28623
- Interest on arrear 18% on (2017-18): 5097
- Total Arrear: 62037
- Current Property Tax: 1400
- Current Fire Tax: 0
- Total: 1400
- Bill Amount: 63437
- Rebate Amount: 0
- 1% Rebate: 0
- Current Year Total Collection: 0
- Payable Amount: 63437
- Exemption Amount: 0
- Exemption Remarks: null
- Special Rebate Amount: 33720
- Payable amount till 30-06-2018: 29717

Remarks: N/A
Kindly attach final approved document before updating data.

Choose file: No file chosen
Last Updated on: N/A Update Data
Advance Correction Module

Delete My Property

Enter Property ID: 59C919U194

Note: You can set
In case of delay in updated data reflection and in abnormal behaviour press reset button.
Once a property is deleted, its status can not be reverted back!

Ownership Related

Unique Property Id: 59C919U194
Owner Name: Rajesh
Gender: M
Relation Type: null
Relation Name: null
Mobile Number: null
Email Id: null

Is Editable

Kindly attach final approved document before deleting property data.

Choose File: No file chosen

Last Updated on: N/A
Delete Property
PROPERTY TAX BILL

STAGE-5
DEPLOYMENT OF CITIZEN SERVICES

JULY 2018
<table>
<thead>
<tr>
<th>Year</th>
<th>Total Properties</th>
<th>Demand (Rs)</th>
<th>Recovery (Rs)</th>
<th>Non recovered (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>1150</td>
<td>2145000</td>
<td>440000</td>
<td>1705000</td>
</tr>
<tr>
<td>2016-17</td>
<td>1630</td>
<td>2560000</td>
<td>896000</td>
<td>1664000</td>
</tr>
<tr>
<td>2017-18</td>
<td>2721</td>
<td>4550000</td>
<td>1820000</td>
<td>2730000</td>
</tr>
</tbody>
</table>
impact on Year wise assessment

- Ward 05

- 2015-16: INR 21,45,000.00
- 2016-17: INR 25,60,000.00
- 2017-18: INR 45,50,000.00

(yearwise assessment)
• The service delivery channel for the user is a single window web enabled solution for assessing the tax, payment of tax and grievance redressal also.

• The complete system is paperless and the user can view their property details, register any changes in their data through online portal and even can view the progress of their file online.

• The system is 24 x 7 working the user can access the same anytime.

• The complete solution is online acting as a single window solution for assessing the tax, payment of tax and grievance redressal also so the user need not go to any place and get all the facilities on his/her mobile phone.
• The solution is completely online and driven by a single window for assessing the tax. Data validation, generation of demand notices and grievance redressal is through online portal.

• The entire system is paperless and the user can view their property details, register any changes in their data through online portal. He can even view the progress of their grievance redressal file online along with the officer’s details who is handling the file at that moment.
OVERVIEW OF ADDRESSING ALGORITHM

EIGHT DIGIT UNIQUE ID

- Shortest Property ID (8 Digit)
- 3-Dimensional
- Unique ID can be generated for every 2 meter land
- It can also be used as Postal address
- Property ID is generated using Location Information through the encoding process of Algorithm using numbers and letters

Locating on Map

<table>
<thead>
<tr>
<th>Latitude</th>
<th>Longitude</th>
<th>Floor No</th>
</tr>
</thead>
<tbody>
<tr>
<td>28° 49.227</td>
<td>76° 09.923</td>
<td>Ground Floor</td>
</tr>
</tbody>
</table>

Encoding Algorithm

G0973US0
RESEARCHING TO DEVELOP TRANSPARENT, ACCOUNTABLE, CITIZEN CENTRIC, GEO-ICT ENABLED URBAN GOVERNANCE DIGITAL PLATFORM

- PROPERTY TAX MANAGEMENT
- DISEASE CONTROL & HEALTH
- DISASTER MANAGEMENT
- REVENUE RECORDS
- MONITORING MINING
APPLICATIONS
LAND INFORMATION MANAGEMENT

High-Resolution Satellite Image
50cm

Project UDAAN
5cm Resolution
APPLICATIONS
MITIGATION OF VECTOR BORNE DISEASES
COMPARISON WITH SATELLITE DATA

50 cm resolution Satellite vs 5cm UAV data
LAND RECORDS

APPLICATIONS

MUSAVI Revenue Maps

DIGITISATION Scanning & Vectorisation

GIS Basemap with Revenue Information

GEO REFERENCE Basemap linked to GPS

PUBLIC DOMAIN Accurate Revenue Records

JAMABANDI Revenue Records

DIGITAL ROR
Legacy Data Validation

- Disputes Resolved: 758
- Property Tax Base Increased from 32,875 to 60,786
THANK YOU