Pilot on developing smart biometric identification platform for bovines – an experience from small holders dairy system in India

Presented By

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Bovine Identification

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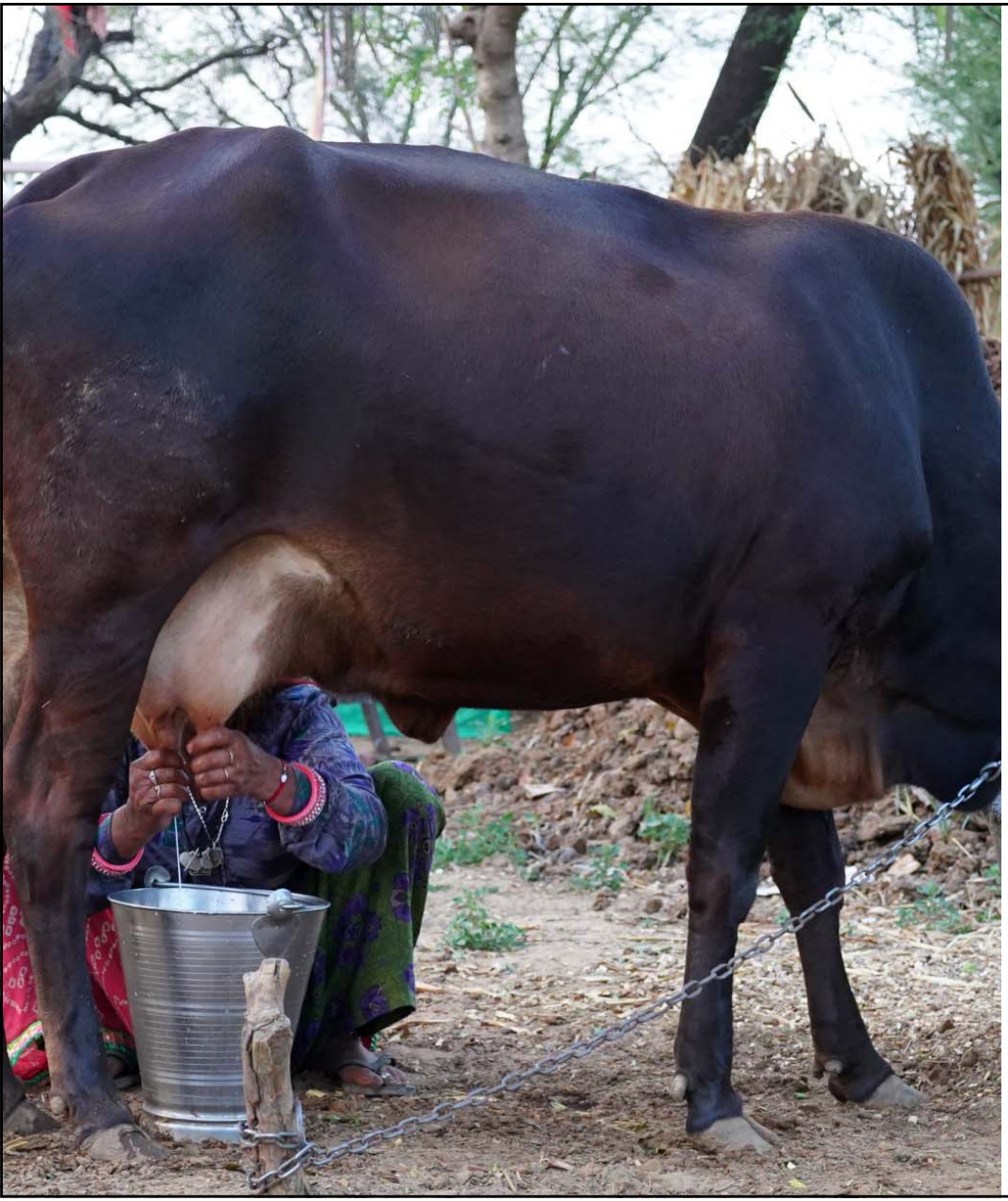
Identifying Individual animal accurately with the help of unique identifier or marker

➢Need of Bovine Identification

- Controlling disease outbreak
- Vaccination management
- Production management
- Traceability
- Assigning ownership

➢Existing practice for animal identification in India : ear tags with 12 digit UID



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BIOMETRIC IDENTIFICATION IN SMALL HOLDERS DAIRY SYSTEM

WHY ?????

Dairying in India

Huge bovine population (302.37 million) with recognized 50 cattle and 17 buffalo breeds

(*www.nbagr.res.in*)

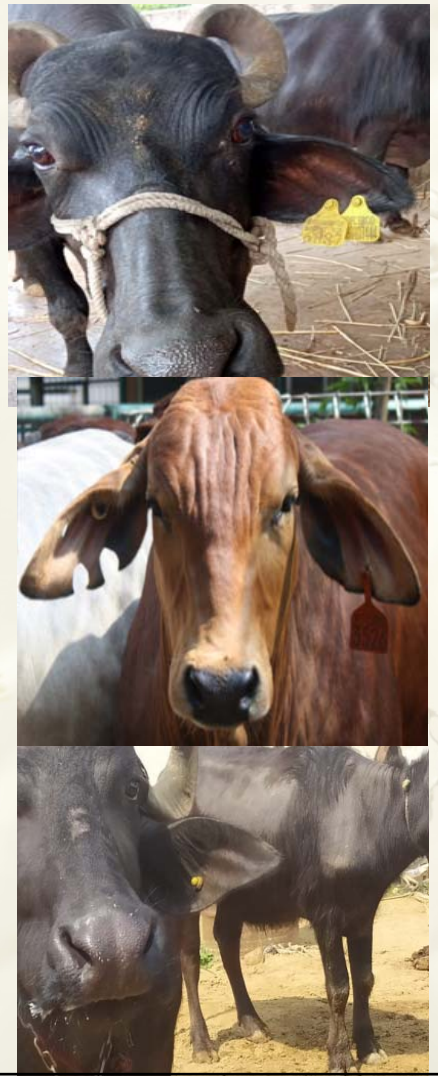
Presence of multiple stake holders (Govt., Milk Cooperatives, NGOs, Trust)

Small holding of a farm : average herd size with 2-5 animals, combination of cows and buffaloes

Low capital investment, the short operating cycle and steady returns - made dairying a preferred supplementary livelihood option for rural households in India.

Typical herd size in India

Challenges of Plastic Ear Tag based Identification System



- Do not perform well in Long term traceability
- Loss of ear tags
- High chances of detachment during open grazing
- High chances of identity theft
- RFID ear tags are expensive
- Loss of identity hinders effective delivery of Govt. schemes

Objective

to develop an end-to-end solution for bovine identification that is accurate, user-friendly, easily accessible, cost effective and capable of building reliable livestock traceability systems.

ACKNOWLEDGEMENT

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For developing AI based application

statlogic

DVARA E-Dairy

Statlogic India Pvt. Ltd.

Dvara e Dairy solutions

ACKNOWLEDGEMENT

For capturing image & other meta data

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KERALA LIVESTOCK DEVELOPMENT BOARD

URMUL TRUST

Saras

Dudhsagar The Pride of India

Sabarmati Ashram Gaushala
(Managed By NDDB Dairy Services)

Animal Breeding Research Organization

11 Implementing agencies , 14 Projects covering 6 cattle & 2 buffalo breeds, 110 field supervisors & respective Monitoring officers from NDDB

Various phases of the Pilot Project

Phase-1 (Developing smart image capturing app)

- Training of the field supervisors to make them acquainted with the muzzle image capturing technique using Android phone

- Capturing muzzle images along with facial features using initial version of image capturing app

- Capturing other metadata like geo-location of the animal, timestamp, ear tag number of the animals, owner details etc. & data uploading

- Quality control of the images

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Various phases of the Pilot Project

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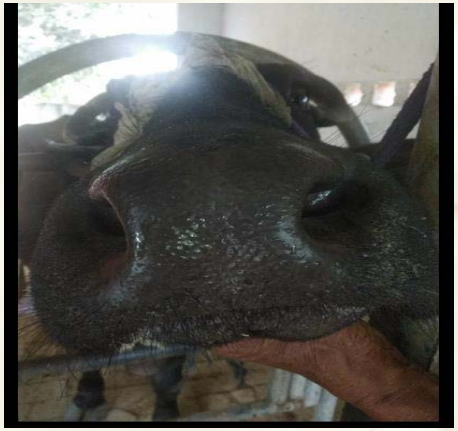
Major Challenges in obtaining good quality images



1. Bad light condition

2. Image out of focus

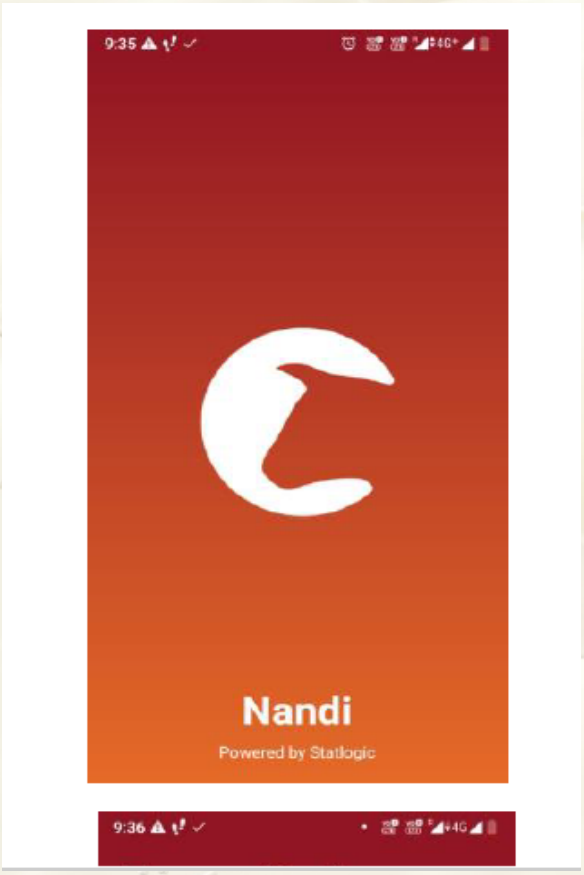
3. Image taken far from the animal

4. Partial muzzle

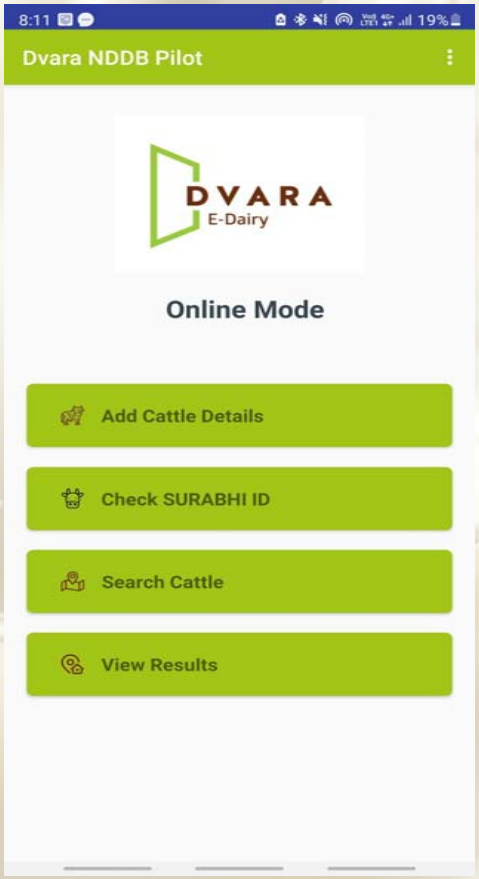
- Initially, >70% of the captured images found unfit for further processing

Steps followed under the Pilot Project

- Upgradation of image capturing app on the basis of feed back received from the field
- Development of the smart Artificial Intelligence (AI) based image capturing app with auto quality control features

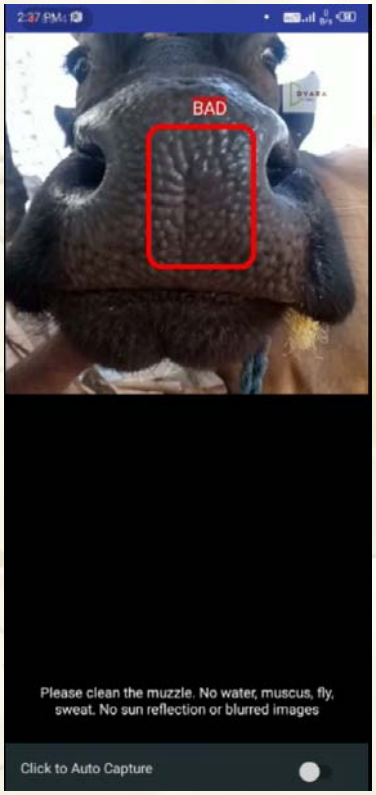


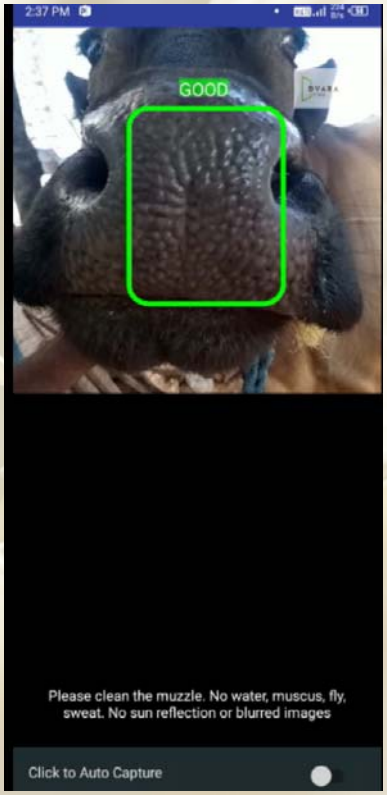
Nandi app - Statlogic



Dvara app – Dvara E Dairy

Quality Control at farmer's doorstep





Onboarding of Good quality images from the field for further processing raised upto a level of 98%

Capturing Muzzle image

~ 2 feet distance

Minimum Requirement of Smart Phones

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- Operating system : Android 8.0 or higher version
- Main Camera : 8 MP
- RAM :3 GB
- Processor: Quad-core 1.2 GHz

Various phases of the Pilot Project

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Phase-2 (Image upload & Validation of the data)

- Finally capturing of 10050 muzzle images with facial features from 2030 Cattle and Buffaloes using android mobile phone & on boarding the data into server

- Rigorous Cross validation validation of data

Image enhancement & Noise Reduction

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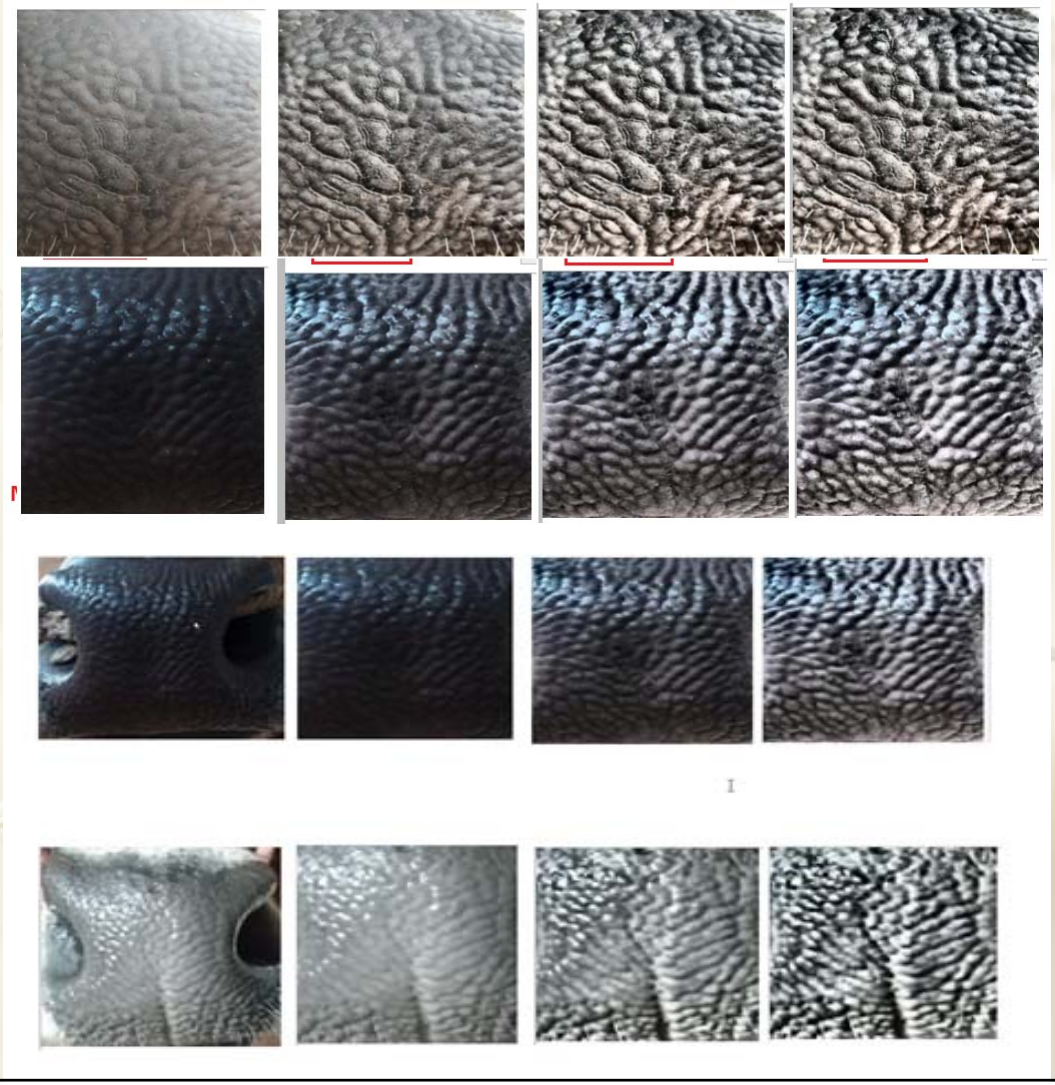

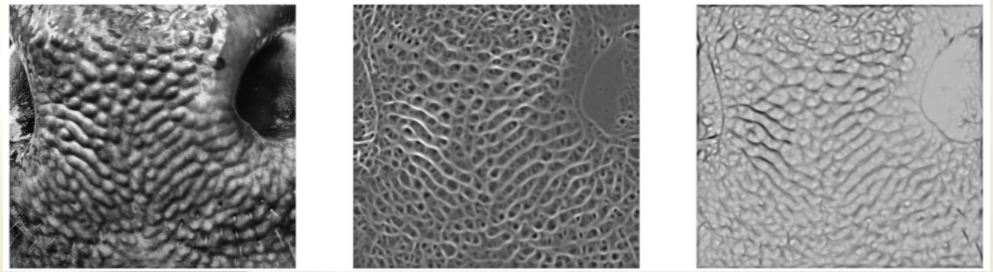

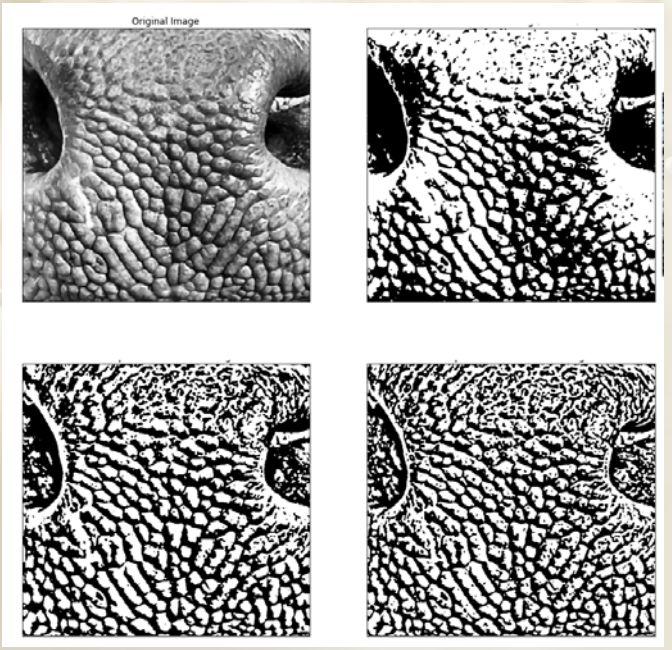

Results obtained from cross validation

- Cross validation carried out on the basis of >200 animals indicated > 90 accuracy in identification of animal on the basis of muzzle & facial image

- Being, one-shot learning model, the accuracy continued to improve Incrementally with the number of verifications.

Major Outcome from the Pilot Study

1. Development of mobile application with the Features – Improved Image Collection, Security, Muzzle Validation

Each image 500kb to 1.2MB

3-6 muzzle images collected for each cattle during onboarding

Only direct image capture, no attach option, auto delete after upload

Offline mode data collection

Built-in data security, no data/ image access and tampering

Validated users

Auto/manual upload on better network connectivity

Muzzle Match test online/offline mode with report generation

2 (a). Successful handling o the corner cases (pigmented muzzle)

Image at reference data base

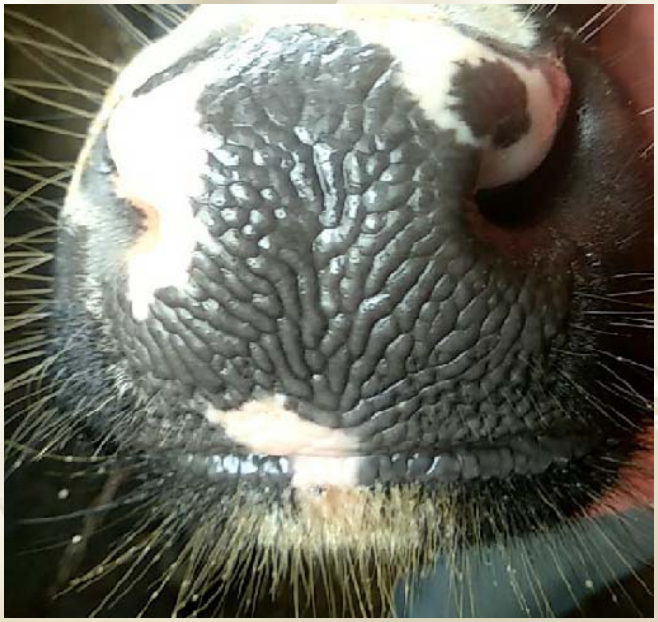

Image used for cross validation

..contd

2(b). Successful handling of the corner cases (different muzzle orientation)

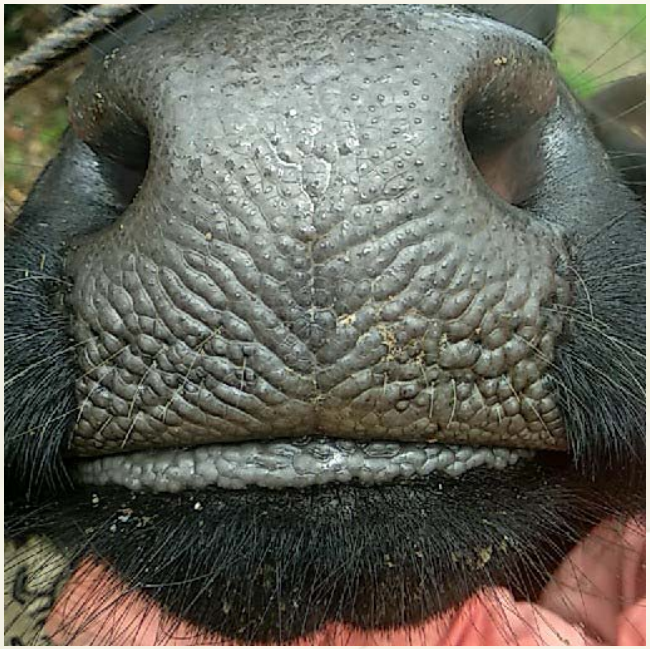

Image at reference data base

Image used for cross validation

..contd

2 (c). Successful handling of the corner cases (light variation)

Image at reference data base

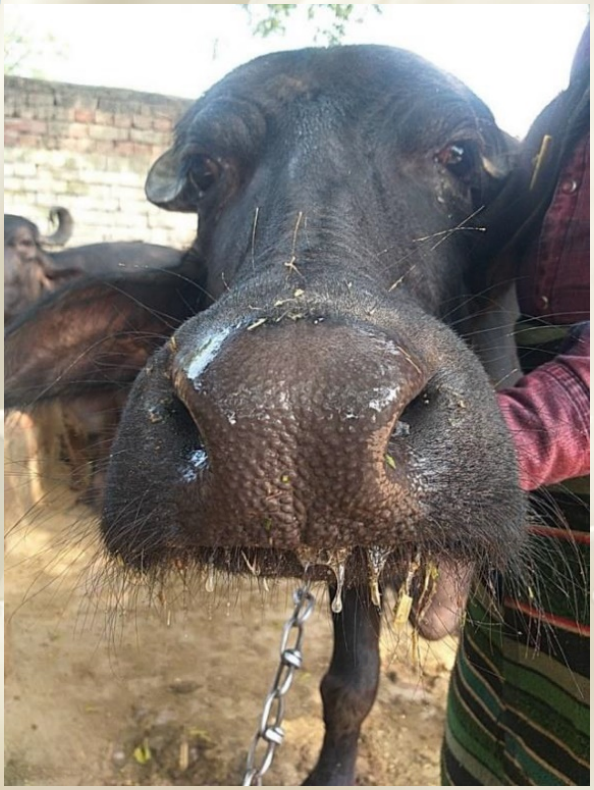

Image used for cross validation

3. Time requirement to process identification

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Case	No of records in DB	Request Time – Best case (Worst case)	DB Query Time	Identification Time	Response Results	Total Time – Best case (Worst case)
2 km radius	10,000	5.001 (30.001)	0.01	0.02	2	7.031 (32.031)
District	2,00,000		0.2	0.4	2	7.601 (32.601)
State	60,00,000		6	12	2	25.001 (50.001)
Entire DB	19,00,00,000		190	380	2	577.001 (602.001)
Entire DB (projected)	30,00,00,000		300	600	2	907.001 (932.001)

There must be separate unique identification number for each bovine biometric record that is different from the 12-digit ear tag number.

CONCLUSION

- This pilot project demonstrated the usability of biometric identification system for bovines owned by smallholder dairy farmers across diverse breeds and geographic conditions as a complementary to existing ear tag based system

- Bovine biometrics integrated with distributed Blockchain may be helpful in establishing a verifiable and secure traceability platform

Our Team Members

R O Gupta

G Kishore

Nilesh Nayee

Krushna M Beura


Thank You


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