System and Method for Crop Mapping and Water Accounting

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Abstract— **This presents system and method of generating dynamic crop maps and water accounting reports via UAV. The invention interfaces a drone with a cloud-based mobile application to determine optimal amount of water required for agricultural per season. The mobile application collects crowd sourced information from farmers, agricultural practitioners, and local authorities. Further, the drone verifies and captures details like field size, location and crops grown, water sources using image processing techniques.**

Computations are made on the collected data in comparison with traditionally recorded statistics to estimate water utilization data. Finally, crop maps and water reports are generated and are available to controlling authority officials for analysing and making an informed decision.

The project gives details about the design and implementation of the proposed invention. Firstly, the app is divided into 3 interfaces: Farmer (for collecting field details), Authority (for verifying the registered details) and Controlling authority (accessing and analysing water reports and crop maps). Local authorities can verify the crowd sourced information via two methods: through drone or manually visiting the site. After that, Google maps API is used to generate crop-type maps for every season. At the backend, water requirement of each crop grown in a particular area is computed along with quantity of crop grown, water source used, soil type of land, temperature etc.

Thus, controlling authority officials can access and analyze these dynamic crop maps and proper

water reports and make informed decisions to ensure optimal use of irrigation water.

Introduction

We developed a System called "Agri Loco" which is an Android application

India is one of the most water-challenged countries in the world. One of the major reasons for falling groundwater levels is inefficient use of water for agriculture.

Traditional techniques of water conveyance, percolation, and excess use of groundwater prevent spatial visualization of water utilization in both major and minor irrigation projects.

Our app: 'Agriloco' calculates water accounts at various spatial and temporal scales of irrigation. This helps in making informed decision during the ensuing crop season and leads to optimal utilization of irrigation water.

Crowd sourced information from farmers, agricultural extension service providers, and local administration is used for generation of crop type maps for a particular irrigation season which in turn helps to produce water accounts.

This would help in proper water accounting and hence providing sufficient and not altered amount of water required in agriculture.

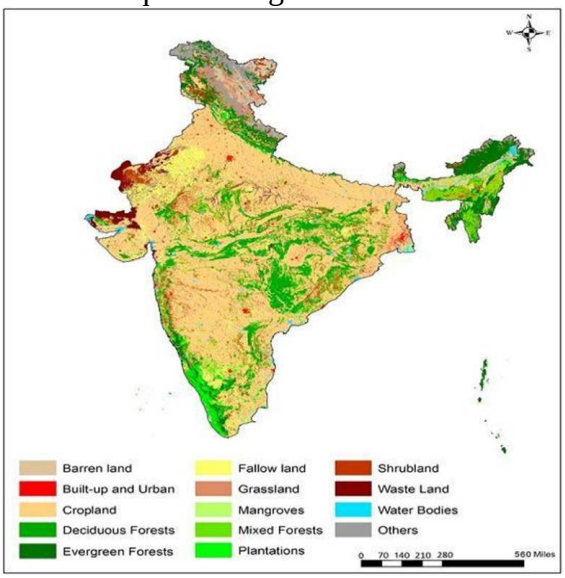


Figure 1: LULC map of India

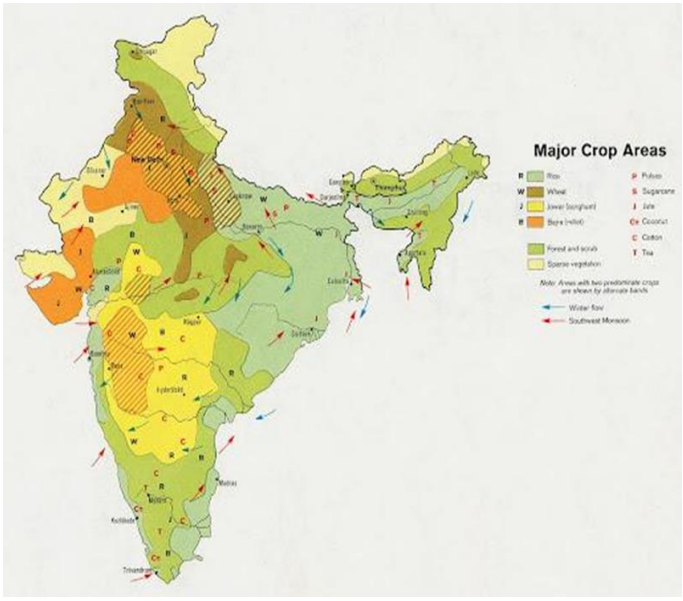


Figure 2: Traditional crop map of India

Scope of the System

The proposed system will be beneficial in a number of ways. The "Agri Loco" is actually about producing water accounts and crop-type maps for every season by crowd sourcing information from farmers on interface 1. Data associated to fields, crops grown, water sources utilized etc. is taken as input.

Our invention: 'Agriloco' is a cloud-based mobile app which consists of 3 interfaces: farmer, authority, water ministry.

- This app produces water accounts and crop-type maps for every season by crowd sourcing information from farmers on interface 1. Data associated to fields, crops grown, water sources utilized etc. is taken as input.

Then this data is verified by local authorities (such as patwari) on interface 2 of the application. This ensures accuracy in preparing maps and water accounts.

How Does Agri Loco Work?

1. Firstly, the mobile application collects crowd sourced information of fields from farmers, agricultural practitioners, and local authorities.

2. Then, controlling authority officials use drone to determine field size, crop type, and location using camera with image processing techniques.

3. This is done to verify the field details and analyze them for preparing reports. Verification can optionally be done manually by visiting the site also.

4. Crop maps are produced based on the details captured using Google maps API.

5. Computations are done at the backend to estimate water utilization data. This is done based on the factors like water requirements of each crop, water sources used, crop grown per area.

6. Finally, controlling authority officials can access and analyze generated crop maps and water reports.

Figure 3: Registration Interface for new Farmer

Figure 4: Login Page for available profiles

What Are Agri Loco Used For?

Crop maps are generated automatically and can be scaled from micro to macro level.
Water reports are available in tabular format for better data statistics.
There is an additional notification feature in the app. The controlling authority can use it to directly notify farmers and local authority for any updates, schedules, or farmer programs.
Google maps used give higher resolution than existing LULC maps with 56m resolution.
App has secure access as unique login credentials are provided to every profile user: farmer, authority, and controlling authority.
Proper water accounting results in optimal use of water.
Mobile app eliminates the pen and paper process and henceforth increases the accuracy, time and cost efficiency of the work.

Literature Survey

Proposed invention presents a system and method of generating dynamic crop maps and water accounting reports. It consists of a drone and a cloud-based android application.
The mobile application collects crowd sourced information of farmers and their respective fields. This includes stakeholders like farmers, agricultural practitioners, and local authorities.
Drone is used to determine field size, crop type, and location using a camera with image processing techniques.
This is done to verify the field details and analyze them for preparing reports. Verification can also be done manually by visiting the site.
After capturing all these details, crop maps are produced using Google maps API.
Computations are done at the backend to estimate water utilization data. This is done based on the factors like water requirements of each crop, water sources used, crop grown per area.
Finally, generated crop maps and water reports can be accessed and analyzed by the controlling authority officials.
Hence, informed decision can be made for optimal utilization of agricultural water

Figure 5: Manual verification of crop

Figure 6: UAV with camera and GPS for Automatic Verification

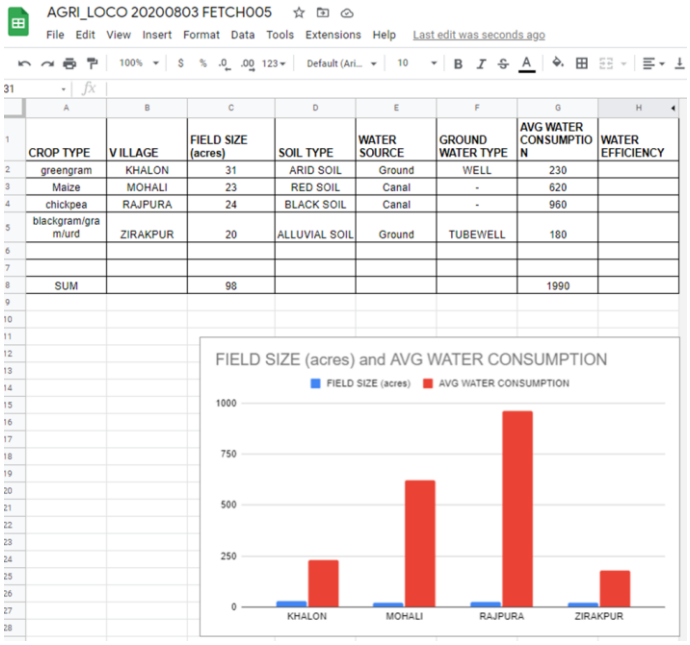
Conclusion

The primary objective of this project work is to develop a System and method for crop mapping and water accounting to estimate optimal water requirements for different seasons.

This aim is achieved by developing a cloud-based mobile application interfaced to a drone.

The invention involves agricultural stakeholders to collect field information at micro-level and then verify and analyse those details through a drone.

This generates scalable crop maps resulting in more precise water accounting reports. Thus, the proposed invention will facilitate controlling authority of India to make informed decision during ensuing crop season for making optimal use of irrigation water



CROP TYPE	V ILLAGE	FIELD SIZE (acres)	SOIL TYPE	WATER SOURCE	GROUND WATER TYPE	AVG WATER CONSUMPTION	WATER EFFICIENCY
greengram	KHALON	31	ARID SOIL	Ground	WELL	230	
Maize	MOHALI	23	RED SOIL	Canal	-	620	
chickpea	RAJPURA	24	BLACK SOIL	Canal	-	960	
blackgram/gram/urd	ZIRAKPUR	20	ALLUVIAL SOIL	Ground	TUBEWELL	180	
SUM		98				1990	

Figure 7: Exported data (water utilisation & crop report)

REFERENCES

[1] [1] Ministry of Human Resource Development, Smart India Hackathon 2020 (sih.gov.in*), 2020.

[2] [2] Satpalda Geospatial Services,

[3] https://www.satpalda.com/blogs/significance-of-land-use-land-cover-lulc-maps, 2018.

[4] [3] Marco L. Napoli, "Beginning Flutter: A Hands-on Guide to App Development", Wrox, First Edition, 2019.

[5] [4] Neil Smith, "Firebase Essentials", CreateSpace Independent Publishing Platform, Second edition, 2017.

[6] [5] Michael Burton, "Android App Development for Dummies", Wiley, Third Edition, 2018

[7] [6] Kumar A., H.S. Sheoran, M. Yadav, R.S. Hooda, Geospatial approach for block wise area estimation of Kharif season crops in Fetehabad district, Haryana (India), Int. J. Sci. Engg. and Tech. Research, Vol 4(1): 148- 153, 2015.

[8] [7] Piotrowski P, Witkowski T, Piotrowski R, Unmanned remote-controlled flying unit, Measurement Automation and Robotics 19: 49-55, 2015.

[9] [8] Unger, J., Reich, M., and Heipke, C., UAV-based photogrammetry: monitoring of a building zone. In ISPRS Technical Commission V Symposium. Riva del Garda, 2014

[9] Siebert, S., and Teizer, J., Mobile 3D mapping for surveying earthwork projects using an Unmanned Aerial Vehicle (UAV) system, 2014.