Reflecting real-time monitoring of Agricultural equipment in Rythu Bharosa Kendra

S.Vasavi
Department of Artificial Intelligence&Data science,
Velagapudi Ramakrishna Siddhartha Engineering college,
vijayawada, India.
vasavi_movva@vrsiddhartha.ac.in

Bhargav Mupparisetty
Department of Artificial Intelligence&Data science,
Velagapudi Ramakrishna Siddhartha Engineering college,
vijayawada, India.
218w1a5436@vrsec.ac.in

NarasimhaReddyVemula
Department of Artificial Intelligence&Data science,
Velagapudi Ramakrishna Siddhartha Engineering college,
vijayawada,India.
218w1a5465@vrsec.ac.in

A.Nageswara Rao
Andhra Pradesh Space Application Center (APSAC),
vijayawada, India.
nrakella@gmail.com

2024 IEEE International Conference on Interdisciplinary Approaches in Technology and Management for Social Innovation (IATMSI) | 979-8-3503-6052-3/24/$31.00 ©2024 IEEE | DOI: 10.1109/IATMSI60426.2024.10503537

***Abstract* - The Rythu Bharosa Kendra (RBK), an initiative by the Andhra Pradesh government, seeks to bolster farming communities by supplying quality seeds, fertilizers, and agricultural supplements while offering vital extension advisories at the village level. To modernize their operations, a proposed automated system will replace manual record-keeping by storing data directly into a database, facilitating seamless facility transactions, and generating comprehensive service reports. By outfitting RBK vehicles with GPS devices and integrating React technology for a user interface, administrators gain real-time insights into vehicle movements, optimize routes, and efficiently monitor the distribution of agricultural resources. This innovative approach not only streamlines RBK's processes but also ensures timely and effective support to farmers while minimizing paperwork and enhancing overall operational efficiency.**

Keywords— Web application, Data management, Geo location system Global positioning System (GPS) React technology, Rythu Bharosa Kendra (RBK).

I. INTRODUCTION

Approximately 62.15% of its working population reliant on agriculture and related pursuits. However, the current scenario sees farmers heavily dependent on private dealers for essential inputs like Seeds, Fertilizers, Pesticides, and farm supplements, leading to potential misinformation and exploitation by these private entities. To address this predicament caused by reliance on private agencies, the Government of Andhra Pradesh has pioneered an innovative approach.This approach that helps farmers from buying seeds to selling the crop, is called "Rythu Bharosa Kendra" (RBK). RBK's were first launched in the state of Andhra Pradesh in October 2019. It integrates all the requirements of the farmers, like Agri labs, seed distribution and many more. Several departments operate under RBK, such as Integrated call centres (ICC), aiding farmers with solutions via phone calls, and Custom Hiring Centres (CHC), providing machinery like sprayers and tractors. With approximately 10,778 RBKs established across key areas, the Community Hiring Centres (CHC) within RBKs offer farm equipment based on land size. However, the absence of a tracking system leads to uncertainty about task completion, causing confusion among CHC members. Manual monitoring of tractor arrivals at CHCs lacks insights for members or the Kisan group. Implementing a system to automate user details entry into databases becomes crucial for monitoring and confirming equipment reach, ensuring efficiency within RBK operations.

A. Objectives of proposed system

- To create a web application that could provide an application for farmers to avail machinery and other facilities.
- To store the details directly into the database so that no intermediate process is required.
- Providing transcripts to the user so that effective use of resources by the RBK and to provide quality of service.
- To live-monitor the vehicles that are given as inputs to the farmers so that no misuse of these machinery take place.

II. LITERATURE SURVEY

Even though Rythu Bharosa Kendra (RBK) acts as one-stop shops for all the farmer's needs at panchayat level by providing many services like pesticides, farm machinery, e-crop booking etc, but there is a lack of transparency in the process of providing these facilities to the farmers. In RBK's collecting the data of the farmer for Application is done manually by the farmer[1]. This rises issues which include hand-written work and later entering the received data into the databases by the members of RBK's manually. Community Hiring Centres (CHC), run by Rythu Bharosa Kendram do not have an organized system for collecting information directly from the user[2]. This is due to no proper Web Application that could meet the demand of monitoring as well as automating the tasks in the RBK.

The information collected later entered into the database[3]. Initially the information is taken using pen and paper only. Later, the collected information is entered into database manually which is a time-consuming process. Community Hiring Centres (CHC) run by RBk's do not have a mechanism to track or monitor the vehicles[4]. Hence, proper analysis on routes of supplement carrying vehicles like Tractors can be known by using GPS.

GPS projects was initiated by US Military in 70's[5] and civil use was allowed from 1980's which allowed GPS to be installed in vehicles. Geocoding [6] enables a user to convert the given address into geo-coordinates that can be represented on a map. A reverse geocoding enables the user to convert geo-coordinates into address. The method is used in many applications of vehicle tracking in present days. The geo-

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coordinates collected by the GPS are transmitted in different ways [7]. Some of the transmitting techniques include Wi-Fi, LoRa etc. A good web-design [8] may decrease the screen time of the user along with increasing the productivity of the user. Hence, a good UI&UX design is always important to make the user understand the way to navigate through the website.

III. METHODOLOGY

A web application serves as an interface between the GPS-based system and the automobiles that require tracking along with the ability to enable the farmers to fill the applications for getting Farm supplements from Community Hiring Centres with ease. The RBK's facilities are being live monitored by means of this online application. React was used in the design of the online interface, giving administrators and farmers alike an easy method to work together efficiently. There are two main sections to the web application: one for farmers and the other for administrators.

The overall proposed system to the mentioned problems is depicted by using a diagram as shown in Fig. 1.

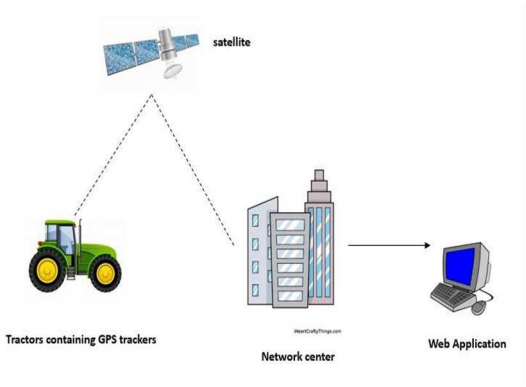

Fig. 1. Proposed System Architecture

Vehicles carrying farm supplements are equipped with GPS modules that gather GPS co-ordinates of the particular place. The design of the GPS tracker is shown in Fig. 2. The GPS device constantly receives information about the location, with the help of satellites. The Node MCU module used to collect the data i.e. the coordinates of the place and send to the cloud. The ESP8622 module transmits the analyzed information, to a server or a cloud-based platform using Networks [9]. The interface is designed to be user friendly allowing users to access real time data from the server and present it in a format that's easy to understand by the user. Users have the option to view vehicle locations and applications status, each farmer applying for how many farm equipment, total count of each farm equipment that is given for the farmers and other relevant information with the help of the website. The location of the vehicle is displayed on an interactive map that specifies the location of that particular farm supplement at that point of time. The tracking will be continuous until the tractor or the farm equipment is returned back to the Community Hiring Centres (CHC) enabling safety and timely delivery of the equipment to farmers.

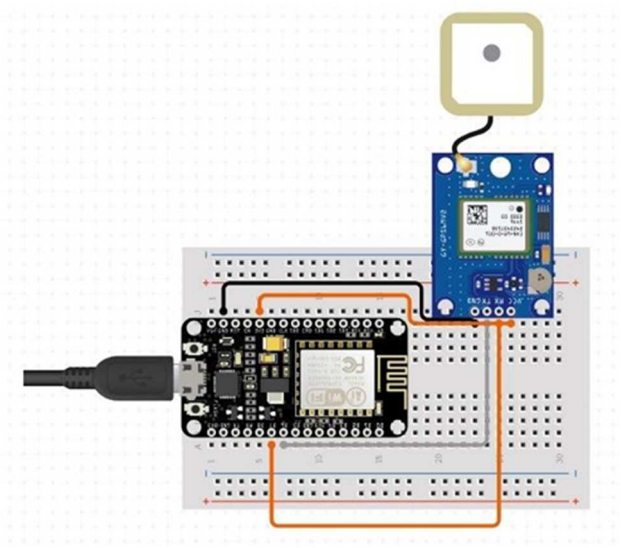

Fig. 2. GPS Tracker Design

The GPS device contains the following components:

- NEO-6M GPS module
- ESP8266 Node MCU

The connections are made to the Node MCU module and NEO-6M module as shown in the figure-2. The GPS tracker after the integration of the parts is shown in Fig. 3.

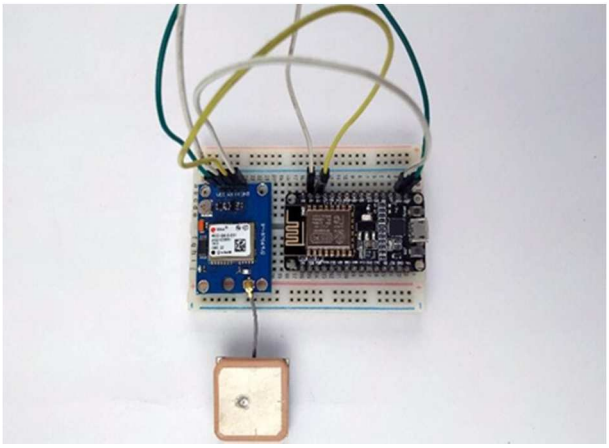

Fig. 3. GPS Tracker

This will be equipped with additional modules like Global System for Mobile Communication (GSM) module or Long Range (LoRa) technology so as to transmit data over distances. This trasmitted data is then sent to the cloud for the storage and then using any end connection like an API, the coordinate data is bought to the web page, then the location is displayed on the map made using java leaflet. Java Leaflet is a popular framework that provides platform for the user to create their own maps for their websites, using the map tiles from Openstreetmap or any other opensource application, then the coordinates are displayed on the map using a marker that indicates the position of the tractor or the farm supplement at that point of time.

Web application

The Yantra Seva Scheme, an Andhra Pradesh government project, is detailed on the web application main screen [10], as depicted in Fig. 4. Anyone may quickly go via the home screen because it is strong and has a straightforward appearance.

Fig. 4. Home page of Web Application

Administrator portal - To enable the administrator and user to retain access control over the data, the web application is divided into two main domains. Certain important activities, such as creating an account for a farmer by gathering his information, are assigned to the administrator. Following the collection of data, an algorithm included into the application creates a unique 12-digit ID which contains the first two digits telling about the location of the farmer and the next digits from the user aadhar number and other are the numbers generated by the pseudo random number generating algorithm for each farmer based on the user's location [11]. The location of the specific vehicle that has been dispatched to the farmer can be viewed by the administrator. In addition, the user has the ability to retrieve helpful data from the database for later use. Fig. 5 flowchart illustrates how each unique identification is created.

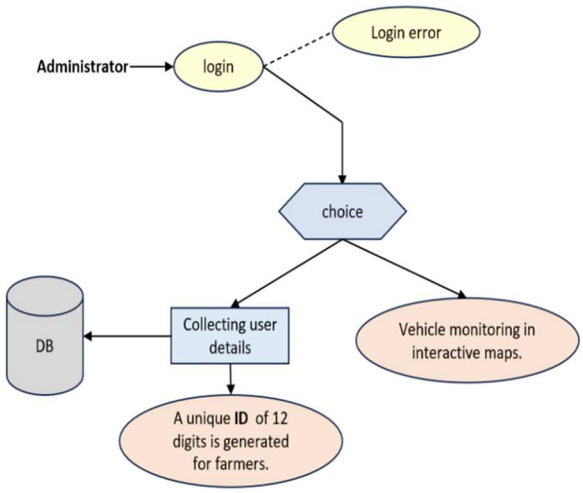

Fig. 5. Process flow of Administrator Portal

The farmer receives a special 12-digit ID when the administrator sets up an account. The administrator is given access to a live page that shows him where the tractors that are leased to the farmers are located.

Real-time vehicle movement may be shown on the map thanks to the GPS coordinates that are continuously sent in by the GPS module that is mounted to the vehicles. Every time a farmer receives a vehicle, the desired farmer ID is linked to the specific MAC (Media Access Control) number of the GPS module that is mounted to that particular vehicle. The administrator registers the particular farmer, then generates the ID of the farmer and gives the ID to the farmer for later use. The web page that is used to create the farmer ID contains an application about the details of the farmers and it is represented in the Fig. 6.

Fig. 6. Farmer account creation

Along with live monitoring the status of the facility is also tracked whether the facility has been completed or not [12] and each time updates the status of the assigned facility. Along with this, administrators are also the access to retrieve the previously stored information from the database about the farm supplements given between two given dates, number of farm supplements applied by a particular farmer and also the count of each farm supplement given until now. The administrator can set the status of the facility and have the facility to view the Tractors location by using the GPS devices and the location of the tractors is displayed on the separate web page that contains an interactive map that was created using the Java Leaflet. These supplements are displayed on the map using java leaflet as shown in Fig. 7.

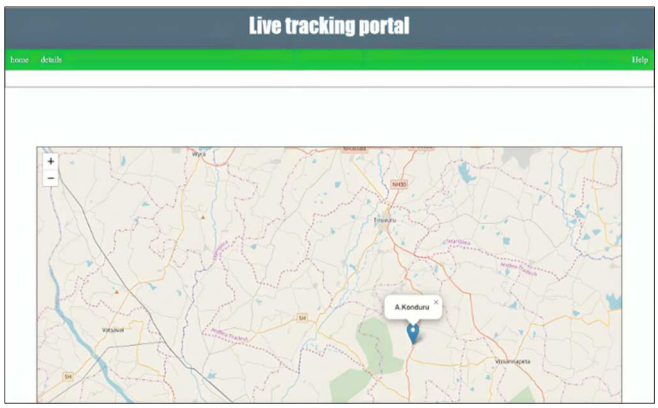

Fig. 7. Web page with Map

Farmer portal – Applications for providing agricultural supplements are among the features that can be accessed through the Farmer or User Portals. In order to request a specific supplement, the user inputs the information requested in the application portal. An individual application ID is created each time a user completes the form so that it may be

recognized later. The generating function creates a unique 10-digit identity by selecting the relevant characters. The 10-digit unique application number is formed by the user Aadhar id to identify the application belonging to the particular person with ease and then the other digits are generated by the pseudo random number generator. Fig. 8 illustrates the creation of a unique ID process.

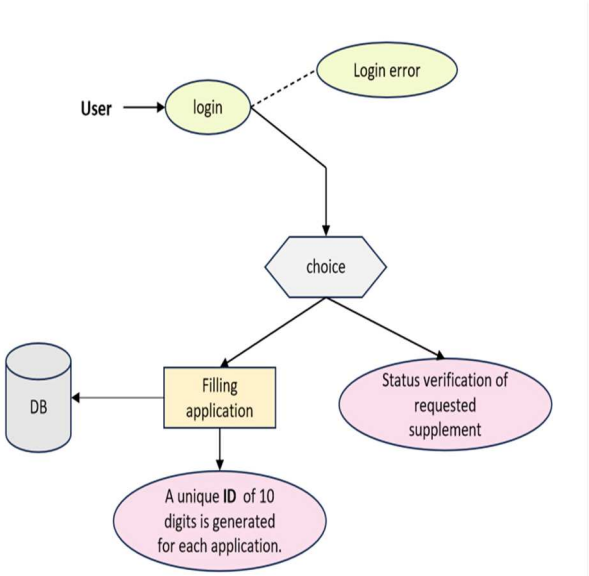

Fig. 8. Process flow of Farmer Portal

A transcript including the farmer's information and the facility he requested is generated upon the successful completion of the facility delivery, as seen in Fig. 9. The user's information are displayed as a barcode in the transcript, and the generated QR code provides the facility's current status to the user. Simply scanning the QR code on the transcript will allow the user to see the status. By doing this, the user's time lag when opening the page multiple times will be decreased.

Fig. 9. Customer Transcript

A user can fill the application by himself so that he can avail the facilities that are required. An application is provided to the user which contains the basic details about the user and the farm supplement that he is requesting for. Each application will have an application Id that is used to track the status of the application whether the facility has been given, yet to give or already given. The application will contain a QR code that contains the link to the status page so that user need not go the website more number of times and login into the portal but can just open the application status page and can know the status of their application. An application id is generated for each application. The web page that is used for the application is shown in Fig. 10.

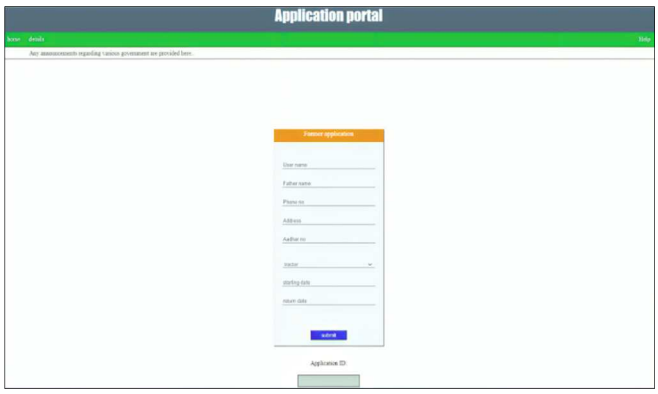

Fig. 10. Supplement requesting Application

User is also given access to know the status of the particular application. The user also given access to edit his details at any time. This enables the user to update his profile efficiently and also enables the members of the CHC to get the upto the date information about the farmer. The web page that enables the user to edit their information is shown in Fig. 11.

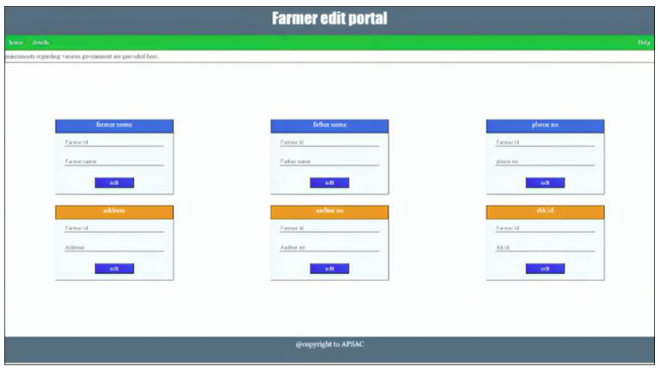

Fig. 11. Edit page for Farmers

Database – A database to store the details of the farmer as well as the administrator is created [13]. The database contains six relations to store the login credentials and user details. The relations are:

Admin, Admindetails, Createfarmer, RequestApplication, Applicationstatus, Setstatus.

Admin relation stores admin username and password. Admindetails stores the basic details of the CHC members. Createfarmer stores the details of the farmers while creating the account and gives out a 12-digit unique Id. RequestApplication stores the details of farm supplemets that farmer requests for. Application status stores the status of the application and

updates the status based on the CHC member commands. Setstatus is the relation that stores the status of the Application as mentioned by the CHC member.

BOYCE CODD NORMAL FORM(BCNF)

Boyce uniquely identifies Y for every functional dependency (FD) X–>Y in a given relation. Hence each table from the database is taken individually then calculated for BCNF as shown in TABLE I.

TABLE. I. CHECKING RELATIONS FOR BCNF

SNO	Procedure	Result
1	admin (admin id, admin name) **closure** (admin id) $^{+}$ = {admin name} **Candidate keys** admin id **Non-trivial functional dependencies:** FD = {admin id à admin name} Here admin id is a super key	BCNF
2	admin details (admin name, password, email phone no) **closure** (phone no) $^{+}$ = {admin name, emai password} (email)$^{+}$ = {admin name, email, password} **Candidate keys** phone no, email, (phone no, admin name), (email, admin name), (email, password), (email, phone no), (phone no, password), (phone no, email), (email, password, admin name) **Non-trivial functional dependencies:** FD = {email à admin name, email password, email àphone no, (email, admin) password, phone no à admin name, phone no password} **Super keys** Email, phone no Here email is a super key	BCNF

IV. RESULTS

The outcomes are attained by the proposed system after successfully implementing it. Some database queries are used as input to the proposed system. Fig. 12 shows the result of executed query to get the information about facilities between given dates. Th result of executed query to get the information about facilities between given dates. For result the input query is:

```
SELECT farmer_name, phno, aadhar_no, application_id
FROM application
WHERE (
        SELECT application_id
        FROM applicationstatus
        WHERE starting_date='$starting_date'
        AND return_date = '$return_date'    );
```

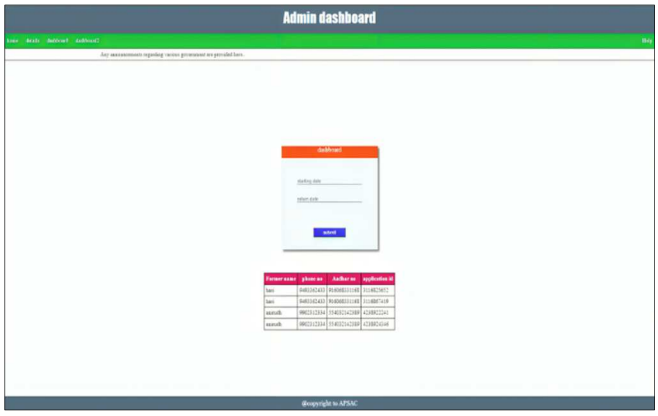

Fig. 12. Output of list of Farmers

To get the information about the farmers who make request for particular supplement or facility then the query used as input is shown in Fig. 13.

```
SELECT farmer_name, father_name, phno, address, aadhar_no, application_id
FROM application
WHERE supplement = '$supplement';
```

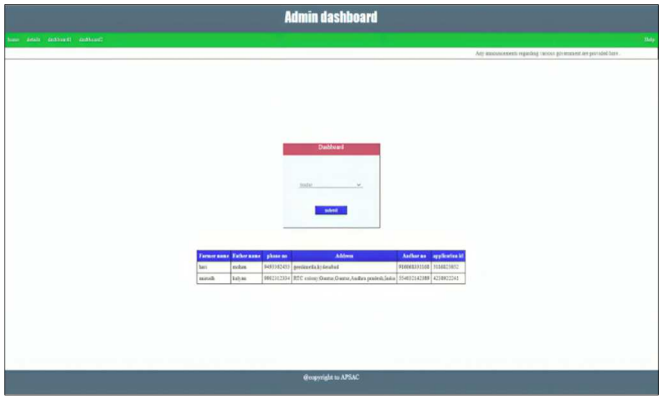

Fig. 13. Output using Farmer Id

To get the details of the supplements count that the Community Hiring Centre(CHC) has given to the farmer. This query gives the total count of each of the supplement that are given to farmers so as to help the members of CHC to decide the most demanding supplement so that they can buy that particular supplement in the next financial year. Hence it is very essential to know the supplement that is mostly used or requested by the farmers. For this count of supplements the query is shown in Fig. 14.

```
SELECT farmer_name, supplement, aadharo

FROM application

WHERE aadhar_no IN(

                SELECT aadhar_no
                FROM createfarmer

            WHERE farmer_id='$farmer_id ');
```

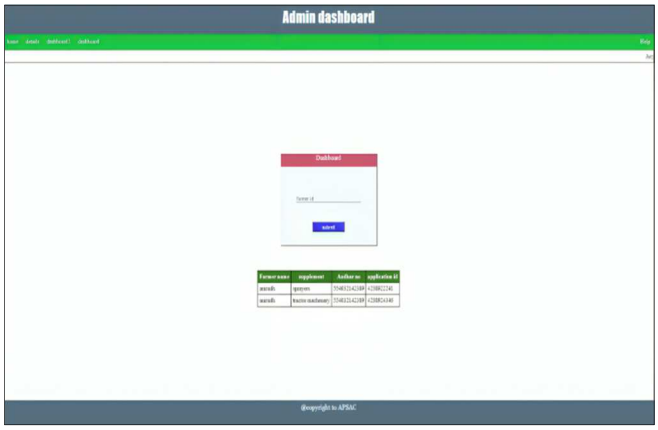

Fig. 14. Results of Farm Supplement Details

V. SUMMARY AND CONCLUSIONS

The government of Andhra Pradesh's Rythu Bharosa Kendra offers crucial agricultural inputs and extension advice with the goal of assisting farmers. By creating a web application, the problem design seeks to automate the implementation of RBK. Farmers can place requests for supplies and equipment using this program, and the data is immediately entered into the database. Record keeping is made easier by creating 12 unique digits based on the information provided by each farmer. The system guarantees the safe use of the GPS devices, permits real-time monitoring of RBK cars equipped with them, and keeps an eye on the orderly flow of traffic. The goals, process, and intended results of the structure are outlined in the paper. It emphasizes the advantages of database management, GPS technology, and user-friendly web interfaces for professionals and farmers.

ACKNOWLEDGEMENT

The authors would like to acknowledge Dr K.Sundar Garu Vice Chairman, Andhra Pradesh Space Application Center (APSAC) for their value suggestions during the project execution.

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