Research Proposal

**Application Format**

**FORMAT-1**

**Segment A (Personal Information)**

1. **Name of the PI(Principal Investigator):**
2. **Institute Name:**
3. **Department:**
4. **Address of the Institute:**
5. **Date of Birth:**
6. **Sex:**
7. **Category (please specify SC/ST/PH/OBC/General):**
8. **Telephone No.: -**
9. **Mobile No.:**
10. **Email Address:**
11. **Present Position:**
12. **Please indicate the broad area of application: e.g** Engineering/Health and Nutrition/Agriculture and related activities/Any other
13. **Please specify the theme**:
14. **Qualifications:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No** | **Degree** | **Institute/University** | **Year of Graduating** | **Subject** | **Percentage** |
| **1.** | **Graduation** |  |  |  |  |
| **2.** | **Post -Graduation** |  |  |  |  |
| **3.** | **PhD** |  |  |  |  |

1. **Professional Achievements Briefly:**
2. **Total Publications:**
3. **Five best publications in the proposed area of work:**

**Segment B: General Information**

1. **Project Title (should be focused not exceeding 15 words):**
2. **i. Name of the Researchers(PI and CO-PI):** 

   1. **Name of the Mentor:**
3. **Name of Organization & Address:**
4. **a. Type of Organization:**

**Academic institution:**

**Research organization:**

**S&T Council: NA**

**Other (please specify):**

1. **Whether project activities require any clearance from relevant authorities in respect of any environmental/legal/ethical issues?** e.g Yes/No
2. **Duration (months):** e.g 24 months
3. **Cost (Rs. in Lakhs): Recurring Rs. \_\_\_\_\_\_; non-recurring Rs. \_\_\_\_\_\_\_\_\_\_\_-**

**Segment C- Technical Details**

**1. Title**

**Crop Yield Prediction with Carbon Footprint Integration**

**2. I. Statement of the Problem**

**i. State the main problem you seek to address:**

Agricultural yield prediction is often inefficient, leading to resource mismanagement, economic losses, and environmental harm. Existing systems do not adequately integrate environmental factors such as carbon emissions, which are critical for planning sustainable agricultural practices.

**ii. Who has this problem, where does it occur?**

This problem affects farmers and agricultural planners in rural and semi-rural areas. These regions often face unpredictable climatic conditions and limited access to tools for precise agricultural forecasting.

**iii. How did you come to know of this, did the people who have the problem approach you, or did you visualize it yourself?**

The problem was identified through surveys and discussions with farmers, who highlighted concerns about yield unpredictability. Environmental studies and an analysis of agricultural data trends also revealed the critical gaps in existing systems, motivating the research team to develop a comprehensive solution.

**iv. Why is it important to solve it?**

Addressing this problem is essential to enhance resource efficiency, increase economic returns, and promote sustainable farming practices. Incorporating carbon footprint data into predictions can help mitigate climate change impacts while empowering farmers to make informed decisions.

**II. Baseline Data of the Identified Location/Beneficiary**

The dataset includes:

* **Climatic Data**: Annual rainfall and average temperature.
* **Agricultural Inputs**: Pesticide usage and land area statistics.
* **Environmental Metrics**: Carbon footprint in kg CO2 per hectare.
* **Geographical Scope**: Data sourced from rural farming communities.

**III. Proof of Concept/Prototype Devised (if any)**

The proposed system integrates a trained Decision Tree Regressor model into a Flask-based web application. Farmers can input data such as rainfall, temperature, pesticide use, carbon footprint, and crop details to receive real-time yield predictions.

**Architectural Diagram of the Proposed System**

* **Input Layer**: User-provided data including climatic, agricultural, and environmental parameters.
* **Processing Layer**: Preprocessor for data normalization and encoding.
* **Prediction Model**: Decision Tree Regressor trained on historical data for accurate yield forecasts.
* **Output Layer**: Predicted yield and insights displayed on a web interface.

**IV. Technology Gaps & Suggested Solution**

**Technology Gaps**

* Existing models lack integration of environmental metrics like carbon footprint.
* Limited accessibility of yield prediction tools for small-scale farmers.

**i. Outline your idea or solution you plan to develop:**

The project proposes a machine learning-based crop yield prediction system that incorporates carbon footprint data. Delivered via a user-friendly web app, it provides accurate forecasts and actionable insights to farmers.

**ii. Did you think up the technological solution within your team or was it thought up in consultation with others (who):**

The solution was developed by the research team in collaboration with agricultural and environmental experts to ensure practical applicability and scientific accuracy.

**3. Review of Status**

Existing yield prediction systems focus on weather and soil conditions but often overlook environmental metrics. Tools available to farmers lack user-friendliness and scalability. This project aims to bridge these gaps by integrating advanced environmental data and providing an accessible platform for real-time predictions.

**4. References**

1. International Journal of Agriculture and Environmental Research – Articles on integrating climate data into yield prediction.
2. Studies from the Indian Council of Agricultural Research (ICAR) on carbon footprint analysis in farming.
3. Python-based machine learning resources, including scikit-learn documentation.
4. Flask documentation for building scalable web applications.

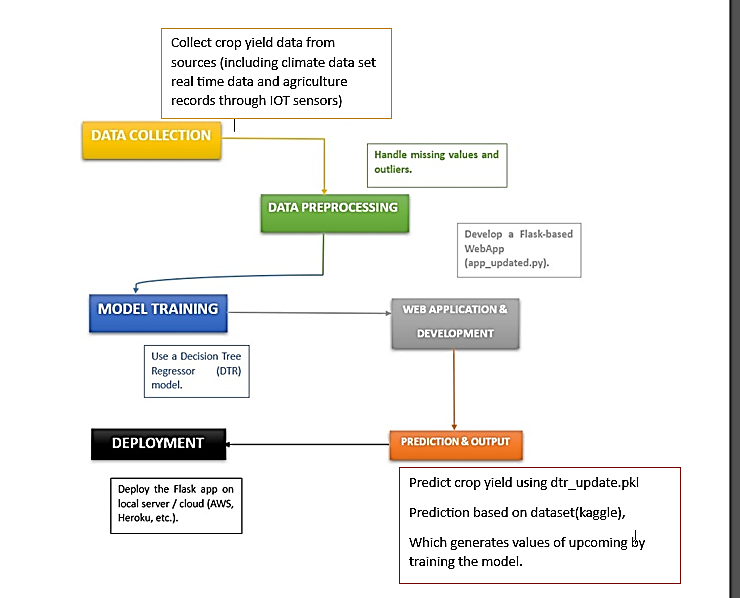
**5. Proposed Objectives**

1. Develop a machine learning-based predictive model incorporating environmental and agricultural data.
2. Build an accessible Flask-based web application for real-time yield predictions.
3. Validate the accuracy of predictions using real-world data and refine the model.
4. Educate farmers on sustainable practices using insights derived from the carbon footprint data.
5. Ensure scalability of the solution to other crops and regions.

**6. Methodology**

This project addresses societal challenges by combining data-driven decision-making with sustainable farming practices. By integrating carbon footprint data into crop yield prediction, it promotes resource efficiency and reduces environmental harm. The model development includes data preprocessing, training a Decision Tree Regressor, and building a web application for real-time predictions. Field trials will validate the system and ensure its practical applicability. The methodology involves defined steps such as data collection, feature engineering, iterative model optimization, and user training programs to achieve measurable outcomes.

|  |  |  |  |
| --- | --- | --- | --- |
| **Phase** | **Nature of Work** | **Description of Work** | **Duration (Months)** |
| **I** | **Data Preparation** | **Data cleaning, feature engineering, and organization** | **2** |
| **II** | **Model Training** | **Training and validating the Decision Tree Regressor** | **3** |
| **III** | **App Development** | **Building the Flask web application** | **2** |
| **IV** | **Field Testing** | **Pilot trials and gathering feedback from farmers** | **3** |
| **V** | **Refinement** | **Refining the model and app based on feedback** | **2** |
| **VI** | **Final Deployment** | **Launching the system and monitoring its performance** | **2** |



**8. Deliverables**

|  |  |  |
| --- | --- | --- |
| **Deliverable** | **Mark √** | **Brief Description** |
| Product Development/Adaptation | √ | Development of a machine learning-based predictive model and a web application for real-time yield predictions. |
| Technology Package for Development | √ | Integration of environmental and agricultural data into a user-friendly system for scalable deployment. |
| Technology Capability Development, Training & Documentation | √ | Comprehensive training materials, manuals, and tutorials for stakeholders; research papers detailing findings. |
| Scientific Knowledge/Data Generation | √ | Insights on the relationship between carbon emissions and agricultural productivity for future technology development. |
| Others |  | Collaboration opportunities with agricultural and environmental bodies for sustained innovation. |

**9. Estimated Benefits**

|  |  |  |
| --- | --- | --- |
| **Benefit Type** | **Mark √** | **Brief Description** |
| **Economic** | **√** | **Enhanced yield prediction accuracy leading to optimized resource use and increased profitability for farmers.** |
| **Employment Generation** | **√** | **Creation of roles for training, maintenance, and deployment of the system in farming communities.** |
| **Social** | **√** | **Empowerment of rural communities through knowledge-sharing and accessibility to advanced technology.** |
| **Environmental** | **√** | **Reduction in agricultural carbon footprint, contributing to global sustainability efforts and potential CDM benefits.** |
| **Others** |  | **Improved collaboration between local governments, research organizations, and farmers for holistic growth.** |

**10. Self-Sustainability of the Project After SEED’s Support**

The web application’s scalable design ensures long-term sustainability through affordable subscriptions for users and partnerships with agricultural organizations. Local training programs will build user capacity, reducing reliance on external support.

**11. Possibility of Replication**

The system is adaptable to different regions and crops with minor modifications. Distribution strategies include:

* Collaborating with state governments for large-scale dissemination through public programs.
* Partnering with agricultural cooperatives and market players to reach end-users.

**12. Measurable Indicators**

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Indicators (as applicable)** | **Description** |
| **1** | **Increase in crop production** | **Measured improvement in yield through data comparison before and after system adoption.** |
| **2** | **Increase in land productivity** | **Enhanced efficiency of land use based on crop output per hectare.** |
| **3** | **Change in land use pattern** | **Documented shifts in land allocation for different crop types due to improved predictions.** |
| **4** | **Increase in irrigated area and/or drinking water coverage** | **Increase in areas effectively irrigated due to optimized resource planning.** |
| **5** | **Increase in family income** | **Higher profitability due to accurate predictions and reduced resource wastage.** |
| **6** | **Increased availability of resources and assets** | **Enhanced access to farming tools, inputs, and infrastructure as a result of project interventions.** |
| **7** | **No. of beneficiaries using facilities created** | **Number of farmers adopting the web application and utilizing its features.** |
| **8** | **Increase in livelihood/employment opportunities** | **Job creation in system deployment, training, and maintenance within agricultural communities.** |
| **9** | **Diversification of livelihood activities** | **Shift to high-yield crops or diversified agricultural practices due to improved predictions.** |
| **10** | **Improved linkages with banking/financing institutions** | **Number of farmers accessing financial services based on accurate crop forecasts.** |
| **11** | **Improved linkages with authorities** | **Collaboration with district authorities and government programs to support project scaling.** |
| **12** | **No. of SHGs or technology user groups formed** | **Formation of groups to facilitate the adoption and dissemination of the technology.** |
| **13** | **Improved linkages with market/enterprises** | **Increased market access and partnerships for farmers using the technology.** |
| **14** | **Improved health of beneficiaries** | **Reduction in manual labor and exposure to unsafe conditions through optimized planning.** |
| **15** | **Improved access to energy sources** | **Utilization of technology to reduce energy use in farming practices.** |
| **16** | **No. of skilled/non-skilled workers trained** | **Total participants trained in using the system and understanding its applications.** |
| **17** | **No. of new technologies/products developed** | **Machine learning models and web-based solutions created during the project.** |
| **18** | **Adoption of newly developed product** | **Measured by the number of users and usage frequency of the web application.** |
| **19** | **No. of organizations motivated for replication** | **Agencies or NGOs adopting similar systems for their regions.** |
| **20** | **No. of publications produced** | **Research papers, reports, or manuals published to document findings and innovations.** |

**Segment D: Budget Details**

**BUDGET ESTIMATES: SUMMARY**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | |  |  | **Budget** | **(Rs. in lakhs)** |
| **Sr. No.** | **Item** | |  |  |  |  |
|  |  | | **1st Yr** | **2nd Yr** | **3rd Yr** | **Total** |
| **A** | **Recurring** | |  |  |  |  |
|  | 1. Manpower | |  |  |  |  |
|  | 2. | Consumables |  |  |  |  |
|  | 3. | Travel |  |  |  |  |
|  | 4. | Demo/Training programmes (if applicable) |  |  |  |  |
|  | 5. | Contingencies/Other costs |  |  |  |  |
|  | 6. | Institutional Overheads\* |  |  |  |  |
| B | Non-Recurring | |  |  |  |  |
|  | Permanent equipment | |  |  |  |  |
|  | Construction of work shed/structures | |  |  |  |  |
|  | Fabrication of prototype equipment | |  |  |  |  |
|  | Grand Total (A+B) | |  |  |  |  |

* 1. Financial Year: April to March
  2. It is essential to provide brief & adequate justification for each item of expenditure.

1. **Recurring:**

**1. BUDGET FOR MANPOWER**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S.No.** | **Designation** | **No.** | **Qualification** | **Monthly** |  | **Budget (Rs. in lakhs)** | | | |
|  |  |  | **&** | **emolument** |  |  |  |  |  |
|  |  |  | **experience** | **(Rs)** |  |  |  |  |  |
|  |  |  |  |  | **1st Yr** |  | **2nd Yr** | **3rd Yr** | **Total** |
| 1 |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |  |  |

**2. BUDGET FOR CONSUMABLES\***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr. No.** | **Description of consumable** | **Qty./Yr** |  | **Budget (Rs. in lakhs)** | | |  |
|  |  |  | **1st Yr** |  | **2nd Yr** | **3rd Yr** | **Total** |
| 1 |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |

\* Includes items like chemicals, glasswares, supplies, seed, pesticides, fertilizers, raw materials for fabrication, stationery, etc.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **3. BUDGET FOR TRAVEL** | | | |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  | **Sr. No.** | **Purpose** |  | **Budget (Rs. in lakhs)** | | | |  |
|  |  |  | **1st Yr** |  | **2nd Yr** | **3rd Yr** | **Total** |  |
|  | 1 |  |  |  |  |  |  |  |
|  | 2 |  |  |  |  |  |  |  |
|  | 3 |  |  |  |  |  |  |  |

1. International travel is not permitted from travel budget.
2. The project personnel shall exercise utmost austerity while traveling.
3. Please provide detailed justification for budget proposed under first two headings.
   1. **FIELD TESTING/DEMO/TRAININGS\***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr. No.** | **Description of field** | **No/Yr** |  | **Budget (Rs. in lakhs)** | | |  |
|  | **testing/demos /trainings** |  |  |  |  |  |  |
|  |  |  | **1st Yr** |  | **2nd Yr** | **3rd Yr** | **Total** |
|  | - | - | - |  | - | - |  |

\* Include material for technology field testing/demo, training manuals, training expenses for beneficiaries. **Note:** For training give details about the subject of training(s), no. of beneficiaries/training, duration of training days, cost /training).

**5. BUDGET FOR CONTINGENCIES\***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr. No.** | **Item** | **Qty./Yr** |  | **Budget (Rs. in lakhs)** | | |  |
|  |  |  | **1st Yr** |  | **2nd Yr** | **3rd Yr** | **Total** |
| 1 | Documentation |  |  |  |  |  |  |
| 2 | Servicing of equipment |  |  |  |  |  |  |

\* Includes items like computer time, secretarial assistance, documentation, cost of technology transfers/acquisitions (intellectual fees), lab/field trials, maintenance/servicing of equipment, incidental expenses, etc.

**B. Non-Recurring**:

**BUDGET FOR PERMANENT EQUIPMENT/WORKSHED/STRUCTURES**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No.** | **Equipment/Item details** | **Qty** | **Budget** |
|  |  |  | **(Rs. in lakhs)** |
| 1 |  |  |  |
| 2 |  |  |  |

1. Include installation charges, transport, taxes/duties/levies, etc. Please try to avail tax/duty exemptions as applicable to your institution/organization.
2. Budgetary quotations will be required for permanent equipment (estimates, if the equipment is to be fabricated locally for prototype testing etc) and other items under non-recurring head, once project is approved for financial support.
3. Drawings/layouts, etc. prepared by authorized professionals/agencies should be submitted for proposed work shed/structures, if applicable, and supported by documents showing availability of required land along with consent letter from the owner (Panchayat/individual/Govt./etc.).
4. Proper record should be maintained for the items procured under this Head.

**Annexure-I**

**CERTIFICATE FROM THE RESEARCHERS**

**PROJECT TITLE:**

1. We agree to abide by the terms and conditions of the grant.
2. We did not submit this or a similar project proposal elsewhere for financial support.
3. We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the project. We shall not request financial support under this project, for procurement of these items.
4. We undertake that spare time on permanent equipment will be made available to other users.
5. We understand that this is PI centric project aimed to encourage young researchers towards societal research and it will not be transferred to any other researcher/scientist.
6. We have enclosed the following materials:

|  |  |  |
| --- | --- | --- |
| ITEMS |  | NUMBER OF COPIES |
| (a) | Endorsement from the Head of | One |
|  | the Institution (on letter head) |  |
| (b) | Copies of the proposals | 3 |
| (c) | Registration certificate, Memorandum | One |
|  | of association, rules and regulations of |  |
|  | the institution, Audited Balance Sheet |  |
|  | and annual report of previous three years (in case of Voluntary Organization). |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date : ………………** | **Name & Signature of** | **Name & Signature of** | **Name & Signature** |  |
| **Place:………………..** | **PI** | **Co-PI** | **of Mentor** |  |
|  |  |  |  |

**Annexure-II**

**PROFORMA FOR BIODATA OF INVESTIGATOR (PI)**

|  |  |  |  |
| --- | --- | --- | --- |
| **A.** | **Name** | **B.** | **Date of Birth** |
| **C.** | **Institution:** | **D.** | **Whether belongs to SC/ST-** |

1. **Academic and professional career:**

**Academic career (From Graduation to highest qualification level indicating subject and area of specialization – Enclose copy of certificate of highest qualification):**

**Professional career:**

1. **Award/Prize/Certificate etc. won by the principal investigator:**
2. **Five best publications in the proposed area of work:**
3. **Publication (Numbers only)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Books** | **Research Papers, reports** | | | **General articles** | |
|  | **Patents** | **Others (please specify)** | |  |  |  |
| **H. (1)** | **List of completed and ongoing projects** | | | **:** |  |  |
|  |  |  |  |  |  | |
| **Sl. No.** |  | **Title of Project** | **Duration** | **Total Cost** | **Funding Agency** | |
|  |  |  | **From to** |  |  |  |
| (2) | List of projects submitted | |  |  |  |  |
|  |  |  |  | | |  |

**ANNEXURE III**

**UNDERTAKING FROM RESEARCHERS**

I will undertake all the approved activities under the project till the completion of the project tenure. Failure to complete the project objectives (without any justified reason) or leaving in midterm of the project would make me liable for returning the fund completely including manpower component.

(Name of the PI)

Signature with date

(Name of the Co- PI)

Signature with date

(Name of the Mentor)

Signature with date