THESIS CAPSULE RESEARCH PROPOSAL

Proposed Research Title

GeoCrop Portal**:** Crop Information Portal using Geographic Information System (GIS) Application

Name of the Proponent(s)
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| **Research Discipline/Topic**	**Sector/Priority Areas/SDG**
- Machine Learning - Data Science and Analytics	- SDG 09: Industry, innovation, and Infrastructure - SDG 15: Life on Land

Rationale/Introduction:

In Zamboanga City, agriculture is essential to maintaining environmental sustainability, economic stability, and food security. The industry does, however, confront a number of difficulties, such as inefficient crop placement due to a lack of alignment with the ideal environmental conditions for growth and yield and limited access to quick and accurate crop information. We propose establishing a crop information portal using a Geographic Information System (GIS) application in order to solve this problem. This portal serves as a centralized platform for all pertinent agricultural data, comprehensive and up-to-date data on crop distribution, land use, and the best locations for growing particular crops.

Technology has advanced, but there is still a big gap in Zamboanga City's access to and availability of geographical data for agricultural decision-making. The deficiency of integration in current information systems leads to fragmented data sources and limited access for farmers, policymakers, and other relevant stakeholders. Our research seeks to fill this niche by utilizing GIS technology to create an interactive and user-friendly platform that integrates disparate datasets into a single interface.

The primary goal of this study is to fill a major gap in Zamboanga City's agricultural information management and decision support systems. This region's farmers continue to use antiquated methods and inconsistent information sources, which leads to poor resource distribution, inefficient crop management strategies, and increased susceptibility to outside variables like climatic unpredictability. GIS has been utilized in the prediction of cotton habitat and plant-level growth, allowing for the identification of suitable areas for cultivation (GIS-based volunteer cotton habitat prediction and plant-level, 2021). By offering a thorough and easily navigable spatial data repository, our study seeks to close this gap by enabling users to make knowledgeable decisions and implement sustainable agriculture practices.

In developing the Crop Information Portal using the GIS Application, our study expects a number of benefits and outcomes. First off, farmers will be able to optimize their production plans and minimize potential losses thanks to the portal's increased crop monitoring, yield forecasting, and risk assessment capabilities. Second, improved decision support tools for resource allocation and land use planning will help policymakers and agricultural extension services. Thirdly, by providing customized conditions that are ideal for the growth of particular crops, the portal will empower users. In addition, the agricultural community will gain from innovation, capacity building, and knowledge exchange because of the interactive features and user-friendly layout of the portal. In the end, the data generated will advance research and technology while supporting the socioeconomic development and resilience of Zamboanga City's agriculture sector.
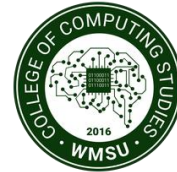
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Objectives (General and Specific. Statement of the specific purpose to address the problem areas of the research)

General:

- Develop a Crop Information Portal using Geographic Information System (GIS) Application for crop suitability analysis and place recommendation that utilize machine learning.
- Provide Farmers and Agribusiness access to accurate and timely crop information.

Specific:

- Develop machine learning models to examine past agricultural data, covering growth patterns, yield, and environmental influences, in order to identify trends and patterns.
- Utilize machine learning techniques to analyze crop adaptability and suggest the best crop placement locations based on environmental factors.
- Develop a user-friendly interface using Django framework, allowing users to interact with Crop Information Portal, supplying thorough agriculture data and tools for making decisions where to suitable place to plant the crop.
- Develop scripts with GDAL or GeoPandas to incorporate a variety of spatial datasets into the Crop Information Portal database, including satellite photos, weather information, and soil characteristics.
- Conduct thorough testing and validation of the system to assess its predictive accuracy, usability, and performance under various scenarios, ensuring its effectiveness in real-world applications.

Features of the Proposed Study (Since you are expected to develop a system, list down what your proposed system can do)

- **Comprehensive Crop Information:** Provide access to a wide range of crop-related data, including crop distribution, planting and harvesting seasons, agronomic practices, and pest and disease management strategies.

- **Interactive Mapping Interface:** GIS technology has the ability to present spatial data in an interactive map interface so that users can see land use classifications, crop distribution patterns, and other geographic data.

- **Crop Suitability Analysis:** Utilize crop suitability models to evaluate environmental elements like topography, soil type, and climate in order to suggest the best crops for specific places.

- **Decision Support Tools:** Give farmers and policymakers access to decision support tools such as yield forecasts, crop monitoring, risk assessment, and land use planning features.

- **Mobile Accessibility:** Develop a mobile-friendly version of the portal to enable access from smartphones and tablets, ensuring usability for farmers in remote areas with limited internet connectivity.

- **User Feedback Mechanism:** Establish a feedback system to get feedback and suggestions from users on how to make the portal more useful, user-friendly, and relevant to their needs.
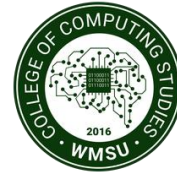
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Methodology (Discuss how the research/project will be implemented)

Among the specific data that will be required for this research are satellite images, soil samples, temperature data, and maps illustrating the distribution of crops. Obtaining access to publicly available datasets, registering with relevant APIs that offer real-time weather information, and possibly doing field surveys to confirm and enhance preexisting data will all be part of the data collection process.

The target population includes farmers, agricultural extension workers, and researchers involved in crop cultivation and management.

The research will employ specific methodologies, including machine learning algorithms and multi-criteria decision analysis (MCDA), for crop suitability analysis. These algorithms will be implemented using the scikit-learn and TensorFlow Python libraries provided by the Django framework. The Django web framework, and GIS libraries like GDAL or GeoPandas for handling geographical data processing will be the development tools. The system will go to meticolous testing and will undergo validation to evaluate the predicted accuracy and efficacy. Iterative improvements to improve usability and reliability will be based on user feedback. Depending on the complexity and domain-specific knowledge required, consulting with agricultural specialists or GIS professionals might be important to evaluate study findings, ensure accuracy in data processing, and provide domain-specific insights.

Expected Output

Publication
Scientific publications that add to the body of knowledge in the domains of agriculture, geographic information systems, and decision support systems by describing the research project's methods, conclusions, and results in peer-reviewed journals.

Product
Development and implementation of the Crop Information Portal as a physical product, offering users access to interactive mapping interfaces, decision support tools, and extensive agricultural data to optimize crop management techniques.

People Services
Increased capacity and expertise in GIS-based agricultural information systems among stakeholders, including farmers, agricultural extension workers, policymakers, and researchers, through training workshops, webinars, and capacity building activities.

Target Beneficiaries:

- **Farmers -** Farmers will benefit from the Crop Information Portal's increased accessibility to extensive agricultural data and tools for decision support. By means of the platform-enabled informed decision-making process, they may optimize crop management tactics, increase productivity, reduce risks, and eventually enhance profitability.
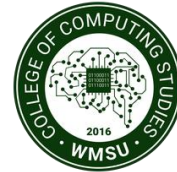
- **Agricultural Extension Workers** - Using real-time data and analysis, agricultural extension staff can use the portal to offer farmers customized advise and recommendations. This makes it possible for them to provide extension services that are more focused and effective, which benefits farmers and raises agricultural productivity.

- **Researchers and Academia** - Academics and researchers can use the data and insights produced by the project to carry out additional research, examine patterns, and create creative solutions to problems facing agriculture. This promotes cooperation and creativity within the research community and advances scientific knowledge.

- **Agribusinesses** - Agribusinesses may find investment opportunities, obtain market intelligence, and improve supply chain management with the help of this platform. They can also produce items and services that are specifically tailored to meet the specific needs of farmers, which will boost their profitability and market competitiveness.

Expected Outcomes:
- **Increased Productivity -** The goal of the project is to increase crop yield and efficiency by providing farmers with timely and relevant agricultural information. Higher harvests and better farmer livelihoods will result from this.
- **Sustainable Practices -** The initiative promotes the implementation of sustainable agriculture practices, which enhance environmental sustainability and resilience, by spreading information on crop diversification strategies, optimal management practices, and techniques for conserving natural resources.
- **Empowerment and Capacity Building** - The initiative gives farmers, agricultural extension agents, and other stakeholders more access to information and decision-support tools, enabling them to take charge of their operations, develop their skills, and come up with creative solutions to problems in agriculture.