Institution Details

Province	Sindh	**City**	Karachi
Institution	National University of Computer and Emerging Sciences (FAST-NU)	**Campus**	Karachi
Department	Computer Science	**Degree Level**	BS
Degree Program	Software Engineering	**Telephone**	
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Qualification	Masters		

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Qualification	Masters		

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Project Details

Project Title	AI-Enhanced Regional Tree Planting Predictor for Minimizing Climate Impact		
Group Details	**Member 1 Name: Muhammad Taha Jawaid** **Member 1 Roll#: 21K - 3881**	**Member 2 Name: Imran Ali** **Member 2 Roll#: 21K - 3877**	**Member 3 Name: Taha Ali** **Member 3 Roll#: 21K - 3867**
Project Area of Specialization	Artificial Intelligence, IoT		
Project Start Date	26 - August - 2024	**Project End Date**	30 - May - 2025
Project Summary (less than 2500 characters)	Ai-Enhanced Regional Tree Planting Predictor is a web-based application that solves the challenges facing urban polluted areas concerning heat and air quality. The project utilizes IoT sensors to analyze the areas suffering from pollution and heat. Our goal is to suggest places to plant trees by using AI-pre-trained models where trees will impact more than any other areas and enhance the sustainability of the environment. The application provides suggestions to policymakers, government, environmentalists, charitable organizations, and every individual who wants to plant trees and help nature improve. By focusing on areas with the highest needs, the project aims to lower temperature, mitigate pollution, and contribute to a healthier and sustainable environment. This application will use pre-trained AI models to collect environmental factors and predict areas to plant trees. The whole mechanism will turn the concrete jungle into a suitable environment for humans and animals. It will provide shelter against extreme weather conditions and will keep the temperature under control. This project is collectively designed to reduce the effects of air pollution and deforestation on our regional environment. Pre-trained AI models will be used to predict the effects of plantations on different suggested regions Hence, this platform will help its audience to build a healthy environment and play the role of reducing air pollution which is a major reason for the increasing number of different diseases.		
Project	● The objective of the AI-Enhanced Regional Tree Planting Predictor is to use IoT sensors and AI technology to identify areas that are hugely affected by pollution and heat and recommend optimal locations for tree planting to control the increasing temperatures and air pollution. ● By analyzing environmental data collected through IoT sensors, the project aims to reduce air pollution, lower temperatures, and improve overall environmental sustainability. ● By suggesting optimal locations for plantation, this project will play a major role to reduce the effects of global warming and deforestation.		

Objectives (less than 2500 characters)	● Another objective is to inform the audience about the increasing air pollution and its dangerous impact on health and how this application can make a huge impact on their lifestyles. ● To introduce the people and charity foundations with better solutions to plant trees in suitable locations. ● By focusing on these issues and fulfilling the identified research gaps, the project aims to contribute to the field of Artificial Intelligence and IoT, offering innovative solutions that enhance the precautionary measures taken by a society to battle against extreme weather conditions
Literature Review / Background Study	Planting trees is considered to be one of the most effective responses to climate change. The elements that we consult to determine the location to carry out the plantation of the tree include temperature, humidity, air quality, and soil condition. The application of computers and environmental sensor networks has enhanced environmental planning, which has in turn enabled the provision of more effective recommendations on increasing the cover of trees in urban areas, regulation of temperature within the environment, and enhancing fair quality of air. Consequently in recent times the government is imposing important decisions for monitoring the environment and assisting urban planners with technologies. As per the study conducted by the Geo News recent article Punjab Pakistan is one of the leading areas where environment measuring through satellite is used for mitigating air pollution and escalating level of smog in every year. This system solicited satellite data to embrace the factors and determine locations that had a negative influence on air quality thus offering critical information to policy makers and government to respond. This is a success story at least regarding the province of Punjab that how efficiently the environment can be well monitored and managed by adopting modern and advanced technology. **Basic Requirements for location-based recommendations** Punjab satellite monitoring program has been set the example here by using implementation of an intelligent system that can easily be followed by the other Pakistani federal and Provincial governments. Satellite monitoring using satellite data is ideal for extensive environmental surveillance, while IoT sensors are detailed enough to track ideas such as tree planting at a more defined level. With both satellite and sensor data inputs, a system can provide environmental information that considers both macro and micro environments. The integration of such technologies makes it possible to use limited resources in the rightful manner, whereby afforestation efforts are only focused to regions that provide more benefits to the society and environment. **Advantages of Decision Making with Reference to Data** This study therefore reveals that effective environmental planning involves the use of data to inform the decision making process. Sensors and AI pre-trained models have given accurate information. For instance, to plant trees in certain climatic conditions or in certain regions, AI can suggest tree species that would grow well in such conditions, humidity levels, weather and air quality, increasing the effectiveness of planting campaigns carried by different political and charitable organizations. Trees cools surface areas and minimizes the city's warming effect which proves that trees can decrease local temperature through shading, which cools existing surface areas in the city. In addition, trees provide an ecological service of fixing carbon dioxide in the atmosphere and

	freshness of air. However, when trees are planted where research has recommended the placement of trees, their cooling and air cleaning effects increase. **Conclusion** The AI-Enhanced Regional Tree Planting Planner — which leverages IoT data and artificial intelligence models — presents a progressive approach toward urban greening initiatives. This approach is similar to the monitoring system implemented in Punjab using satellites where environmental data is gathered in real time within specific states.
Project Implementation Method (less than 2500 characters)	Implementing AI-Enhanced Regional Tree Planting Planner is structured around a system designed to optimize tree planting locations based on real-time environmental data. The overall approach involves the use of IoT sensors and Pre-trained AI-models to ensure that trees are planted in areas where they can provide maximum benefits, such as reducing heat or improving air quality. **System Architecture** The system architecture will consist of four major components: 1. **IoT Sensor Network**: A network of environmental sensors will be integrated across different regions like Shah Latif Town and New Karachi. These sensors will measure temperature, humidity, and air quality. The data will be sent to a centralized processing unit for analysis. 2. **Pre-trained AI Models**: The Pre-trained AI Models will analyze environmental data. These models will check the areas that are most in need of tree planting, focusing on regions with high temperatures or poor air quality. Historical data will be used to improve the accuracy of recommendations. 3. **User Interface**: A web-based interface will allow users to enter their location and receive recommendations for tree planting. The interface will display visual data, such as maps showing optimal planting areas in regions like Sadar, based on sensor inputs. **Methodology** 1. **Data Collection**: IoT sensors will be installed to collect environmental data from various locations. These sensors will monitor temperature, humidity, and pollution levels, providing continuous updates. 2. **Data Processing**: The data will be processed and analyzed, such as heat or poor air quality. The AI model will prioritize areas for tree planting based on these trends, ensuring that the most demanding regions receive attention. 3. **Recommendation**: The system will generate tree planting recommendations. For example, if Sadar shows consistent rise in temperatures than DHA, the system will suggest focusing planting efforts in Sadar to control the rising heat. 4. **User Interaction**: The web interface will present users with a map displaying sensor data and recommended planting areas. Users can input their location and see suggestions for tree planting, ensuring that they make effective decisions.

Benefits of the Project (less than 2500 characters)	The AI-Enhanced Regional Tree Planting Planner offers a solution to government and charitable foundations by utilizing data and AI analytics for tree planting recommendations. Traditional tree planting methods, often based on outdated or generalized data, are less effective. This system enhances decision-making by providing specific data, such as recommending planting in high-temperature areas like Sadar over cooler regions like Malir Cantt. **Resource Allocation** By using AI to analyze environmental data, the system ensures that resources are allocated to areas that will benefit most from tree planting. This data-driven approach not only reduces the temperature but also improves air quality in targeted areas, making environments more healthier. **Contribution to Sustainability** This system directly contributes to environment sustainability by promoting greener cities, reducing global warming effects, and creating healthier environments. By integrating AI and IoT technologies, it sets a new standard for environmental management and urban planning. In summary, the AI-Enhanced Regional Tree Planting Planner revolutionizes urban forestry by offering precise, real-time, and scalable solutions that promote environmental sustainability and smarter urban growth.
Technical	AI-Enhanced Regional Tree Planting Planner contains various functional and technical modules. Every module defined below contributes to the overall functionality of the system. **Module-1. IoT Sensor** In this module sensors that will monitor real-time environmental factors such as temperature, air quality, and humidity, will be deployed in different areas of Karachi such as Sadar, Malir Cantt and Bahria Town. This data will be collected from sensors and transmitted to the centralized system for analysis. Important technologies that will be used are wireless communication protocols. **Module-2. AI Pre-trained Models**

Details of Final Deliverable (less than 2500 characters)	The module relies on pre-trained AI-models to evaluate environmental data and to recommend tree planting. It examines the information for patterns, including places with extreme temperatures or a lack of air quality, and categorizes regions by the requirement for tree planting. Frameworks including TensorFlow have been used to create this module. **Module-3. User Interface** Different types of interfaces will be implemented in a project such as the web-based interface will allow users to enter their location and can check the recommendations generated by the system for tree planting. A map-based visualization tool will provide environmental information collected from sensors that will highlight the area's benefits from tree planting. Different types of front-end technologies like React, Angular, etc will be implemented.
Final Deliverable of the Project	The following modules will be presented at the conclusion of the AI-Enhanced Regional Tree Planting Planner project: 1. **IoT Sensor Network Module** ○ Environmental sensors will be deployed in different areas for real-time data collection (temperature, humidity, air quality). 2. **Data Processing and Storage Module** ○ Cloud-based systems will be implemented for data storage and preprocessing (filtering, error correction). 3. **AI Analytics Engine** ○ Machine learning algorithms will be implemented for analyzing environmental data and generating recommendations. 4. **User Interface Module** ○ Web-based platform for user interaction and real-time recommendations, including map visualizations. 5. **Recommendation System Module** ○ Delivers suggestions for tree planting localized to the user, based on sensor data and AI analysis. 6. **Reporting and Feedback Module** ○ Reports on environmental conditions will be generated and will allow users to provide their feedback for improvement in the system.
Core Industry (Optional)	IoT and Artificial Intelligence
Core Technology	Python, pre-trained Artificial Intelligence models

References

[1] B. K. Kaginalkar et al., "Review of urban computing in air quality management as smart city service: An integrated IoT, AI, and cloud technology perspective," Frontiers in Environmental Science, vol. 10, 2022.
[2] K. L. Bowler et al., "Urban greening to cool towns and cities: A systematic review of the empirical evidence," Landscape and Urban Planning, vol. 182, pp. 12-24, 2019.
[3] T. K. Patil et al., "An IoT Based Air Pollution Monitoring System for Smart Cities," Journal of Urban Technology, 2021.
[4] P. Zhang et al., "Artificial Intelligence in Green Building," Energy and Buildings, vol. 247, 2021.
[5] S. Lee et al., "Urban Vegetation Mapping from Aerial Imagery Using Explainable AI," IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 14, 2021.

Project Key Milestones

Elapsed time in (days or weeks or month or quarter) since start of the project	Milestone	Deliverable
Month 1	Project Scope & Objective	FYP Proposal
Month 2	Finalizing system flow	System Diagram
Month 3	Research and selection of IoT sensors	Data Collection Strategy
Month 4	Detailed Documentation	SRS, SDS, Use cases & Mock Data
Month 5	Set up Sensors	Initial integrations of IoT Sensors
Month 6	Integrate AI pre-trained models	Sensor data pipeline

Month 7	Frontend & Backend Development	Fully functional Frontend & Backend
Month 8	Verification & Validation	Reports and Feedbacks from stakeholders

Project Equipment Details

Item(s) Name	Type	No. of Units	Per Unit Cost (in Rs)	Total (in Rs)
ESP-32	Micro Controller	3	1200	3600
DHT-11	Sensor	3	400	1200
MQ-135	Sensor	3	400	1200
			Total in (Rs)	6000