**Team Project AgriTech**

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**Abstract.** This project has successfully developed a dynamic web application tailored to streamline the management of horticultural operations. It serves as a comprehensive diary for agricultural management, where users can authenticate via credentials or mobile SSO to track and manage tasks associated with plant care, including fertilization and irrigation. The application notably features a robust 'Search/History' module for retrieving historical data and generating analytical reports, greatly aiding in decision-making. The development was characterized by an agile approach with iterative updates and adaptive solutions, such as utilizing local storage for data handling when faced with backend challenges. This documentation details the application’s functionality, installation, and the agile development processes employed, offering insights into both the technical and operational aspects of the application.

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**1.Introduction**

**Purpose of the Project:** This web application has been developed with the aim to significantly enhance the management and operational efficiency within the agricultural sector. It serves as a sophisticated digital platform tailored specifically for horticulturists, enabling them to manage a variety of agricultural operations with enhanced precision and ease. By integrating advanced features for tracking, managing, and analyzing daily agricultural activities, the application addresses critical aspects of modern farming management.

**Scope of the Application:** The application's scope is comprehensive, covering an extensive array of functionalities essential for robust agriculture management. It facilitates task scheduling, resource allocation, financial management, and offers advanced analytical tools to optimize operational efficiency. During its development, the application was adapted to include local storage solutions for data handling when challenges with backend database communications arose, showcasing its adaptive technology use in real-world scenarios.

**Intended Audience and Stakeholders:** Designed primarily for horticulturists and farm managers, the application also proves invaluable for a broader audience including agricultural consultants, technology solution providers, and researchers. With its capability to handle complex data and provide actionable insights, it supports these stakeholders in making informed decisions, enhancing productivity, and driving innovation in agricultural practices.

**2.** **System Requirements**

**2.1 Hardware:**

**Compatibility:** The application is platform-agnostic, designed to operate seamlessly across a wide range of devices. It is optimized for use on desktops, laptops, tablets, and smartphones that support modern web browsers. This universal compatibility ensures that users can access the application in various operational environments without the need for specialized hardware.

**Performance Considerations:** To handle the application’s data-intensive operations effectively, a device with a minimum of 4 GB RAM and a recent multi-core processor is recommended. These specifications support the robust functionality of the application, particularly when managing extensive agricultural data and performing complex analyses.

**2.2 Software**

**Web Browsers:** The application requires an up-to-date web browser with JavaScript enabled, critical for accessing full functionality:

**Google Chrome (latest version):** Chosen for its fast performance and broad support for the latest web standards, ensuring a smooth user experience.

**Mozilla Firefox (latest version):** Selected for its strong privacy tools and comprehensive developer features, making it suitable for secure and extensive web development.

**Apple Safari (latest version):** Ideal for users on macOS and iOS, known for its system integration and energy efficiency, providing an optimal experience on Apple devices.

**Microsoft Edge (latest version):** Recommended for its compatibility with various web standards, particularly on Windows devices, facilitating broad accessibility.

**JavaScript Requirement:** JavaScript must be enabled in the browser settings, which is essential for dynamic content handling and interactive features, ensuring the application’s interfaces are responsive and engaging.

**2.3 Network**

1.Internet Connection: A stable and reliable internet connection is crucial as the application leverages cloud services for data storage, real-time data synchronization, and remote access to its features. This connectivity is vital for the application’s functionality, especially in managing and updating real-time agricultural data.

2.Bandwidth Requirements: A broadband connection with at least 5 Mbps speed is advisable to accommodate large data transfers efficiently and minimize operational delays, enhancing the application’s responsiveness.

3.Cloud Accessibility: It is essential to configure network settings appropriately, such as adjusting firewalls and proxy servers, to ensure uninterrupted access to cloud platforms where the application data is managed. This setup supports seamless cloud interactions, vital for maintaining the integrity and availability of data across the application.

**3.** **Features and Functionalities**

The agricultural web application is meticulously engineered to enhance the efficiency and decision-making capabilities within the agricultural sector. Here is a detailed look at its primary features:

**3.1 Task Management:**

**Scheduling and Organization:** The application includes a sophisticated calendar interface that allows users to schedule a diverse array of agricultural tasks such as planting, watering, and harvesting. This system supports recurring tasks and offers customizable reminders to aid in meticulous farm management.

**Real-time Tracking:** With real-time updates, the application enables users to monitor the progress of tasks continuously. It provides the flexibility to adjust schedules dynamically in response to changing weather conditions or labor availability, ensuring optimal resource utilization.

**Notifications and Alerts:** To keep operations on track, the application sends automated notifications about upcoming tasks and critical deadlines. This feature is crucial for ensuring that all farming operations are executed timely, enhancing overall farm productivity.

**3.2 Financial Tracking:**

-Comprehensive Record Keeping: Users can diligently record every financial transaction associated with their agricultural operations. This includes detailed entries for expenditures on seeds, fertilizers, pesticides, and labor costs.

-Categorization and Budgeting: Financial entries can be categorized into various segments such as equipment purchases, supply costs, and sales revenue, facilitating streamlined budget management and effective financial oversight.

-Report Generation: The application offers robust reporting tools that enable the generation of detailed financial reports on different timelines—weekly, monthly, or annually. These reports are instrumental in providing insights into profit margins, operational costs, and identifying financial trends, supporting strategic financial decisions.

**3.3 Data Analytics:**

1.Advanced Search Capabilities: Equipped with powerful search functionalities, the application allows users to access and analyze historical data based on multiple parameters. This capability is key for conducting in-depth trend analysis and operational assessments.

2.Custom Reporting Tools: Users benefit from the ability to create tailored reports focusing on specific data points such as crop yields, resource allocations, and financial outlays. This adaptability is invaluable for targeted analysis, aiding in the preparation of compliance reports and presentations.

3.Visual Data Representation: To facilitate the interpretation of complex datasets, the application presents information in intuitive formats—charts, graphs, and tables. These visual tools help users quickly understand data and derive actionable insights, enhancing decision-making processes.

**4.** **Usage Guide**

**4.1 Login:**

The application ensures secure and swift access through multiple authentication methods. Users can choose to log in using traditional credentials or benefit from the convenience of mobile Single Sign-On (SSO). This dual-option approach not only enhances security but also facilitates ease of access. Upon successful login, the system displays personalized settings and preferences, crafting a user experience uniquely tailored to individual needs and operational roles.

**4.2 Navigate:**

At the heart of the application lies an intuitive dashboard that serves as the central command hub. It provides users with a clear, consolidated view of the day's priorities, such as scheduled tasks, financial summaries, and active plant cycles. This streamlined navigation system is designed for efficiency, enabling users to seamlessly transition between various management sections—plant management, financial oversight, and task tracking. This centralization makes it simpler for users to oversee all aspects of farm management from one cohesive interface.

**4.3 Operate:**

Within the operation module, users have the ability to actively engage with their agricultural tasks. They can add new plant profiles with comprehensive care instructions, schedule necessary tasks that automatically adjust based on real-time weather conditions, and record financial transactions. The module is equipped with user-friendly forms and interactive tools that ensure data remains current and accessible, facilitating a comprehensive approach to farm operations management.

**4.4 Analyze:**

The application's robust search and history functions provide powerful tools for data access and analysis. Users can explore past records to uncover significant trends and operational insights. This analytical capability is crucial for projecting future needs and making informed decisions that drive both efficiency and profitability in agricultural operations. The ability to analyze historical data enables farmers and managers to strategize effectively, ensuring sustainable success.

**5.** **Technology Stack**

**Languages and Frameworks:**

**Backend**: The application is developed using **C# and ASP.NET Core**, chosen for their robust backend capabilities and efficient processing power. This combination is ideal for handling the complexities of agricultural data management, ensuring stability and scalability.

**Frontend**: For the frontend, **React.js** is employed to create a responsive and dynamic user interface. This framework supports real-time interaction and smooth navigation, essential for providing an engaging user experience across various devices.

**Database Technologies:**

**SQLite**: Instead of using a traditional SQL Server setup, local development leverages **SQLite**. This database technology is a compact, high-reliability, embedded SQL database engine. SQLite's self-contained nature, requiring no separate server, makes it an excellent choice for developers working in environments with limited resources. It supports a broad subset of SQL standards and is optimized for applications requiring portability and low-latency access, making it highly suitable for mobile or standalone applications.

**External Libraries or APIs Integrated:**

1.Cloudflare is integrated to bolster security and performance, especially in local testing environments. Cloudflare simulates real-world security and performance conditions, ensuring the application remains secure and performs optimally under various scenarios.

2.React Libraries:

**Material-UI**: Utilized for its rich set of UI components, helping create a visually appealing and functional frontend.

**Axios**: Chosen for making efficient HTTP requests, Axios simplifies the process of communicating with the backend, facilitating robust data handling and retrieval.

3.**SignalR**: This library is critical for enabling real-time communication features within the application. SignalR allows for instant updates and notifications across the client interface, a necessary functionality for modules that depend on immediate data refreshes and interactive user engagements.

**6.** **Development Process**

The project was executed over eight weeks using an Agile methodology, structured into four two-week sprints. This approach allowed the team to flexibly adapt and incrementally improve the application, aligning closely with evolving project goals and ensuring sustained progress. Each sprint was methodically organized into distinct phases to enhance efficiency and outcome.

**Key Phases:**

**Planning:** Initiating each sprint, the team engaged in detailed planning sessions to identify and prioritize tasks, setting a clear direction and objectives for the upcoming activities.

**Execution and Daily Monitoring:** Daily stand-ups were essential for the team to discuss ongoing progress and address challenges promptly, ensuring any issues were swiftly managed and did not impede development.

**Testing and Review:** Rigorous testing and continuous integration were fundamental throughout the development process, ensuring each feature adhered to high-quality standards and functioned as intended before progressing to the next stage.

**Technological Implementation:** The application incorporated WebSockets technology to effectively address real-time data synchronization challenges, significantly enhancing user experience by enabling smooth and uninterrupted updates.

**Feedback and Iteration:** Following each sprint, comprehensive reviews were conducted to gather and analyze feedback from all stakeholders. This feedback was crucial for refining features and making necessary adjustments in the subsequent sprint plans, ensuring the application continued to meet and exceed stakeholder expectations.

**7.** **Conclusion**

The development of the agricultural web application has effectively met the intricate demands of contemporary farming management by integrating key functionalities such as real-time updates, comprehensive task management, and detailed financial tracking. Executed using an Agile methodology, the project significantly boosted operational efficiencies and enhanced decision-making capabilities. The strategic implementation of WebSockets for seamless data synchronization and the utilization of a local database for development have equipped the application with a robust and user-friendly interface, suitable for the dynamic needs of agricultural professionals.

Looking ahead, the application is poised for further enhancements that will include the integration of advanced analytics and improvements in mobile accessibility. These upgrades aim to ensure that the application remains responsive to evolving user requirements and the latest technological advancements. This ongoing commitment to innovation and continuous improvement is designed to keep the application at the forefront of agricultural technology solutions, driving greater efficiency and productivity in farming operations.