Ethical Considerations

Technological Ethics and Equity

Sprint 1: Foundation Establishment and Initial Deployment

Objective: Ensure the implementation of infrastructure and preliminary services.

Ethical Issue: The use of thermal imaging and artificial intelligence analysis technologies in FarmBot can enhance crop yields. However, if data access is not equitably distributed, it may widen the gap between large farms and smallholders. Moreover, the proliferation of agricultural automation might lead to significant unemployment among traditional farmers as manual tasks are increasingly performed by the FarmBot system.

Equal Data Access: Ensure that all users, whether large farms or smallholders, have fair access to technological resources and data to prevent the monopolization of information.

Customized Services:

1. Small Holders: Offer a basic version of the FarmBot system, which includes automated irrigation and simple thermal imaging monitoring suitable for small-scale crop management.
2. Medium to Large Holders: Provide a standard FarmBot system that includes automated irrigation, thermal imaging monitoring, and basic data analysis services.

Privacy Protection: Future planning for data minimization and anonymization: Implement the principle of data minimization by collecting only the information necessary for the project objectives and anonymizing collected data to ensure it cannot be traced back to individuals. Establish strict data access control measures to ensure that only authorized personnel can access sensitive data, and that the data is used solely for project research.

Sprint 2: Function Expansion and Deeper Collaboration

Objective: Expand system functions and increase the depth of collaboration.

Customized Services: Large Holders: Supply an advanced version of the FarmBot system with sophisticated thermal imaging technology, AI-driven crop health analytics, automated planting schedules, and comprehensive data analysis services.

Stakeholder Collaboration: Establish cooperative mechanisms with farmers, research institutions, and governments to jointly decide on the project's direction and applications, ensuring that the interests of all parties are balanced.

Addressing Unemployment Among Traditional Farmers: Establish a multi-stakeholder platform involving the government, the FarmBot organization, and agricultural enterprises. This platform will provide professional training to traditional farmers to transition into agricultural technology specialists.

Sprint 3: Continuous Optimization

Objective: Optimize current operations and prepare for future development.

Universal Design of Interface and Functions: To ensure that the FarmBot project's user interface meets the needs of all users, including the elderly, individuals with low technical skills, and the visually impaired, we will design an intuitive, easy-to-understand, and easy-to-operate user interface. Measures will include high-contrast visual layouts and simplified operation steps. Although the core FarmBot system already possesses these functionalities, our focus will be on integrating the thermal imaging camera to ensure its seamless operation.

Future Outlook

Future Development Plans: To reduce energy consumption, we will utilize the latest low-power thermal imaging and sensor technology in the FarmBot system. The device's energy management system will be optimized using smart algorithms to reduce energy use during non-

critical periods, such as decreasing the frequency of thermal imaging scans when sunlight is sufficient. Furthermore, we will implement a recycling and reuse plan for electronic devices to minimize environmental impact. While these plans primarily target the use of the thermal imaging camera, they will also contribute to the overall energy efficiency of the FarmBot system.

Risk Assessment

No.1	Data Privacy and Security
Risk	The thermal imaging camera collects extensive imagery and data that may include sensitive information. If not properly protected, this data could lead to privacy breaches.
Probability and Impact:	• **Probability:** Moderate • **Impact:** High
Mitigation Strategies:	• Implement the principle of data minimization, collecting only the essential data required for the project. • Anonymize collected data to prevent tracing back to individuals. • Use encryption technologies to secure data during transmission and storage. • Establish strict data access controls to ensure that only authorized personnel can access sensitive data.

No.2	Data Fairness
Risk	Unequal access to data could give large farms an advantage, exacerbating inequalities between large-scale and smallholder farmers.
Probability and Impact:	• **Probability:** High • **Impact:** High
Mitigation Strategies:	• Ensure that all users, regardless of farm size, have fair access to technological resources and data. • Implement transparent data-sharing policies so all users understand how their data is used and shared. • Offer tiered services based on farm size to ensure affordability and access for smallholders.

No.3	Environmental Impact
Risk	The use of thermal imaging cameras may increase energy consumption, leading to a negative environmental impact.
Probability and Impact:	• **Probability:** Moderate • **Impact:** Moderate
Mitigation Strategies:	• Utilize the latest low-power thermal imaging and sensor technologies. • Optimize the device's energy management system using smart algorithms to reduce energy use during non-critical periods. • Implement a recycling and reuse plan for electronic devices to minimize environmental impact.

No.4	Accessibility of Technology
Risk	The complexity of agricultural technology may make it difficult for some farmers, particularly those with low technical skills or visual impairments, to use.
Probability and Impact:	• **Probability:** Moderate • **Impact:** High
Mitigation Strategies:	• Design an intuitive, easy-to-understand, and easy-to-operate user interface that meets the needs of all users. • Conduct usability testing with diverse user groups to refine the interface and ensure it meets accessibility standards.