6.0 Knowledge Representation for AI Solution in Crop Disease Detection

1. Disease Detection and Actual Disease Presence:

- Predicate: CropDiseaseDetection(image, disease)
- Connective: → (implies)
- Knowledge Representation (KR): ∀x (CropDiseaseDetection(x) → Disease(x))

Explanation: This knowledge representation states that for any given image of a crop, if the AI system detects a disease, then there exists a disease affecting that crop. This KR is crucial in ensuring that the AI system accurately identifies and classifies crop diseases based on the images provided. The correct semantics are maintained as the implication captures the relationship between the detection of a disease and the actual presence of a disease.

CropDiseaseDetection(x)	Disease(x)	CropDiseaseDetection(x) → Disease(x)
True	True	True
True	False	False
False	True	True
False	False	False

2. Timely Action After Disease Detection:

- Predicate: TimelyAction(farmer)
- Connective: ∧ (and)
- Knowledge Representation (KR): ∀x (CropDiseaseDetection(x) ∧ TimelyAction(x))

Explanation: This KR asserts that for any farmer, if there is a crop disease detection, then the farmer takes timely action. The conjunction ensures that both conditions, disease detection and timely action, are met. This KR supports the goal of providing farmers with actionable insights and enables them to respond promptly to protect their crops.

CropDiseaseDetection(x)	TimelyAction(x)	CropDiseaseDetection(x) ∧ TimelyAction(x)
True	True	True
True	False	False
False	True	False
False	False	False

3. User-Friendly Interface Adoption:

- Predicate: UserFriendlyInterface(user)
- Connective: ↔ (if and only if)
- Knowledge Representation (KR): ∀x (UserFriendlyInterface(x) ↔ AdoptAI(x))

Explanation: This KR establishes a bidirectional relationship, stating that a user-friendly interface is adopted by users and, conversely, if the AI system is adopted, it implies a user-friendly interface. This is crucial in ensuring that farmers readily adopt the AI solution, enhancing the overall usability of the system.

UserFriendlyInterface(x)	AdoptAI(x)	UserFriendlyInterface(x) ↔ AdoptAI(x)
True	True	True
True	False	False
False	True	False
False	False	True

4. Collaborative Efforts in the Project:

- Predicate: Collaboration(partner1, partner2)
- Connective: ∨ (or)

- Knowledge Representation (KR): ∃x ∃y Collaboration(x, y)

Explanation: This representation asserts that there exist at least two partners engaged in collaboration. This KR supports the collaborative efforts essential for the project's success by encouraging partnerships between technology and agricultural experts.

Collaboration(x, y)	∃x ∃y Collaboration(x, y)
True	True
False	False

5. Data-Driven Decision-Making After Disease Detection:

- Predicate: DataDrivenDecision(farmer)
- Connective: → (implies)
- Knowledge Representation(KR): ∀x (CropDiseaseDetection(x) → DataDrivenDecision(x))

Explanation: This KR signifies that for any farmer, if there is crop disease detection, it implies data-driven decision-making. This underlines the importance of data analytics in providing actionable insights for effective crop protection and management strategies.

CropDiseaseDetection(x)	DataDrivenDecision(x)	CropDiseaseDetection(x) → DataDrivenDecision(x)
True	True	True
True	False	False
False	True	True
False	False	True

In summary, these knowledge representations, expressed in First-Order Logic (FOL), provide a clear and semantic understanding of the logical relationships crucial for the successful

implementation of the proposed AI solution in Crop Disease Detection within the Malaysian agriculture industry. Each representation supports the specified goals, ensuring correctness in both semantics and syntax.