Project Overview

Background

The FarmBot project is an agricultural technology project started by Rory Aronson in 2011. Through robotic technology, various tasks can be completed on raised beds, such as precise sowing, clearing weeds, watering plants, etc. It is the first robotic technology used in A revolutionary breakthrough in agriculture.

In agricultural scientific research, a hardware device that can accurately monitor crops in an experimental environment is needed to support researchers in exploring various planting conditions, optimizing planting strategies, and improving research efficiency. It is particularly important to integrate hardware devices, such as thermal imaging cameras, into FarmBot.

In the consumer market, consumers are particularly interested in specially cultivated healthy vegetables, such as organic vegetables and other crops. Efficiently cultivating crops requires farm robots to integrate diverse hardware facilities to accurately feedback effective information to growers.

Therefore, integrating thermal imaging cameras into FarmBot is of great significance to promote the development of agricultural scientific research and meet the needs of consumers and growers.

Project overview

Dr. Nir Lipovetzky uses this platform to research the development of new agricultural sensors at the University of Melbourne. This project will try to integrate thermal imaging cameras into the farmbot on the Parkville campus and use network technology to manage the device.

Thermal camera-FLIR AX8

FLIR AX8 is a product provided by Teledyne Flir. This product integrates camera and thermal imaging. The advantage is that it is compact and easy to install. This product supports automatic analysis and alarms, and is compliant with Ethernet/IP and Modbus TCP standards, and can share monitoring results to a programmable chip.

Project scope

Objective

The project aims to integrate a FLIR AX8 thermal imaging camera with the FarmBot system at the University of Melbourne's Parkville campus. This integration will enhance the FarmBot's capabilities in monitoring plant health, adjusting irrigation based on thermal data, and aiding agricultural scientific research through precise data collection.

Scope Description

Hardware Integration

- Camera Installation: Securely mount the FLIR AX8 camera on the FarmBot, ensuring stable and accurate data capture across different operations.
- Power Compatibility: Design and implement a power solution that matches the FarmBot's electrical specifications to operate the thermal camera without risk of damage.
- Data Interface Integration: Establish a reliable connection between the camera's Ethernet/USB interface and the FarmBot system to ensure seamless data transfer.

Software Development

- Data Collection and Management: Develop software components to collect, store, and manage thermal imaging data effectively.
- Thermal Data Analysis: Integrate AI algorithms to analyze thermal imaging for detecting plant health issues, irrigation needs, and growth stages.
- User Interface: Enhance the FarmBot web application to display real-time thermal imaging, provide historical data access, and allow user interaction for monitoring and adjustments.

Testing and Validation

- Functional Testing: Ensure all integrated components function correctly together, including real-time data display, automated notifications, and AI-based analysis.
- User Testing: Conduct user testing with stakeholders, primarily agricultural scientists and students, to validate the usability and effectiveness of the new features.
- Performance Evaluation: Assess the system's performance in terms of speed, accuracy, and reliability under different agricultural conditions.

Deployment

- Implementation: Roll out the integrated system on the Parkville campus for real-time operational use.
- Training and Documentation: Provide comprehensive training sessions for users and detailed documentation covering operation, troubleshooting, and maintenance.

Deliverables

- A fully functional FarmBot integrated with the FLIR AX8 thermal imaging camera.
- Software modules for data collection, management, and analysis.
- A user-friendly interface on the FarmBot web application for accessing and interpreting thermal data.
- Comprehensive documentation and user manuals.

Constraints

- The project must adhere to the budget constraints set by the University.
- The integration must comply with the technical specifications of both FarmBot and the FLIR AX8 camera.
- All development and testing must be completed within the project timeline to coincide with the agricultural cycle at the University.

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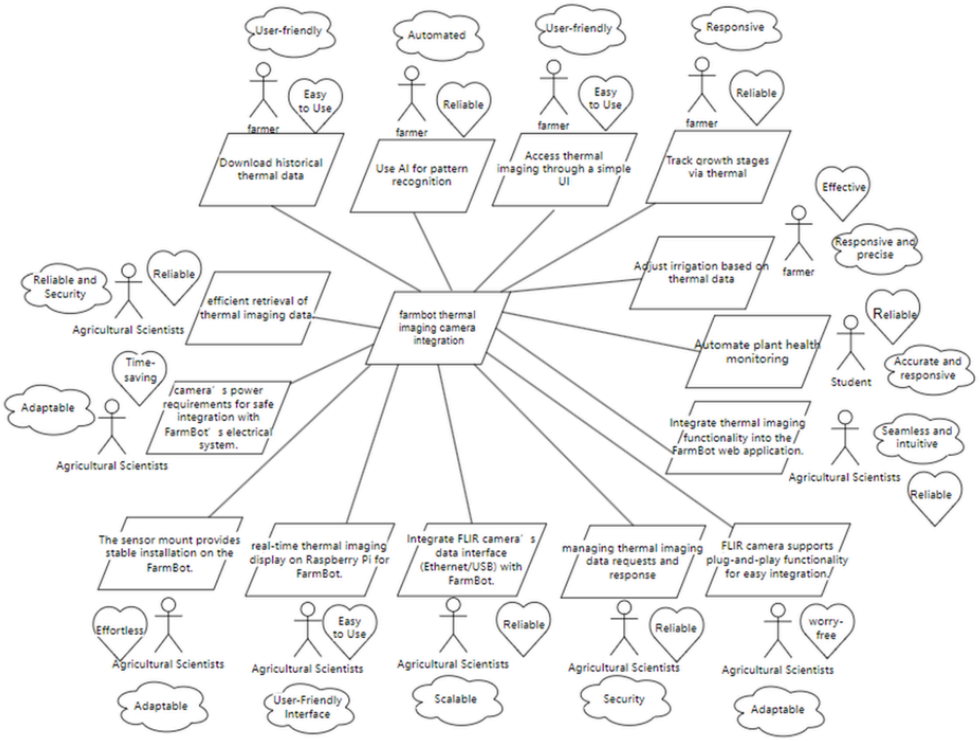
Project goals

- Integrating new agricultural sensors: thermal imaging cameras
- Using information technology to collect and visualize thermal camera data
- Operate farmbot to conduct agricultural experiments based on thermal imaging camera data

DO-BE-FEEL list

WHO	DO	BE	FEEL
Agricultural Scientists	Real-time thermal imaging display on Raspberry Pi for FarmBot.	User-Friendly Interface	Easy to Use
Agricultural Scientists	Integrate FLIR camera's data interface (Ethernet/USB) with FarmBot.	Scalable	Reliable
Agricultural Scientists	The sensor mount provides stable installation on the FarmBot.	Adaptable	Effortless
Agricultural Scientists	FLIR camera supports plug-and-play functionality for easy integration.	Adaptable	Effortless and worry-free
Agricultural Scientists	Camera's power requirements for safe integration with FarmBot's electrical system.	Adaptable	Time-saving and efficient
Agricultural Scientists	Managing thermal imaging data requests and responses	Security	Reliable
Agricultural Scientists	Efficient retrieval of thermal imaging data.	Security	Reliable
Agricultural Scientists	Integrate thermal imaging functionality into the FarmBot web application.	Seamless and intuitive	Reliable
Student	Automate plant health monitoring	Accurate and responsive	Informed and Reliable
Student	Adjust irrigation based on thermal data	Responsive and precise	Effective
Student	Track growth stages via thermal	Responsive	Reliable
Student	Access thermal imaging through a simple UI	User-friendly	Easy to Use
Student	Use AI for pattern recognition	Automated	Reliable
Student	Download historical thermal data	User-friendly	Easy to Use

GOAL MODEL



Personas

Clark Andrews - Agricultural scientist

Friendly | Clever | Go-Getter

Age: 32
Work: Agricultural scientist
Family: Single
Location: San Jose, CA
Character: Strong agricultural technology background

"What I hope most is that this solution can help me improve the yield and quality of crops while protecting the environment, so that technology can truly serve sustainable agriculture."

Motivation

When conducting agricultural research, Clark often encounters the challenge of accurately monitoring and simulating the impact of different planting environments on crop growth. This has led her to seek ways to reduce the negative environmental impact of agricultural activities while trying to increase crop yields and quality. On a professional forum, Clark read a discussion about FarmBot, an agricultural robot, and learned that it can accurately perform tasks such as planting, weeding, and watering, while monitoring crop status in real time through the user interface. Inspired by this possibility, she decided to delve deeper into FarmBot, hoping that the system would help her optimize her planting strategies and achieve her sustainable farming goals.

Goals

- Use high technology to improve crop yields.
- Efficient use of manpower, water and land.
- Practice sustainable agriculture and reduce environmental burden.
- Cultivate healthy vegetables to meet your health needs.

Frustrations

- Lack of accurate crop growth monitoring tools
- Lack of equipment to simulate the effects of different environmental conditions on crop growth

Bio

Clark is technology and innovation savvy, using data analytics and modern agricultural techniques to drive her research.
Outside of the lab, Clark is an avid gardener, growing his own organic fruits and vegetables. She regularly shares her knowledge and experience through workshops and social media to inspire others to adopt more sustainable living practices. Emma's ultimate goal is to bridge the gap between technology and traditional farming to create a more sustainable and food secure future.

Personality

Introvert	Extrovert
Analytical	Creative
Loyal	Fickle
Passive	Active

Preferred Channels

- Social Media
- Mobile
- Email
- Traditional Ads

Brands

slack

ResearchGate

Google Scholar

Carlos Rivera- Students doing research

Age: **22**
Work: **Student**
Family: **Single**
Location: **Cerritos, Coahuila, Mexico,**
Character:**A curious young man**

"I hope to learn more about agriculture by using FarmBot to prepare for my future career development. I hope to bring some innovative ideas and solutions to my hometown during the study process."

Diligent | Creative | Curious

Goals

- Learn and practice farming knowledge by using FarmBot
- Learn the application of modern agricultural technology
- Able to provide some innovative ideas and solutions for agricultural development in hometown

Frustrations

- Lowes' financial resources may be limited and he may not be able to afford the cost of the purchase
- More time and effort will be needed to overcome these technical barriers

Bio

Carlos is an agriculture student from a rural area of Mexico. He has a strong interest in agricultural technology and sustainable agriculture and hopes to become an agricultural scientist in the future. Having lived on a farm since he was a child, he has a deep understanding of the cultivation and growth process of crops, but he is also aware that traditional agricultural methods have certain limitations in resource utilization and environmental protection. Carlos loves nature and the outdoors, and enjoys exploring new agricultural techniques and growing methods. He often participates in volunteer activities to help local farmers improve agricultural production methods. He also studied agricultural science in college and was active in campus agriculture programs.

Personality

Introvert	Extrovert
Thinking	Feeling
Sensing	Intuition
Judging	Perceiving

Motivation

Carlosmmersed in agricultural theory but hungry for real-world experience, Carlos stumbled upon FarmBot while looking for practical learning resources. This innovative tool provides him with a real-time canvas to observe and interact with crops as they grow, bridging the gap between classroom lectures and real-world agriculture. Through FarmBot, not only can he apply and deepen his academic knowledge, but he can also pioneer agricultural research that will transform traditional agricultural practices in his community. This discovery motivated him to use FarmBot as a means to combine theory with practice, and fueled his desire for agricultural research.

Brands

stackoverflow

Persona2