 FarmIT: Smart Agricultural Solution System (SASS)

A row of green plants in a field

AI-generated content may be incorrect.Healthier crops for a healthier world

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## Product description

The FarmIT is an innovative IoT-based solution designed to transform farming practices by monitoring crop health, soil conditions, and weather patterns. Utilizing advanced sensor technology, the system continuously collects real-time data on essential agricultural parameters such as soil moisture, temperature, pH levels, and nutrient concentrations. This comprehensive monitoring empowers farmers to make informed decisions regarding irrigation, fertilization, and pest management.

At the heart, FarmIT is robust data analytics software that processes and analyzes the gathered information. This software identifies trends and patterns, providing valuable insights that enable farmers to anticipate challenges and optimize their practices. For example, it can forecast weather conditions and predict potential disease outbreaks, allowing for proactive management strategies tailored to specific crops and local environments.

The system also encourages collaboration through partnerships with agricultural businesses and industry experts. These alliances grant farmers access to valuable resources, best practices, and ongoing support tailored to their unique needs. This network facilitates knowledge exchange and keeps farmers informed about the latest advancements in agricultural technology.

To ensure successful implementation, the FarmIT includes comprehensive training programs. These programs equip farmers with the skills to operate the system effectively, interpret data, and make informed decisions based on the insights provided. By emphasizing education, the system promotes a seamless transition to smarter farming practices.

Overall, FarmIT represents a significant advancement in agricultural technology, providing farmers with the tools they need to enhance productivity, sustainability, and resilience in their operations.

## Technical Details

Creating the Smart Agriculture System is not a simple feat. For the system to perform all of its functions as intended, many different smaller machine systems are required to be constructed. Each machine must perform its job well, be it reading moisture, temperature, and nutrient levels in the soil or capturing data about the weather to predict incoming changes. Not only that, but it will also need to gather data about pests and the health of the plant.

Soil sensors that measure critical parameters such as moisture, temperature, and nutrient levels, as well as a weather station that captures essential climatic data. Alert notifications to inform farmers of any critical changes. Comprehensive training materials will be provided, equipping farmers with the necessary skills to maximize the system's benefits. Software, hardware, and even security are a must.  
 To create sensors that can monitor nutrients, water, temperature, pests, and crop health, an IoT system will need to be created by incorporating LDR (light dependent resistor) sensors, DHT11 temperature and humidity sensors, water motor(s), and a device that will relay this information to an app, accessible by computer or phone via internet and/or Bluetooth connections. The best device for this would be a small computer, which will be built into the system itself and powered by the system’s cord, cable, or solar panel.   
 Different models built for different uses will have different power sources. Outdoor plants will need cables that are built for outdoor use, while indoor plants need simple cords with plugs that match the native power outlets. Most importantly, larger farm-use systems will use solar power for convenience. A separate outdoor model would not need to rely on such large amounts of energy.  
 While the sensors gather data, IoT (Internet of Things) technology is necessary to utilize that data to identify upcoming weather patterns and use machine learning algorithms to give accurate results. By placing a sensor under the leaf and stem of the plant, monitoring the crop’s health should also be a simple and efficient process via the app. All of the data used by the app will be encrypted as well, protecting your data and any entered information from anyone who may try to access it. However, before any of these technologies can be used, the right materials (sensors, cords, internet modules, computers, and more) will need to be acquired from production companies and manufacturers. Not only that, but to program the interface and IoT/machine learning systems, programmers will need to be partnered with.   
 To meet our goals, it will need to pass the following tests: Sensor accuracy and durability of water, soil, plant health, weather, and pest sensors. The power supply must supply enough power to the significant model. Successful WiFi and Bluetooth connectivity, as well as proper data transmission to the app and website’s cloud. Machine learning results must be accurate consecutively. The Smart Agriculture will need to be able to read and transfer all data at once in large amounts to the app/website’s cloud. Lastly, the data must be properly encrypted.

## Defined Goals (MVP)

The FarmIT is an innovative IoT solution designed to empower farmers in monitoring crop health, soil conditions, and weather patterns. It will leverage soil sensors and a weather station to gather critical data, which will be securely aggregated on a cloud platform and presented through a user-friendly app featuring real-time insights and alerts. Comprehensive training materials will equip farmers to use the system effectively.

The development process will encompass thorough market research, prototype testing, and iterative refinements before a broader launch. Success will be evaluated based on user engagement and improvements in crop yield, establishing a robust foundation for future advancements in agricultural technology.

## Testing (RTM)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Task No.** | **Req. ID** | **Category** | **Requirement Description** | **Status** | **Notes** | **Doc. No.** |
| 1 | 1.01 | Power Supply | Test solar panel functionality in clear weather conditions | Planned |  |  |
| 1.02 | Power Supply | Test solar panel functionality in cloudy weather conditions | Planned |  |  |
| 1.03 | Power Supply | Verify indoor power cord compatibility with standard wall outlets | Planned |  |  |
| 1.04 | Power Supply | Verify battery-powered models' function for an expected duration before recharging. | Planned |  |  |
| 1.05 | Power Supply | Test solar charging efficiency under varying sunlight conditions | Planned |  |  |
| 1.06 | Power Supply | Validate power consumption rates under continuous operation | Planned |  |  |
| 2 | 2.01 | Sensor Accuracy | Verify that soil moisture sensors provide accurate readings in normal conditions. | Planned |  |  |
| 2.02 | Sensor Accuracy | Verify that soil moisture sensors provide accurate readings in drought conditions. | Planned |  |  |
| 2.03 | Sensor Accuracy | Verify that soil moisture sensors provide accurate readings in excessive rain conditions. | Planned |  |  |
| 2.04 | Sensor Accuracy | Test soil temperature sensors for accuracy at high temperatures | Planned |  |  |
| 2.05 | Sensor Accuracy | Test soil temperature sensors for accuracy at low temperatures | Planned |  |  |
| 2.06 | Sensor Accuracy | Validate nutrient level sensors for detecting nitrogen levels | Planned |  |  |
| 2.07 | Sensor Accuracy | Validate nutrient level sensors for detecting phosphorus levels | Planned |  |  |
| 2.08 | Sensor Accuracy | Validate nutrient level sensors for detecting potassium levels | Planned |  |  |
| 2.09 | Sensor Accuracy | Verify whether the weather station captures real-time temperature data | Planned |  |  |
| 2.10. | Sensor Accuracy | Verify whether the weather station captures real-time humidity data | Planned |  |  |
| 2.11 | Sensor Accuracy | Verify whether the weather station captures real-time wind speed data | Planned |  |  |
| 2.12 | Sensor Accuracy | Verify whether the weather station captures real-time precipitation data | Planned |  |  |
| 2.13 | Sensor Accuracy | Test pest detection sensors for identifying common agricultural pests | Planned |  |  |
| 2.14 | Sensor Accuracy | Test pest detection sensors for identifying rare agricultural pests | Planned |  |  |
| 2.15 | Sensor Accuracy | Confirm crop health monitoring sensors provide accurate readings for leaf conditions. | Planned |  |  |
| 2.16 | Sensor Accuracy | Confirm crop health monitoring sensors provide accurate readings for stem conditions. | Planned |  |  |
| 2.17 | Sensor Accuracy | Verify light-dependent resistor (LDR) sensor accuracy in daylight conditions. | Planned |  |  |
| 2.18 | Sensor Accuracy | Verify light-dependent resistor (LDR) sensor accuracy in low-light conditions. | Planned |  |  |
| 3 | 3.01 | Sensor Durability | Test soil sensors for functionality after prolonged exposure to water | Planned |  |  |
| 3.02 | Sensor Durability | Test soil sensors for functionality after prolonged exposure to dirt | Planned |  |  |
| 3.03 | Sensor Durability | Verify whether the weather station operates correctly after exposure to high wind speeds. | Planned |  |  |
| 3.04 | Sensor Durability | Verify weather station operates correctly after exposure to heavy rainfall. | Planned |  |  |
| 3.05 | Sensor Durability | Ensure pest detection sensors remain functional after continuous outdoor exposure. | Planned |  |  |
| 3.06 | Sensor Durability | Validate resistance of sensor casings to UV exposure over extended periods. | Planned |  |  |
| 3.07 | Sensor Durability | Test sensor resistance to extreme temperature variations | Planned |  |  |
| 4 | 4.01 | Connectivity | Tested WiFi connectivity under optimal signal strength | Planned |  |  |
| 4.02 | Connectivity | Test WiFi connectivity under weak signal strength | Planned |  |  |
| 4.03 | Connectivity | Verify Bluetooth connectivity with Android devices | Planned |  |  |
| 4.04 | Connectivity | Verify Bluetooth connectivity with iOS devices | Planned |  |  |
| 4.05 | Connectivity | Validate Bluetooth reconnection after temporary signal loss | Planned |  |  |
| 4.06 | Connectivity | Verify that the system automatically reconnects to WiFi after signal loss | Planned |  |  |
| 4.07 | Connectivity | Test connectivity to multiple devices simultaneously | Planned |  |  |
| 5 | 5.01 | Performance | Verify system load handling with the maximum number of connected sensors | Planned |  |  |
| 5.02 | Performance | Test delay in sensor data updates under high network traffic | Planned |  |  |
| 5.03 | Performance | Measure power efficiency under different usage scenarios | Planned |  |  |
| 5.04 | Performance | Evaluate system startup time after reboot | Planned |  |  |
| 5.05 | Performance | Test responsiveness of mobile app under varying network conditions | Planned |  |  |
| 5.06 | Performance | Test continuous operation of sensors over extended periods | Planned |  |  |
| 6 | 6.01 | Usability | Verify correct display of data visualization elements in the app | Planned |  |  |
| 6.02 | Usability | Test multi-language support for farmers in different regions | Planned |  |  |
| 6.03 | Usability | Ensure training materials provide clear instructions for farmers | Planned |  |  |
| 6.04 | Usability | Conduct farmer usability tests for feedback on system efficiency | Planned |  |  |
| 7 | 7.01 | Security | Validate firewall settings for secure remote data access | Planned |  |  |
| 7.02 | Security | Test for unauthorized API access attempts | Planned |  |  |
| 7.03 | Security | Verify encryption strength for data transmission | Planned |  |  |
| 7.04 | Security | Confirm data backup and restore functionality | Planned |  |  |
| 7.05 | Security | Evaluate intrusion detection and logging effectiveness | Planned |  |  |
| 8 | 8.01 | Machine Learning | Validate AI-driven irrigation recommendations | Planned |  |  |
| 8.02 | Machine Learning | Test the predictive accuracy of pest infestation models | Planned |  |  |
| 8.03 | Machine Learning | Ensure adaptive learning in response to climate change | Planned |  |  |
| 8.04 | Machine Learning | Assess AI model retraining efficiency | Planned |  |  |
| 8.05 | Machine Learning | Validate data-driven crop rotation insights | Planned |  |  |
| 9 | 9.01 | Data Processing | Test cloud storage latency for large datasets | Planned |  |  |
| 9.02 | Data Processing | Ensure accuracy of historical trend analysis | Planned |  |  |
| 9.03 | Data Processing | Validate integration with third-party analytics tools | Planned |  |  |

## Feasibility

(How possible is this idea and what kind of timeframe will be involved to create, market, and sell our concept?)

As far as Marketing and selling go, we could show what competitors offer compared to what FarmIT is capable of.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Competitor Feature Comparison | LetPot Automatic Watering System | Garduino-Automated Gardening System | 12 Seed Pods Smart Garden | FarmIT's Smart Agriculture System |
| Affordable | ✓ | X | ✓ | ✓ |
| Water Plants Automatically | ✓ | ✓ | ✓ | ✓ |
| Monitors Plant Water | X | ✓ | ✓ | ✓ |
| Monitors Temperature | ✓ | X | X | ✓ |
| Monitors Soil | X | ✓ | X | ✓ |
| Monitors Crop Health | X | X | X | ✓ |
| Monitors Weather | X | ✓ | X | ✓ |
| Predicts Weather | X | ✓ | X | ✓ |
| Data Accessible through Phone | ✓ | X | X | ✓ |
| Bluetooth Accessible | ✓ | X | X | ✓ |
| Internet Accessible | ✓ | X | X | ✓ |
| Available In Small Home Size | ✓ | X | ✓ | ✓ |
| Available Outside Size | X | ✓ | X | ✓ |
| Available in Large Agricultural Farm Size | X | X | X | ✓ |
| Easy Assembly | ✓ | X | ✓ | X |

## Special Considerations/ Marketing Efforts

(This is where we will put information like extra costs from legal fees and patenting, backups for supply chain issues and their cost difference, Marketing ideas, etc)

The food we eat today is far less nutritious than the food that was grown by farmers even 50 years ago. As shown in the graph below, the fruits and vegetables that used to be grown on America’s cropland has higher concentrations of essential minerals such as vitamin A, calcium, and iron.

A chart with numbers and symbols

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One of the main reasons for this degradation in food quality has to do with declining soil quality over the last couple of decades. Soil has become less nutrient-rich due to erosion and therefore less well-suited to grow crops that contain the vitamins and nutrients that we as humans need to function well in our day to day lives. By investing in FarmIT, as well as our intensive training program; customers will get the chance to grow healthier foods for themselves, their communities, and even their customers by getting accurate, up-to-date information about soil quality and recommendations to improve crops.

A graph of a graph showing the growth of soil erosion

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One factor that needs to be addressed is how we could market FarmIT to rural farmers, as they are sometimes portrayed as too proud to accept help from changing technology. Whether this idea is merely a stereotype of rural farmers or not, the idea should still be addressed and accounted for, which is where our research comes into play. As portrayed in the graph below, the US birthrate has been in decline for many years. This decline affects rural farmers just as much if not more so than other US citizens, considering the fact that agricultural tasks used to be completed as a family-unit. With less children around to pitch in a helping hand with simple tasks, everything now falls to the farmer. Pitching our product using this data set may increase FarmIT sales by providing a valid reason for our target demographic to accept and even invest in help from us.

A graph showing the growth of the stock market

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## Summary

The FarmIT proposal introduces an innovative IoT-based solution designed to revolutionize farming practices through real-time monitoring of crop health, soil conditions, and weather patterns. By seamlessly integrating advanced sensor technology with a robust cloud-based data analytics platform, this system empowers farmers with actionable insights that optimize operations, enhance productivity, and promote sustainability.

Key components include state-of-the-art soil sensors that measure vital parameters such as moisture, temperature, and nutrient levels, complemented by a weather station that captures essential climatic data. Together, these tools provide a comprehensive overview of the farming environment, enabling farmers to make informed decisions that significantly improve crop yield and resource efficiency.

To further support farmers, FarmIT features timely alert notifications, ensuring they are promptly informed of critical changes and can take immediate action to mitigate potential risks. Comprehensive training materials will facilitate smooth adoption, equipping farmers with the skills needed to fully leverage the system’s benefits.

Our development process includes thorough market research, prototype testing, and iterative refinements based on user feedback, ensuring the final product meets users' specific needs. We will measure success through user engagement, satisfaction ratings, and tangible improvements in crop yield and resource management.

By investing in FarmIT, stakeholders will contribute to the advancement of agricultural practices and foster a sustainable future for farming. This proposal outlines a clear path to transform the agricultural landscape through innovative technology, positioning us as leaders in the smart agriculture movement. We invite you to join us in this exciting journey toward a more efficient and sustainable agricultural future.

## Timeline and Budget

Creating our smart agricultural system budget involves strategic financial planning to ensure our Minimum Viable Product is successful. Starting with hardware expenses, which are integral to our system, soil sensors at a professional-grade level cost around $100 to $500 each. Averaging at $300 each, we plan to purchase 100 sensors, totaling $30,000. Wireless weather stations, priced at $850 each, will require ten units, leading to a total cost of $8,500. Additionally, IoT gateway devices, which connect all sensors and transmit data, are $300 each. For five units, we will spend $1,500. We also need calibration equipment to ensure sensor accuracy, estimated at $3,000 based on supplier quotes, In total, our hardware costs add up to $42,000.

For shipping costs overall the most cost effective option would be amazon prime which would only cost $139 annually and their standard shipping prices range from 6.19 a box which for example if we got 1000 boxes that would equal $6,190 , However most customers may want their products earlier than amazons’ two day shipping I that case are options would be FedEx or UPS, FedEx’s options for us would be FedEx ground which is Approximately $22.06 per box depending how big the customer order is shipping prices would equal $22,060 for 1000 boxes and For FedEx express saver it would be $42.65 and being a faster more reliable method it would cost us $42,650, Moreover the UPS methods the UPS Ground will cost us $8.05 per box totaling $8,050, UPS Next Day Air Early costs us $18.95 per box costing us $18,950. The average of these prices are $19,780. These estimates were retrieved from each delivery website.

Furthermore, software licensing is another important financial factor. A license for data analytics software, essential for gaining insights into our agricultural data, is estimated at $10,000 yearly. Cloud data storage to keep our data secure will cost $1,200 a month, leading to an annual expense of $14,400. The development of a mobile application for farmers and stakeholders is projected to run around $20,000, depending on necessary features. Additionally, building a website as an online platform for system access and support is estimated at $5,000. Thus, our total software costs come to $59,400 annually.

Labor fees make up the largest part of our budget, covering salaries for the project team. A project manager who oversees the project makes about $116,190 a year. We will have two IoT engineers at $129,899 each, bringing the total to $259,798. A data scientist, essential for analyzing our data and providing insights, earns $108,020 annually. An agricultural specialist, who ensures the system meets farmers' needs and aligns with best practices, is estimated at $98,000. We will also have two software developers, each earning $112,000 per year, totaling $224,000. A marketing specialist, tasked with promoting the system to farmers and ag businesses, is budgeted at $85,130. We will need a training coordinator to help educate users about the system, with an estimated salary of $61,680. Lastly, our administrative support staff is budgeted at $40,000. The final total for labor costs for the year comes to $992,818.

Training is essential to ensure everyone can effectively use our smart agricultural system. We plan to conduct five staff workshops to educate users on the system, with each session costing about $1,500, resulting in a total of $7,500 for the workshops. Additionally, we plan to develop e-learning modules to provide ongoing training resources, estimated at $10,000. Therefore, the total value for our training costs would be $17,500.

We have included a contingency fund, which is 10% of the overall budget, to cover any unforeseen costs in our product's future. Our contingency fund will amount to a total of $112,249.80, based on standard contingency planning.

In summary, our hardware expenses total $43,000, our software licensing amounts to $59,400, labor costs are $992,818, training expenses total $17,500, and our contingency fund is $112,249.80. Consequently, the overall budget for our smart agricultural system is $1,234,747.80.

**Timeline:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Phase No.** | **Phase** | **Year** | **Months** | **Task** |
| 1 | Research & Planning | 2025 | March to April | Define exact product requirements & technical specifications |
| Research & Planning | 2025 | March to April | Secure partnerships with sensor & hardware suppliers |
| Research & Planning | 2025 | March to April | Finalize MVP design & system architecture |
| Research & Planning | 2025 | March to April | Develop budget allocations & secure funding (if needed) |
| 2 | Prototype Development | 2025 | April to July | Procure initial hardware components (soil sensors, weather stations, IoT devices) |
| Prototype Development | 2025 | April to July | Develop firmware & software integrations for sensors |
| Prototype Development | 2025 | April to July | Build early-stage cloud infrastructure & mobile app |
| Prototype Development | 2025 | April to July | Conduct initial prototype testing in a controlled environment |
| Prototype Development | 2025 | April to July | Gather feedback & refine hardware/software based on findings |
| 3 | Testing & Iteration | 2025 | August to December | Perform full-scale field testing with selected farmers |
| Testing & Iteration | 2025 | August to December | Validate sensor accuracy, durability, and real-time monitoring |
| Testing & Iteration | 2025 | August to December | Optimize power efficiency & connectivity (WiFi, Bluetooth, mobile app access) |
| Testing & Iteration | 2025 | August to December | Conduct security audits to ensure safe data handling |
| Testing & Iteration | 2025 | August to December | Implement machine learning models for predictive analytics |
| 4 | Production & Deployment | 2026 | January - April | Finalize hardware selection & optimize production costs |
| Production & Deployment | 2026 | January to April | Manufacture & assemble devices for initial deployment |
| Production & Deployment | 2026 | January to April | Establish logistics & distribution channels for shipping |
| Production & Deployment | 2026 | January to April | Conduct training workshops for early adopters & beta testers |
| Production & Deployment | 2026 | January to April | Launch marketing campaign to drive awareness |
| 5 | Market Launch & Scaling | 2026 | May to June | Officially launch FarmIT with a structured rollout plan |
| Market Launch & Scaling | 2026 | May to June | Provide customer support & ongoing training materials |
| Market Launch & Scaling | 2026 | May to June | Monitor real-world performance & gather post-launch feedback |
| Market Launch & Scaling | 2026 | May to June | Expand to additional farms & refine based on user needs |
| Market Launch & Scaling | 2026 | May to June | Plan long-term updates, scalability, and new features |

**Budget Table:**

|  |  |  |  |
| --- | --- | --- | --- |
| Categories | Quantities | Unit Costs ($) | Total Costs ($) |
| Hardware: Soil Sensors | 100 | 300 | 30,000 |
| Hardware: Wireless Weather Stations | 10 | 850 | 8,500 |
| Hardware: IoT Gateway Devices | 5 | 300 | 1,500 |
| Hardware: Calibration Equipment | 1 | 3,000 | 3,000 |
| Logistics and Packaging | 1 | 19,780 | 19,780 |
| Software: Data Analytics License | 1 | 10,000 | 10000 |
| Software: Cloud Data Storage | 12 | 1,200 | 14,400 |
| Software: Our Mobile Applications Development | 1 | 20,000 | 20,000 |
| Software: Website Development | 1 | 5,000 | 5,000 |
| Labor: Project Manager | 1 | 116,190 | 116,190 |
| Labor: 2 IoT Engineers | 2 | 129,899 | 259,798 |
| Labor: Data Scientist | 1 | 108,020 | 108,020 |
| Labor: Agricultural Specialist | 1 | 98,000 | 98,000 |
| Labor: 2 Software Developers | 2 | 112,000 | 224,000 |
| Labor: Marketing Specialist | 1 | 85,130 | 85,130 |
| Labor: Training Coordinator | 1 | 61,680 | 61,680 |
| Labor: Administrative Support | 1 | 40,000 | 40,000 |
| Training: A total of 5 Staff Workshops | 5 | 1,500 | 7,500 |
| Training: Our e-learning Modules | 1 | 10,000 | 10,000 |
| Our 10% Contingency Fund | 1 | 112,249.80 | 112,249.80 |
|  |  |  |  |
|  |  |  |  |
| Hardware |  |  | 43,000 |
| Logistics and Packaging |  |  | 19,780 |
| Software |  |  | 49,400 |
| Labor |  |  | 992,818 |
| Training |  |  | 17,500 |
| Contingency fund of 10% |  |  | 112,249.80 |
| Our grand total comes to: |  |  | 1,234,747.80 |

## References

“Organic Farming Images - Free Download on Freepik.” *Freepik.Com*, www.freepik.com/free-photos-vectors/organic-farming. Accessed 25 Feb. 2025.

## Supplimental Documentation

**Our Mission Statement:** Constantly innovating the best technology to create a healthier life for healthier people in a healthier world.

**Our Logo:**

A logo on a green background

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**Watermark:**

A logo with a blue and yellow design

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