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COALINGA COLLEGE

FIELD ROBOTIC DEVICE

AgSTEM Kit 2025

Instructor Guide: Field Robotic Device AgSTEM Kit

Introduction

The **Field Robotic Device AgSTEM Kit** introduces students to the exciting world of agricultural robotics using the **Amiga autonomous robot**. Designed for learners from elementary through community college, this kit provides a scaffolded exploration of robotic technologies that are transforming modern farming. Students will interact with the Amiga's **"follow mode"**, observe its mobility and utility, and for advanced learners, operate implements via a **three-point hitch system**.

This kit supports **STEM learning**, **career exploration**, and **agricultural literacy**, and is aligned with NGSS and CTE standards where appropriate. Students engage in inquiry-based learning, problem-solving, and real-world application through **presentations**, **video demonstrations**, **hands-on activities**, and **guided reflection**.

Kit Components

Each AgSTEM experience includes:

- **Age-appropriate presentation slides** (2nd–college)
- **Pre/post student surveys**
- **Student worksheets & logs**
- **Video demonstration of Amiga robot in action**
- **Hands-on activity using Amiga's follow mode and (when appropriate) hitching/pulling implements**

Sequence of Use

The full experience is designed to be delivered in a **60–90 minute block** but can be adapted to shorter segments or multi-day use.

Before the Session

1. **Set up the robot and test follow mode** (and implement hitch if applicable).
2. Print:
    - Age-specific **pre-survey**
    - Student **worksheet or log sheet**
3. Load the **video demonstration** for preview.

Delivery Outline

Segment	Description	Time
1. Welcome & Pre-Survey	Introduce robotics in ag; collect baseline interest & knowledge	5–10 min
2. Presentation	Use age-appropriate slide deck to build background knowledge	10–15 min
3. Video Demo	Show Amiga operating in follow mode and with an implement	5–10 min
4. Hands-On Activity	Students interact with Amiga and complete a task trail	25–40 min
5. Reflection & Post-Survey	Discuss observations and evaluate learning	10–15 min

Hands-On Activities by Grade Level Overview

All activities center around **Amiga's follow mode**, with added complexity in upper grades. Activities are outlined in detail in the **Instructor Activity Guide** and include:

- **Grades 2–3:** *Follow the Farm Trail* – students lead Amiga on a simple chore path.
- **Grades 4–5:** *Robot Trail Challenge* – students complete a guided farm tool mission.
- **Grades 6–8:** *Precision Follow Test* – includes elevation/obstacle elements.
- **Grades 9–10:** *Tool Tow Challenge* – students lead Amiga while it pulls a mock implement.
- **Grades 11–12:** *Field Trial with Implement* – students analyze robot + tool performance.
- **Community College:** *Operational Evaluation Lab* – technical testing & performance metrics.

Pre/Post Surveys Overview

Surveys are tailored to each grade level and measure:

- Student familiarity with agricultural robots
- Awareness of careers in ag technology
- Understanding of robot capabilities
- Interest in STEM and ag-related pathways

Instructor Note: Surveys are quick to administer and should be collected before and after the session for assessment or grant reporting.

Student Worksheets & Logs Overview

Each activity includes a custom **worksheet or log sheet** with:

- Observation prompts
- Data collection tables (upper grades)
- Open-ended reflection questions

Instructor use:

- Distribute before the hands-on segment
- Review responses for engagement and understanding
- Use to spark discussion or guide debrief

Video Demonstration Overview

A short video is included that showcases:

- The Amiga robot activating **follow mode**
- Basic navigation behind a human lead
- Demonstration of towing a simple implement

Instructor Notes:

- Show before the hands-on activity
- Pause and discuss sensor placement, movement, and use cases
- Optional: replay after activity for deeper comparison

Instructor Tips

- **Test follow mode** in the environment ahead of time, especially outdoors or in mixed terrain.
- Adjust implement load based on student strength and robot stability.
- Use cones, rope, or signs to clearly mark student pathways.
- Reinforce career connections throughout (engineer, technician, ag entrepreneur).
- Encourage teamwork and safe handling of the robot and implements.

Optional Extensions

- **Writing Prompt:** "If I had a robot on my farm, it would help me by…"
- **Career Research:** Assign students a job title from the robotics field to investigate.
- **Math Integration:** Use measurement and time data from logs for basic rate/ratio analysis.

Summary

The Field Robotic Device AgSTEM Kit allows students to engage in authentic agricultural experiences using state-of-the-art robotic tools. With structured lessons, hands-on applications, and career-aligned content, this program supports cross-disciplinary learning and builds awareness of emerging technologies in food production.

Table of Contents

Meet the Amiga: Your Field Robotics Helper

Amiga is an autonomous, all-electric field robot designed to support farmers with everyday tasks in agriculture. Created by **Farm-ng**, the Amiga combines advanced **computer vision**, **mobility**, and **tool-carrying capacity** to make farm work safer, faster, and more efficient.

Key Features:

- **Follow Mode:** Amiga can follow a person hands-free using vision-based tracking—just like a well-trained farm helper!
- **Three-Point Hitch:** It can pull small farm tools like planters, weeders, or rollers, making it useful in a variety of crops and field layouts.
- **Electric Powered:** It runs quietly on battery power and can be recharged easily, making it eco-friendly.
- **Modular Design:** Tools and trays can be added or removed depending on the job—whether that's planting seeds, hauling bins, or towing implements.

Why It Matters:

Amiga helps reduce the physical workload of farm labor, improves efficiency in small to mid-sized farms, and gives students a hands-on introduction to **robotics in real-world agriculture**.

Whether you're learning how sensors work, how robots move, or how to program follow behavior, **Amiga brings robotics to life right on the farm**.

Presentation 2nd – 3rd Grade

2nd-3rd Grade Farming Robots: Meet the Amiga!

Get ready to meet the Amiga, a super cool robot that helps farmers grow yummy food! It's like a smart helper for big farm jobs.

Why Use Robots on Farms?

Faster Work

Robots work quickly.

They never get tired.

Safer Jobs

Robots handle tricky tasks.

Keeps farmers safe.

Robots make farm work super fast and safe. They can keep working all day, every day!

How Do Robots Work?

Robot Eyes

Cameras help them "see."

Smart Brains

Computers help them "think."

Move on Their Own

They drive themselves.

Robots use cameras and computers to understand their surroundings and move around all by themselves, just like a smart car!

Follow Mode: A Robot Friend

Follows the Farmer

Like a helpful puppy.

Stays Very Close

Always by their side.

The Amiga robot has a special "Follow Mode." It can trail behind the farmer, just like a little shadow, making farm work easier.

NOTES: Some jobs that would normally take several field workers can now be done with one farmer and the Amiga.

Why Follow Mode is Super Cool

Carries Heavy Things

Helps farmers lift big loads.

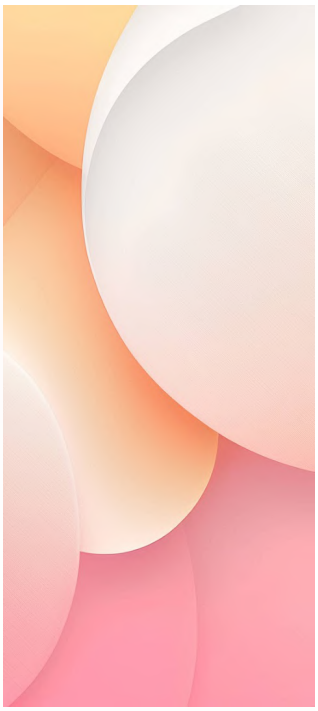
Less tiring for people.

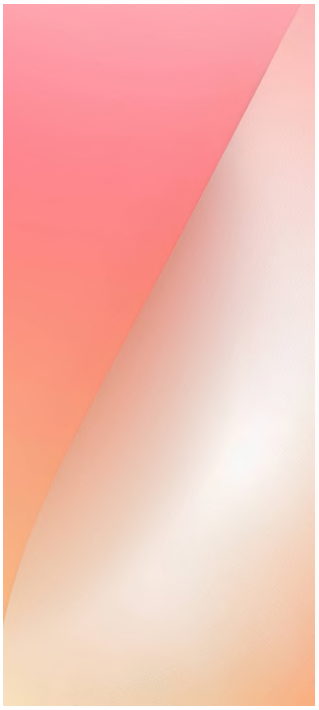
Saves Time

No more trips back and forth.

Gets jobs done faster.

Follow Mode is amazing because it helps farmers carry heavy items and saves them a lot of time by reducing extra trips across the field.





Robot Navigation: Point A to B

Set a Path

Tell it where to go.

Follow the Map

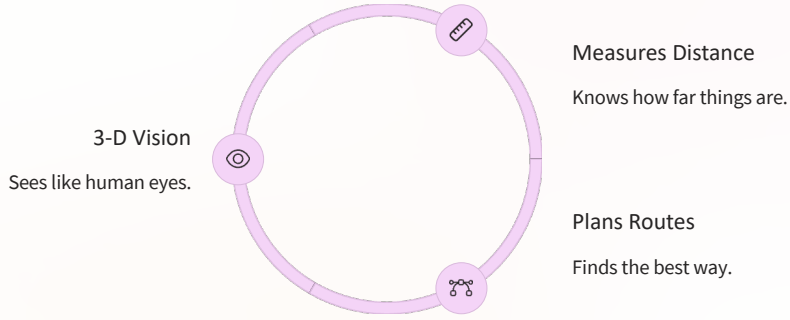
Like using a GPS.

Reach the Spot

Arrives exactly there.

Besides following, the Amiga can go anywhere you tell it to! You just give it a destination, and off it goes, like following a map.

Amiga's Smart Robot Eyes



The Amiga has super smart 3-D eyes! This means it can tell how far away things are, helping it move safely and know exactly where to go.

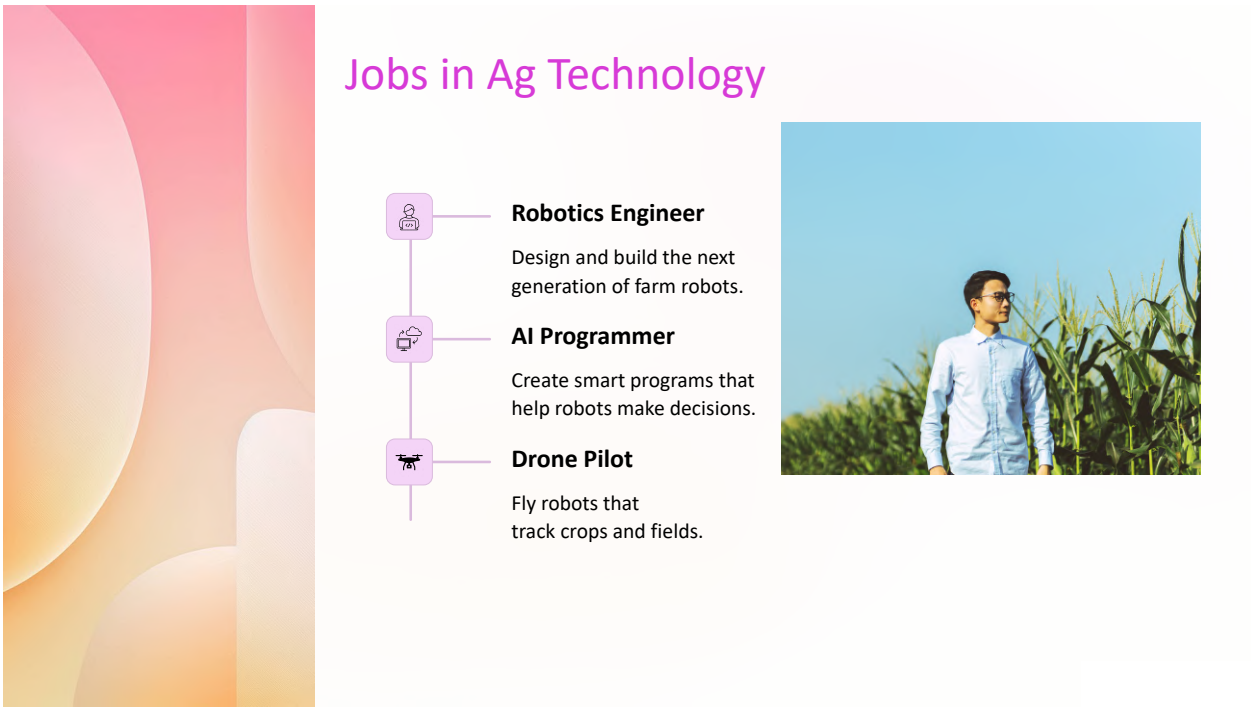
NOTES: Instead of paying for surveyors to come look at the farm, the Amiga can now do this job.

Robot Spray Tools

- **Attaches Sprayer** — Connects special tools.
- **Water Plants** — Gives plants drinks.
- **Healthy Boost** — Sprays safe helpers.

Robots like the Amiga can also have special spray tools! They can spray water to help plants grow strong, or safe chemicals to keep them healthy.

NOTES: Instead of paying for a person to come to the farm and spray for pests, the Amiga can now do that job.



NOTES: **Cool Jobs with Farm Robots!**

Farm robots are helping farmers grow food in new and exciting ways. Want to help make or work with farm robots someday? Check out these awesome jobs!

Robot Builder (Robotics Engineer)

Makes farm robots and decides what parts they need—like wheels and arms—and how they move.

Robot Programmer (Software Developer)

Writes the computer instructions that tell the robot what to do—like when to move, stop, or pick fruit.

Electric Helper (Electrical Engineer)

Makes sure the robot's wires and power systems work, so the robot can turn on and do its job.

Robot Mover Designer (Mechanical Engineer)

Designs how the robot moves—like its wheels, arms, and body—to work well on the farm.

Farm Helper (Precision Ag Specialist)

Uses cool tools and robot data to help farmers know when and where to plant, water, or spray crops.

Data Detective (Data Scientist)

Looks at numbers and info from robots to help farmers make smart choices about their crops.

Robot Fixer (Field Tech)

Fixes robots if they stop working and makes sure they're safe and ready to go.

Drone Flyer (Drone Pilot)

Flies drones over the farm to check plants, take pictures, and even spray fields.

Tech Connector (IoT Specialist)

Makes sure all the farm robots and machines can "talk" to each other and work as a team.

Farm Boss (Agribusiness Manager)

Helps the farm decide what robots to buy and how to use them the best way.

Science Explorer (Research Scientist)

Tries out new robot ideas, runs tests, and helps make robots better and smarter.

Big Idea Starter (Entrepreneur)

Starts a business to make and sell new farm robots and solve farm problems in creative ways.

What Did We Learn Today?

1

Amiga Robot

Our farm helper

2

Smart Sensors

How robots see

3

Helpful Tasks

Follow, map, spray

Any Questions?

What would YOU invent a robot to do?

Presentation 4th – 5th Grade

4th-5th Grade: How Robots Are Helping Farmers!

Welcome, young innovators! Today, we'll discover how amazing robots are transforming farms. Get ready to meet some incredible helpers!

What We'll Learn Today

1. **Meet the Amiga**
   Our special farm robot friend
2. **Robot Superpowers**
   How robots see and move
3. **Helping Hand**
   Ways robots assist farmers
4. **Future Jobs**
   Exciting careers with robots

Meet the Amiga Field Robot

A Farm Helper

The Amiga is a special robot

Works in fields

Many Talents

Can drive itself

Carries heavy loads

Helps plants grow strong

NOTES: Instead of hiring multiple field workers, the robot can now work autonomously, decreasing the need for farm labor.

Why Use Robots on Farms?

Save Time

Farmers work faster

Super Speed

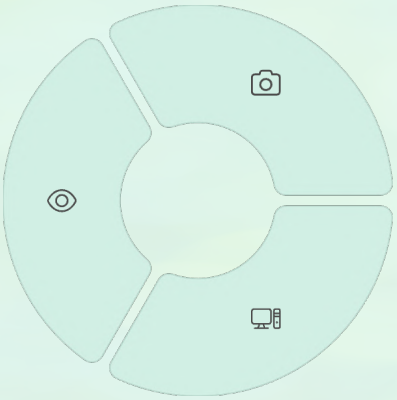
Robots are quick

Stay Safe

Handle hard jobs

Avoid dangerous tasks

How Robots See and Move



Sensors

Like robot eyes

Help them feel

Cameras

Take pictures

Help them see

Computers

Robot brains

Tell them what to do

NOTES: Instead of hiring surveyors to come to the farm, the Amiga can now do that work for the farmer with less labor costs.

Amazing Robot Modes

1. **Follow Mode**

   Robot stays close to a person

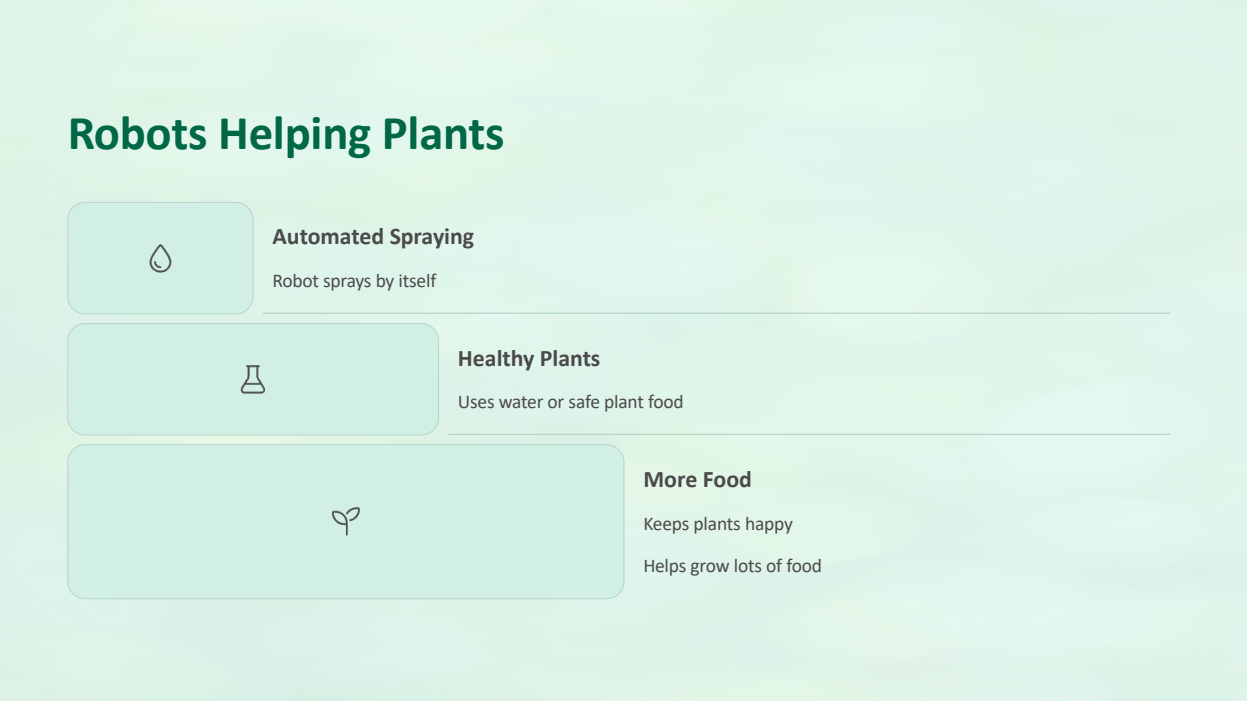
2. **Point-to-Point**

   Goes to a spot on a map by itself

3. **3-D Vision**

   Sees how far things are

   Helps avoid bumps



NOTES: Instead of hiring PCAs, the Amiga can now check for pests and spray insecticides and herbicides when needed.

NOTES: **Awesome Jobs in Farm Robotics!**
Farm robots are changing the way we grow food, and there are lots of exciting jobs that help make it happen. If you like building, fixing, flying, or solving problems, one of these jobs could be for you!

Robotics Engineer

Builds farm robots and decides how they move and what parts they need, like wheels, arms, or tools to plant seeds.

Software or AI Developer

Writes the computer code that tells robots what to do. Some even teach robots to think and learn using **artificial intelligence (AI).**

Electrical Engineer

Works on the wires, batteries, and power systems that help the robot run and stay connected.

Mechanical Engineer

Designs how the robot moves and what it looks like. They build the frame, wheels, arms, and other moving parts.

Precision Agriculture Specialist

Uses robot data to help farmers decide when and where to plant, water, or spray crops to grow more food and waste less.

Data Scientist

Looks at information (called **data**) that robots collect from the farm. They use it to help farmers make smart decisions.

Field Robotics Technician

Fixes and maintains farm robots. If something goes wrong, they make sure the robot gets back to work.

Drone Pilot

Flies drones over farms to take pictures, check crops, or spray fields. They must fly safely and understand the data the drone collects.

IoT Specialist (Internet of Things)

Connects smart devices on the farm—like robots, sensors, and machines—so they can "talk" to each other and work together.

Agribusiness Manager

Helps farms choose the right technology and robots. They also find ways to save money and grow food in smart, sustainable ways.

Research Scientist

Studies new ideas and tests ways to improve farm robots. They work with schools and companies to invent better tools.

Entrepreneur

Starts a business to create and sell new farm technology. They think creatively to solve big problems in farming.

How Do You Get These Jobs?

Go to college and study things like robotics, computers, farming, or science.

Some people go even further and earn master's or doctoral degrees.

You can also take special classes to learn skills like flying drones or working with farm tech.

What Did We Learn Today?

1

Amiga Robot

Our farm helper

2

Smart Sensors

How robots see

3

Helpful Tasks

Follow, map, spray

Any Questions?

What would YOU invent a robot to do?

Presentation 6th – 8th Grade

6th-8th Grade Field Robotics: The Amiga and the Future of Farming

Welcome to our exploration of the Amiga robot and how it's transforming modern farming! Today we'll discover how robots are changing agriculture and shaping the future of food production.

Why Robotics in Agriculture?

Traditional Farming Challenges

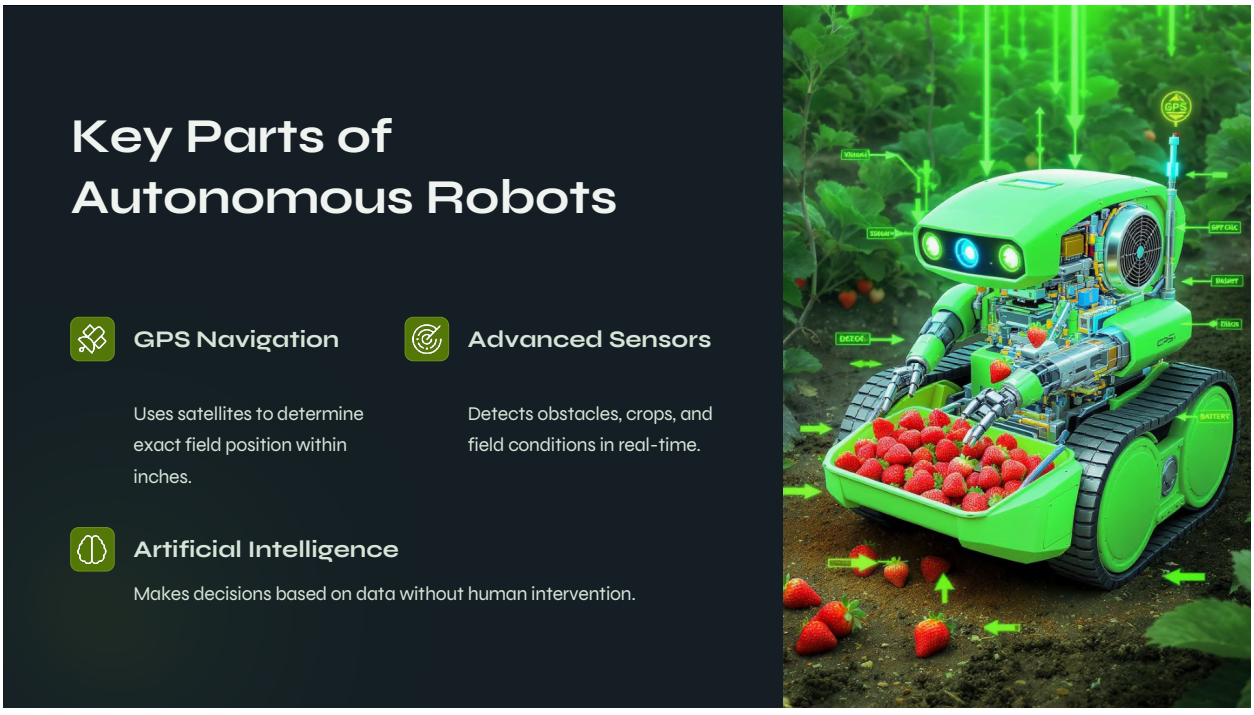
- Labor shortages
- Time-consuming tasks
- Weather constraints

Robotic Solutions

- 24/7 operation
- Precision work
- Reduced resource waste

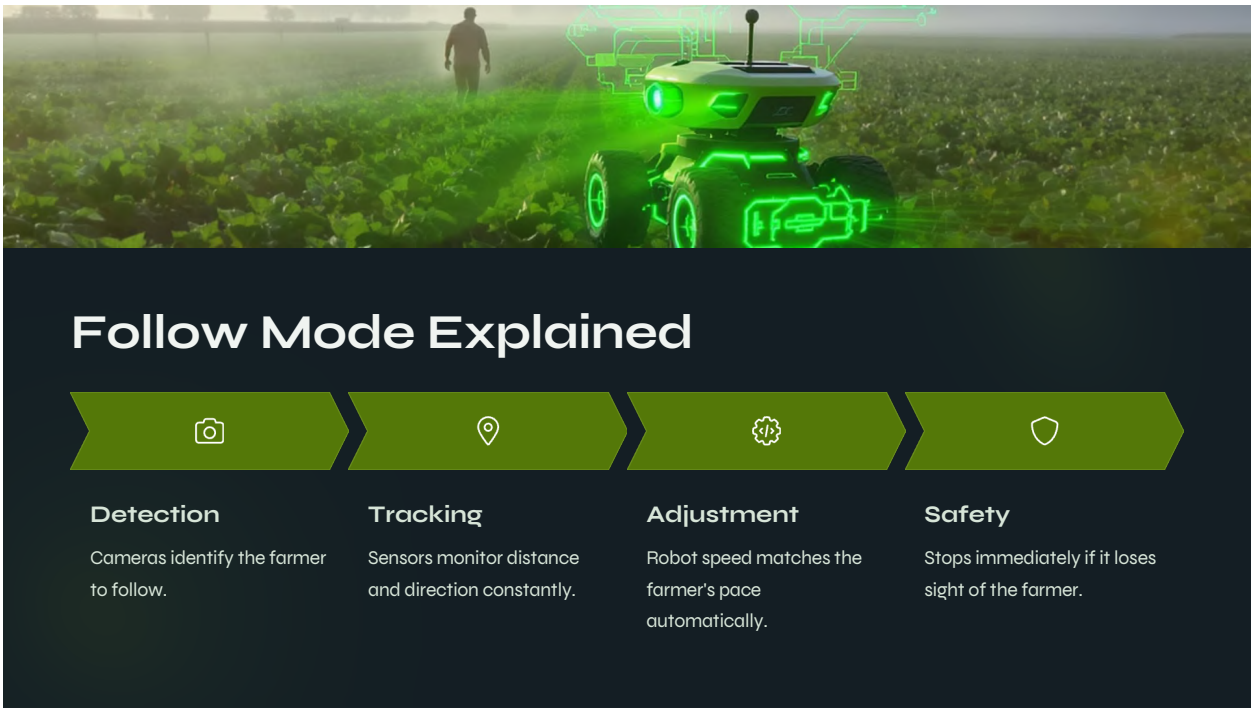
NOTES: **Self-Driving Tractors and Machines**
Autonomous Tractors: These tractors can drive themselves across fields using GPS and sensors. Farmers don't have to sit in them the whole time!
Harvesting Robots: Special robots gently pick fruits and vegetables so they don't get damaged. This saves time and effort.
Drones Watching Over Crops

Aerial Monitoring: Drones with cameras fly over fields to check how healthy the plants are and if there are any bugs or problems.
Smart Farming: Drones can also help spray water, fertilizer, or bug spray only where it's needed, which helps protect the environment.
Watering with Smart Irrigation
Smart Irrigation Systems: These systems use sensors in the ground to check how wet the soil is. They water the crops only when needed, saving water.
Planting with Robots
Precision Planting: Robots can plant seeds at the perfect depth and space them out just right, helping plants grow better and faster.
Fighting Weeds with Robots
Weed-Control Robots: These robots can find and remove weeds without hurting the crops. This means farmers don't have to use as many weed-killing chemicals.
Spraying the Smart Way
Precision Sprayers: Robots with sprayers can aim right at the spots that need fertilizer or pest control, using less spray and keeping the rest of the field clean.
Why Use Robots in Farming?
Faster and Smarter: Robots can work all day without getting tired. They help farmers get more done in less time.
Save Money: Robots can help lower costs by doing work that used to take a lot of people and time.
Better for the Earth: Robots help use water, fertilizer, and chemicals more carefully, which is good for the environment.
More Accurate: Robots are very exact, which helps crops grow better and gives farmers bigger harvests.



NOTES: **Self-Driving Farm Machines (Autonomous Tractors)**

How They Move: These tractors use GPS and sensors to drive themselves around the field. They follow a planned path and can avoid obstacles like rocks or trees.
Farming Jobs: Self-driving tractors can plow the soil, plant seeds, and do other farm work without needing a person to drive them. They are very careful and accurate, which helps crops grow better.
Robots That Help with Harvesting
Picking Fruit: Harvesting robots have cameras and smart programs (AI) that help them spot fruit that is ready to pick. Their robot arms are gentle so they don't damage the fruit.
Sorting and Packing: Some robots can even sort the fruit by size or ripeness and pack it into boxes, getting it ready to go to stores.
Robots That Fight Weeds
Finding Weeds: Weed control robots use cameras and smart tools to tell the difference between weeds and crops.
Removing Weeds: Once they find a weed, the robot can pull it out or spray just a tiny bit of weed killer, so the crops stay safe and fewer chemicals are used.
Why Use Farm Robots?
Work Faster: Robots can work all day and night without getting tired, which helps farmers get more done.
Do the Job Right: Robots are very good at doing tasks exactly right, which helps plants grow strong and healthy.
Save Money: Over time, using robots can cost less than hiring workers for every task.
Help the Environment: Robots use just the right amount of water and chemicals, so there's less waste and pollution.
Keep People Safe: Some farm jobs are dangerous. Robots can do those jobs so humans don't have to take the risk.



NOTES: **What Is Follow Mode?**

Follow Mode is a special feature that lets the **Amiga field robot** follow a person, animal, or even another machine all by itself. This is helpful for farmers because the robot can carry tools, harvested crops, or supplies while the farmer moves around the field.

How Does Follow Mode Work?

Sensors and Cameras

The Amiga robot has special cameras and sensors that help it "see" what's around it.
These include:
Visual cameras (like eyes),
Infrared sensors (to see heat),
and **ultrasonic sensors** (to sense objects using sound).
These tools help the robot track what it's following, even if it's dark or the weather is bad.

Finding the Target

The robot scans the area to find what it's supposed to follow—like a person or a tractor.
It uses smart computer programs (artificial intelligence or AI) to figure out what the target looks like and keep track of it.

Following and Moving

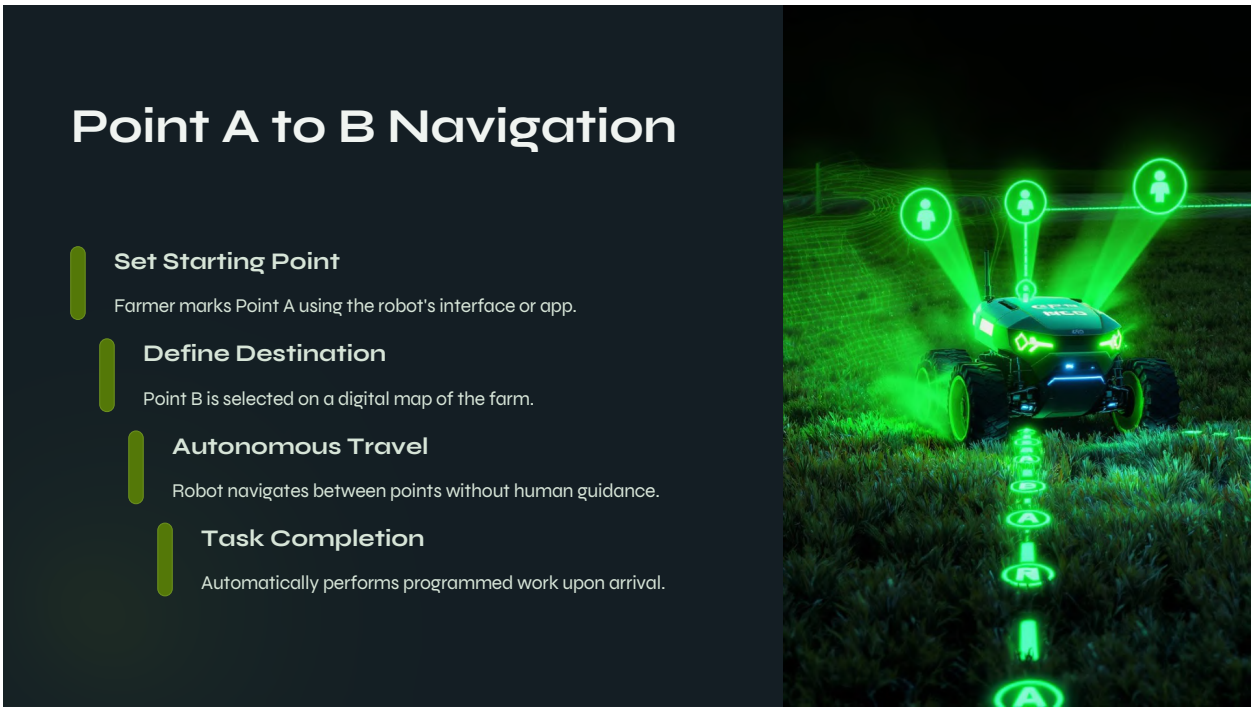
Once it knows what to follow, the robot watches how that person or machine moves.
It then:
Calculates where it needs to go,
Adjusts its speed and direction,
And keeps a safe distance while following.

Avoiding Obstacles

If something gets in the way (like a rock or plant), the robot can steer around it and get back on track.

Why It Matters

This kind of smart movement helps farmers save time and energy while keeping their hands free to do other important tasks.



NOTES: **Why Point A to B Navigation Is Helpful**

Point A to B navigation means the robot moves from one place to another along a planned path. This helps farmers in a lot of ways:

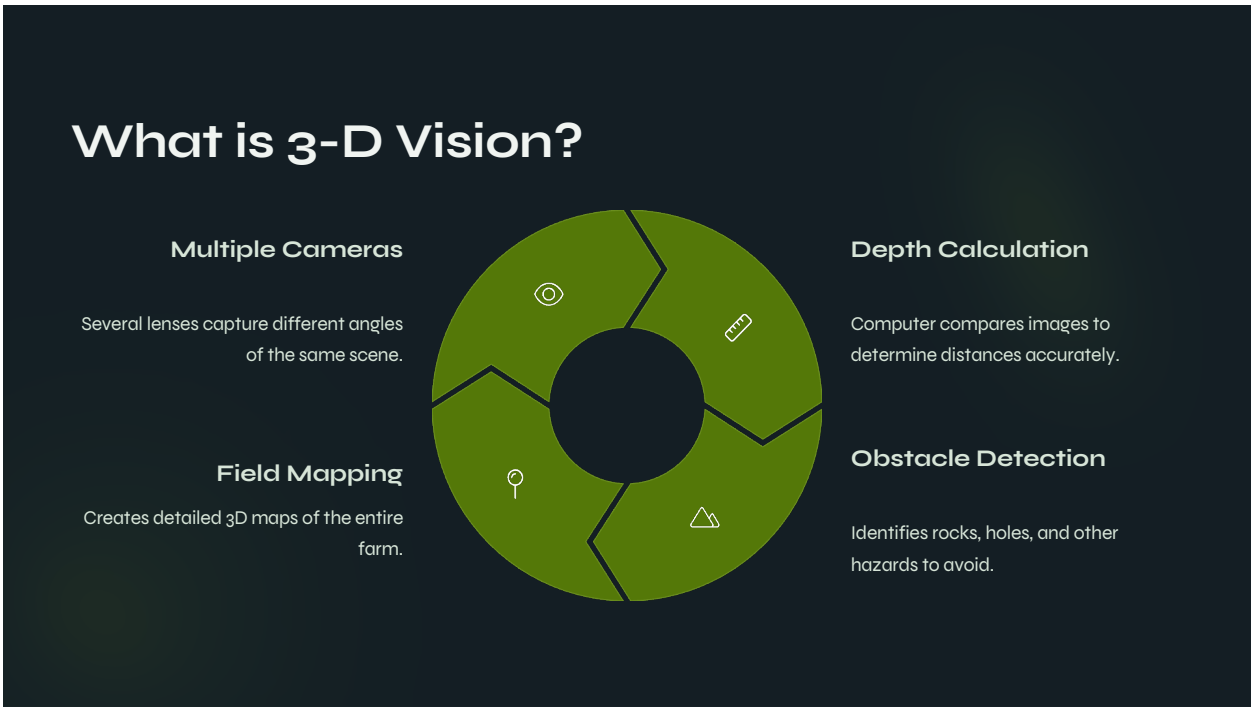
Accuracy: The robot follows the same path every time, so it does its job the right way, without mistakes.

Saves Time: The robot can do boring, repeated tasks by itself, which gives farmers more time to focus on other things.

Uses Less Stuff: Because the robot is so exact, it doesn't waste seeds, water, or chemicals—this helps save money and protect the environment.

Keeps People Safe: The robot can work on its own in the fields, which means fewer people have to do dangerous or tiring jobs.

Works With Other Robots: Farmers can have more than one robot working at the same time in different parts of the field, which helps get more done faster.



NOTES: **How Does 3-D Vision Work in Robots?**

Robots like the **Amiga field robot** use special tools to "see" the world in 3-D, kind of like how people do. Here's how it works:

Stereo Cameras (Like Human Eyes)

The robot has two cameras that take pictures from slightly different angles—just like how your two eyes see things from different spots.

By comparing the two images, the robot can figure out how far away things are and create a map that shows depth.

Depth Sensors

Some robots use tools like **LiDAR** (which uses lasers) or **time-of-flight cameras** (which use light).

These tools send out tiny bursts of light and measure how long it takes for the light to bounce back.

This tells the robot how close or far away things are.

Structured Light

The robot shines a pattern of light (like stripes or dots) onto objects.

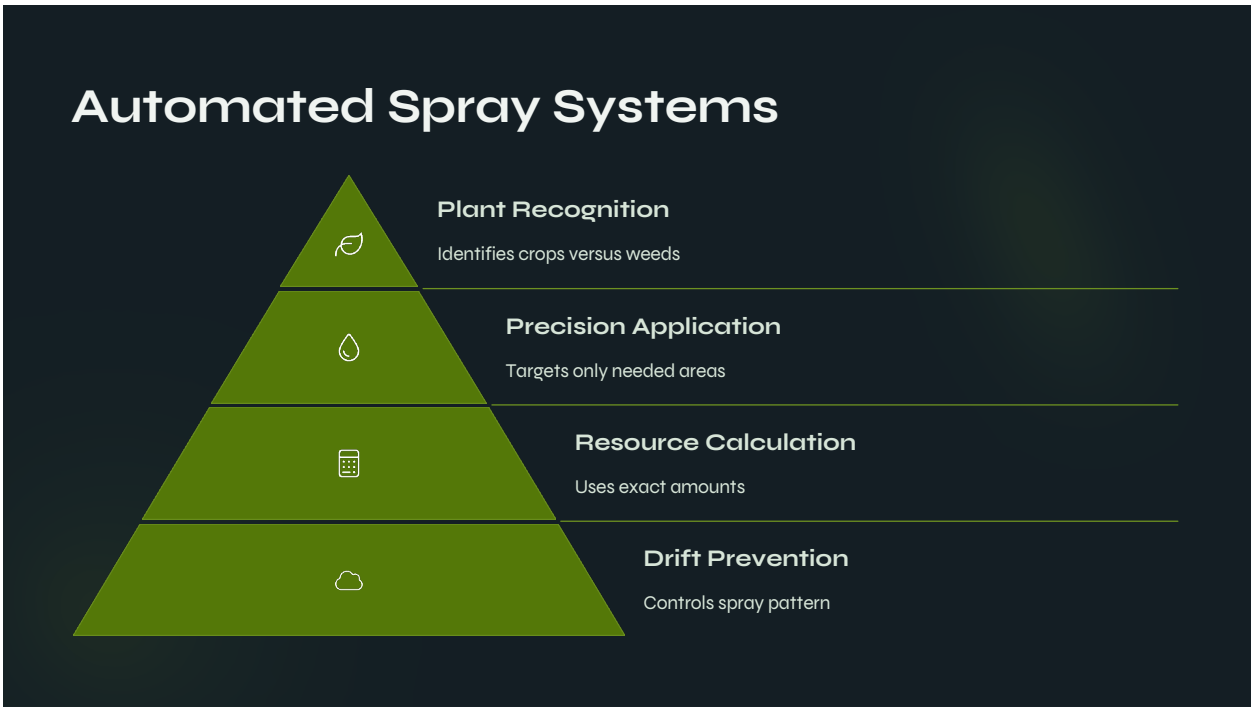
When the light hits different shapes or surfaces, the pattern changes.

The robot watches how the pattern bends or moves to figure out the shape and depth of the object.

Smart Software (Computer Vision)

After collecting all that information, the robot uses special programs to put it all together.

These programs help the robot recognize what's around it, measure distances, and understand how far apart things are.



NOTES: **How Do Robots Spray Crops Automatically?**

Some farm robots, like the **Amiga**, can spray crops all by themselves! Here's how the system works:

Sensors and Cameras

The robot has special cameras and sensors that look at the plants and soil.

These tools help the robot collect information—like which plants are healthy, which have bugs, or which need more nutrients.

Understanding the Data

The robot's computer takes all the information from the sensors and figures out which plants need help.

It looks for signs of disease or pests so it knows where to spray.

Spraying System

The robot has a spray system with nozzles that release just the right amount of chemicals.

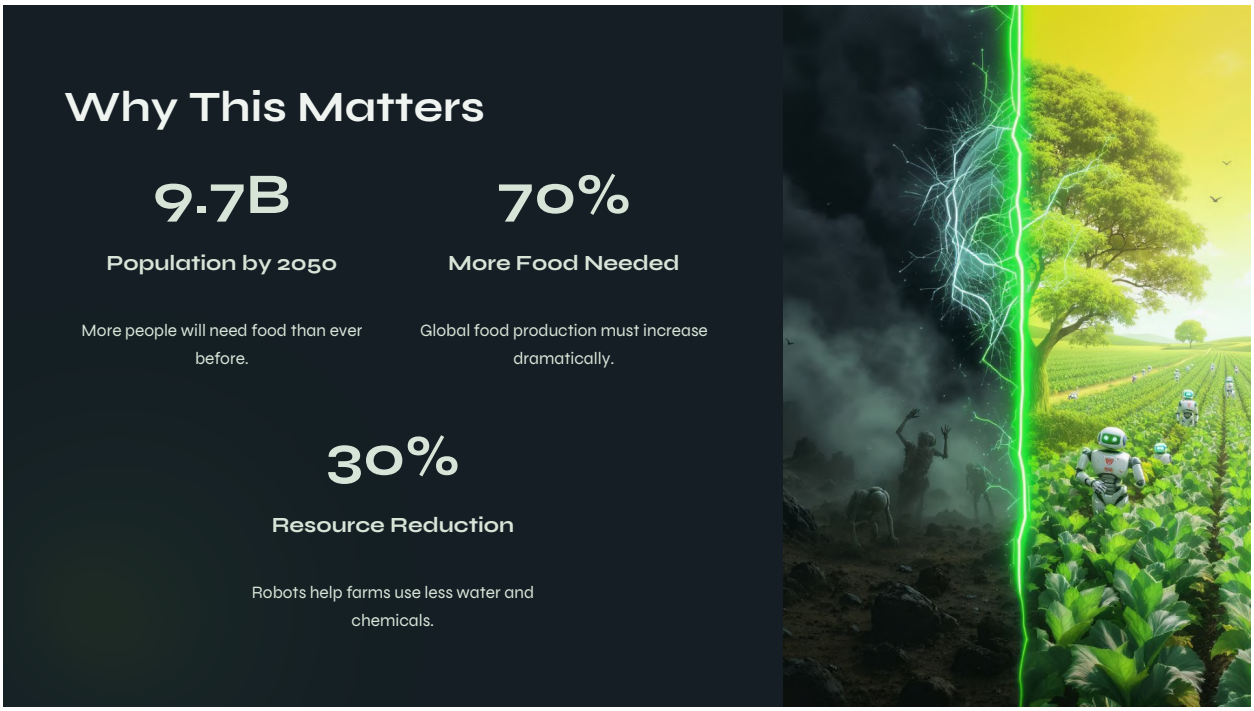
It only sprays the spots that need it, which helps avoid wasting chemicals and keeps the plants safe.

Moving Through the Field

The robot uses GPS to find its way through the field.

It follows a planned route so it doesn't miss any plants that need treatment.

This kind of smart spraying helps farmers save time, use fewer chemicals, and keep crops healthy!



NOTES: **Working with Precision**

Farm robots can do jobs like planting seeds, spraying crops, and picking fruits very carefully and exactly. This helps save water, fertilizer, and bug spray—so nothing is wasted and farmers save money.

Less Heavy Work for People

Many farm jobs are hard and take a lot of time. Robots can do the boring or heavy tasks, so people can focus on more important things like planning and checking crop health.

Better for the Environment

Farm robots use tools like sensors and computers to help farmers care for the land. They only use chemicals when needed and keep track of soil health, which helps the environment and keeps the soil strong for the future.

Handling Weather Changes

Because the weather is getting less predictable, farming is becoming harder. Robots with smart sensors and AI (artificial intelligence) can react to changes like new pests or different weather and help protect the crops.

Helping Feed the World

More and more people are living on Earth, which means we need to grow more food. Farm robots help grow food faster and more efficiently so there's enough to go around.

New Technology for the Future

Farm robots use cool tech like AI, sensors, and data tracking. These tools help not only on farms but also in areas like medicine, factories, and delivery systems.

Learning and Jobs

Using robots in farming gives students a chance to learn about **STEM**—Science, Technology, Engineering, and Math. This helps them get ready for jobs in the future that involve solving real-world problems.

NOTES: **Cool Careers in Farm Robotics**

Farm robots are changing the way we grow food—and there are lots of awesome jobs that help make it happen! Here are some of the career paths you could explore:

Robotics Engineer

Designs and builds farm robots. They figure out how the robot will move, what parts it needs, and how it will do its job.

Software or AI Developer

Creates the computer programs that tell robots what to do. Some work with **AI (artificial intelligence)** so the robot can learn and make smart choices on its own.

Electrical Engineer

Works on the wiring and power systems inside the robot. They make sure everything turns on, runs smoothly, and connects properly.

Mechanical Engineer

Designs how the robot moves and what it looks like. They work on things like wheels, arms, and other moving parts.

Precision Agriculture Specialist

Uses data and technology to help farmers grow crops more efficiently. They figure out where and when to plant, water, or spray based on information from sensors and robots.

Data Scientist

Looks at data collected by robots and helps farmers make smart decisions. For example, they can predict where crops might grow best or where pests could be a problem.

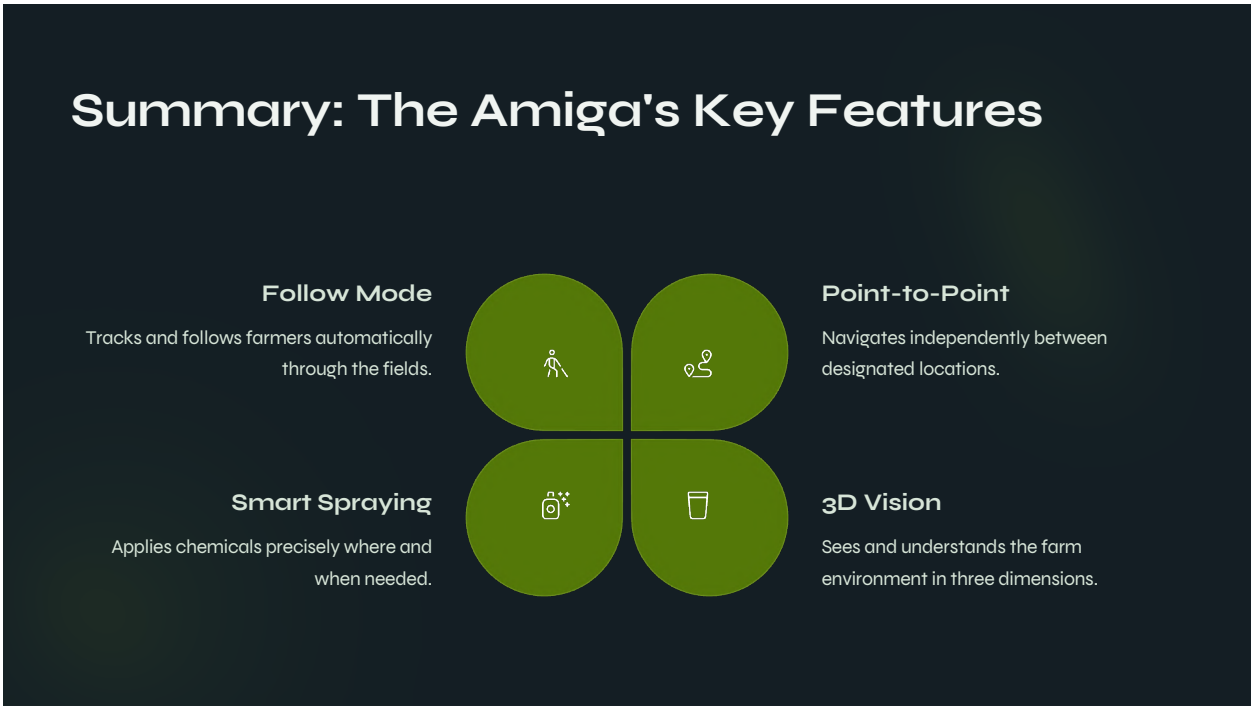
Field Robotics Technician

Fixes and maintains the robots out in the field. If something breaks or needs adjusting, this person gets the robot back in action.

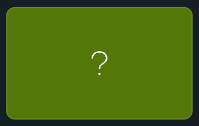
Drone Pilot

Flies drones over farms to check on crops, take pictures, and even spray plants. They need to know how to fly safely and understand the data the drones collect.

IoT Specialist (Internet of Things)
Connects all the smart devices on the farm—like sensors, robots, and machines—so they can "talk" to each other and work as a team.
Agribusiness Manager
Helps farms decide which robots and technology to buy and how to use them. They also look for ways to save money and improve sustainability.
Research Scientist
Studies new ideas and tests out better ways to use robots on farms. They write reports, do experiments, and work with companies and schools to improve technology.
Entrepreneur
Starts their own business to build and sell new farming robots. They think creatively, solve problems, and help bring new ideas to life.
How to Get There: Education Paths
College Degree: Many of these jobs need a college degree in subjects like Robotics, Engineering, Agriculture, or Computer Science.
Advanced Degrees: Some people go on to get master's or doctoral degrees to become researchers or experts in very specific areas.
Training and Certifications: You can also take special classes or programs to learn skills like flying drones or working with sensors and farm tech.



What Do You Think?

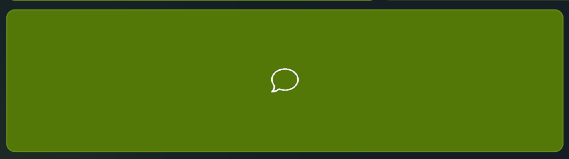


What should farm robots do next?

Harvesting? Planting? Something else?

How would you improve them?

New features? Different designs?



Would you want to work with them?

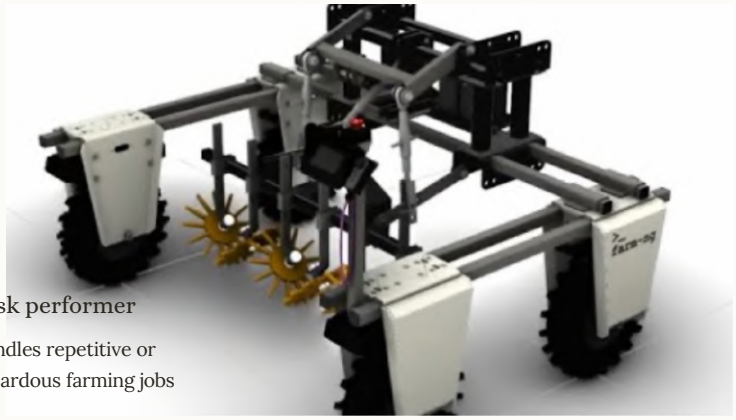
Which AgTech career interests you most?

Presentation 9th – 10th Grade

9th-10th Grade: The Amiga Field Robot and the Future Smart Agriculture

Transforming farming through robotics and AI

What is the Amiga?



Autonomous field robot

Self-operating machine designed for agriculture

Task performer

Handles repetitive or hazardous farming jobs

Agricultural support

Enhances farming operations without constant supervision

Why Use Robotics in Agriculture?

Efficiency

Works 24/7 without fatigue

Completes tasks with precision

Cost Savings

Reduces labor expenses

Optimizes resource usage

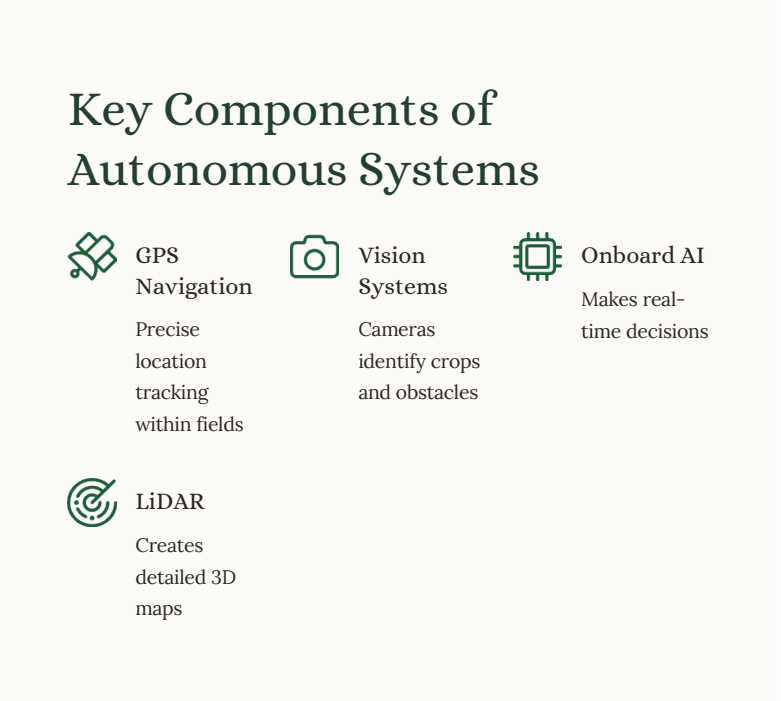
Sustainability

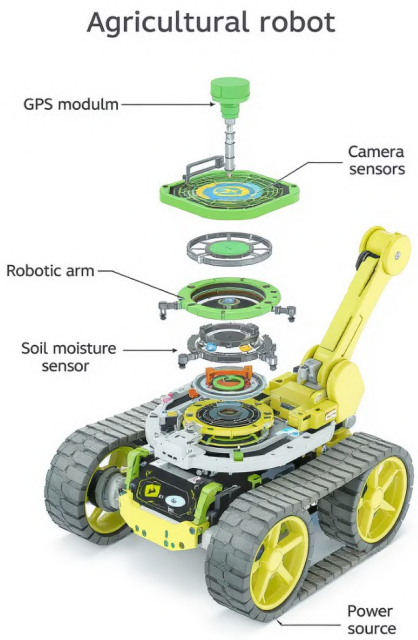
Enables precision agriculture

Data-driven decision making

NOTES: **Autonomous Tractors and Machinery**
Self-Driving Tractors: These tractors use GPS, sensors, and software to drive themselves across fields without a human operator. They can follow precise paths to complete tasks efficiently.
Harvesting Robots: These machines are designed to pick fruits and vegetables carefully to avoid bruising or damage. They increase the speed and consistency of harvests.
Drones for Crop Monitoring
Aerial Surveillance: Drones with high-resolution cameras and sensors fly over fields to check plant health, identify pests, and monitor crop growth.
Precision Agriculture: Drones can apply water, fertilizers, or pesticides only where needed, helping farmers reduce waste and protect the environment.
Automated Irrigation Systems
Smart Irrigation: These systems use soil moisture sensors and weather data to determine when and how much to water crops. This helps conserve water and improves plant health.
Robotic Planting Systems
Precision Planting: Robotic systems plant seeds at the best depth and spacing for healthy crop growth. This improves yield and reduces seed waste.
Weed Control Robots
Targeted Weed Management: These robots use cameras and AI to detect and remove weeds without damaging crops, reducing the need for chemical herbicides.
Automated Spraying Technology
Precision Sprayers: Spraying robots apply pesticides or fertilizers directly to affected areas, avoiding overuse and lowering the environmental impact.
Benefits of Using Robotics in Farming
Increased Efficiency: Robots can work longer hours and with more precision than humans, speeding up farm work.
Lower Costs Over Time: While the equipment can be expensive to buy, it reduces labor and material costs in the long run.

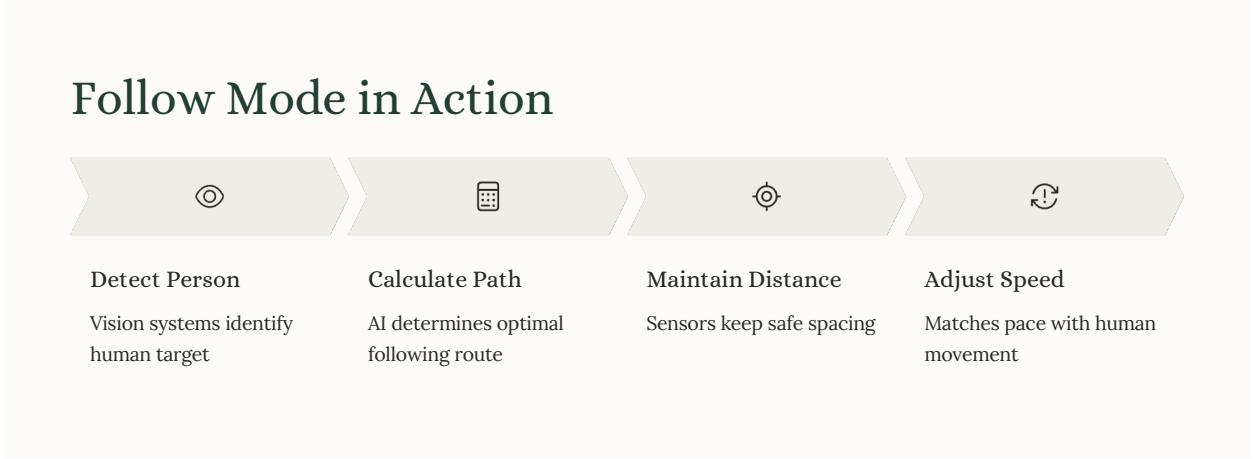
Environmental Sustainability: Robots help reduce waste and use fewer resources, making farming more eco-friendly.
Greater Accuracy: Precision in planting, spraying, and harvesting leads to better crop quality and higher yields.





NOTES: **Autonomous Tractors**
Navigation: These tractors use GPS technology and sensors to move across fields without a driver. They follow programmed routes and can avoid obstacles like trees, rocks, or uneven terrain.
Plowing and Planting: Autonomous tractors can perform tasks such as plowing soil and planting seeds with high accuracy. This helps ensure crops are spaced correctly and planted at the right depth.
Harvesting Robots
Fruit Picking: These robots are equipped with cameras and artificial intelligence (AI) to identify which fruits are ripe. Robotic arms then pick the fruits gently to avoid bruising or damage.
Sorting and Packaging: After picking, some robots can sort fruits by size, color, or ripeness and package them for shipment, saving time and reducing human error.
Weed Control Robots
Weed Identification: These robots use computer vision and AI to spot weeds among crops.
Targeted Removal: Once a weed is identified, the robot either removes it mechanically or applies a small amount of herbicide. This helps protect the crops and reduces the need for chemicals.
Benefits of Autonomous Field Robots
Efficiency: Robots can work around the clock without needing breaks, increasing the amount of work done in less time.
Precision: They perform tasks with great accuracy, which helps improve crop quality and yield.
Cost Savings: Although the technology can be expensive upfront, it can lower costs over time by reducing the need for labor and conserving resources.

Environmental Sustainability: Robots help reduce waste by using the exact amount of water, fertilizer, or pesticide needed.
Safety: Robots can do risky jobs, like working in harsh weather or with chemicals, reducing danger for human workers.



NOTES: **What Is Follow Mode?**
Follow Mode is a feature that allows the **Amiga field robot** to automatically follow a person, animal, or another machine through a field. This technology helps farmers by allowing the robot to carry tools, harvested crops, or supplies as they work, making tasks more efficient and less physically demanding.
How Does Follow Mode Work?
Sensors and Cameras
The robot is equipped with a variety of sensors and cameras to help it detect and track its target. These include:
Visual cameras for detecting shapes and movement,
Infrared sensors to sense heat, and
Ultrasonic sensors that use sound waves to detect nearby objects.
These tools help the robot follow a target accurately, even in poor lighting or changing weather conditions.
Target Identification
The robot uses its cameras and sensors to scan the area and find the person, animal, or machine it's supposed to follow.
It uses **AI (artificial intelligence)** and **image processing software** to recognize and stay locked onto the correct target.
Tracking and Navigation
Once the target is identified, the robot:
Continuously monitors its position,

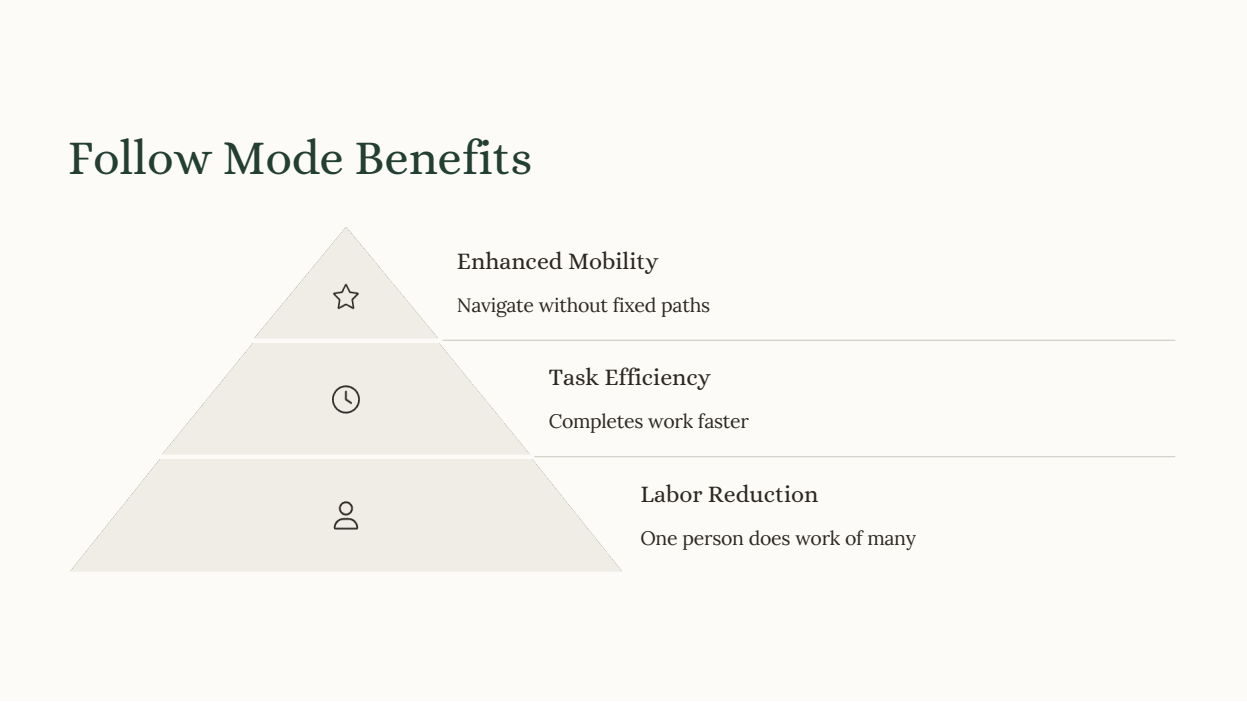
Tracks how the target moves, and
Adjusts its own path and speed to stay at a safe distance.
This helps the robot move smoothly through the field without needing constant human control.

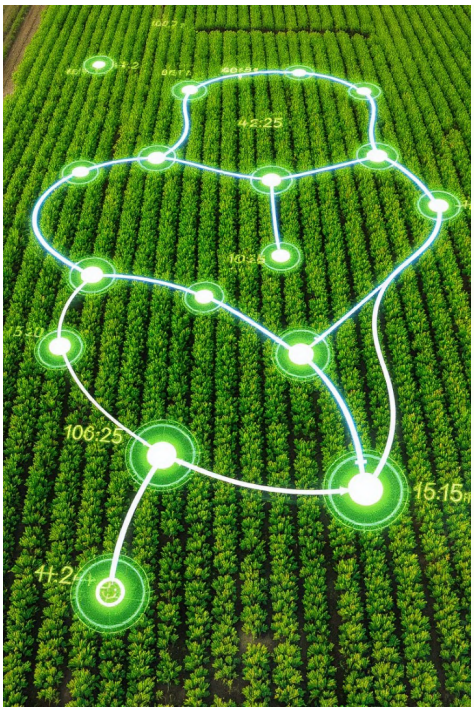
Movement and Obstacle Avoidance

The robot's wheels or tracks are controlled by actuators that respond to real-time data from the sensors.
If an obstacle appears—like a rock or plant—it can adjust its path to move around it and keep following the target.

Why It's Useful in Agriculture

Follow Mode lets the robot assist farmers without slowing them down. It increases efficiency, reduces physical strain, and allows for better focus on the job at hand.





Point A-B Navigation

Set Coordinates

Farmer defines start and end points on digital map

Create Path

Robot calculates optimal route between points

Autonomous Travel

Machine navigates using GPS and internal mapping

Task Completion

Robot performs programmed actions along route

NOTES: **Benefits of Point A–B Navigation in Agricultural Robots**

Point A–B navigation allows a robot to travel between two specific points using a planned path. This technology brings several key benefits to farming:

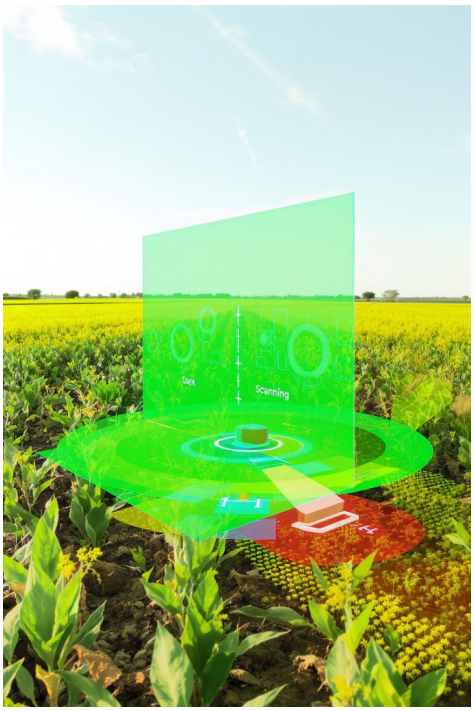
Precision: The robot follows its route accurately, making sure tasks like planting or spraying are done the same way every time, which improves consistency.

Efficiency: Automating routine tasks helps save time and reduces the amount of physical labor needed on the farm.

Cost Savings: By applying seeds, water, or chemicals only where needed, the robot helps prevent waste and lowers operating costs.

Improved Safety: Robots can work in the field without needing a person to guide them, reducing the risk of injury during long or repetitive tasks.

Scalability: Farmers can program several robots to work at once in different areas, which increases productivity and makes it easier to manage large fields.



The Role of 3-D Vision

Spatial Awareness

Creates detailed 3D maps of environment

Understands field geography and layout

Obstacle Detection

Identifies and avoids hazards

Distinguishes between crops and objects

Precision Movement

Navigates between crop rows without damage

Maintains optimal distance from plants

NOTES: **How Does 3-D Vision Work in Robots?**

3-D vision allows robots, like the **Amiga field robot**, to see and understand their surroundings in three dimensions—just like humans do. This helps the robot move through fields, detect obstacles, and interact with objects accurately.

Stereo Cameras

Stereo cameras work like human eyes by capturing two images from slightly different angles. The robot compares these two images to estimate how far away objects are, creating a **depth map** of the area.

Depth Sensors

Tools like **LiDAR** (Light Detection and Ranging) or **time-of-flight cameras** send out light or laser pulses.

They measure how long it takes for the light to bounce back from objects.

This timing data helps the robot figure out the exact distance to different objects and build a detailed 3-D map.

Structured Light

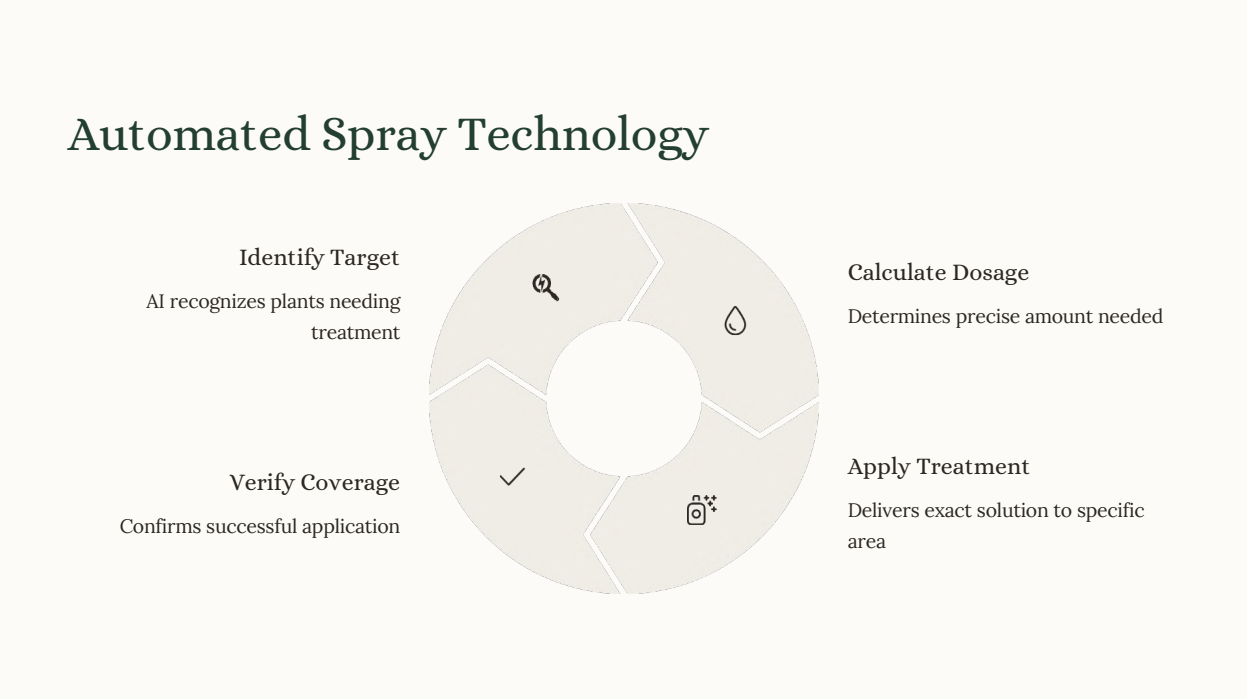
The robot projects a pattern (like lines or dots) onto surfaces.

When the pattern bends or changes shape, the robot can tell how far away or uneven the surface is.

This method helps the robot understand both the depth and shape of objects.

Computer Vision Algorithms

Once the cameras and sensors gather data, **software algorithms** process it to create a 3-D model. These programs identify objects, measure distances, and understand how everything in the robot's environment is connected.



NOTES: **How Does Automated Spray Technology Work?**

Automated spray systems on agricultural robots, like the **Amiga**, are designed to apply chemicals precisely and efficiently. Here's how the system works step by step:

Sensors and Cameras

The robot uses a combination of cameras and sensors to scan the crops and soil.

These tools gather data on plant health, pest presence, and nutrient levels by analyzing things like color changes, leaf patterns, or moisture.

Data Processing

The robot's software analyzes the data collected by its sensors.

It identifies which parts of the field need treatment—such as areas where plants may be diseased or affected by pests.

Spray Mechanism

The robot is equipped with a spray system that includes nozzles for chemical application.

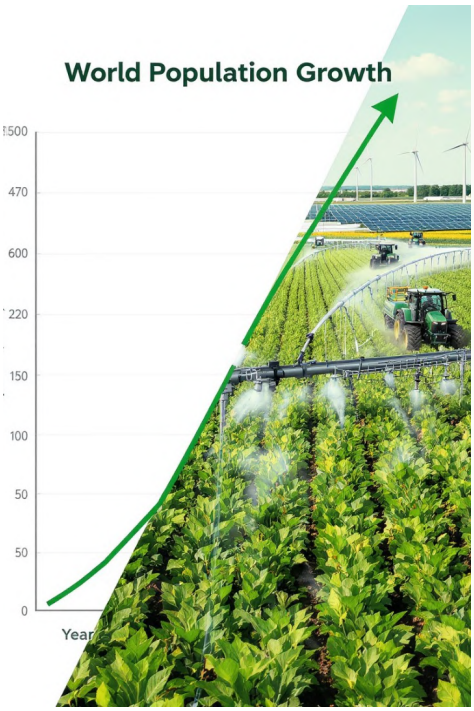
It sprays only the necessary amount of pesticide or fertilizer, and only in the spots that need it, reducing waste and environmental impact.

Field Navigation

Using GPS and other positioning systems, the robot follows a programmed path through the field.

This ensures that all target areas are treated accurately and efficiently.

Automated spray technology improves farming by reducing chemical use, saving time, and increasing crop health and yield.



Why This Technology Matters

30%

Labor Savings

Reduced workforce requirements

25%

Chemical Reduction

Less environmental impact

40%

Yield Increase

More food from same land

10B

Population by 2050

More mouths to feed

NOTES: **Precision and Efficiency**

Field robots can perform tasks like planting, spraying, and harvesting with great accuracy. This precision helps farmers use just the right amount of water, fertilizer, and pesticides, which cuts down on waste and saves money.

Reducing Labor Demands

As farm labor becomes harder to find in some areas, robots can help by doing repetitive and physically demanding work. This allows human workers to focus on more skilled or complex tasks, like monitoring plant health or managing equipment.

Environmentally Friendly Farming

With the help of sensors and data, robots can make farming more sustainable. They apply chemicals only where needed, track soil health, and help farmers make better decisions about how to use their land and resources.

Responding to Climate Change

Climate change brings new challenges to farming, like unusual weather and more pests. Robots equipped with advanced technology can respond to these changes quickly, helping farmers protect crops and adapt to new conditions.

Feeding a Growing Population

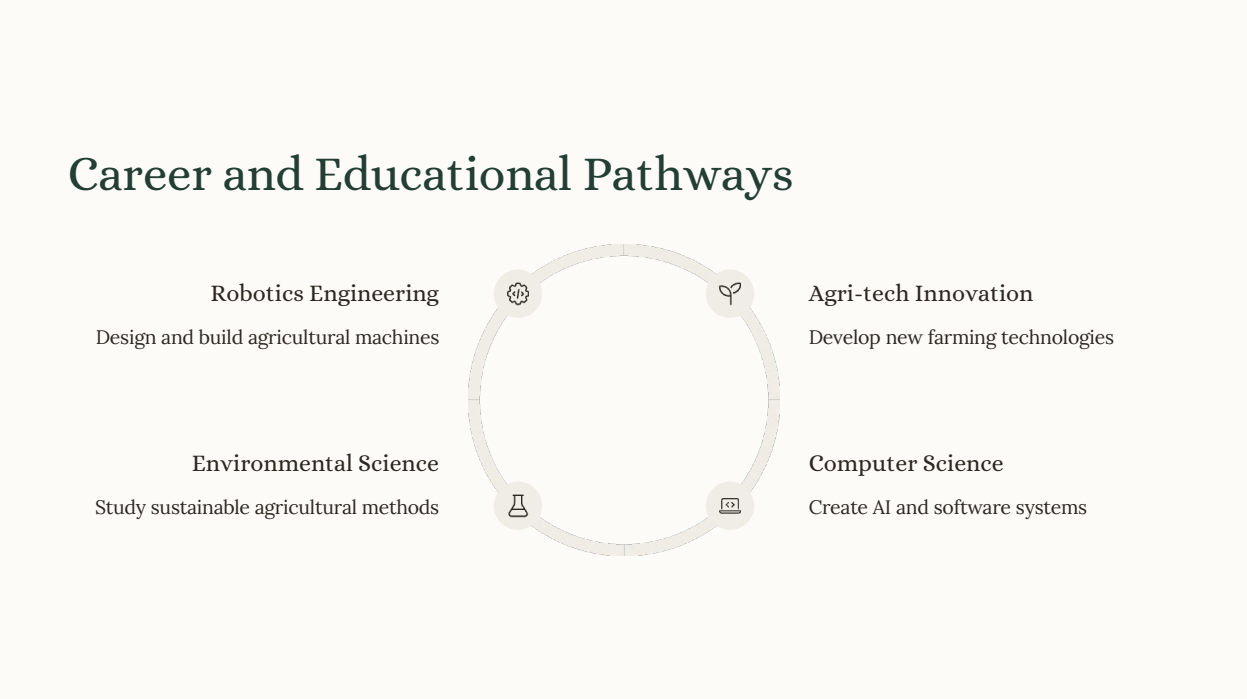
As the world population increases, so does the need for food. Field robotics can boost food production by making farms more productive and helping food get from fields to tables more efficiently.

Driving Innovation

Field robotics combines many advanced technologies—like AI, sensors, and data analysis—that are also used in other industries such as healthcare, manufacturing, and transportation. This pushes innovation forward across many fields.

Education and Career Opportunities

The growth of agricultural robotics creates new learning opportunities in **STEM** (Science, Technology, Engineering, and Math). Students interested in robotics, coding, or environmental science can explore exciting careers in agriculture and beyond.



NOTES: **Career Pathways in Agricultural Robotics**
As technology becomes more important in farming, new career opportunities are opening up in agricultural robotics. These jobs combine science, engineering, and problem-solving to make agriculture more efficient, sustainable, and innovative.

Robotics Engineer
Designs, builds, and tests robots for farming. They work on how the robot moves, what sensors it uses, and how it performs specific tasks like planting or harvesting.

Software Developer / AI Engineer
Creates the computer programs that control the robot's actions. AI engineers develop smart systems that help robots recognize objects, make decisions, and learn from experience.

Electrical and Electronics Engineer
Designs the electrical systems that power the robot. They also work on how sensors, motors, and communication devices connect and work together.

Mechanical Engineer
Develops the physical structure of the robot, such as wheels, arms, and moving parts. They make sure the robot is durable and works well in outdoor conditions.

Precision Agriculture Specialist
Uses data, sensors, and robotics to help farmers improve crop production. They might study soil health, monitor plant growth, and recommend when and where to water or fertilize.

Data Scientist / Analyst
Analyzes information collected by robots and sensors to help make better farming decisions. They use charts, graphs, and models to spot trends and improve efficiency.

Field Robotics Technician

Installs, maintains, and repairs robotic equipment on farms. They troubleshoot problems and make sure robots work safely and correctly in the field.

Drone Pilot / UAV Operator

Operates drones to survey crops, map fields, and even spray plants from the air. They need to understand both flight safety and how to use the data the drone collects.

IoT Specialist (Internet of Things)

Connects farm equipment, robots, and sensors into a network so they can share data. This helps make farming more automated and efficient.

Agribusiness Manager / Consultant

Helps farms and agriculture businesses choose the right technologies. They give advice on how to improve productivity, lower costs, and adopt sustainable practices.

Research Scientist / Academic Researcher

Studies new technologies in agricultural robotics. They perform experiments, write papers, and work with universities and companies to create future solutions.

Entrepreneur / Startup Founder

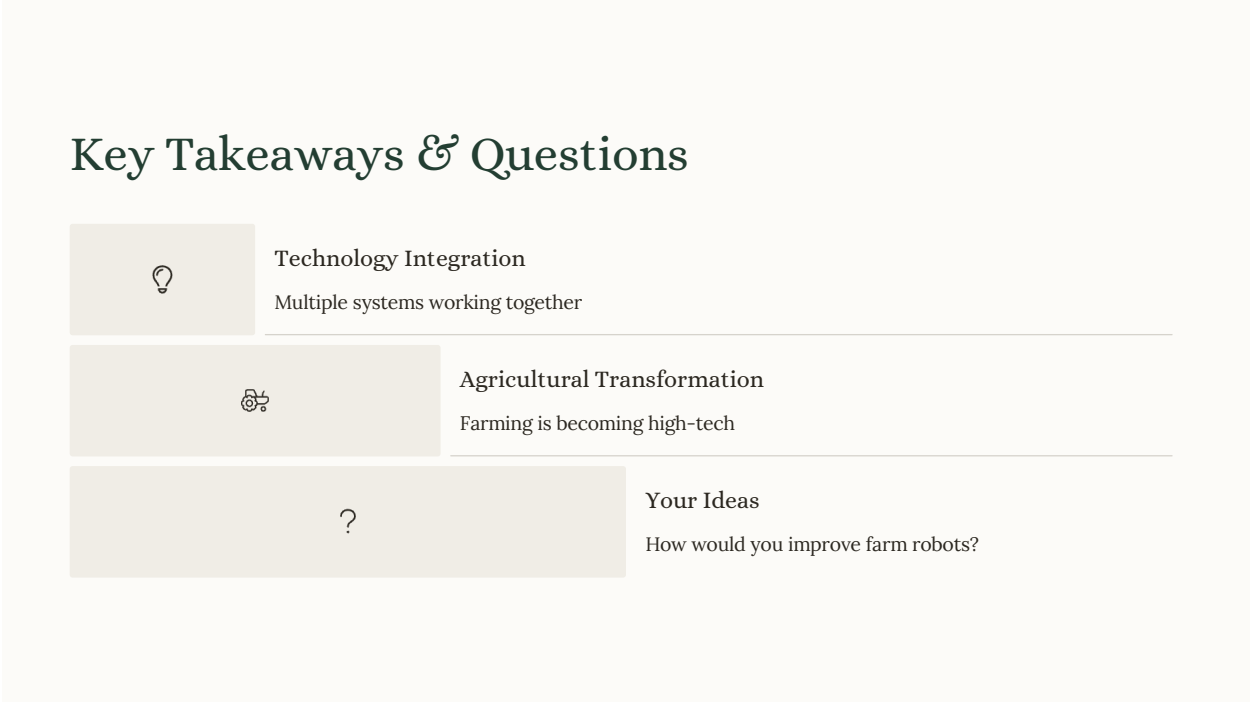
Launches a business focused on agricultural technology. This could mean inventing new tools, building robots, or creating apps for precision farming.

Education and Training

Bachelor's Degree: Most careers require a college degree in fields like Robotics, Engineering, Computer Science, or Agriculture.

Advanced Degrees: Jobs in research or AI may require a Master's or PhD.

Certifications & Hands-On Training: Many careers also offer training programs or certifications, like drone operation or equipment repair, that help you build specific skills.



NOTES: **What Do Field Robots Do?**

Field robots are machines that can complete farm tasks on their own. Common jobs include:

Planting seeds at the right depth and spacing

Spraying water, fertilizer, or pesticides with precision
Harvesting fruits and vegetables without damaging them
Monitoring crop health and soil conditions using sensors and cameras
These robots help farmers save time and reduce waste by doing jobs accurately and consistently.

Technology That Powers Farm Robots

Robots often use **3-D vision systems** to understand their surroundings. Just like human eyes, they use two cameras to judge depth and distance. This helps them move safely through fields and perform tasks without bumping into obstacles.

How Automated Spraying Works

Automated spray technology allows robots to apply chemicals only where needed. This reduces waste, lowers costs, and helps protect the environment. Smart nozzles and sensors make sure the spray is applied at the right time and place.

Designing Robots for the Field

Engineers must consider several things when designing farm robots:
The type of crops the robot will work with
What parts and tools the robot needs
How it will navigate through the field
Safety systems to protect people, plants, and the robot itself

Why Robotics Matters in Agriculture

Using robots in farming:
Increases accuracy and reduces human error
Cuts down on labor costs and saves time
Supports sustainable practices by reducing waste
Improves crop quality and yield

The Future of Farm Robotics

As the demand for food grows and farming faces challenges like climate change and labor shortages, field robotics will play a key role in solving these problems. They will help increase food production and make agriculture more resilient.

Presentation 11th – 12th Grade

11th-12th Grade Agricultural Robotics: The Future of Farming

Exploring how the Amiga robot and Industry 4.0 technologies are transforming modern agriculture

Why Robotics in Agriculture?

Labor Shortages

Farms face critical workforce gaps

Sustainability Demands

Precision technology reduces resource waste

Data-Driven Agriculture

Robots capture field insights at scale

NOTES: **Autonomous Tractors and Machinery**
Self-Driving Tractors: These machines use GPS guidance systems, sensors, and AI-powered software to navigate fields without human drivers. They perform tasks like tilling, planting, and spraying with high precision.
Harvesting Robots: Equipped with advanced vision systems and mechanical arms, these robots harvest crops like fruits and vegetables carefully to minimize damage and maintain quality.

Drones for Crop Monitoring

Aerial Imaging and Data Collection: Drones equipped with multispectral cameras and sensors collect real-time data on plant health, soil conditions, and pest activity. This information helps farmers make informed decisions quickly.

Precision Application: Drones can also be used to deliver targeted applications of water, fertilizer, or pesticides, minimizing waste and reducing environmental impact.

Automated Irrigation Systems

Smart Irrigation Technologies: These systems use moisture sensors, weather forecasts, and algorithms to manage watering schedules. This improves water use efficiency and supports sustainable agriculture.

Robotic Planting Systems

Precision Seeding: Robotic planters use GPS and field data to place seeds at ideal depths and spacing. This ensures uniform crop development, higher germination rates, and improved yield potential.

Weed Control Robots

Automated Weed Detection and Removal: Using AI and computer vision, these robots distinguish between crops and weeds, removing the latter with mechanical tools or targeted spraying. This reduces the need for herbicides.

Automated Spraying Systems

Targeted Application Technology: Autonomous sprayers use real-time imaging and mapping data to apply inputs only where needed. This enhances efficiency and reduces chemical usage, cost, and environmental harm.

Advantages of Agricultural Robotics

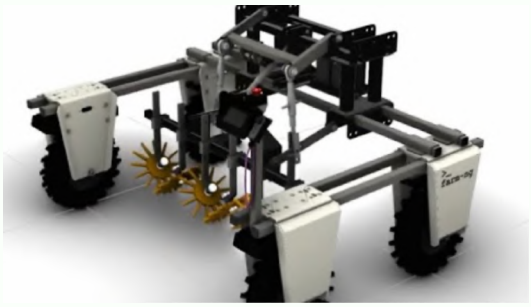
Improved Efficiency: Robotic systems operate with speed and accuracy, often working continuously without fatigue, leading to increased productivity.

Cost Reduction: While initial investment can be high, long-term savings are achieved through reduced labor, optimized input usage, and higher crop yields.

Environmental Sustainability: Robotics support more sustainable farming practices by minimizing water usage, reducing chemical runoff, and lowering emissions.

Enhanced Precision and Yield: Technology enables more exact operations, improving plant health, reducing waste, and increasing both the quality and quantity of agricultural output.

Meet the Amiga Field Robot



Multifunctional Platform

Adapts to various field operations

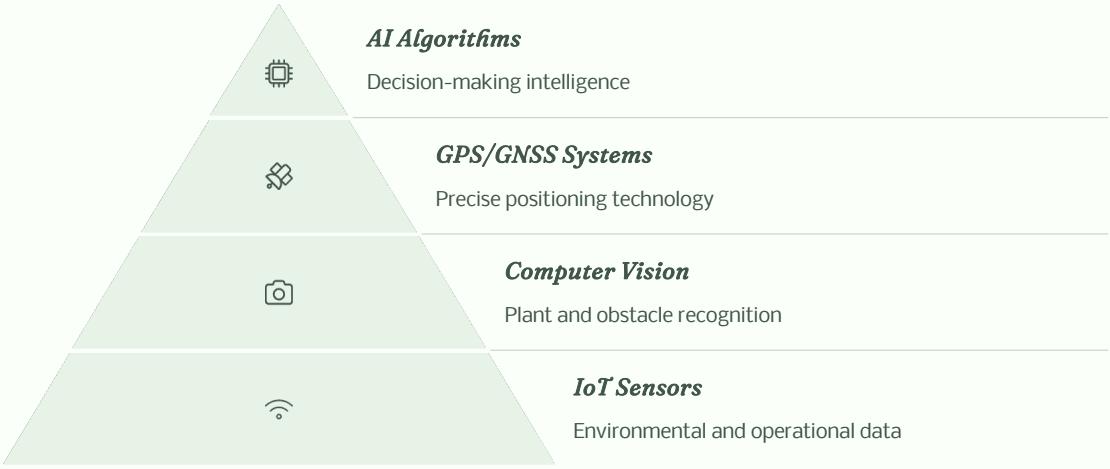
Autonomous Navigation

Works independently with minimal supervision

Precision Technology

Targets specific plants and field areas

Core Components of Agricultural Robotics



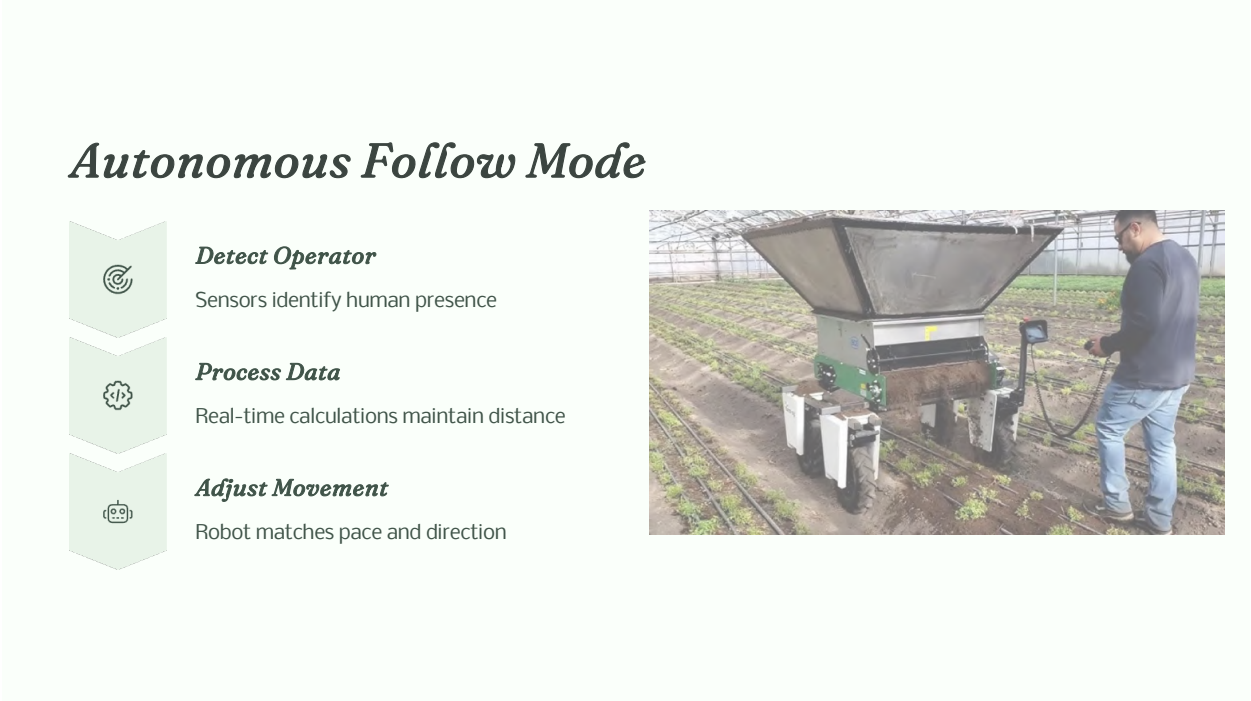
NOTES: **Autonomous Tractors**

Navigation and Control: Autonomous tractors use GPS technology, onboard sensors, and advanced software to navigate fields with precision. They can follow pre-programmed routes and avoid obstacles in real time, increasing operational efficiency.

Field Operations: These machines are capable of performing essential tasks such as plowing, tilling, and planting with minimal human input. Their accuracy ensures optimal seed placement, depth, and spacing, which supports better crop establishment and yield.

Harvesting Robots

Automated Fruit Picking: Harvesting robots are equipped with machine vision systems and artificial intelligence (AI) to identify ripeness and location of produce. They use robotic arms to pick fruit carefully, reducing damage and labor requirements.
Post-Harvest Handling: Some harvesting robots also sort produce by size, ripeness, or quality and package it accordingly. This speeds up the supply chain and reduces human error in post-harvest processes.
Weed Control Robots
Weed Detection: Using AI and computer vision, weed control robots scan fields to distinguish between crops and unwanted plants with high accuracy.
Precision Treatment: After identifying weeds, the robot may remove them mechanically or apply micro-doses of herbicide only where necessary. This reduces chemical usage and supports environmentally responsible farming.
Benefits of Autonomous Agricultural Robotics
Operational Efficiency: Autonomous machines can operate 24/7, significantly increasing productivity during peak planting and harvesting seasons.
Precision Agriculture: These technologies enhance accuracy in tasks like seeding, spraying, and harvesting, leading to improved crop performance and reduced waste.
Cost Effectiveness: While the initial investment in robotic systems can be high, long-term savings are realized through reduced labor, optimized input use, and fewer errors.
Environmental Sustainability: Targeted applications of water, fertilizer, and pesticides minimize runoff and environmental impact, aligning with sustainable farming practices.
Worker Safety: Robots can handle hazardous or repetitive tasks, reducing the risk of injury or exposure for human workers.



NOTES: **What Is Follow Mode?**
Follow Mode is a robotics feature that enables the **Amiga field robot** to autonomously follow a designated target—typically a person, animal, or another machine—across agricultural fields.

This function is especially useful during manual tasks such as harvesting or inspecting crops, as the robot can assist by transporting tools, containers, or harvested produce, reducing the physical workload on the farmer.

How Follow Mode Works

Sensor and Camera Integration

The Amiga robot utilizes an array of sensors and cameras to perceive its surroundings. These include:

RGB cameras for visual recognition,

Infrared sensors for detecting heat signatures,

Ultrasonic sensors to measure distance using sound waves.

These components provide the robot with multi-dimensional environmental awareness, allowing it to operate in diverse lighting and weather conditions.

Target Identification and Recognition

The robot's AI-powered vision system scans the environment and identifies the intended target using **computer vision algorithms** and **machine learning models**. Once recognized, the robot locks onto the target and maintains continuous tracking.

Real-Time Tracking and Navigation

The robot's onboard navigation software calculates the target's movement and adjusts its own path and speed accordingly. It uses:

Kinematic calculations to maintain safe spacing,

Obstacle detection to reroute when necessary,

And **path prediction** to anticipate movement and stay aligned with the target.

Autonomous Mobility and Control

The robot's actuators control its wheels or tracks, allowing for smooth and adaptive motion. If obstacles such as rocks or plants are detected, the robot autonomously alters its route while staying focused on the original target.

Agricultural Applications

Follow Mode enhances on-farm productivity by allowing the robot to function as a mobile assistant during labor-intensive tasks. It improves workflow efficiency, minimizes physical strain on human workers, and supports the integration of **precision agriculture** practices.

Benefits of Follow Mode

30%

Productivity Boost

Increased work efficiency

50%

Labor Reduction

Less manual transport needed

25%

Energy Savings

Optimized movement patterns

Autonomous Point A-B Navigation

Set Waypoints

Define field boundaries and paths

Engage RTK-GPS

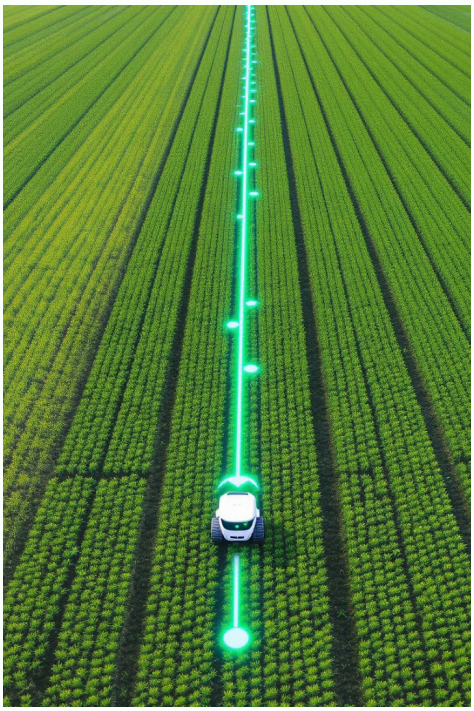
Centimeter-level positioning accuracy

Execute Path

Robot follows course with precision

Adapt to Terrain

Navigates obstacles and elevation changes

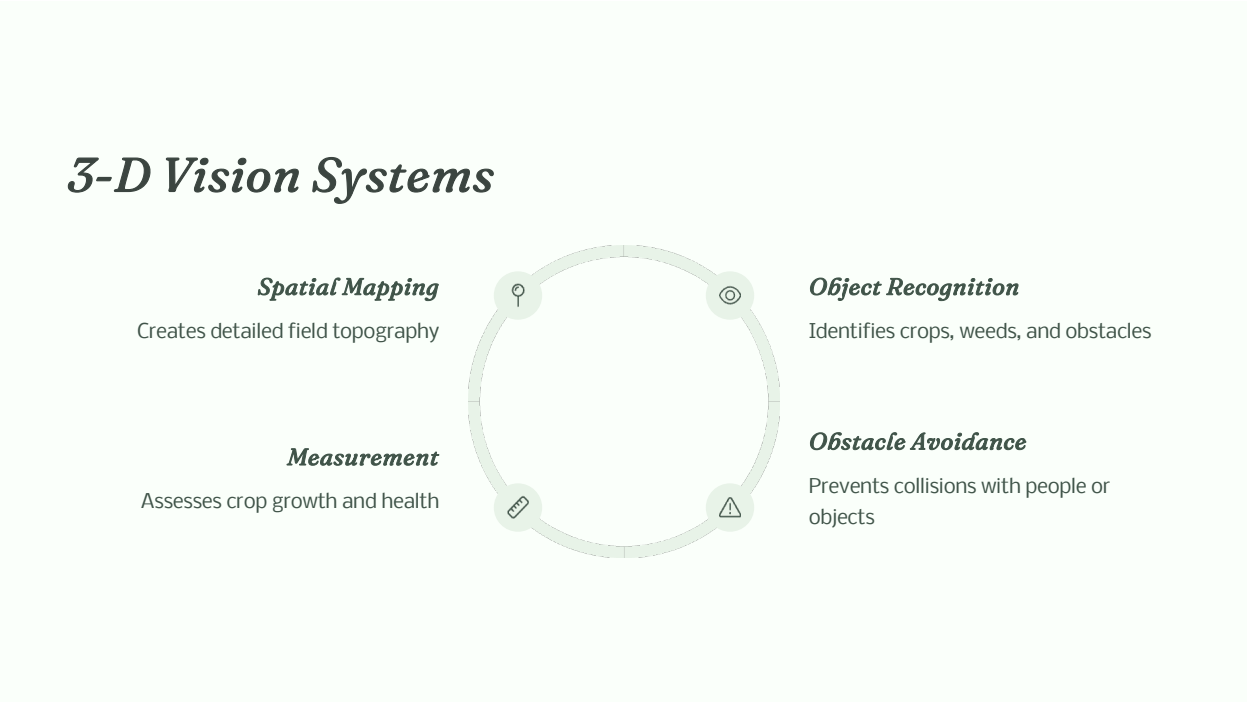


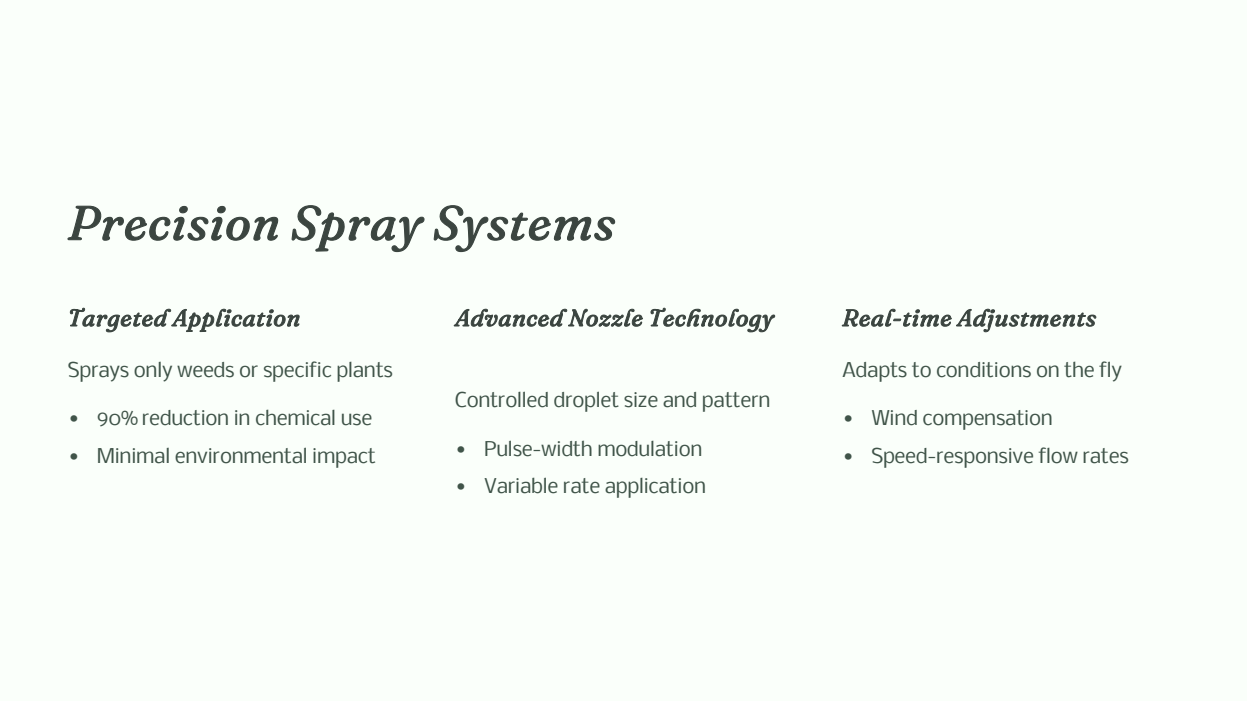
NOTES: **Benefits of Point A–B Navigation in Agricultural Robotics**

Point A–B navigation enables an agricultural robot to follow a predefined path between two locations with precision. This capability plays a significant role in the advancement of automated farming systems.

Precision: Robots accurately follow programmed routes, ensuring consistent execution of tasks such as seeding, fertilizing, and spraying. This level of accuracy enhances uniformity in crop management.

Operational Efficiency: Automating repetitive fieldwork increases overall productivity, allowing tasks to be completed faster and with less human intervention.
Cost Reduction: Precise application of inputs (seeds, water, fertilizers, and pesticides) minimizes waste and reduces input costs over time, contributing to more sustainable farm operations.
Enhanced Safety: Robots reduce the need for human workers to perform labor-intensive or potentially hazardous field tasks, lowering the risk of injury.
Scalability: Multiple autonomous robots can operate simultaneously on different routes, making it easier to manage large-scale farming operations and boost output.





NOTES: **How Does Automated Spray Technology Work?**

Automated spray technology enables agricultural robots, like the **Amiga**, to deliver targeted applications of pesticides, herbicides, or fertilizers with high precision. This system combines sensing technology, data analysis, and autonomous navigation to increase efficiency and reduce environmental impact.

Sensors and Imaging Systems

The robot is equipped with a range of sensors and cameras—such as multispectral or thermal imaging—that monitor crop and soil conditions in real time.

These tools detect signs of pest infestation, nutrient deficiencies, or disease by analyzing visual and environmental indicators.

Data Processing and Analysis

Collected data is processed by onboard software using artificial intelligence and computer vision algorithms.

The system identifies specific areas in the field that require treatment, minimizing unnecessary chemical use and improving crop health management.

Precision Spray Mechanism

A programmable spray system with multiple nozzles delivers chemical treatments only to targeted zones.

The robot adjusts the volume, pressure, and timing of sprays based on the specific needs of each plant or section of the field.

Autonomous Field Navigation

GPS, inertial measurement units (IMUs), and real-time kinematic (RTK) positioning allow the robot to follow a pre-mapped route accurately.

This ensures complete and consistent coverage while avoiding over-application or missed areas.

Automated spray systems support **precision agriculture** by improving input efficiency, reducing chemical runoff, and promoting sustainable farming practices.

Broader Impact of Field Robotics

Environmental Stewardship

Less chemical runoff and soil compaction

Farming Evolution

Smaller, smarter equipment replaces large machinery

Role Transformation

Farmers become tech managers and data analysts

Food Security

Increased production with fewer resources

NOTES: **Precision and Efficiency**

Field robots are capable of performing tasks such as planting, spraying, and harvesting with exceptional precision. This level of accuracy ensures that inputs like water, fertilizers, and pesticides are applied only where needed, reducing waste, optimizing resource use, and lowering production costs.

Labor Savings

Automation helps address the growing shortage of agricultural labor by taking over repetitive, physically demanding, and time-consuming tasks. This shift allows human workers to focus on higher-skill roles, such as data interpretation, machine maintenance, and agronomic decision-making.

Sustainable Farming Practices

By integrating sensor technology, data analytics, and control systems, field robots support environmentally sustainable agriculture. These systems enable targeted chemical applications, monitor soil conditions, and manage resources efficiently—reducing runoff, preserving soil health, and promoting long-term environmental stewardship.

Adaptation to Climate Change

Climate variability introduces new risks like unpredictable weather, increased pest pressure, and shifting growing seasons. Field robots equipped with AI and advanced sensing can rapidly adapt to changing field conditions, helping farmers respond proactively and maintain crop resilience.

Contributing to Global Food Security

With the global population continuing to rise, efficient food production is more critical than ever. Field robotics increase agricultural productivity, improve crop consistency, and support more resilient supply chains, helping to meet growing food demands worldwide.

Driving Technological Innovation

Agricultural robotics combine cutting-edge advancements in artificial intelligence, machine vision, sensor networks, and automation. These innovations not only benefit the agricultural

sector but also contribute to broader technological progress in fields such as healthcare, logistics, and advanced manufacturing.

STEM Education and Workforce Development

The expansion of robotics in agriculture opens new pathways for students interested in STEM. As the industry evolves, there's increasing demand for professionals skilled in programming, engineering, data science, and ag technology—making it an exciting and future-focused career field.

NOTES: **Career Pathways in Agricultural Robotics**

As agriculture evolves through automation and precision technologies, new and diverse career opportunities are emerging at the intersection of farming, engineering, and data science. Below are key career paths shaping the future of agriculture through robotics.

Robotics Engineer

Designs, develops, and tests robotic systems for agricultural use. This includes creating hardware components, integrating sensors and actuators, and ensuring systems can operate in outdoor environments.

Software Developer / AI Engineer

Builds the software that enables autonomous operation. These professionals develop navigation systems, machine learning algorithms, and object recognition tools that allow robots to make real-time decisions in the field.

Electrical and Electronics Engineer

Develops the electrical systems that power and control robotic platforms. Responsibilities include circuit design, sensor integration, power distribution, and ensuring reliable system communication.

Mechanical Engineer

Focuses on the physical design and movement systems of field robots—such as drive systems, mechanical arms, and structural components that withstand tough agricultural conditions.

Precision Agriculture Specialist
Applies agronomic knowledge and technology to improve productivity. They analyze sensor data, monitor crop and soil conditions, and develop strategies for efficient, site-specific farming practices.

Data Scientist / Analyst
Interprets data collected by robotics and sensor networks to optimize farm operations. They create predictive models, track performance metrics, and support data-driven decision-making in agriculture.

Field Robotics Technician
Handles setup, maintenance, diagnostics, and repair of robotic equipment on farms. Technicians ensure systems function correctly and provide support to farmers using robotic tools.

Drone Pilot / UAV Operator
Operates drones for agricultural mapping, crop monitoring, and aerial spraying. Requires FAA certification, knowledge of remote sensing, and the ability to analyze spatial data.

IoT (Internet of Things) Specialist
Manages the integration of connected devices—like sensors, GPS systems, and robots—into farm operations. They ensure real-time data flows between systems and optimize automation workflows.

Agribusiness Manager / Consultant
Advises agricultural operations on how to adopt and implement robotics and other emerging technologies. Focuses on increasing profitability, sustainability, and production efficiency.

Research Scientist / Academic Researcher
Leads innovation in agricultural robotics by exploring new algorithms, hardware, and applications. Often works in universities, government agencies, or industry R&D teams and publishes findings.

Entrepreneur / Startup Founder
Identifies market gaps and launches ag-tech businesses to bring new robotics solutions to the field. This role blends business development, product innovation, fundraising, and regulatory navigation.

Educational Pathways

Bachelor's Degree: Most careers begin with a degree in fields like Agricultural Engineering, Mechanical Engineering, Computer Science, or Robotics.

Master's or PhD: Needed for roles in AI research, academia, and advanced product development.

Certifications & Technical Training: Industry certifications (e.g., drone operation, IoT systems, equipment maintenance) and hands-on training programs offer practical skills for in-demand roles.

Your Role in the Future of Agriculture

Explore

What aspects of agri-robotics interest you most?

Learn

What skills do you need to develop?

Innovate

How will you shape farming's future?

Presentation Community College

Community College Field Robotic Device: The Amiga

Why Robotics?

Robots are used to make tasks easier, safer, and more efficient.

They can work in conditions that are dangerous for humans, perform repetitive tasks with high precision, and operate continuously without fatigue.

In many industries, robots help increase productivity and quality.

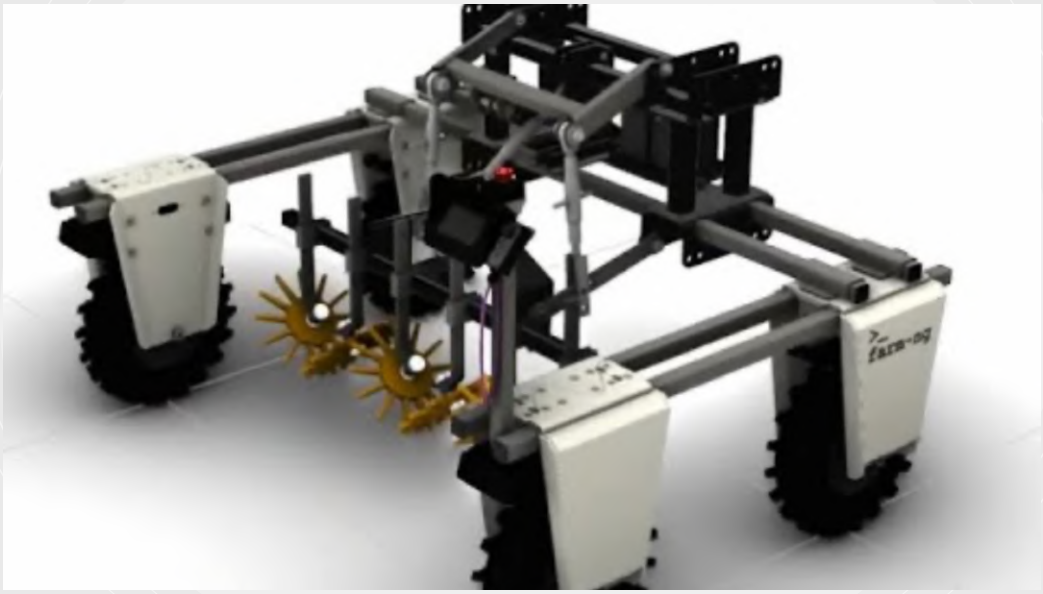
NOTES: **Robotics in Agriculture**

1. **Autonomous Tractors and Machinery**
    - **Self-Driving Tractors:** These tractors can navigate fields without human intervention, guided by GPS and sensors.
    - **Harvesting Robots:** Designed to pick fruits and vegetables with care, minimizing damage and maximizing efficiency.

2. **Drones for Crop Monitoring**
    - **Aerial Surveillance:** Drones equipped with cameras and sensors can monitor crop health, detect pests, and assess field conditions from the sky.
    - **Precision Agriculture:** Drones help in applying water, fertilizers, and pesticides accurately, reducing waste and environmental impact.
3. **Automated Irrigation Systems**
    - **Smart Irrigation:** These systems use sensors to monitor soil moisture levels and weather conditions, ensuring that crops get the right amount of water at the right time.
4. **Robotic Planting Systems**
    - **Precision Planting:** Robots plant seeds at optimal depths and intervals, ensuring uniform crop growth and improving yields.
5. **Weed Control Robots**
    - **Targeted Weed Management:** These robots identify and remove weeds with precision, reducing the need for chemical herbicides.
6. **Automated Spraying Technology**
    - **Precision Sprayers:** Robots equipped with sprayers can target specific areas of crops, applying pesticides or fertilizers only where needed, reducing chemical use.

Benefits of Robotics in Agriculture

- **Increased Efficiency:** Robots can work faster and more accurately than humans, leading to higher productivity.
- **Cost Savings:** Over time, robots can reduce labor costs and increase the efficiency of resource use.
- **Sustainability:** By using resources more efficiently and reducing waste, robotics can help make agriculture more sustainable.
- **Enhanced Precision:** Robots can perform tasks with high precision, leading to better crop yields and quality.



Key Components of Autonomous Operation

1. **Sensors:** Sensors collect data from the robot's surroundings. Common sensors include cameras, GPS, LiDAR (Light Detection and Ranging), and ultrasonic sensors. These devices help the robot understand its environment by detecting obstacles, measuring distances, and identifying objects.
2. **Processing Units:** The robot's brain, or processing unit, interprets the data from sensors. It uses complex algorithms and artificial intelligence (AI) to make decisions based on the information it receives.
3. **Actuators:** Actuators are the robot's muscles, controlling its movements. They enable the robot to move, manipulate objects, and interact with its environment.
4. **Software and Algorithms:** The software and algorithms are the instructions that tell the robot how to process sensor data, make decisions, and perform tasks. Machine learning and AI play a crucial role in enabling robots to learn from their experiences and improve their performance over time.

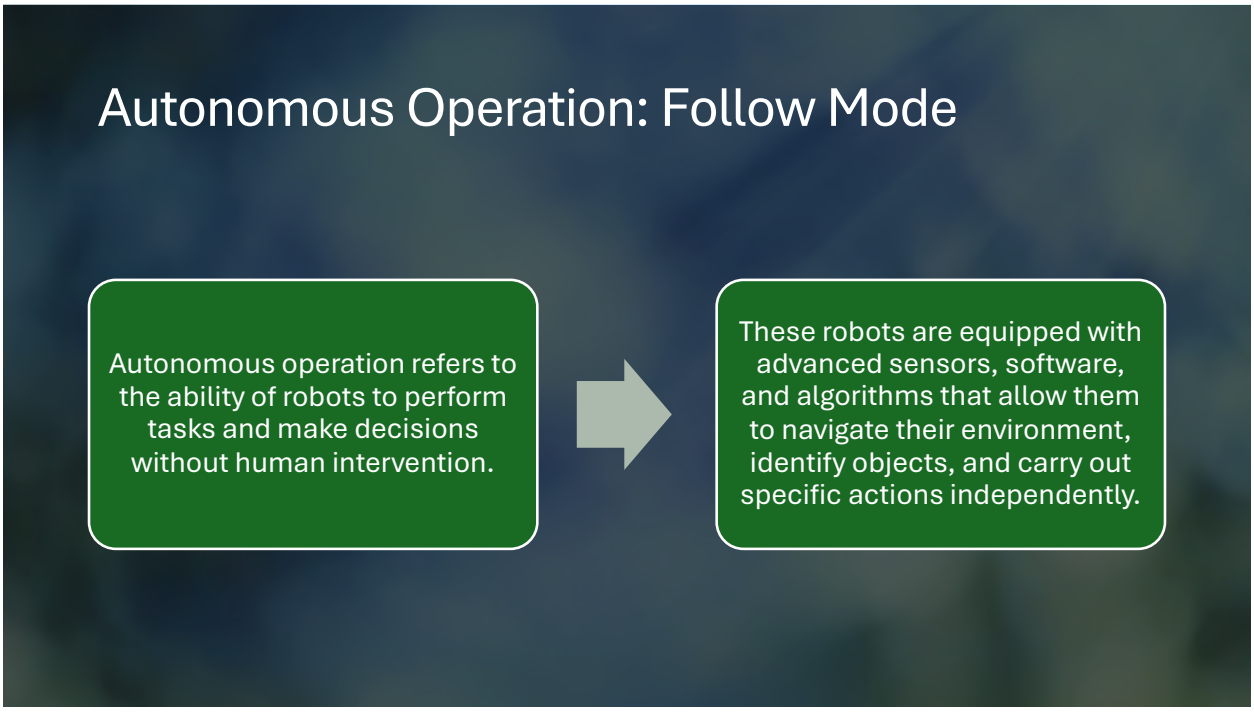
1. NOTES: **Autonomous Tractors:**
    - **Navigation:** Autonomous tractors use GPS and sensors to navigate fields, follow pre-planned routes, and avoid obstacles.
    - **Plowing and Planting:** These tractors can plow fields, plant seeds, and perform other farming tasks without human input, ensuring precision and efficiency.
2. **Harvesting Robots:**

- **Fruit Picking:** Harvesting robots are equipped with cameras and AI to identify ripe fruits. They use mechanical arms to pick the fruits carefully, avoiding damage.
- **Sorting and Packaging:** After harvesting, some robots can sort and package the produce based on size, ripeness, and quality.

3. **Weed Control Robots:**
   - **Weed Identification:** These robots use cameras and AI to identify weeds among crops.
   - **Targeted Removal:** Once a weed is identified, the robot can remove it mechanically or apply a targeted herbicide, minimizing damage to crops and reducing herbicide use.

Benefits of Autonomous Operation in Field Robots

- **Efficiency:** Autonomous robots can work continuously without breaks, increasing productivity.
- **Precision:** They perform tasks with high accuracy, improving crop yields and quality.
- **Cost Savings:** By reducing the need for manual labor and optimizing resource use, autonomous robots can lower operational costs.
- **Sustainability:** Precision in applying water, fertilizers, and pesticides helps reduce waste and environmental impact.
- **Safety:** Autonomous robots can operate in hazardous conditions, protecting human workers from potential dangers.



NOTES: **What is Follow Mode?**

Follow Mode is a feature that allows the Amiga field robot to autonomously follow a person, animal, or another machine. This capability is useful in various agricultural tasks, enabling the robot to assist farmers by carrying tools, supplies, or harvested produce while they move through the fields.

How Does Follow Mode Work?

1. **Sensors and Cameras:**
    - The Amiga field robot is equipped with sensors and cameras that detect and track the target it needs to follow.
    - These sensors include visual cameras, infrared sensors, and ultrasonic sensors to ensure accurate tracking in different lighting and weather conditions.
2. **Target Identification:**
    - The robot's cameras and sensors scan the environment to identify the target.
    - Advanced image processing algorithms and artificial intelligence (AI) are used to recognize the target, whether it’s a person, animal, or another machine.
3. **Tracking and Navigation:**
    - Once the target is identified, the robot continuously monitors its position using its sensors.
    - The robot’s software calculates the target’s movements and adjusts its own path to maintain a safe and consistent distance.
4. **Movement Control:**
    - The robot’s actuators control its wheels or tracks, allowing it to move smoothly and follow the target.
    - The robot can navigate around obstacles, adjusting its path as needed to stay on course.

Benefits of Follow Mode

Increased Efficiency: The robot can carry heavy loads, reducing the need for multiple trips and allowing farmers to complete tasks more quickly.

Reduced Physical Strain: By carrying tools and supplies, the robot helps reduce the physical strain on farmers, improving their overall well-being.

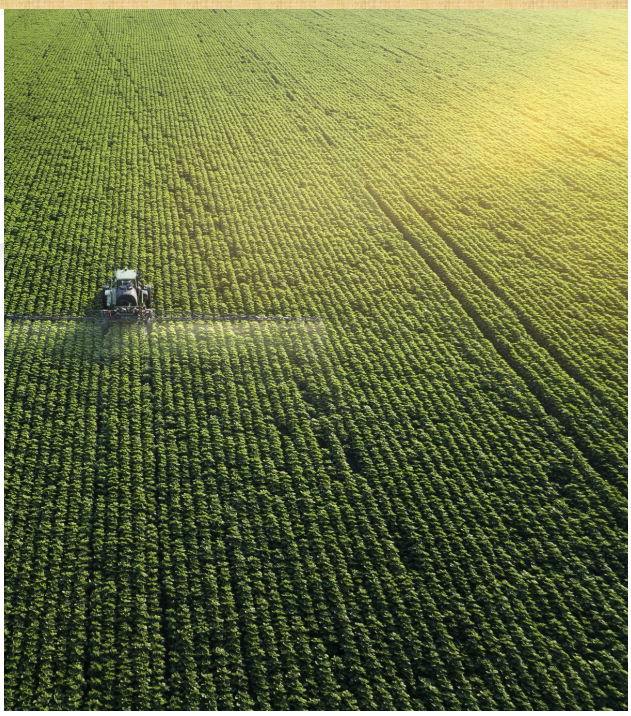
Enhanced Productivity: Farmers can focus more on their tasks without worrying about carrying equipment, leading to increased productivity.

Improved Precision: The robot's ability to navigate and follow accurately ensures it stays close to the farmer without causing disruptions.

Autonomous Operation: Point A-B Navigation

Point A-B navigation is a feature that allows the Amiga field robot to travel autonomously between two predefined points, Point A and Point B, on a field.

This capability is essential for performing repetitive tasks like planting, watering, or transporting goods with high precision and efficiency.



NOTES: **Benefits of Point A-B Navigation**

- **Precision:** The robot follows the predefined path accurately, ensuring tasks are performed consistently and correctly.
- **Efficiency:** By automating repetitive tasks, the robot saves time and reduces the need for manual labor.
- **Cost Savings:** The robot's precise application of resources like seeds, water, and chemicals helps reduce waste and lower costs.

- **Safety:** The robot can navigate through fields without human intervention, minimizing the risk of accidents and injuries.
- **Scalability:** Multiple robots can be programmed to follow different routes simultaneously, increasing overall productivity.

NOTES: **Applications of Point A-B Navigation in Agriculture**

1. **Planting and Seeding:**
    1. The robot can follow a predefined route to plant seeds at precise intervals and depths, ensuring uniform crop growth.
2. **Fertilizing and Spraying:**
    1. The robot can navigate between points to apply fertilizers or pesticides accurately, targeting specific areas and reducing chemical use.
3. **Transporting Goods:**
    1. The robot can carry harvested produce or supplies between storage areas and fields, reducing the need for manual labor.
4. **Field Monitoring:**
    1. The robot can follow a set route to monitor crop health, soil conditions, and other factors, collecting data for analysis.

Logistics

1. **Planting and Seeding:**
    - The Amiga field robot can navigate from one end of a field to the other, planting seeds at precise intervals.
    - This ensures uniform crop growth and maximizes yield.
2. **Fertilizing and Spraying:**
    - The robot can move between points to apply fertilizers or pesticides exactly where needed.

    - This targeted approach reduces chemical use and promotes sustainable farming practices.
3. **Harvesting:**
    - Robots can travel along predefined routes to collect harvested crops, transporting them from the fields to storage areas.
    - This reduces the need for manual labor and speeds up the harvesting process.

Challenges in Autonomous Navigation

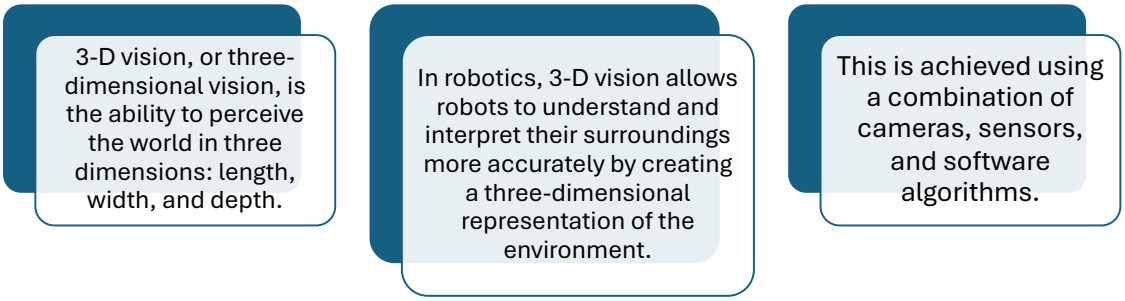
1. **Obstacle Detection and Avoidance:**
    - **Challenge:** Robots must be able to detect and avoid obstacles in real-time to navigate safely.
    - **Solution:** Advanced sensors like LiDAR, cameras, and ultrasonic sensors can help detect obstacles. AI algorithms can process this data to make quick decisions and adjust the robot's path.
2. **Environmental Variability:**
    - **Challenge:** Outdoor environments, especially in agriculture, can be unpredictable due to weather conditions, changing terrains, and varying light levels.
    - **Solution:** Robust sensor systems and adaptive algorithms can help robots adjust to different environmental conditions. Machine learning can enable robots to learn from past experiences and improve their performance over time.
3. **Accuracy of GPS and Mapping:**
    - **Challenge:** GPS signals can sometimes be weak or inaccurate, affecting the robot’s ability to navigate precisely.
    - **Solution:** Combining GPS with other positioning systems like RTK (Real-Time Kinematic) can enhance accuracy. Additionally, creating detailed maps of the environment can help the robot navigate more precisely.
4. **Energy Efficiency:**
    - **Challenge:** Autonomous robots require a reliable power source to operate for extended periods.
    - **Solution:** Improving battery technology and energy management systems can help extend the operational time of robots. Solar panels and other renewable energy sources can also be integrated to provide additional power.
5. **Communication and Connectivity:**
    - **Challenge:** Robots need reliable communication systems to receive instructions and share data, especially in remote areas.
    - **Solution:** Utilizing robust wireless communication technologies like 5G and satellite communication can ensure consistent connectivity. Creating a network of connected devices (Internet of Things) can also enhance communication and data sharing.

Solutions and Advancements

1. **Enhanced Sensor Fusion:**
    - Integrating data from multiple sensors can provide a more comprehensive understanding of the environment, improving navigation and obstacle avoidance.
2. **AI and Machine Learning:**
    - Utilizing AI and machine learning algorithms allows robots to learn from their experiences, adapt to new situations, and improve their decision-making over time.

3. **Improved Battery Technology:**
    - Advances in battery technology, such as higher energy density and faster charging, can extend the operational time of autonomous robots.
4. **Collaborative Robots:**
    - Developing robots that can work together and communicate with each other can improve efficiency and tackle complex tasks more effectively.
5. **Regulatory Support and Standards:**
    - Establishing clear regulations and industry standards for autonomous robots can facilitate their integration and ensure safety and reliability.

What is 3-D Vision?



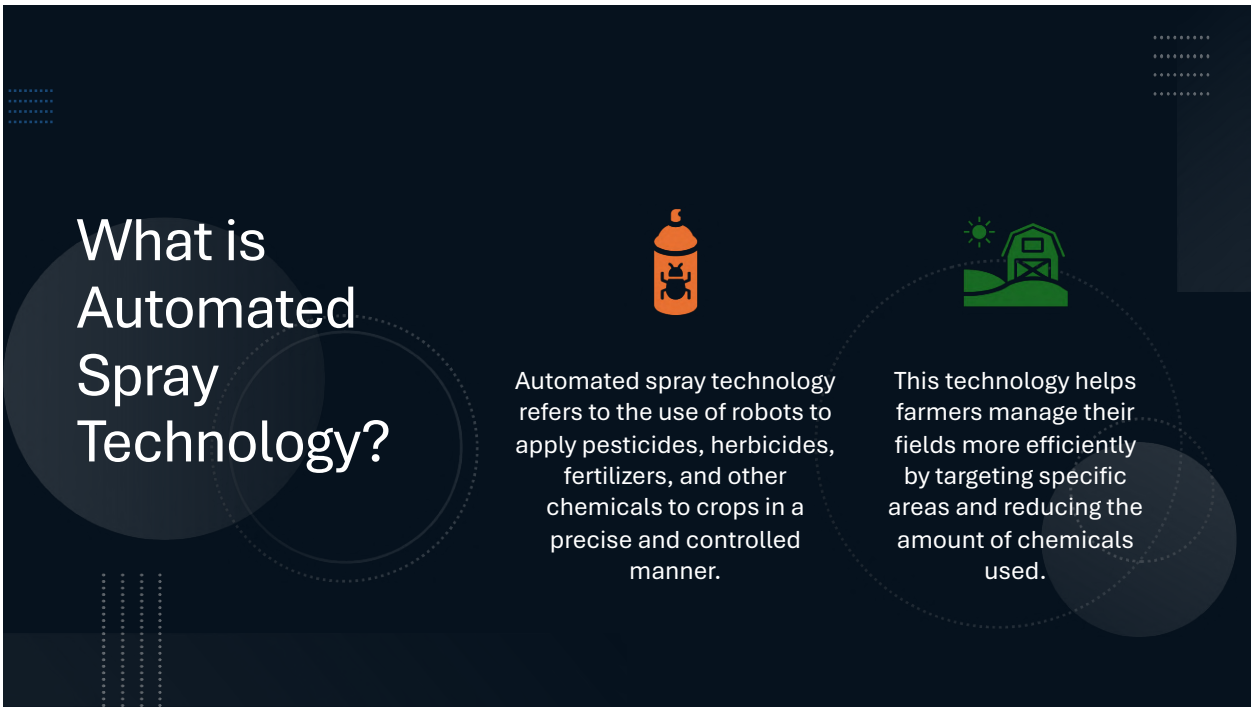
NOTES: **How Does 3-D Vision Work?**

1. **Stereo Cameras:**
   - Similar to how human eyes work, stereo cameras capture two images from slightly different angles.
   - By comparing these images, the robot can calculate the distance to various objects, creating a depth map of the environment.
2. **Depth Sensors:**
   - Depth sensors, like LiDAR (Light Detection and Ranging) or time-of-flight cameras, emit light or laser pulses and measure the time it takes for them to bounce back.
   - This data helps determine the distance to objects, building a detailed 3-D map.
3. **Structured Light:**
   - This method projects a pattern of light onto an object. The way the pattern deforms when it hits surfaces helps the robot calculate the depth and shape of objects.
4. **Computer Vision Algorithms:**
   - Software algorithms process the data from cameras and sensors to create a 3-D model of the environment.
   - These algorithms identify objects, measure distances, and interpret spatial relationships between objects.

3-D Vision in Agriculture Robotics

NOTES: **How the Field Robots Use 3-D Vision in Agriculture**

1. **Crop Monitoring:**
   - Field robots use 3-D vision to scan the field and monitor crop health.
   - They can identify signs of disease, pests, and nutrient deficiencies by analyzing the shape, color, and texture of plants.
2. **Precision Planting and Seeding:**
   - The robot navigates the field using 3-D maps to plant seeds at precise locations and depths.
   - This ensures uniform growth and maximizes crop yield.
3. **Weed Identification and Removal:**
   - Field robots can distinguish between crops and weeds using 3-D vision.
   - They identify weeds and removes them accurately, reducing the need for chemical herbicides.
4. **Harvesting:**
   - During harvesting, the robot uses 3-D vision to locate and pick ripe produce without damaging the plants.
   - They ensure only mature fruits and vegetables are collected, improving the quality of the harvest.
5. **Field Navigation:**
   - Field robots navigate complex field environments by creating and updating 3-D maps.
   - They avoid obstacles like rocks, plants, and equipment, ensuring smooth and efficient operation.
6. **Soil Analysis:**
   - Field robots use 3-D vision to analyze soil structure and conditions.
   - They can assess soil compaction and texture, providing valuable data for optimizing planting and irrigation.



NOTES: **How Does Automated Spray Technology Work?**

1. **Sensors and Cameras:**
   - Field robots are equipped with sensors and cameras that scan the crops and soil.
   - These devices collect data on plant health, pest presence, and nutrient levels.
2. **Data Analysis:**
   - The robot's software processes the data collected by the sensors and cameras.
   - It identifies areas that need treatment, such as plants showing signs of disease or pest infestation.
3. **Spray Mechanism:**
   - The robot has a spray system that can apply chemicals precisely where needed.
   - It uses nozzles to spray the right amount of chemicals at the right time, minimizing waste.
4. **Navigation:**
   - The robot navigates the field using GPS and other positioning systems.
   - It follows a planned path to ensure all target areas are treated efficiently.

Automated Spray Technology: Design and Installation

NOTES: **Key Factors to Consider**

1. **Type of Crops and Fields:**
    1. The design of the spray system should match the type of crops being grown. Different crops may require different types of nozzles and spray patterns.
    2. Consider the field's layout, size, and terrain. A robot designed for flat fields may need adjustments for hilly or uneven terrain.
2. **Spray System Components:**
    1. **Nozzles:** Select nozzles that provide the appropriate spray pattern and droplet size for the chemicals being applied.
    2. **Pumps:** Ensure the pumps can deliver a consistent flow of chemicals at the required pressure.
    3. **Tanks:** The robot should have a tank large enough to hold the necessary amount of chemicals but not so large that it makes the robot too heavy or cumbersome.
3. **Sensors and Cameras:**
    1. Install high-quality sensors and cameras to accurately detect plants, pests, and weeds.
    2. The sensors should be able to function in various weather conditions and lighting environments.
4. **Navigation and Control Systems:**
    1. Equip the robot with GPS and other positioning systems to ensure it can navigate the field accurately.
    2. Implement control software that can process sensor data in real-time and adjust the robot’s path and spray patterns as needed.
5. **Power Supply:**
    1. Choose a reliable power source, such as batteries or solar panels, that can support the robot's operations for extended periods.

    2. Consider energy-efficient components to maximize the robot's operational time between charges.
6. **Durability and Maintenance:**
    1. Use materials and components that can withstand harsh agricultural environments, including exposure to chemicals, dust, and moisture.
    2. Design the robot for easy maintenance and cleaning to ensure long-term reliability.
7. **Safety Features:**
    1. Implement safety systems to prevent accidental chemical exposure to humans and animals.
    2. Ensure the robot can detect obstacles and stop or navigate around them to avoid collisions.

Benefits of Automated Spraying in Agriculture

Precision and Efficiency

1. **Targeted Application:**
    1. Automated spray systems can apply chemicals precisely where needed, reducing waste and ensuring each plant receives the right amount of treatment.
2. **Consistent Coverage:**
    1. Robots can spray crops evenly and consistently, avoiding the variability that can occur with manual spraying.

Cost Savings

1. **Reduced Chemical Use:**
    1. Precision spraying minimizes the amount of chemicals needed, leading to cost savings on pesticides, herbicides, and fertilizers.
2. **Labor Savings:**
    1. Automated systems reduce the need for manual labor, allowing farmers to focus on other important tasks.

Environmental Benefits

1. **Reduced Chemical Runoff:**
    1. By applying chemicals precisely, automated systems reduce the risk of excess chemicals running off into nearby water sources, protecting the environment.
2. **Sustainable Farming Practices:**
    1. Efficient use of chemicals supports sustainable farming practices, promoting soil health and biodiversity.

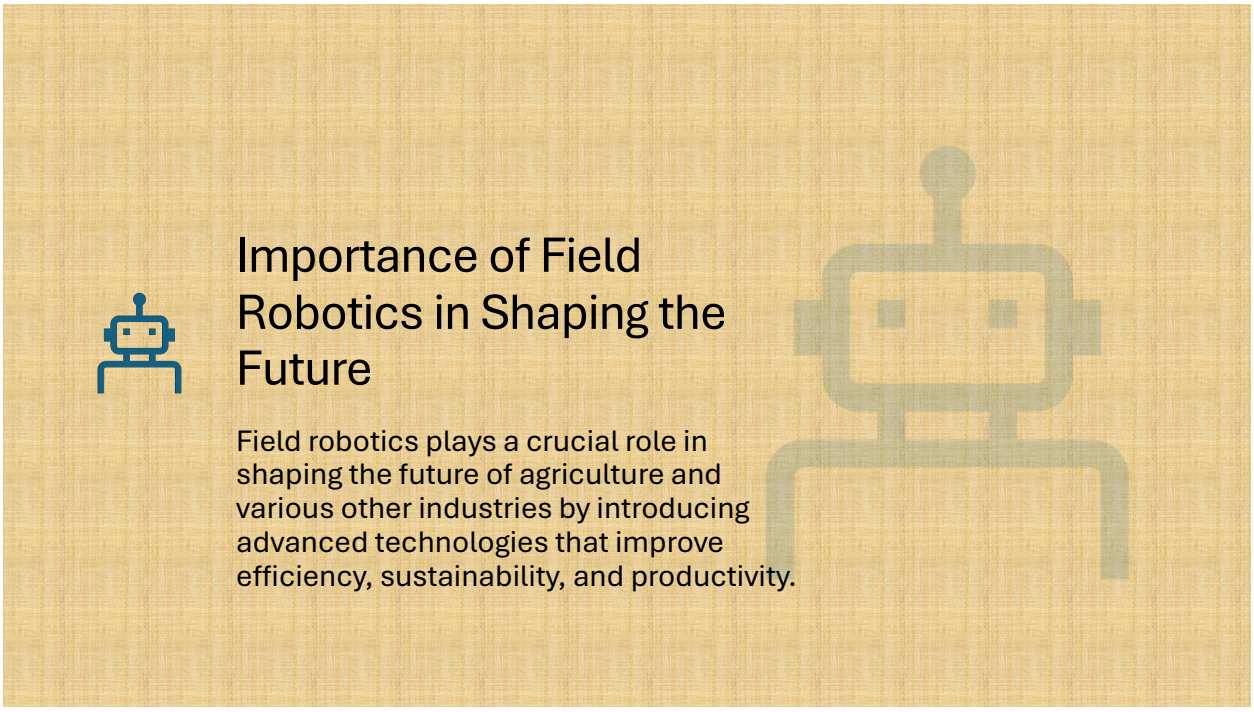
Enhanced Crop Health and Yield

1. **Timely Treatment:**
    1. Robots can monitor crops continuously and apply treatments as soon as issues are detected, preventing the spread of diseases and pests.
2. **Improved Crop Quality:**
    1. Consistent and precise spraying helps ensure healthier crops, leading to higher yields and better quality produce.

Safety

1. **Reduced Human Exposure:**
    1. Automated systems keep humans away from potentially harmful chemicals, reducing the risk of exposure and accidents.
2. **Safe Operation in Harsh Conditions:**

1. Robots can operate in conditions that might be unsafe or difficult for human workers, such as extreme heat or areas with high pest populations.



NOTES: **Precision and Efficiency:**

- Field robots can perform tasks with high precision, such as planting, spraying, and harvesting crops. This precision leads to efficient use of resources like water, fertilizers, and pesticides, minimizing waste and reducing costs.

Labor Savings:

- Automation in agriculture reduces the reliance on manual labor, which is becoming increasingly scarce in many regions. Robots can handle repetitive and labor-intensive tasks, allowing human workers to focus on higher-value activities.

Sustainable Practices:

- By using sensors, data analytics, and precise control systems, field robots enable farmers to adopt sustainable farming practices. This includes targeted application of chemicals, soil monitoring, and optimized resource management, which reduces environmental impact and promotes long-term soil health.

Adaptability to Climate Change:

- Climate change poses significant challenges to agriculture, such as unpredictable weather patterns and pest outbreaks. Field robots equipped with advanced sensors and AI can adapt quickly to changing conditions, helping farmers mitigate risks and maintain crop resilience.

Global Food Security:

- With a growing global population, there is an increasing demand for food production. Field robotics can help meet this demand by increasing agricultural productivity and ensuring more efficient food distribution networks.

Technological Innovation:

- Field robotics drives technological innovation in robotics, artificial intelligence, sensor technology, and data analytics. These advancements not only benefit agriculture but also contribute to advancements in other industries, such as healthcare, manufacturing, and logistics.

Education and Workforce Development:

- The development and adoption of field robotics create opportunities for education and workforce development in STEM fields (Science, Technology, Engineering, and Mathematics). It prepares the next generation of innovators and technicians who will drive further advancements in robotics and related technologies.

Career & Educational Pathways

NOTES: **Career Pathways**

1. **Robotics Engineer:**
    1. Specializes in designing, developing, and testing robotic systems specifically tailored for agricultural applications. Responsibilities include hardware design, software development, and integration of sensors and actuators.
2. **Software Developer / AI Engineer:**
    1. Develops algorithms and software systems that enable robots to perform autonomous tasks, such as navigation, object recognition, and decision-making. AI engineers focus on machine learning models that enhance robot intelligence and adaptability.
3. **Electrical and Electronics Engineer:**
    1. Designs and implements electrical systems, circuits, and components for robotic platforms. This includes power management, sensor integration, and ensuring robust communication between components.
4. **Mechanical Engineer:**

    1. Works on the design and optimization of mechanical systems and structures for field robots. This includes chassis design, mobility systems (wheels, tracks), and mechanisms for manipulation and sensing.
5. **Precision Agriculture Specialist:**
    1. Applies expertise in agricultural sciences and technology to optimize farm operations using robotics and data analytics. Responsibilities include crop monitoring, soil analysis, and recommending precision farming techniques.
6. **Data Scientist / Analyst:**
    1. Analyzes agricultural data collected by robots and sensors to derive insights for improving farm productivity, resource management, and decision-making. Develops models for predictive analytics and optimization.
7. **Field Robotics Technician:**
    1. Performs installation, maintenance, and troubleshooting of robotic systems in agricultural settings. Ensures robots operate efficiently and safely, conducts repairs, and provides technical support to farm operators.
8. **Drone Pilot / UAV Operator:**
    1. Operates unmanned aerial vehicles (drones) equipped with sensors and cameras for various agricultural tasks, such as crop monitoring, mapping, and aerial spraying. Requires skills in flight operations and data analysis.
9. **IoT (Internet of Things) Specialist:**
    1. Implements and manages IoT systems that connect sensors, robots, and farm equipment to optimize data collection and communication. Integrates IoT technologies with agricultural practices for improved efficiency and automation.
10. **Agribusiness Manager / Consultant:**
    1. Provides strategic guidance to agricultural businesses on adopting and integrating robotics and technology solutions. Focuses on optimizing production processes, reducing costs, and enhancing sustainability practices.
11. **Research Scientist / Academic Researcher:**
    1. Conducts research in agricultural robotics, exploring new technologies, algorithms, and applications. Publishes findings in academic journals and collaborates with industry partners to advance the field.
12. **Entrepreneur / Startup Founder:**
    1. Identifies opportunities for innovation in agriculture robotics and launches startups to develop and commercialize new robotic solutions. Involves business planning, fundraising, and navigating regulatory requirements.

Educational Pathways

- **Bachelor's Degree:** Typically in fields such as Robotics Engineering, Mechanical Engineering, Electrical Engineering, Computer Science, Agricultural Engineering, or related disciplines.
- **Master's Degree or PhD:** Provides specialized knowledge and research opportunities in areas like Robotics, Artificial Intelligence, Precision Agriculture, and Data Science.
- **Certifications and Training:** Offered by industry organizations and institutions to enhance skills in specific technologies or applications, such as UAV piloting or IoT integration in agriculture.

NOTES: **Introduction to Robotics in Agriculture:**

- Robotics in agriculture involves using advanced technologies like robots, AI, and sensors to enhance efficiency, sustainability, and productivity in farming.

Applications of Field Robots:

- Field robots perform various tasks such as planting, spraying, harvesting, and monitoring crops with precision and autonomy.

Technological Features:

- Technologies like 3-D vision enable robots to perceive depth and navigate complex environments, crucial for tasks like autonomous operation and point A-B navigation.

Automated Spray Technology:

- Automated spray systems on field robots apply chemicals precisely, reducing waste and environmental impact while improving crop health and efficiency.

Design Considerations:

- Designing spray technology involves factors like crop types, system components, navigation systems, and safety features to optimize performance and reliability.

Benefits of Robotics in Agriculture:

- Robotics enhances precision, efficiency, and sustainability, reduces labor costs, supports environmental stewardship, and enhances crop quality and yield.

Future Outlook:

- Field robotics is shaping the future of agriculture by driving innovation, improving food security, and offering solutions to challenges like climate change and labor shortages.

Career Opportunities:

- Careers in agriculture robotics include robotics engineering, software development, data analytics, precision agriculture, and various technical and managerial roles.

Educational Pathways:

- Education in fields like robotics, engineering, computer science, and agricultural sciences prepares individuals for careers in agriculture robotics through degrees, certifications, and specialized training.

Pre-Presentation Survey: "Farming Robots!" (2nd–3rd Grade)

1. Have you ever heard about robots on farms?
☐ Yes ☐ No ☐ Not sure

2. What do you think a robot can do on a farm? (Check all you think are true!)
☐ Carry heavy things
☐ Fly to space
☐ Water plants
☐ Make sandwiches

3. Which of these do you think is a real job? (Check any you know!)
☐ Farmer
☐ Robot Builder (Robotics Engineer)
☐ Drone Flyer (Drone Pilot)

4. Would you like to use or build a farm robot someday?
☐ Yes ☐ Maybe ☐ No

Post-Presentation Survey: "Farming Robots!" (2nd–3rd Grade)

1. What is the Amiga robot used for?

2. What is something cool a robot can do on a farm?

3. Which job would you like to try when you grow up?
☐ Robotics Engineer
☐ AI Programmer
☐ Drone Pilot
☐ Something else: _____

4. If you could invent a farm robot, what would it do?

Pre-Presentation Survey: "Robots on the Farm!" (4th-5th Grade)

1. Have you ever seen or heard of robots being used on farms?
☐ Yes
☐ No
☐ Not sure

2. What do you think robots might help farmers do? (Check all that you think are true.)
☐ Pick fruit
☐ Watch TV
☐ Water plants
☐ Carry heavy things

3. Which of these sounds like a real job? (Check any you've heard of or think are real!)
☐ Drone Pilot
☐ AI Programmer
☐ Robotics Engineer
☐ Superhero

4. Would you like to have a job where you work with robots one day?
☐ Yes
☐ Maybe
☐ No

Post-Presentation Survey: "Robots on the Farm!" (4th-5th Grade)

1. What is the Amiga robot used for on the farm?

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2. What are two cool things farm robots can do?
1. _____
2. _____

3. Which job sounds the most fun to you?
☐ Robotics Engineer
☐ AI Programmer
☐ Drone Pilot
☐ Farmer
☐ Something else: _____

4. What would YOU like a robot to do on a farm?

Pre-Presentation Survey: "Field Robotics & the Future of Farming" (6th–8th Grade)

1. Have you ever heard of robots being used in agriculture?
☐ Yes ☐ No ☐ Not sure

2. What are some challenges farmers face today? (Check all you think are true.)
☐ Too much free time
☐ Not enough workers
☐ Tasks take a long time
☐ Robots already do everything

3. What do you think farm robots might be able to do?
☐ Drive on their own
☐ Follow a farmer
☐ Water and spray plants

4. Which of these careers have you heard of or find interesting?
☐ Robotics Engineer
☐ AI Programmer
☐ Drone Operator
☐ Sustainable Farmer
☐ I'm not sure

5. Would you be interested in working with farm technology in the future?
☐ Yes ☐ Maybe ☐ No

Post-Presentation Survey: "Field Robotics & the Future of Farming" (6th–8th Grade)

1. Name one way robots are helping farmers today.

2. Describe something new you learned about robot technology.

3. Which of the Amiga's features do you think is the most useful? Why?

4. Which AgTech career seems most interesting to you and why?

5. What would you like to see a farm robot do in the future?

Pre-Presentation Survey: "Smart Agriculture & Field Robotics" (9th–10th Grade)

1. Have you heard of robots being used in agriculture before today?
☐ Yes ☐ No ☐ Not sure

2. What benefits do you think robotics could bring to farming? (Check all you think apply.)
☐ Saves time
☐ Costs more money
☐ Reduces hard labor
☐ Makes farming more accurate
☐ Pollutes the environment

3. What technology might be used in a farm robot? (Check all you think apply.)
☐ GPS
☐ Cameras
☐ LiDAR
☐ Game controllers

4. Which of these careers do you find interesting or want to learn more about?
☐ Robotics Engineering
☐ Agri-tech Innovation
☐ Computer Science
☐ Environmental Science
☐ I'm not sure

5. Could you see yourself working in agricultural technology someday?
☐ Yes ☐ Maybe ☐ No

Post-Presentation Survey: "Smart Agriculture & Field Robotics" (9th–10th Grade)

1. What is one way robots like the Amiga are improving agriculture?

2. Which system or feature did you find most interesting and why?

3. What is one benefit of using automated spray technology?

4. Which career path in agri-tech stood out to you the most? Why?

5. If you could design a feature for a farm robot, what would it do?

Pre-Presentation Survey: "The Future of Agri-Robotics" (11th–12th Grade)

1. Have you heard about agricultural robots or the Amiga field robot before this presentation?
☐ Yes ☐ No ☐ Not sure

2. What challenges do you think modern farmers face today? (Check all that apply.)
☐ Too many workers
☐ Labor shortages
☐ Environmental concerns
☐ Overuse of resources

3. What technologies do you think are used in modern farm robots? (Check all that apply.)
☐ AI (Artificial Intelligence)
☐ GPS/GNSS
☐ IoT Sensors

4. Which agri-tech career paths sound interesting to you?
☐ Robot Programmer
☐ Data Scientist
☐ Precision Ag Specialist
☐ Entrepreneur
☐ I'm not sure

5. Would you consider pursuing a career in agricultural robotics or technology?
☐ Yes ☐ Maybe ☐ No

Post-Presentation Survey: "The Future of Agri-Robotics" (11th–12th Grade)

1. What is one major benefit of using robotics in agriculture?

2. What specific robot feature or system did you find most interesting? Why?

3. What is one way field robotics supports sustainability in farming?

4. Which agri-robotics career pathway would you consider exploring further? Why?

5. What would you like to design or improve in future farming robots?

Pre-Presentation Survey: "The Amiga Field Robot & Smart Agriculture" (Community College)

1. Have you learned about robotics in agriculture before?
☐ Yes ☐ No ☐ Not sure

2. Which of these do you believe are current challenges in agriculture? (Check all that apply.)
☐ Labor shortages
☐ Lack of innovation
☐ Inefficient field practices
☐ Limited use of automation

3. What do you expect robots like the Amiga can do on a farm? (Check all that apply.)
☐ Navigate autonomously
☐ Spray crops with precision
☐ Follow a person
☐ Upload data to social media

4. Which of these fields are you interested in learning more about?
☐ Robotics Engineering
☐ Precision Agriculture
☐ Data Science
☐ Sustainable Technology
☐ I'm not sure

5. Would you consider a career related to ag technology or automation?
☐ Yes ☐ Maybe ☐ No

Post-Presentation Survey: "The Amiga Field Robot & Smart Agriculture" (Community College)

1. What is one function of the Amiga field robot that stood out to you?

2. Which feature (e.g., Follow Mode, Point A-B, 3D Vision, Spray Tech) do you find most applicable to real-world farming?

3. How can field robotics support sustainability and efficiency in agriculture?

4. Did this presentation impact your interest in careers related to ag robotics or technology? Why or why not?

5. What further questions or topics would you like to explore related to agricultural robotics?

Hands-On Activity Grades 2–3: “Follow the Farm Trail”

Objective: Introduce the idea of robots following farmers to help with chores.

Materials:

- Amiga robot (pre-set in follow mode)
- “Farm trail” path marked with cones, signs, or rope (include pretend crop stops)

Activity Steps:

1. Students take turns walking a simple marked trail with the Amiga robot in follow mode.
2. Along the trail are pretend “chores” (e.g., picking up a plush fruit, placing a cone to mark a row).
3. Discuss how the Amiga followed them and helped carry “crops.”

Key Concepts: What is follow mode? Why might a farmer want help carrying tools or crops?

Hands-On Activity Grades 4–5: “Robot Trail Challenge”

Objective: Demonstrate that robots can follow a path and assist with light field tasks.

Materials:

- Amiga robot (set to follow mode)
- Marked “path” with direction signs or numbered checkpoints
- Small bin or simulated light tool payload on the Amiga deck

Activity Steps:

1. Students walk the path while Amiga follows behind carrying a “toolbox.”
2. At each checkpoint, students pretend to perform a task (e.g., inspect a crop, drop a seed marker).
3. Debrief: Why is it helpful that Amiga can follow them hands-free?

Extension Idea: Talk about roles like farm assistants, robotics operators, and tech support in agriculture.

Hands-On Activity Grades 6–8: “Precision Follow & Task Test”

Objective: Practice controlling Amiga’s follow mode while simulating real field conditions.

Materials:

- Amiga robot (in follow mode)
- Pre-mapped path with turns, elevation changes (small ramps), or barriers
- Load materials like seed bags, fake plants, or watering cans

Activity Steps:

1. Students lead the Amiga through a defined “field row” course with obstacles.
2. Challenge: Maintain a safe and accurate following distance without losing connection.
3. Reflection: What issues might arise in real farms? How could they be fixed?

Career Link: Intro to ag tech roles — UX tester, robotics maintenance, and sensor technicians.

Hands-On Activity Grades 9–10: “Tool Tow & Path Follow Challenge”

Objective: Operate the Amiga robot using follow mode while pulling a mock implement.

Materials:

- Amiga robot
- Three-point hitch system or tow bar
- Small implement (e.g., garden roller, seed spreader, or mock-up of a weeder)
- Obstacle course or mock field plot

Activity Steps:

1. Students activate follow mode and walk the path while Amiga pulls the implement.
2. Observe how weight or turns affect performance (e.g., turning radius, lag).
3. Students log observations and propose ways to improve traction, turning, or hitch angle.

Extension: Identify what sensors help with stability while towing.

Grades 9–10 Log Sheet: Tool Tow & Path Follow Challenge

Student Name: _____
Date: _____
Team Members (if any): _____

Activity: Follow Mode + Pulled Implement

Implement Type (circle one):
Seeder Roller Mock Weeder Other: _____

1. How well did the Amiga robot stay in follow mode during your trial?

2. Did the pulled implement stay in line or drift off path?

3. Were there any turns or terrain changes that caused problems?

4. What suggestions would you make to improve the Amiga's towing ability?

Hands-On Activity Grades 11–12: “Field Operations Trial with Towed Implement”

Objective: Simulate real-world farming operations with follow mode and implement use.

Materials:

- Amiga robot with three-point hitch
- Functional implement (lightweight or scaled) like:
  - Roller
  - Seeder (manual drop)
  - Sprayer (mock)
- Tape measures, stopwatch, log sheet

Activity Steps:

1. Students perform a test run where Amiga follows while pulling a tool over a marked area.
2. Record:
   - Time to complete the course
   - Distance stayed behind leader
   - Implement performance (did it track straight? Leave marks?)
3. Analyze how terrain and movement affect robot performance.

Wrap-Up: Teams present ideas to improve efficiency or apply in real-world tasks.

Grades 11–12 Log Sheet: Field Operations Trial

Student Name: _____
Date: _____
Plot ID / Row #: _____

Activity: Follow Mode with Functional Implement

Implement Type: _____

Trial Start Time: _____ End Time: _____
Total Duration: _____ min Distance Covered: _____ ft

Checklist:

Observation	Yes	No	Notes
Robot followed consistently	☐	☐	
Tool tracked in a straight line	☐	☐	
Hitch remained stable	☐	☐	
Task completed successfully	☐	☐	

1. Describe any problems with robot or implement movement.

2. How did the terrain (grass, gravel, slope) affect the robot's behavior?

3. What improvements would you suggest to the system?

Hands-On Activity Community College: "Ag Robotics Evaluation Lab"

Objective: Operate Amiga robot in follow mode while towing a three-point hitch implement and evaluate performance metrics.

Materials:

- Amiga robot
- Calibrated or prototype implement (seeder, sprayer, etc.)
- Survey flags or GPS pins
- Rubric/log sheet with the following:
    - Hitch angle
    - Follow accuracy
    - Task execution (e.g., row straightness, seeding depth)

Activity Steps:

1. Students define a test plot and plan their movement route.
2. Perform a full run with the Amiga in follow mode pulling the implement.
3. Collect and analyze:
    - GPS-based or visual data on row spacing/coverage
    - Stability of hitch over terrain
    - Consistency of follow behavior

Deliverable: Technical lab report or mini-presentation connecting performance to sensor calibration, hitch setup, or human/operator input.

Community College Log Sheet: Amiga Evaluation Lab

Student Name: _____
Date: _____
Instructor: _____

Activity: Follow Mode + Hitched Implement Performance Test

Robot Setup:

- Hitch Angle: _____ degrees
- Implement: _____
- Weight Class: ☐ Light ☐ Medium ☐ Heavy

Field Plot Dimensions:
Length: _____ ft Width: _____ ft

Time to Complete Trial: _____ min
Average Distance Maintained from Operator: _____ ft
Number of Path Deviations: _____

Observations:

Metric	Score (1–5)	Notes
Follow accuracy		
Tool tracking stability		
Task execution quality (e.g., row straightness, seed drop)		
Hitch stability over terrain		

1. What were the biggest challenges during the trial?

2. Which settings or setup choices most affected performance?

3. Based on today's test, what recommendations would you make to improve follow mode operations on farms?

Worksheet: Field Robotic Device (2nd-4th Grade)

Name: _____ Date: _____

Part 1: What Are Robots in Agriculture?

1. **What Are Robots in Agriculture?**
    - Draw a picture of a robot on a farm and explain what you think it does to help farmers.

2. **Tasks Robots Do:**
    - Write down one thing that robots can do on farms to help grow crops.

_____

_____

_____

Part 2: Learning About Robot Technology

3. **Understanding Robots:**
    - Look at the picture of the robot and describe what parts you see. How does the robot move?

4. **Spraying with Robots:**
    - How do robots spray water or other things to help plants grow? Why is this important for farmers?

Part 3: Why Robots Are Helpful

5. **Benefits of Robots:**
    - Draw another picture showing how robots help farmers grow food better. What do you think is good about robots helping on farms?

6. **Thinking About the Future:**
    - Imagine you are a farmer with a robot helper. What would you ask the robot to do to help you grow food?

Part 4: Drawing and Talking About Robots

7. **Draw Your Own Robot Helper:**
    - Draw a picture of a robot you think would be helpful on a farm. What would your robot do to help farmers?

Worksheet: Field Robotic Device (5th-6th Grade)

Name: _____ Date: _____

Part 1: What are Robots in Agriculture?

1. **What are Robots in Agriculture?**
    - Explain in your own words what robots do on farms to help farmers.

_____

_____

_____

2. **Tasks Robots Perform:**
    - List two things that robots can do on farms. How do these tasks help farmers grow crops?

_____

_____

_____

Part 2: Exploring Robot Technology

3. **Understanding 3-D Vision:**
    - What is 3-D vision technology, and why is it helpful for robots on farms?

_____

_____

_____

4. **Spraying with Robots:**
    - How do robots use spray technology to help farmers? Why is this important for growing plants?

Part 3: Benefits of Robots in Agriculture

5. **Benefits of Robots:**
    - List two ways that robots help farmers grow food better. How do robots make farming easier or better?

6. **Imagining the Future:**
    - Imagine you are a farmer in the future. How could robots help you grow food on your farm?

Part 4: Reflection and Discussion

7. **Thinking About the Future:**
    - How do you think robots will change farming in the future? What do you think farms will look like with robots helping?

Worksheet: Field Robotic Device (7th-8th Grade)

Name: _____ Date: _____

Part 1: Introduction to Robotics in Agriculture

1. **What are Robotics in Agriculture?**
    - Define robotics in agriculture and explain how robots are helping farmers.

_____

_____

_____

2. **Tasks Robots Do:**
    - List two tasks that robots can do on farms. How do these tasks make farming easier?

_____

_____

_____

Part 2: Exploring Robot Technology

3. **Understanding 3-D Vision:**
    - What is 3-D vision technology, and why is it important for robots in agriculture?

_____

_____

_____

4. **Spraying with Robots:**
    - How do robots use spray technology to help farmers? Why is this helpful for growing crops?

Part 3: Benefits and Career Exploration

5. **Benefits of Robots in Agriculture:**
    - List two benefits of using robots on farms. How can robots make farms better?

6. **Future Careers:**
    - Choose one job related to robots in agriculture. Describe what this job does and why it's important.

Part 4: Reflection and Discussion

7. **Future of Farming with Robots:**
    - How do you think robots will change farming in the future? What do you think will be different?

Worksheet: Field Robotic Device (9th-10th Grade)

Name: _____ Date: _____

Part 1: Introduction to Robotics in Agriculture

1. **What is Robotics in Agriculture?**
    - Define robotics in agriculture and explain how robots are used in farming.

_____

_____

_____

2. **Tasks Robots Perform:**
    - List three tasks that robots can perform in agriculture. How do these tasks help farmers?

_____

_____

_____

Part 2: Understanding Advanced Technologies

3. **Exploring 3-D Vision:**
    - What is 3-D vision technology, and how does it help robots navigate farms and perform tasks?

_____

_____

_____

4. **Automated Spray Technology:**
    - Describe how robots use automated spray technology to apply chemicals in fields. Why is this technology important for farmers?

Part 3: Benefits and Career Exploration

5. **Benefits of Robotics in Agriculture:**
    - List three benefits of using robots in agriculture. How can robots improve farming practices?

6. **Career Opportunities:**
    - Choose two career paths related to robotics in agriculture. Describe each career and what skills are needed to pursue them.

Part 4: Reflection and Discussion

7. **Future of Robotics in Agriculture:**
    - Discuss how you think robotics will impact farming in the future. What challenges can robots help solve?

Worksheet: Field Robotic Device (11th Grade-Community College)

Name: _____ **Date:** _____

Part 1: Understanding Robotics in Agriculture

1. **Define Robotics in Agriculture:**
    1. What is robotics in agriculture, and how does it differ from traditional farming methods?

2. **Applications of Field Robots:**
    1. List and describe at least three tasks that field robots can perform in agriculture. How do these tasks benefit farmers?

3. **Technological Features:**
    1. Explain the importance of 3-D vision technology in field robots. How does it help robots navigate and perform tasks autonomously?

Part 2: Advanced Technologies in Agriculture

1. **Automated Spray Technology:**
    1. Describe how automated spray technology works on field robots. What are the advantages of using this technology in agriculture?

2. **Design Considerations:**
    1. What are the key factors to consider when designing spray technology for installation on field robots? Provide at least three considerations.

Part 3: Benefits and Career Opportunities

1. **Benefits of Robotics in Agriculture:**
    - List and explain three benefits of using robotics in agriculture, such as precision, efficiency, and sustainability.

2. **Career Opportunities:**
    - Research and choose three different career paths related to robotics in agriculture.

      Describe each career path, including required education and responsibilities.

Part 4: Reflection and Discussion

8. **Future Outlook:**
    - Discuss the future outlook of robotics in agriculture. How might advancements in

      robotics technology continue to impact farming practices in the future?

Video Demonstration

Welcome to the video demonstration of the Amiga field robotic device. In this short clip, you'll see the Amiga activate its *Follow Mode*, allowing it to autonomously trail behind a human lead. Watch how the robot navigates smoothly across the field, maintaining a safe and consistent distance. You'll also get a glimpse of several simple implements that can be attached using the standard three-point hitch system, showcasing the Amiga's versatility in real-world agricultural tasks.

As you view the video, pay close attention to the placement of the sensors, the robot's movement, and how it interacts with the environment. This is a great opportunity to begin thinking about how robotics are used to make farming tasks safer, faster, and more efficient.

https://www.youtube.com/watch?v=PHSModXxGDs