

Robot Farmers Executive Summary

A. Opportunity

The startup called Robot Farmers aims to address the issue of difficult farm work, the price of grocery store produce, and worldwide hunger and starvation. Working on a farm can be very challenging. The task of harvesting certain fruits, vegetables, berries, and other crops in the average American farm field is currently being collected by unlucky humans for minimum wage or less. Robot Farmers would like to one day automate most if not all aspects of farming for the reasons listed above. However, full scale farm automation for most crops is probably at least 20 years away, so a more obtainable goal is to automate just one farming task, such as using a group of robots to gather strawberries.

Using solar powered robots, capable of making precise movements, to harvest many of our currently grown crops — and without damaging them in the process — could be just around the corner. Solar powered machines, such as humanoid robots (with possibly many arms), will one day be able to gather crops at a fast rate and gently place them in containers. There are a variety of sensors that could be added to the robots' limbs to determine the weight of an object, speed and force of a movement and action, color of an object, and much more.

The economic opportunities involved with solving the mundane farming processes are boundless. Robots that specialized in farming would also likely be able to perform a variety of other tasks with a few programming adjustments, such as washing and putting away dishes. Farm owners that grow crops that aren't being harvested by tractors would likely be interested in renting a robot that was able to perform crop harvesting tasks currently required by human farmers.

Engineers from all fields, researchers, designers, programmers, marketers, lawyers, part-assemblers, and a huge variety of other professionals would be needed to make and positively promote a world class, large scale, robotics industry.

B. Product/Service

The product and service would include one or more rentable robots of a variety of sizes and features able to garden and farm many acre fields with minimal supervision, and all relatively quickly. An excellently designed robot and its software could be patented unless the robots could be supervised enough to possibly maintain the technology (or at least the program) as a trade secret.

The product/market fit for a robot with programmable/downloadable task-performing capabilities is limitless for any company or individual that wants a physically repetitive task performed.

C. Financials/Funding

A full size robot that would be capable of performing a single task could possibly be built with parts that exist today for about \$2,000. However, there will always be an endless combination of upgrades, modifications, adjustments, and improvements that could be made to reduce or increase the price per unit and its functionality. The most expensive component would currently be the motors for each of the robot's arm and leg joints. A very cheap prototype could be made for much less than two grand using a bit of creativity. However, a very cheap electric motor will either be too noisy/squeaky/heavy/bulky/energy inefficient/jerky/inaccurate and much more. Designing an electric motor that minimizes the weight, size, and power consumption while maximizing the precise movement capabilities would likely increase the initial build time and cost of the unit. However, advancements with such a motor would also likely be highly

profitable if patented. A mobile solar power charging station would also be another possibly expensive addition (if not built by hand), with the price later depending on the size of the field, the number of robotic units operating, and the electrical demands per robot.

An inexpensive/basic initial program could be created for the robot to perform exactly one task with decent precision. More time and programming would be needed to create a very nice program that would allow a robot to be able to smoothly control its movements and provide more precision over each of its tasks. With enough time and effort spend on programming, every single farming task could be handled by a robot, autonomously.

Grants such as those from the Big Bang! Business Competition and volunteers would likely be the main source of funding and motivation for this startup, until at least one unit was operational. With fully functioning, energy efficient, robotic units built, farmers interested in this technology would then likely provide the next largest source of funding. If the robot farmers became an integral part of our society, and produce prices dropped significantly, donations would probably be the final source of revenue.

Back in 2012, according to the USDA, (<https://usda.library.cornell.edu/concern/publications/8s45q876k?locale=en>) California harvested 38,500 acres of strawberries at 72,000 pounds per acre. This equated to a total production of 2.77 billion pounds of strawberries produced in a year. Additionally, in 2016, the average price per pound for fresh retail strawberries was \$2.51 (<https://www.ers.usda.gov/data-products/fruit-and-vegetable-prices>). Therefore, strawberry farming alone in California is a multi-billion dollar industry. Developing robots to assist with such a task could generate a large revenue for this company. Strawberries and other crops are also grown every single year, and can be grown year-round in green houses. There can also be health hazards associated with harvesting certain crops due to pesticides, herbicides, insecticides, etc, without proper safety equipment. Another exciting and highly profitable crop is the grape. Davis is next-door to Napa wine country, and harvesting a cluster of purple grapes should be even easier than detecting and gathering a small, single red strawberry.

D. Implementation

The vision is to create specialized robots capable of assisting American farm owners and workers with many of today's tiring and monotonous farming practices, such as picking strawberries in a multi-acre field. A major goal and effect of this idea is to reduce to price of healthy farm-fresh fruits, vegetables, and berries for the average American, to reduce highly preventable food related illnesses (such as E. coli incidents that occur when workers gather crops without washing their hands after using the restroom), and hopefully soon, eliminate hunger and starvation worldwide with a fully automated robotic farming team.

Allowing the robots to operate in a field, preferable always at least several yards away from any human workers, would eliminate the risk of accidental injury to humans.

E. Team

Professional engineering ethics will take priority over any business interests. Second to ethics would be that this company must try to hire as many Americans as possible, with highly competitive salaries and benefits. The robotic units would need to be constantly reengineered and upgraded with high quality, long lasting components that would allow the robots to work in a variety of conditions for very extended periods of time. With financial resources, more can be done much faster. Large prototypes can be built, a variety of electric motors can be purchased and tested as joints, and other students, volunteers, professors, and employees can be brought together to transform this startup into America's next greatest company.