How your solution addresses the problem identified in this call for innovation

Specifically mobile manipulation technologies for assistive robots that help people in and around the home. To get assistive robots that can work around and with people in the home requires hardware and software technologies that make robots safer, more useful, and more affordable.

ReliableRobots.com is developing a hydraulic humanoid suitable for use in and around the home. Our small 2” rotary actuator has been tested delivering 250 lbs. lift at the end of a 3 ft. bar. Our 3” actuator is designed for 375 lbs. to provide greater shoulder lift for the arm assembly. With two arms this robot can lift 500 lbs. which will lift most humans from any position in or around the home. This strength bests many competitors in loading or unloading a car, pickup, or ambulance, doing gardening work to grow and prepare food for meals, provide entertainment playing games indoor and outdoor, with adequate software, educate cradle to Ph.D. and more.

To make this robot more useful we have a new computer language called Ruletalk to enable easier development of tasks by home users than traditional programming. We are working to connect Ruletalk to robot hardware through the Raspberry Pi which connected in a small network can run all limbs, cameras, and other sensors providing touch compliant safety.

The initial price of this robot is projected to be $120,000 but with volume production we expect the price to be no more than a new Toyota vehicle. Currently working parts and others can be seen in the ReliableRobots.com video and photos.

The market opportunity and your current traction

The current market can be considered unlimited since a good salesman can follow another and resell the customer. Credit purchases can enable sales to people who could not afford the list price. The market can include nearly everyone that has a cell phone worldwide, depending on the tasks performed. Over time nearly every human performance task can be programmed, except exchanging feelings, as humans do. The robot can free people from physical work to operate as spiritual beings.

While there are several kinds of robots that assist in and around the house, from cleaning floors to cooking dinner, there are none currently able to do the heavy lifting sometimes required in and around a home in a safe manner dealing with immediate human proximity. So this will be the preferred robot for all homes.

Currently the robot has some parts working but these parts and the whole robot are not currently for sale. The robot is in a pre-prototype stage so there is no market traction. Pre-marketing conversations with farmers has shown some interested and others not. Everyone wants to see what it does first.

So we expect market traction to grow when we can post videos of the robot successfully performing a variety of human tasks with safe human compliance. We may lock in orders with a variety of rent and lease buy options with setup programming and support options enabling various lengths of try / buy schedule.

Your business model and go-to-market strategy to deliver value to customers

The current business model is individual inventor, hiring machine shops and other professional services as necessary on a cash basis as poverty income permits. That is expected to change with the ability to afford permanent employees, growing from privately heled to a publically traded company over time.

Taking the robot to the market will at first be by informal presentations to a wide variety of potential users until sales, software, and hardware production expand to enable targeting the most lucrative markets as we learn what they are. We might be able to establish regional sales facilities like auto makers do. We might be able to integrate our robot with the Toyota marketing system once our robots are good enough for people to love them like they to their vehicles.

Many other marketing and service systems can be explored. One hope is eventually the robot can be programmed to repair itself or a service robot can be sent to handle repairs. Depending on large volume pricing we may be able to have a buy-one donate-one strategy to help people in poor nations get them. We may also explore government foreign trade programs.

To retain security from hackers, we plan to add value by implementing Asimov’s four laws to the extent possible. We will also consider doing upgrades by physical memory devices to reduce the ease of hacking online. As our AI improves we will eventually be able to deploy final upgrade where all possible tasks are available in every robot with a particular set of peripherals.

Your company's technology and how you're applying it to the problem

As you can see on my website www.reliablerobots.com the hydraulic rotary actuators are the primary component supplying 250 lbs. lift at 3 ft. These actuators are arranged in a standard 7 per limb configuration giving 3 axis motion for shoulder and wrist plus one elbow. For the electronic layer you can see a working microcontroller made by Parallax with power amplifiers and telephone connectors to simply wiring. The Raspberry Pi computer was selected for price and the ability to network as many as needed to get neural network visual object identification in real time, plus it is already used by a 3 axis CNC maker. The NASA robot uses several cameras around its body and that kind of placement will maximize safety and accuracy without needing to rely on sensors that are less long lived. We are also exploring using hydraulic pressure sensors to enable switching between accumulator and pump to reduce power usage to extend battery life. Some exploration of position and torque sensing for the actuators has been done.

The AI is intended to achieve K-12 performance since that is the level that is often useful for entry level jobs. We are exploring the computer science involved in making a self-learning software based on the expert system model, which can provide full symbolic modelling and backtracking accountability not available with neural networks. The CYC system which stalled at 4th grade performance for years demonstrates that the highest level of human text must be mastered before pursuing K-12+.

Founding team’s background and expertise

Kirk W. Fraser was farm raised, attending school for 3.5 years by boat, graduated from University of Oregon with a BS in computer and information science, working as a computer operator then upon graduation working to convert Bonneville Power Administration engineering software from CDC to IBM mainframe through Infotech, did similar work for Volkswagen, worked for Tri-met writing Cobol, the U.S. Forest Service writing Fortran, and the Washington County Sewer Agency (called USA, now Clear Water Resources) writing GIS maps. Started developing and selling an object database internationally. Became a landlord learning most aspects of home maintenance and customer management. Pursued the expensive hobby of hydraulic humanoid robot development. Also wrote three Christian books.

Current expertise pertaining to robots helpful in and around the home include skills of detailed home maintenance, some construction, gardening, robot hydraulics, mechanical design, electronics, and software. I also am familiar with exceeding the state of the art of Ph.D.’s in Bible study which will help developing an AI that can think like humans do.

Founder has skills at learning from others work. Learning from both DARPA Robotics Challenges, this robot is designed to fall without breaking, yet fit in the human form factor. Learning from Boston Dynamics, a future design will use metal printing to improve size, flexibility and weight. Learned gait mastery is a priority for stability. Learned AI video object recognition and response is a key to humanoid autonomy.

The competitive landscape and how your approach is unique

The DARPA Robotics Challenge drew around 25 robots, most of which were hydraulic but were slow, clumsy, and weak. A recommended hand only had 10 lbs. grip strength. My hand is designed for 50 lbs. each finger with a possible total load of 250 lbs. making my hand crush the competition. My robot arm can lift a person of average weight and both arms can double it. Competitors may assist but most are unable to lift a person that is down on a floor, bed or chair. My rotary actuators will exceed limb speed of the original Atlas robot which used straight cylinders. I await prototype completion to discover if my robot can out run newer Boston Dynamics products.

Having seen software used by one team in a DARPA Challenge, I am convinced the readability of my Ruletalk language will make programming much faster and easier. It also is a first step to a natural language parser, required for a general AI.

My intention in hiring will be better than that used by OpenAI. They hired many neural network experts and then have a robot project but their purpose is unclear since owner Elon Musk wants to stop AI progress. I want to produce a robot that can be deployed worldwide to help everyone, not just continue as an academic exercise. So I will hire ambitious young team members from university talented and gifted programs since as Musk says, degrees don’t mean anything, it’s what you can do.

A NASA like soft suit for careful human contact is planned.

Financial performance, and projections

This robot project has been a business expense for many years. At first I applied thousands from an inheritance then the slight excesses of my poverty income as a landlord. There has been no sales except scrapping obsolete stock and parts.

The $2 million award will enable me to hire more help for all aspects of the robot, especially software. It is expected the robot will walk in less than a year, by two we should see $120,000 a month in orders, multiplying as we get more tasks learned in software. Based on competitor ReThink Robotics, we should expect to process 10 orders monthly. But due to our home assist focus, we should get more orders from wealthy retired people than from industry. So I expect cash flow to be about $1,200,000 in the second year, $12 million in the third year, and more in following years.

It is expected further design improvements and a growing task library will improve marketability. We will provide a means of sharing application software, while protecting against malware by fully simulating software use before adding it to the library. A simple improvement will be further testing of the robot lift beyond the tested 250 lbs. – it may be able to do 300 lbs. or more simply by trying more weight until it fails. We will need more failure and endurance testing to establish reliability parameters. With audio AI and text to speech systems available we will add them to improve human interaction, routing all commands through pre-action simulation to retain human safety.

Funding history, if any

The robot has been a loss for many years, with close to $100,000 initial investment in robot parts then dribbling small amounts of hobby cash with large amounts of work for many years.

There have been no formal rounds of external funding.

Response to listed hardware technology interests

Safe, lightweight arms
Our arm is made lightweight by using 6061 Aluminum mostly. We may convert to plastic for less weight. Safety will come from a sensor suite for position, torque, touch, and video.

Grippers designed for common daily tasks
Our hand grip is a 4 finger and thumb design, aluminum covered by rubber and sensors. It approximates a large male hand.

Technology for better tactile sensing
Touch sensors tend to wear out quickly so we will work with a variety of other solutions such as a silicone layer sensed by direct contact with a video camera, capacitive, and proximity sensors experimenting to maximize reliability and life.

Torque sensing joints
A torque sensor can be embedded in the joints to detect motion resistance for human obstacle compliance.

Low-cost compute – Raspberry Pi plus a power transistor board

Response to listed software technology interests

Solutions to compensate for lower-precision, lower-fidelity hardware

Increasing sensor precision can be achieved by using more expensive high precision high speed sensors such as laser position sensing and production line video cameras. Motion planning with high precision too leaves only motion execution which may need more precise valves or a valve for gross positioning and another for fine positioning. Carefully selected delays may enable drifting into a more precise position.

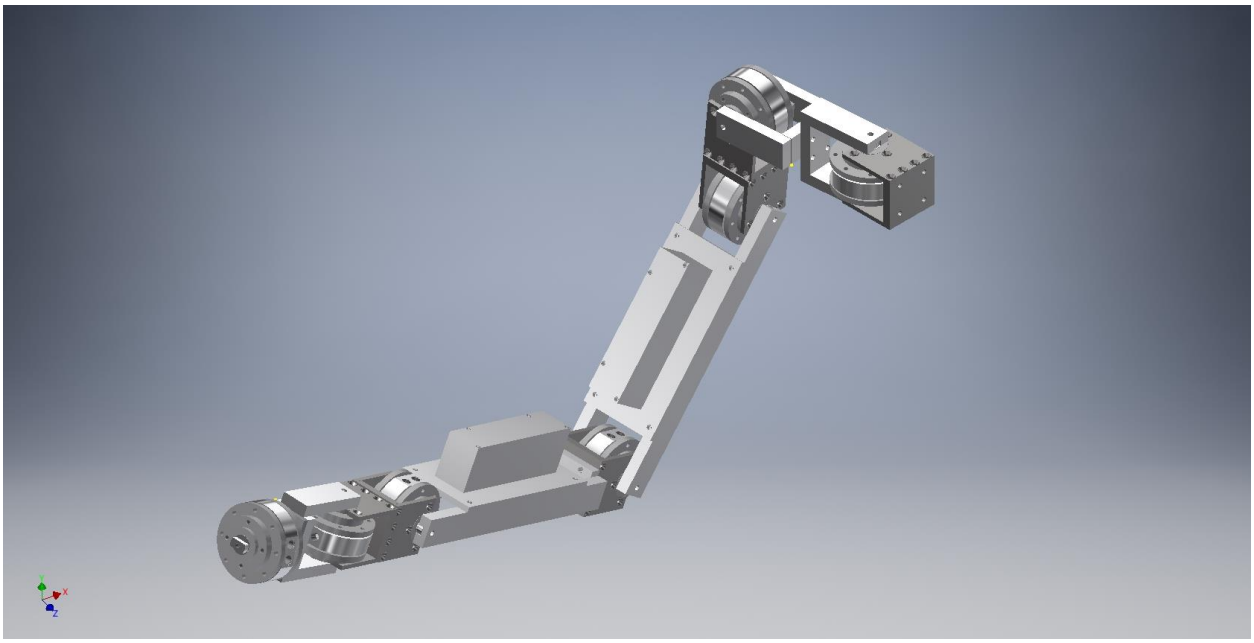
Algorithms to learn from or annotate data

Neural Networks (Deep Learning AI) can be applied to vision, sound, and other repetitive tasks. For example, annotating video frames with object identification. Annotating text with parse information will be a part of creative general intelligence work.

Solutions to apply lessons learned from simulation

This is an essential part of providing Asimov's Laws safety, instantly simulating planned motions to discover any unsafe conditions that could endanger humans before executing planned motions and gracefully correcting any motions that are found to potentially endanger humans by action or inaction.

Reliable Robots Arm



Lightweight aluminum construction, 250 lbs. repeatable load. Future conversion to plastic for lighter weight is possible. Four of these on a torso with hands and feet make a hydraulic humanoid.

It should be noted arms with less performance are not safe when lifting and transporting an adult human.