PAWS - Project Proposal

Samantha Johnson

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PAWS (Psychological Assistance and Wellness System) is an in home mental health robotic pet companion. This companion is geared toward individuals with moderate-severe mental health conditions who would benefit from constant supervision and stimulation from an external source. The target consumer is a young to middle aged adult, who may live alone or are in a situation where there is limited supervision, and who also suffers from a metal health disorder such as depression, anxiety, bipolar disorder, or PTSD. The goal of this product is to provide companionship, motivation, emotional stabilization, activity notifications, and emergency resources to aid in the recovery process for an individual suffering from a mental illness. This product hopes to speed up the recovery time and decrease the relapse rate for these individuals, as well as reduce the high number of suicides that occur amongst this group.

The developed product will be a wheeled mobile pet-like robot that will be capable of interacting with its human companion through voice commands, wearable technology, and facial expressions and gestures. The focus of this project will be on the assistance and navigation aspect of PAWS. This is a crucial component of the system because the robot needs to learn about its environment, which would be the home of the human, so that it can effectively assist the human as necessary. Also the robot needs to understand the specific signs that the human displays that mean they are in crisis and need assistance. The learning capabilities of PAWS will allow it to be tailored specifically to its human and its environment so that it can be integrated seamlessly into its human's life.

The machine learning method used for the assistance and navigation component of PAWS will be reinforcement learning. This will allow the robot to acquire feedback from its environment and human in order to map out its surroundings and learn which locations are important or detrimental to its human's mental health. The objectives of the assistance and navigation system are that the robot will be able to make a map of its surroundings so that it can always determine the quickest path to the human, and also that the robot will be able to take feedback from sensors to assess the human's mental state and from that determine if the human is in need of assistance. For example, if the human simply gets up to use the restroom, the robot will assess the humans mental state and know that it does not need to follow. But if the human leaves the room and shows signs of distress, i.e. raised heart rate, certain brain activity, or vocal indications such as yelling or crying, the robot will know it needs to assist the human and immediately plan its path to the human's location. The robot will utilize the information it gains through its reinforcement learning to determine optimal trajectories for navigation that will be used in the control algorithm. The control method that will be used is the forward model, so the robot will plan out a global path to its objective and use a control system to stay on the optimal path.

The robot will be created in simulation using CoppeliaSim (formerly VREM) and programmed using Lua, which is the language utilized in the software. There is also the option to use the Python API to interface with the simulation if Lua becomes too difficult to implement the algorithms. It will be expected that the human the robot is assisting will be using a wearable technology to transfer data and feedback to the robot. The robot will also be equipped with several other sensors to facilitate its navigation and assistance abilities.