Pipe Crawler Build Instructions

Our pipe crawler robot is constructed of 80/20 channel strut, PVC pipe, various wheels, gears, and electric motors. A sensor package was developed using a SparkFun ESP32 Thing and mounted to the robot.

1. Chassis Construction

The chassis was constructed with 80/20 channel struts. A “U” shape was created with 3 strut sections to house the drive train, and to mount the motor. A vertical section of 80/20 was attached to the center rear of the top section to mount the grasping arms.

1. Drive Train

The drive train consists of a DC motor, a set of reducing gears, an axel, and a drive wheel. The axel was run through holes drilled in the side sections of channel strut. A section of threaded barstock was used for the axel, requiring a bushing to prevent the axel from “walking” when the threads rubbed against the channel. The bushing was made of 0.006” sheet metal rolled around the axel.

Setting up the gearing consisted of making a set screw for the first gear attached to the motor. The motor is on a sliding mount on the channel strut to allow it to mate to the second drive gear. The second gear is directly attached to the axel with epoxy and nuts. The axel is held in place using nuts on the outside of the channel struts.

1. Grasping Arms

Initially the grasping arms were prototyped with cardboard. A sketch was made and we cut our first set of arms from acrylic. The acrylic arms were too flimsy so we made another set of arms out of ¾” PVC pipe and fittings. A set of wheels is attached the to bottom of the arms to allow the arms to slide along the bottom and side of the pipe. A rubber band is used to provide tension in the arms os they can grab the pipe and hold the robot in place. Using too many rubber bands can create too much pressure on the drive train and prevent it from moving.

1. Sensor Package Attachment

The Pipe Crawler is equipped with sonar, a CO2 detector, and a volatile gas (VOC) detector. The sonar is used for finding holes, and the CO2 and VOC detectors are used to establish the safety of the area the robot is inspecting. The package is based around a SparkFun ESP32 Thing breakout kit. The microprocessor hosts a web server accessible through the local WiFi network that reports the sensor data in real time.