

Now Hobbie has an arm with a gripper. The up/down movement of the arm is controlled by motor#3 and the open/close of the gripper is controlled by motor#4.. It became necessary to know the grippers position in space. It is impossible to have it pick up an object if you do not know how far the gripper is from the floor. Kind of useless to try to grab a 24cm high object if the gripper is at a height of 30cm from the floor. I decided to use a 3-axis gyro sensor to help me. To know where you are in space is very important when you live in BC bud country. Without going into a detailed explanation, the Y-axis is up/down with zero being horizontal. A plus value is up and a minus value is down. I attached the sensor to the top of the arm near the gripper.

On a tangent: try to move just the upper joint of any finger (not the thumb) without having the middle joint move.

My initial testing showed a problem. I wrote some code to read the gyro and determine if the arm was above/below the horizontal. My code then determined the direction and the amount of time to run the motor to get to the horizontal. My problem was that the motor would not stop. After a few days I reported the problem to the tec support guys in Shenzhen, China (a 16 hour time difference). They could not replicate the problem. They sent a video of it working on their robot. I noticed that they had the gyro sensor on the table, not attached to the robot. I ran their test and had no problem. Another week of testing and I came up with a "solution/fix". I had to put a piece of cardboard between the bottom of the sensor and the arm. I reported this to the support guys and here is their response to all worldwide users:

"We have verified that this application does have some influence on mBlock online program.

While the mBlock offline program won't be affected. Thus, we suspect the issue may be also on the mBlock software. Our engineers will do further checking. Thanks for your feedback!

Temporarily, it is suggested to install it on mechanical part with the cardboard or Plastic gasket."

"Online program" means you are running the program from your computer and using an USB cable to pass commands to the robot. "Offline program" means you have downloaded the program to the robot and it is running in autonomous mode. In non-computer speak "Offline program" means you, the human, are doing a task by your self without any interruptions. "Online program" means you are receiving individual instructions, from your better half, on how to do a task. The difference is critical when you have to program the wait time between each simultaneous step.

In order to alleviate my frustration with the gyro sensor, I decided to learn about the compass sensor. Everyone knows a compass is simple. It just gives a reading between 0 and 359. Not this one. It has a X, Y, and Z axis and values. Hmm sounds like the gyro with an extra button. Yes, you have to calibrate the compass by pressing the button and rotating the sensor around a minimum of 360 degrees. I did this and then attached the compass to Hobbie. I then programmed Hobbie to make four 90 degree right turns and report the compass reading. The values were 315, 245, 262 and 293. Long story short, after another day of testing, I found that if I attached the compass vertical versus horizontal, Hobbie would report 307, 44, 133 and 245.

I now have two different types of power for Hobbie.

- when Hobbie wants to go for an independent walk, there is the battery holder with eight AA 1.2V rechargeable batteries. There is also a backup holder with eight AA rechargeable batteries. Therefore a full charge of 9.6V/2.5A and then constantly decreasing
- When I am programming/testing/debugging, which is most of the time, I now have an universal wall plug-in AC/DC 30W adapter where I can set the voltage to 6/7.5/9V. I needed to add a 5.5mmx2.1mm center positive barrel plug, as that is what Hobbie requires. Hobbie wants the

9V.

The drivers of the big dump trucks at Fort Mac make about \$125,000 a year. It takes four drivers to keep the truck going thru the year. That is about \$500,000. The route that they drive is very predictable. At beginning of shift, drive from garage. During the shift, pick-up stuff at one end and drop-off at the other end. At the end of the shift, return to garage. All of this happens in a private area where all traffic is controlled and all vehicles have GPS, accurate to 3m.

Hobbie thought this was too easy a task, even without a GPS. So Hobbie is learning to sort recycle. These are the tasks that Hobbie is learning:

- drive from the robot garage to the recycle pit which contains tall and short containers
- pick up a container
- deliver the container to the correct tall or short recycle area
- return to recycle pit and repeat until pit is empty
- drive back to garage

Hobbie can now execute each task by it self. The next step is to combine all the tasks into one program. I predict than within one year, at least 50% of the Fort Mac drivers will be gone. The routes will be programmed and with in-truck cameras, a supervisor can handle a minimum of four trucks.

Have you ever wondered why the majority of containers are circular? Water bottles, pop/beer cans, pill containers. And then they are placed in square/rectangular boxes. It does not seem like an efficient shape to fill with. Lots of empty space between the containers.

Also Hobbie does not like them. The ultrasonic pulse comes straight back from a square item but not from the side of a round one. (Remember the throwing a ball against a wall straight-on versus at an angle.) Also there is less surface area to grab with a round versus square object. As an example, hold your left hand out palm up. Attempt to grab the middle of a water bottle between your index and ring fingers.

I was going to include a video of the recycle program but Hobbie developed a problem. It would suddenly lurch when making a turn. I eventually took off the tracks and rebuilt all four wheel assemblies. It appears that over time the set screws come lose. They are about ½ the size of a grain of rice and, of course, are on the inside of the wheel well against the motor and not accessible when everything is assembled. Since I do not know when this started, some of my timed waits are wrong.

I will have to develop a maintenance program. Since all the motors are electrical, the only lubrication required is for the mechanic.

The next report will have an introduction to Hobbies new friend Pocito.