MTE 121: Final Project Idea

Problem description

With the ongoing pandemic, it remains vital to wash our hands regularly to reduce the spread of viruses. This practice is essential when doing group work in class, as team members often come in contact with the same tools or other objects. Yet, it is often challenging for all group members to remember to sanitize their hands frequently. By solving this problem, we would like to make group work safer to continue to benefit from in-person classes this semester.

Solution Idea

We want to turn our Lego EV3 Robot into a reminder and incentive for everyone in a group to practice hand hygiene. When the program starts, it will ask a user to input the number of group members using the buttons. For example, the robot may display a message saying: "Use up button to add group members. Press enter to start." The program will store the number of group members in memory for future use.

The program will reset the first timer to zero and begin counting to an unspecified number of seconds. When the timer value exceeds this time limit, the robot will use the motor encoders to slowly roll forward a predetermined distance from its starting position and then stop.

After it has travelled forward, the robot will use the medium motor to dispense the sanitizer somehow. This may be by lifting the bottle off the ground or even by pumping the bottle. The specific way the robot will dispense sanitizer will need to be decided using trial and error once we have signed out the EV3.

The robot will be equipped with an ultrasonic sensor to judge when a team member has approached to sanitize their hands. That is, when the ultrasonic sensor senses a small value compared to its original value, it will know that one team member has successfully sanitized their hands. Using the number of group members entered at the start of the program, the robot will wait for everyone to wash their hands before exiting a while loop.

The robot will output a unique chime that a group member will compose to celebrate the fact that all members have practiced good hand hygiene. The program will then have the robot return to its original position by using the motor encoders. It will then restart the first timer and count to that unspecified number of seconds, continuing the main program loop that will encourage hand sanitization again. The program will end after a certain number of iterations or when the exit button is pressed.
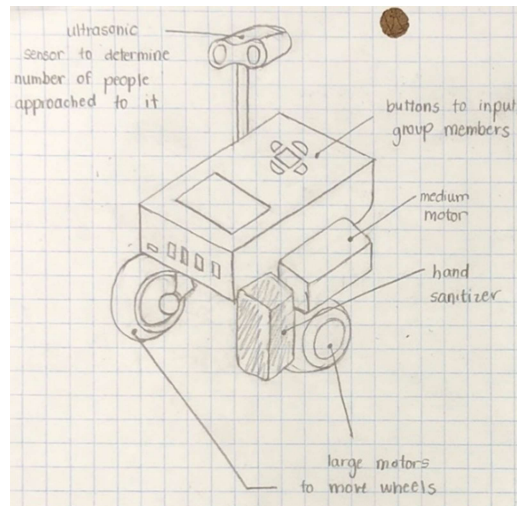
Robot Configuration

Figure 1: Configuration of the Robot

Motors
Two large motors: Used to move the robot's wheels (MotorA and MotorD).
Medium motor: Will be implemented to dispense the sanitizer to each group member.

Sources of Input
Buttons: Up and enter buttons used for group member input.
Motor Encoders: Used to measure the distance travelled by the robot. Could also be used to control the motion of the medium sized motor.
Ultrasonic Sensor: Measures the distance in front of the robot to determine the number of people that approached to sanitize their hands.
Sound output: Produce chime that will be played when all group members have successfully washed their hands.

Unusual features

As mentioned above, our Lego EV3 Robot will provide a hands-free way to dispense hand sanitizer. It is designed to be used in conjunction with the medium motor, which has a precise and fast response. This will be useful for accuracy when dispensing the hand sanitizer, through either a pump bottle or a squeeze bottle. If we were to make this automated, hand sanitizer would only be dispensed once the robot senses something under/near the bottle. This way the robot will ignore any objects outside of this area, and will not dispense hand sanitizer at unintentional times. These possible factors ensure that the sanitizer does not damage any part of the EV3 hardware or permanently alter the Lego elements during building.

List of Additional Parts

In addition to the "standard" parts kit, we will require the hand sanitizer and the bottle. This will be attached to the robot's medium motor so that it can be easily removed and reattached when needed. To do this, we will use the provided box of extra Lego pieces to build a secure holder for the bottle.