Torque calculations:

Each DC motor must be capable of generating a torque proportional to the load requirements of the mobile robot. The torque can be calculated using the following formula:

$$F_{friction} = \mu * \mathrm{N} \tag{1}$$

μ: coefficient of friction. N: normal force (Reaction).

$$N = m * g \tag{2}$$

m: robot mass with payload. g: gravitational acceleration.

$$F_{acceleration} = m * a \tag{3}$$

a: robot acceleration.

The total force required for the robot to move:

$$F_{total} = F_{friction} + F_{acceleration} \tag{4}$$

$$T = \frac{F_{total} * r}{k} \tag{5}$$

k: number of DC motors (one motor in our case).

The nominal torque and velocity were

The minimum nominal torque is 8.5 $kg.cm$ and the nominal velocity equals 245 rpm.

Our DC motor

The chosen motor is a 12 volts 350 RPM dc motor (with encoder) with the following specifications:

- Nominal Voltage: 12V
- Gear Reduction Ratio: 34:1
- No Load Speed: 350 rpm
- No Load Current: 20 mA
- Maximum efficiency point parameters: 2.0kg.cm/285rpm/5.0W/0.65A
- Maximum power point parameters: 5.8kg.cm/180rpm/9.0W/1.65A
- Stop current: 5.5A
- Stall torque: 12kg.cm
- Hall Resolution: 374
- Weight: 98g

We chose this dc motor because it has high torque and good speed control, we need this torque especially in starting the motion and in heavy turns as it needs high torque.

The torque helps to maintain a constant speed under in the existence of external loads so it is perfect for this application, also it has a good accurate encoder with 374 pulse per rotation which help to control the velocity and to measure the distance depending on wheel odometry.

Additionally, this motor can be easily controlled by a motor driver (which is BTS 7960 in our case), this make it suitable for robotics applications that requires precise motion.