DESIGN OF WHEEL ENCODER USING IMU:-

Encoders are electro-mechanical devices that are useful feedback elements in closed-loop control systems

They can be used in applications requiring feedback of position, velocity, distance, etc. The examples listed below illustrate the vast capabilities and implementations of an encoder:

• Robotics  
• Labeling Machines  
• Medical Equipment  
• Textiles  
• Drilling Machines  
• Motor Feedback

• Assembly Machines  
• Packaging  
• Printers  
• Testing Machines  
• CNC Machines

For motion control, we need encoders which can provide low cost, smaller physical size, high frequency and high resolution and easily fixable(MOST IMPORTANT).They can be of different types like Rotary encoder, Incremental encoder, Absolute encoder .

For Speed control purpose, we need to fix the encoder with the axis of the wheel to get the position/speed of the wheel. But sometimes its tedious to fix the encoder as may be the diameter of encoder may not match with the diameter of the shaft of the wheel. To avoid this problem, we designed a small, robust, cost efficient, easily fixable Device having high precision.

The Encoders available in market now a day:

* Most of the encoders need to be mechanically coupled with the shaft of the wheel. Which requires designing of the shaft. And some are mechanically coupled with the motor shaft. Which results in less availability of options for choosing a motor of exact specifications.
* They are very expensive. For ex : the cost of an encoder with 1000 ticks is about xyz and gives precision angle of (360/1000). Means we can measure the angle of 0.36 (degree) for the measurement of angular velocity of the wheel.
* Some encoders are used to measure angle at which the shaft is present. These encoders are available with some specific motors only. And cost about 25,000/-(about $400)
* They are robust.

The encoder that we have made:

* It is small in size.
* It has inbuilt charging and power supply. So there is no need of any external wires for activating.
* It has inbuilt Bluetooth module. So it can be easily connected wirelessly.
* It has very high precision angle of 0.01(Degree). And can calculate 0.01 change in angle. To measure angular velocity.
* It can measure rpm ranging from (0 – 2000).
* It doesn’t require any shaft or mechanical coupling with the motors. We just need to stick it on the wheel no matter at the outside or inside. No matter outside or inside.

Description of sensor:

1. 9DOF (BNO055) ( 9 degree of freedom) with filtered output. Which integrates the output from accelerometer, gyroscope and magnetometer to give absolute orientation. It has a triaxial 14-bit accelerometer, a triaxial 16-bit gyroscope with a range of ±2000 degrees per second.
2. Bluetooth module.
3. A microcontroller with atmega328p. To obtain output from 9DOF module and process it to calculate the angular velocity. And transmit it through Bluetooth module.

Working on the sensor from the starting:

* We started with the BNO055 sensor and microcontroller to obtain the angle of the sensor. Then we made a prototype to measure the angle of orientation of the sensor. When the testing was perfect we modified the code to measure the velocity of the wheel. The output that we were obtaining very rough. The velocity that we were receiving was very fluctuating. Then we modified the code so as to get running average, in that we were taking previous 10 values and outputting the average of all the values. We cross-checked the velocity output velocity with the help of odometer.