CHAPTER 1

INTRODUCTION

1.1 Introduction to studies

A spherical rolling robot has drawn considerable attention for its high mobility, simple shape, and interesting application. Example applications of the rolling robot include indoor or outdoor navigation, security tasks and human development (Kaznoz et al., 2010). Since this robot can been capsulated completely, it can operate even in the hazardous or dirty environment. While the spherical shape of the robot is easy to roll, accurate actuation and control can become a hard problem, because it can slip as well as roll.

The rolling sphere robot has attracted wide attention of researchers in recent years due to its certain advantageous in mobile robot's applications compared to the other types of robots. Sang et al., (2010) introduced a new robot which has a spherical outer shell to accommodate all its mechanism, control devices and energy sources. The rolling robot is invented in globular shape as it needs to roll and move on ground surface using actuators placed inside. Omnidirectional motion can be pulled off as this spherical robot can recover collision against obstacles with ease. In addition, the shape of round does not cause any danger to human as it can bounce back when it comes in contact with human. Furthermore, Karakubo (2012) anticipated to be used in military force, rover robot, and anonymous surveillance robot.

The construction of this robot consists of acrylic clear sphere which divided into two hemispheres. The bottom hemisphere comprises of batteries for axes, rotors, dc motor assembly, and weight for stability purpose. The other half covers the holder for the batteries. These hemispheres will undergo rolling motion as the driving mechanism will keep the hemisphere frequently change position. The center of mass is

placed beneath at geometric centre of spherical. As a result, the ball does not fall over with inertia force and also maintain centre of mass at contact point (Agraval, 2000).

For the movement and rolling of the sphere robot, the drive system is usually located inside the shell which all the devices and components are protected by the outer shell that used acrylic material which show strong hardness characteristic. Therefore, the robot can withstand heavy external force.

This project focuses on control system, speed and design for the stability of the robot where the Arduino controller is introduced and chassis that holds drivetrain and gyroscope sensors is implemented. The chassis is compact, with tight clearances on the front and back (Niu et al., 1997). The internal device that control the robot is an easily fabricated two wheeled differential drive, placed on the circuit board and controlled by the Arduino.

In our design, the body and the wheels are connected by a gear mechanism to the motor. The Arduino will control the motor that is connected to the wheels in order to move the robot. According to the formula, speed of motor is dependent on mechanical and electrical parameters but in robotic field, we can change the speed of motor by changing the voltage of the sources (Arvin et al., 2009). The rolling sphere robot with two differential wheels mechanism which is controlled by Arduino is developed in this project is because of several reasons.

Back in the years when the sphere robot started to receive significant attention by the researchers, only a few researchers study about this mechanism. Niu Xuelei et al., (2014) developed an easily fabricated miniature spherical robot, constructed from readily available component, software and materials but in this project, we strive to develop a simple spherical robot in medium size that is control by Arduino controller which used two differential wheel mechanism. This design is selected as it is found to be highly suitable for prototyping as well as for educational purpose.

We decided to make improvement a rolling sphere robot from speed control system and stability aspects. This is the second rolling sphere robot project in UMP

and we need to improve from the previous rolling sphere robot by implement the gyroscope sensor and redesigned the chases.

1.2 Problem Statement

Working in environment especially in an industrial area filled with obstacle and dangerous ambience can cause myriad damage to the personnel in terms of physical injurious and cause detrimental to health.

Hence, to halt this problem to occur in near future, Rolling Sphere Robot was developed. This robot can move around mud and snow without getting stuck to it due to ball- shaped outer structure. There is no need for personnel to apply force to move this robot at any point. The robot can be operated via smartphone which is used to communicate with Bluetooth module. This have high probability to decrease workers risk and energy in completing a task.

The main limitation of rolling sphere robot is their inability to move omni-directionally and the less efficient control system of the robot. This in turn makes them hard to interact and perform any task given by human. Therefore, the rolling sphere robot has advantages in achieving the above requirements. The task of making the robot move in all direction is a challenging task.

1.3 Objectives

The Rolling Sphere Robot is to be developed to be used in dangerous and hazardous environment. Hence, a robot with better performance in terms of rotational motion is needed to deal with environment such as snow, mud, desert and also area with dangerous animal can be harmful for human. Thus, with the help of rolling sphere robot, humans will not have to risk their life perfoming a task. The aim is to make the rolling sphere robot moving smoothly. This project were done with the following specific objectives:

1. To improve the stability of Rolling Sphere Robot.