CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The current practice of measuring accurate distance travelled for an object often use techniques with limitation, where it is very difficult to be used on variety purpose. There is another way of measuring distance, laser displacement gauge which can accurately measure small displacement, but then, the device is too expensive. Therefore, there techniques in measuring distance, which is accelerometer. Accelerometer is a device used to measure acceleration of a motion structure. From the acceleration, a formula had been generated to obtain distance. Theoretically if one wanted to measure vibration, either position, velocity or acceleration, it can be generate using integration and differentiation.

Accelerometer is useful in measuring the amount of dynamic acceleration to analyse the way the device is moving where, from the acceleration obtained it will convert into velocity and the distance itself. Accelerometer used in this project is triple axis accelerometer breakout ADXL335. The breakout board for the 3-axis ADXL335 from Analog Devices is a low noise and power consumption accelerometer. The sensor range is within +/- 3g. The interface of the accelerometer is 3V with an output of analog voltage for each three outputs.

There is another advantage in using the accelerometer for measurements, where the size very small and can be easily attached to a body. It is also has wide frequency and dynamic ranges. Accelerometer is measurement equipment because of its ability to pick up high frequency content with high sensitivity.

The accelerometer will be program by using Arduino Uno which is a microcontroller board that is based on the ATmega328. This type of arduino has 14
digital input/output pins of which 6 can be used as PWM outputs, six analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. This board contains everything which will be needed to support the microcontroller. It is simple to use by simply connect it to the computer with a USB cable and control the input/output by program using its own compiler. The operating voltage is 5V while the DC current per I/O Pin is 40 mA.

Milling Machine is the equipment for machining process of using a rotary cutter in removing the material from a work piece. In advance, it can cut in a direction at an angle with the axis of the tool. This equipment can be move in three positions including x, y, and z axes. There are many types of Milling Machine exists, and one of it is CNC Milling Machines. CNC Machines can exist in virtually any of the forms of manual machinery like horizontal mills. Measurement and calibration of the altitude using accelerometer on Milling Machine can be done with the results of acceleration of the Milling Machine. The present of the accelerometer in the Milling Machine can be used for inertial measurement of velocity and position, vibration and shock measurement, and also measurement of gravity to determine the orientation of the Milling Machine. In this project the main function of the accelerometer used on Milling Machine is inertial measurement of velocity and position.

1.2 PROJECT SYNOPSIS

Accelerometer is main equipment which will be used along this project. Therefore, in order to organize the schedule every detail works need to be done and it includes few steps until final part. First of all, research on accelerometer is done before further investigation on others, such as, distance calculation and application on Milling Machine. The research includes its functions, how the accelerometer works, condition of the accelerometer, specification of the accelerometer, and simple application of the accelerometer. Accelerometer has a potential technique to measure acceleration, which can then be converted to distance.

Accurate distance calculation of the Milling Machine motion is needed in order to get the exact position. Accelerometer attached to the Milling Machine will help us in recording the acceleration of the Milling Machine up and down. From the acceleration, programming which had been structured will lead us in getting the exact distance of the
Milling Machine motion. Accelerometer functions in inertial measurement of velocity and position where acceleration is single integrated for velocity and acceleration is double integrated for position. Inertial measurements are non-contact method to measure acceleration, velocity and distance travelled. Velocity is the integral of acceleration while the distance is the integral of velocity which is also the double integral of acceleration.

The projects continue with the research on Milling Machine. The research includes the operation of the Milling Machine, and how the accelerometer being connected to the Milling Machine. The Milling Machine operates in multiaxis motion. Therefore, from the movement up and down of the Milling Machine, accelerometer is attached to get the distance travel between the z-axis motions of the Milling Machine.

Measurements of distance is an advantage in manipulating the acceleration from the accelerometer, it is physically small and can be easily attached to the Milling Machine. In motion, acceleration is one of the measurements required because of its ability to pick up high frequency and sensitivity, yet it is cheap and available in the market. In order to gain the value of the distance, c-program for distance calculation need to be build and run before combine the program with accelerometer to get the acceleration.

Simulation of accelerometer is to be done after the research and build the c-program of the distance and the acceleration. The simulation will be tested on actual accelerometer in order to manipulate the acceleration value. If there is mistake after the test, modification is needed before build the device. The test needs to be done many times to make sure the consistency of the distance reading before test the device on Milling Machine. Calibration of the distance data is done after completed the test on Milling Machine, and followed by analysis of data.

1.3 PROBLEM STATEMENT

This project is all about developing a device which distance data can be found from acceleration data through double integration. The focus is developing the device in order to measure accurate distance calculation using accelerometer. Using integration method errors exists, so from that minimization of the errors is needed so the distance calculation is very close to the actual distance value. This device is attached to the