CHAPTER 4
ANALYSIS AND DESIGN

4.1 Analysis

First of all, the researcher will analyze the frame of the spider robot. The main things that will be analyzed are how balanced the frame of the spider robot is, how munch the max rotation of each joints can rotate, and find a way how the spider robot can stand still with one of its leg raised.

After the researcher tests the spider robot physically, the researcher will develop a walking algorithm for the spider robot based from the informations gathered at the first analysis. The walking algorithm developed by the researcher must meet the main project's requirement to make the spider robot able to walk on titled grounds.

After the walking algorithm has been made, the researcher will test it on the normal and tilted grounds. The researcher then analyses how balance the spider robot is, and how fast the spider robot can walk on normal and titled grounds. If the result of the analysis don't meet the expectation of this project, the researcher will try to develop the current algorithm or even make another new algorithm that expected to peform better than the last algorithm.

If the current algorithm seems to meet the expectation of the project's main goal, the researcher will then analyze the balance and the speed of the spider robot on both normal and titled grounds. The researcher will use a stopwatch to determine the spider robot's speed, and judging the spider robot's balance by observing where the spider robot's start position and the Spider Robot's stop position.

4.2 Design

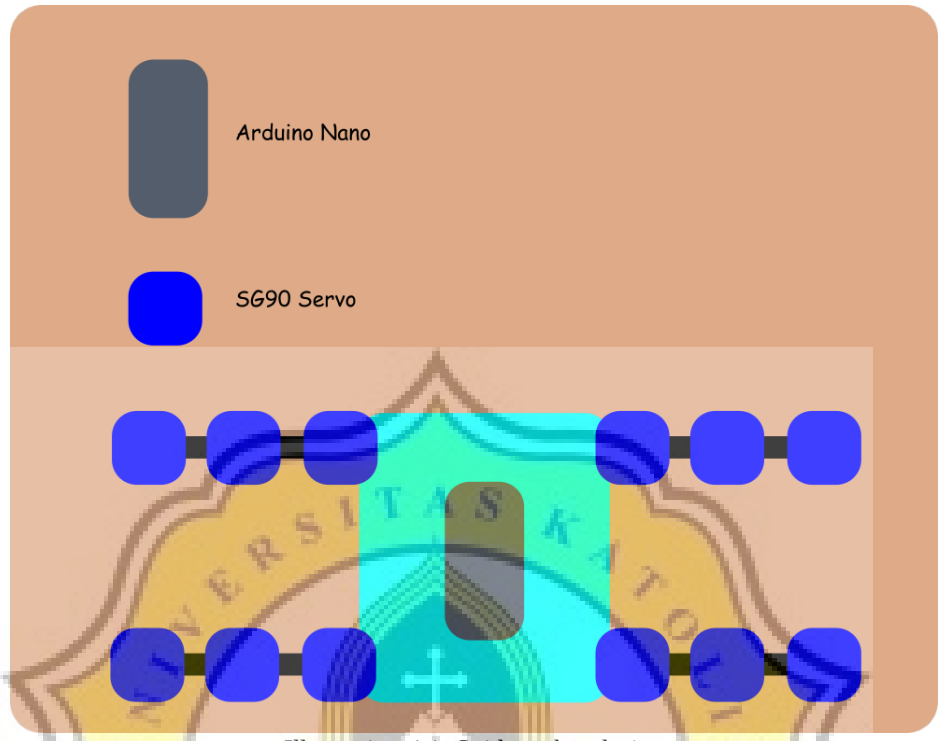

Illustration 4.1: Spider robot design

This spider robot uses 12 SG90 servos total, 3 SG90 servos on each legs for the joints. The researcher uses an Arduino Nano as the “brain” for the spider robot and an Arduino Nano Shield to make the wiring process easier. Other than that, the researcher uses a potentiometer to determine how the spider robot will walk, either normal or titled walk.

SG90 servo is a servo that can rotate up to 180 degrees. The brain, Arduino Nano, will be the one that commands all of the servos on spider robot when will a servo rotates, and how far a servo rotates. All 12 servos are inserted to each joints.

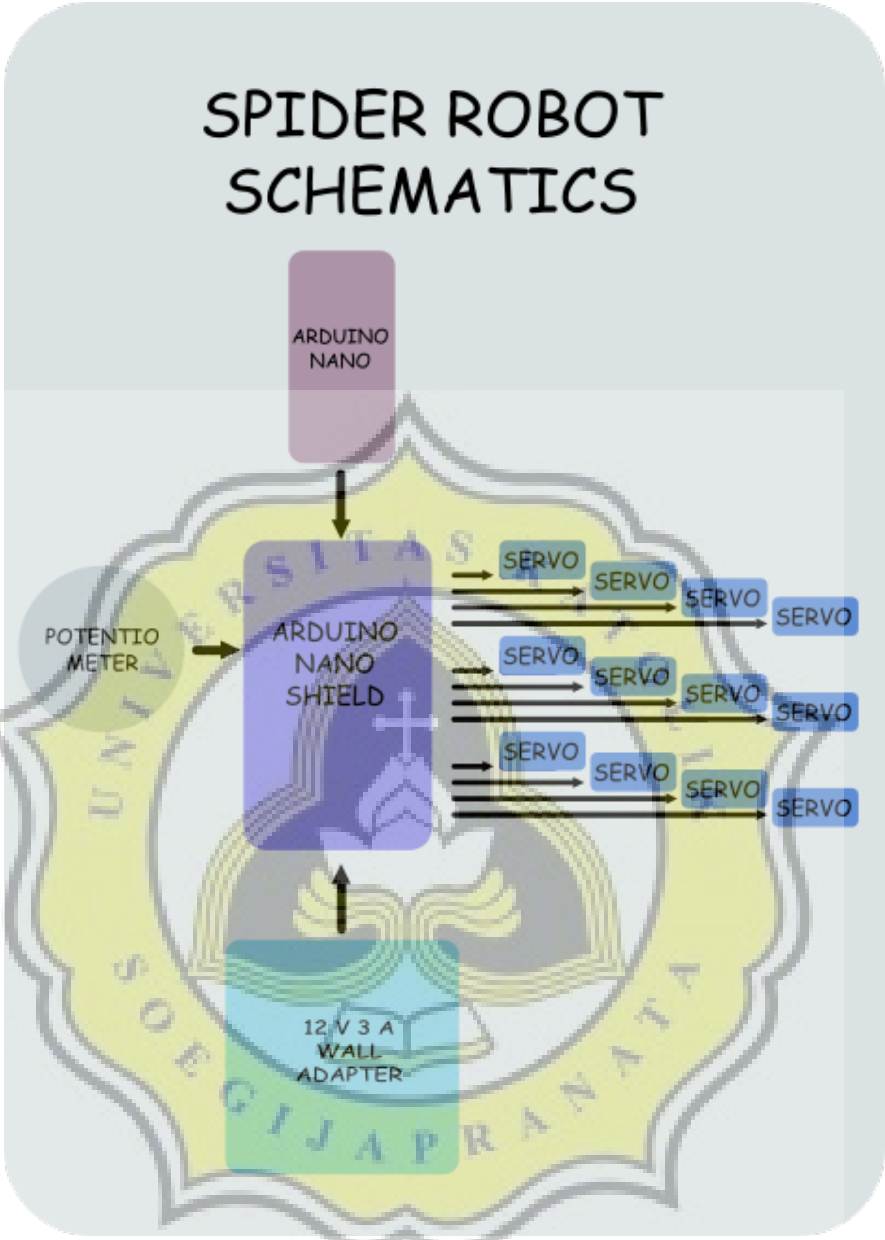

Illustration 4.2: Spider robot schematics

Since the servo requires higher ampere than other modules, especially in this project, 12 servos are required, the Researcher can't just rely from the power given by Arduino Nano. To solve the problem, the researcher uses a 12 Volt 3 Ampere wall adapter. The researcher uses a 12 Volt 3 Ampere wall adapter because the Arduino Nano itself can't provide enough current to power all 12

SG90 servos at once. But, the researcher can't just directly feed all 12 SG90 servos and the Arduino Nano with 12 Volt and 3 Ampere, because SG90 servos operates at 4.8 Volt, that surely makes feeding a servo with 12 Volt will be a bad idea. To regulates the wall adapter's voltage, the researcher uses a XL4015 step down to regulates th wall adapter's voltage to 5 Volt.

Before starts making the walking algorithm, the researcher first needs to know the maximum angle on each joints. After the researcher have done it, the Researcher needs to calibrate all servos, since every servos have its own "mean" angle.

After the researcher has known all servos maximum angles and have been calibrated, the researcher can start developing a non-titled walking algorithm. The researcher will start developing a non-titled walking algorithm first because the non-tilted walking algorithm will be the base algorithm that will be developed to the walking algorithm that capable to handle both normal and titled grounds.

After the non-titled walking algorithm has been done, the researcher will develop the non-titled walking algorithm to a walking algorthim that capable to handle both normal and titled-grounds. The researcher will make a modifier method that modify each of the spider robot's servo's angle. The modifier method will determine which servo's angle are going to be modified to make it capable to walk on tilted grounds.

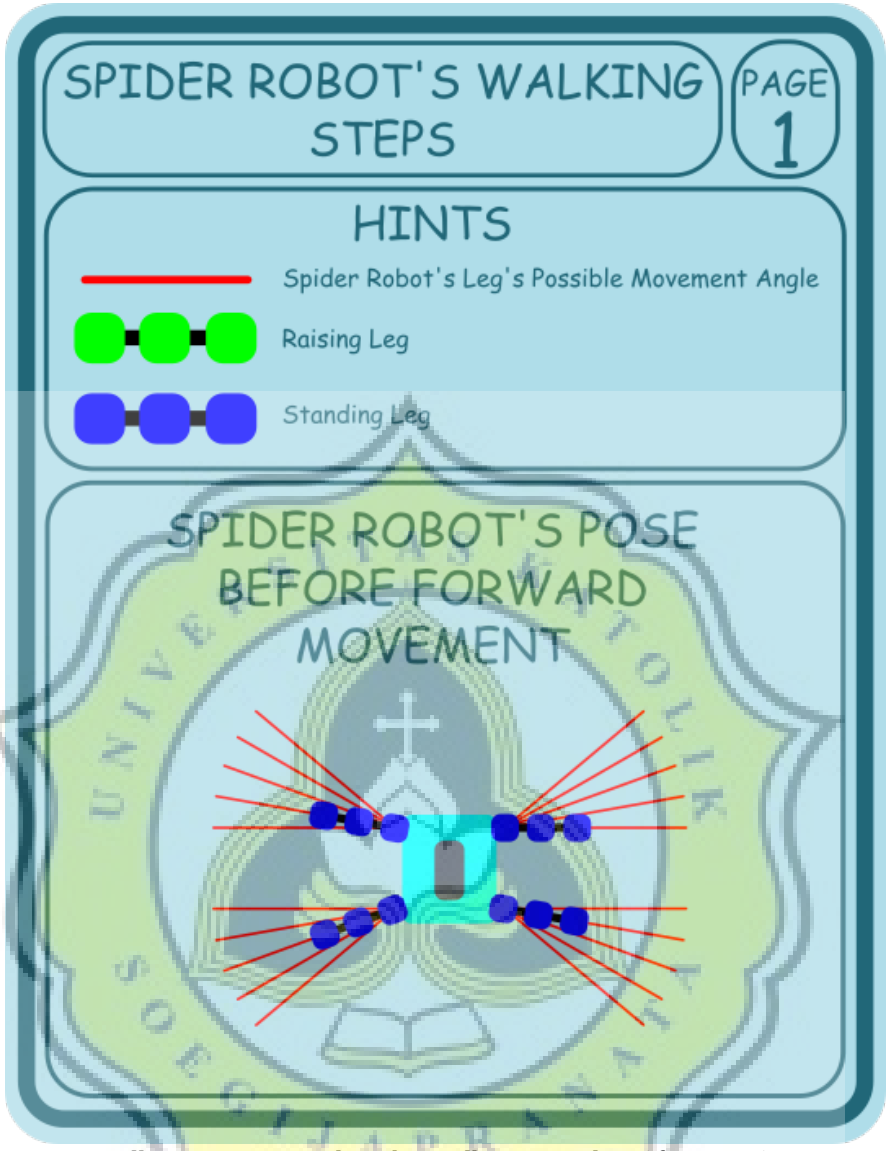

Illustration 4.3: Spider robot walking procedure (first page)

The researcher will use a wood plate that can be left, right, up, down titled. The wood plate itself will become the arena where the spider robot's walking algorithm will be tested. The spider robot's feet will be applied first with rubber to make the spider robot's feet less slippery. Other than that, the researcher will use a potentiometer that will determine how the spider robot will walk, either normal or titled.

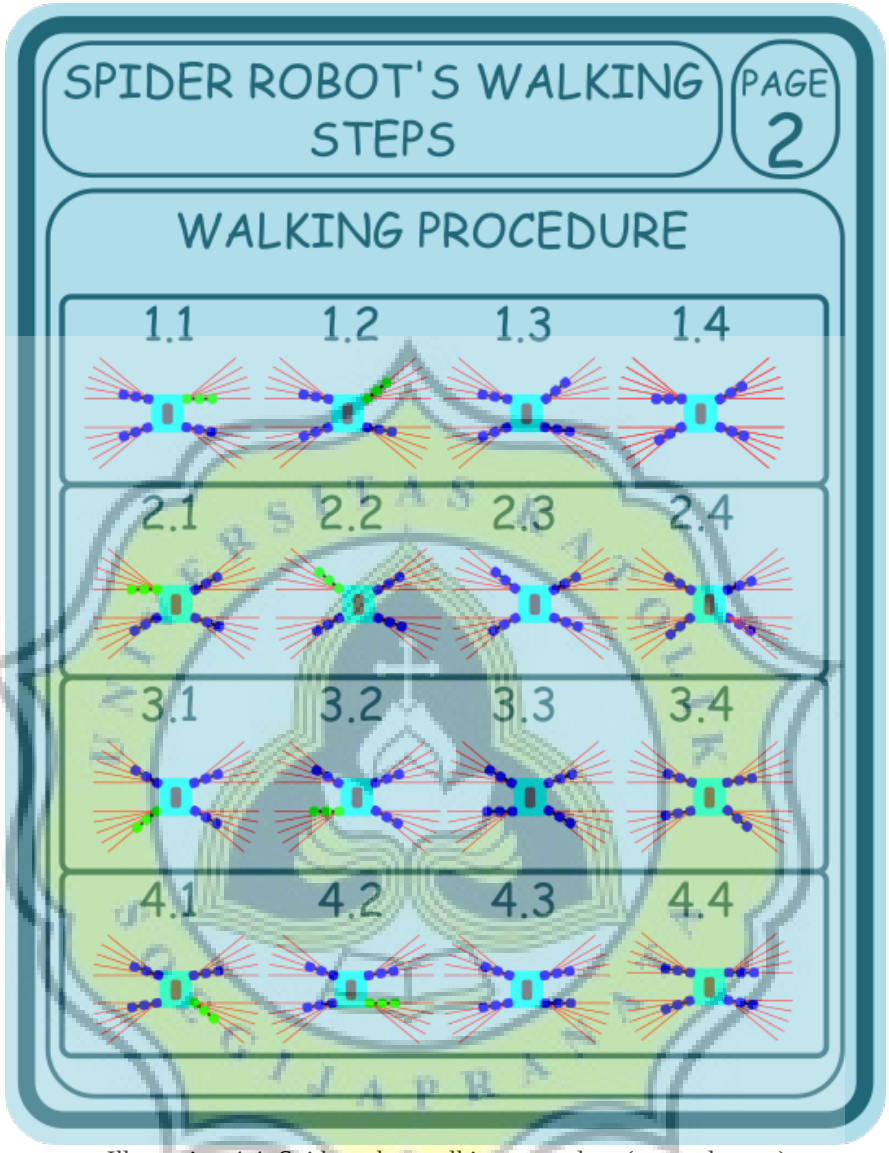

Illustration 4.4: Spider robot walking procedure (second page)

After the walking algorithm that capable to handle both normal and titled grounds has been made, the researcher will test it first on normal grounds, to make sure the spider robot can stand balancedly with one of its leg raised. After that, the researcher will test the spider robot's walking algorithm on tilted grounds and then analyze how fast and balanced the spider robot's on titled grounds. The researcher

will use a stopwatch to determine the spider robot's speed and will observe the spider robot's balance by looking at spider robot's start and finish position.