

**Jacques Princivil**

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**Professor. Kapila**

**Supervisors: Mish, Joey, Dong Yong**

**CA: Thelma**

**Project Members: Christopher Clinton, Ankur Nagpal, Kevin Krupnov**

**Abstract:**

Agriculture has been one of the most leading sources of natural resources in the world, which provides both humans and animals the basic necessities for life. One common necessity is the consumption and use of food. By applying the aspects of Skid Steering to form a skid loader will generally allow the amount of speed and efficient use of power to dirt bound surfaces. Skid Steering is the use of hydraulically powered motors to move a gear train that supplies movement to generally oil laden gears. This allows the increase of torque. Not only does the percentage of torque increases but this action causes a retardation in wheels causing it to maneuver favorably as oppose to the conventional steering of cars. This form of driving allows a smaller turning radius in one fixed position, as the conventional steering of cars does not.

With this steering it general gave the traction between the ground and its wheel (the increase of the wheels pulling power). This form of steering combined with the obstacle avoidance method coexisting with the robot generally move better. My general goal is to create a more advanced form of steering through a drive system made for strictly manual steering by human control into an autonomous control system. The robot was able to easily gain traction on dirt as well as avoid obstructions in its path.

**Introduction:**

Agriculture has always been a reliable source to the survival of the world's population. It provides us with a great percentage of our food and is the byproduct of all of our supplies. These materials consist clothing and shelter in addition to this concept it provides materials used in making many industrial products, such as paints and medicines.

Before the development of agriculture, people got all their food by gathering wild plants, hunting, and fishing- which are commonly basic to the needs of humans. This importance came from a different era where technology for agriculture was scarce. Where Farmers had little time for other activities. But as agriculture developed and farm output increased, fewer people were needed to produce food. The people who weren't farmers could then develop the arts, crafts, trades, and other activities of civilized life.

Over the years new forms of technology has been able to further the cultivation of plants in a huge way but still minuscule in terms of the population demand of agriculture. This has been a lead cause in food shortages as well as hunger. My engineering goal is to create an automated planter which can plant seeds in an expedient amount of time correcting the problems of the world. I propose a new method of control and steering based on the previously used method of Skid Steering. My responsibility for the experiment is the aesthetics as well as the mechanical components which is essential to its

completion. The autonomous device purpose is to plant seeds and watering the seed. The mobility of this robot depends on skid steering in which each of the two motors (one for each side) connects to a sprocket, and each sprocket is connected by two chains to each wheel. The applications of this form of driving or drive system can be found in the military uses, construction as well as the agriculture They distribute the power from a single hydraulic motor to both wheels. In my project {the five basic concepts which must be addressed localization, Environmental mapping, Path planning, motor control and communication} [1]. These concepts would have to correlate with the apparent movement of the wheels. There are two wheels which move independently with hydraulic systems “This type of mobile robot can trace various paths because turning radiuses of the robot can be specified freely. For these reasons many studies of motion planning and control have been done for this type of mobile robot.” [2].

To create this new form of control I will use all terrain wheels to simulate the old form of skid steering by

running tests against different surfaces to see what type of material and or environment can not create the stable form of mobility. To be able to allow the full mobility of the device it must not be constrained to certain friction medians. In order to allow this one must increase the input of power as “In practice wheels do not have fixed boundaries but, differentiate between various tolerances.

This is in correlation with the load transfer effects that apply to the wheels while motion and power increases to allow the skid of the wheels” [4] for an increases amount of friction between the surfaces of the floors as wheel as its turning radius. To incorporate a plan for manual steering into a design model for strictly autonomous steering.

“ To determine torque speed requirements to assist actuator we chose zero and low speed paring, and high speed random steer conditions to investigate the worse case loads. A high level of steering assist can be a source of instability of the plant that result in vibration of a steering column and undesirable vehicle performance”[5]. With a direct current control system this

allows more torque that can result as more traction between the wheels to any surface it is applied to. {The same issues that scientist addressed is that the velocity and power creates a more difficult time to avoid obstacles }.[6]

## **2. Methodology**

In order to create thus autonomous form of steering I first conducted test with 3 different types of motors to see which is better. The two classifications for these Motors are Alternate Current motors as well as Direct current motors. The difference between these two is that with an AC motor you can directly control it with a computer as oppose to an DC current due to the increase amount of voltage it needs. With these different I will calculate

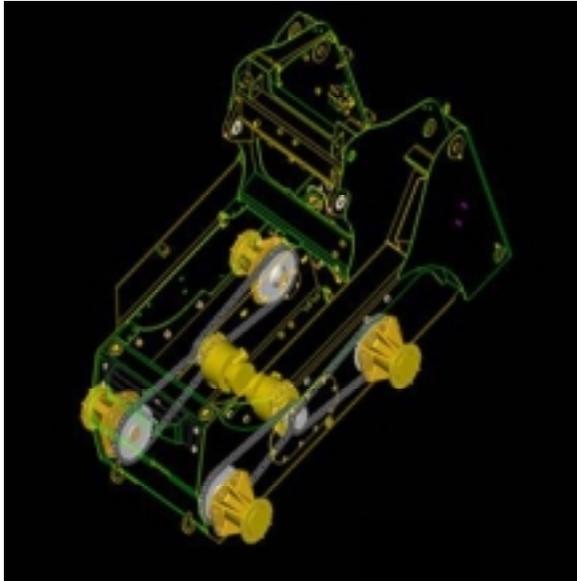
*-Horse-Power*

*-Full-load Torque*

-Braking torque

### **3. Mobility**

*Figure1. Shows a depiction of the drive system of a Skid Loader*

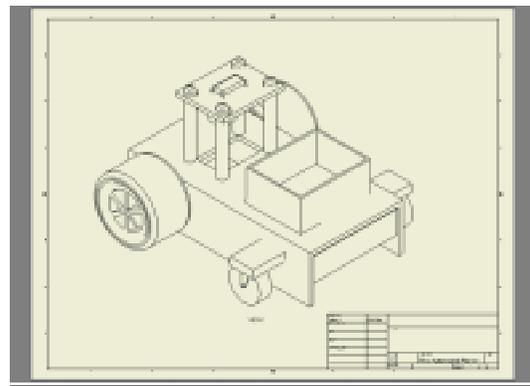


Skid steering is a form of steering which allows for a more balance control of moving which is accomplished by creating a differential velocity between the inner and outer wheels. The term skid refers to a restraint provided when the brake linings are moved hydraulically against the brake drum to retard the wheel's rotation. This retardation of the wheel allows for a desirable turning radius in on fixed position as oppose to the steering of a car where it gives a larger turning radius

moving out of its fixed position. “The drive system on the skid steer loader contains no transmission. Instead, it uses pumps and hydraulic motors to provide power to the wheels or tracks.”[7]

### **3.1 Robot design**

*Figure2: depicts general design of a robotic Skid loader. Robot dimensions or 12 inches X 6 inches X 3 inches.*



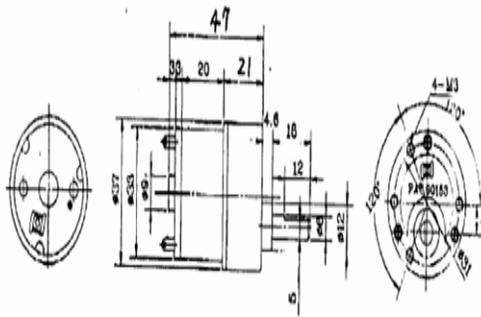
In a skid loader system it uses hydraulic pumps to move but is still considered a diesel engine due to the amount of oil it takes to keep the gears in working functionality. Diesel engines are more efficient than gasoline engines. A skid steer loader or may function on several hours a day. With the aid of a cooling system component which allows the robot to work in order

To provide the same level of

traction and power we incorporated a Dc motor that contained its own gearbox.

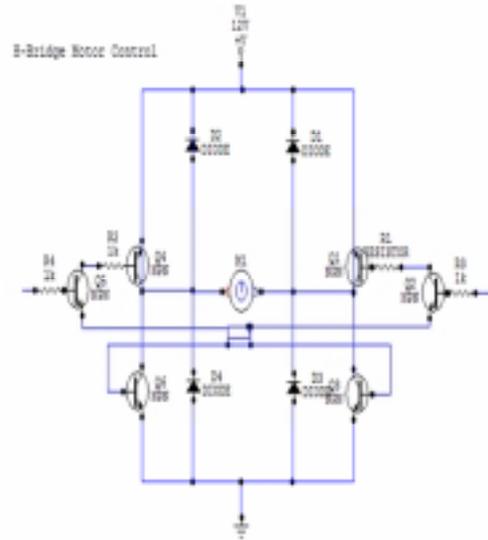
*Figure3: Shows the outer dimensions of a low torque motor.*

**I. OUTER DIMENSIONS :**



Since the gear box is filled with a oil laden type system with the exception of direct current , it is favorable in stimulating the aspect of Skid steering. To control the directional force as well as the motors speed I implemented H-bridges.

*Figure 4: Depiction Of H-bridge wiring schematic performed on circuit maker*



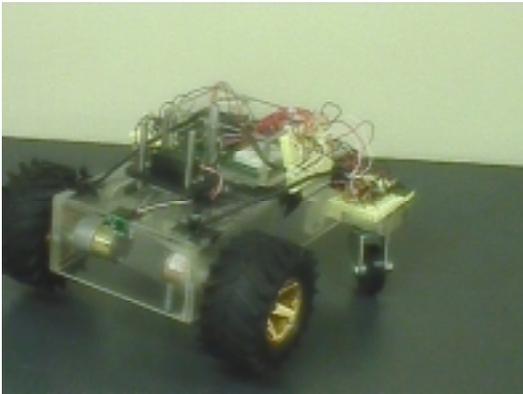
**3. Sensors**

Today's autonomous robots are able to navigate freely in known and unknown environments. In order for these robots to maneuver around these environments they to be able to avoid obstacles, hence the name obstacle avoidance. The equipment that will allow them to do this are sensors. Many sensors have been created for this task and have been used in various ways. Many engineers have used ultrasonic sensors that contain the ability to calculate the distance of objects in order to compute a possible route around the object [7 and 10]. In addition to ultrasonic sensors, infrared sensors could also be used to measure distances [8]. A possibility for an alternate method of obstacle avoidance would be to "utilizes sensor fusion procedures to create a map of the vehicle's environment" [12]. In which case, the robot would be able to reach its desired location faster due to its knowledge of its surroundings. An interesting

theory brought up by Michael Evans [11] is how plant roots use touch sensing to feel the obstacle and work around the obstacle while keeping in contact with it. By using a combination of reflective navigation and a “free-target approach behavior” the robot can move through unfamiliar environments and make its way to its goal location [9]. Our robot will be able to utilize these types of sensors to find a way around these objects and reach its goal location.

## **4.Results**

***Figure 5 shows full construction of the robot***



The gardener performed its task when testing it outside. It was able to gain full mobility between the surfaces of the wheel. The servo motor which drilled work better than expected to. The Drill had enough force which allowed to drill through the soil but also drilled through the crevices of cement and create a puntrue hole through it. The seeder which was connected to

another servo deposited seeds. As for the water pump dissipated out enough water, however due to the orientation of the tube this motion caused it to leak profusely.

## **5. Conclusion:**

Our robot showed considering promise to the world of agriculture. This device will allow production of vegetation more efficiently. The sensors applied to robot allowed it to refrain from colliding with any objects in its path as well as continue its task.