Fabrication of Water Hyacinth Harvester

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***Abstract*—One of the most invasive species in the world, the water hyacinth (Eichhornia crassipes) overruns waterways and ecosystems, causing a number of ecological, physical, and economic problems. Water hyacinth decrease water quality by reducing the amount of available sunlight for aquatic organisms, leading to reduced photosynthesis rates and dissolved oxygen levels. Blockage of waterways disrupts boating, fishing, and other water activities. The growth of water hyacinth can be controlled by biological method, chemical method and manual/mechanical method. In biological method the insects (commonly weevils) are used to control the growth of water hyacinth which is effective and a long term process. Chemical methods uses herbicides that seems to be an economically feasible way but the water quality will be affected which is dangerous for aquatic life. Manual removal requires a large labour force hence the labor cost incurred is more.**

The project aims to develop a water hyacinth harvester, a mechanical model which is a short term control measure. This harvester can be used to remove thewater hyacinth in water bodies like lakes, ponds and rivers, thereby eliminating the blockages in water ways. The model consists of picking roller which picks the water hyacinth in water bodies by rotary motion. The water hyacinth is then collected in the collecting bin through a belt conveyor. Then it will disposed in river beds for further processes.

I.INTRODUCTION

Water hyacinth is the free floating perennial plant that can grow to a height of 3 feet. The dark green leaves blades are circular to elliptical in shape attached to a spongy inflated petiole underneath the water is a thick, heavily branched, dark fibrous root system. The water hyacinth has striking light blue to violet flowers located on terminal spike. Water hyacinth is a very aggressive invader and can form thick mats. If these mats covers entire surface of the pond they can causes oxygen and depletions and fish kills. Water hyacinth should be controlled so they don't spread over entire pond as shown in fig 1.

They have long, spongy and bulbous stalks. The feathery, freely hanging roots are purple-black. An erect stalk supports a single spike of 8-15 conspicuously attractive flowers, mostly lavender to pink in color with six petals.

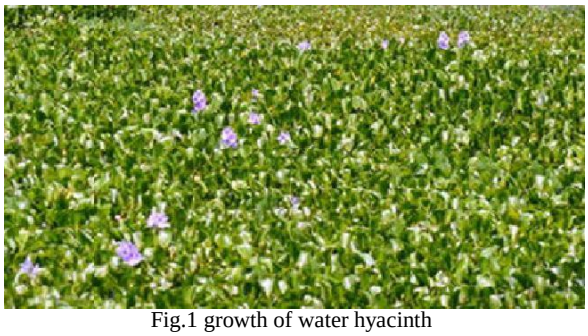


Fig.1 growth of water hyacinth

When not in bloom, water hyacinth may be mistaken for frog's-bit (Limnobium spongia). One of the fastest growing plants known, water hyacinth reproduces primarily by way of runners or stolons, which eventually form daughter plants. Each plant can produce thousands of seeds each year, and these seeds can remain viable for more than 28 years. Some water hyacinths were found to grow up to 2 to 5 meters a day in some sites in Southeast Asia. The common water hyacinth (Eichhornia crassipes) are vigorous growers known to double their population in two weeks.

1.1.1 Leaves

Leaves are bright green, waxy, smooth and fleshy. They occur as a rosette at the base of the plant and consist of two parts—a petiole (leaf stalk) and a leaf blade. The leaf blade has smooth edges, is glossy, circular to heart-shaped and up to 30 cm in diameter. Two types of leaves occur – those with petioles that are bulbous (swollen) and those that are non-bulbous (not swollen) (see Figure 1). Each petiole contains large air cells, enabling the plant to float. The greater the amount of air, the more bulbous the petiole is. Leaves with bulbous petioles– enlarged/swollen petioles up to 25 cm long. This type of leaf is more characteristic of plants growing in infestations with low plants numbers or along the open-water edge of infestations. Leaves with non-bulbous petioles – leaves are up to 60 cm long, slender and erect. This leaf type is more typical of plants in crowded, dense infestations.

1.1.2 Flowers

Between 3 and 35 (more commonly about 8) flowers occur along a spike about 15 cm long, that usually extends above the leaves. The flower head is attached to a stem (up to 60 cm long) that has two leafy bracts positioned below the flower spike. Each flower is funnel-shaped, has 6 petals, is bluish-purple in colour, 4–7 cm long and 4–6 cm wide. Individual flowers only last a few days. Once all of the flowers on the spike have matured, generally after about 18 days, the spike bends down into the water and releases its seeds.

1.1.3 Stems

Two types of stem occur:

- Upright stems up to 60 cm long, with flowers,
- Horizontal vegetative stolon, or runners, about 10 cm long that produce new plants.

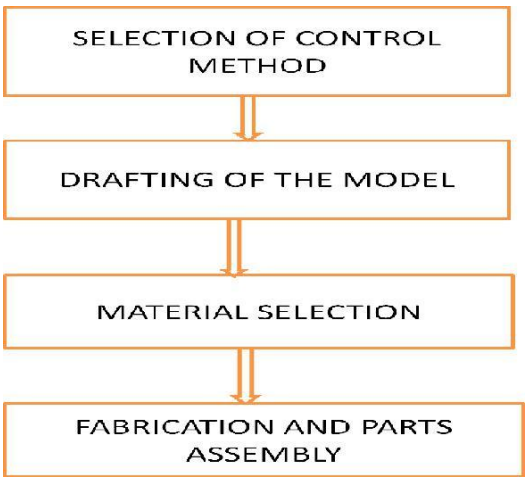
1.1.4 Roots

Roots shown in fig 1.4 are black to purple in colour, fine, fibrous and feather-like. In deep water they can be up to 1 m long and may trail freely behind the plant. In nutrient rich water, roots are usually much shorter. In shallow water the roots may become attached to the muddy bottom, allowing the plant to persist for several weeks after water levels drop.

II. PROPOSED WORK

2.1. METHODOLOGY:

The methodology of water hyacinth harvester is shown in fig. from the available different control methods, the control method that is to be used is selected. Next step is drafting of the water hyacinth model. Then materials are selected for the harvester. Then the parts are fabricated and assembled together



2.2. DESCRIPTION OF EQUIPMENTS:

2.1.1. DC MOTOR

A DC motor is a device that converts direct current (electrical energy) into mechanical energy. The very basic construction of a dc motor contains a current carrying armature which is connected to the supply end through commentator segments and brushes and placed within the north south poles of a permanent or an electro-magnet. Now to go into the details of the operating principle of DC motor it's important that we have a clear understanding of Fleming's left hand rule to determine the direction of force acting on the armature conductors of dc motor. Here in water hyacinth harvester two DC motors were used to run the conveyer belt as well as the pedal.

2.1.2. BELT CONVEYOR:

A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium the conveyor belt that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. There are two main industrial classes of belt conveyors; Those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport large volumes of resources and agricultural materials ,such as grain, coal, etc.,

2.1.3. LIFTING BAG

A lifting bag is an item of diving equipment consisting of a robust and air-tight bag with straps, which is used to lift heavy objects underwater by means of the bag's buoyancy. The heavy object can either be moved horizontally underwater by the diver or sent unaccompanied to the surface. Besides as a piece of diving equipment there are also lifting bags used on land for lifting cars or heavy loads or lifting bags which are used in machines.

2.1.4. PROPELLER

A propeller is a type of fan that transmits power by converting rotational motion into thrust. A pressure difference is produced between the forward and rear surfaces of the airfoil-shaped blade, and a fluid (such as air or water) is accelerated behind the blade. Propeller dynamics, like those of aircraft wings, can be modeled by either or both Bernoulli's principle and Newton's third law.

A marine propeller of this type is sometimes colloquially known as a screw propeller or screw, however there is a different class of propellers known as cycloidal propellers - they are characterized by the higher propulsive efficiency averaging 0.72 compared to the screw propellers average of 0.6 and the ability to throw thrust in any direction at any time. Their disadvantages are higher mechanical complexity and higher cost.

2.1.5. CONTAINER:

A container is a basic tool, consisting of any device creating a partially or fully enclosed space that can be used to contain, store, and transport objects or materials. In commerce, it includes "any receptacle or enclosure for holding a product used in packaging and shipping." Things kept inside of a container are protected by being inside of its structure. The term is most frequently applied to devices made from materials that are durable and at least partly rigid.

2.1.6. BATTERY

In our project we are using secondary type battery. It is rechargeable type. A battery is one or more electrochemical cells, which store chemical energy and make it available as electric current.

2.1.7. CONTROL UNIT

MICROCONTROLLER

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer.

Micro controller is a stand alone unit, which can perform functions on its own without any requirement for additional hardware like i/o ports and external memory. The heart of the microcontroller is the CPU core. In the past, this has traditionally been based on a 8-bit microprocessor unit. For example Motorola uses a basic 6800 microprocessor core in their 6805/6808 micro controller devices.

III.CONSTRUCTION AND WORKING

The model consists of picking roller which is run by using the DC motor. As the picking roller rotates, the water starts flowing towards it thereby bringing water hyacinth to the picking roller. The water hyacinth picked by the picking roller will be sent to the conveyer belt. The conveyer belt then transfers the water hyacinth to the collecting tank. Then it will disposed in river beds for further processes. This entire set up is placed over the lifting bag which can be moved by means of a propeller.

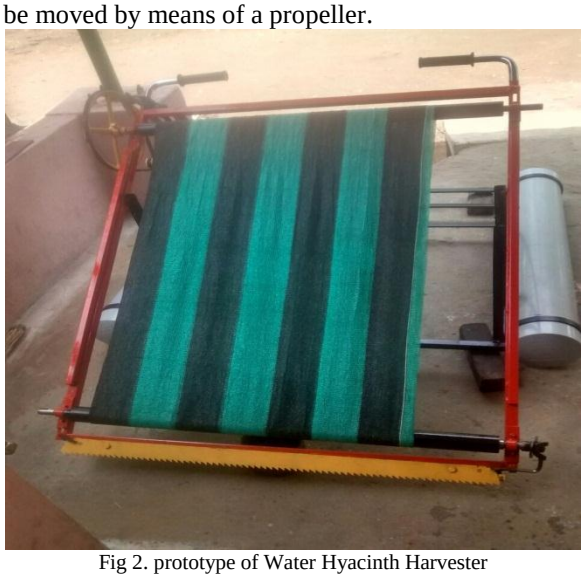


Fig 2. prototype of Water Hyacinth Harvester

IV. CONCLUSION

It is understood that mechanical control method is an effective way of controlling the water hyacinth. The fabricated model of “Water Hyacinth Harvester” is aimed at reducing manual work in Water hyacinth removal thereby reducing labour cost involved. The model can be scaled up and with minor developments that can be used in real time environment. This reduces the blockages in waterways and maintains the quality of the water.

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