

Aqua Automatic Food Feeder

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Abstract:- Asia dominates the aquaculture production, contributing around 91% of the world's total by volume and 82% by value. Asian countries, such as Thailand, have been the top ten aquaculture producers in the world. The region has the highest variety of cultured species. Asia has also been the highest seafood-consuming region of the world, accounting for two-third of the world's food fish supply, the increase of which mainly came from aquaculture in recent years.

1. INTRODUCTION

The fisheries sector in Malaysia has provided direct employment to 89,453 fishermen and 21,507 fish culturists [1]. The consumption of fish in Malaysia is expected to increase by 14% by 2010 and currently, the country is producing 89% of the fish supply for its own consumption. With the marine harvest almost stagnating, the industry is dependent on the aquaculture to cater for the growing demand. Currently, the aquaculture industry contributes to about 13.2% of the total fish produced. Malaysia has the potential to become a major player in the aquaculture industry in Asia Pacific, if more companies enter the sector.

The importance of aquaculture in the overall fish supply is growing. In the future, aquaculture production is expected to overtake capture production of food supply. The growth in aquaculture for high value species has an important impact on international fish trade. In recent years, tilapia and catfish have also entered international trade successfully. The unit values of tilapia and catfish were surprisingly strong and have shown an increasing trend. Feeding frequency for various sizes of tilapia at 28°C (National Research Council, Washington, 1993)

Size of fish (grams)	Times fed dairy
0-1	8
1-5	6
5-20	4
20-100	3-4
>100	3

Tilapia is the second most important cultured food fish in the world after carp. Tilapias are also among the easiest and most profitable fish to farm. This is due to their omnivorous diet, mode of reproduction, strong resistance to diseases and rapid growth. They grow best when fed 2-3 times per day although adequate growth can be obtained with a single daily feeding. Catfish has also become an important and popular food traded globally, with a great potential to feed the world and contribute significantly to the economies of the developing countries.

Feeding fish is labor-intensive and also expensive. Feeding frequency is dependent on labor availability, farm size, as well as fish species and sizes. Large catfish farms with several ponds can usually be fed only once per day because of time and labour limitations, while this may be done twice per day at smaller farms. Generally, growth and feed conversion increases with feeding frequency. In the intensive fish culture systems, fish may be fed as many as five times a day in order to maximize growth at optimum temperatures. Table 1 shows the feeding frequency for Tilapia of different sizes.

1.2 Project motivation

Food and feeding are the keywords of growth and production, their management being one of the main challenges for aquaculture development. The adjustment of food delivery to match fish appetite plays a key role to maximize the income or benefit for aqua industrialist. Related to economic aspect, especially for highly invested aquaculture project, the control of fish feeding will determine the survivor of the company involved. The correct practice or management of fish feeding also link to small aqua project which cannot be ignored as this matter contribute on how they can return good profit from this aqua activities. Conditions which prevail in intensive aquaculture make this problem complicated. These difficulties can impede the adjustment of food delivery to match variation in fish demand, leading to environmental pollution when overfeeding fish and growth loss when underfeeding fish. The effects are same whether the purpose is for industry or even small aqua activities such as aquarium and pond livestock.

In order to solve this problem, several direct and indirect techniques have been developed. Self feeders may be used for direct adjustment, whereas indirect methods have also been used based on hydro acoustic technology for control of feed waste. Therefore, the aim of the present study is the development of a feeder that can handle good control of fish food feedings.

2. MATERIALS REQUIRED FOR DESIGN

2.1 ACRYLITE MATERIAL

Acrylic sheet is a continuously manufactured acrylic sheet. It is produced by an innovative process, resulting in a sheet offering the easy handling and processing of extruded sheet, along with the high optical characteristics and low stress levels expected of cast products. Colorless ACRYLITE FF sheet carries an exclusive 10-year limited warranty on light transmission – your assurance of a quality product. A printed copy of the warranty is available from CYRO Industries or wherever ACRYLITE® acrylic sheet is sold.

2.2 FOOD MOVER (SCREW CONVEYOR)

Screw conveyor is a mechanism that uses a rotating helical screw blade called a "flighting", usually within a tube, to move liquid or granular materials. They are used in many bulbs handling industries. Here screw conveyor made up of acrylic material. Screw conveyor in modern industries are often used horizontally or at a slight inclined as an efficient way to move semi solid materials, including food waste, wood chips, aggregates, cereal grains, animal feed, boiler ash, meat and bone meal, municipal solid waste, and many others. the first type of screw conveyor was the Archimedes' screw, used since ancient times to pumps irrigation water. they usually consists of a through or a tube containing either a spiral blade coiled around a shaft, driven at one end and held at the other, or a "shiftless spiral", driven at one end and free at the other, the rate of volume transfer is proportional to the rotation rate of the shaft. in industrial control application the device is often used as a variable rate feeder by varying the rotation rate of the shaft to deliver a measured rate or quantity of material into process. screw conveyor can be operated with the flow of material inclined upward. when space allows, this is a very economical method of elevating and conveying. as the angle of inclination increases, the capacity of the given unit rapidly decreases.

2.3 BALL BEARING

A ball bearing consists of an inner ring (IR), an outer ring (OR), a complement of balls, and a separator to contain the balls. (See Figure.) The outer diameter of the inner ring (IROD) and the inner diameter of the out erring (ORID) have a groove in which the balls roll on. This groove is commonly called the *pathway*. The raised surfaces on each side of the pathway are called the *shoulders*. The balls are held equally spaced around the annulus of the bearing by the separator. The basic dimensions of the bearing are the bore (B), outside diameter (OD), and the width (W).

For most bearings, the radius of curvature across the pathway of an inner ring is held to 51-52% of the ball diameter while the radius of curvature across the pathway of the outer ring is held to 53-54% of the ball diameter. As the pathway radius of curvature approaches 50% of the ball diameter(100% of the radius), the stress between the ball and pathway decreases; however, it also moves the contact of the ball higher up the pathway wall producing more friction as the balls revolve around the bearing. For ball bearings, the best balance between stress and friction is attained with the pathway curvature slightly above 50% as described above for inner and outer rings. The number is higher for outer rings because, in the rotational plain, outer rings present a concave surface to the balls lowering the contact stress compared to the inner rings which, in the rotational plane, present a convex surface to the balls raising the stress.



2.4 STEPPER MOTOR

A stepper motor is an electro mechanical device, which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence [7]. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation of input pulses applied.

Stepper motors are used in many different types of applications this makes it difficult to recommend a general step-by-step design flow chart. The design process is more an iterative process, involving experimentation. The purpose of this application note is to show how system performance is affected by motor and driver selection. Some popular motor and drivers are dealt with, as well as the importance of the gearing between the motor and the load.

A stepper motor can be a good choice whenever controlled movement is required. They can be used to advantage in applications where you need to control rotation angle, speed, position and synchronism. Because of the inherent advantages listed previously, stepper motors have found their place in many different applications. Some of these include printers, plotters, high end office equipment, hard disk drives, medical equipment, fax machines, automotive and many more.

2.5 MICROCONTROLLER

• A microcontroller is a small, low-cost computer-on-a-chip which usually includes:

An 8 or 16 bit microprocessor (CPU).

A small amount of RAM.

Programmable ROM and/or flash memory.

Parallel and/or serial I/O.

Timers and signal generators.

Analog to Digital (A/D) and/or Digital to Analog (D/A) conversion.

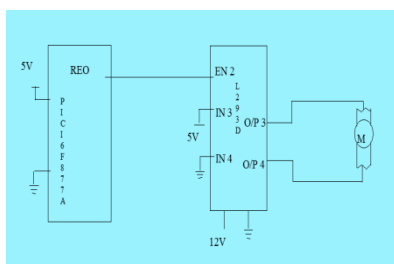
• Often used to run dedicated code that controls one or more tasks in the operation of a device or a system.

• Also called *embedded controllers*, because the microcontroller and support circuits are often built into, or embedded in, the devices they control [8].

• Devices that utilize microcontrollers include car engines, consumer electronics (VCRs, microwaves, cameras, pagers, cell phones ..), computer peripherals (keyboards, printers, modems..), test/measurement equipment (signal generators, millimeter's, oscilloscopes)

• Microcontrollers usually must have low-power requirements (~.05 - 1 W as opposed to ~10 - 50 W for general purpose desktop CPUs) since many devices they control are battery-operated.

CIRCUIT DIAGRAM



3. WORKING MECHANISM

The design mainly contains a Tapered container that holds the fish food, the container bottom is fixed with a rotating screw conveyor with the help of Ball bearings to avoid friction of moving parts and a fish pond placed right below the feeder.

The design follows the following mechanism:-The Tapered container contains the fish food on top of the rotating screw conveyor which is here used as a food mover to push the food forward to dump into the pond. The screw conveyor is controlled by the stepper motor that rotates on a step basis. The Stepper motor is controlled by a microcontroller that is programmed to rotate the screw conveyor through the motor at particular intervals preventing the wastage of food. This design minimizes the problems of fish keepers or aquarists by shifting it from manual to the automatic mode, and also helpful on maintaining the fish health because they are feeding small portion of food at scheduled intervals and precise feedings at appropriate times, the automatic feeders can be successfully used to feed diabetic fish. This fish feeder prevents overeating by releasing the right quantity of food at scheduled times. Hence we finally

come to a conclusion that the above design is simple, economical and affordable, therefore we choose the above design for fabrication.

The model contains tapered container which holds 1000 grams of food and a screw conveyor of diameter 10mm which rotates step by step with the help of stepper motor. By testing for one rotation of screw conveyor, it discharges 0.3grams of fish food. Therefore for testing purpose programmed has been set for 20 rotations. Therefore it discharges 5 grams of fish food into the tank which will be sufficient for fishes one time in a day. If number of fishes increases number of rotations of screw conveyor increases by altering the program using user defined switch provided outside the feeder.

3.1 Table: - Amount of food Discharge

SI Number	Number of rotations	Quantity (gm)
1	1	0.3
2	5	1.556
3	10	3.398
4	15	3.996
5	20	5.032

4. CONCLUSION

Fish feeder system is a device that has been developed and designed to dispense the exact amount of pellets at particular intervals regularly. However, this particular system also shows the capability or their function in repeating the task daily, accurately and timely. Hence promising efficiency and productivity in Aquaculture for years to come and is dependable. This device feeds food to the fishes at right schedule and amount pre-defined by user, therefore avoiding the issue of overfeeding and underfeeding the fishes.

Also another advantage of using an automatic feeder is that fishes love to be fed on daily schedule, and when they are fed at appropriate schedules, every single day, they love it even more. Another great advantage of using this type of feeder is that we can specify the amount of food that we would like to be fed to the fishes into the tank for every feeding.

Feeding the fishes on a daily basis regularly is also responsible for fishes leading a healthy and a longer life. Now a days since we know how busy we are with our daily life, with our busy schedule we do forget to feed fishes and due to which fishes become slimy and die. Their deaths also contaminate the pond also killing other fishes and hence it is required to feed them daily and regularly.

Again in our daily life it's a hectic job for us to feed the fishes timely with lots of responsibility to do. Be it home or in aquaculture there is always a lot of human work involved for feeding the fishes and keeping a count on the quantity to feed his kind messy job and its very important job to feed fishes timely for their healthy growth and hence this device that we have designed helps preventing all these problems.

5. REFERENCES

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