$\approx$ ICSE International Journal of Computer Sciences and Engineering Open Access

**Review Paper** 

Volume-5, Issue-7

E-ISSN: 2347-2693

# **Smart Automatic Fish Feeder**

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Available online at: www.ijcseonline.org

Received: 23/Jun/2017, Revised: 06/Jun/2017, Accepted: 23/Jul/2017, Published: 30/Jul/2017

*Abstract*— This paper deals with the design of smart fish feeder system for the application of home aquarium. An automatic fish feeder is a device/product which provides the right amount of fish food at a predetermined time and it helps the aquarist to feed their pet fish when on a vacation or too busy to maintain a regular feeding schedule. It also ensures their pet fishes are fed in healthy way and on time. The aquarist can set the daily feeding time, feeding amount, number of repetition with time delay and also other optional limits. It can repeat its task accurately on daily basis. Further, the system is smartly monitored for the feed level and details are send to the aquarist via Short Message Service (SMS). The whole process uses electro mechanical feeding and feedback control mechanism with PIC microcontroller incorporated with Global System for Mobile Communication Modem (GSM) and a miniature seed sprayer model, an ultrasonic sensor-warning system. This mechanism is actuated by relay with gear motor.

Keywords- Electro Mechanical Feeding system, Speed sprayer, ultrasonic sensor, RTC and GSM module

#### I. INTRODUCTION

Manual feeding uses the man power which requires the aquarist's precise amount of food to avoid the waste of pellet that was supplied to the fish. Meanwhile, it is not practical if the aquarist goes out of town for many days and leaving the fish without food. There are several problems which had been known through research study on commercial fish feeder available in market and also through research journal. This system is trying to improve the efficiency and reliability of the previous available automatic fish feeder [1, 2]. The amount of fish pellets during feeding system is the major criteria. The amount of fish pellets through manual feeding is in accurate; it could seriously affect fish's health. If the amount of fish fed is small, then there could be severe loss of fish due to starvation. On the other hand, if the amount exceeded from the required amount, this can cause contaminate the water and clog up important filters in the aquarium. Hence the aquarist must be able to feed their fish at correct interval time with desired amount [2, 3]. The user interface system is the medium where interactions between human and feeder system occur. The lack of user interface in automatic fish feeder can be overcome by setting the feeding time and its amount. For the effective operation of user end fish feeder control, the interface system is needed while the fish pellet container is empty [4]. The proposed system is implemented with system controller, fish feeder mechanism, user interface, and motor with feedback system. The

feedback system includes smart devices such as an ultrasonic sensor and a GSM modem. It mainly focuses on the smart fish feeding system for home aquarium application. The design of automatic fish feeder makes a timely, accuracy feeding equipment which can replace or reduce the use of labour in aquaculture industries or individual domestic aquarist.

#### **II. RELATED WORK**

#### A SMART FISH FEEDER SYSTEM

This development of automatic fish feeder intelligent system that could alerts aquarist through GSM modem. The mechanical and electrical part in the system consists of PIC microcontroller, GSM modem, keypad, ultrasonic sensor and geared DC motor and is shown in figure 1. The feeder will distribute fish pellets at predetermined time on the other hand if the sensor is triggered when the fish food level is low, the controller would give instructions to the GSM modem to send a text message to alert the aquarist. The block diagram of the automatic fish feeder system consists of various blocks such as LCD, Driver circuit, Relay, GSM Modem, Keypad, RTC, Ultrasonic sensor and Oscillator.

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Figure 1. Block Diagram

## III. METHODOLOGY

The methodology includes the hardware design of automatic fish feeder. The system process flow is shown as in the Figure 2. A GSM modem which accepts a SIM card, and operates over a subscription to a mobile operator, which is similar to a mobile phone. A GSM modem has an interface that allows applications such as SMS to send and receive messages over the modem interface in an efficient way. For sending and receiving SMS, the mobile operator will be charged.

# **RTC & ULTRASONIC SENSOR**

The Real Time Clock (RTC) is a prime component used to allow digital system to continuously keep track of time relative to human perception. They typically operate at slower speeds and consume much less power (500nA with oscillator running) than a general purpose clock. RTC requires a small portable supply using a battery (Li-ion battery-3.3V) when the rest of the system is switched off. The circuit is shown in figure 3. The other benefits of RTC are Low power consumption (important when running from alternate power), Frees the main system for time-critical tasks and more accurate than other methods.

Ultrasonic sensor is same as that of RADAR. Ultrasonic sensors generate high frequency ultrasonic sound waves and evaluate the echo. The time interval between sending the signal and receiving the echo is calculated by using sensors in order to find the distance to an object. The technology is limited by the shapes of surfaces and the density or reliability of the material.

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A short ultrasonic wave is emitted to detect the objects and then echo is listened. The ultrasonic sensor emits a short 40 kHz burst. This wave travels through the air at 1130 feet per second, hits an object and then reflected back to the sensor. It provides an output pulse to the host and terminate when the echo is detected, hence the width of this pulse match to the distance to the target. It has the features of Supply Voltage – 5 V DC, Supply Current – 30 mA, Range – 2 cm to 3 m (0.8 in to 3.3), Burst Frequency – 40 kHz for 200 µs, Delay before next measurement – 200 µs

# **GEAR MOTOR:**

A Geared DC motor consists of an electric motor and a reduction gear train integrated in it. This greatly reduces the complexity and cost of designing and constructing power tools. The appliances with high torque at relatively low shaft speed can be used. Gear motors are available at low cost it provides motive force at low speed. Key specs are 12V, 100 RPM, gear ratio 100:1 and a max of 300mA current rating at load. When the torque is increased, the output speed of the gear motor is reduced with gear train reducing mechanism. For large driven loads, the reduction gearing allows small electric motors to move very slowly than large sized electric motors.

### IV. RESULTS AND DISCUSSION

# PROTEUS SIMULATION MODEL

The proteus is the simulating software which helps to attach many components with PIC microcontroller virtually for a simulation out. It helps to simulate the output of the controller components and also to observe the variations in change it if needed. The simulation circuit is shown in figure 4. Below is the screenshot of the successful simulation of the automatic fish feeder in proteus.



Figure 4. Screenshot of Proteus simulation

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Figure 5. Design of the feeder system

**Hopper:** It is an inverted pyramid structure which is used for the feed storage. It is made of sheet metal.

**Seed sprayer:** They are the arms of the feeder system. It acts as feed sprinklers. There are four arms each at an inter angle of 90 and made of steel tube of diameter 0.5 inch.

**DC motor:** A DC gear motor is chosen to meet the requirements for the rotation of the sprayer. The RPM rating used is 100.

**Bearing**: It's a supporting screw for a proper alignment of the DC gear motor with the sprayer.

Fish Feed: It is the food for the fishes in the tank.

**Fish Tank:** It creates a suitable environment for the fishes. The feeder system is designed for any fish tank with dimensions 2 feet width and  $1\frac{1}{2}$  feet height.

**Supporting frames:** It provides the necessary support and strength for the mechanical model. They act as the side stands for the feeder system. They are made of mild steel of 1-inch tube.

**Metal paste:** This is used for proper fixing of plates between joints and also to avoid any loss through small hole caused during welding.

# HARDWARE

The working model of smart fish feeder is shown in figure 6. An External supply is given to the hardware circuit board and then the LCD turns ON to display "Automatic Fish Feeder". Next, it asks for the mobile number to which the alert SMS has to be sent from the GSM modem. This is done with keypad buttons. The keypad consists of five push buttons:

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SET, MOVE, ENTER, INCREMENT and DECREMENT. Once after the mobile number is entered the GSM starts initialization. After the GSM initialization the LCD displays the real time in 24-hour format (HH:MM: SS) and the distance measured by the ultrasonic sensor.



Figure 6. Prototype model of automatic fish feeder

The real time can be the set or changed by pressing the MOVE button, and then the relay ON and OFF time is entered by pressing the SET button which makes the duration of the feed predetermined. And this operation repeats in every 12-hour interval. So, when the RTC reaches the set time, the relay is switched ON and it triggers the gear motor which dispenses the feed for the time interval. It decides the feeding amount at specified interval. The feedback system indicates low fish food level (using ultrasonic sensor) in the hopper to warn user and if it is low, an alert SMS is sent to the stored mobile number which indicates "TIME TO REFILL FOOD". Further, the feeding process can also be done smartly by turning ON the relay by sending a SMS (\*1) and turning OFF the relay by sending another SMS (\*2).

### V. CONCLUSION AND FUTURE SCOPE

A smart automatic fish feeder is successfully constructed and implemented to satisfy the user objectives at home or workplace. It is controlled by a RTC which allows the user to adjust the cycle time and fish food dispensing time as when required. Further, the feeding mechanism can be easily controlled by sending SMS to the controller of the feeder system. The working of the feeder is tested for real time situations and the final prototype is developed and installed. The smart automatic fish feeder has a wide range of useful applications in Homes, Workplace, Fish farming industries and Aquarium shops.

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