SMART FISH TANK USING RASPBERRY PI

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Abstract - In modern days many people have fish as their pets in home. Everyone loves fishes and required aquarium for their home. But maintaining aquarium is difficult task. We need to change water time by time, feed fishes time to time. Again it is difficult to check the conditions of an aquarium manually. Therefore it important to automate the aquariums. Here we have implement an IOT based system which monitor and control the whole aquarium automatically and provide real time status on user's Smartphone application. It contains water quality management in which It will monitor the physical changes in the water and will maintain it to the ideal conditions, with required changes. The aquarium will perform all the steps automatically like temperature control, Cooling Fan, light monitor, feeding etc. It will reduce the manual effort required in maintenance of aquariums by automating the aquarium management process and also automatic food feeding system operated by servo motor mechanism which used to feed fishes on regular time intervals. The aim of our project is to replace manual maintenance of fish aquarium with an automated system by using IOT.

***Key Words*:** Aquarium, IOT, Smartphone, Automatic

1.INTRODUCTION

Pet ownership has been increasing at a steady pace in the last 20 years. After cats and dogs, the most popular pet is now the freshwater fish. The maintenance of fish aquariums is a very difficult task itself.Whenever you have to clean up your aquarium or you have to feed, you have to do a lot of things. You have to Turn off your aquarium's power head/air pump and feed manually and turn on the air again after an hour.

In the Current system all equipment's such as light, heater, and filter are to be controlled manually using electrical switches for this the person needs to come near the aquarium and manually control the electrical switches to turn on /off the equipment's. The fishes needs to be fed twice a day even this requires the owner to walk up to fish tank and feed the fish manually which makes the task of maintaining an aquarium much more difficult. At times when the owner is on vacation he has no control over the aquarium and also can't feed the fish.The project with which we came up is a Smart Aquarium.

The project will be more efficient than the systems available in market, now days. In addition to the efficiency it will be of lower cost as well The project's audience is the group of people interested to keep fishes at home or offices but don't have time to take care of, or they are worried to keep asking their neighbours to take care of the fishes in their absence. Fish keeping is itself an industry which comes in agriculture. The scope behind developing IOT based fish feeder is to reduce manual work. This device can provide regular feeding without disrupting the owners work; owners can monitor feeding process with their smartphone virtually. Fish feeder using wireless communication the system can be implemented by setting fish feeder feed fishes at a certain time you can command it for dispatched the food. It will replace the manual maintenance of the fish aquarium. The Fish feeder will be automated and can be easily controlled from the mobile phone via web application anytime anywhere in just one click using a dashboard.

The aquarium will perform all the operations automatically like temperature control, pH control, monitor lighting, feeding, water renewal etc. It will reduce the manual effort required in maintenance of aquariums by automating the aquarium management process.

2. System requirements

A.Hardware Requirements

The Smart Aquarium's most components were taken from a normal aquarium such as glass box, filter, heater, and aquarium lights. These components were responsible to maintain clean water, specified temperature of water and provide lighting to the aquarium. The components required to automate this process were raspberry pi 3 model b, relays, servo motor, jumper wires and webcam.Relays acts as switches to control lights, filter and Heater.The raspberry pi acts as server and receives commands from the client that is android app. The raspberry pi responsible to control all equipments of the aquarium. Which are connected to its Gpio pins. A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. It is responsible to provide lighting in aquarium.The feeder is powered by servo motor and controlled using PWM signals.On receiving signal the servo motor spins and drops the fish feed.The filter keeps the water clean by continuously pumping it through a sponge.The heater maintains the specified temperature of water in aquarium.The webcam captures the video of the aquarium and provides live video streaming in android app.

B. Software Requirements

OS: Raspbian (kernel version-4.4), Windows 10, Android, Pi4j, Motion, Android studio, Web browser, Putty, Winscp were required to develop smart aquarium. Raspbian is official operating system of raspberry pi and is used to power raspberry pi. Windows is used on laptop which is used to control the raspberry pi. The pi4j project is intended to provide a friendly object-oriented I/O API and implementation libraries for Java Programmers to access the full I/O capabilities of the Raspberry Pi platform. Android Studio is the official integrated development environment (IDE) for the Android platform. Putty is used to communicate with pi using ssh. Winscp is used to transfer files to and from raspberry pi.

C. System Architecture

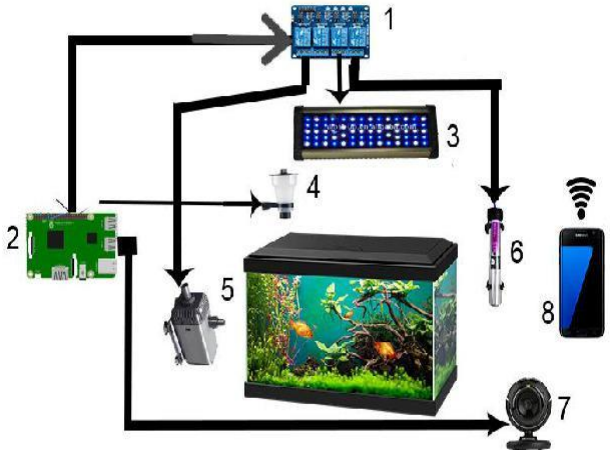


Fig-1: Smart aquarium tank

1. Relays
2. Raspberry pi
3. Light
4. Feeder
5. Filter
6. Heater
7. Webcam
8. Android smart phone

The webcam is connected to raspberry pi3 model b through usb 2.0. The webcam used in this project is iball c 12.0 webcam which provides a high quality video stream. The video stream is captured by webcam and transferred to raspberry pi. The raspberry pi uses a motion freeware to connect and stream video feed received from the webcam. The motion configuration file is fully customizable and also allows to change video quality.

The fish feeder is powered by a servo motor. The servo motor is connected to raspberry pi 3 model b using 3 pins Vcc, Gnd and signal. The Vcc pin is connected to 5v vcc and Gnd to Gnd. The signal pin is connected to GPIO01 pin

which uses pulse width modulation to drive the motor to desired angle and back. In this project the feeder rotates a total of three times and back and drops appropriate food required for fish.

To control light using relays . Relays are connected using 3 pins that is Vcc, Gnd and logic pin that is GPIO0. The Gpio0 is used to turn relay on or off. A logical low turns it on and a logical high turns relay off.This property enables the user to control high voltage devices.

The heater is controlled using Relays which are connected to raspberry pi. Relays are connected using 3 pins that is Vcc,Gnd and logic pin that is GPIO2. The Gpio2 is used to turn relay on or off. A logical low turns it on and a logical high turns relay off.

The filter keeps the water clean. Relays are connected using 3 pins that is Vcc,Gnd and logic pin that isGPIO3. The Gpio3 is used to turn relay on or off. A logical low turns it on and a logical high turns relay off.This property enables the relay to turn on /off filter.

The android app has 6 pages each designed for a different task. The app starts with a splash screen displaying the name of the project and lands up on the menu. The menu has 4 options such as live stream, controls, help and about. The live stream option navigates to a new page where video stream of the aquarium is displayed. The control option directs to control activity page which has 4 button to control light, feeder, heater and filter of the aquarium. The help option has information to use the app. The about section has details on the version, motivation and developers.

3. IMPLEMENTATION

Live stream

The live stream was implementated using a webcam, raspberry pi and motion. The webcam is connected to raspberry pi using usb 2.0. The motion software is used to capture footage from the webcam and stream it to web browser on port 8081. The motion software has a configuration file which can used to set width and height of the footage it also provides range of settings to modify the footage.

Raspberry pi Server

A sever controlling lights, feeder, heater and filter is implementated in this stage. The raspberry pi is programmed using pi4j to control the Gpio pins which in turn control the various equipments of the aquarium. The program written in pi4j uses wiring pi to control these Gpio pins. The server uses java socket connection to read from the client(android app). The server is started on the port 6000 using the commands.

a. Pi4j –compile fServer.java
b. Pi4j –run fServer.java

On successful run of server message is printed Server started on port 6000

Android app

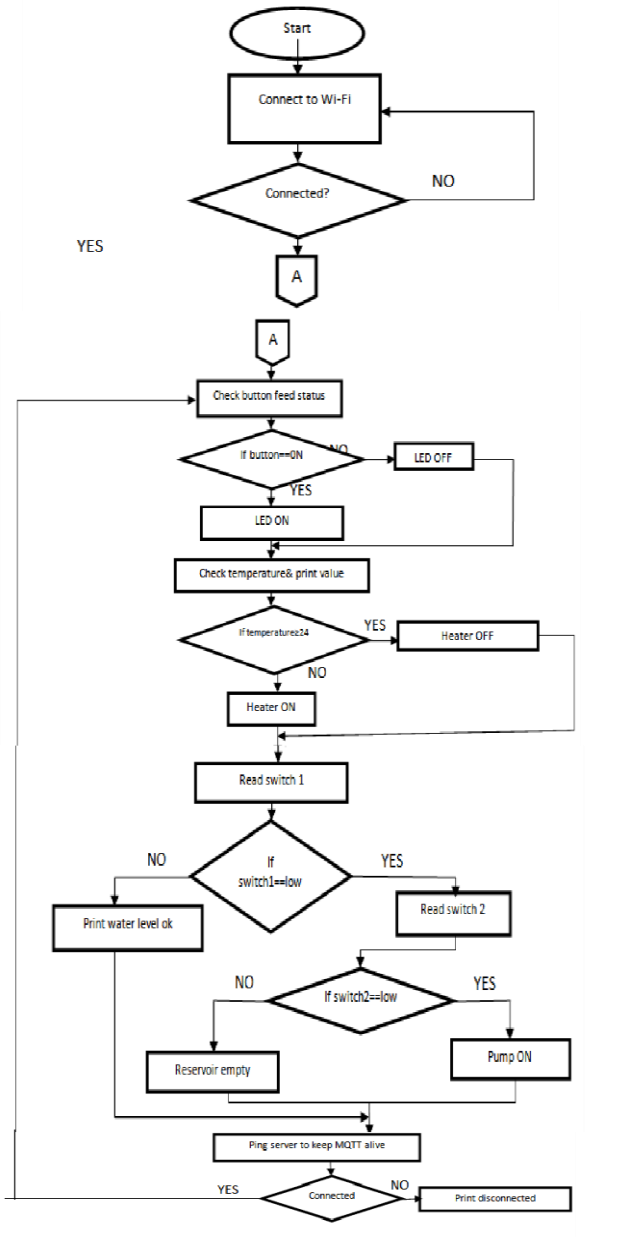
The android was developed using android studio. It was divided into 6 modules the splashscreen, menu, main activity, about, help and live stream. The android app uses java socket connection to write to the buffer on raspberry pi server. These strings are read and corresponding fuctions are called.

Flow chart

We have designed an automated aquarium system based on IOT. It has the following features

- An automatic and manual control of light, where in automatic control light(led strip)will be turned on/off at specific time and in manual control user can turn on/off the light through Google assistant /button provided on dashboard.
- An automatic fish feeder, which feeds small portions of food at scheduled intervals.
- An automatic temperature control, where the heater is turned on depending on temperature of tank water, also the continuous temperature values of tank water are displayed on dashboard.
- An automatic control of water pump, where depending on the water levels of tank and reservoir the status of motor will be automatically controlled.

Thus user can monitor and control the aquarium using the Adafruit IO dashboard from any modern web browser using a computer/laptop.We have also created a web mobile app for quick access to Adafruit Io dashboard using mobile.



4. CONCLUSIONS

We started off the project with aim to accomplish the simple looking task of designing an Smart Aquarium. But with time and experiences it was learnt that this was not at all an easy task, specially interfacing the relays and servo motor .Though we are able to achieve all the goals of our project but still we think that lots of advancement can be done on this project. We have provided the platform and the platform is ready for everyone to work on it. For advancements, we need more time, money and hard work .Money would remain the critical issue cause in order to upgrade the project many of the stuff would need an up-gradation. Nevertheless this project has been a success as far as learning and practical implementation of Computer science and engineering concepts is concerned. The basic idea proposed in this project works well and can be implemented on any aquarium. Having a Smart Aquarium, will save our time and we would not have to be worried for our fish and their aquariums for long time.

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