# Smart Aquarium

## Introduction:

As the love for aquatic organisms is increasing, people are keeping varieties of fishes and aquatic plants in their homes. Witnessing the fishes swim is truly fascinating, but when it comes to maintaining the aquarium, it's actually a boring and time-consuming task that many don't like to do.

As a solution for this issue, this interactive Smart Aquarium system has been designed using Raspberry pi-4. The intent behind designing this is to help all those pet lovers who don't want to be pond keepers!

It just requires the user to send command via mail to Rpi's mail id and the action, associated with the command, will automatically be performed by Rpi

## Code Overview:

The code essentially consists of three classes, namely *Email, Aquarium_functions* and *RaspPi*. The *Email* class has member functions that make interaction between user and Raspberry Pi possible by sending, receiving and reading mails.The *Aquarium_functions* class has methods that allow Raspberry Pi to perform physical computing.

Finally, the *RaspPi* class has two data members, namely *interact* and *function*, which are instances of *Email* class and *Aquarium_functions* class, respectively. All the activities in the program are performed by calling the methods using a global object of the *RaspPi* class.

## *Class Organization:*

```
class Aquarium_function():
        SendPic():
        GlowLED(i):
        Stream(i):
        SendAlbum():
        CheckLevel():
        Feed():
        Alter():

class Email():
        Read_Mail():
        Send_Mail(choice):
        Del_Mail():
```

```
class RasPi():
        interact=Email()
        function=Aquarium_functions()

Rpi=RaspPi()
```

***Aquarium_functions* class methods**

**SendPic():**

This method uses picamera module to capture a snap of aquarium and calls *Send_Mail* method of *Email* class to send it to user's mail. Before and after taking the picture, *GlowLED* method is called with parameter 1 and 0 respectively.

**GlowLED(i):**

*GlowLED* activates the necessary GPIO pins to glow a white LED connected to them when the camera takes pictures or records video during night time. Datetime module is used to determine the time of the day. When this method is called with its parameter 1 or True, it starts glowing LED, which gets switched off when the same method is called with parameter 0 or False.

**Stream(i):**

*Stream method* allows fish watchers to have fun as it streams the live video of aquarium on YouTube. When this method is called with parameter 1 or True, it starts live streaming, and calling it with parameter 0 or false makes it stop the livestream

**SendAlbum():**

If the user wants to view all the pictures of aquarium at once, then this method should be called. *SendAlbum* compresses all the images taken so far into a zip file and calls *Send_Mail method* to send it to user.

**Feed():**

This method, when called, activates the required GPIO pins associated with the fish-feeder, which basically is a Linear Resonant Actuator (LRA) supported food particle scattering setup. Switching on the LRA for few seconds will scatter sufficient number of particles for the fishes to consume. After few seconds, the method deactivates the pins.

**CheckLevel():**

To check whether water in the aquarium is above a required level, one end of a semi-insulated conducting material, from which a floating material is suspended, is connected to an input GPIO pin of Rpi, and the other end to one of its ground pins. It is set up in a way that only when water level is above the required threshold, the suspended floating material will close the circuit. Thus, this method checks whether the GPIO pins are receiving the 'low' input or not, and calls *Mail_Send* method to notify the user if the aquarium needs to be filled

**Alter():**

The time interval between two fish feeding routines and two water level check routines can be altered on request by the user. And this is what exactly the *Alter method* does. It reads the time duration from the mail sent by user and changes the same in the program.

***Email* class methods:**

**Read_Mail():**

This method is the most essential as it is the one that reads mails sent by user and calls the necessary methods of *Aquarium_functions* class to perform the desired actions. There are totally six commands that the user can give through mail. They are, STARTSTREAM, STOPSTREAM, FEED, ALTER, PICTURE and ALBUM. Feeding the fishes can be done on request too, though it's an automated process

**Send_Mail(choice):**

*Send_mail* method sends reply, picture and album zip file to user. It has a parameter named 'choice' which decides what it should send. If choice is 'ALBUM' it sends the zip file and if choice is 'PICTURE', it sends the latest picture that was taken.

**Del_Mail():**

*Del_Mail* plays a crucial role of deleting all the mails after they have been read and executed by Rpi. The non-deleted mails cause a serious problem as they may be reread and re-executed by Rpi

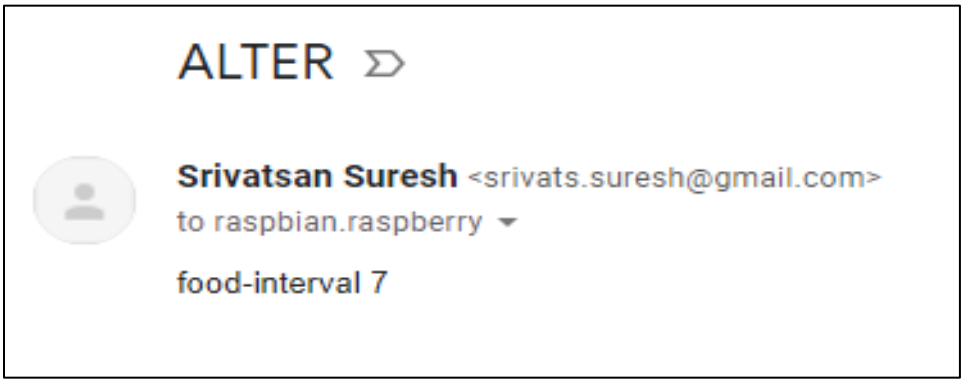
**Hardware Setup :**

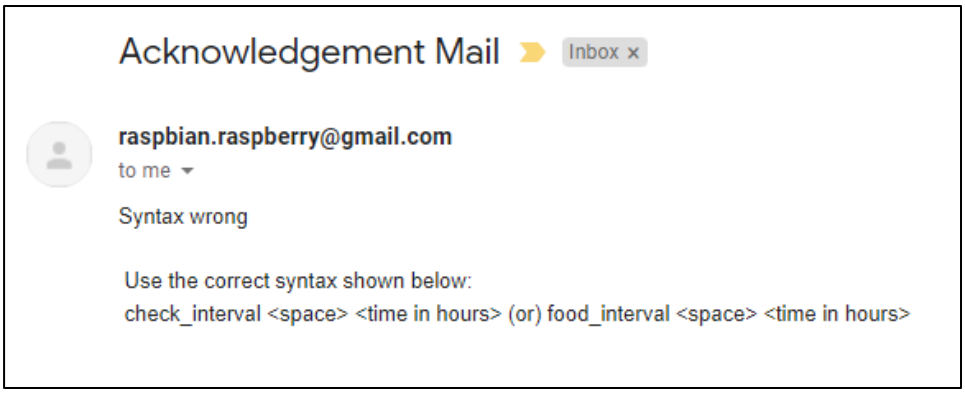
Raspberry Pi powered by power bank and connected to the environment through breadboard and wire setup

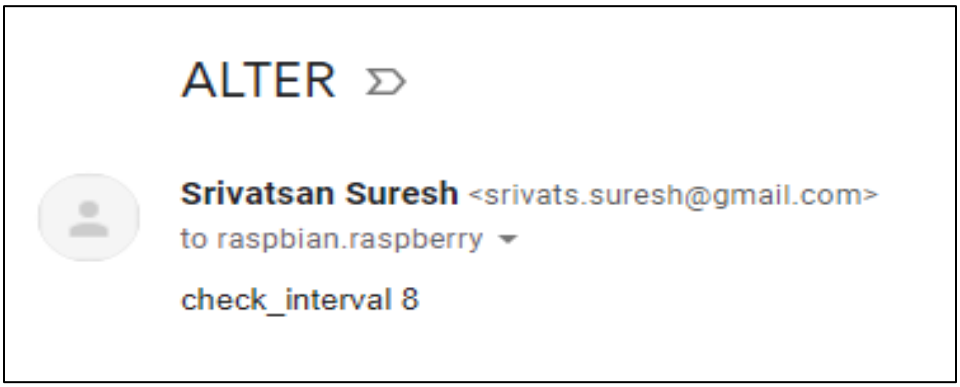
Smart Aquarium system featuring water level sensor, fish feeder, PiCamera, and LED for night photography

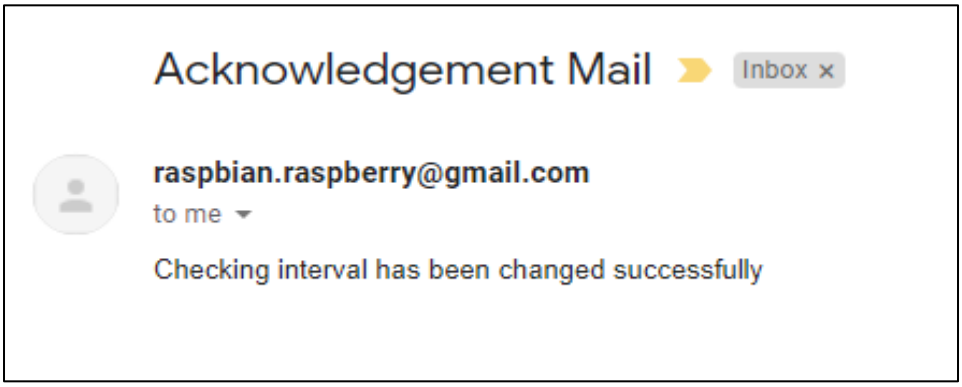
**Commands And Responses:**

**ALTER**




Acknowledgement Mail
Inbox ×
raspbian.raspberry@gmail.com
to me
Syntax wrong
Use the correct syntax shown below:
check_interval <space> <time in hours> (or) food_interval <space> <time in hours>


ALTER
Srivatsan Suresh <srivats.suresh@gmail.com>
to raspbian.raspberry
check_interval 8

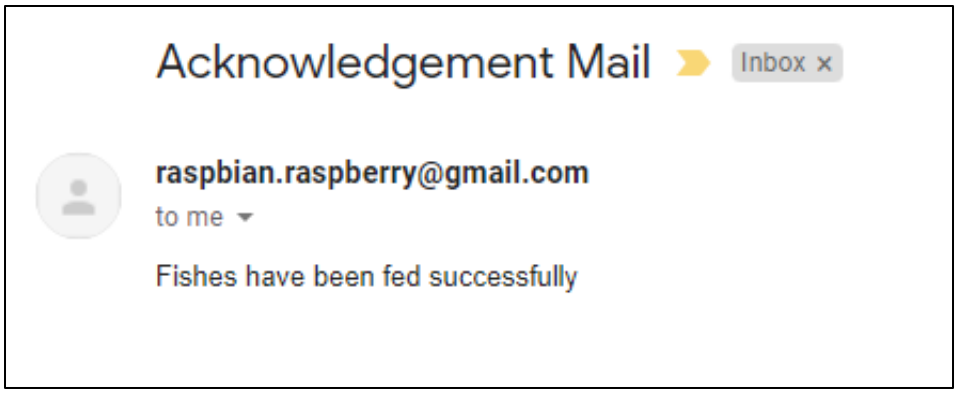

Acknowledgement Mail
Inbox ×
raspbian.raspberry@gmail.com
to me
Checking interval has been changed successfully

**FEED**

FEED

**Srivatsan Suresh** <srivats.suresh@gmail.com>
to raspbian.raspberry

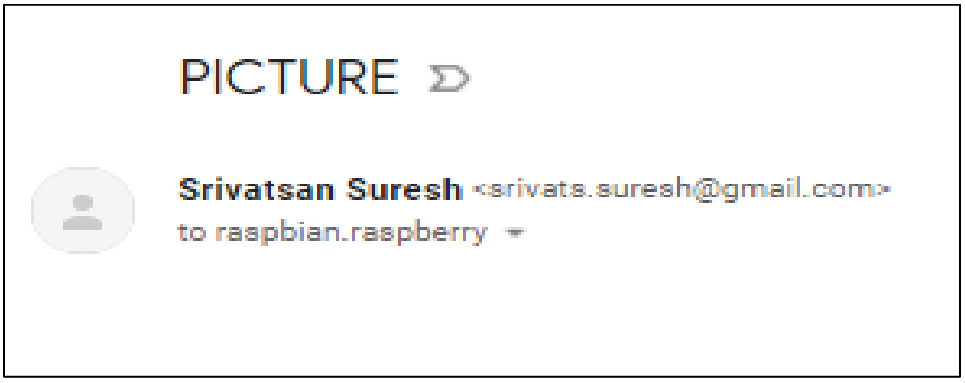
Fish feeder scattering food particles as LRA attached to it vibrates on receiving pulses from Rpi's GPIO pins

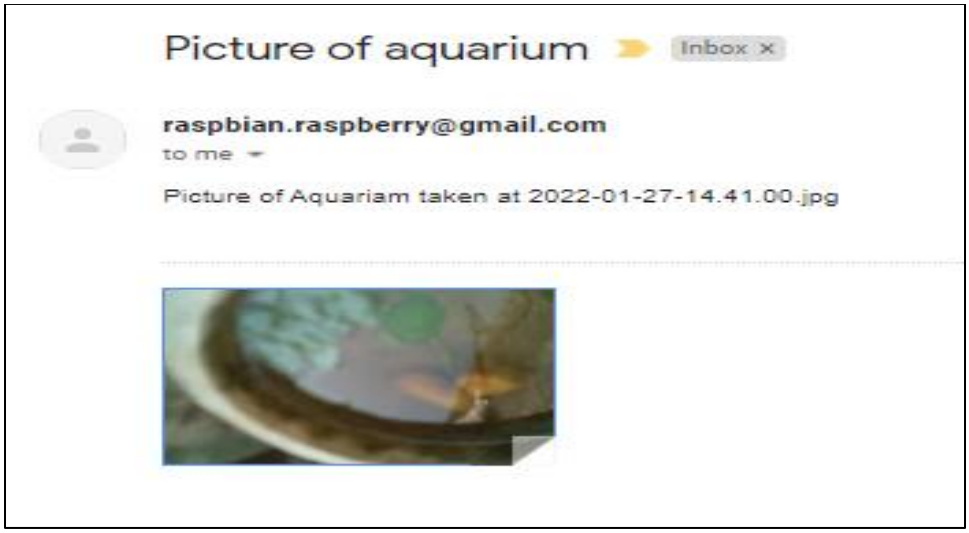



https://youtu.be/fun6i_T3vs4

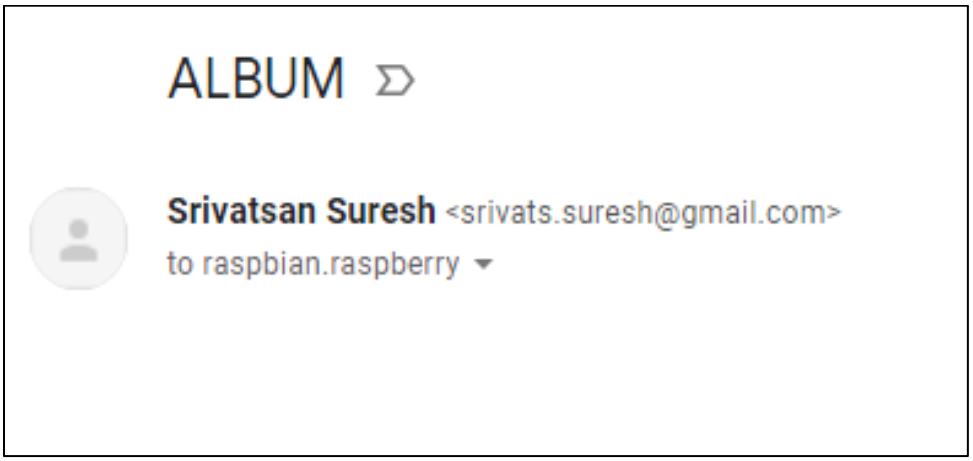
(YouTube video showing fish feeder in action)

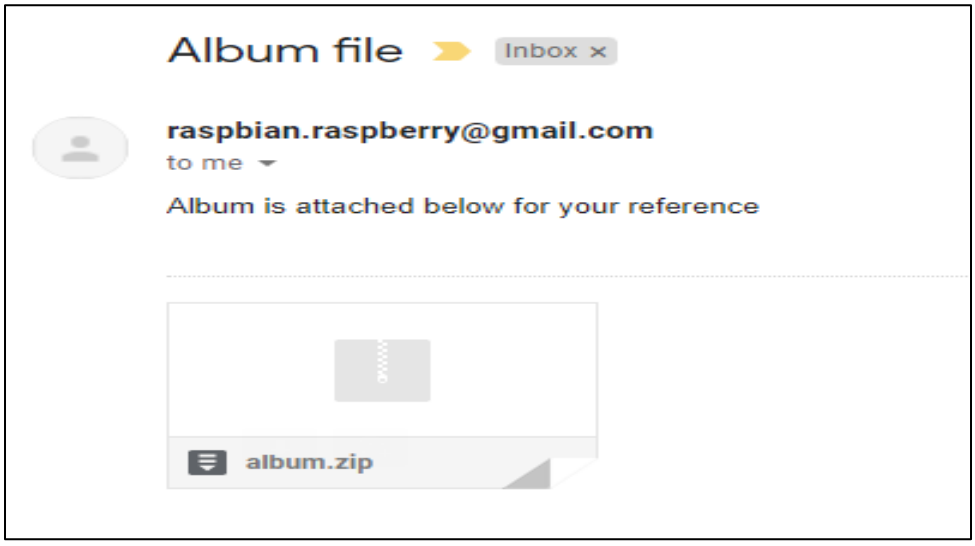
**SENDPIC**

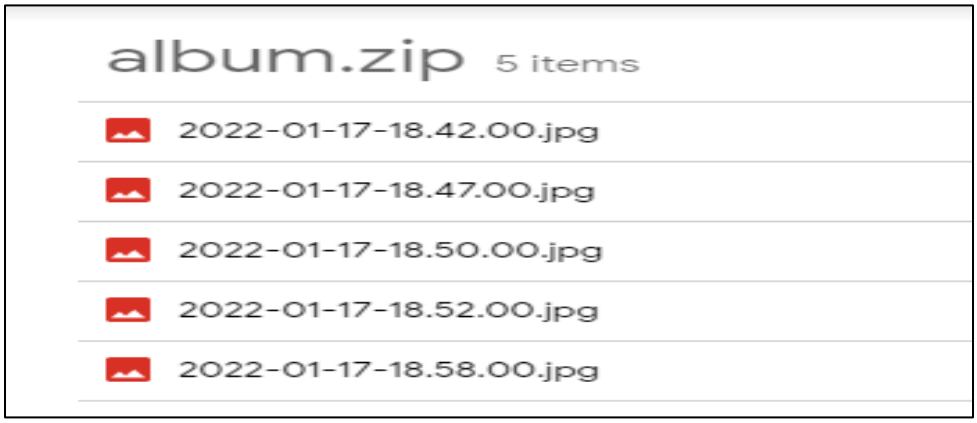


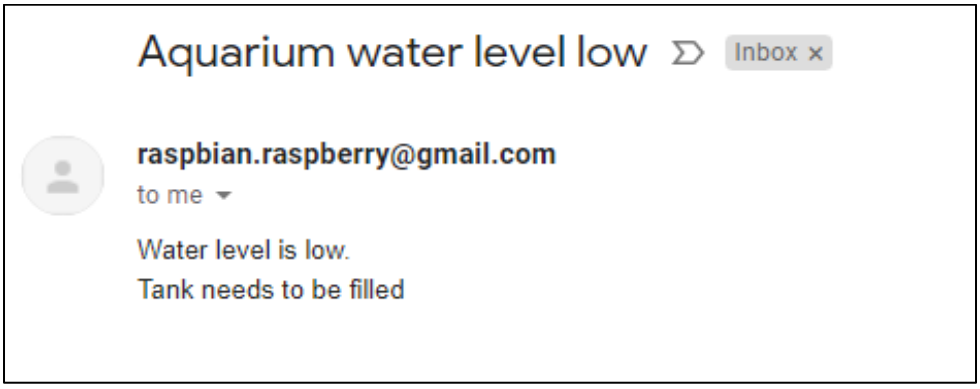
**ALBUM**


ALBUM
Srivatsan Suresh <srivats.suresh@gmail.com>
to raspbian.raspberry


Album file
Inbox ×
raspbian.raspberry@gmail.com
to me
Album is attached below for your reference
album.zip

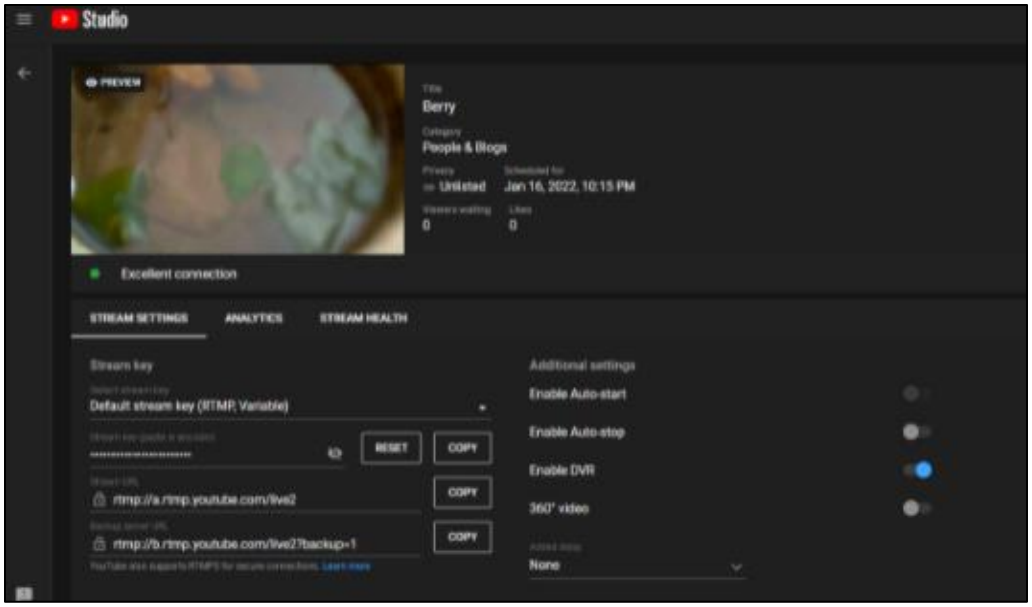

album.zip 5 items
2022-01-17-18.42.00.jpg
2022-01-17-18.47.00.jpg
2022-01-17-18.50.00.jpg
2022-01-17-18.52.00.jpg
2022-01-17-18.58.00.jpg

**CHECK LEVEL**



Water level reduced below the required unit and, thus, the level tester has entered the insulation region

**LIVE STREAM:**



Live streaming the aquarium on YouTube