Software Engineering Group Project
Group: G
Interim Group Report

Project Title:
System for the detection, organization, and communication of sea turtle hatching events.

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1.Abstract

According to the World Wildlife Fund for Nature (WWF), half of the sea turtle species are critically endangered and currently, almost all of the sea turtle species are witnessing a rapid decline in their population. A National Ocean Service report reveals that out of every 1000 hatched sea turtle eggs, only one makes it to the sea and manages to become an adult. If sea turtles keep dying at the current pace, unfortunately, many of the species will go extinct within a span of 20 years (Brahambhatt, 2022). So in collaboration with Dr Nik Fadzly bin Nik Rosely, we will be developing a turtle hatching sensor to detect the exact time that the first individual of a nest emerges from its eggshell.

2.Introduction

2.1 Purpose

The aim of this project is to determine the first emergence of the turtle deep in the sand up until the final emergence on top of the sand layer. With this, we can determine the time needed for the total time for the turtle to emerge from the egg up to the top of the sand layer. With this data, we can determine the best average time for the turtle eggs to hatch and increase the hatch rate of the turtle eggs.

2.2 Client

Dr Nik Fadzly bin Nik Rosely, a lecturer in University Science Malaysia.

2.3 Project Scope and Deliverables

The objectives of this project are to:

1. Implementing a color detection software to detect color changes in the sensors created by Dr Nik and recording them into a database.
2. Compiling all the changes into a report and sending it via email or saving it locally on the computer.
3. Implement a webpage for researchers to access and monitor the sea turtle egg hatching process on-site.

2.4 Existing Solutions

Our egg hatch detection project has a webpage which will show the video feed of either a webcam or an external camera depending on the input source. Users will be able to add more camera feeds and edit currently existing ones by pushing the '+' button on the webpage. Users will need to access the link at the top of the webpage which will redirect them to a chatbot channel which will give status updates at regular interval about the status of the turtle eggs.

On the manage streams page, adding streams will take user input on what name they want their streams to be and the camera input

of their choice,for example, users are able to connect a camera using bluetooth, HDMI etc while naming them ‘bedroom camera’ or ‘camera 1’.

3. Product Details

3.1 Product Features

The major features of the Hatchery Monitoring Webpage and HatcheryBot will be the following:

- **Natural Language Responses:** The responses by the telegram chatbot will be written in standard and understandable English
- **Multistream Monitoring:** The webpage will provide different camera streams for easy monitoring.
- **Daily Updates:** A telegram chatbot will be provided if requested on the site which will provide daily updates on the hatchery eggs’ condition

4. Project Description and Requirements Specifications

4.1 Project Description

Chelonia mydas, or the Green Sea Turtles, are among the most common sea turtles found on Malaysia's East and West coasts. One of the most studied components is the hatching rate and the hatching mechanism. We are interested in studying the exact time that the first individual emerges from its eggshell (which is hard to pinpoint since the egg clutches are buried deep within the sand). There is a delay from the moment of emergence from the shell to the digging process, right up to the emergence on top of the sand. We need to build a sensor that can detect the first emergence(within the sand) and the final emergence on the top sand layer. We are interested in the time and, if possible, the environmental conditions during the process. The system should be cheap, robust and can work online and offline.

4.2 Functional Requirements

4.2.1 Basic Color Detection

- The program is able to detect color changes in the LEDs and record them in a database.
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4.2.2 Report generation

- A report is generated based on the changes of the LEDs with the exact time of the change and send to the user via email or telegram. If there is no internet access then a report is generated locally.

4.2.3 Color identification

- The program should be able to differentiate the different colors emitted by the LEDS based on the parameters defined in the program.

4.3 Non-Functional Requirements

4.3.1 Python Language

- The software is developed using python language. We are using open cv to detect color and flask to send the processed video to the admin page.

4.3.2 Multi Threading

- The program should be able to process multiple streams at once and display them in the admin page by using multi-threading.

4.4 Problem Description

Dr.Nik is a researcher at a Terengganu turtle hatchery working to improve the conditions of the egg hatching process of turtles and seeking to know more about the conditions of the surroundings during the egg hatching process and the time it takes for the entire egg hatching process to finish.Thus, Dr.Nik has requested for a program to calculate the hatching time of the turtle eggs and ID the eggs.

5.Group Organization and Responsibilities

5.1 Workload Division

During our first meeting of the project, the workload was divided equally among all the members and was unanimously decided upon which member would work on which part of the software development. All members had agreed to working on

their tasks and confirmed again by the Group Leader that this was what they wanted to work on.

Responsibilities on the group project were as follows. The Group Leader worked with another group member on designing the interface of the website and all the features it had on it. One group member was tasked with developing the database needed for the website and as extra support for the next group, the color detection software development and implementation. Two group members were assigned and an extra was added as support as this was the most challenging.

A hands-off approach was taken by the Group Leader into completing the project. All parties were working by themselves to achieve the required goals set by the Group Leader. A biweekly progress check was held by the Group Leader to make sure that every group member was working on their part to keep up with the updates on the group project so that everything ran smoothly.

5.2 Meetings

Meetings during the project of the first semester consisted of many different types. Firstly, there was the meeting with our lecturer, Dr. Tomas, which was held biweekly within Microsoft Teams which was considered high priority and was important for each member of the group to attend. The date, time and attendance of group members of this type of meeting have been recorded in an excel sheet ,shown below. THis also includes our first meeting with our client Dr. Nik which was on 20th of October 2022.

Meeting	Date	Dylan	John	Malavika	Zi Jun	Inthra	(x indicates attendance)		
1	7/10/2022	x	x	x	x	x			
2	20/10/2022	x	x	x	x	x			
3	21/10/2022	x	x	x	x				
4	4/11/2022	x	x	x					
5	22/11/2022	x	x	x	x	x			
6	2/12/2022	(changed to email update)							

Secondly, informal meetings are only attended by group members and are held whenever during the course of this project. Due to time constraints this semester, informal meetings needing the attendance of all members are only held 2 to 3 times and these meetings are only held if there was important information needed to convey to all group members. On the other hand, informal meetings were also held between group members of their respective parts to finish up their part in the group project before the deadline.

Only formal meetings such as the biweekly meetings held with the lecturer were recorded and any other meeting/meetings held between group members of their respective parts were between themselves only and thus no information was recorded.

6.Project Workflow

6.1 Initial Thoughts

When the project was first revealed around the start of the semester, we had a meeting discussing the plan on how to tackle developing the entire software. Initially, we thought we had to use motion detectors in the sand to detect the hatching of the turtle eggs through the vibrations in the sand as the turtle were slowly climbing up and emerging through the sane. Later, after conversing with our client, Dr. Nik, he had explained to us what we needed to do in detail which was to develop a software that could detect colors through a video feed and detect a color that was being projected by an LED which was taped onto a stick that could detect the movement of the turtle as they were working their way through

the sand and change the colors of the LED as the turtles slowly make their way out of their eggs and onto the surface.

The further explanation done by Dr. Nik helped us understand the project description more deeply. After that, we had a physical meeting with all the members discussing the methodology we were going to use. We had decided on using a website to develop and implement the software.

6.2 Initial Design of the Website

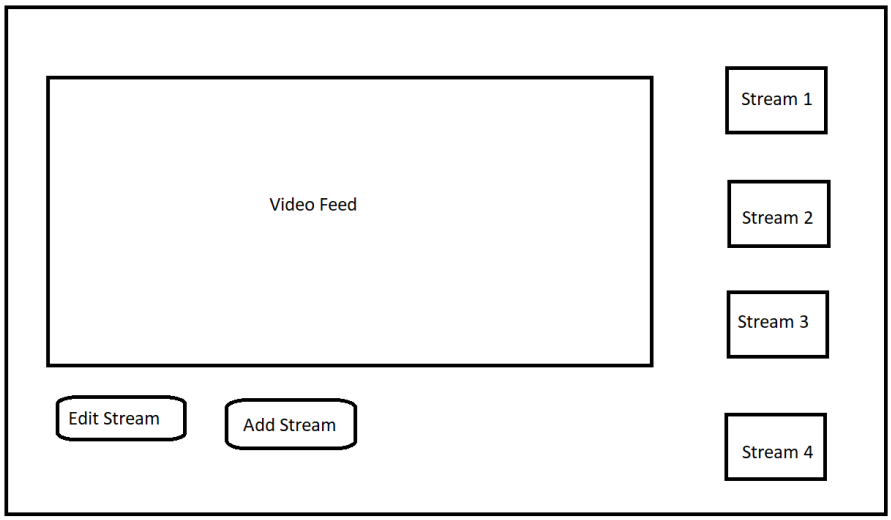


Diagram 6.2a
Initial design and blueprint of the website

The front-end website implementation was done by the group leader, Dylan Pee and another group member, John Chieng. Using HTML and CSS, a webpage consisting of various different elements was implemented. When we first started, the problem of hosting the website on either a web-server or through a web-hosting site was a main problem. Since we did not know whether we were going to have the website stream the video feed through an online service or it being a client-side video stream, we tried to implement other video streaming websites APIs' onto our own website but it ultimately did not work. After consulting the client, he informed us that the online feature can be implemented through a telegram chatbot giving updates on the current status of the turtle eggs. With this, now we have a telegram bot to implement to help with finishing the online requirement of the program. With a major problem solved, we could now continue working on the site to make it better.

6.3 Mid-Implementation of the Website

Now with a clear understanding of what we were supposed to do we could finally start on the framework of the website. At first, a sidebar was implemented to help organize the different video streams that were going to be implemented in the future. The sidebar had buttons showing from top to bottom showing 'Stream 1' to 'Stream 8' with the name of the website at the very top of the sidebar 'Turtle Streams'.

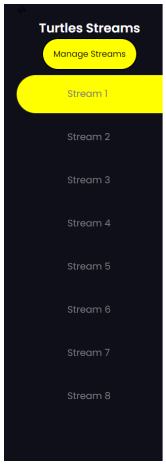


Diagram 6.3a

First iteration of the video stream website

After that, as a test for running live video feeds, we used javascript to take the user input of their webcams which also needed the permission from the user to access the webcam. A popup asking for permission to access the webcam will be shown.

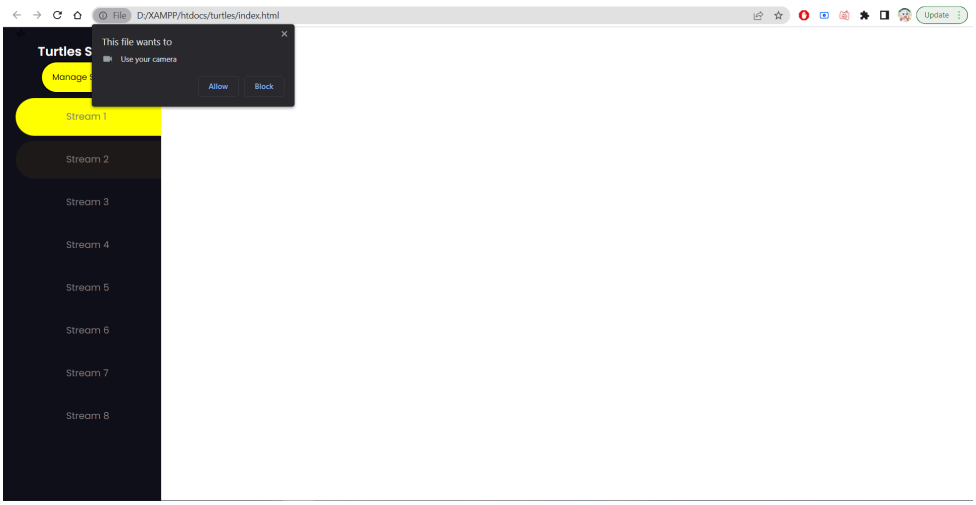


Diagram 6.3b

Javascript popup asking for permission to access webcam

Once permission was granted, the webcam would stream onto the website and show the video feed through a box. If permission was not granted, another javascript popup would ask to give permission to the webcam for the website to work. A manage streams button was also added to be used later.

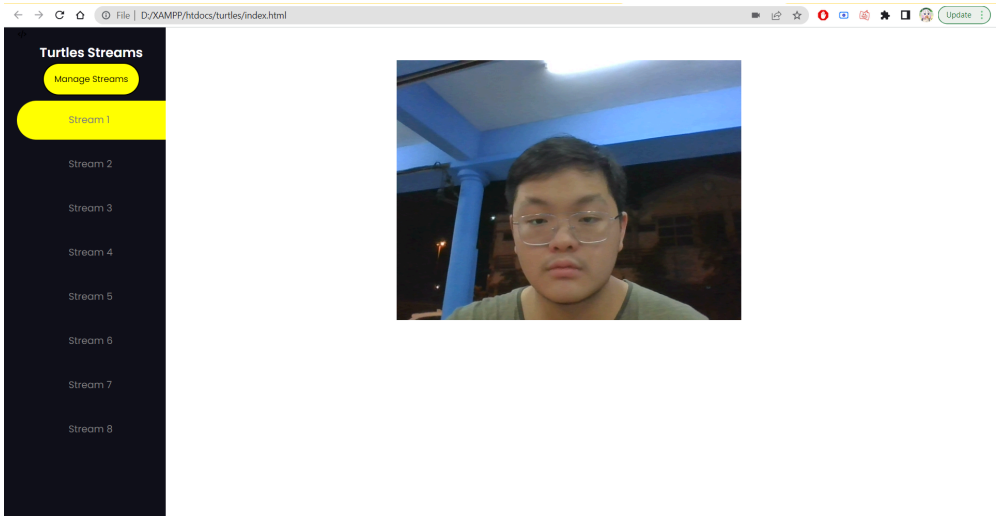


Diagram 6.3c
Javascript popup showing video footage of webcam

A temporary database was made in order to help organize and identify the different streams on the website. This included stream ID and stream URL (this was implemented before we knew that we did not need online streams). To access and manipulate the data of the website, a ‘Manage Streams’ page was also added. This page was a simple interface which included a multiple-selection delete button, an add stream button, a table showing the Stream ID, Stream URL and an Edit Stream button to change the ID and/or Stream URL.

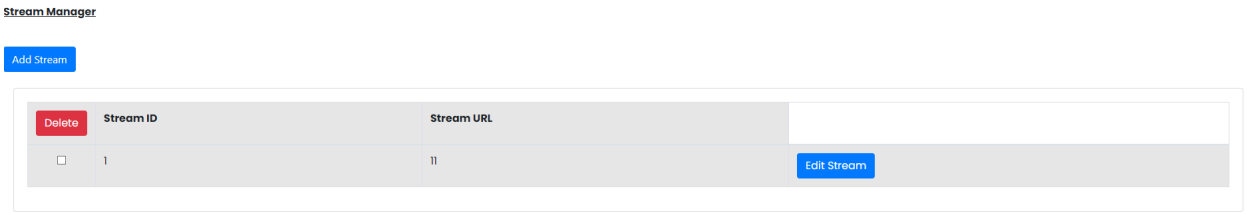


Diagram 6.3d

Manage Streams webpage

6.4 Final Iteration of the Prototype Website

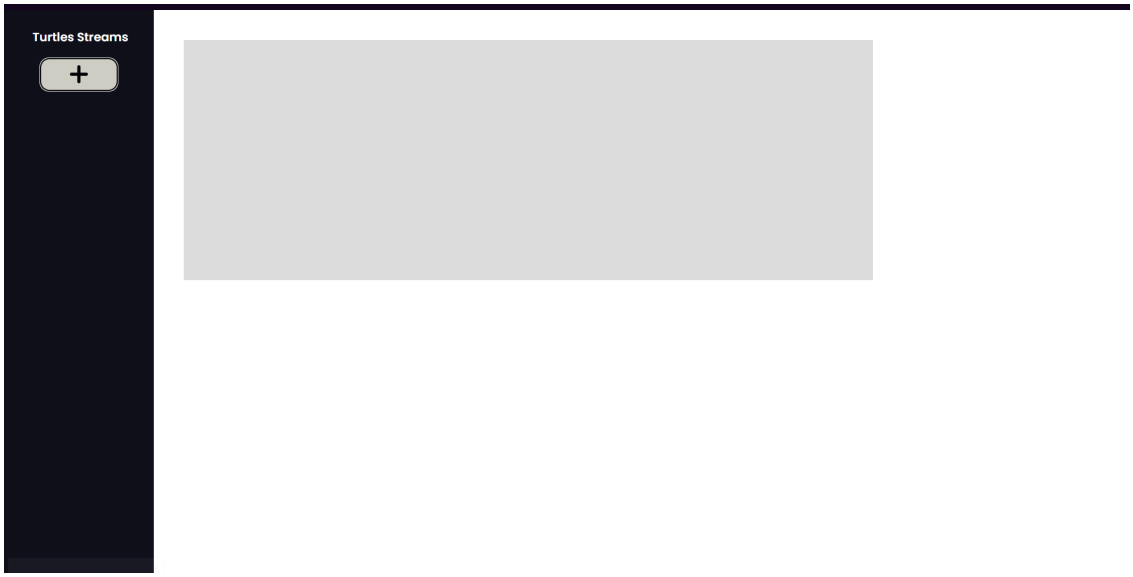


Diagram 6.4a

Final iteration of the prototype website

Few changes were made in accordance to minimalise the look of the page :

- Instead of having all 8 streams in the sidebar showing nothing, a ‘+’ button was added which would take the user to the manage streams page
- A box showing where the stream should be placed has been added

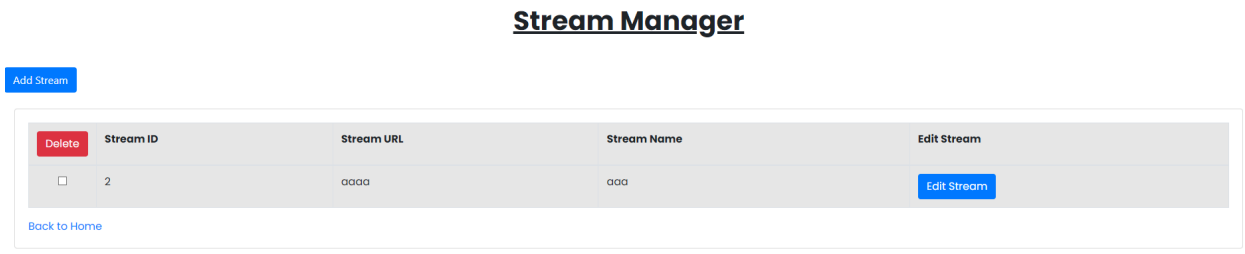


Diagram 6.4b
Final iteration of the prototype stream manager page

The Stream Manager page has also been touched up a bit and some back-end coding has been changed:

- Add Stream button now works and shows a javascript popup to access and manipulate the database values
- Edit Stream button now works and shows a javascript popup to access and manipulate the database values

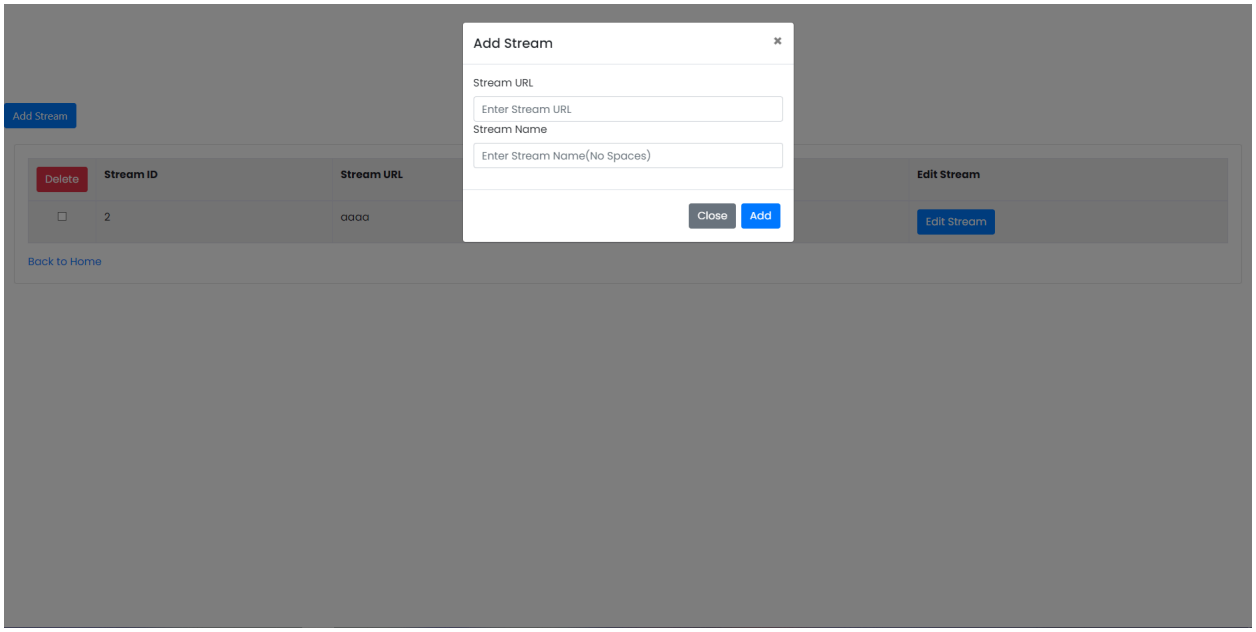


Diagram 6.4c

Javascript popup of the Add Stream button

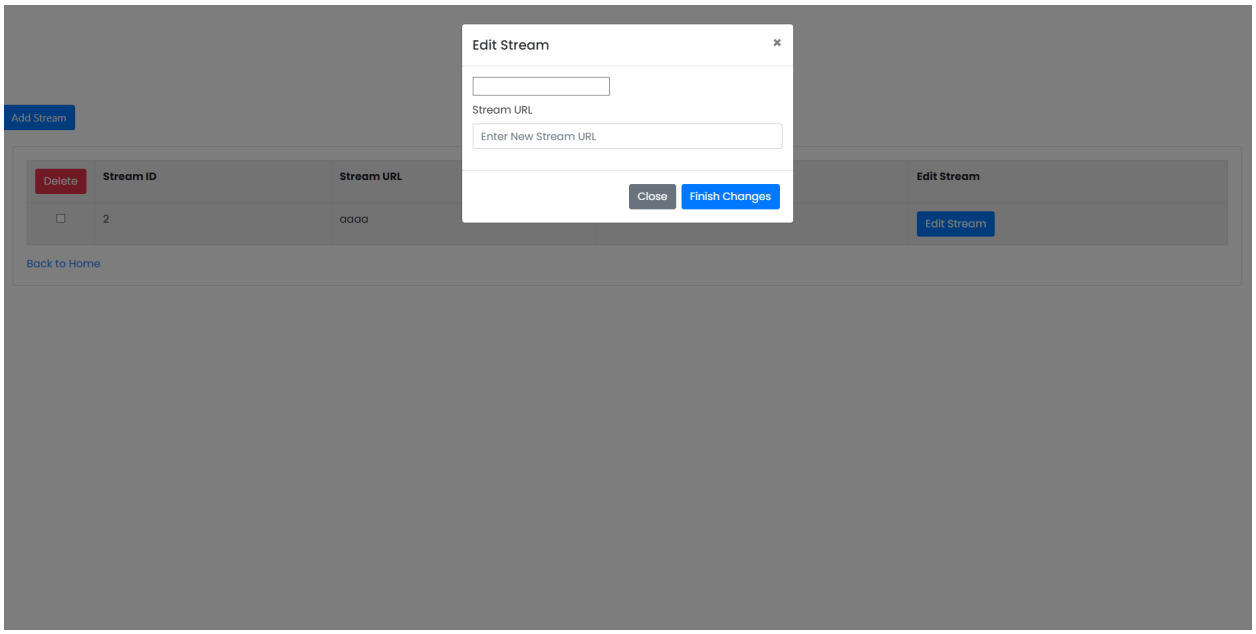


Diagram 6.4d

Javascript popup of the Edit Stream button

6.5 Turtle Hatching Detection Program

6.5.1 Criteria

- **Basic Color detection**
  Able to detect different colors on screen depending on the defined parameters.

- **Color Differentiation**
  Able to differentiate between different colors and accurately identify them.

- **Real Time color detection**
  Able to detect colors in real time and their changes while recording them in a database.

- **Multiple Stream Support**
  The program should be able to handle multiple streams at once using multi-threading and allow the admin to manage them through the admin page.

- **Generate report everyday at a specified time**
  Using telegram's api we would send the generated reports obtained from the database to the user everyday.

If there is no internet access, a local report file will be generated instead.

6.5.2 Description

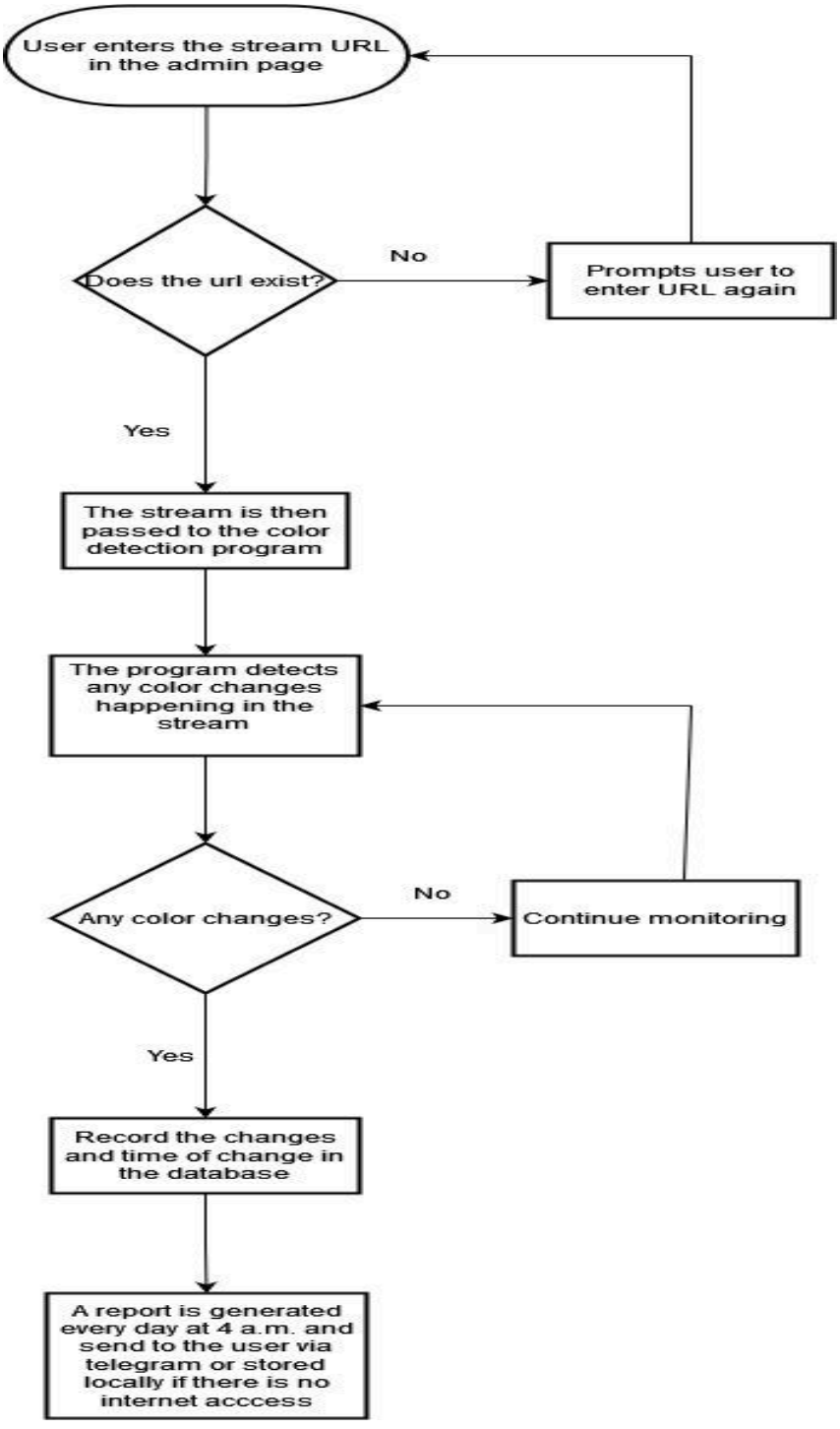
- **Introduction**

- The program will be given a video feed from a camera which is pointed at the turtle nests. On top of each nests are LED light indicators that indicate the stage of which the turtle eggs are in using different LED colors. The program will then record the initial stage of the LEDs and continuously monitor them. Any changes in the LEDs are then detected and recorded in a database. A report is then generated everyday at 4 a.m. which is then sent to the user for review.

- **Admin Page**
- Using the admin page the user is able to manage the streams and watch the color detection processes in real time.

6.5.3 Detection FlowChart

The following is the flow chart for the color detection system. To see a clearer image please refer to this link.



8. Discussion

Throughout our work thus far we have made practical decisions in order to familiarize us with the technologies we will be utilizing. We decided to use user defined rgb ranges to define the colors instead of using **machine learning** which may cause some inaccuracies in some cases. To improve this we can use machine learning combined with open cv in order to create a color identifying artificial intelligence instead of following parameters defined by users which have a higher error margin.

Current color detection program only supports one stream at one time. This could be improved by using **multi-threading** which utilizes all the threads of the CPU each processing their own stream.

Further work could also be done on the connection admin page where in its current stage cannot be remotely accessed when outside of the local area network which can make remote work troublesome. A simple **virtual private network** can solve this issue.

Furthermore, the current layout of the admin page could be improved on as to increase usability of the page and all its

functions. Allowing it to be more intuitive rather than the user figuring out all the functions themselves.

Currently we have yet to implement the pass through of the processed video to the admin page as we are still learning flask. We hope to achieve that by the end of next semester. As of now we have achieved what we set out to do, a semi functional prototype. Now all we need to do is piece them together and it should be functioning.

9.Conclusion

All in all with a semi-working prototype in hand , we are encouraged by the potential that this program holds, not only in the field of Environmental Ecologist but in many other fields as well , with a bit of modification and imagination this technology can be applied anywhere. However, the program at its current stage still is still not ready to be deployed as it still needs more refining but we hope that by the end of next semester we are able to release our first working prototype.

10.Reference

1. Brahambhatt, R. (2022, October 31). *A nest-monitoring device can save more sea turtle hatchlings and fight extinction*. ZME Science. https://www.zmescience.com/science/news-science/a-nest-monitoring-device-can-save-more-sea-turtle-hatchlings-and-fight-extinction/