SMART AQUARIUM: FISH BEHAVIOUR ANALYSIS

Abhinav Pratap Singh[1],Tera Mahitha[2], Kushal M Reddy[3] ,Govardhan Reddy[4] Dr.Mithun Hanumesh[5]

[1] Student, Dept. Of IT, Alliance University, Karnataka, India
[2] Student, Dept. Of CSE, Alliance University, Karnataka, India
[3] Student, Dept. Of CE, Alliance University, Karnataka, India
[4] Student, Dept. Of CSE, Alliance University, Karnataka, India
[5]Assistant professor, Dept of CE, Alliance university, Karnataka, India

ABSTRACT

Our project's main goal is to use fish behaviour analysis to improve the Smart Aquarium experience. We have created a web-based platform that allow customer to evaluate and learn about the behaviour of their fish by utilizing the MERN stack. The mission of our initiative is to extend user awareness and competence is fishkeeping by using the questionnaire personalized for the given user and delivering articulated answer that have been crafted based on thorough research. We eye the creation of a seamless and oriented user interface to be utilized by aquarium enthusiasts to acquire a better and stronger bond with their aquatic pals through persistent assignment to enhancement and optimization.

Keyword :- *MERN, IoT, UI, AJAX ,JSON, API*

1. INTRODUCTION

Introduction In the world of aquatic pet care, keeping a Certainly, the aquatic pet care world necessitates the full grasp of fish behaviour to maintain a healthy and peaceful environment in an aquarium. Nevertheless, it can be tedious and subjective to manually conduct observations and analysis of fish behaviour using the present methods. Our Smart aquarium system which analyses fish behaviour with the purpose of solving these problems and bringing a new approach of aquarium experience is at the center of our project.

The combination of the most creative technological elements with the classic hobby of the aquarium has got our project. We implement the MERN stack (MongoDB, Express.js, React.js, Node.js) to set up an elaborate platform in a way that can be simply used. We aim to offer our aquarium hobbyists educational resources and information that will allow them to understand better how fish behave and at the same time establish a connection beyond just being another buddy. Our effort to merge the newest tech with the traditional hobby of fishkeeping is what makes our project exciting and innovative.

We are going to use the MERN (MongoDB, Express.js, React.js, Node.js) platform to create a powerful app while still having it to be simple and cute. No, the objective is to supplement aquarium hobbyist's knowledge and give them the right information and resources about fish pal behaviour thus they will develop a special connection with their aquatic friends. Our project's aim is to narrow down the information gap between scientific subjects and aquarium keepers. We depart from this group of enthused fans who in most cases tend to use subjective observation and trial-and-error methods towards a more structured approach for systematically analysing and interpreting fish behaviour. The basis of our venture is mainly the integration of aquaculture and technology with a long-term aim of ultimately obtaining a harmonious relationship between humans and aquatic life. We will remain fully concentrated on enhancing the platform throughout the development process so that it remains accurate, useful, and usable to boost the Smart Aquarium users' experience.

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2. REVIEW OF LITERATURE:

First off, the investigation of Internet of Things based systems for tracking and managing aquatic habitats offers a glimpse into how technology might be used to improve aquarium configurations (Jebali et al., 2020). Understanding the possibilities of incorporating smart technology into the project's framework requires this viewpoint. Second, the review on fish behaviour quantification offers insightful viewpoints on behavioural metrics measurement, providing an organized method for assessing fish behaviour (Stuart et al., 2019). The foundation for developing measures and parameters inside the framework for fish behaviour analysis is laid out by this review. Furthermore, the systematic review on computer vision-based automated fish behaviour analysis emphasizes the developments in technology-driven analysis techniques, which might be helpful in creating automated fish behaviour analysis tools (Nielsen et al., 2020).

Additionally, useful manuals and resources like "Understanding Fish Behaviour" and "How to Set Up a Smart Aquarium" provide information on typical fish habits, best practices for setting up aquariums, and integrating smart technologies .These resources complement the project's objectives and offer a useful grasp of the subject.
To sum up, the literature study provides a solid basis for the literature review for the SMART AQUARIUM project by addressing a wide range of subjects such as automated analytic techniques, quantitative behaviour analysis, Internet of Things applications, and useful advice.

3. METHODOLOGY:

3.1 Identify the needs of customer and users through field visits/surveys:

We spoke with aquarium hobbyists from a variety of backgrounds throughout our field visits to obtain a thorough grasp of their requirements and problems. We discovered a few significant issues that users confronted through in-depth interviews and observation sessions, such as the difficulty of precisely interpreting fish behaviour, the absence of organized advice for aquarium maintenance, and the need for individualized insights catered to their situation.
By addressing a larger audience and obtaining quantitative data on user preferences and priorities, surveys supplemented our field research. To find reoccurring themes and rank features according to how well they might meet user needs, we examined survey replies.

3.2 Translate the needs of customer into product:

After combining the information from surveys and field trips, we created a comprehensive list of product criteria that captured the demands and preferences of our target market. The core features that developed out of Smart Aquarium were the ones including the online form for filling out behaviour assessment questions, a real time mechanism for delivering individualized insights and a convenient interface which made it easy to navigate.
To guarantee clarity and conformity with customer objectives, each need was meticulously categorized and documented, providing the groundwork for ensuing design and development efforts.

3.3 Specification of the product:

With the product requirements in hand, our development team and I worked together to determine the parameters and scope of the Smart Aquarium platform. This included defining each component's functionality, laying out the technical issues (data storage and security procedures, for example), and charting the user experience from the first encounter to the receipt of insights.
To ensure that the finished product would live up to user expectations and offer a flawless user experience, thorough wireframes and mock-ups were made to visualize the user interface and validate the suggested design with stakeholders.

3.4 Designing the solution for required customer needs.:

Based on requirements and product specifications, the design team formed a groundwork for a solution that tackles all the known difficulties. The user-friendly interface of the questionnaire is designed considering the concept of user-cantered design. It brings interactive elements and shows the way to the users to invite them.

Backend systems were constructed to handle user replies, use machine learning algorithms to analyse data, and produce personalized insights on behavioural patterns that were established beforehand and research findings. Incorporation of an extensive depository that contained fish behaviour information will also ensure that customers get detailed and favourable response depending on their situation.

From the very start of the design and development process, user feedback has been sought and continuously included until the appropriate solution was arrived at that could adapt to the everchanging needs of our target audience Our efforts were fruitful and we came up with Smart Aquarium- an enclosed system which not only solves the problems faced by aquarium lovers but also provides them with useful information which eliminates the guesswork and thus provides them a pleasant experience.

4. Implementation:

We had to do a lot of window-testing during the development of the Smart Aquarium platform, so we could make sure it did work and would be effective. The testing, iteration and in the end, validation were the phases of the experiment process which was crucial for ensuring the powerfulness of the platform from satisfying the requirements and successfully serving the users.

4.1Testing and Validation:

We went through the process of tedious and comprehensive examination of all parts and components of Smart Aquarium platform to discover errors, mistakes, and inconsistencies. As part of the evaluation, both manual testing and automated processes were used for finding discrepancies, ease of use and suitability for various cases.

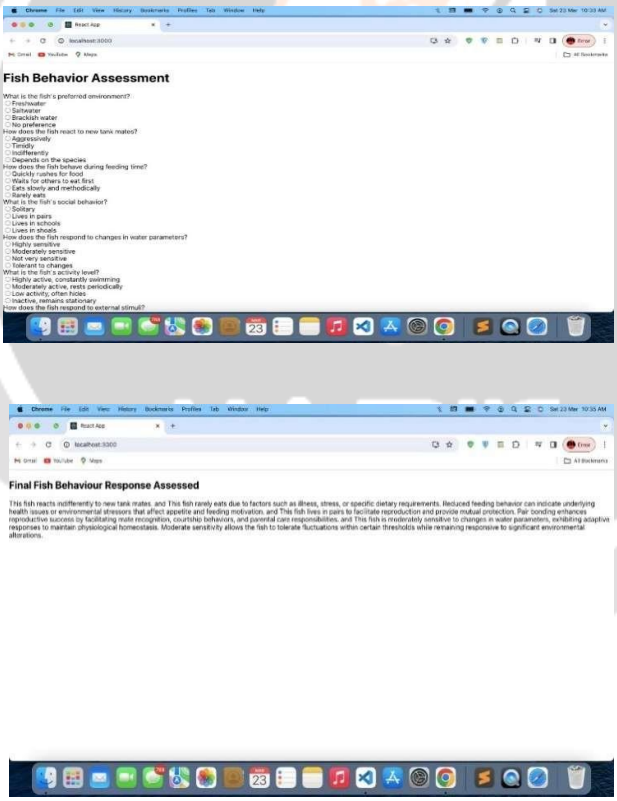

Fig 1:Screenshot of the in-phase development of project

4.2 Iterative Development:

The platform was continuously verified, fixed and improved on the beta-test basis: critical bugs were detected and solved according to users' feedback. Through iterative process, we made the app more and more user-friendly and performance-driven allowing us to also to add new features when needed or redesign part of the app when needed

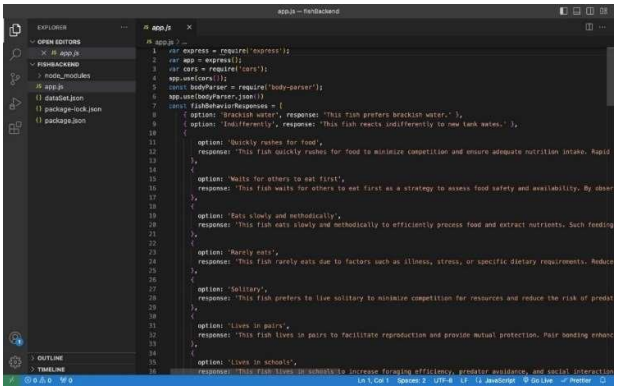

Fig 2: Iterative responses for the different response selection.

4.3 User Feedback:

Users' input is one factor that should be considered in planning an experimental process. We collected user feedback from different stages of development, through questionnaires, interviews, and user testing sessions to apprehend the experiences, preferences and any trouble spots a user may encounter. The most important thing was to guarantee that the already existing platform could be customized in accordance with the target audience's needs and expectations; this feedback was then included into the continuous development process.

4.4 Validation of Data Analysis Technique:

In addition to a close look at the platform's work we also tested to make sure the methods we employed to produce individualized insights for the user work. I used several methods to test the validity and reliability of the research. For instance, I compared the results with observed behavioural patterns and the recommendations from the experts.

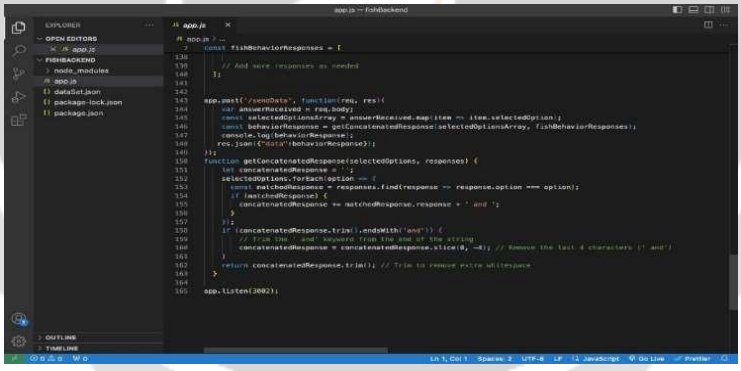

Fig 4.4: The figure depicts the coding logic of the project.

4.5 Performance Evaluation:

To test how suitable the Smart Aquarium platform is for different usage scenarios, such as its responsiveness, scalability, and efficiency, a performance test was conducted. Therefore, the process was figuring out whether the system worked according to the pre-determined metrics and standards and to the think over ways of processing the user request simultaneously.

4.6 Documentation and Reporting:

As the study progressed, the project members were always up to date with the documentation and reporting as they were used to track the progress, share the results to the concerned parties, and retain all vital notes in the project. This documentation tool, although a small one, was nevertheless an irreplaceable thing helping to promote collaboration, to keep transparency and to assist the decision-making process.

The testing ensured that our Smart Aquarium platform could indeed meet and even surpass the standards established for the product by the market. It was able to do so by ticking all the boxes provided for the customers. Besides, we were also able to find areas that lack optimization and improvement. This insight from the experiment method brought up some suggestions and revision for system version.

4.7 Result and Discussion:

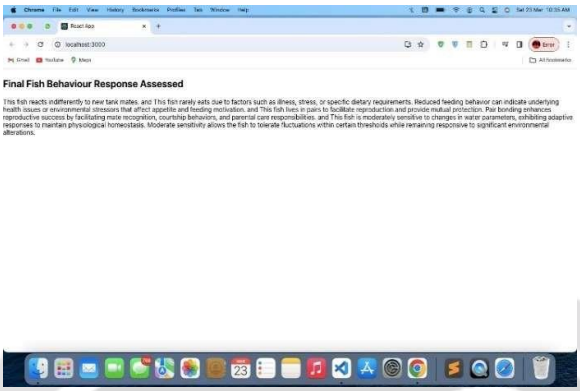

Fig 3: Fish Behaviour Response

When it comes to helping aquarium, hobbyists understand and control fish behaviour, the Smart Aquarium platform has produced encouraging results. By means of user participation and iterative refinement, the platform provides a formal framework for assessing fish behaviour and providing tailored insights. He platform's usability and efficacy in helping users through the assessment process have been rated well by users.

Performance evaluation has highlighted its scalability and resilience in a variety of usage circumstances, guaranteeing a smooth user experience. These results demonstrate how the platform may greatly improve the aquarium experience, and further development and optimization are anticipated.

5.Conclusion:

To make the life of fish aquarium enthusiasts easier by helping them discover and control the fish's behaviour, there has been a Smart Aquarium platform development which is a real breakthrough. With MERN stack that powers a user-friendly webpage, consumers now have a formal system to review and assess fish behaviour.

Using data-driven analysis methodologies and prestored replies that were researched-based, users now can easily get individualized insights that will aid them to provide the right care for their fish friends. The service, after getting feedback from the audience and improving itself, fulfils the desire and wishes of its prospective customer groups.

6. Future Scope

Moving forward, there are several areas of future work that can further enhance the Smart Aquarium platform:

6.1 Styling and Responsiveness:

Ongoing alteration of website designed by the team to improve better user experience via assurance of responding on range of devices and by making meaningful design.

6.2 Accuracy Enhancement:

Adding the promising additional optimization of the assessment algorithms to the existing and further acceleration of the response's relevant generation and behaviour analysis precision.

6.3 Additional Features:

To add to the features and value, activities that are automated like notification on abnormal activity, real time monitoring and compatibility with the Internet of Things can be added.

6.4Community Engagement:

To have a fostering environment, community features would be developed so aquarium lovers can collaborate and exchange their expertise among themselves. Our focus will be to improve and make the Smart Aquarium

more comprehensive through identification and provision of these 4 items, in the future work. This will provide users with the tool not only that will peacock throughout but also helps them develop a strong bond with their aquatic friends.

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