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Human-computer interaction for aquatic animal tracking and monitoring water quality parameters

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Abstract

Water monitoring is a crucial task in aquaculture to improve productivity. Researchers have concentrated on using reagent-free sensor setups and wireless sensor setups to monitor water quality parameters such as temperature, PH, dissolved oxygen, total ammonia nitrogen, etc. For shrimp farming, manual monitoring necessitates a competent individual to keep an eye on the pond water quality, shrimp survival habitat, diseased shrimp, appropriate shrimp diet, fertiliser addition to maintain water quality, etc. Manual monitoring is challenging around-the-clock. Aquatic habitat is stressed by abrupt climate changes, dissolved oxygen shortages, temperature variations, and pH level modifications. The aqua fauna becomes ill or dies as a result, which lowers productivity. Therefore, the development of a remote monitoring system for prawn cultivation is necessary. The goal of this research project is to create a system for remote aqua monitoring. The majority of individuals on the planet use smartphones in today's highly technologically evolved environment. These days, farmers are also capable of using smartphones. This encourages the researcher to use Android application development to create a remote aqua monitoring system.

Keywords: Aquaculture, Underwater, Aqua-farmers, Application

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Introduction

Aquaculture is the production of aquatic animals for human consumption. Compared to other animal sectors, aquaculture farms have grown more in recent years. In India, the aquaculture industry maintains survivability, creates jobs for over five million people, ensures food and alimentary safety, and fosters the economic development of underprivileged fishing villages (Dionisio *et al.,* 2022). Over INR 14 lakhs crore is contributed to the Indian economy by the industry, which accounts for 1.4% of the country's GDP and 5.4% of the GDP from agriculture (Duško *et al.,* 2021). This sector contributes significantly to exports abroad (Bahadur *et al.,* 2024). Because the shrimps' habitat is underwater, farmers may not be able to determine if the shrimps are alive or not in pond aquaculture systems (Chatterjee and Sanyal, 2024). The high death rate is caused by bacterial, fungal, or viral illnesses, poor water quality, or changes in the climate (Choudhary and Verma, 2025; Carter and Zhang, 2025). The aqua farmers might not be aware of this, which results in significant financial loss (Suvarna and Bharadwaj, 2024). Conventional methods of diagnosing water quality criteria for sustainability and health are expensive and time-consuming (Iyer and Deshpande, 2024). Because shrimps live in an underwater environment, it is also exceedingly difficult to determine their death rate (Mann *et al.,* 2022; Nandy and Dubey, 2024). Despite the fact that this industry creates more jobs and boosts the national economy, there is no adequate automation system or monitoring system to determine if aquatic creatures are alive or not (Mitra and Shah, 2024). In order to solve these issues, research is being done to create a remote monitoring system that will forecast aqua farmers and use Android application development to stop significant financial losses before they happen (Gao, 2024; Suleiman, 2023). Shrimp mortality will be decreased and aquafarmers' profitability will be increased by routine monitoring of water quality and shrimp survival (Mann *et al.,* 2021).

Proposed Framework

Humans are living smarter lives thanks to modern technology. Continuous improvement makes it possible to monitor the operation of the unit (farm, manufacturing process, etc.) and maintain a safety level through remote monitoring. Remote monitoring systems collect data regarding any unit's or process's mechanism and send it to the end user via an electronic device via the internet. Google released Android, an open source mobile application platform built on Linux that lets developers freely alter the source code to suit their needs (Zhang *et al.,* 2023). Additionally, it gives developers an easy-to-use hardware platform that enables them to swiftly and easily realise their ideas. This enables Android to receive more enhancements for the mobile platform. Figure 1 displays the overall architecture.

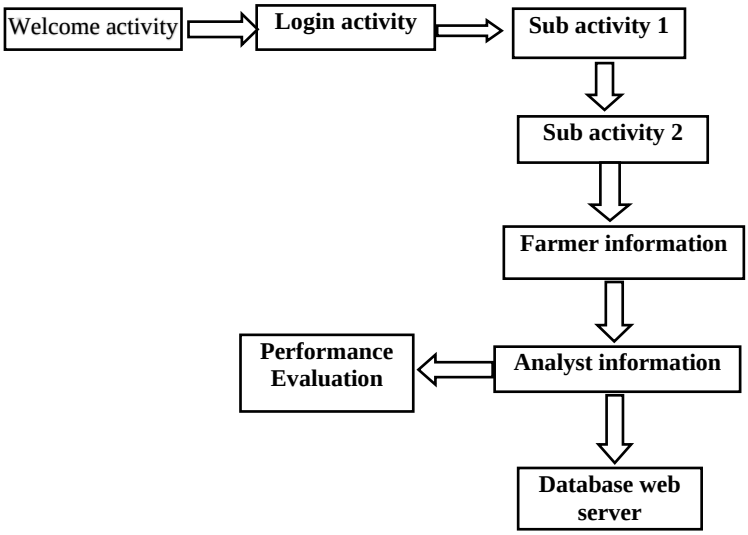

Figure 1: Overall architecture.

An application, or APP, is a comparable method of accessing a website that can retrieve information and abstracts from the internet. The use of smartphones has grown in recent years since they are not only a useful tool for communication but also a necessary component of daily life and daily interactions. Even those without formal education can easily operate a smartphone (Lombana *et al.,* 2022). Applications for people's lives can be added indefinitely. The internet makes it possible to monitor anywhere, at any time, and with a smartphone, no further equipment is required. It is simple to create new applications for the Android system because of open source and the availability of free development tools. An Android-based smartphone software called AQUAMON is being created to track the state of aquaculture, namely prawn farming, by using these qualities (Lin *et al.,* 2022). The requirement for remote prawn cultivation monitoring in the current technological era greatly boosts individual aqua-farmers' bottom lines. An Android software called AQUAMON was created to allow users to remotely monitor plants and aquatic life using their phones. This program enables the early identification of anomalous conditions that could affect the water quality and prawns (Anue, 2020). The farmer can make large income by keeping an eye on the undersea aquatic habitat. Shrimp growth primarily depends on pond water quality maintenance. Therefore, the two main elements that determine the aqua-farmer's business are pond water quality and survivability monitoring. This app makes it possible to monitor the water quality of pond aquaculture and the survival status of prawns anywhere in the world at any time using live video and still images.

Experimental Results and Discussion

Our suggested AQUAMON app primarily monitors the water quality and prawn condition on a regular basis. By logging into the app, the authorised individual can see the current state of Pond aquaculture in detail. From any location at any time, the aquatic farmer may monitor the state of prawn farming. The development of the AQUAMON app

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for the aquafarmer community is a result of the ease of managing smartphones. An Android phone notice is sent to the aquatic farmer when an adverse condition arises. Our mobile monitoring system's universal data transmission service enables the Aqua Monitoring features. Figure 2 display welcome screen appearances on mobile phone below.

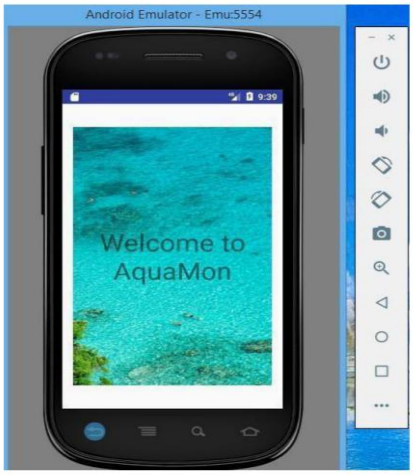
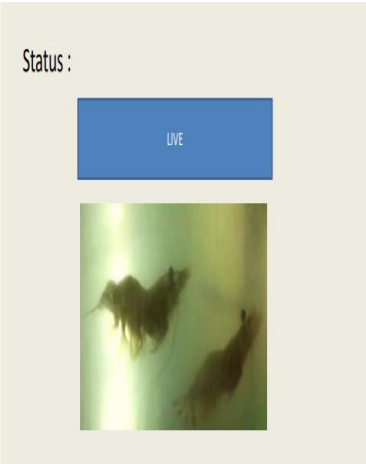


Figure 2: Welcome screen appearances on mobile phone.

Following the login process, our suggested system will request the data needed by a pathologist or farmer. The intent will link the database and offer the details when the appropriate button is clicked. For instance, the smartphone device displays information about water and prawns when the farmer button is clicked. The app will link appropriately when the appropriate buttons are selected. The built software will link to the image analysis output from the server and display the output status in both text and picture format if the farmer clicks the Shrimp information button. The outcomes of the fuzzy classifier model that is kept on the server will run when the farmer clicks on the water information. These images show in figure 3.

Farmer and analyst activity.

Shrimp and water information.



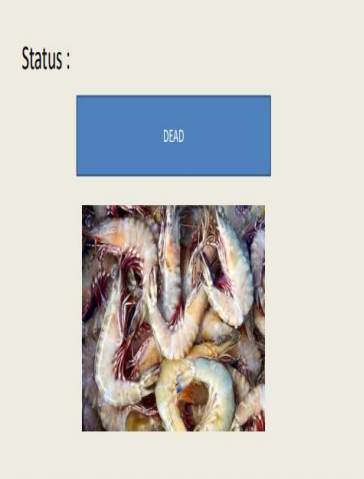


Figure 3: Information screen appearance on an Android mobile phone.

The early diagnosis of sickness is a crucial duty since prawns are susceptible to bacterial and viral infections. This might be recognised and accomplished in subsequent effort.

Conclusions

These days, an efficient computing platform is the result of the quick rise of smartphones. The development of the mobile internet has opened up a fantastic opportunity for online applications to be moved to portable devices. We have successfully created a mobile application for smartphones and other comparable gadgets, such as PDAs. Aqua farmers and technicians can use this tool to remotely monitor and make prompt decisions on pond system maintenance. For aqua-farmers, particularly prawn farmers, our suggested AQUAMON app is incredibly helpful. An individual farmer can use this app to see the current state of pond aquaculture at any time and from any location. Knowing the survival status and water quality parameters early on helps a farmer avoid suffering significant financial losses. Good Manufacturing Practice (GMP) can be accomplished with this app.

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