PAPER SUMMARY ASSIGMENT

NAME : DAFFA FARREL GIOVANY

NIM: 1202230040

CLASS :IT06-02

Before I summarize these papers, I want to start with a fundamental question: how can a technology we often hear about in the context of smart cities or smart homes, like the *Internet of Things* (IoT), be truly applied to help a sector as traditional and fundamental as fisheries?

My curiosity stems from a basic question: if it's true that IoT can monitor fishing boats or pond water quality in real-time, to what extent can we trust this system? Isn't there a significant risk that this just becomes a complex and expensive technological gimmick, impractical for the average fisherman or fish farmer? How can an automated system distinguish between a real emergency on the high seas and a simple temporary signal interruption? And for fish farming, how do these sensors perform in a dynamic and often dirty water environment?

What's more worrying is the implementation. Is this technology robust enough to withstand harsh field conditions—corrosive seawater, unpredictable weather, or the humid environment of a fishpond? Who is responsible if a system error causes losses—for example, the system fails to send an emergency signal or misreads water parameters, leading to mass fish death? Are these IoT predictions and monitoring designed to replace human roles, or just as support tools that still require validation and expertise from fishermen and farmers?

Ultimately, will the normalization of this technology improve safety and productivity in the fisheries sector, or will it just create new dependencies and add operational complexity that isn't really needed?

Analysis of Paper 1: ***Fishing Boat Safety Monitoring System Based Internet Of Things*** **(Budiman & Suryani, UNIKOM)**

Reading the paper by Arief Budiman and Taryana Suryana feels like seeing exactly how a real-world problem is answered with a very specific technological solution. This paper doesn't talk about grand concepts; it focuses on one crucial problem: the difficulty UPP (Port Authority) Pangandaran faces in monitoring fishing boats and the slow handling of emergencies at sea.

A statement in the introduction immediately catches my eye: "*UPP pangandaran experience difficulty to monitor fishing boats sailing in the ocean. and they also have difficulty obtaining information when there is an emergency in the ocean*". This isn't a theoretical problem; it's a matter of life and death. Emergency information that often arrives late from other passing ships was the main trigger for this research.

What makes this paper interesting is how the authors clearly lay out the technological architecture. They don't just say "using IoT," but detail it clearly:

- **GPS Module** to get the ship's position.
- **NRF24 module** to send data from the ship to the receiving station on land.
- A **panic button** as the trigger for an emergency report by the captain.
- **Sim800 module** to send data to the web server so it can be accessed online.

This is a direct answer to the "how does it work?" question. The system is designed with a logical flow: the captain presses the emergency button, the monitoring tool sends location and status data, and the officer on land receives this information via an application to follow up.

The software development method used is prototyping, which consists of stages like communication, quick planning, modelling, prototype construction, and feedback. This approach is very suitable for a hardware-based project like this, as it allows for continuous evaluation and improvement based on user needs.

So, this paper proves that IoT is not just a concept. It is a practical tool that can be built to improve fisherman safety. Its added value is crystal clear: changing the emergency reporting system from passive and slow to active and real-time. This isn't about replacing humans but giving them a better tool to protect themselves.

Analysis of Paper 2: *DESIGN OF LOT BASED WATER MONITORING SYSTEM (SIMONAIR) FOR ARWANA FISH CULTIVATION* (Sholihah, et al., IPB)

If the first paper took us to the open sea, this second paper by Walidatush Sholihah et al. brings us to a more controlled, yet no less complex, environment: Arowana fish cultivation. This is a significant shift in focus, from human safety to the optimization of biological cultivation. The problem is also different, no longer about location, but about the quality of the fish's living environment.

This paper highlights a fundamental problem in aquaculture: *"Water quality management has been one of the inhibiting factors in aquaculture, because it requires time, procedures and several stages to assess aquaculture water quality parameters, so farmers are late in handling the fish which results in death*". In other words, manual water quality measurement is slow, inefficient, and often too late, which is fatal for high-value fish like Arowana.

This is where SIMONAIR, the system they developed, comes in as a solution. The system is designed to monitor six key parameters in real-time: **pH, temperature, salinity, TDS (Total**

Dissolved Solids), TSS (Total Suspended Solids), and ammonia. This answers the question "what is being monitored?". These parameters are critical, especially ammonia, which comes from leftover feed and fish waste and can become toxic if it exceeds the limit.

Technically, SIMONAIR uses an **ESP32** microcontroller, a popular choice for IoT projects as it already has integrated Wi-Fi. The workflow is simple: the sensors read data from the water. the data is processed by the ESP32 and then sent to a display or website to be monitored by the farmer.

One very interesting thing about this paper is its honesty regarding technical challenges. The authors acknowledge that some sensors, specifically the salinity and pH sensors, showed unstable results and required recalibration. "This is because the salinity sensors on the market still use conductivity as a sensing method, where electrolysis cannot be avoided". This admission is crucial because it shows that IoT implementation in the field is not as perfect as it is on paper. The quality and accuracy of the sensors become critical determining factors.

In conclusion, this paper provides a concrete example of how IoT is applied in precision aquaculture. Its added value is enabling continuous monitoring and rapid decision-making, which is crucial for sensitive commodities like Arowana fish. However, the paper also serves as a reminder that the biggest challenge often lies in the hardware itself—namely, sensor accuracy and stability.

Analysis of Paper 3: ***Aqua Fishing Monitoring System Using IoT Devices*** **(Islam, et al., DUET)**

This third paper, by Md. Monirul Islam et al., serves to reinforce and complement the SIMONAIR paper. The focus is the same: water quality monitoring for fish farming using IoT. However, this paper provides a slightly different perspective by using a specific platform and explaining a more general framework.

The research objective is very clear: "to design and develop a real-time smart-based water temperature, PH and turbidity monitoring system". Like SIMONAIR, this system uses various sensors to measure water parameters, such as **temperature, pH, and turbidity**. This data is collected and analysed to provide useful information for fish farmers.

The main differentiator in this paper is its emphasis on using an IoT cloud analytics platform, namely **Thing Speak**. Thing Speak is a platform that allows users to collect, store, analyse, and visualize sensor data in the cloud. This answers the question "where is the data sent?". By using a platform like this, data is not just displayed but can also be analysed to see trends (e.g., average, minimum/maximum values) that can aid in decision-making.

The proposed workflow is very systematic: sensors read data, data is sent to an Arduino, then forwarded to the IoT platform , and finally can be accessed via a web or mobile application. This is a classic end-to-end IoT architecture and shows how different components (hardware, connectivity, cloud, and user application) work together.

By reading this paper after the SIMONAIR paper, we can see the same pattern: the problem is inefficient manual monitoring, the solution is real-time sensors, and the goal is more optimal cultivation. However, this paper goes a step further by explicitly mentioning the use of a cloud analytics platform, highlighting the importance of not just collecting data, but also processing it into actionable insights. This confirms that the added value of IoT is not just in "monitoring," but also in "analysis."

Analysis of Paper 4: *State of the Art Techniques for Water Quality Monitoring Systems for Fish Ponds Using IoT...: A Review* (Manoj, et al., 2022)

This final paper, a review by M. Manoj et al., serves as the 'glue' that binds all the pieces together. If the previous three papers were case studies, then this paper is the big picture. It steps back to look at the entire research landscape of water quality monitoring systems for fish ponds using IoT over the past decade (2011-2020).

The paper firmly states the advantage of IoT over traditional methods: "traditional systems for checking water quality are energy-consuming, involving the initial collection of water samples from different locations and then testing them in the lab". In contrast, IoT-based systems allow for real-time and automated monitoring. This confirms the arguments raised by the previous papers.

What is most valuable about this paper is its synthesis. It identifies the most important and commonly monitored water quality parameters, which align with those discussed in the SIMONAIR and Aqua Fishing papers: **pH, Dissolved Oxygen (DO), nitrogen, ammonia, and temperature**. The paper also confirms that the common baseboards used are **Arduino and Raspberry Pi**, exactly as used in the case studies.

The summary table of existing systems shows that research in this field is very active and diverse, using various combinations of sensors and technologies. This proves that the solutions discussed in the previous papers are not isolated examples, but part of a larger technological trend in the aquaculture sector.

By reading this review paper, we get validation that the problem raised (inefficient manual monitoring) is a universal problem in aquaculture, and the proposed solution (IoT) is the main direction of technological development in this field. This paper provides a broader context and confirms that efforts like the development of SIMONAIR are relevant and in line with global scientific progress.

Conclusion

Thus, the conclusion from reading these four papers proves that IoT for the fisheries sector is not just a gimmick, but a mature technological solution that can answer real-world problems. This series of papers takes us on a journey, from the safety challenges of fishermen on the high seas to the complexity of maintaining a mini ecosystem in fish farming.

The **Budiman & Suryana** paper demonstrates the application of IoT for **human safety**, where the speed of location information and emergency status can save lives. Meanwhile, the **Sholihah et al.** and **Islam et al.** papers show the application of IoT for **biological sustainability**, where real-time monitoring of environmental parameters can increase productivity and reduce the risk of crop failure. Finally, the review paper by **Manoj et al.** confirms that these examples are part of a larger global movement to digitize the aquaculture sector.

Collectively, these papers answer my initial questions. The added value of IoT is very real: it transforms processes that were once manual, periodic, and slow into automated, continuous, and instantaneous ones. The technological framework is also consistent: sensors for data acquisition, microcontrollers (like Arduino, ESP32) for local processing, and internet-based platforms for data transmission and visualization. However, challenges such as sensor accuracy and calibration remain a reminder that this technology requires careful implementation and good maintenance.

With a careful and evidence-based approach, IoT is not a threat to traditional ways of working, but a bridge to a safer, more efficient, and more sustainable fisheries service.

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