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Developing Intelligent Technology Innovation to Sensorship and Real- time processing for Tilapia Raising Farmers'

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ABSTRACT: Maintaining proper water the quality was considered an important factors for farmers' in culturing Tilapia from the knowledge management throughout using and accessing of citizenship, digital technology in Thailand 4.0. Specific purpose for developing intelligent technology innovation to sensorship and real- time processing for Tilapia raising farmers'. The studies found that an intelligent technology innovation to sensorship and real- time processing using 3 sensors, which are sensors for measuring dissolved oxygen content, and sensors to measure water temperature equipment for measuring the acidity-base of water (PH), by connecting via a microcontroller (NodeMcu ESP8266) to gather information and process the data received from the sensor. Then send the data to be displayed through a web browser designed through the device (NB-IoT), which transmits data via 3G / 4G for display real-time water quality data in the form of a web application that can be displayed both on computers and smartphones using node.js into development. By separating the work into 2 parts which are the real time display sections and the controlling part. Finally, this system has been developed to help farmers' a knowing the changes in water quality will be affected the Tilapia culture including management within the Tilapia farms.

KEYWORDS: Intelligent technology innovation, sensorship and real- time processing, Tilapia raising farmers'

I. INTRODUCTION

Tilapia is another type of economic fish with high quality, can create job, create a career and income for Tilapia farmers' in Thailand. Which the current trend into consumption of Tilapia consumption, especially in the United States and the European Union. [1] Because Tilapia is a white meat fish, it is in demand among health conscious consumers including the elderly group that is likely to increase in addition, the Tilapia meat has good taste, is cheap compared to other types of white fish, therefore suitable for use as a raw material in the food processing industry to create added value. While the export volume of Tilapia and its products from the report of the Fisheries Economics Group [2] found that Thailand has exported 2,398.2 tons of Tilapia and products with a value of about 73.9 million baht.

From the current condition when to compare with the last year instead, it found that the amount of exports of Tilapia and its products both to export and value have decreased of 13.8% and 33.0% respectively. Caused by the production still lacking good management system and conforming to aquaculture standards (e.g., the culture processes including the impact of the Covid-19 situation) for the resulting in a decrease in domestic consumption and exports. The water quality was considered of a important factor for affecting growth and food intake as well as the risk of disease of aquaculture fish. [3] Therefore farmers must continuously monitor and follow up.

In the past year, a group of fish farmers' raised in floating cages of LamPaoTown Dam in Chaiyaphum Province, Thailand, a experiencing the dead fish problem due to sewage and inclement weather of affecting water quality to cause the fish of cause water knocking of resulting from sudden climate change, causing a lot of damage to farmers'. Truong. T. M.,et .al [4] said that the environment had a severe impact on the aquaculture of farmers, and to add that the seasons, weather and climate affect aquaculture and explains the factors that affect fish growth that are caused by weather and seasonal influences that affect water quality (e.g., water temperature, dissolved oxygen content, etc.). Growth rate, survival rate and risk of disease of fish for affecting business management and income of farmers.

These are factors of problem and obstacle in managing the Tilapia business chain to due to the farmers lacking knowledge in production and good management and efficiency, combined with the lack of technology and innovation needed in production and management to affected towards quality control and production standards. An advancement in technology has grown exponentially, especially the issue of intelligent technology innovation that the Thai government has driven to be Thailand 4.0, the Thai farmers' must be driven by innovation and technology in order to make Thai agriculture of high quality and sustainable. Geetha. S. and Gouthami. S [5] by relying on technology, media systems, computers, electronics and sensors to assist in the production process or various agricultural processes. Application of automation to meet the needs of manufacturers, consumers, including marketing, and to explain the working process of internet of things (IoT) that is a collaborative process of sensors, networks, and artificial intelligence to support the use of developing technology for farming to increase productivity. Suanpang. P. and Jamjuntr. P [6] have to proposed the intelligent farm prototype design using internet of things to case studies in Thailand, which uses sensors to measure the environment and display it through a web application includes collecting data to control the amount of water suitable for plant growth, is a technology that can help farmers increase productivity and can reduce costs a lot. Can be seen that at presenting internet of things to use in agriculture to become intelligent agriculture, and to said that agriculture has changed in technology in the last few years. Along with increasing population and the needs of the world. By internet of things (IoT) is an interesting technological innovation in intelligent farming. An introducing new paradigms to present of fish farming is one of the rapidly growing food sector businesses. However, a presenting internet of things that is a new concept of support and problem solving in the operation and management of the Tilapia cage culture system That requires technological innovation to help to be awareness of water quality that affects the growth and survival of aquaculture with the highest quality and efficiency, therefore, it is important to know the changes in water quality so that farmers can be prepared for timely prevention measures. Abir Tawfeeq. H, Vijayalakshmi.

K [7] said that aquaculture depends on many factors such as environmental conditions, including biological factors are affects the growth, survival that affects income from profits, by different parameter values must be inspected and controlled, after that development of intelligent Tilapia aquaculture system using internet of things and data analysis to inspect Tilapia farms for the farmers can finding the problems in a timely manner to maintain the right environment, from systems with work processes using the Arduino microcontroller and sensors to control. The data and impressions are stored in the cloud to enable farmers to access information via mobile applications or web applications that are linked everywhere and at any time. A research in specific purpose for developing intelligent technology innovation to sensorship and real- time processing for Tilapia raising farmers' to problem solving of fish raising in floating baskets by farmers' groups in reducing the mortality rate of fish raised, the changing environment that affects the growth Including management within the Tilapia farms, including the feeding process of raising Tilapia in floating baskets for example suitable for growth with the changing environment, in order to create additional income for farmers, and is the motivation for Tilapia farmers to use more technology and innovation in agriculture that will result in the product being expected to increased productivity and sustainability.

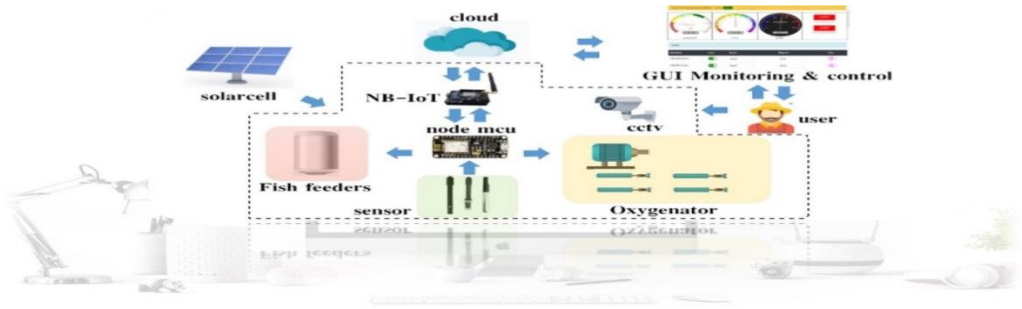
II. REVIEW LITERATURE

A Designing and Controlling Water Quality Inspection System: Afifah. F. N [8] to conducted research of designing and controlling the water quality inspection system in the Tilapia farming farm using the Internet of Things (IoT) and NodeMCU, saying that fish farming is important in enhancing the potential and strength of the community, the important factor that has an influence on fish farming is the quality of water by using physical parameters such as temperature, pH level and water turbidity. An impact of water quality on the physical growth of fish, because of the limitations of farmers who are unable to monitor the quality of water 24 hours a day. And has created a system that can monitor and control water quality in real time using turbidity sensors to detect water turbidity and a pH sensor to detect the acidity and alkalinity of the water, including temperature sensor to detect the water temperature in the fish pond from the use of processing and microcontroller control as Node MCU. The sensors deliver results periodically to the Cayenne application in real time, which can be viewed via smartphones and PCs. The control system consists of two modes of the automatic mode and manual control mode for add water to the culture pond, from the turbidity and temperature and temperature test results, it is found that the quality of the water quality changes in the pond and the Cayenne application with IoT technology can provide drainage pump operation and add water to the pond. With NodeMCU able to transmit data via an internet connection as well. Loyola. L and Lacatan. L [9] to say that water quality is the most important factor in aquaculture, with water quality affecting fish health and growth. The farmers who raise aquaculture must understand and awareness of the water quality requirements of aquaculture for growth and survival. Therefore, necessary for fish growers to ensure that the physical and chemical conditions of the water source are possible within the appropriate range. However, the water quality monitoring in the fishery should be in real time, water parameter analysis must be done as soon

as possible to ensure that the water quality is suitable for Tilapia culture. In the research for developing intelligent technology innovation to sensorship and real- time processing for Tilapia raising farmers'of this study want to developed a system that can check the water parameters in the Tilapia pond, analysis and evaluation of various parameters to determine the suitability and survival rate of Tilapia That is based on water quality using decision trees in determining water quality by using an Arduino microcontroller device which used of internet of things (IoT) come to help for providing farmers with Tilapia knowledge to understand and manage water quality in the fish pond effectively. Also, increasing the productivity and income of fish farmers, positively impacting agricultural production in the area of fish farming.

System Design: Zhu. X, Li. D, He. D, Wang. J, Ma. D, and Li. F [10] the precision and reliability are to essential in a remote monitoring system, therefore need to design a system that is stable and with accuracy of processing, data transmission, control of equipment installed in the system and data display for enable the work to work efficiently. System design into developed of intelligent technology innovation to sensorship and real- time processing for Tilapia raising farmers' to designed the system divided into 3 parts which have components to shown as figure 1.

Figure 1:- System overview design



• ***Hardware;*** *to consists of, 1) NodeMcu ESP8266 microcontroller,, 2) NB - IoT board, 3) Sensor devices consisting of 3 devices which are sensor devices to measure dissolved oxygen content, sensors to measure water temperature and equipment for measuring the acidity-base of water (pH), 4) Relay, 5) Fish feeding equipment, 6) pumps and aerators, 7) CCTV.*

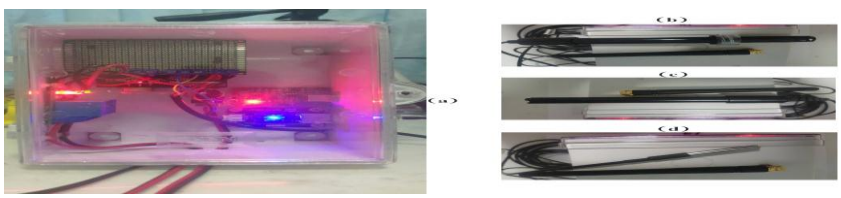
• ***Software;*** *to consists of, 1) Arduino integrated development environment (IDE) is a tool for programming in the Arduino language, compile the program and upload the program to the board, 2) Node js is used in the design of the monitoring system and manual device control through a web browser, which can be used for both computers and smartphones*

• ***Solar Power;*** *for supplying electricity to the equipment, consisting of, 1) solar panel monocrytalline, 2) battery, 3) solar charge controller.*

III. MATERIALS AND METHODS

System Implementation: In the development and installation of the system, there are 3 sensors which are dissolved oxygen sensors, water temperature sensors, and acid-base sensors to connect to the microcontroller board for water quality measurement, and the microcontroller board was connected to a relay to control the on-off of the aerator in case the dissolved oxygen in the water to measurement results from sensors lower than the specified threshold or the controller to open – close and ordering the automatic feeding and closing system according to the set time with manual control system. All data will be sent through the device NB-IoT via the 3G / 4G network to bring the data to display on the application webpage, at the same time receiving values from the control using the manual control system through the web application page on activating the aeration system and the fish feeder system via relay control to shown as figure 2.

Figure 2:- Equipment storage boxes and sensors



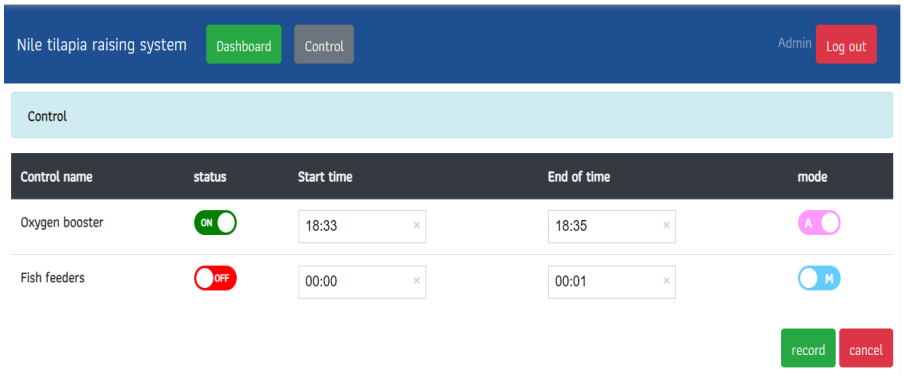
• Equipment storage boxes (a) • PH sensor (b) • Dissolved oxygen sensors (c) • Water temperature sensor (d)

Software Monitoring: Real-time display system is displayed in the form of a web application, which can be displayed both on computers and smart phones using node.js to design to be responsible for displaying, processing, storing data in the database. [14] Node.js is a framework suitable for use with IoT in real- time rendering. Software monitoring will be installed on the Google cloud and can be used with all operating systems, the system is divided into 2 parts: real- time display and control of equipment, aerators and fish feeders. In the display section, it is displayed in 3 sub-sections, showing the installation area in the form of a map real- time, display of dissolved oxygen values, PH and water temperature to received values from sensors, including the status of the aerators and fish feeders, and the last part, showing the past 24 hours of dissolved oxygen values to shown as figure 3.

Figure 3:- Impressions of software monitoring

Installation area, (a) the real-time display of dissolved oxygen values, PH and water temperature to receive the value from the sensor, the status of aerators and fish feeders, (b) display the past 24 hours of dissolved oxygen values, and (c) water temperature**.** the control equipment, aerators and fish feeders. It is a control section which can adjust the control mode automatically and manually. In automatic control, the aerator will operate in the event that the sensor dissolves oxygen in the water has a lower measurement value than the set value in the system. Aerator will fill the air with water and will stop working when the sensor dissolves the dissolved oxygen in the specified criteria. In the part of manual control, can be done by setting the on-off time as specified by the controller according to the appropriate situation. Fish feeder in the control part will set the feeding time, by specifying the feeding times for each period by specifying the time for releasing food into the pond in accordance with the established criteria, can be adjusted manually as appropriate according to the situation, like an aerator to shown as figure 4.

Figure 4:- Controls, aerators and fish feeders



Study Area: A location of the system installation are the fish raising group in floating baskets at Lampa Town Dam of Chaiyaphum Province. Arising from the integration of farmers by forming a community enterprise group and has to received support from government agencies to make use of water sources under the project to promoted of Tilapia farming include supporting the production factors such as fish cages, fish food, technical education to becoming the water source that has the largest fish cage culture in Chaiyaphum Province, the area for installing the system to shown as figure 5.

Figure 5:- Area for installing the system

IV. FINDINGS AND DISCUSSIONS

The developing intelligent technology innovation to sensorship and real- time processing for Tilapia raising farmers' that have designed of intelligent agriculture technology for Tilapia aquaculture farms using a based on internet of things (IoT), the system will receive data from 3 sensor devices, which are sensors that measure the amount of dissolved oxygen, sensors to measure water temperature, and equipment for measuring the acidity-base of water (PH) to connected via a microcontroller (NodeMcu ESP8266) for collect data and process the data received from the sensors, then send the data for display via a web browser designed through the NB-IoT device, which transmits data via 3G / 4G to show the water quality data that is measured with all 3 sensors into real- time. Ready to display the status of aerators and fish feeders, which is connected by relay to the microcontroller board. In the event that the sensor device measures the amount of dissolved oxygen in the water to able to be measured within the specified criteria which the microcontroller will to instruct the aerator to stop working via the relay device, or via the web application via manual control, for the fish feeders will to works via connection with a relay with a microcontroller, by working according to the time limit for releasing food into the pond or in the case of commands via the web application, using the manual control system as same as the aeration system. In the software system, showing results via the web application, which can be displayed on both the computer system and the smartphone by separating the operations into 2 parts which are, a) the real time display section will be divided into 3 sub-sections, (1) namely the installation area will be divided into 3 sub-sections, namely the installation area, (2) the real-time display of dissolved oxygen values, PH and water temperature of received values from sensors, including the status of the aerators and fish feeders, (3) display the past on 24 hours of dissolved oxygen values, PH and water temperature, b) the control part will by controlling the aerator and fish feeder by the system can be adjusted both automatically and manually, if it is an automatic system adjustment, the system will operate as set by the system. But in the case of switching to manual control mode, the users have to manually set the on-off time both in aerators and fish feeders.

V. DISCUSSIONS

An intelligent technology innovation to sensorship and real time processing using 3 sensors, which are sensors for measuring dissolved oxygen content, and sensors to measure water temperature equipment for measuring the acidity-base of water (PH), by connecting via a microcontroller (NodeMcu ESP8266) to gather information and process the data received from the sensor. Then send the data to be displayed through a web browser designed through the device (NB-IoT), which transmits data via 3G / 4G for display real-time water quality data in the form of a web application that can be displayed both on computers and smartphones using node.js into development. By separating the work into 2 parts which are the real time display sections and the controlling part. Zhu. X, Li. D, He. D, Wang. J, Ma. D, and Li. F [10] to presented of the precision and reliability are to essential in a remote monitoring system, therefore need to design a system that is stable and with accuracy of processing, data transmission, control of equipment installed in the system and data display for enable the work to work efficiently. Obado. S. A [11] to create a water quality inspection model in fish ponds with IoT, by saying that fish farming is an important part of food security in developing countries around the world, help generate income for farmers and provide food sources for the community. However, fish farmers face many problems during the production period and most importantly Monitoring and managing production resources, water is the main resource in the fish farming process, if the lack of effective water quality checks and quality changes such as temperature and water level changes and a most fish farmers still do not use technology in the production process By using experience when making decisions in the control process, most of them have errors due to the complexity involved. Internet of things (IoT) is a technology that farmers can use to manage fish farming by installing sensors that can communicate with smartphones and have to monitor and manage fish ponds. Saparudin. F. A, Chee. T. C, Ghafar. A. S. A, Majid. H. A, E. Katiran. E, and Science. C [12] a mentioning the quality of water Is one of the important factors affecting the growth and mortality rate of aquatic animals, especially In a high density aquaculture system.

In general, fish farmers perform water quality tests on their own, which may affect aquatic animals that need immediate and immediate care. Therefore, water quality inspection systems for high density aquaculture environments, which should include multiple sensor nodes and sensors / hybrid node servers, which is used to collect and manage water quality parameter information of many tanks. Sensor nodes, collect and store water quality parameters in the local database and send to the server node via wireless communication. Server nodes used for data analysis, processing and allowing data access through a web browser using Wi-Fi. In system development to presented in the conceptual of wireless inspection system that focuses on the use of sensor nodes to set real-time water parameters, this system can be used efficiently and is easy to use with the capability of wireless networks. Huan. J, Li. H, Wu. F, and Cao. W [13] has developed water quality monitoring systems for aquaculture ponds based on NB-IoT technology. By the system collecting data wirelessly with a microprocessor connected to the sensor, namely temperature, pH, dissolved oxygen and other environmental parameters by centralizing data management of fish breeding ponds. The system uses the STM32L151C8 microcontroller and real-time sensor detection to data collection and data transfer with IoT to the cloud via NB-IoT technology, using Keil software to design the data formats of the wireless communication and data transmission modules. Use Java to develop application, validation and access to the cloud platform, basic equipment control and data processing to take to a control of the module and turn off the equipment, found that the system can receive water quality parameters in time and with accuracy in controlling the dissolved oxygen within water.

VI. CONCLUSIONS

An intelligent technology innovation to sensorship and real- time processing for Tilapia raising farmers' including a hardware to consists of, **(**1) NodeMcu ESP8266 microcontroller, (2) NB - IoT board, (3) Sensor devices consisting of 3 devices which are sensor devices to measure dissolved oxygen content, sensors to measure water temperature and equipment for measuring the acidity-base of water (pH), (4) Relay, (5) Fish feeding equipment, (6) pumps and aerators, (7) CCTV, software to consists of, (1) Arduino integrated development environment (IDE) is a tool for programming in the Arduino language, compile the program and upload the program to the board, (2) Node js is used in the design of the monitoring system and manual device control through a web browser, which can be used for both computers and smartphones, solar power for supplying electricity to the equipment, consisting of, (1) solar panel monocrytalline, (2) battery, (3) Solar charge controller. The system has a stable overall work to real-time and accurate data transmission, can actually meet the needs of the production process include providing accurate information, technical support for water quality control and production process management for the raise Tilapia farmers' to effectively and quality.

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