

Design and Development of Web-based Water Distribution Scheduler for National Irrigation Administration: Cagaycay River Irrigation System

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ABSTRACT

This study presents the development and evaluation of a Web-Based Water Distribution Scheduler designed for the National Irrigation Administration (NIA) – Cagaycay River Irrigation System in Camarines Sur, Philippines. The project addresses persistent water distribution challenges among Irrigator's Association (IA) beneficiaries in the municipalities of Goa, San Jose, and Lagonoy, Camarines Sur, specifically poor communication regarding water release schedules and unauthorized water usage. To resolve these issues, a dual-component web application was developed: a secure administrative module for NIA personnel to manage distribution schedules, and an accessible interface for farmers to monitor real-time water release updates via any internet-connected device. The system was evaluated on its functionality and usability by three key stakeholder groups. Results indicated highly satisfactory mean scores from IT specialists (4.7 functionality, 4.8 usability), farmer representatives (4.8 functionality, 4.8 usability), and NIA staff (4.6 functionality, 4.9 usability). These findings demonstrate that the proposed system is highly acceptable and serves as an effective technological intervention to streamline water distribution management and improve communication between the administration and local farmers.

Keywords: Web-based, Web application, Monitoring, Scheduling, Distribution, Irrigators

INTRODUCTION

Climate change has reduced global agriculture productivity by 21% since 1961 according to a recent study by Nature and Climate Change. Over the years food systems which represent a third of total greenhouse gas emissions which are a major factors to biodiversity loss brought about by the impact of El Nino and other climate related phenomenon. The incorporation of technology innovations created for other industries, including as Global Positioning System (GPS), communication systems, and imaging systems, has helped agriculture systems over the past 20 years. Later, genetics and the automation of agricultural processes contributed to advancements. Precision agriculture (PA) has recently been made possible by the integration of new tools, processes, and technologies thanks to the age of communications and information technology (IT). Modern agriculture is increasingly dependent on the employment of sensors, intelligent actuators, onboard computers, communication systems, information processing, remote control and

monitoring, and global positioning systems (GPS). Thus, technology plays a vital role in agriculture productivity through employing information technology.

On December 2021, the National Irrigation Administration recorded 65.28% irrigation development, irrigating 2,04,392.66 hectares of agricultural land nationwide. The National Irrigation Administration (NIA) is a government-owned and controlled corporation created under Republic Act (RA) No. 3601 on 22 June 1963. It is the agency that is primarily responsible for irrigation development and management. Its charter was amended by Presidential Decree (PD) 552 on 11 September 1974 and PD 1702 on 17 July 1980 wherein its capitalization was increased and the authority of the agency was broadened. The National Irrigation Administration - San Jose, Camarines Sur obtains water for its irrigation system from the Cagaycay River in the municipality of Goa, Camarines Sur extending down to the municipalities of San Jose and Lagonoy. These areas have a system in place for distributing water so that everyone has access to enough to irrigate their farms through the National Irrigation Administration using the conventional or manual scheduling of water distribution to its farmer beneficiaries in order to personally inform the farmers of their water schedule, which is periodically forgotten and can cause dispute among the farmer beneficiaries in the watering of their farms. Hence, this study will provide innovative mechanism employing web-based application for water notification and distribution to the stakeholders.

In the study of Garcia et.al (2020), they realized that optimal irrigation programming requires consistent investment in equipment, expenditure on operation and maintenance, and qualified technical and maintenance services. They underscored those technological approaches is worthwhile in farms with low water availability, high profitability, and significant technical-economic capacity. It is in this light that this study will design and develop a web-based water distribution scheduler along Cagaycay River Irrigation System that will be useful and beneficial to the farmers and the farming community and recommend policies that would enhance the water distribution system.

This study attempted to develop a web-based water distribution scheduler along Cagaycay River Irrigation System of National Irrigation Administration in San Jose, Camarines Sur. This project is aimed to answer the difficulties and problems encountered by the National Irrigation Administration personnel in – charge of the water distribution scheduling which resulted to complaint from the farmer beneficiaries of the agency. These farmer beneficiaries are the irrigators association that composed of nine (9) total associations.

Kadeghe G. Fue, Camilius Sanga (2015) in their research study entitled “Remote Scheduling System for Drip Irrigation System Using Geographic Information System” described the GIS-based irrigation scheduling system was designed for the scheduling daily drip irrigation water deliveries and regular monitoring of irrigation delivery performance for maximum yield. The “Scheduling” program computes the right amount of irrigation deliveries based on tea water requirements. The “Monitoring” program gives information on the uniformity of water distribution and the shortfall or excess.

In the paper by Yu Fan, et. al (2023). “Water distribution and scheduling model of an irrigation canal system” This work attempts to answer the water distribution problem in irrigation districts based on channel hydrodynamic simulation and employing the hydraulic factor of water level growth in backwater areas. Two distinct models were established: the supply-decided water distribution and scheduling model (SD-WDSM) and the demand-decided water distribution and scheduling model (DD-WDSM). To ensure the model's applicability, it was implemented in the Bojili irrigation district. The findings demonstrate that the SD-WDSM can control the check gate's length to regulate the backwater area's length, guaranteeing a high flow rate at the turnout gate. The water diversion canals were grouped together using DD-WDSM's

rotation irrigation system, allowing the turnout gate within the group to open and close simultaneously for the administrator's convenience.

METHODOLOGY

This study used the descriptive method of research in the context of system development. Descriptive was used in discussing the results of the testing phase while developmental will be use during the system development while a Focus Group Discussion (FGD) was employed for the data collection technique in which a selected group of people discusses a given topic or issue in-depth, facilitated by the researchers. The data was analyzed using the percentage technique and arithmetic mean after conducted the testing of the developed web-based water distribution scheduler system.

Sources of Data

This research aims to develop and implement a web-based water distribution scheduler along Cagaycay River Irrigation System of National Irrigation Administration in their farmer beneficiaries of the different irrigators association. The proponents conducted interviews one-on-one or with a small group. The interviewees come from the members of the different Irrigators Association under the NIA-Cagaycay River Irrigation System.

Data Gathering Instrument

The proponents formulated survey questionnaires and interview questions for data gathering. These tools helped the researches to acquired data that was used in the study. Survey questionnaires were used in the data gathering. These are carefully formulated, set, and arranged by the researchers. The questionnaires were given to the respondents which will also be collected back to systematically evaluated and tabulated the respondent's answer. The researchers were also visited the office of the National Irrigation Administration located at Del Carmen, San Jose, Camarines Sur to conduct interview and also visited the different Irrigators Association members and officers. The conducted interviews, authorized by the respondents, will serve as legal references for the researchers. All these data collecting paraphernalia were solely used for the purpose of the study.

Data Gathering Procedures

The researchers seek approval from the concerned government agencies (NIA) to make this study possible. Random farmers and irrigators association members were also asked to answer the survey questionnaires. Survey questionnaires were given to random people to check the significance of the study to be conducted. Researchers were also conducted interviews to different people who are also a farmer of the municipality of San Jose, Goa and Lagonoy in the 4th Congressional District of Camarines Sur. The data that were collected during the said process helped the researcher to evaluate the effectiveness of the proposed development and implementation of the web-based water distribution scheduler of National Irrigation Administration – Cagaycay River Irrigation System to make appropriate generalizations.

Statistical Treatment of Data

The following statistical treatments were used to treat the data:

This statistical formula was used to determine the *mean* of functionality and usability of the developed web-based water distribution scheduler.

Formula: $\bar{x} = \frac{\sum fx}{n}$

Where:

\bar{x} = mean

f = frequency of each class

x = midpoint of each class

n= total frequency

System Development Methodology

Inception. This is the planning cycle of the system development wherein the researcher developed a web-based water distribution scheduler for National Irrigation Administration.

Elaboration. In this cycle, the researcher designed the requirements needed in system development. Included were the system components, system architecture, contextual diagram.

Construction. The researcher utilized open-source programming language/web development language. Additional tools are used like XAMPP package that includes the MySQL database software and PHP, CSS and notepad that serve as an editor windows for developing the HMTL code.

Transition. After the beta testing, minor refinement was done to integrate corrections of bugs and the users’ feedbacks which were focused mainly on fine-tuning of system, configuring, installing, and usability issues. In this cycle, the researcher assured of the usability of the system to its target clientele.

System Design

A. System Architecture

Figure 1. Web Architecture for the Water Distribution Scheduler System

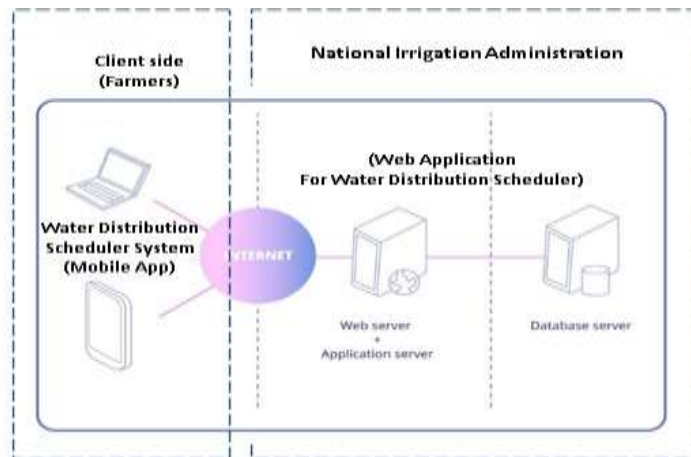


Figure 1 shows the proposed web architecture of the web-based water distribution scheduler which divided into two (2) major parts, first part is the management side wherein the new developed system will installed and to be managed by the NIA-CRIS IT staff/personnel. The administration system is composed of at least one (1) server computer with the following specifications:

Table 1. Computer Server Hardware specifications

Item	Specifications	Remarks
CPU	Intel Xeon 3.5 to 4.0 GHz	or equivalent
RAM	16 Gb to 32 Gb	or higher
Storage	SSD 100 Tb	or higher

LAN/WIFI	IEEE 802.11	Compatible
Monitor	19-21 inches	or wider
Keyboard	Optical, USB	or wireless
Mouse	Optical, USB	or wireless

Table 1 lists the recommended hardware specifications and requirements for both system installation and web hosting. The agency has two options for hosting the web application: it can use their own server or sign up with any reasonably priced web hosting provider.

The client side comprises the second portion of the architecture, which can be accessed online by a desktop computer, laptop, or mobile device if one is available. This system design demonstrates that in order for users to access the built application, they must be online.

Current Water Distribution Scheduling

Figure 2 show the current water distribution scheduling of National Irrigation Administration was done manually by the assigned personnel who are also responsible for the distribution of the schedule to the irrigator association president or other officers through a text message, and the receiver of the message is now responsible to relay the message to the other irrigators/farmers under their control as their members in the Irrigator’s Association cluster. These processes sometimes lead to miscommunications that lead to water distribution trouble.

Figure 2. Current architecture of water distribution scheduling

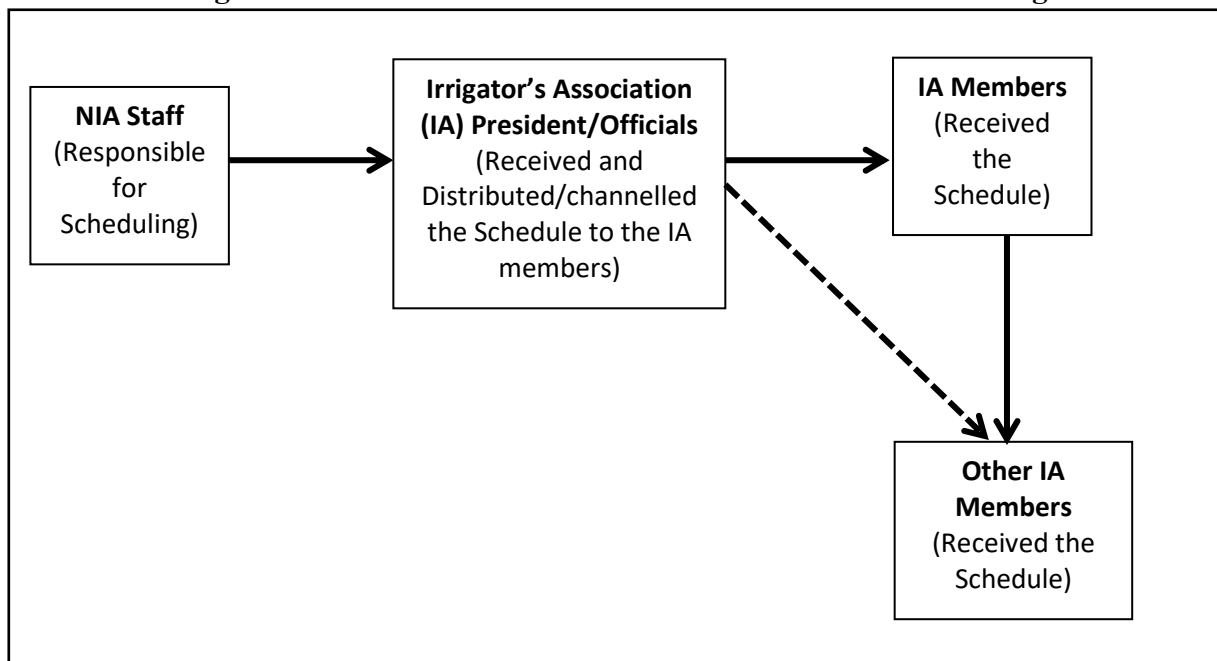


Table 2 shows the seven (7) irrigator's association, which is made up of farmers supplied by the National Irrigation Administration - Cagaycay River Irrigation System for water distribution. They are all located in the municipalities of Goa, San Jose, and Lagonoy, Camarines Sur. It also specified the territory covered by each irrigator's association in hectares and showed how the acreage was distributed by municipality. The entire area in hectares that the NIA-CRIS serves is approximately 2,134.99.

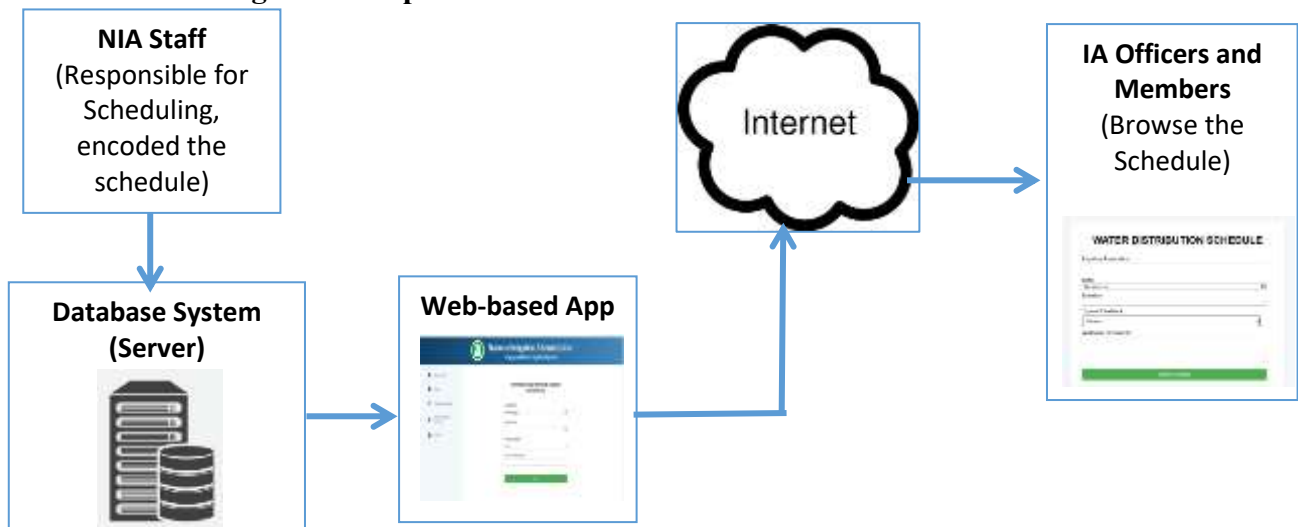
Table 2. Irrigator’s Association Service Area

Irrigator’s Association	Service Area (HA)			
	Total Area per IA	<i>Goa</i>	<i>San Jose</i>	<i>Lagonoy</i>
1. TATISAN	277.96	228.19	29.22	20.24
2. BMCE	167.60	0.80	24.91	141.86
3. CLABFIA	389.95		169.85	220.09
4. NAPUDIA	285.06		285.06	
5. LAGONOY FIA	179.95		15.15	164.80
6. MANTAMFIA	128.47		128.47	
7. MATOON/LAT. E	266.40		266.40	
8. KFIA	213.31		213.31	
9. BSRT	226.29		96.61	129.68
Total	2,134.99	228.99	1,228.98	677.02

Proposed Water Distribution Scheduler

Figure 4 shows the proposed water distribution scheduling in which this is with the application of a new and trended technology today that easily facilitated the distribution of water schedule by browsing in the internet using their available internet capable devices or technology.

Figure 4. Proposed architecture of water distribution scheduler



System Interfaces (NIA-CRIS Management Side)

Figure 5. The system's front page/user interface



Figure 6. The system's user login form/module



Figure 7. The system's user registration form/module



Figure 8. The system's IA Registration Form/module



The screenshot shows the 'National Irrigation Administration' interface for the 'Cagaycay River Irrigation System'. A sidebar on the left contains navigation options: Agency Profile, Users, Irrigation Association, Water Distribution Scheduler, and Credits. The main content area features a registration form with two tabs: 'Register Irrigator's Association' (selected) and 'Register Member'. The form includes input fields for 'Irrigator's Association ID', 'Irrigator's Association Name', and 'IA President', followed by a 'Register' button.

Figure 9. The system's IA Member Registration Form/module



The screenshot shows the 'National Irrigation Administration' interface for the 'Cagaycay River Irrigation System'. The sidebar and header are identical to Figure 8. The main content area features a registration form with two tabs: 'Register Irrigator's Association' and 'Register Member' (selected). The form includes input fields for 'First Name', 'Middle Name', 'Last Name', 'Address', 'Land/Farm Size', and 'Location', followed by a 'Register' button.

Figure 10. The system's Water Distribution Scheduler Form/module



The screenshot shows the 'National Irrigation Administration' interface for the 'Cagaycay River Irrigation System'. The sidebar and header are identical to the previous figures. The main content area features a 'Water Distribution Scheduler' form. It includes input fields for 'Schedule ID', 'Select Date' (with a calendar icon), 'Select Time' (with a clock icon), 'Select Duration' (a dropdown menu set to '1 Day'), and 'Area of Distribution'. A green 'Send' button is located at the bottom of the form.

Using the web development paradigm, HTML, CSS, and the PHP framework were used to design the system interfaces of the built system. The application's home page, or user interface, is depicted in Figure 5. It is made up of sections such as the credits menu located on the left side of the page, the irrigator's association, users, agency profile, and water distribution scheduler. The agency name and logo are displayed in the upper section. The windows for user registration and log-in are displayed in Figures 6 and 7. These facilities are meant for additional employees who wish to register in the system as well as the agency (NIA) workers who will oversee the system. The system's login window is used for authentication, allowing users to safely and freely utilize the application for scheduling and other related tasks.

The registration of the Irrigator's Association and its members is made easier by Figures 8 and 9. With the use of these tools, the system administrator can register the official irrigators association and its members, enabling them to effectively oversee and communicate with the members—particularly the officers—by sending schedules and other pertinent communications.

The primary function of the online application, which makes scheduling easier, is shown in Figure 10. This feature will be used by the person in charge of creating the water distribution schedule to send the planned schedule over the internet or cloud. The water distribution schedule may now be viewed and evaluated by farmers and members of the irrigator's organization from this module, keeping them informed and alert for its proper execution.

The information that the farmers or irrigators could view on the client-side interface, depicted in Figure 11, included the irrigators association's schedule for water release, the day and time of the release, and the duration of the water's availability to them. The names of their association officers and the designated (TDA) Terminal Drainage Area in-charge are also showed up on the screen. This in-charge is responsible for the opening and closing of the water gates or check gates according the given water distribution schedule.

Figure 11. Irrigators/farmers user interface side that shows the current water distribution schedule



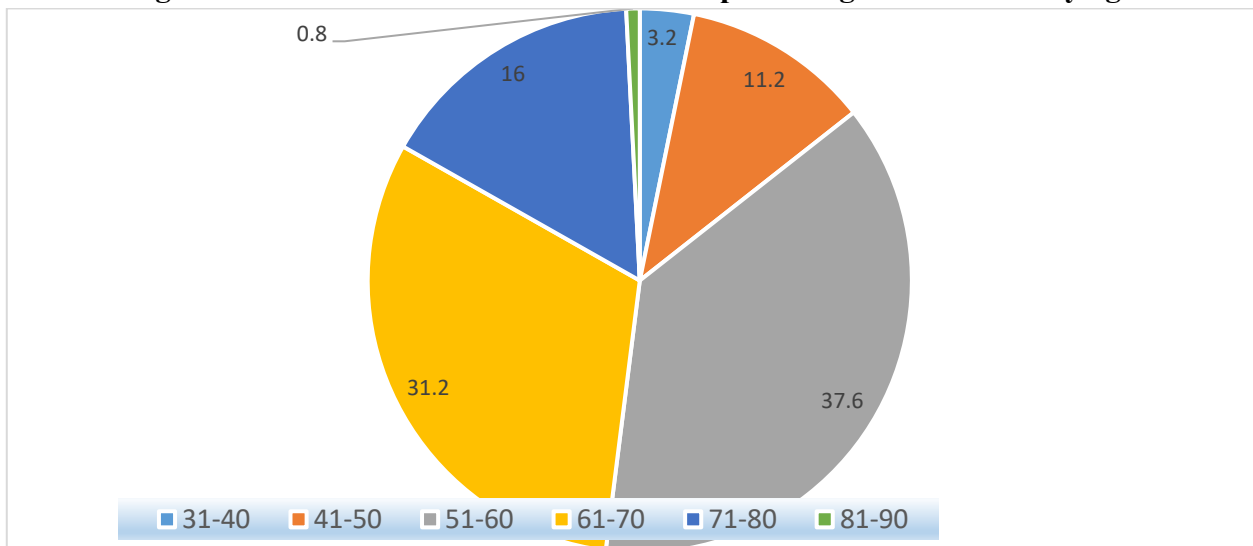
RESULTS AND DISCUSSIONS

Part I. Respondent’s Profile

Table 3. Age of the Farmer -respondents by age bracket (NIS- CRIS)

AGE	FREQUENCY	PERCENTAGE
31 – 40	4	3%
41 -50	14	11%
51 – 60	47	38%
61 – 70	39	31%
71 – 80	20	16%
81 – 90	1	1%
TOTAL	125	100%

Figure 12. Farmer NIA-CRIS beneficiaries percentage distribution by age



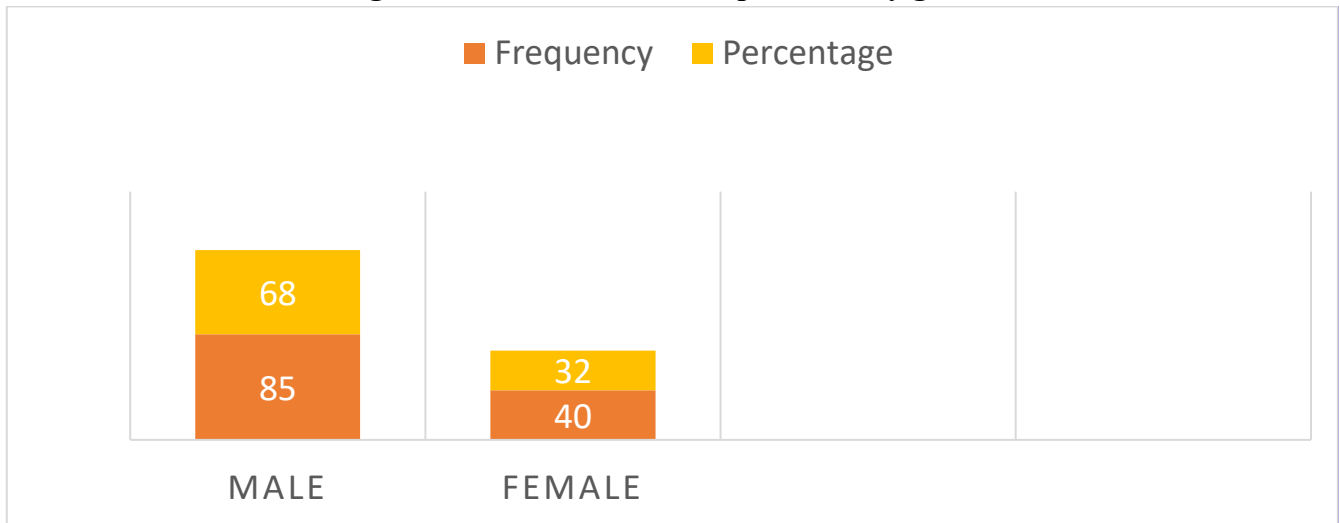
Majority of the farmer -respondents posted thirty eight percent (38%) aging from 51 to 60 followed by 31% aging 61 to 70. There were only three percent with four respondents aged forty and below. This implies that the famers population were less interested to engage in farming at the younger age as compared to the middle-aged adults and older age.

Table 4. Gender of the respondents

GENDER	FREQUENCY	PERCENTAGE
MALE	85	68%
FEMALE	40	32%
TOTAL	125	100%

Majority with sixty-eight (68%) percent of the respondents were males and thirty-two (32%) percent were females. It is observed in the Philippines that majority of the famers engaged in actual farming.

Figure 13. Distribution of respondents by gender



Majority of the respondents were male that posted sixty eight percent (68%) and thirty two percent (32%) were female. The male dominated the farmer population.

Table 5. Civil Status

	FREQUENCY	PERCENTAGE
SINGLE	4	3%
MARRIED	110	88%
WIDOW/WIDOWER	10	8%
SEPARATED	1	1 %
TOTAL	125	100%

Table 6. Educational Attainment

	FREQUENCY	PERCENTAGE
College	12	10 %
Vocational	8	6%
High School	62	50 %
Elementary	43	34 %
TOTAL	125	100%

Almost half of the farmers- irrigator members were high school graduates posted fifty percent (50%), these graduates have graduated under the old curriculum of the Department of Education as Fourth Year High School).

Farm Profile

Table 6. Size of Farm or Rice Field.

	FREQUENCY	PERCENTAGE
< or 1 hectare	91	72.8%
2 or > hectare	15	12%
3 or > hectare	12	9.6%

4 or > hectare	0	0%
5 or > hectare	7	5.6%
TOTAL	116	100 %

Table 6 clearly describe that majority of the respondents fall under the category of 1 hectare or less, with 91 individuals (72.8%). This indicates that most of the participants are small-scale landholders, suggesting limited land resources and possibly subsistence or small-scale farming practices.

The next group, 2 hectares or more, consists of 15 respondents (12%), followed by 3 hectares or more with 12 respondents (9.6%). These groups represent a smaller portion of the population, indicating that moderate-sized landholdings are less common.

Interestingly, there are no respondents (0%) who own or manage 4 hectares or more, showing a gap in this category.

Lastly, only 7 respondents (5.6%) fall under 5 hectares or more, making large-scale land ownership the least represented group.

Overall, the data suggest that the respondent population is dominated by small-scale landowners, with very few medium to large landholders. This distribution may have implications for agricultural productivity, access to resources, and vulnerability to risks, as smaller landholdings often face greater limitations in terms of income, technology, and resilience.

Table 7. Land Owned.

Land Ownership	FREQUENCY	PERCENTAGE
YES	60	48%
NO	65	52%
TOTAL	125	100%

The table 7 shows the distribution of respondents based on land ownership, with a total of 125 respondents. Out of the total, 60 respondents (48%) reported that they own land, while 65 respondents (52%) indicated that they do not own land.

This indicates that a slightly larger proportion of respondents are non-landowners. The difference, although small, suggests that land ownership is not common among the majority, and more than half of the respondents may rely on alternative arrangements such as renting, leasing, or working on others' land. The data imply that land tenure insecurity or limited access to land ownership may be an issue within the study population. This situation can have important implications for economic stability, agricultural productivity, and long-term investment in land development, as individuals who do not own land may have less control over its use and fewer incentives to invest in improvements.

Table 8. Mode of Land Acquisition.

	FREQUENCY	PERCENTAGE
DAR Recipient	6	4.8%
Tenant	78	62.4%
Inherited	34	27.2%
Bought	7	5.6%

TOTAL	125	100%
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Table 8 present the distribution of respondents according to their mode of land acquisition. It is shown that the majority of respondents were classified as tenants, accounting for 78 individuals (62.4%), indicating that land is primarily accessed through tenancy arrangements rather than ownership. This is followed by those whose land was inherited, with 34 respondents (27.2%), suggesting that family transfer remains a significant means of land acquisition.

A smaller proportion of respondents were able to acquire land through purchase, with 7 individuals (5.6%), while only 6 respondents (4.8%) were identified as recipients of the Department of Agrarian Reform (DAR).

The land acquisition among the respondents is largely characterized by tenancy, with relatively limited instances of ownership through purchase or government redistribution programs.

Table 9. Agricultural Product Produced.

	FREQUENCY
Root Crops	8
Vegetable	19
Corn	18
Rice	85
Abaca	6
Coconut	13

Table 9 present the types of agricultural products produced by the respondents. It is observed that rice is the most commonly produced crop, with a frequency of 85, indicating that it is the primary agricultural product among the respondents. This is followed by vegetables (19) and corn (18), which are also widely cultivated, though to a lesser extent compared to rice.

Meanwhile, coconut (13) and root crops (8) are produced by a smaller number of respondents, suggesting moderate engagement in these types of agricultural activities. The least produced crop is abaca, with a frequency of 6, indicating minimal involvement in its production.

Table 9 inferred that agricultural production among the respondents is largely concentrated on rice farming, while other crops are produced on a smaller scale.

Encountered problems by the farmer- beneficiaries and members of the Cagaycay Irrigators System (CRIS)

Several problems were identified by the farmer-beneficiaries during the Presentation, consultation and validation of survey results and the newly designed and developed web-based water distribution scheduler held last September 5, 2024 at the 2nd Floor, ParSU – College of Hospitality and Tourism Management (CHTM) Hostel that were attended and participated- in by selected members, officers of the CRIS irrigators association. The attendees were representatives from various irrigators associations namely; CLAB-FIA of Agpo, Lagonoy, Camarines Sur; TATISAN-FIA of Napawon, Goa, Camarines Sur; BMCE-FIA, Exihomo, Lagonoy, Camarines Sur; NAPUDIA-FIA Pugay , San Jose, Camarines Sur; MANTAM-FIA, Tambangan, San Jose, Camarines Sur; CLAB-FIA, Kinalansan , San Jose, Camarines Sur; MATOON/LAT E-FIA, Del Carmen, San Jose , Camarines Sur; BSRT-FIA, Teres, Lagonoy,

Camarines Sur; and Kinalansan Farmers-Irrigators Association (KFIA), including representatives and officials from the National Irrigation Administration (NIA); CLAB-FIA, Agpo Lagonoy, Camarines Sur; TATISAN-FIA, Napawon, Goa, Camarines Sur; BMCE-FIA, Exihomo, Lagonoy, Camarines Sur; FIA, Agpo, Lagonoy, Camarines Sur; NAPUDIA-FIA, Pugay, San Jose, Camarines Sur; MANTAM-FIA, Tambangan, San Jose, Camarines Sur; CLAB-FIA, Kinalansan, San Jose, Camarines Sur; MATOON/LAT E-FIA, Del Carmen, San Jose, Camarines Sur; and BSRT-FIA, Teres, Lagonoy, Camarines Sur.

Through Focus Group Discussion (FGD), the participants identified several recurring problems which considered to be perennial in the area. They posted and summarized the problems encountered on-site; (1.) poorly implemented projects, (2.) not properly maintained main canal and its lateral canals, (3.) dilapidated irrigation facilities, (4) cropping calendar, (5) insufficient water supply especially during dry season and (6) discipline among its members. However, having not only part of the problem, the participants also provided possible solution and recommendation to solve the problems such as; proper distribution of the available water on-site, allocate budget and construct dam to augment water supply and installation of solar pumps or STW.

On the other hand, there were issues and concerns that were raised and discussed during the presentation that was presented by the NIA personnel. There were outdated data of Irrigators association (IA), non-submission and delayed submission of reports, maintenance cleaning (before, during and after), LIPA preparation and there were complaints from the irrigators association members left unaddressed.

Water distribution in the National Irrigation Administration's Cagaycay River Irrigation System is manually scheduled by the responsible office staff. The individuals in charge of water gate control will get the schedule once it has been finalized, and they will be responsible for overseeing and carrying out the water distribution to the designated area or Irrigators Association area. The irrigators association's designated technical water tender receives this schedule via text message, and members of the association are also informed of it.

Due to the agency's traditional or manual scheduling preparation, there are instances where members of the irrigator's association or the farmers are misinformed, are refused access to water because information is not shared, and this causes misunderstanding over who should receive the water schedule.

Proposed System Evaluation Result

Table 10. Summary of Result

Parameters	IT Experts	NIA-CRIS Staff	IA Representative	Mean
Functionality	4.7	4.6	4.8	4.7
Usability	4.7	4.9	4.8	4.8

Table 10, shows the summary result evaluated by ten (10) IT Experts, five (5) NIA-CRIS Staff and nine (9) farmers from the Irrigator's Association members as representative. The evaluation process was done thru sending the evaluation tool thru email to the target IT expert evaluators or visiting in their house or by meeting in a place comfortable and convenient to them. In the part of NIA staff and farmers or irrigator's association members, the evaluation was done during presentation and validation of the research data gathered held last September 5, 2024 at PSU San Jose Campus hostel as the venue and it is participated by the NIA employee and the farmer sectors through their Irrigators Association officers and

members. The evaluation tools are consisting of three (3) evaluation criteria which are functionality, Usability and Acceptability, each criteria have four (4) key indicators that the evaluator used to rate. This evaluation tool was based from the ISO 25010 which is Software Quality Standard.

The key indicators are also rated on a likert scale of 5 to 1 (highest to lowest order), with the following verbal interpretation: 5 - far more than what is expected, 4 - more than what is expected, 3 - presence of the expectation, 2 - less than what is expected, and 1 - absence. The suggested system was scored for functionality with a mean of 4.7, which means extremely acceptable, and usability with a mean of 4.8, which also means highly acceptable.

CONCLUSION AND RECOMMENDATION

The study is about Design and Development of Web-based water distribution scheduler for National Irrigation Administration – Cagaycay River Irrigation System. It sought answers to the following objectives:

1. Identify the problems encountered by the farmers and the National Irrigation administration in the implementation of irrigation water distribution;
2. Evaluate and assess the present manual mode of NIA water distribution scheduling.
3. Test the functionality, usability and acceptability of the developed system (web-based scheduling system).

The proponent conducted research through several government and business agencies that employ IoT-based water scheduling and compared them to the current study. It examined how authorities or organizations distribute water distribution schedules for irrigation systems in accordance with the agricultural sector, particularly rice growing. The researcher did a check of the other NIA branches in the Bicol region to guarantee that the proposed idea had not yet been utilized by the said agency branches and it found that this project is needed by the agency.

Next, the proponent should seek advice from NIA staff and other IT experts to evaluate and test the system's functionality, acceptability, and usefulness.

The proponent follows the descriptive research methodology to evaluate the present water distribution scheduling of the National Irrigation Administration – Cagaycay River Irrigation System that includes data gathering procedures that employs survey questionnaire and focus-group-discussion (FGD), and statistical treatment and analysis. It also adopt the phases of system development life cycle in the development of the web based water distribution scheduler. These includes initiation, analysis, design, development and implementation.

During the testing phase, IT experts and staff of the National Irrigation Administration and selected Irrigator's Association officer and members evaluated the system performance as to functionality, acceptability and usability.

FINDINGS

To address the aforementioned issues, the researcher employed the descriptive developmental technique of study in the context of system development. The descriptive method was used to present the findings of the evaluation of the technical components of the system in terms of functionality, acceptability, and usefulness of the developed system. Following system testing, the data was analyzed using the percentage technique and the arithmetic mean. The software development life cycle (SDLC) was also used to design the suggested system. The specific findings are as follows:

1. The National Irrigation Administration - Cagaycay River Irrigation System uses human labor to prepare water distribution schedules for each irrigator's association and farmer beneficiaries served by the agency in the municipalities of San Jose, Goa and Lagonoy.
2. The practicality of applying the proposed web-based water distribution scheduler is viewed as vital and timely in technological terms for the National Irrigation Administration - Cagaycay River Irrigation System, which is confronting a new information technology trend. The results showed that respondents agreed and strongly encouraged the adaptation and use of the suggested system.
3. Following a review of the collected data and the study's evaluation results, the researcher proposed the establishment of a web-based water distribution scheduler for the National Irrigation Administration's Cagaycay River Irrigation System.
4. The experts deemed the produced Web-based Water Distribution Scheduler to be very usable, with 95% rating it as such, and 90% rating it as accurate.
5. According to the results, respondents strongly believed that the built web-based water distribution scheduler was simple to use and operate. The developed system demonstrates a sense of proficiency, and the design was appropriate for the sort of system. Most respondents agreed that the system would provide credible information on water distribution schedule. Similarly, information found in this system would have yielded relevant results.

CONCLUSION

Based on the study's findings, the following conclusions are drawn: regarding the Cagaycay River Irrigation System, which is currently in use by the National Irrigation Administration for creating water distribution schedules, the researchers came to the conclusion that a web-based water distribution scheduler could be more advantageous and assist the agency staff responsible for scheduling in carrying out their duties more effectively and efficiently. In addition, the schedule was deemed transparent, which benefits the farmers and members of irrigator associations.

It is also concluded that the developed web-based water distribution scheduler exhibits usability and accuracy.

RECOMMENDATIONS

Based on the conclusions the following recommendations are hereby offered:

1. It is recommended to use the web-based water distribution scheduler in the National Irrigation Administration – Cagaycay River Irrigation System.
2. It is also recommended that this system be used by the other branch of the agency.
3. The developed system can also be used by other researcher having related projects for their references and comparison.

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