

Analysis of Water Quality Status of Cengklik Reservoir based on Pollution Index, Boyolali Regency, Central Java, Indonesia

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Abstract: Anthropogenic activities such as fishing, fish ponds, and domestic trash contribute the most to the water quality of the Cengklik reservoir. This research aimed to analyze the water quality status and Pollution Index of the Cengklik reservoir. Water quality status was calculated by using the Pollution Index method. The results indicated that the water quality of the Cengklik Reservoir is strongly influenced by the sources of water pollutants and the surrounding area's ambient conditions. The results revealed that the water quality at the inlet is lightly polluted, with pollutant index values (Pij) of 2.56 at the inlet (CI1) and 4.02 at the inlet (CI2).

Keywords: Water quality, Pollution Index, Cengklik water reservoir, Indonesia

1. INTRODUCTION

Indonesia has various potentials for abundant natural wealth in living and non-biological natural resources. Indonesia still has a lot of natural resources that aren't being used to their full potential. One is the potential wealth of Indonesian waters, sea, or freshwater, such as lakes, rivers, and reservoirs[1]. A reservoir is one of the bodies of water that can significantly benefit people. Reservoir building serves numerous purposes, including irrigation, generating electrical energy through hydroelectric power, supplying potable water, flood control, recreation, fisheries, aquaculture, and capture. The reservoir is developed over a large region, considering the water supply used to fill the dam. Rivers and rainwater can fill reservoirs[2]. The Cengklik reservoir is one of the reservoirs in the Central Java region in Indonesia and has a dual role in ecology and economics. The Cengklik reservoir's ecological role is related to its hydrological capabilities, including the catchment area and flood control, providing water for the surrounding area, irrigation, and freshwater fish farming. Global water scarcity and the volume of wastewater effluents from industrial sites and urban agglomerations are causing considerable environmental, economic, and societal concerns^{6,7}. Because of the massive volumes of contaminated water, production water can be a significant environmental hazard and a possible source of freshwater for domestic or agricultural use [2], [5].

The number of activities around the Cengklik reservoir area benefits the community in the economic field. However, the community and local government have not paid serious attention to the environmental aspect. Many land uses do not adhere to ecological principles, such as constructing food stalls on the edge of the reservoir but not equipped with wastewater treatment facilities, causing the wastewater to enter the reservoir[5], [6]. It creates a considerable risk of

water pollution in the reservoir, as seen by the abundance of water hyacinth. Furthermore, the Cengklik reservoir underwent silting, which increased water levels. The substantial growth was partly due to the river silting and the vast amount of waste buried in the reservoir due to being swept away by river currents, requiring the reservoir bottom to be drained regularly by dredging [5], [7].

In practice, there are limits because the responsibility of regulating and supplying water resources services may still overlap; ineffective law enforcement and water management frameworks have yet to be established. The Citarum River in West Java is one of the world's most polluted due to insufficient government attempts to reduce pollution[8], [9]. This study provides the picture of water quality with PI for the Cengklik reservoir to support the Boyolali policymaker for ensuring water management sustainability.

2. STUDY AREA DESCRIPTION

The study was conducted at Boyolali Regency; it is located between 110° 22' - 110° 50' East Longitude and 7° 7' - 7° 36' South Latitude, Central Java Province. Boyolali has three reservoirs: Bade, Kedung Ombo, and Cengklik. Cengklik Reservoir is located between Ngargorejo and Sobokerto villages in Ngemplak Boyolali District. Three volcanoes surround this location: Merapi, Merbabu, and Lawu. The Cengklik Reservoir is located between 109°11'28"-109°14'58" east longitude and 7°1'31" - 7°2'18" south latitude. Cengklik Reservoir has a 6792.71 hectares watershed and covers 306 ha, of which 296 hectares are inundated, with an embankment length of 1693 m and a width of 750 m. In these conditions, the Cengklik reservoir may drain 1578 hectares of technically irrigated rice fields.



Figure 1. Map of the Cengklik Reservoir area and its surroundings (Source: Boyolali Regency Regional Development Planning Agency, 2010)

3. METHODOLOGY

In this study, various types of data related to the study were collected; the type of data collected includes reservoir water quality data obtained from laboratory testing of reservoir water samples. A reservoir water sampling is carried out on the reservoir water body, the flow of river water entering the reservoir, and the flow of river water leaving the reservoir body. Laboratory testing of reservoir water samples was carried out on chemical parameters such as pH, TSS, BOD, COD, Total Phosphate, Ammonia, Total Coliform, and detergent. The instruments used in this research include pH meter, DO meter, spectrophotometer, thermometer, Gravimetric, cooler box, boat, camera, bucket, dipper, Winkler and incubation, and Reflux K₂Cr₂O₇. The Pollution Index (PI_j) Method is used to determine the current state of water quality.

$$PI_j = \sqrt{\frac{(C_i/L_{ij})^2_M + (C_i/L_{ij})^2_R}{2}}$$

Note:

PI_j: Pollution Index

C_i: Concentrations of water quality parameters

(i): (units adapted to Water quality parameters observed)

L_{ij}: Standard of water quality parameters (i) designation of water (j) (unit adjusted for water quality parameters observed)
 (C_i/L_{ij})_M: Maximum value

C_i/L_{ij} (C_i/L_{ij})_R: Average value C_i/L_{ij}

4. RESULTS AND DISCUSSION

Based on the Law of the Republic of Indonesia Number 5 of 1990 about the conservation of biological natural resources and ecosystems, conservation aims to balance living natural resources and their ecosystems to help people improve community welfare and the quality of human life[10].

4.1 Water quality analysis of Cengklik Reservoir

Table 1 displays the results of chemical parameters from laboratory water sample analysis from various sampling sites.

Table 1. Test Results of Cengklik Reservoir Water Laboratory.

Parameters								
Parameter	pH	TSS	BOD	COD	PO4-	NH3-N	T. Coliform	Detergent
Unit		mg/l	mg/l	mg/l	mg/l	mg/l	MPN/100ml	mg/l
RWQS	6-9	50	3	25	0,03	0,75	5000	0,2
Sample area								
CB1	6,29	4	3,82	20,35	0,0382	0,3660	460	0,0088
CB2	6,30	8	3,80	19,32	0,0250	0,3652	430	0,0043
CB3	6,32	11	4,14	20,42	0,0233	0,3856	430	0,0043
CO1	6,44	8	5,55	29,00	0,0793	0,3774	350	0,0066
CO2	6,54	14	4,39	19,01	0,0500	0,3938	540	0,0059
CI1	6,53	24	4,79	18,90	0,0936	0,3829	920	0,0043
CI2	6,60	28	3,86	16,87	0,2441	0,3633	920	0,0043

Note: RWQS: Reservoir Water Quality Standard

CO1: Reservoir Outlet 1

CB1: Reservoir Body 1

CO2: Reservoir Outlet 2

CB2: Reservoir Body 2

CI1: Reservoir Inlet 1

CB3: Reservoir Body 3

CI2: Reservoir Inlet 2

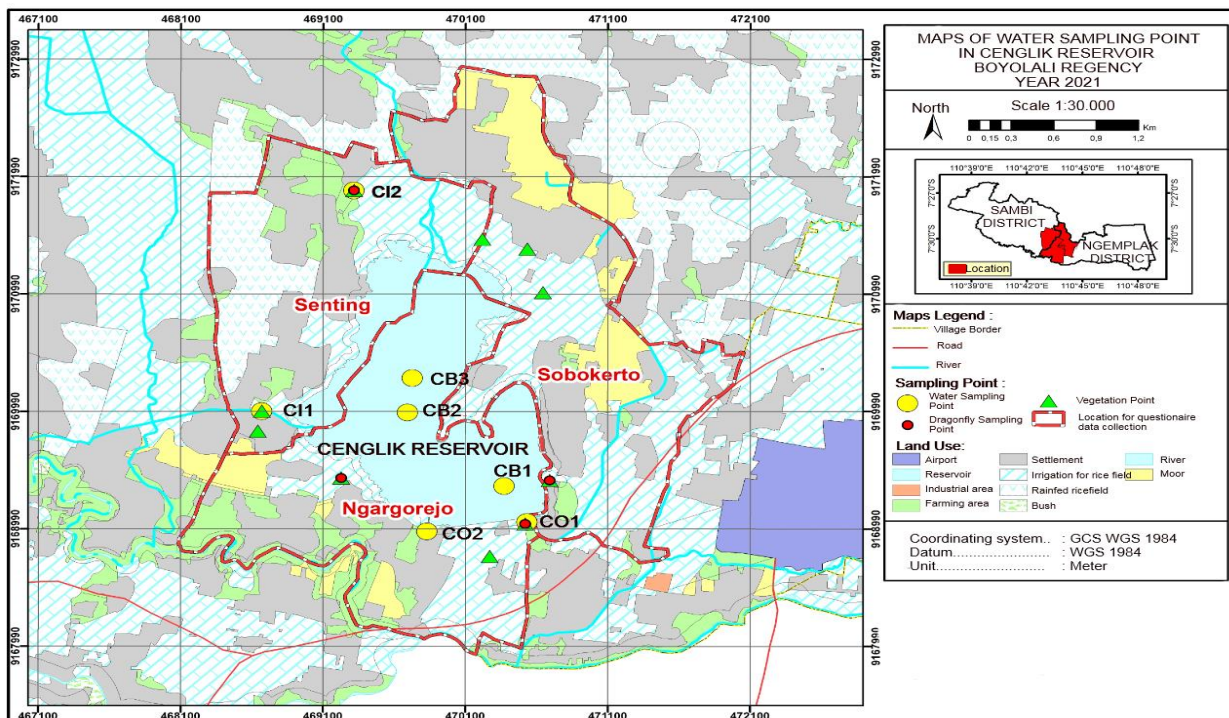


Figure 2. Map of Cengklik reservoir water sampling points and Pollutant Index (Pij) values.

The water quality of the Cengklik reservoir can be determined by comparing the results of the Cengklik reservoir quality test with the quality standards regulated by the government based on Government Regulations No. 22 of 2021 for reservoir water bodies. Based on observations, the pH value of the

Cengklik reservoir water can be seen in Figure 2. The highest pH value at the CI2 sampling point (Cengklik Reservoir Inlet 2) is 6.6. In contrast, the lowest pH of the Cengklik reservoir water occurs at the sampling point CB1 (Cengklik reservoir body 1), which is 6.26. The pH value of the Cengklik

reservoir water still meets the reservoir water quality standard according to PP 22 of 2021.

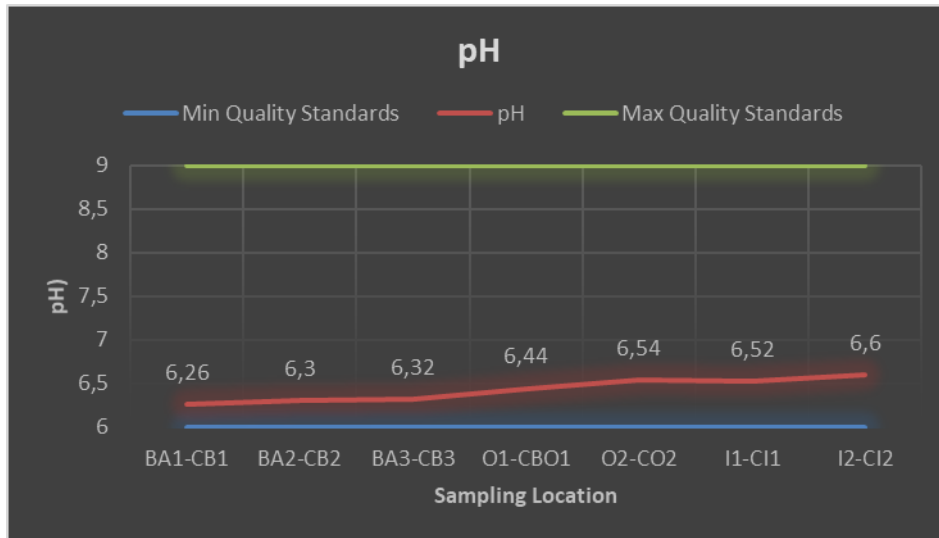


Figure 3. The pH value of the Cengklik reservoir water sample

The BOD5 value of the Cengklik reservoir water is based on observations in figure 3. The highest BOD5 value occurred at the sampling point of CB1, or Outlet 1, was 5.55 mg/L, while the lowest BOD5 of Cengklik reservoir water occurred at the

sampling point of CB2 or Water Agency 2 was 3.8 mg/L. Based on the analysis results, BOD5 values in all current Cengklik reservoir water samples exceed quality standards.

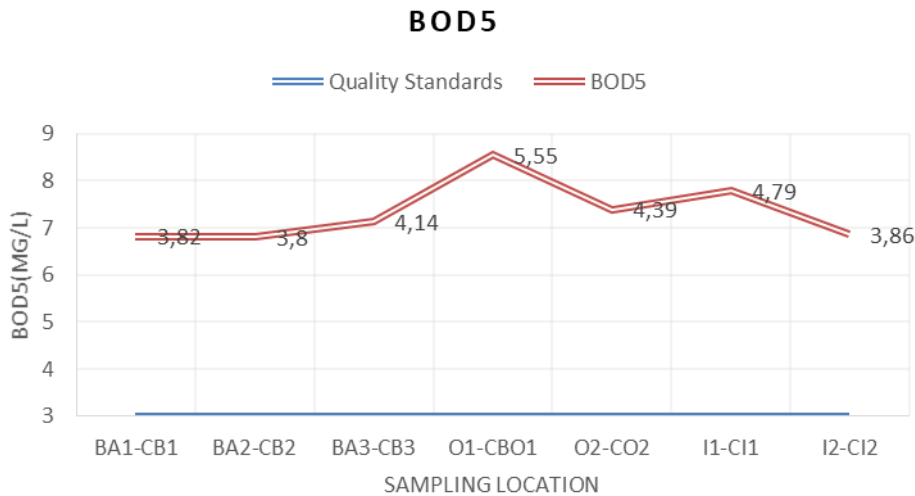


Figure 4. BOD5 value in the Cengklik reservoir water sample

COD value Cengklik reservoir water based on results observed in figure 4. The highest COD value occurred at the sampling point B01 or Outlet 1 was 29 mg/L, while the lowest COD of Cengklik reservoir water occurred at the sampling point CI2 or Inlet 2, which was 16.87 mg/L. Based on the

analysis results, almost all of the COD parameters of the Cengklik reservoir still meet the quality standards, except for the sampling point at CBO1 (Waduk Water Agency 01), which is 29 mg/L, with a quality standard of 25 mg/L.

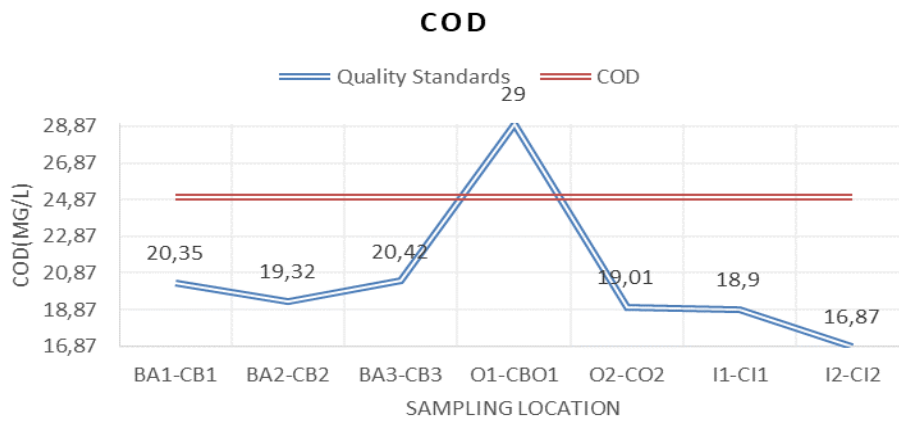


Figure 5. COD value in the Cengklik reservoir water sample

TSS parameter value of Cengklik reservoir water based on the results' observation in figure 5 showed that the highest TSS value occurred at the sampling point CI2 or Inlet 2 was 28mg/L. In contrast, the lowest TSS of Cengklik reservoir

water occurred at the sampling point of CB1 or reservoir body 1, which was 4mg/L. All TSS parameter values of Cengklik reservoir water still met the quality standard.

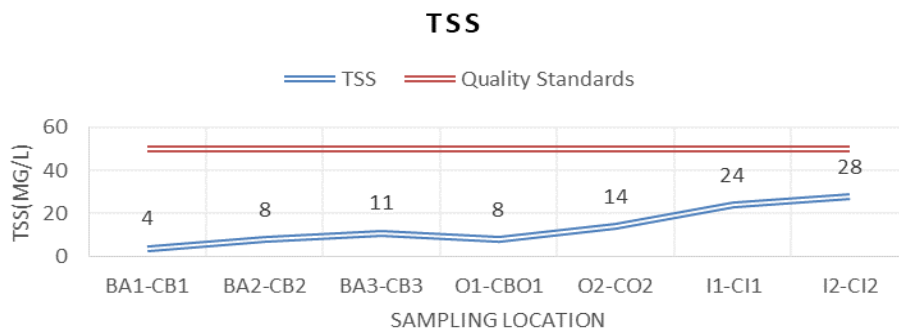


Figure 6. TSS value in the Cengklik reservoir water sample.

The parameter value results of Total Phosphate in Cengklik reservoir water in figure 6 showed that the highest PO₄-P at the sampling point C12 or Inlet 2 was 0.2441mg/L. In contrast, the lowest PO₄-P of the Cengklik reservoir water at the sampling point of CB3 or water body 3 was 0.0233mg/L.

Only 2 (two) of the 7 (seven) PO₄-P parameter values of Cengklik reservoir water meet the reservoir water quality standard, which is 0.03 mg/L, and all of them are in the reservoir body.

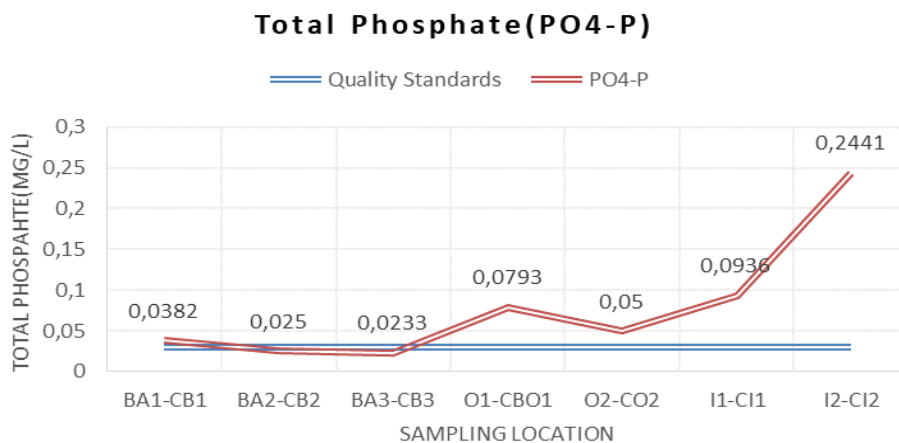


Figure 7. PO4-P value in the Cengklik reservoir water sample

The NH3-N value of the Cengklik reservoir water in figure 7 showed that the highest NH3-N value occurred at the sampling point of CB2 or Outlet 2 was 0.3928mg/L. In contrast, the lowest NH3-N of Cengklik reservoir water

occurred at the sampling point of CB2 or reservoir body 2 was 0.3652mg/L.

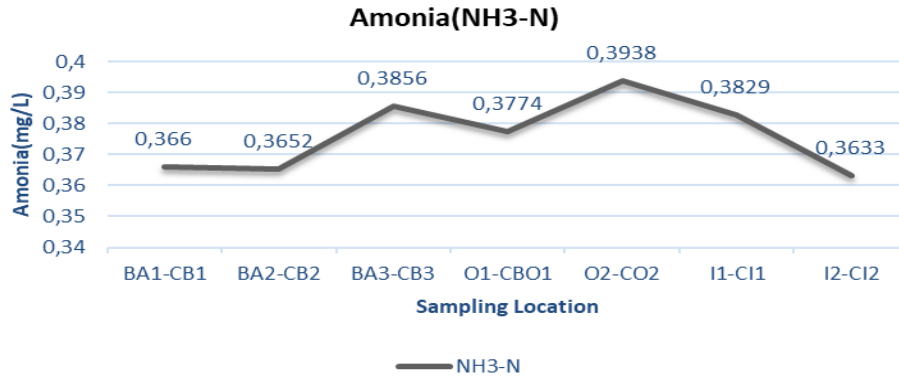


Figure 8. NH3-N value in the Cengklik reservoir water sample.

The Cengklik reservoir water detergent value in figure 8 showed that the highest detergent value occurred at the sampling point CB1 or reservoir body 1(one) was 0.0088mg/L. In contrast, the lowest detergent water from the

Cengklik reservoir occurred at the sampling CB2, CB3, CI1, and CI2 are 0.0043mg/L. The current value of Cengklik reservoir water detergent still meets the quality standard of 0.2 mg/L.

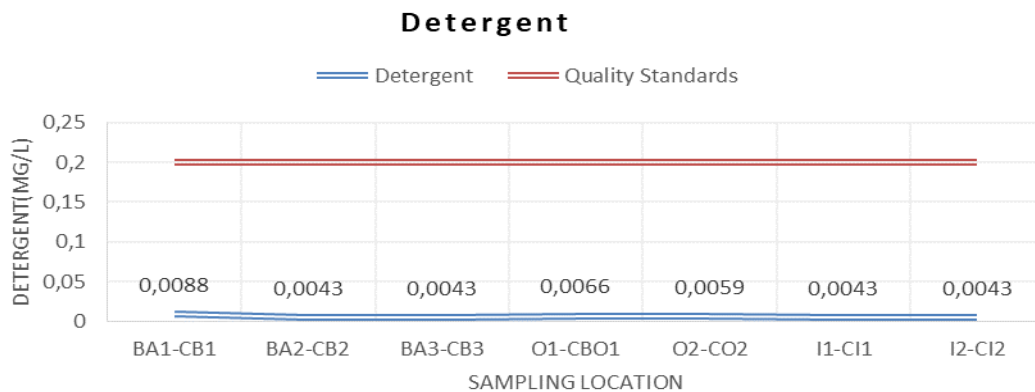


Figure 9. Detergent value in the Cengklik reservoir water sample

The results of the total coliform value of the Cengklik reservoir water in figure 9 showed that the highest Total Coliform value occurred at the sampling points CI1 and CI2 or Inlets 1 and 2 of 920 NPM, while the lowest Total Coliform

water from the Cengklik reservoir occurred at the sampling point CB1 or Outlet 1, which was 350NPM. Cengklik currently still meets the quality standard, which is 5000 NPM.

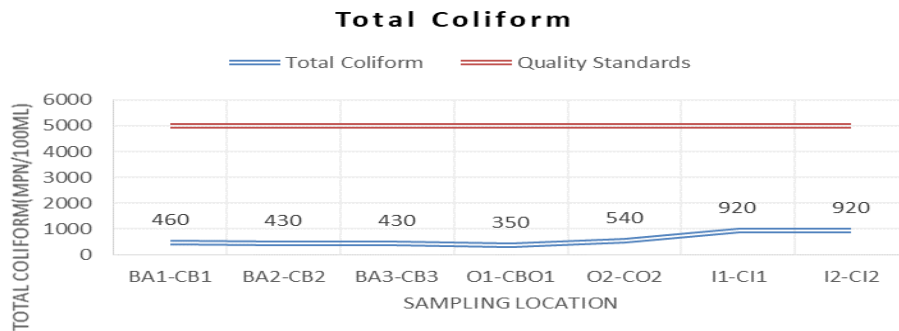


Figure 10. Total Coliform value in the Cengklik reservoir water sample

4.2 Pollution Index

The Pollution Index highlights contamination levels (Minister of the Environment Decree No. 115/2003). The Pollution Index (PI) is calculated for a specific purpose. The criteria are established following the score in Table 2.

Table 2. Criteria for assessing status water quality using the Pollution Index

Score	Criteria
$0,0 \leq PI_j \leq 1,0$	Good Water Quality
$1,0 \leq PI_j \leq 5,0$	Moderately Polluted
$5,0 \leq PI_j \leq 10$	Polluted
$PI_j > 10$	Extremely Polluted

Source: Minister of Environment 2003 [11]

The Pollution Index (PI) calculation can calculate water quality status. Table 3 shows the calculation results for the water quality status of the Cengklik Reservoir.

Table 3. Calculation of the Pollutant Index of Cengklik Reservoir water quality

Sample Code	Location	Ci/Lij, Avg	Ci/Lij, Max	Pij	Water Quality Status
CB1	R.Body 1	0.698013	1.524711	1.1857	Moderately Polluted
CB2	R.Body 2	0.586135	1.513312	1.1476	Moderately Polluted
CB3	R.Body 3	0.609976	1.699396	1.2767	Moderately Polluted
CO1	R.Outlet 1	1.098511	3.110760	2.3328	Moderately Polluted
CO2	R.Outlet 2	0.794523	2.109244	1.5938	Moderately Polluted
CI1	R.Inlet 1	1.028211	3.470773	2.5596	Moderately Polluted
CI2	R.Inlet 2	1.236723	5.552233	4.0222	Moderately Polluted

Note: R. Body: Reservoir body

R.Outlet: Reservoir Outlet

R.Inlet: Reservoir Inlet

The Pollutant index calculation results show that all water sampling locations are lightly polluted. The lightest pollution is in the reservoir body, and the most polluted site is reservoir Inlet 2 (CI2).

Table 4. Status of Cengklik Reservoir Water Quality in 2021

Month	Pij	Water Quality Status
January	5.63	Polluted
February	9.21	Polluted
March	15.68	Extremely Polluted Extremely
April	19.83	Polluted
May	23.40	Extremely Polluted Moderately
June	3.94	Polluted
July	12.72	Extremely Polluted Moderately
August	4.41	Polluted
September	1.32	Moderately Polluted
October	3.33	Moderately Polluted

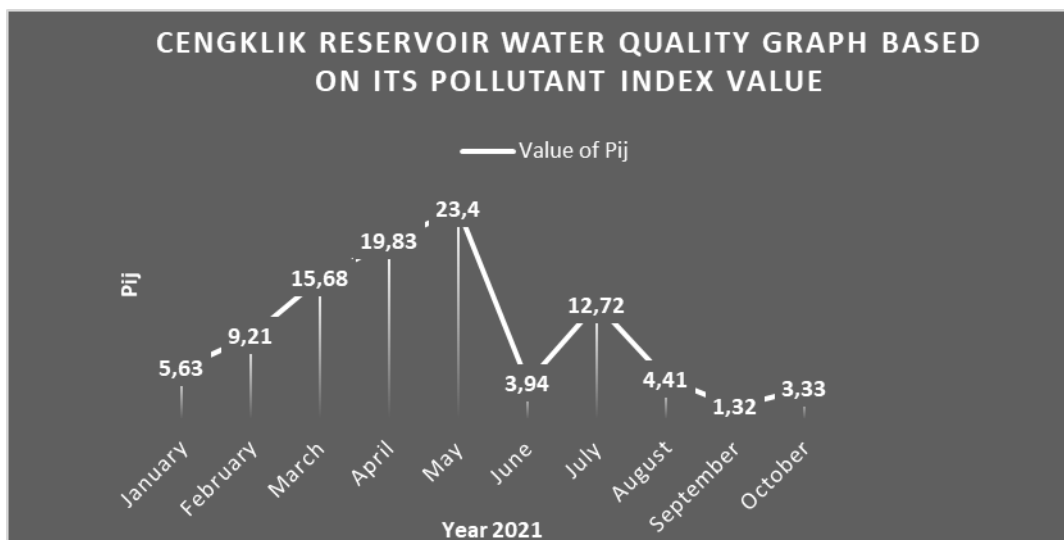


Figure 11. Graph of Cengklik Reservoir Water Quality based on its Pollutant Index value

Based on the results of monitoring the water quality of the Cengklik reservoir carried out by the Bengawan Solo River Basin Center, the reservoir water quality trend is shown in Table 4 and figure 11. Based on the water quality monitoring data of the Cengklik reservoir conducted by the Bengawan Solo, it can be seen that the water quality of the Cengklik reservoir tends to be poor, especially during the rainy season, from January to May.

5. CONCLUSION

The water quality of the Cengklik Reservoir is strongly influenced by the sources of water pollutants and the surrounding area's ambient conditions. The results revealed that the water quality at the inlet is lightly polluted, with

pollution index values (Pij) of 2.56 at the inlet (CI1) and 4.02 at the inlet (CI2). As a result, the water became polluted.

Furthermore, climate factors substantially impact the water quality of the Cengklik reservoir. When a large amount of water is added, it changes water flow and water conditions in the reservoir body, resulting in excessive suspended particles or pollutants in the reservoir water, leading the reservoir water quality to deteriorate. The results of this study reinforce the water quality status and Index of Pollution; the findings indicated Cengklik reservoir was polluted. However, this result is necessary for further investigation to get the whole picture. Further research can assess the environmental impact factors affecting the pollution of the Cengklik reservoir and the social-economic benefits to the surrounding community.

6. FINANCIAL SUPPORT

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7. CONFLICTS OF INTEREST

There are no conflicts of interest

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Education as an Actor in Environmental Governance

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Abstract: Evolution of humans cannot be complete without thinking about education as a variable in that process. When the world is currently dealing with the issues of sustainable development, the term environmental governance is often heard quite a few times and it cannot be discussed without the mention of its link with education. This short paper takes the reader on an introspective journey about the meaning and significance of education in the field of environmental governance whilst making arguments on the relation between collaboration for global environment governance efforts and education that guides and feed the willpower and drives human actions. Through this paper, the author is seeking to increase the dialogues and global discussion about education as an active actor for the achievement of long-term goals in the sphere of environmental governance.

Keywords: education, environmental governance, global collaboration, willpower, environmental action

1. INTRODUCTION

Humans have been evolving long before the documentation of evidence began. Even if it is not said enough but education plays a key role in that evolution. Since there cannot be physiological evolution if the information fed to brain doesn't evolve simultaneously, how can one imagine evolution without education. Same is the case when the discussions about environment governance occur from individual to international levels. When the term education is mentioned, it is often confused with literacy which in fact is merely a milestone towards educated society. Education can come from anywhere. It is not bound by the boundaries of institutions, but it is the foundation for the success of these institutions in the long run. Whenever the statements like 'lack of will' or 'lack of motivation' are thrown around while discussing environmental issues, one always forgets how will or motivation only develop whilst one is informed and educated properly. It's easy to shift the blame to the unwillingness of the uninformed and uneducated humans from the privileged informed ones and keep echoing the similar thoughts in an echo chamber. The unequitable distribution of knowledge is often ignored which in itself shows the unaware minds of the literates at decision making positions. Education not only accelerates the evolution of human intelligence, but also attacks the problems at the root cause instead of trying to fix them after they have happened. But one may wonder while studying environmental governance, how does education come into frame for global governance for environmental issues? This paper is an attempt in that direction. Through this paper, the author is attempting to seek answers to the following questions:

- What is the meaning and importance of education in the context of environmental governance?

- How education guides the willpower and drives action to achieve collaboration required for global environmental efforts?

These questions may sound a bit long to be compiled in a short paper, but it is worth trying. Let's try and understand together the role of education as an invisible actor for environmental governance.

2. WHAT IS 'EDUCATION' FOR ENVIRONMENTAL GOVERNANCE? WHY IS IT IMPORTANT?

While discussing environmental governance, it is inevitable to leave the structural elements like actors, and institutions out of the dialogue. The actors and institutions bring with them the patterns of interactions that lead to different outcomes when various environmental resources and processes flow through these governance structures (Vatn, 2015). Education is that invisible thread that links these elements of environmental governance systems in various forms like knowledge, flow of information, acquisition of power, decision making for policy implementation to name a few. Education in context of sustainability is usually what motivates changes in ideas, values, knowledge, skills, and behavior to formulate a more environmentally friendly and just society for everyone (Wikipedia contributors, 2022a). Education is the key process required to shift power in any system and environmental governance is one such system which can benefit a lot from educated minds that have the ability and position to take difficult decisions which are backed up by knowledge rather than a hunch. Education can be attained from any means, but institutions play an important role in smooth flow of knowledge through a proper passage. Whenever the complex issues like environmental governance are discussed, it is often forgotten that decisions taken while being in power can only sustain in the long run if they have some sort of

rationale and logic behind it. Education in context of governing environmental issues lies in the power of knowledge and equitable access to it globally, which goes beyond merely knowing facts to conditioning of the brain to act for a just environment. The major issue faced by environmentalist and policy makers while managing environment is not related to achieving balance of natural resource availability and its usage. But the major issue lies in resolving conflicts to achieve that balance (Haughton, 2015). That's where education comes into picture. Education has the power to lead collaboration between people through knowledge sharing and communication which seems to be lost when people, instead of working together to achieve the same goals, do not indulge in healthy communication or exchange of collaborative ideas (Haughton, 2015; van der Molen, 2018). Education also helps to break down barriers like stereotypes and prejudice while making decisions concerning environmental policies as it helps to understand emotions and their implications for everyone involved in the process (Haughton, 2015). It not only makes the interactions between various actors in environmental governance system much smoother, but also helps in continuous two-way communication (Vatn, 2015). But how does education lead to collaborative action in the area of environmental governance?

3. EDUCATION AS DRIVER OF MOTIVATION

Education driving motivated action to collaboration in environmental governance

Education is crucial in making global populations recognize and address various environmental issues (e.g., increasing carbon dioxide emissions, melting of ice sheets, etc.) through changes in behaviors and psychology (Mäki & Crosier, 2019).

One cannot even begin to imagine the formation of Intergovernmental Panel on Climate Change (IPCC) if it hadn't been for educational awareness about climate change. IPCC development took place from the Advisory Group on Greenhouse Gases, which is an international level scientific body (Wikipedia contributors, 2022b). This shows an example of decision making due to educational transfer between scientific actors and political actors through coordinated efforts which led to establishment of the IPCC as an instrument to educate the future decisions based on facts and knowledge rather than just political emotions (Haughton, 2015). This is nothing but an indication of power shift from political actors into the hands of scientists conducting research. It may not be a power shift in absolute sense, but it does relay that the political actors will have to make decisions based on these kinds of research. Even the sustainable development goals have quality education as the fourth goal placed way before the goals concerning environment and sustainability (Desa, 2016; Wikipedia contributors, 2022c).

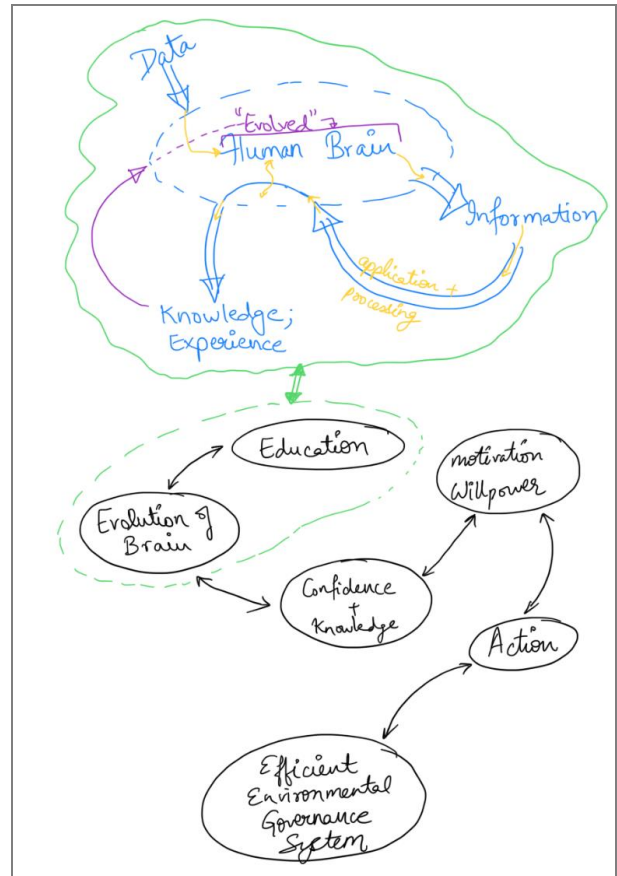


Figure 1: Educated mind making efficient environmental governance system (Breiting & Mogensen, 1999)

Education is not just limited to a small group of scientists or policy makers; it is meant to connect every soul on earth through evolved human brain. The goal number 13 also talks about handling climate change via improvement in field of education which points out that education is required to make action happen (Desa, 2016). Another example where education brings in collaborative efforts is how the whole world has in its own way come together whenever youth environmental activists like Greta Thunberg talk about climate change and failure of political actors in saving the climate. The mass movement of young protestors is solely due to educational awareness guiding the shift of power from bottom to upwards instead of other way around (Holden, 2019; Walker, 2017). It showcases how the education in environmental issues at every level cause shift of power from the hands of few to the hands of all. In any type of environment where human interactions happen, education exchange becomes absolutely necessary to achieve results when the timelines and schedules are strict. Environmental governance is an extremely interdisciplinary system as it entails the governance of environment which is being impacted so drastically that few individuals cannot handle the huge responsibility of making decisions and this also signals that education brings people together to achieve goals much faster than would be achieved separately (Clark et al., 2011; McClaren & Hammond, 2005). This means

education intuitively gives rise to collaboration and is needed in environmental governance framework.

4. DISCUSSION & CONCLUSION

In the realm of environmental governance, the meaning of education is vast and goes beyond the term "literacy". The framework of environmental governance systems needs constant education at each and every level with equitable access in order to achieve global consensus every time while discussing environmental issues. Education leads to evolved mindset that helps human to think beyond their self-interest and as a part of the environmental system. It has the power to feed motivation and willpower that leads to action with collaboration. And it is needless to say that collaboration often leads to resolution of conflicts which distributes power and help increase the efficiency of environmental governance system. It would not be incorrect to say that education does form a key thread in the complex fabric of environmental governance and without it, this fabric cannot be sewed or mended.

5. ACKNOWLEDGEMENT

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Home Automation System Design Using Arduino Nano and HC06 Bluetooth Module

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Abstract: Home automation is rapidly playing an important role in today's technologically advancing world. The aim of automation is making life easier for the user by eliminating the rigorous nature of manually operating home appliances like fan, television, light and Home Theater. This paper propose a home automation using Arduino Nano and HC 06 Bluetooth module interfaced together and can wirelessly communicate with an Android or IOS mobile phone that is Bluetooth enabled. Using this system, a fan and a television is wirelessly controlled using Bluetooth terminal software downloaded from google play store. The system was design and tested using two LEDs, a yellow LED and red LED representing the television and the fan respectively. The result shows that home automation can be achieved using Arduino Nano and HC06 Bluetooth module interconnecting other appliances in the household as well.

Keywords: Home Automation; Arduino Nano; Bluetooth; Graphic User Interface (GUI); Mobile Phone

1. INTRODUCTION

Controlling home appliances automatically is a way of complementing people's effort especially the oldest, sick and disabled by making things around the home easy and accessible to them. Advances in technology has been able to make that possible with people having the control remote in their hands in the form of mobile phones. This automation is made even easier and handy by the advances in Nano technology with Arduino Nano, which is smaller, breadboard friendly and can be programmed and easily interfaced with HC06 Bluetooth module.

People nowadays have mobile phones with android/ios applications, which can easily be used as Graphic User Interface (GUI) for connecting with the Bluetooth and therefore creating user window that allows the user to type in string of command from the phone that is read by the Bluetooth module and is transmitted wirelessly to the Arduino Nano. This string of command enable the output pin of the Arduino that is connected to the switching circuit made with Bipolar Junction Transistor (BJT) and relay circuit that interconnect the alternating current(a.c) mains supply with the design and providing isolation between the a.c mains supply and the direct current (d.c) supply. The home appliance can be switched ON or OFF using commands that are sent from the mobile phone.

2. LITERATURE REVIEW

Researchers in the past have suggested different methods of achieving home automation; this section will provide the possible method suggested by these researchers.

Naresh, D. et al. presented a Bluetooth based home automation system using ARM9 as a standalone embedded system board to control home appliance connected to ARM7 and communication is established between the ARM7 and ARM9 with Bluetooth device[1]. While [2][3] in their work presented a method of Bluetooth based home automation system using cell phone and Arduino Bluetooth board.

[4] Presents a GSM base automation system using app-inventor for android mobile phones. In his paper, message can be sent via the phone and a controller connected to an appliance using GSM module turns OFF/ON the appliance.

Other studies such as presented in [5][6][7] has examples of Internet of things, which are automations that require network coverage, thus in areas where there may be inconsistent coverage, this could pose a big problem for users. The authors in [8] presented a low cost and flexible home control and environmental monitoring system. It employs an embedded micro-web server in Arduino Mega 2560 microcontroller, with IP connectivity for accessing and controlling devices and appliances remotely. These devices can be controlled through a web application or via Bluetooth Android based Smart phone applications. [9] Presented a home automation system using Arduino Uno and HC05 Bluetooth module to control home appliance using mobile phones.

Bluetooth employs UHF radio waves in the ISM band, in the range of 2.402 GHz to 2.48 GHz [10] and has the advantage that it is not control by network providers, once the mobile phone is Bluetooth enable; it guarantees automation just like a Bluetooth remote control.

3. METHODOLOGY

This paper presents home automation system that is able to control a fan and television set using Arduino Nano and Hc06 Bluetooth module with Bluetooth terminal application downloaded from google play store. The Bluetooth terminal permits user to be able to send strings of command that turns ON/OFF these home appliances. The Bluetooth terminal application eliminates the complicated Java coding process and is user friendly. This application can be install on an android phone and provides GUI with which the user communicate using string that are easily understood.

4. BLOCK REPRESENTATION OF THE SYSTEM

Figure 1 represents the block diagram of the proposed automation system. The input is a mobile phone that is equipped with Bluetooth and serves as the GUI where the command is send to the HC06 Bluetooth module. The Bluetooth module receives the command within 10meters coverage area and pass it to Arduino Nano. The Arduino Nano reads the command through a serial port and compares the command from the Arduino and if the command match, the Arduino will execute. The switching circuit comprises of a transistor and relay which as a switch and as an isolation point respectively.

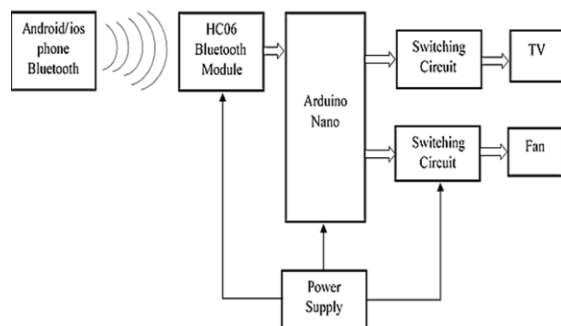


Figure 1. Block Representation of Home Automation System

4.1 Interfacing Arduino Nano with HC06 Module

The HC06 Bluetooth module used in this project is a slave device. That means, on its own, it cannot initiate a connection but rather, a master Bluetooth device (such as smart phones and PC) state the connection.

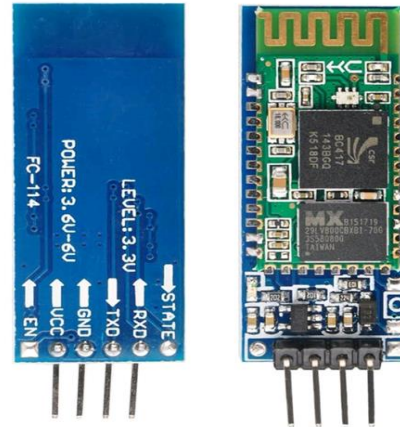


Figure 2. HC06 Bluetooth Module

The Arduino used for this design is the Arduino Nano microcontroller board that is based on the Atmega328p, which is widely used in robotics, embedded systems, automation, Internet of Things (IoT) and electronics project [9]. The Arduino Nano is selected because it is relatively small, easy to program and breadboard-friendly. Figure 3 shows the pin out of the Arduino Nano.

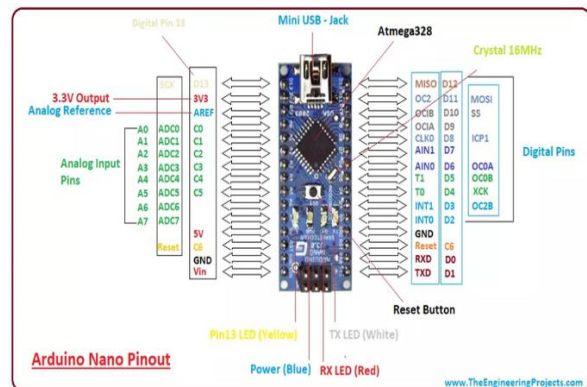


Figure 3. Arduino Nano Pin Out

The communication protocol between HC06 and android is universal synchronous asynchronous Receiver Transmitter (USART). The HC06 Bluetooth use the serial protocol, which support AT command listed in the data sheet. The received pin of the HC06 is a 3.3V logic and the transmit pin of the Arduino is a 5V logic which means for the Arduino to effectively communicate with the HC06, a voltage divider is needed at the HC06 receive pin. Thus, figure 4 shows the connection between the Bluetooth and Arduino.

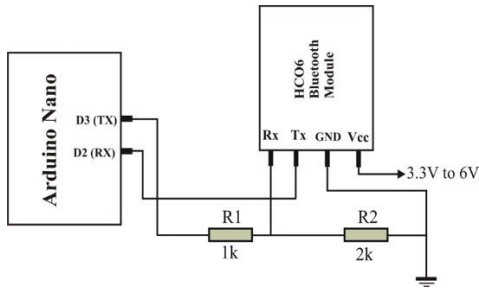


Figure 4. Interfacing HC06 and Arduino Nano

4.2 Switching Circuit

The switching circuit comprises of a Silicon NPN low power high frequency bipolar transistor (2N3904) and a 5V, 10A relay for proper isolation between the mains and the control circuit. The interconnection of these components together with a free wheel diode give rise to the switching circuit of figure 5.

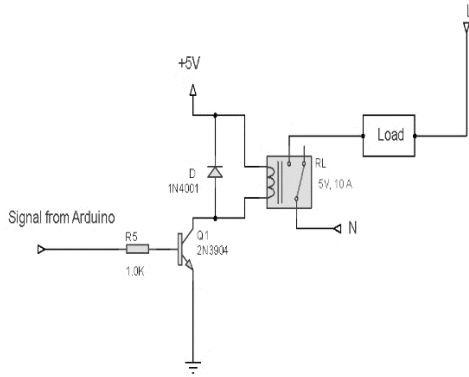


Figure 5. Switching Circuit

4.3 Flowchart for the Home Automation System

The flowchart representing the home automation system for ON/OFF appliance is shown in figure 6.

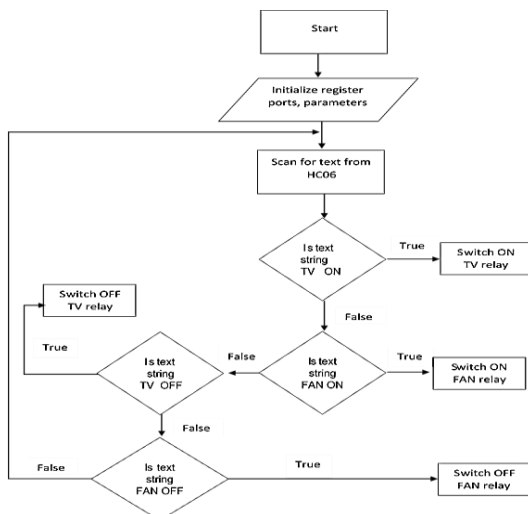


Figure 6. Flowchart for Home Automation System.

4.4 Hardware Implementation

Figure 7 shows the complete circuit design of the home automation system using proteus 8 professional. Figure 8 and 9 is the screen shot of the component layout and constructed prototype using YELLOW LED for TV and RED LED for FAN.

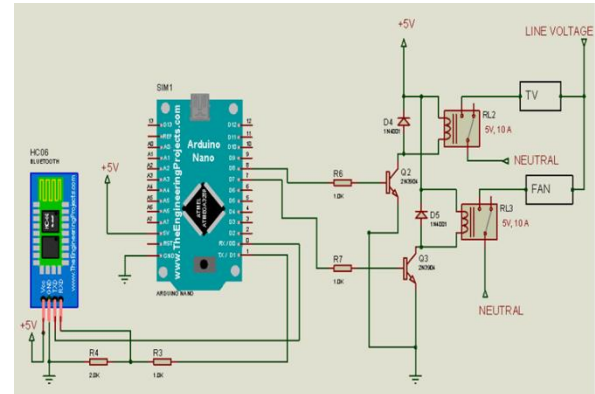


Figure 7. Circuit Design using Proteus 8 Professional

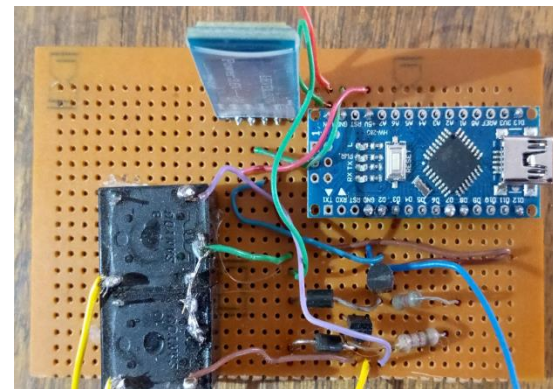


Figure 8. Component Layout



Figure 9. Constructed Prototype of Home Automation System

5. TESTING AND RESULT

5.1 GUI for testing

The Home Automation System Design was tested using Bluetooth terminal application downloaded from google play store. Figure 10 shows the screen shot of the user terminal.

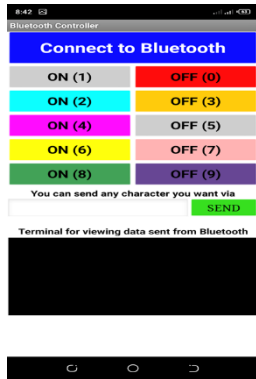


Figure 10. Mobile Application

The commands shown in table 1 can be sent via this terminal window.

Table 1. Bluetooth Terminal Command for Turning Appliances ON/OFF

s/N	Command	Refference
1	TV ON	Turns TV LED ON
2	TV OFF	Turns TV LED OFF
3	FAN ON	Turns FAN LED ON
4	FAN OFF	Turns FAN LED OFF

5.2 Result.

To connect to the HC06 Bluetooth module, a password is required (in this case; 1234) and then connection will be established between the mobile phone and the HC06.

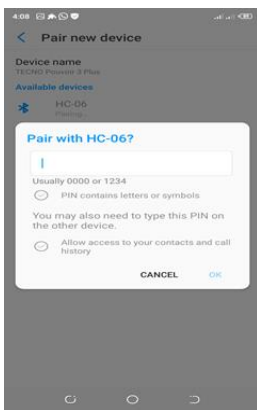
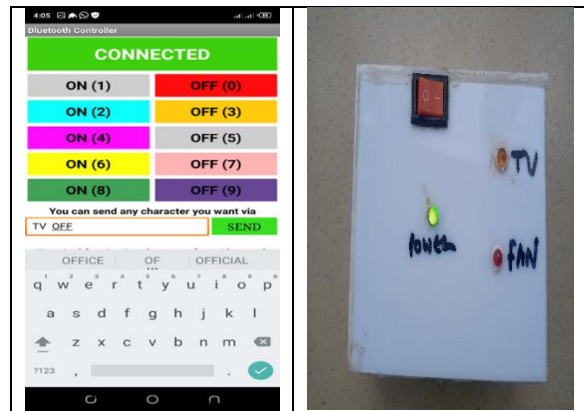


Figure 11. GUI for the Password

The screen shot for the first result (TV ON) is shown in figure 12 (a) and (b):



The screen shot for the second result (TV OFF) is shown in figure 13 (a) and (b):



The screen shot for the third result (FAN ON) is shown in figure 14 (a) and (b):



The screen shot for the fourth result (FAN OFF) is shown in figure 15 (a) and (b):



6. CONCLUSION

The proposed Home Automation System Design prototype has been successfully implemented and test result shows that it works well. This system can be integrated with other house appliances to achieve control. The system is user friendly and is cost effective. The main aim is to have a centralized automated system control of home appliances. The appliance can be controlled and the status monitored from a remote location using the application.

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Comparison Between Fuzzy Logic and PID Controllers in Temperature Control of Laboratory Incubator

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ABSTRACT: Incubators are very essential equipment that finds wide application in the fields of medical Laboratory and microbiological research organization. This is because Incubator monitors and maintains conducive environment that is suitable for culturing, or growing of micro bacterial and enzymes, for the purpose of clinical diagnoses in Health centres, or process development in manufacturing industries. In this paper, a transfer function model for an incubator was developed upon which a designed Fuzzy logic controller acts to control the incubator Temperature, by computing appropriate Voltage. A PID (Proportional Integral Derivative) controller was also designed and tested on the same model. Findings were that the fuzzy logic controller tracked the optimum Temperatures for culturing of Mesophilic and thermophilic bacterial at 37 °C and 54.94 °C respectively. In comparison with the Fuzzy logic controller, the PID controller tracked at 37 °C and 55 °C for the two selected set points. In addition, the fuzzy logic controller gave faster rise time (3.30 mS, 3.45 mS and 13.72 mS) and settling time (1.60 mS, 2.04 mS and 5.55 mS) as compared to PID controller which presented longer rise time (53.61 mS, 53.68 mS and 53.62) and settling time (254 mS, 336 mS and 345 mS) for the given set points respectively.

Keywords: PID Controller, Fuzzy logic Controller, Incubator, Mesophilic bacteria, Moderate Thermophilic bacteria, Temperature control.

1. INTRODUCTION

Temperature control is a cardinal issue that affects human living as well as micro-bacterial survival in their natural habitation. Temperature is an essential physical quantity that is found in most application of home appliances, scientific laboratories equipment and industrial processes. It is the major control parameter in the procedure of industrial manufacturing all over the world [1]. Electrical appliances such as laboratory incubators need their temperature to be controlled accurately within a desired range. The main issue in every temperature control strategy is to monitor and maintain temperature status of a device or facility [2].

There are many types of bacteria in existence; however, this paper centred on monitoring and maintaining temperature range for culturing Mesophilic and thermophilic (moderate) bacteria considering the dominantly warm climate in this part of the World, which favours the survival, and multiplication of these classes, and their resulting economic importance to human existence.

Mesophilic bacteria is a class of bacteria whose growth temperature range from 20°C to 45°C with optimal temperature of 37°C [3][4]. They thrive in moderate temperature (same as human body temperature) hence they are responsible for most human infections[5]. Depending on their growth temperatures range, thermophilic organisms have been arbitrarily divided into three classes: Moderate thermophiles, with optimal growth temperature between 45-65 °C; Extreme thermophiles which grow between 65-90 °C; and Hyper thermophiles, that grow optimally at temperatures over 90 °C [6]. Thermophilic bacterial are those bacterial whose growth temperature range from 45°C to 85°C with optimal temperature at 55°C [3]. Only moderate thermophilic bacteria class is considered in this paper.

2. SYSTEM DESCRIPTION

Basically, a temperature control system comprises of heating element, a controller, a driver (actuator), signal

conditioner (amplifier) signal detector (sensor), signal indicator (display), and the environment whose temperature is to be controlled. In this work, the environment whose temperature is to be controlled is an incubator which can be used in Laboratories for the purpose of culturing bacterial, or for preservation of specimen. Figure 1 present a simple block diagram of an incubator temperature control system using fuzzy logic controller.

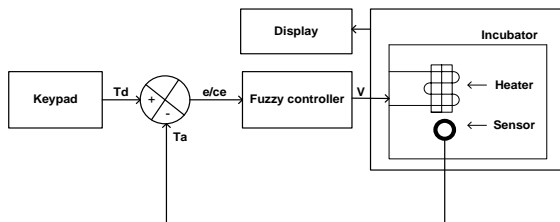


Figure 1. Simplified block diagram of a Temperature control system

The heater element is a major component of the incubator because it produces the heat which is distributed into the incubator by convectional flow of the air molecules within the incubator chamber. Desired temperature (T_d) is inputted through the keypad, and the display show both the desired (T_d) and the Actual temperature (T_a). The fuzzy logic controller simply takes in error (e), and change in error (ce) as an input variable; and then make use of the fuzzy set to modify the temperature. If the actual temperature is less than the desired temperature, the controller compute voltage which is the control signal, so as to increase or reduce the temperature to the required set point. The sensor, which is usually placed inside the incubator, picks up the actual temperature in the incubator and feed this value back to the comparator. The comparator computes the error, and the change in error, which is again given to the controller to act in a manner that will balance any offset by sending the appropriate signal that will correct the error, and ultimately drive the system's process (incubator temperature) to the desired set point, or as close as possible.

3. SYSTEM MODELLING

The heating system is modelled as a first order plus dead time (FOPDT) system, similar to the model presented by [7]. The general equation representing FOPDT is given in equation (1):

$$G(s) = \frac{Ke^{-\theta s}}{Ts + 1} \quad (1)$$

Where $G(s)$ is the transfer function of the system, K is the process gain, θ is the delay and T the time constant.

The process model was obtained as shown in equation 2.

$$G(s) = \frac{7.72}{15.78s + 1} \quad (2)$$

Equation (2) is the transfer function model, representing the heating system in the incubator, where 7.72 is the process gain, 15.78 seconds is the time constant, and the dead time of 2.6 seconds.

4. DESIGN OF FUZZY LOGIC CONTROLLER

Design of a fuzzy controller involves Fuzzification process, the knowledge base, which is the combination of the data base and the rule base, and Defuzzification of the output of the controller. The fuzzy controller shown in Figure 2 accepts error E as the input variable. This input is fuzzified in accordance with the membership function that is provided in the data base. The controller then applies the rules in the data base; and selects the ones that are applicable as a consequent to the antecedent under consideration at a time. The result, which is the consequent of the rules so fired, is reshaped by the application of appropriate implication method. The result of the implication process is then aggregated and fuzzified into a single crisp value corresponding to the control action acting on the gain of the heater to either reduce or increase the temperature of the incubator.

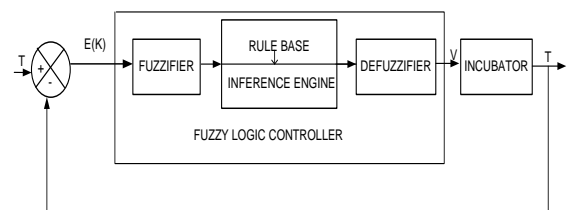


Figure 2. Fuzzy logic Controller in a closed loop system

4.1 Fuzzification

Fuzzification is the process of converting crisp values of process variables into fuzzy sets. Figure 3 show the

membership function for the Fuzzification of input variable to the fuzzy controller, which is Error.

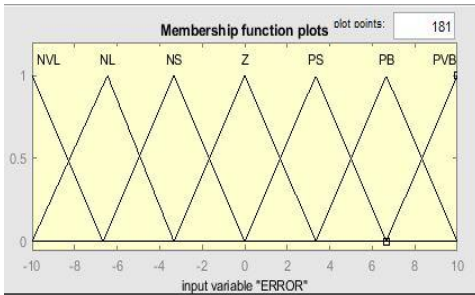


Figure 3. Input membership function ERROR

4.2 Data base

The data base is a store which provides relevant information that enables the controller to perform an operation. It contain input variables, output variables, the universe of discourse for each variable, the demarcation of the universe of discourse into sub sets or fuzzy sets with or without overlap and the membership function assigned to each fuzzy set. the output variable is assigned seven (7) linguistic terms, each representing a membership function as follows: Very- Very Small (VVS), Very Small (VS), Small (S), Moderate (M), Big (BG), Very Big (VBG), Very-Very big (VVBG) within domains [-39.97 24.85], [24 96], [66.85 128.2], [87.44 163], [120 197.1], [154 231.5], and [197.2 277.3] respectively.

The universe of discourse for error is between [-10 10]; and has seven (7) membership functions in domains represented as [-13.334 -6.66], [-10 -3.332], [-6.666 0], [-3.33 3.348], [0 6.654], [3.348 10], and [6.654 13.37]; carrying linguistic variables as: Negative Very-Large (NVL), Negative Large (NL), Negative Small (NS), Zero (Z), Positive Small (PS), Positive Large (PL) and Positive Very Large (PVL) respectively.

Figure 4 present the output membership function for the fuzzy logic controller.

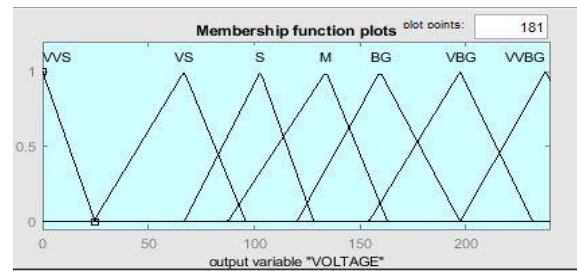


Figure 4. Output membership function

4.3 Rule base

In the operation of the fuzzy controller, the IF THEN rules are used to represent the antecedent and the consequent part respectively. The rules that govern the action of the fuzzy controller are presented in Figure 5.

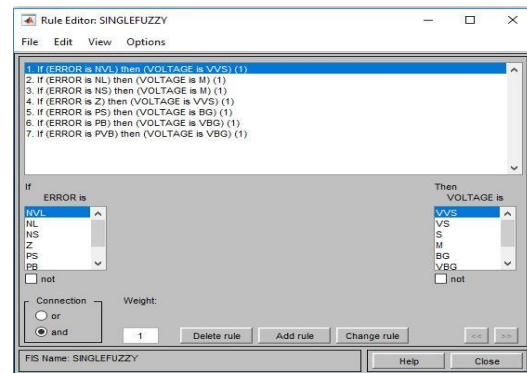


Figure 5. Fuzzy controller rules

4.4 Fuzzy inference engine

The task of the inference engine is to combine the fuzzy IF THEN rules for mapping the set N from the controller input space U to a fuzzy set B' in the controller output space V using the production rules and the knowledge base of membership function (Ajit, 2012). Figure 6 show the rule aggregation.

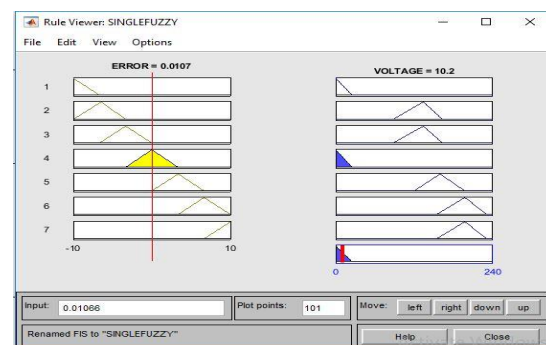


Figure 6. Fuzzy controller rules aggregation

4.5 Defuzzification method

This is a process by which all the aggregated fuzzy sets are transferred into a single crisp value necessary for the control action to take place.

Equation (3) describes the method of Defuzzification used.

$$Dfz_{-V} = \frac{\sum_{i=1}^k Ai \times xi}{\sum_{i=1}^k Ai} \quad (3)$$

Where x_i is a running point in a discrete universe of discourse and A_i is its membership value in the membership function.

The Simulink model for the fuzzy controller is presented in Figure 7.

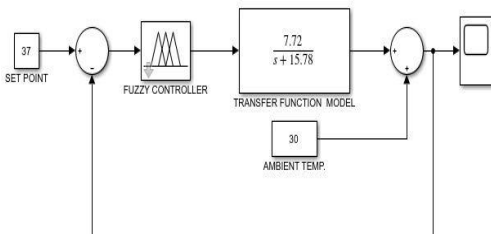


Figure 7. Simulink Block model of the Fuzzy controller

4.6 Design of PID Controller

The design of the PID controller was done using the Ziegler- Nichols rules for tuning PID controllers. Ziegler and Nichols proposed rules for determining values of the proportional gain K_p , integral gain K_i and derivative gain K_d based on the transient response characteristics of a given plant [8]. The determination of these gains is referred to as tuning. Based on the rules the PID controller gains were obtained as shown in Figure 8. The tuned parameters for the gains in Figure 8 are; 2.7341 for the proportional gain (P), 86.2354 for the integral gain (I) and -0.0062922 for the derivative gain (D) respectively.

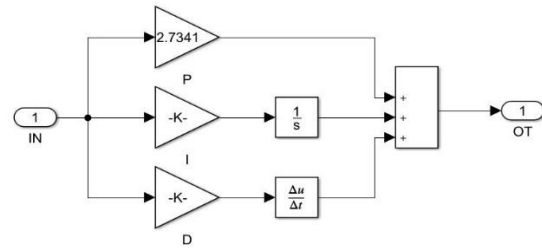


Figure 8. PID controller gains after tuning.

From Figure 8 the point marked IN is the error signal into the PID controller; whereas OT is the controller output (voltage) supplied to the heater. Figure 9 shows the Simulink block diagram of the PID Controller Model.

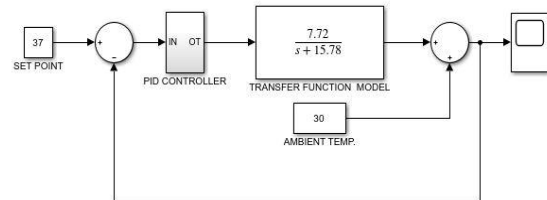


Figure 9. Simulink Model of PID Controller

4.7 PID versus Fuzzy logic Controller

The two controllers were cascaded to view their responses more closely in a single scope. The incubator model was reduced to a sub system and the cascaded Simulink Model of the two controllers, in MATLAB, is shown in Figure 10.

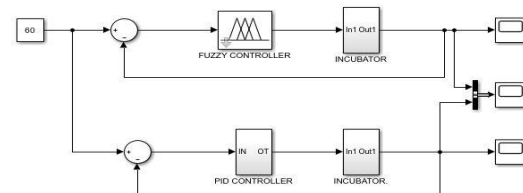


Figure 10. Simulink Model for the cascaded PID- Fuzzy controllers

The middle scope on the right hand side of Figure 10 combines the output from the fuzzy logic controller, as well as the output from the PID controller, to portray clearer view when making comparison between the two controllers.

5. RESULTS AND DISCUSSION

The combined response for the two controllers as viewed at the middle scope, in Figure 10, is presented from Figure 11a to Figure 11c; being the output responses for the two controllers at 35 °C, 37 °C and 55 °C set points respectively.

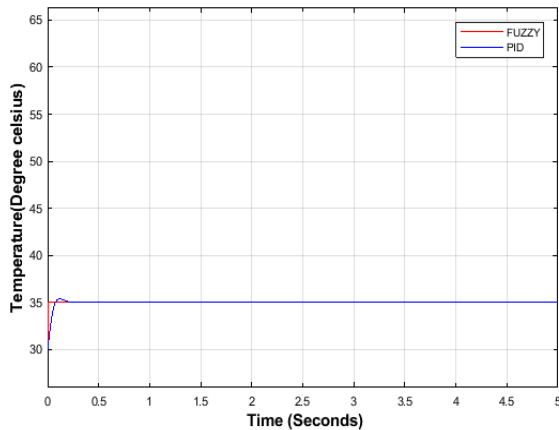


Figure 11a. Controllers Output at 35°C set point.

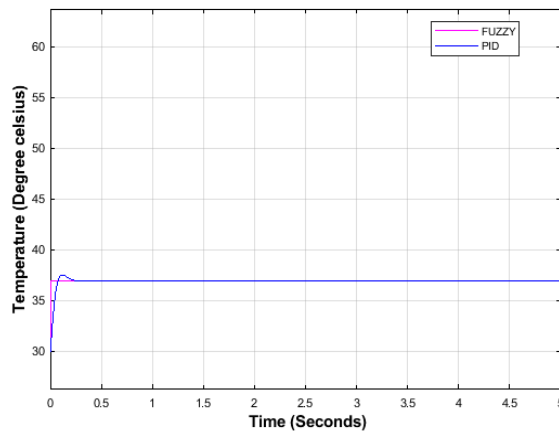


Figure 11b. Controllers output at 37°C set point.

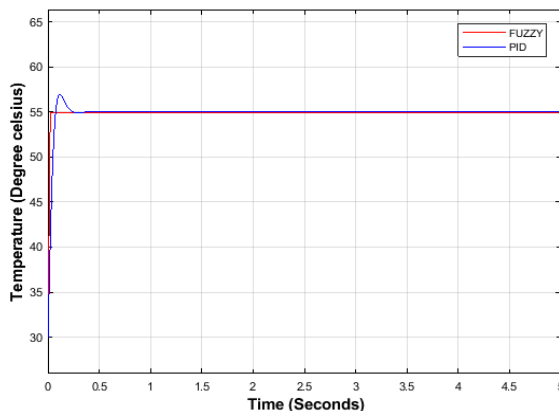


Figure 11c. Controllers Output at 55°C set point.

5.1 Performance Evaluation

Comparison, in terms of the transient responses of the two controllers, is presented in Table 1.

Table 1. Comparison between Fuzzy and PID controller

Temp. (°C)	Fuzzy Controller			PID Controller		
	Rise time (mS)	Settling time (mS)	Overshoot (%)	Rise time (mS)	Settling time (mS)	Overshoot (%)
35	3.30	1.60	0	53.61	254	5.22
37	3.45	2.04	0	53.68	336	5.98
55	13.72	5.55	0	53.62	345	6.81

In terms of performance, the fuzzy logic controller appears to be better as can be seen in Table 1. Fuzzy logic controller did not give overshoot in all the set points; whereas the PID controller gave a little overshoot in all the set points. The rise time; and the settling time is also less in fuzzy controller response as compared with the PID controller response in all the set points. This shows that the overall transient response of the Fuzzy logic controller is better than that of the PID controller.

6. CONCLUSION

The results from the simulation carried out on the two controllers; have shown that, both controllers performed greatly in terms of set point tracking. However, the Fuzzy logic controller performed better for the fact that in all the set points, the tracking was without any overshoot whereas the PID

controller has overshoot in all the set points. In addition, the fuzzy logic controller gave faster rise time (3.30 mS, 3.45 mS and 13.72 mS) and settling time (1.60 mS, 2.04 mS and 5.55 mS) as compared to PID controller which presented longer rise time (53.61 mS, 53.68 mS and 53.62) and settling time (254 mS, 336 mS and 345 mS) for the given set points respectively.

7. RECOMMENDATIONS

In view of the outstanding performance of the fuzzy logic controller over the PID controller, it is recommended that the technique of fuzzy logic be employed more in the design of incubator temperature control which at the moment heavily utilizes the PID control technique. For further research, a hybrid of fuzzy logic controller and any other intelligent controllers such as genetic algorithm can be used to further improve on this one.

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Research on the Essentials and Skills of Taekwondo Technical Training

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Abstract: Research on the essentials and skills of taekwondo technical training is the focus of this paper. Through the aesthetic stage of Taekwondo's aesthetics, it summarizes the aesthetic intuition, aesthetic comprehension and aesthetic transcendence of the aesthetic subject in the aesthetic activities, and what kind of aesthetic function the subject should have in the aesthetic transcendence link. Taekwondo special athletes have relatively stable skills, basic specifications, and have the certain actual combat ability and competition experience. In the special training, it is necessary to combine the characteristics of the project and the specific conditions of the athletes. This paper gives the novel ideas for the efficient training.

Keywords: Essentials and skills; taekwondo; technical training; methodology design; data mining

1. INTRODUCTION

Taekwondo special athletes have relatively stable skills, basic specifications, and have the certain actual combat ability and competition experience. In the special training, it is necessary to combine the characteristics of the project and the specific conditions of the athletes, appropriately increase the physical training under the premise of further focusing on technical and tactical training, and reasonably arrange the exercise load, so as to comprehensively improve the athletes' competitive level. Taekwondo has a certain amount of some exercise and exercise intensity load, and is a sport that the human body can withstand. It can make people strong and the bones, improve people's speed, reaction, sensitive strength and also endurance quality, improve the function of human internal organs and the flexibility of the human nervous system, and enhance the human body's ability to fight and resist [1-5].

At the same time, through offensive and defensive exercises, we can learn to master practical techniques and the ability to defend yourself, and develop real skills for maintaining social justice. Taekwondo is a confrontational sport that focuses on the combined use of manipulative and leg techniques. It also has certain requirements on the endurance and flexibility of the body. In the taekwondo movement, there are many exercises about the leg method, and the leg method is also a relatively concentrated exercise method in the taekwondo movement. There are many ways to learn the leg technique. Through high and low, left and right, straight bends, etc., the actual combat of the confrontation can be improved, thereby improving the probability of winning from listed aspects.

(1) The basic movement training of Pinshi is the basis for creating the artistic conception of the Taekwondo. Every basic movement is a necessary part of the composition of the posture, and the connection of the movements of the posture and the mastery of the difficult movements are the necessary tasks at this stage. One of the ultimate goals to be achieved in this link is to complete the whole set of movements skillfully and accurately.

(2) In the process of the taekwondo teaching and training, in terms of the speed quality of students, the special speed quality that is mainly emphasized is the reaction speed, the

pace movement speed and the action speed. The main teaching and training methods used to improve the speed of taekwondo of students mainly include reaction speed training using signals or targets, pace movement speed training using various pace exercises between marches, and single action or combination of actions. The fast training of the action and speed training and other methods.

(3) In the process of practicing Taekwondo Pinshi, the realization of the fighting mood of Pinshi achieves the spiritual realm of further forgetting reality and transcending perception, thus reaching the highest level of creation at this stage, which is also the experience and discovery of the philosophy of life. Of course, this philosophy of life is thousands of then absolutely, everyone's experiences and discoveries are different, and they belong to the individual's artistic conception [6-9].

In the figure 1, the general framework of the taekwondo technical training is presented and in the next sections, the details will be discussed.



Figure. 1 Taekwondo Technical Training

2. THE PROPOSED MODEL

2.1 The Basis of the Taekwondo

For taekwondo, although the requirements for physical fitness are focused, they are focused on the premise of the overall development. However, the focus is on the general premise of comprehensive development and must not be neglected. The reason why the reason for this is that all physical qualities affect each other. The lack of one aspect will inevitably have an impact on the development of other qualities [10-12].

In the process of Taekwondo Pinsei exercises, it is important to make sure that the practitioner is proficient in the basic technical movements of Pinsei. Only on the basis of mastering the technical movements of Pinsei It is only on the basis of the mastery of the technical movements that the taekwondo posture can be aesthetically correct. This is the premise and guarantee of the aesthetics of the posture. In the process of the gesture exercise, the practitioner is familiar with the basic technical movements of taekwondo gestures.

After mastering basic taekwondo techniques, the practitioner must actively create his or her own fighting mood, because fighting is already the core of the taekwondo aesthetic. We should then consider listed focuses.

(1) Interval training is the practice of some resting strictly at intervals after one exercise load, before proceeding to the next exercise. To take this training method to reasonably arrange the intensity of each exercise with the number of repetitions and intermission time.

(2) Specifically, in the process of taekwondo teaching and training in colleges and universities, it is necessary to comprehensively improve the physical fitness level of students through physical fitness training, including strength training, speed training, endurance training, flexibility training, and sensitivity training. aspects of the content.



Figure. 2 The Basis of the Taekwondo Training

2.2 Essentials and Skills of Taekwondo Technical Training

In taekwondo training, the task of cultivating athletes' rational use of the tactical ability under various complex conditions should be placed in an important position.

Tactical ability includes tactical awareness, tactical theory, tactical quality, tactical quantity and tactical application. The abilities are integrated and finally put into practice.

At the same time, the use of the tactics must be pertinent, effective and flexible, and use tactics flexibly and flexibly according to the ever-changing situation on the field, and then strive to make the situation develop in a direction that is beneficial to oneself. Due to the contradiction between the technical requirements of taekwondo and the physiological

structure of the human body, the injury of the ankle ligament occupies the first place in all kinds of injuries. Among them, the lateral ligament of the ankle joint is the most injured, which is due to the anatomical structure factors such as the supratolar joint of the ankle joint being large and small in front and back, the lateral ligament is weaker than the medial ligament, and the lateral malleolus tip is lower than the medial malleolus tip. In training, the quick transition of offense and defense, moving and dodging need to quickly change the center of gravity and moving direction of the body, which will cause excessive varus of the ankle joint, causing damage to the lateral ligament; Back kick, when the foot leaves the ground, the foot is naturally in the plantar flexion and varus position. If the center of gravity is unstable or the field is uneven when landing, the front and outer side of the foot will land on the ground, and the body will tilt to one side, resulting in lateral ligament damage. According to the theoretical analysis of the sports training item group, Taekwondo is a skill-oriented combat confrontation project, with technology and skills taking the lead, followed by physical fitness. In terms of its confrontation characteristics and the elements of the technology itself, speed is more important than strength, specific endurance is more important than general endurance, and accuracy is more important than the number of legs. Especially with the revision of the new rules, the hitting scale for the head is completely relax, as long as there is contact to score, which puts forward higher requirements for flexibility.

3. CONCLUSIONS

Research on the essentials and skills of taekwondo technical training is the focus of this paper. Sensitive quality is the ability of the taekwondo athletes to then complete technical movements quickly, accurately and flexibly during exercise. Athletes must have a high level of sensitive quality in order to successfully complete a series of difficult movements in the process of exercise. In the future, we will apply the model into the applications.

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Research on the Explosive Training Skills of Wushu Sanda Athletes

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Abstract: Research on the explosive training skills of Wushu Sanda athletes is conducted in this paper. Wushu Sanda is the product of the modern transformation of traditional Chinese martial arts. It was developed because it is completely based on the actual combat ability of martial arts. Explosive strength training is through the professional sports training, allowing athletes to coordinate with each other, so that athletes can release greater and stronger strength in the shortest time during exercise. This paper studies the combination of the models, and the proper integration is discussed.

Keywords: Wushu; Sanda; training skills; explosive training; training; athletes

1. INTRODUCTION

Wushu Sanda is the product of the modern transformation of traditional Chinese martial arts. It was developed because it is completely based on the actual combat ability of martial arts. It once brought certain vitality and vitality to the development of Chinese martial arts that was once routine.

In the competition with other fighting events also won praise for Chinese martial arts. However, in the current training, we are facing with the listed challenges.

(1) For a long time, the development of Wushu Sanda has not been able to make substantial progress, precisely because the Wushu world has not fully grasped the special characteristics of the movement [1-4].

(2) The sparring coaches themselves may not have a clear understanding of wushu sparring teaching cognition is not clear enough, and in the daily training process, they do not incorporate the traditional as the coaches themselves may not have a clear understanding of the teaching of the sparring, but they do not integrate the best elements of traditional martial arts techniques, such as gong, techniques and methods, with sparring techniques. The result is that the training techniques are very uniform, and the level of the athletes' confrontation ability is affected.

(3) Competitive sports are different from school sports and mass sports for the purpose of improving physical and mental health, further mastering sports skills, aesthetic leisure and entertainment. Physical activity as the main goal.

Based on the review, the functionality of the Wushu Sanda can be considered from listed aspects. (1) Practicing Wushu Sanda has a regulating effect on people's psychology, which can relax nerves in a tense state, relieve pressure, and help sleep; Practicing the Wushu Sanda can also make people's mentality more positive and healthy, and improve self-confidence. (2) The Wushu Duan system test can use the test content of setting routines and actual combat at the same time, not only can learn from each other's strengths and make progress together, but also meet the different needs of the practitioners, so that Wushu has physical fitness, performance appreciation, competitive confrontation and also will-quality

cultivation at the same time function. (3) Wushu Sanda has a variety of attack and defense skills, and these routines need to be effectively trained in daily practice and can be used proficiently. In the Sanda training process of the "combination of fighting and training" mode, by improving the practice of Sanda routines, it helps athletes to comprehensively improve their hitting ability and defense ability. In daily training, the practically applied moves are also flexibly combined to re-establish Sanda routines that conform to the athlete's own characteristics, build a comprehensive system that fully fits the athletes, and at the same time cultivate the athletes' ability to flexibly apply the Sanda routines to actual combat.

In the figure 1, the example of the Wushu Sanda is presented and in the next sections, the details will be discussed.



Figure. 1 Example of Wushu Sanda

2. THE PROPOSED MODEL

2.1 Athlete's Explosiveness Analysis

More and more coaches apply the method of the combined strength training to training practice, which will improve the overall physical quality of the Chinese athletes, especially for coaches to develop explosive power of athletes. Based on the review, the related models are [5-9]:

(1) The essence of compound training is to form an overall dynamic linkage through the combination of a single training content, and use the integration of various action contents, so that the application of sports training items can improve the overall physical fitness of athletes in a targeted manner. For

example, the application of the squat-up training program in compound training is not solely to strengthen the power of the leg muscles. During this process, the athletes' joint muscle mobility and cardiac fitness will also be further improved.

(2) The training of explosive force can accelerate the speed from centrifugal contraction to the centripetal contraction. The effective combination of traditional strength training methods and super length training methods is an effective way to then improve the explosive power of athletes.

(3) In the training process, the effective combination of fast strength exercises and basic strength, or the effects of strength training can migrate and influence each other, which will produce a good training effect.

Explosive strength training is through the professional sports training, allowing athletes to coordinate with each other, so that athletes can release greater and stronger strength in the shortest time during exercise. The graph of the relationship between strength and speed shows that in the process of exertion, the greater the force load, the slower the movement speed, and the force load has been increased until the movement speed is terminated. In the process of sports training, when a large load force is used, the contraction ability and strength of the muscles are improved, which will effectively improve the strength component of the explosive force, and when a small load force is used in the sports training process, the speed of the explosive force Ingredients can be effectively enhanced. The figure 2 shows the pattern.

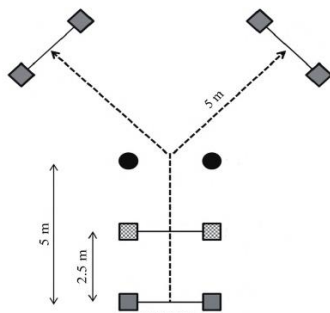


Figure. 2 The Analysis Pattern

2.2 Training Skills of Wushu Sanda Athletes

The domestic academic circles introduced the theory of alienation into the study of Wushu Sanda relatively late. The current research focuses mainly on the form of the alienation phenomenon of Wushu Sanda and the reasons for the phenomenon of Wushu Sanda alienation. Few studies take alienation theory as the theoretical basis to study movement of the Wushu Sanda. Analysis of the connotation, causes and governance paths of alienation phenomenon. The teaching content of competitive Sanda is different from the teaching content of the school Sanda, and the teaching content of competitive Sanda does not meet the requirements of school Sanda. Competitive Sanda teaching focuses on techniques and tactics, and has high requirements for athletes in all aspects of physical fitness.

The ultimate goal is to achieve excellent results in actual combat. The school's Sanda focuses on cultivating students' interest, mastering basic martial arts skills and keeping fit. Therefore, the teaching of the Wushu Sanda should correctly understand similarities and differences between competitive Sanda and school Sanda. Wushu Sanda teachers should pay

attention to the confusion between competitive Sanda and school Sanda teaching modes when creating textbooks. The technical structure of Wushu Sanda is more complex, the definition of technical standards is relatively vague, and the requirements for modern transformation technology are also higher. In the technical application of Wushu Sanda, the emphasis is always on "far kicking, close punching, and falling close to the body", which not only emphasizes the rational use of Wushu Sanda's complex techniques, but also clearly expresses characteristics of Wushu Sanda technology. Under the design of complex technical structure, the special training of Wushu Sanda can not only stop at boxing or leg training, but requires a comprehensive training system - designed with the basic technical system of "fist, leg, throw" Special training system. However, apart from "fist, leg, throw" which constitute the core of the technical structure, the footwork and defense system of Wushu Sanda should also be included in the technical structure. In the "combination of fighting and training" Wushu Sanda training, the practice of martial arts is a particularly important part, and the combination of fighting and training is more conducive to improving the level of martial arts skills of athletes.

Skill exercises are complex and systematic, and need to be practiced according to the actual level of the athlete. Sanda is a professional competition venue. Athletes from both sides of the same weight use the kicking, hitting, and throwing techniques in martial arts to defeat the opponent's sparring and sparring sports, and use reasonable techniques to hit the opponent's scoring area, according to the number of points scored. Evaluate victory and defeat. The separation of fighting and practice leads to the completely different training methods of Taolu and Sanda, and different training methods make the lack of internal connection between Taolu and Sanda. In order to improve the training effect, Sanda abandoned the traditional martial arts technical movements with huge content, and directly practiced several movements (kicks, punches, and falls) with obvious actual combat effects, and carried out high-intensity repeated practice for a long time to achieve a very high technical level.

3. THE CONCLUSIONS

Research on the explosive training skills of the Wushu Sanda athletes is conducted in this paper. Chinese Wushu is an indispensable structure in Chinese traditional culture. Wushu has rich connotations on thoughts, behaviors and values of life. Therefore, the training mode of "combining fighting and training" can improve the skills and life connotation of Sanda athletes. Combined practice is to combine the valuable and practical techniques of traditional martial arts with the techniques of sanda, and to split the boxing techniques of traditional martial arts, such as Taijiquan and Xingyiquan reasonably, so as to make it more in line with the daily training of sanda athletes. In the future, we will apply the model into the further discussions.

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Application of Doppler Radar in Short-Term Near-Term Weather Forecast

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Abstract: Application of Doppler radar in short-term near-term weather forecast is the focus of this paper. Short-term now weather forecast can effectively improve the ability of meteorological disaster forecast and early warning. Conditional provinces or counties and cities can realize real-time update of the meteorological information and real-time insertion of sudden and severe weather warning information through public media. The application of modern meteorological methods provides the possibility for the production and timely broadcasting of the short-term and the near-term weather forecasting. This paper gives the combination of the Doppler radar to enhance the general model.

Keywords: Weather forecast; short-term near-term; Doppler radar; data analysis; systematic analysis

1. INTRODUCTION

Carrying out meteorological disaster risk assessment, put forward systematic action countermeasures to prevent and reduce the hazards and risks of meteorological disasters, and play an active role in the safe operation of the cities and the response to meteorological risks of major events [1-5].

Short-term now weather forecast can effectively improve the ability of meteorological disaster forecast and early warning. Conditional provinces or counties and cities can realize real-time update of the meteorological information and real-time insertion of sudden and severe weather warning information through public media such as the TV, radio, and website. The development of the short-term now weather forecast service is a concentrated expression of the general utilization of modern meteorological forecasting methods.

The application of modern meteorological methods provides the possibility for the production and timely broadcasting of the short-term and the near-term weather forecasting. The accuracy of weather forecasts varies with the length of the time limit. the longer the time period, the less accurate the forecast is, while the shorter the time period, the more accurate the forecast is. The shorter the statute of limitations, the higher the forecast accuracy. In addition, when the time limit is short, the more accurate the weather information is, the easier it is to grasp the regularity of the weather. The shorter the time limit, the more accurate the weather information is, the easier it is to grasp the regular changes in weather, the stronger the prediction ability, and the higher the accuracy rate. With the help of the modern modern weather information collection equipment, meteorological departments can readily and comprehensively as the more information is collected, the more accurate it is.

Based on a large amount of information, and with the help of the weather patterns that have been mastered, we can themake relatively accurate forecasts of short term weather conditions. With the current technology, the performane can be enhanced from the listed aspects.

(1) In general, the length of time has an important impact on the accuracy of the weather forecast. The longer the time, the lower the accuracy; the shorter the time, the higher the accuracy. Short-term and near-term weather forecasts have the shortest time and the highest accuracy. Because the time is short, the analysis of meteorological data can better grasp the law of weather changes.

(2) In practice, the track forecast of tropical cyclones is an important index content for evaluating forecasting capability. The track forecast error of tropical cyclone refers to the error between the forecasted cyclone center position and the best positioning center position. The path forecast error value will vary with the frequency of forecast and forecast period, and in general, it refers to the average error of the path forecast in the entire lifetime from the tropical cyclone generation number to the weakening stop number.

(3) Short-term and near weather forecast to do accurate detection and timely release, of course, need to have a strong modern science and technology to do the support, the meteorological department equipment update quickly. This also provides technical conditions for making short - term approaching weather forecasts. In particular, the processing of relevant data by the general computer processing system greatly accelerates collection and processing of meteorological data.

In the figure 1, the weather forecast model sample is defined and in the following sections, we will introduce the proposed model in detail.

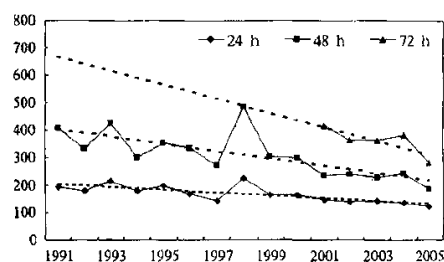


Figure. 1 Weather Forecast Trend

2. THE DESIGNED MODEL

2.1 The Doppler Radar Analysis Patterns

The pulse Doppler weather radar adopts a pulse transmission system, and the average power of the transmitted pulse peak is large. Compared with direct measurement of the transmission power by a large power meter, the indirect measurement method combining a digital oscilloscope and a small power meter is widely used in the radar station at present. The system contains the listed aspects [6-12].

(1) Radar data collector. Performs functions such as signal processing, data acquisition, servo control, status monitoring, and generation of the basic radar data, and runs the RDAsc program within it.

(2) The software operation relies on the direct reading and automatic analysis and judgment of the original data files of Doppler radar stereo scanning, that is, the T-scan files need to be then operated. If there is a local radar, the software can automatically read directly from the local area network data sharing system of the unit. Otherwise, the T-scan file can be downloaded from the provincial meteorological data sharing network server to the local radar data database, and then read and discriminated.

A dual base Doppler weather radar system consists of a conventional regular Doppler weather radar as the active radar and one or more remote passive low gain receivers together. The beam emitted by the active radar scatter in all directions when encountering a weather target, and while the active radar monitors While the active radar monitors the backscatter, the passive receiver antennas monitor the lateral scatter signal. Two- and three-dimensional wind fields are constructed based on the radial velocities in different directions. In the figure 2, the pattern is presented.

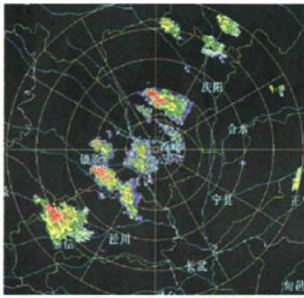


Figure. 2 Doppler Radar Analysis Pattern

2.2 The Short-term Near-term Weather Forecast

The modern short-term near-term weather forecast can well avoid such a situation. The professional information release platform enables the meteorological department to send the latest meteorological situation and meteorological knowledge to the local government and the local government together with latest weather conditions and meteorological knowledge regularly or irregularly as needed and possible public release.

The supplementary role of this core weather forecast further highlights the strong forecasting ability of the short-term now-aware weather forecasting for the sudden weather. Short-time proximity weather forecasting is very liberal because it is more flexible and popular among The public is welcome, so in the production of short time proximity weather forecasts, it is also possible to the format of the broadcast can be changed

at any time to add some meteorological knowledge that the public is more concerned about. To achieve accurate and timely short-term near-term weather forecast, of course, it is inseparable from advanced instruments and equipment, and more fuss about equipment configuration and technology development. Of course, modern meteorology needs to be equipped with the most advanced meteorological service equipment and establish a service system with the complete functions and higher professionalism. In particular, a number of technical innovation teams should be organized to forecast and study disastrous weather.

Forecast and research on meteorological content such as the rainstorm, typhoon, haze, blizzard, etc., can carry out relevant forecast analysis from different angles and aspects.

3. THE CONCLUSIONS

Application of Doppler radar in short-term near-term weather forecast is the focus of this paper. The fundamental driving force for the improvement of weather forecasting level is the numerical development of forecasting technology. After more than 20 years of research and development, the National Meteorological Center After more than 25 years of research and development, the National Meteorological Center has established a number of operational numerical forecasting models, including global medium-term numerical forecasting model, the limited regional numerical forecast model, typhoon path forecast model, and the other operational numerical forecasting model system. This paper gives the novel ideas for the enhancement. In the future, we will consider the novel applications.

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