LITERATURE REVIEW OF THE INTERNET OF THINGS ON THE DRINKING WATER MANAGEMENT SYSTEM

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Abstract Excessive use of water will result in reduced clean water resources. At present the standard for water use in Indonesia is 60 liters per day per population but in reality the current use of water is 144 liters per day per population so that it still exceeds the standard. This article reviews water supply and distribution systems and research related to managing water consumption for daily needs. This review covers the process of water production to distribution to the community and the use of technology in managing water resources. The benefits of using IoT in water management allow users to monitor and control of water consumption in real time. Real-time control is achieved through the use of microcontroler-based platform such as Arduino Uno, NodeMCU and Wemos. Data is made available through mobile device access or website.

***Index Terms*— Internet of Things, Water Management, Water Flow Sensor, Microcontroller.**

I. INTRODUCTION

NATURAL resources are everything that comes from nature that can fulfill human needs. Many things are included in natural resources ranging from biotic components consisting of animals and plants but also abiotic which consists of various types of metals, soil and water [1]. Water is a natural resource that is very important for the life of the general public and business. Currently in Indonesia, the water usage limit per family is 10m3 or if calculated per person it is around 60 liters / day [2]. However, when viewed from the use of water in Indonesia, it reaches 144 liters per person [3]. And most of its use for bathing, namely 60 liters or 40% of the amount of water used per person per day. According to data summarized by the world health organization (WHO), water use in 2017 [4] 71% (5.3 Billion People) of the world's population have received good water use services and around 144 million other people have not received it even the predictions that in 2025 [4] Half of the world's population will live in areas experiencing water shortages.

In Indonesia, too, in the face of declining water availability and increasing water demand, regulations / laws are made to regulate water use in the community. This means that there are regulations issued by the Ministry of Home Affairs to regulate tariffs and limits on water use. There is also a law issued in 2019 regulating the use of water resources in Indonesia.

Currently in Indonesia, the distribution of clean water to the community is carried out by the respective local governments as described in the law [37]. Starting from the search for water sources, processing to community distribution. Perusahaan Daerah Air Minum (PDAM) is a Badan Usaha Milik Daerah (BUMD) that is tasked with managing it at the regional level.

As a result, excessive use will certainly reduce the source of the water. This will also have an impact on the price of water itself where, like the law of the economy, where demand increases and stocks run low, the price will rise. This price increase has begun to be felt in Indonesia, for example in the Province of Bali. With the high price of water from the Perusahaan Daerah Air Minum (PDAM), many business actors use Ground Water. This can have a negative impact on the environment because the excessive exploitation or extraction of ABT can threaten the intrusion of sea water, making the existing fresh water replaced by sea water. This is trying to overcome by the regional government which is given the authority to regulate Ground Water in their regions [48]. by making local regulations on tax on the use of Ground Water up to 20% [49] [50] [51].

The technology that is currently a trend is IoT or the internet of things. Internet of Things is a concept in which certain objects have the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. From the concept that is owned by IoT, it will certainly be very helpful in managing something. One of the possible fields of application of IoT is in the field of water management. It can be seen from the many studies that have been done that discuss water management.

This article examines natural resources, production processes, distribution of water to customers and research on the use of technology for water management. The results of this review are expected to provide insight into how the application of IoT technology in the field of drinking water treatment in Indonesia.

II. Procedures For Paper Submission

A. *Perusahan Daerah Air Minum (PDAM)*

Perusahan Daerah Air Minum is a regionally owned business unit, which is engaged in the distribution of clean water for the general public. In 2019, the number of PDAMs recorded in Indonesia that participated in the performance assessment was 380 PDAMs serving 11,949,604 customers. From this number, there were 224 PDAMs or 55.3% whose performance was healthy then there were 102 or 27.2% of PDAMs whose performance was unhealthy and for the number of PDAMs whose performance was sick in Indonesia, it was 54 or 17.5 [54].

Indonesia has several ways of channeling water to the community. However, in general what is done in the process of distributing water is taking water from a water source, processing it according to state standards and then distributing it to the community. In general, the stages of drinking water supply in Indonesia are shown in Figure 1.

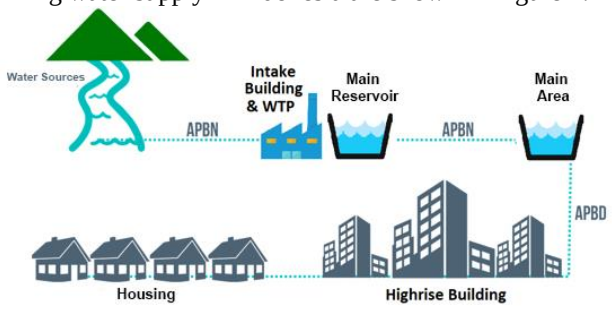


Figure 1 Flow of Water Supply

Water Resources are water, water sources, and water resources contained therein. The water in question is all water that is on, above, or below the ground surface, including in this definition surface water, ground water, rainwater, and sea water on land [37]. And currently water is a natural resource controlled by the state [53]. In distributing water to the community, funds are needed. These funds are taken from the State Revenue and Expenditure Budget (APBN). In the 2020 draft budget, Indonesia budgeted Rp. 22.07 trillion for equitable zoning, drinking water and sanitation throughout Indonesia [54].

Water obtained from water sources is not only distributed directly by the community. Water must go through a chemical cleaning / processing process first at the Intake Building & Water Treatment Plant (WTP) [32]. After that, it is collected in the main reservoir (Example in Denpasar: reservoir in Waribang) before being distributed to the community. To reach a large area, the water will usually be stored in a regional reservoir again before being channeled to the local community.

Basically, there are 3 important units in the clean water treatment system in various regions in Indonesia, namely as follows [6][34]. as shown in Figure 2.

B. *Intake Building*

This intake building serves as the first building for the entry of water from water sources. In general, water sources for clean water treatment are taken from rivers. In this intake building there is usually a bar screen which functions to filter objects that are also inundated in the water. Furthermore, the water will enter a tub which will be pumped to the next building, namely the Water Treatment Plant.

C. *Water Treatment Plant*

Water Treatment Plant or more popular with the acronym WTP is the main building for clean water treatment. Usually this building consists of 4 parts, namely: the coagulation bath, the flocculation bath, the sedimentation bath, and the filtration tank as shown in Figure 2 [36].

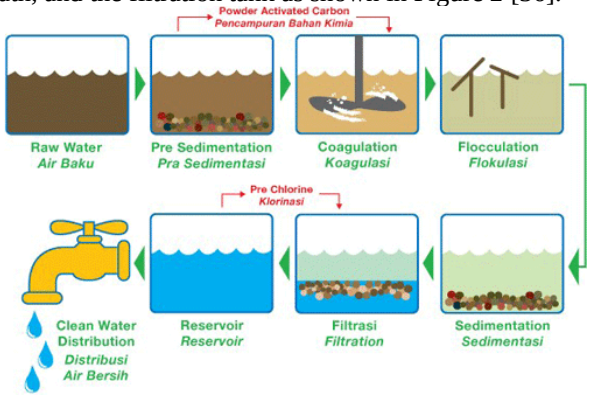


Figure 2 Typical flow of a Water Treatment Plant in Indonesia [35]

Raw water which still has bacteria, parasite, mineral and ion particles is introduced into the pre-sedimentation process. In the pre-sedimentation stage, discrete particles such as sand, clay, etc. are deposited, which will facilitate the coagulation stage. In the coagulation stage, the colloid particle destabilization process is carried out. The purpose of this process is to separate water from the impurities dissolved in it. Furthermore, flocculation of the floc formation process is carried out under slow stirring to increase the interconnection between the shaky particles so as to increase their fusion (agglomeration). Then the sedimentation process is carried out to settle colloid particles that have been destabilized by the previous process and enter the filteration process to filter water before entering the reservoir and distributed to the community.

D. Reservoir

After the WTP and in the form of clear water, before being distributed, the water enters the reservoir. This reservoir serves as a temporary storage area for clean water before it is distributed through the pipes by gravity. Because most of our distribution uses gravity, this reservoir is usually placed in a place with a higher elevation than the places that are the target of the distribution. Usually located on a hill, or mountain. This combination of water treatment units is called IPA - Water Treatment Plant. To save on development costs, usually the intake, WTP, and reservoir are built in one area with a high enough height, so there is no need for a pumping station with a large push pump capacity to deliver water from the WTP to the reservoir. Only then, after arriving from the reservoir, clean water is ready to be distributed through pipes of various sizes to each distribution area.

E. Customer Water Volume Measurement

Water meter is a type of measuring instrument for the volume of drinking water in a piping network to serve users, both individuals and groups by paying attention to technical and non-technical aspects, so that the community can easily obtain a certain amount of water, the quality according to the drinking water requirements for health. Each country has water meter guidelines and standards, here are the standards for water meters compiled from guidelines [7]. The main requirements that must be met by the water meter, such as the resistance of the equipment, safety of the equipment for health, the calculation is not affected from the outside And there are also technical requirements that must be fulfilled such as having to be sealed, there is verification, showing the volume of water clearly without having to dismantle the equipment [7].

There are also standards that must be owned by the water meter which is regulated in the Indonesian National Standard (SNI). For the maximum allowable error rate on the water meter is 5% and the meter is only 1 way where backflow is not calculated. There are also rules for the size of the water meter as in Figure 3.

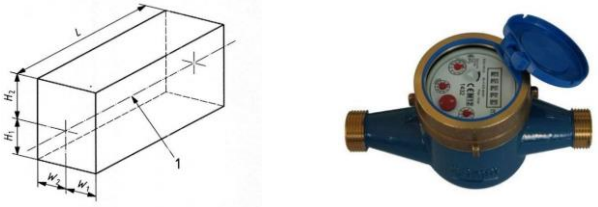


Figure 3 Water Meter Size

The meter size has a characteristic thread size or nominal size of the flange at the end of the connection. For each water meter size is permanently linked to the overall dimensions [52]. The dimensions of the water meter, as shown in Figure 3, must comply with Table 1.

TABEL I
STANDART DIMENSTION WATER METER [52]

Nominal Diameter Size (mm)	L (mm)	w1 w2 (mm)	h1 (mm)	h2 (mm)
15	165	65	60	220
20	190	65	60	240
25	260	100	65	260
32	260	110	70	280
40	300	120	75	300
50	200	135	216	390
65	200	150	130	390
80	200	180	343	410
100	250	225	356	440
125	250	135	140	440
150	300	267	394	500
200	350	349	406	500
250	450	368	521	500
300	500	394	533	533
350	500	270	300	500
400	600	290	320	500
500	600	365	380	520
600	800	390	450	600
800	1200	510	550	700
> 800	1,25xDN	0,65xDN	0,65xDN	0,75xDN

All sizes in table 1 are calculated in millimeters and DN is the nominal diameter of the flange and threaded connection. For long tolerances DN 15 to DN 40-0 / -2 mm, DN 50 to DN 300-0 / -3 mm and DN 350 to DN 400-0 / -5 mm. Tolerances for water meter lengths greater than DN 400 must be agreed between the user and the manufacturer.

III. INTERNET OF THINGS

Internet of Thing (IoT) can be defined as the ability of various devices to connect and exchange data through the internet network. IoT is a technology that allows control, communication, collaboration with various hardware, data via the internet network. So it can be said that IoT is when we connect things (things) that are not operated by humans, to the internet [8].

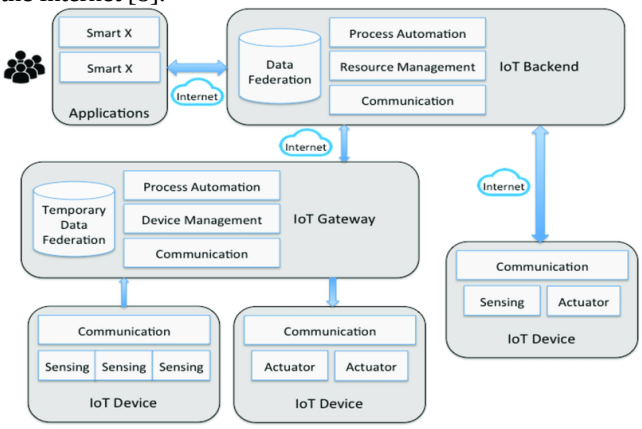


Figure 4 Internet of Things (IoT) Architecture

The explanation of the following figure is explained as follows [33]:

1. IoT device or device from IoT is a device that contains sensors or actuators. There are also tools that will be used to communicate / connect to the internet to transmit data.

2. IoT gateway a physical device or software program that serves as a connection point between the cloud and controllers, sensors and other smart devices. Doing device settings, processing and temporary data storage here.

3. Iot Backend is a place for processing what is obtained through IoT devices or a set of data from IoT devices. The data that has been then displayed to the application.

4. Application is an interface that can be seen by the user

to communicate with the device or view information. This application can be in the form of a website, mobile application or others.

If you look at the trends that are happening on the google trends about IoT, the results are shown in Figure 5.

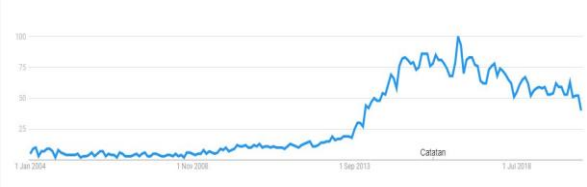


Figure 5 Worldwide IoT trends [46]

When viewed from the trend in the world of IoT, it began to be discussed a lot around 2013 and then it has increased from year to year. 2016 was the year for the most searches on IoT. After 2006 the search for IoT has decreased but not significantly.

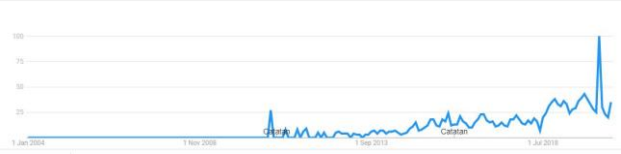


Figure 6 Indonesia IoT trends [46]

In Indonesia, IoT experienced a search level in 2014 and experienced until 2020 in February. However, after February it experienced a very sharp decline.

IoT is not only about controlling devices remotely, but also how to share data, virtualize real things into the form of the internet, and so on. The internet becomes a link between machines automatically. In addition, there are also users who act as regulators and supervisors of the operation of these tools directly. The benefit of using IoT technology is that the work done by humans becomes faster, younger and more efficient.

IV. Materials and Methods

This study attempts to conduct an overview of the drinking water supply and distribution system in Indonesia. In particular, we will examine how technology users, especially IOT, in the field of drinking water management. The following is a research schematic as shown in Figure 7.

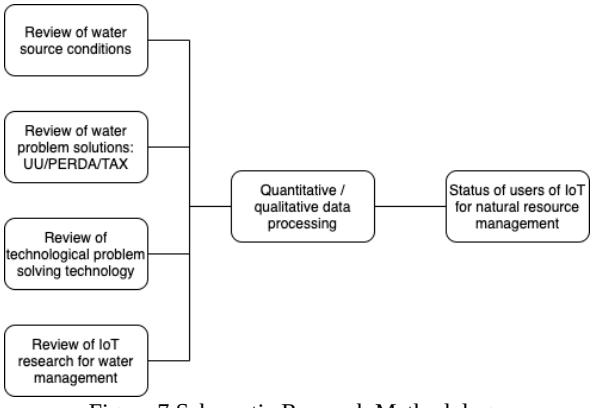


Figure 7 Schematic Research Methodology

In the early stages, data and information collection was carried out by checking the current use of water management which is commonly used in the community. Followed by a review of the rules used in the management and distribution of water supply to the community as well as checking articles related to water supply. A review of the literature on water resources and IoT technology was conducted. In the second stage, the collected data is processed qualitatively or quantitatively. In the last stage, after all the information is processed, the status of the users of IoT research in the field of natural resource management will be obtained.

V. Results and Discussion

In this study, a review of the supply, distribution, regulation and research related to the field of water management in Indonesia has been carried out.

A. Standart and Rules

If viewed from the regulations and laws that regulate the quality of clean water that will be distributed to the community, there is a regulation from the Ministry of Health (2017). Where this regulation specifically regulates the standard of environmental health quality and water health. The following are the water sanitation standards used in Indonesia. There are mandatory parameters which are parameters that must be checked periodically in accordance with statutory provisions, while material parameters are only required to be checked if geo-hydrological conditions indicate potential contamination related to additional parameters. Water for Hygiene Purposes Sanitation is used for personal hygiene maintenance such as bathing and toothbrushes, as well as for washing foodstuffs, eating utensils and clothes. In addition, water for sanitation hygiene can be used as raw water for drinking water [41].

Peraturan Kementrian Dalam Negeri (2016) for regulations governing prices for PDAMs nationally issued by [9]. Where there are several important points are explained here as an example. The tariff for standard needs must be affordable in the community where the rate given to the community must not exceed 4% of the basic income of the community. However, there are also progressive tariffs where customers who use water excessively will be charged a progressive fee where this fee is determined by each region. Here also regulates general water use in the family by the Ministry of Home Affairs. Where here there is a standard of water use for people in Indonesia. Standard of Basic Needs for Drinking Water is the need for water of 10 cubic meters / head of family / month or 60 liters / person / day, or as large as other volume units which are further stipulated by the Minister in charge of government affairs in the field of water resources.

The Law of the Republic of Indonesia (2019) regulates water resources. Repeal and not enforce Law Number 11 of 1974 concerning Irrigation. The consideration of the drafting of a further law to regulate water resources is to consider the starting reduction in water sources owned and the increasing need for water by the community. On the

basis of state control over water resources, the central government and / or regional governments are given the task and authority to regulate and manage water resources, including the task of meeting the minimum daily basic needs of water for the community [37].

The Republic of Indonesia Government Regulation (2018) regulates the use of Groundwater. Groundwater management is carried out based on the groundwater management implementation strategy with the principle of balance between conservation efforts and groundwater utilization. To obtain a groundwater utilization permit or groundwater exploitation permit, an applicant must submit a written application to the Regent / Mayor with a copy to the Minister and Governor. To support groundwater management, the Minister, Governors and Regents / Mayors organize a groundwater information system. Regarding the financing of groundwater management, it is determined based on the real need for groundwater management [38].

The Republic of Indonesia Government Regulation (2018) regulates the minimum services provided to the community. There are many things that are regulated in this law, one of which is water. This law states that the need for drinking water must be met by local governments. Compulsory Government Affairs are government affairs that are obliged to be carried out by all Regions [39].

The Republic of Indonesia Government Regulation (2014) regulates user rights in obtaining and using or exploiting water for various purposes. Guarantee of everyone's right to obtain water for their basic daily needs at least in order to fulfill a healthy, clean and productive life. Recognition of the customary rights of the local customary law community to water and similar rights as long as they do not conflict with national interests and laws and regulations [40]. Of the several laws that have been reviewed, the following is a table grouping laws based on their use categories.

TABEL II
REGULATION / UNDANG-UNDANG ABOUT WATER

No	Regulation	Year	Category
1	Permenkes No. 32 tahun 2017	2017	Clean water standards to carry out sanitation in Indonesia that is safe for the environment and health.
2	Peraturan Menteri Dalam Negeri Nomor 23 Tahun 2006	2016	Tariff rules and fair limits for water use.
3	UU 17 tahun 2019	2019	Use of water resources for their respective regions.
4	Peraturan Pemerintah Republik Indonesia Nomor 43 Tahun 2008	2008	Use of underground water.
5	Peraturan Pemerintah Republik Indonesia No. 2 Tahun 2OI8	2018	The minimum service that must be provided to the Indonesian people.
6	Peraturan Pemerintah Republik Indonesia Nomor 69 Tahun 2014	2014	Use of water in various ways. To meet various basic needs.

B. Water Use Management System

Water use management system is an activity to plan, develop, distribute, and manage the optimal use of water resources. The components of a water management system are maintaining water resources, controlling the destructive force of water and utilizing water. The following is a review that has been done on previous research and discusses water use management systems with the help of technology.

Research conducted by Hakim et al. (2018) Conducting water monitoring is very important for companies that use high water, besides being able to emphasize costs it also has a big impact on the environment. Research and studies on water management systems have been implemented in various places in various ways. Among academics, several improvements have been made to the implementation of the water management system to produce measurable and accurate data on water consumption in a place where research has been carried out by designing a tool capable of monitoring water use digitally. This tool is equipped with a water flow sensor which can capture the amount of water flow that passes through the pipe and is displayed on an LCD which is also installed on the device. The results of this water flow can also be connected / viewed via an Android smartphone [10].

Research conducted by Wijayanto et al (2016). Research on the measurement of water use discharge [11]. In this study, which measures the discharge of household water use, measures water using a flow water sensor which can find out the amount of flow through the pipe. This research tool can pass restrictions on water use which is set via the button available on the tool. If the water usage set has exceeded that set, the servo motor on the appliance will make a turn to turn off the running tap.

Research conducted by Putra et al (2017) Research on water use monitoring devices [12]. This research takes a concept such as PDAM which summarizes the usage of each registered point and then calculates the number of uses. This research is based on a website where there is one user, namely the admin, whose job is to check the calculation of water usage. This tool still uses the LAN cable as a liaison between the device and the available server.

Research conducted by Ariessanti et al (2020) Monitoring the use of water in PDAM Tirta Benteng Tanggerang [13]. which is a company owned by the local government that distributes clean water to the community. Currently, the information on bills that customers charge from water consumption is still minimal. Customers only know the bill when they want to make payments. Not only that, sometimes the fees charged are very large because customers cannot see how much water is used. Thus in this study discusses a prototype water use monitoring system based on IoT using a Wemos D1 Mini microcontroller by measuring the volume of the water connection. The method used in this research is evolutionary prototype where the tool is a series of prototypes of several components. The results of this study are expected to improve service to customers.

Research conducted by Guntur Research which monitors the use of water and electricity [14]. The results of this study indicate that the embedded system based PDAM electricity and water usage monitoring system in boarding houses can provide solutions for boarding house owners in terms of monitoring and controlling the use of electricity and PDAM water in their boarding houses. With the embedded system-based PDAM electricity and water usage monitoring system in boarding houses, it can control the electricity and water consumption of PDAM of each boarding room tenant which will have an impact on saving electricity and PDAM water.

Research conducted by Kautsar et al (2015) To measure water use using a water flow sensor that uses the principle of the hall effect to monitor water consumption and bills to be paid. This study designed a digital monitoring system based on the ATMega 328 microcontroller by measuring the water discharge from the tube connection [15]. The output of this system contains information about the water discharge, the volume of water in cubic meters is also added to the unit price. The results of testing the accuracy of the water flow sensor reached 98.8%, while the photodiode sensor has a reacehed water turbidity scale measurement of 0 - 173 NTU.

Research conducted by Zakaria et al (2019) conducted research on water flow through PDAM pipes. Starting the research method by conducting a survey and continuing with the sensor that will be used. The monitoring system uses Firebase which aims to be able to transmit data in real time [12]. Using a sensor with the YF-s201 type with an error rate of 0.91%.

Research conducted by Rohman et al (2017) tried to make a water filter on a small scale, namely households. Using the fuzzy_FID control method with the parameters Kp, Ki, Kd on the PID control. Using 1 water clarity sensor and 2 flowmeter sensors it was found that the speed of water flow could affect the water clarity [16].

Research conducted by Ayubi et al (2015) aims to determine the speed and flow of water flowing in the pipe. In this study, using two input calculation methods, namely the venturimeter and water flow sensor. The water discharge is directly proportional to the difference in height indicating the pressure in each section, and the discharge is inversely proportional to the cross-sectional area. From the results of these checks, the water flow sensor error is 1.75% [17].

Research conducted by Paksi et al (2019) tried to detect the flow of water flowing in pipes using a water flow sensor. Designed with the IoT concept and supported by an Android application that is used as a user interface. This research produces a water meter. Researchers proved that what they made was stable with a precision value of 100%, a recall value of 75% and an accuracy of 75% [18].

Research conducted by Sirait et al (2017) aims to control and monitor water use. Detect the part of the leak that occurs in the pipe. By using the water flow sensor YF-B1. The average accuracy of this study is 91% [19].

Research conducted by Yonathan Dwi Utomo (2019) designed a device using a NodeMCU microcontroller to calculate the discharge of water use based on IoT. The read data will appear on an LCD with a size of 20x4 and all data will be displayed in real time because the Real Time Clock (RTC) module has been added [20].

The research conducted by Tio Riyanto (2018) is based on the frequent use of irregular water and waste of water. Researchers designed a device that can remotely control water taps and monitor water usage using an android cellphone [21].

Research conducted by Ferry Andre Ariyanto (2019). Design a device that can read the water flow rate from the PDAM using a WEMOS microcontroller combined with a ½ size water flow sensor. By placing the appliance in each house, it will be easier to retrieve the data with an accuracy rate of 90% [22].

Research conducted by Irodah (2017) is based on data that researchers found that 27% of PDAMs are unhealthy and 19% of PDAMs are sick, researchers designed a PDAM bill recording tool. The system uses Arduino UNO Atmega 328, Bluetooth Module, Micro SD Card Module as core components. According to research the maximum distance without a hitch is up to 20.3-meters with data transfer rates <1 millisecond [23].

Research conducted by Rifai (2019) designed a device that will be connected to the internet using a NodeMCU microcontroller. The data obtained will be sent to Thinger.io web server which will be processed to obtain the total cost of water usage [24].

Research conducted by Gunawan (2018) designed a device that contains a YF-B1 water flow sensor to calculate the cost of using water. Get the measurement accuracy of 91%. Android application is built using Android Blynk [25].

Research conducted by Ramadhan (2019) tries to apply microcontroller technology to the flow meter using a water flow sensor which is then controlled by NodeMCU and the amount of water discharge is calculated, then the results will be displayed in the Android application. Then the results that have been obtained are in the form of the number of usage per month and will be displayed in the android application. The test results obtained are the water flow sensor accuracy data which has an average reading of 0.34 seconds longer than the predetermined time, the overall accuracy data of the tool testing without using Blynk which has an average accuracy value of 99.06%, and accuracy data. The set point test on the Blynk application has an average accuracy value of 97.91% [26].

The research conducted by Kusuma (2019) departed from a questionnaire distributed in 2018/2019 that 90% of hostel employees agreed with the lack of a schedule for watering in the garden. In this final project, the Smart Garden Watering module used is Ethernet with Rasberry pi. How it works with the Soil sensor opening and closing when humidity is less. There is also a waterflow meter that is used to detect water usage. The data obtained is then sent to Antares. The maximum results were obtained for watering and the accuracy of water was 83.6% [27].

Research conducted by Yaddarabullah et al (2018) Recording data from internet of things devices into applications requires a data communication system, including MQTT and Socket Connection. However, the

data communication system that has been used has a disadvantage, namely that it cannot be customized for multiplatform. In this study, research and modeling were carried out on the use of another data communication system, namely Service Oriented Architecture in order to support multiplatform applied to PDAM water meter recording devices [28].

Research conducted by Fathoni and Winardi researchers made a tool that can measure the discharge of water contained in the refill water filling depot. Using a water flow sensor in a piped water to refill it, then the results will be stored in the database. With this, it is hoped that users will find it easier to check sales when they have several water refill outlets [29].

The research conducted by Arifin (2019) departed from BLUD UPT SPAM customers in Musi Rawas Regency who wanted to know water usage in real time. Then a system is designed to know real time water usage. Using a water flow sensor, the Arduino Uno contains an Ethernet module to connect the device to the internet. Using a website-based visualization with a delay of a few seconds because it takes a little time to send data until it can be displayed on a website page [30].

Research conducted by Devy (2020) This system regulates the debit and time zone of water distribution to consumers. Water discharge is detected by the waterflow sensor, the valve is connected to the servo motor and the time zone uses the DS1307 RTC. The water pump is controlled to maintain the volume of water in the reservoir. The water level in the reservoir is detected using the HC-SR04 ultrasonic sensor. Water distribution is monitored on PCs (Personal Computers) and smartphones using Delphi and Thingspeak programming. The reading of the water discharge generated at the peak usage time for each faucet was 1.9: 1.8: 1.8, while the initial distribution ratio for each faucet was 2.5: 2.3, 1: 1 and 2.5: 2.3 [31].

Research conducted by Joseph (2018) created a system for managing water. Using an Arduino uno microcontroller combined with NodeMCU to communicate with the network. This tool uses a laser sensor which is used to determine the height of the water. Then the data obtained is displayed to an operator computer. By combining these tools is able to prevent water overflowing in the tank [42].

Research conducted by Gowthamy (2018) presents a low-cost system design for real-time monitoring of water quality and water quantity in the IOT (internet of things). Using the Arduino Uno base microcontroller with the help of the ESP8266 as wifi to connect to the internet. Presenting a prototype monitoring system of AI usage whose output is in the form of graphs issued to the website [43].

Research conducted by Salam (2014) conducted trials to measure the water pressure in a water tank. Using the Arduino Uno as a microcontroller combined with the GPRS Shield which is used to transmit information obtained from the measurement sensor attached to the water tank. The data obtained is then displayed on the LCD data Website that has been programmed to obtain information from the sensor [44].

Research conducted by Sivasankari (2018) monitors the water level and can look for the ph of the water. Built using a Raspberry Pi which is combined with a water level sensor and a pH sensor. The results obtained by the tool are then displayed on a tv monitor which can give alerts when the water has reached a specified limit [45].

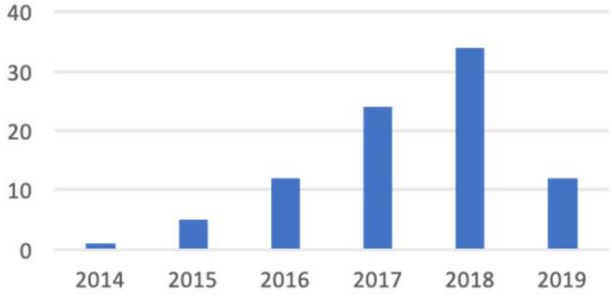
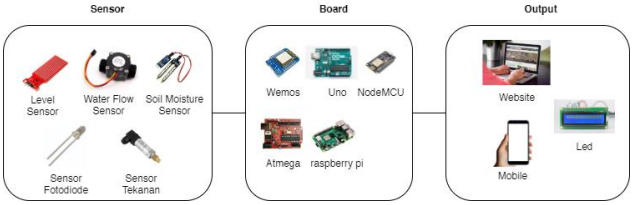


Figure 9 S 2014-2019 IoT research

Based on the picture. 8 studies using IoT keywords from 2014-2019 were recorded on the Neliti.com website. There has been an increase in research using the IoT keyword from year to year but has decreased in 2019. The Indonesian language research using the IoT keyword on the Neliti.com website is the most populous in 2015. If the tools from research on water management using IoT can be summarized as figure 9.



Gambar 9 IoT Water Management Tool

Untuk penelitian IoT pengelolaan air berdasarkan board yang digunakan dalam penelitian IoT control/monitoring penggunaan air yang terdiri dari (NodeMCU, Arduino UNO, Wemos, ATMEGA, Rasberry Phi) ditampilkan pada gambar 10.

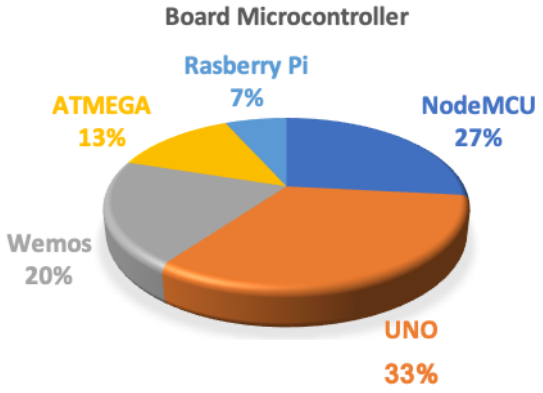


Figure 10 Use of Microcontroller Board

Based on the results of the review above, it is found that the Arduino Uno board is the board most often used to make IoT applications with 33% usage of all other board uses. The grouping based on the output platform used in research on IoT control / monitoring of water use which consists of (Website, Android, LCD) is shown in the figure. 11.

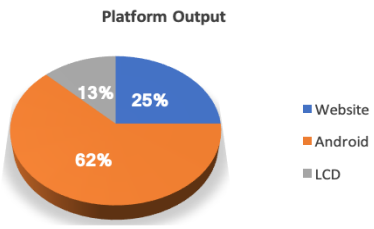


Figure 11 Use of the Output Platform

Android is the choice for output from the most favorite pre-installed devices. Android gets about 62% usage for platform output. Then followed by the website which is used as much as 25% of the total usage. The grouping based on the place used in IoT control / monitoring of water use research consisting of (Household, PDAM, Prototype, Garden, Water Filling Depot) is shown in Figure 12.

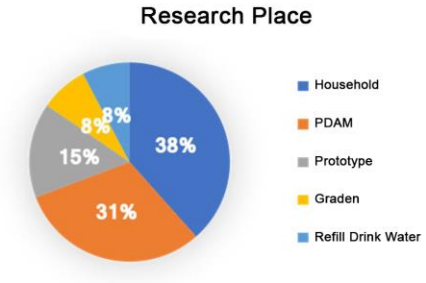


Figure 12 Place of Research

Households are the places where IoT-based water management is tested most often. The measurement of home use is used to determine the use of a family. Followed by PDAM in second place as the research site most often used for conducting research. This happens because PDAM is the provider responsible for water availability in the community.

C. Plans for the Application of IoT in Monitoring Water Use

From the reviews that have been carried out on all aspects contained in the water use management system. starting from standard tools, sensor accuracy, microcontrollers and other features that may be contained in a water use management system, a water use management system based on internet of things can be designed.

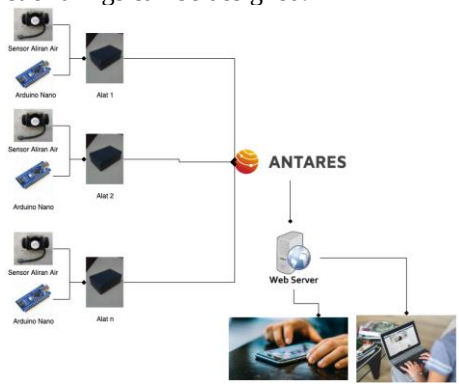


Figure 13 System Schematic Design Ideas

Sensors and a microcontroller will be combined to make a device that can capture the flow of water passing through a pipe. This tool will be wrapped using a special box that meets the standards required to make a water meter. from this tool will send data to Antares so that it can be accessed by the API that has been created in the webserver. In the webserver a web-based system is created to show the analysis carried out with the water flow. It is hoped that with the right analysis it can help the owner of the house / villa / boarding house in making decisions in using water more wisely.

VI. Conclusion

This study has presented various reviews of the presentation, distribution and management of water use management tools. It is found that the serving and distribution of water in Indonesia is carried out by the region itself. The price in each region is different depending on the regional policy itself. Meanwhile, regulations such as regulations for water quality are issued by the Ministry of Health. The regulations governing prices are regulated by the Ministry of Home Affairs.

From the results of a review of the literature that develops technology in clean water management, it is found that boards and platforms are commonly used to conduct IoT-based research. In technology development, some commonly used features are also obtained, namely Iot free, cost prediction, analysis & visualization and usage strategies. Where these four features will be used as one in the next research.

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