Telecommunications, Computers, and Electricals Engineering Journal (TELECTRICAL)
Vol. 1, No. 3, February 2024, pp. 292~305
ISSN: 3026-0744, DOI: 10.26418/telectrical.v1i3.73628

Design a Monitoring and Automation System for Drinking Water Filling with Voice Commands using Google Assistant

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Article Info

Received Dec 09, 2023
Revised Dec 21, 2023
Accepted Jan 25, 2024

Keywords:

Drinking Water Filling Station
Gallon Water Monitoring
Google Assistant
Voice Commands
Water Volume

ABSTRACT

Drinking water filling stations currently still use faucets or buttons to stiffen drinking water filling, where the user is sometimes negligent which results in water overflow during the drinking water filling process and the availability of gallons of water at drinking water filling stations also often runs out. The purpose of this study is to monitor the availability of gallons of water at drinking water filling stations and fill drinking water with voice commands according to the desired water volume using Google Assistant. The command code given is "Turn on the Water Pump", "Turn Off the Water Pump", "Turn on 240 Milliliters", "Turn on 600 Milliliters" and "Turn on 1000 Milliliters" to Google Assistant. The result obtained from this study is the percentage of success of the command code which is 100%. Google Assistant is not able to detect voice commands with environmental conditions of noise interference above 88 dB. The average response speed the tool works at when given a command is 2253 milliseconds. The average error percentage of the HC-SR04 ultrasonic sensor with a manual gauge to determine availability in gallons is 1.8%. The success percentage of the E18-D80NK infrared sensor is 100%. The average error percentage of the Water Flow Sensor Yf-S201 with a measuring teapot when filling 240 milliliters of drinking water is 8.51%, 600 milliliters is 4.05% and 1000 milliliters is 2.35%.

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1. INTRODUCTION

Water is a substance that has a very important role for the survival of humans and other living things. Humans will die faster from lack of water than from lack of food. The human body itself consists mostly of water. In the body water is the most important composition.contained in the body is about 50-80%, because most of the human bodyconsists of fluids, then fluid intakeis needed by the body which is usually obtained from drinking water and foods that contains water. As a result of lack of fluid intake can cause lack of concentration and can interfere with daily activities. Water also can also help to reduce heat in the body[1].

Drinking water is an important need and is indispensable for humans in carrying out daily activities. The routine is quite hectic and the work is quite a lot that requires most people to carry a water bottle wherever they go. When you are outside the house, drinking water carried in bottles cannot meet the needs due to routine and a lot of work. Drinking water is not always available in various locations, especially when you are doing activities outside the home. In meeting the need for drinking water, people's habits will be to buy bottled drinking water that is often found and sold in the community. Growing consumption of single-use bottled water has received criticism due to potentially adverse environmental outcomes[2].

In its development, there have been many works and innovations to meet the drinking water needs of the community in public places, such as airports, train stations, hospitals, and universities, the availability of drinking water filling stations. Drinking water refilling stations (DWRS) are a growing business, providing affordable drinking water for middle–low urban households in developing countries in the last two decades[3]. With the existence of drinking water filling stations, people can easily get drinking water without having to buy drinking water that uses single-use plastic bottles so that it will increase the amount of plastic waste. Community activities in public places make drinking water filling stations very much needed because they help in the supply of drinking water.

Filling drinking water using faucets and charging buttons is often also misused because it is easily accessible to everyone, such as children who use it as toys and some irresponsible people. When filling a drinking water bottle, there is also often an overflow of water due to the user's negligence when filling a drinking water bottle. Likewise, gallons of water as a source of water at drinking water filling stations often run out, because the demand and need for drinking water in public places is quite high which results in filling drinking water is not always possible. People who do not get drinking water complain and report it to the manager of the drinking water bottle refilling station to always check and replace the new gallon of water at the filling station if it runs out.

Therefore, the author is interested in conducting research by designing and building a monitoring system and automation of drinking water filling with voice commands using Google Assistant. Users can fill drinking water without making direct contact just by giving a command to the smartphone to fill the bottle according to the desired volume of water. To determine the availability of water in gallons used as a water source at the filling station so that it can be monitored by the station manager, namely using the HC-SR04 sensor, where sensor reading data is sent to the Blynk application to provide data on water height and remaining gallons of water at the drinking water filling station managed by the manager. The microcontroller used is ESP32 and to determine the volume of water that comes out when filling drinking water using a Water Flow Sensor YF0S201.

2. LITERATURE REVIEW

2.1. Previous research

As for some previous research or similar research that has existed before which became the material for the preparation of this study.

Hasbi Ade Setiawan and Tri Rijanto have conducted a research entitled "Design a Control System for Filling Bottled Drinking Water Using Arduino Uno with a *Load Cell Sensor*". This study aims to design and build a bottled water filling control system and to determine the accuracy of the design of the 330 mL and 600 mL bottle AMDK filling control system using Arduino Uno with a load cell sensor. From the test results on filling AMDK bottles, the results of testing the accuracy or accuracy of water volume during the AMDK filling process for 330 mL and 600 mL bottles are automatically obtained[4].

Sumardi Sadi, Sri Mulyati and Mohamad Chaerudin Maisandi have conducted a research entitled "Design an IoT-Based Beverage Bottle Water Filling Device Using NodeMCU ESP32 with Google Firebase". This study aims to design and build a beverage bottled water filling to determine the volume of water. From this tool that has been made, test results were obtained for the ideal filling time delay in filling bottles of 300 mL and 600 mL obtained a time delay of 8.5 seconds and 16 seconds with the ESP32 microcontroller controller[5].

Andi Syofian and Yultrisna have conducted a research entitled "Automatic Beverage Provider Machine Using Microcontroller-Based Voice". This study aims to design an automatic minunan machine tool using a voice-based microcontroller that can control four types of drinks, namely coffee, tea, milk and mineral water, with commands through voice applications to pour them into glasses. This tool is equipped with an Ultrasonic sensor HC-SR04 as a meter of available beverage capacity and an Infra Red sensor as a glass detector and a DS18B20 temperature sensor as a beverage temperature meter. The sensor read data is processed on the Arduino Mega 2560 Microcontroller to control electronic devices[6].

2.2. Drinking Water Filling Station

Drinking water filling stations are facilities provided in public places such as in parks, train stations, airports, shopping centers, hospitals, universities and other public places. The purpose of the drinking water filling station is so that people can get drinking water by refilling the water bottles used so that it will reduce the use of single-use plastic bottles and save costs and reduce negative impacts on the environment. Drinking water refilling stations (DWRS) are a growing business, providing affordable drinking water for middle–low urban households in developing countries in the last two decades[3].

2.3. Monitoring

Monitoring is carried out by digging to obtain information regularly based on certain indicators, with the aim of knowing whether the ongoing activities are in accordance with the agreed plans and procedures. Monitoring indicators include the essence of activities and targets set in program planning. Monitoring is an activity that aims to monitor or observe something[7].

2.4. Google Assistant

Google Assistant is a virtual assistant powered by artificial intelligence and developed by Google that is mainly available on mobile devices and smart home devices. Google Assistant is a smart personal assistant, considered an improvement over Google Now designed to be more personal with voice control with the keyword "Ok Google". Google Assistant can answer and respond to the information we want such as asking for the weather, time, location and even commands to open certain applications on the smartphone. The following image is what Google Assistant uses[8].

2.5. ESP Rainmaker

ESP RainMaker is a platform for iOS or Android that is used to control Espressif chips modules over the internet. The RainMaker ESP application can facilitate IoT product maker designers and can be integrated with smartphones or with Cloud backends whose hardware modules have been provided to users. Users can use the modules easily by inserting program scripts into the Arduino IDE program implanted into the microcontroller with Espressif chips. ESP RainMaker has the advantage that ESP RainMaker is also integrated with several voice assistants, including: Alexa Voice Assistant, Google Assistant, Apple Home Kit and Matter so that it allows users to activate smart device control with voice features with other assistant applications that are integrated with the RainMaker ESP application[9].

2.6. Blynk

Blynk is a server service platform used to support Internet of Things projects. Blynk Apps serves to create interfaces with various kinds of input output components that support sending and receiving data and representing data according to the selected components. Data representation can be in the form of visual, numbers, or graphs. Blynk Cloud Server is a cloud-based Backend Service facility that is responsible for managing communication between Blynk Apps and the hardware environment[10].

2.7. ESP32 Microcontroller

Microcontroller is a microcomputer chip that is physically in the form of an IC (Integrated Circuit). Microcontrollers have the main parts, namely, CPU (Central Processing Unit), ROM (Read Only Memory) and I/O (Input/Output) ports. Microcontrollers can perform enumeration, perform serial communication and interrupt. Microcontrollers work based on the program (software) embedded in them and the program is made according to the desired application. Application. Microcontrollers are normally related to reading data from outside or controlling tools from outside[11].

The ESP32 microcontroller is a single 2.4 GHz WiFi and Bluetooth combo chip designed with TSMC's ultra-low power 40 nm technology[12]. ESP32 microcontroller is a microcontroller that will be used as a controller. ESP32 microcontrollers are used in Internet of Things (IoT) systems in remote monitoring and control that must require an internet network. The Pin Out of the ESP32 microcontroller can be seen in figure 1.

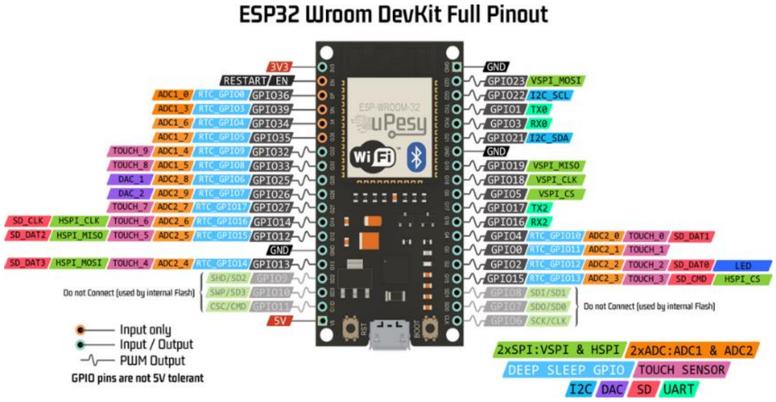

Figure 1. The pin out of the ESP32 microcontroller.

2.8. Infrared Sensor E18-D80NK

Infrared sensor is a sensor that works to detect obstacles or objects in front of the sensor. Infrared sensors have two main parts consisting of an IR transmitter and an IR receiver. The function of the IR transmitter is the part whose job is to emit infrared radiation to an obstacle or object, while the function of the IR receiver is to detect radiation that has been reflected by objects coming from the IR transmitter[13]. The type of infrared sensor used is the infrared sensor type E18-D80NK, where this sensor is able to detect the presence or absence of an object. When the object is in front of the sensor and can be reached by the sensor, the output of the sensor circuit will be logical "1" or "high" which means the object "exists". Conversely, if the object is in a position that is not reached by the sensor, then the output of the sensor circuit will be "0" or "low" which means the object "does not exist"[14]. The E18-D80NK Infrared sensor can be seen in figure 2.

Figure 2. The E18-D80NK infrared sensor.

2.9. Water Flow Sensor YF-S201

Water Flow Sensor YF-S201 is used to measure the volume or discharge of flowing water. This sensor is made of plastic where there is a rotor and hall effect sensor. The working principle of the Water Flow Sensor is that when water is flowing and passing through the valve, the magnetic rotor will rotate, the rotation of the magnetic rotor will rotate according to the speed of the water flow. The hall effect sensor will produce a pulse signal in the form of voltage according to the volume of water flowing[15]. Water Flow Sensor YF-S201 can be seen in figure 3.

Figure 3. Water flow sensor YF-S201.

2.10. Ultrasonik Sensor HC-SR04

Ultrasonic Sensor HC-SR04 is a sensor that converts physical quantities (sound) into electrical quantities. In this sensor ultrasonic waves are generated through an object called piezoelectricity. This piezoelectric will produce ultrasonic waves with a frequency of 40 kHz when an oscillator is applied to the object. Ultrasonic sensors are commonly used for contactless disclosure as diverse as distance measurement applications. This device generally emits ultrasonic sound waves towards a target that reflects back the waves towards the sensor. Then the system measures the time it takes for the wave to transmit until it returns to the sensor and calculates the target distance using the speed of sound in the medium[16]. The Ultrasonic Sensor HC-SR04can be seen in figure 4.

Figure 4. The ultrasonic sensor HC-SR04.

3. RESEARCH METHODOLOGY

3.1. Place and time of research

The test was conducted at the Electric Car Secretariat, Faculty of Engineering, Tanjungpura University, Pontianak. This research starts from June 2023 to October 2023 starting with dataset retrieval, determining data variables, designing tool design, tool manufacturing process, tool testing, data collection and data analysis.

3.2. Tools and materials

The tools used in this study are soldering used to melt tin, tin is used to glue each electronic component, voltmeters are used to measure voltage and electric current flowing on electronic components and screwdrivers are used to install bolts on tools. The materials used in this study are ESP32 microcontroller used as a controlling brain on the device, Infrared Sensor E18-D80NK used to detect drinking water containers or bottles, Water Flow Sensor YF-S201 used to measure the volume or discharge of water flowing during the filling process, Ultrasonic Sensor HC-SR04 is used for reading water availability in gallons, Liquid crystal display (LCD) is used to display the data read by the sensor used, Relay is used as a controller (switch) of the output device connected either from the adapter or power supply by disconnecting and connecting the current, Water Pump in this study is used as a water pump in the process of filling water from gallons to drinking water bottles and the adapter is used as a device in providing direct current (DC) to the relay in turning on the water pump.

3.3. Research Methods

The research method uses several methods to collect data in this research which is depicted in the form of a flowchart in Figure 1 as follows:

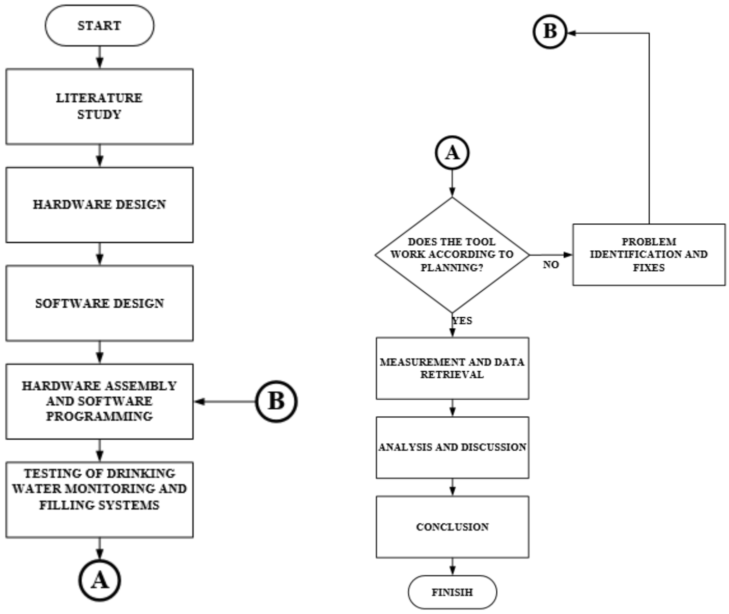

Figure 5. Research flow chart.

The methods carried out in this study are, as follows:

1. Literature studies are carried out by searching, collecting data information and studying supporting theories from various sources of information both obtained offline and online data can be found from various sources, namely articles, journals, datasheets, web pages (verified) and books. The data to be collected are in the form of electronic components, schematic circuits, program codes and so on related to this research.
2. Hardware design includes designing wiring diagrams and identifying the components used
3. Software design includes Arduino IDE programming script design program, design on Blynk application, design and integrate ESP Rainmaker into Google Assistant.
4. Hardware assembly and software programming includes connecting each hardware device and entering software program scripts that will be used for testing in knowing it functions in such a way.
5. Testing the monitoring and filling system for drinking water includes testing for each hardware and software to find out whether the tool functions in accordance with the purpose of this study, namely monitoring the availability of water in gallons as a source of water at drinking water bottle refilling stations and filling drinking water according to the desired volume. If the tool does not function properly in accordance with the design, the identification of problems and repair of the tool will be carried out so that it is in accordance with the designer in the research.
6. Measurement and data retrieval include measuring the results of testing tools for data collection. The data taken is in the form of sensor readings and system tests that have been designed for analysis
7. Analysis and discussion are analyzing and discussing data obtained from the results of measurements and taking equipment trials both from sensor readings, system testing and tool performance.
8. The conclusion is the result of the research that has been done.

3.4. Device Design at Drinking Water Filling Station

The design of the device design at the drinking water filling station is the design of an illustration of the position of each electronic component on the designed device. The design carried out is the position of each hardware used and installed in the chasing box of the station. Hardware used such as electronic components, sensors, water pumps and so on. In the design of the equipment design at the drinking water filling station, a block diagram of each monitoring and automation system for drinking water filling will be explained using Google Assistant. An illustration of a drinking water filling station can be seen in figure 6 and a system block diagram of the research to be conducted can be seen in figure 7.

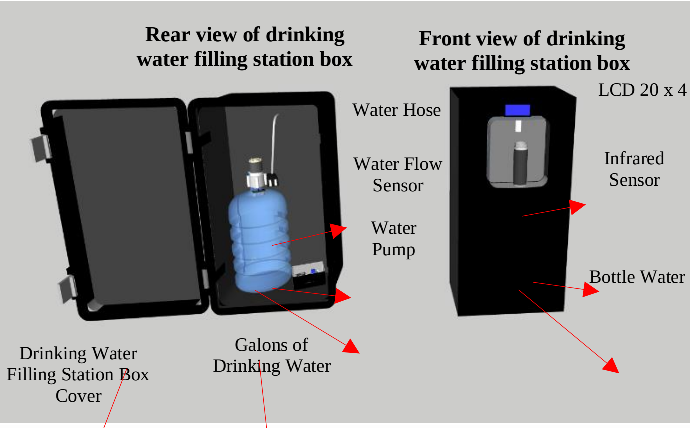

Figure 6. Illustration of hardware position on drinking water filling station box

In figure 6 it is ilustration of the position of each electronic component in the designed tool and the electronic circuit of the entire system at the drinking water filling station. The electronic components that will be installed are 1 Ultrasonic sensor, where the sensor will be attached to a gallon lid that can be removed and reinstalled, so that every change of gallon water when empty only replaces the new gallon that has been filled with water. Water flow sensor 1 piece connected to the water pump so that the volume of water flowed by the water pump will be directly read by the water flow sensor. Infrared sensor 1 piece that will be installed on the side where the drinking water bottle is placed when filling. Water Pump is attached to the inner box wall of the filling station. Relay, NodeMCU ESP32 and other components and tools and supporting materials are placed in the component box.

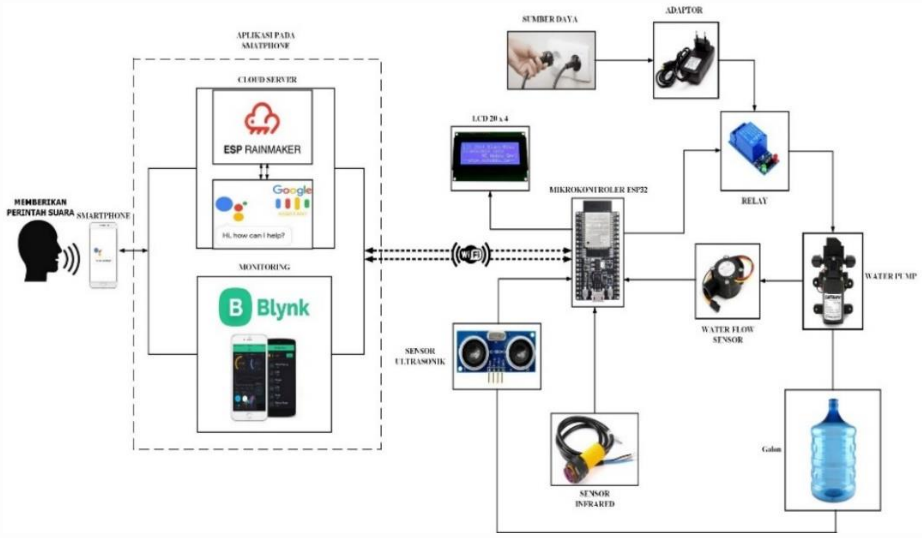

Figure 7. Block diagram of monitoring and automation system for drinking water filling with voice commands using google assistant

In figure 7 it is explained, the design of the system block diagram design was carried out in explaining the flow of software and hardware systems in the monitoring system and automation of drinking water filling with voice commands using Google Assistant. System design consists of the integration of each software and hardware used. In the design of the ESP application software, Rainmaker is used as a cloud server to integrate with Google Assistant to make interactions between users according to the command code given in running the designed hardware and tools. In this study, the device name on the display of the ESP Rainmaker application is "Drinking Water Filling Station" and the command code integrated in Google Assistant is "Water Pump", "240 milliliters", "600 milliliters", "1000 milliliters".

In monitoring the availability of water at gallons filling stations as a source of water for refilling drinking water bottles which will use the Blynk application on the station manager's smartphone to monitor the availability of water on gallons of filling stations remotely and in real time using ultrasonic sensors that have been placed on the gallon cap so as to know the water level in gallons in centimeters (cm) and residue water or the volume of water in gallons in units of Liters (L).

In hardware design, it will assemble and test electronic components whether they function properly where each component will be programmed using Arduino IDE Software. The electronic components are ultrasonic sensors, water flow sensors, LCDs, infrared sensors, relays and other electronic components where the Arduino programming script on each electronic component will be implanted into the ESP32 microcontroller as a controller.

4. RESULT AND DISCUSSION

The design of a monitoring system and automation of drinking water filling with voice commands using Google Assistant needs to be tested with a view to knowing the performance, accuracy, efficiency and reliability of the tools that have been designed. The testing process is carried out to compare the results of the tools that have been designed and use manual tools in taking data on the measured variables.

4.1. Blynk App Test Result

The results of testing the Blynk application on the station manager's smartphone are used to monitor the availability of water in gallons remotely and in real time from ultrasonic sensor reading data that has been placed on the gallon cap so that it knows the water level in gallons in centimeters (cm) and the remaining water or volume of water in gallons in liters (L). A display in the Blynk application showing the high value of water and remaining water from ultrasonic sensor reading data can be seen in Figure 8.

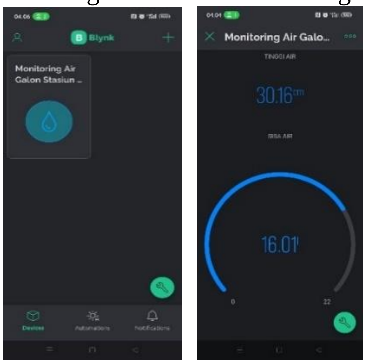

Figure 8. Display of high value water (cm) and remaining water (L) gallon filling station on blynk application

4.2. Command Code Test Result Given to Google Assistant

Command code testing is done to find out when given a command to Google Assistant the tool works according to the command that has been given. Command code testing is carried out with 5 types of tests, namely given commands with a distance to a smartphone of 20 cm with environmental noise conditions of 60 decibels (dB) and command codes given "Hey Google, Turn on the Water Pump", "Hey Google, Turn Off the Water Pump", "Hey Google, Turn on 240 Milliliters", "Hey Google, Turn on 600 Milliliters", and "Hey Google, Turn on 1000 Milliliters" to Google Assistant with the expected results of the tool will work according to the given command code. A total of 150 attempts were made with each command code made 30 attempts. Based on Table 1, the results of command code testing from a total of 150 attempts were found to be all successful, resulting in a 100% success percentage that proves the tool works according to the command code given to Google Assistant. The command code test result data can be seen in Table 1.

Table 1. Command code test result given to google Assistant.

No	Type of Testing	Expected Results	Amount			Succes Percentage (%)
			Attempt	Succed	Failed	
1	Give the Command "Hey Google, Turn On the Water Pump" to Google Assistant	Google Assistant responds to "Sip, Turn On Water Pump" and the water pump is on to perform drinking water refilling	30	30	0	100%
2	Give the Command "Hey Google, Turn Off the Water Pump" to Google Assistant	Google Assistant responds "Okay, Turn Off Water Pump" and Water pump Off, stop filling drinking water	30	30	0	100%
3	Give the Command "Hey Google, Turn On 240 Milliliters" to Google Assistant	Google Assistant responds to "Sip, Turn on 240 Milliliters" and the water pump turns on to fill drinking water and the water pump turns off when the water is filled with 240 Milliliters	30	30	0	100%
	Give the Command "Hey Google, Turn On	Google Assistant responds to "Sip, Turn on 600 Milliliters" and the water pump is on to fill				

4	600 Milliliters" to Google Assistant	drinking water and the water pump turns off when the water is filled with 600 Milliliters	30	30	0	100%
5	Give the Command "Hey Google, Turn On 1000 Milliliters" to Google Assistant	Google Assistant responds to "Sip, Turn on 1000 Milliliters" and the water pump is on to fill drinking water and the water pump turns off when the water is filled with 1000 Milliliters	30	30	0	100%
Total			**150**	**150**	**0**	**100%**

4.3. The Results when Commanded with Noise Interference Conditions

Testing when given commands with noise interference conditions at decibels (dB) to compare and find out the ability of Google Assistant to detect commands given with a distance to a smartphone of 20 cm. In this test by turning on the sound of music on the speaker so that the maximum ability of gGoogle Assistant is obtained in detecting the commands given. Based on Table 2 test results when given a command with a noise disturbance condition of 88 decibels (dB), Google Assistant is not able to detect the command given because the sound of music played using the speaker is stronger than the sound of the command given to charge, so the device cannot work to fill drinking water. So that Google Assistant is almost able to detect noise interference conditions below 88 decibels (dB). Test results when given a command with noise disturbance conditions at decibels (dB) can be seen in Table 2.

Table 2. Test results when commanded with noise interference conditions of 88 decibels (dB).

No	Type of Testing	Expected Results	dB	Amount			Succes Percentage (%)
				Attempt	Succed	Failed	
1	Give the Command "Hey Google, Turn On the Water Pump" to Google Assistant	Google Assistant responds to "Sip, Turn On Water Pump" and the water pump is on to perform drinking water refilling	88	15	0	15	0%
2	Give the Command "Hey Google, Turn Off the Water Pump" to Google Assistant	Google Assistant responds "Okay, Turn Off Water Pump" and Water pump Off, stop filling drinking water	88	15	0	15	0%
3	Give the Command "Hey Google, Turn On 240 Milliliters" to Google Assistant	Google Assistant responds to "Sip, Turn on 240 Milliliters" and the water pump is on to top up drinking water	88	15	0	15	0%
4	Give the Command "Hey Google, Turn On 600 Milliliters" to Google Assistant	Google Assistant responds to "Sip, Turn On 600 Milliliters" and the water pump is on to top up drinking water	88	15	0	15	0%
5	Give the Command "Hey Google, Turn On 1000 Milliliters" to Google Assistant	Google Assistant responds to "Sip, Turn on 1000 Milliliters" and the water pump is on to fill drinking water	88	15	0	15	0%
Total				**75**	**0**	**75**	**0%**

4.4. The Results of the Tool's Response Time Testing Detect and Work when given a Command to Google Assistant

The results of the response time test of the tool detect and work when given a command to Google Assistant to measure and find out the average time of response speed from when given a command to Google Assistant until the water pump starts and fills drinking water. This test was carried out with 5 tests, namely given commands with a distance to a smartphone of 20 cm with environmental noise conditions of 60 decibels (dB) and each test was carried out 30 commands. To measure the response time when given a command to Google Assistant until the water pump starts by using a stopwatch and making observations when the water pump is on and looking at the serial monitor on the Arduino IDE software. Based on the results of measurements using a stopwatch and making observations by looking at the serial monitor on the Arduino IDE software. In Table 3, data obtained from the test results of the response time of the device detects and works when given the commands "Turn on the Water Pump", "Turn off the Water Pump", "Turn on 240 milliliters", "Turn on 600 milliliters" and "Turn on 1000 milliliters" to Google Assistant, obtained The total average duration of the tool works is 2253 milliseconds or equal to 2.253 seconds. The data of the test results of the response time of the tool detects and works when given commands to Google Assistant can be seen from the Table 3.

Table 3. The results of the tool's response time testing detect and work when given a command to google assistant.

No	Type of Testing	Expected Results	Attempt	Average Time Respone Tool Work (ms)	Information
1	Give the Command "Hey Google, Turn On the Water Pump" to Google Assistant	Google Assistant Respond to the Water Pump on and fill drinking water according to the instructions given	30	2069	Succed
2	Give the Command "Hey Google, Turn Off the Water Pump" to Google Assistant	Google Assistant Respond to the Water Pump on and fill drinking water according to the instructions given	30	2152	Succed
3	Give the Command "Hey Google, Turn On 240 Milliliters" to Google Assistant	Google Assistant Respond to the Water Pump on and fill drinking water according to the instructions given	30	2275	Succed
4	Give the Command "Hey Google, Turn On 600 Milliliters" to Google Assistant	Google Assistant Respond to the Water Pump on and fill drinking water according to the instructions given	30	2375	Succed
5	Give the Command "Hey Google, Turn On 1000 Milliliters" to Google Assistant	Google Assistant Respond to the Water Pump on and fill drinking water according to the instructions given	30	2395	Succed
Total Average Duration of Work Tool				**2253**	

4.5. HC-SR04 Ultrasonik Sensor Test Result

Ultrasonic sensor testing HC-SR04 to determine the height of water and remaining water in gallons and to compare water height using a ruler measuring instrument and remaining water by means of gallons filled with water every 1 liter to 19 liters using a measuring teapot and measuring using a ruler and observing the suitability of sensor readings. Based on testing and analysis from Table 4 the data of the measurement of water height (cm) using a ruler measuring instrument and remaining water (L) in gallons when compared with the HC-SR04 Ultrasonic sensor reading data can be seen the average error percentage is 1.8%, where the value of high water and remaining water is interconnected because if the high value of water in the gallon is high, Then the remaining water in the gallon is a lot, and vice versa if the high value of water in the gallon is low, then the remaining water in the gallon is low too. The results of the HC-SR04 Ultrasonic sensor testing can be seen in table 4.

Table 4. HC-SR04 ultrasonik sensor test result data.

No	Measurement using Manual Surveying Tool		HC-SR04 Ultrasonik Sensor Reading Data		Error Percentage (%)	
	Water Level using Ruler(cm)	Water Waste using a Teapot(L)	Water Level (cm)	Water Waste (L)	Water Level	Water Wase
1	1.75	1	1.77	1.01	1.14	1
2	3.5	2	3.52	2.02	0.57	1
3	5.25	3	5.61	3.21	6.85	7
4	7	4	7.18	4.11	2.57	2.75
5	8.75	5	8.99	5.15	2.74	3
6	10.5	6	10.66	6.1	1.52	1.66
7	12.25	7	12.68	7.26	3.51	3.71
8	14	8	14.13	8.09	0.92	1.12
9	15.75	9	15.86	9.08	0.69	0.88
10	17.5	10	17.72	10.14	1.25	1.4
11	18.7	11	19.62	11.23	4.91	2.09
12	21	12	21.54	12.33	2.57	2.75
13	22.75	13	23.14	13.25	1.71	1.92
14	24.5	14	24.53	14.05	0.12	0.35
15	26.25	15	26.49	15.17	0.91	1.13
16	28	16	28.02	16.04	0.07	0.25
17	29.75	17	29.77	17.04	0.06	0.23

18	31.5	18	31.74	18.17	0.76	0.94
19	33.25	19	33.36	19.10	0.33	0.52
Average sensor reading data					**1.8**	**1.8**

4.6. E18-D80NK Infrared Sensor Test Result

Infrared sensor testing E18-D80NK is carried out to determine the performance of the sensor to detect the presence of glasses or drinking water bottles by making observations during the testing process. If the glass or bottle of drinking water has been placed at the drinking water filling station, the Infrared sensor E18-D80NK will detect the glass or bottle of drinking water and the reading is displayed with the sentence "There is a > Ready Bottle" on the LCD of the drinking water filling station, the water pump can work and the process of filling drinking water can be done. If the glass or bottle of drinking water has not been placed at the drinking water filling station, the Infrared sensor E18-D80NK will detect the glass or bottle of drinking water and the reading is displayed with the phrase "No Bottle > Pump Off" on the LCD of the drinking water filling station, the water pump cannot work and the drinking water filling process cannot be carried out. And if a glass or bottle of drinking water is taken during the filling process, then the water pump will turn off. Based on the test data from Table 5 can be seen if the glass or bottle is placed in the filling place and given a command to Google Assistant, the water pump can start. If the glass or bottle is not placed in the filling station and given a command to Google Assistant, the water pump is off. If a glass or bottle of drinking water is taken during the filling process, the water pump turns off. From the test results carried out, the percentage of sensor success is 100% which shows good performance. Data on the test results of the E18-D80NK Infrared sensor can be seen in Table 5.

Table 5. E18-D80NK Infrared Sensor Test Result Data.

No	Type of Testing	There is a bottle		No Bottles		Succes Percentage
		Information	Attempt	Information	Attempt	
1	Give the Command "Hey Google, Turn On the Water Pump" to Google Assistant	Water Pump On	15	Water Pump Off	15	100%
2	Give the Command "Hey Google, Turn On 240 Milliliters" to Google Assistant	Water Pump On	15	Water Pump Off	15	100%
3	Give the Command "Hey Google, Turn On 240 Milliliters" to Google Assistant	Water Pump On	15	Water Pump Off	15	100%
4	Give the Command "Hey Google, Turn On 1000 Milliliters" to Google Assistant	Water Pump On	15	Water Pump Off	15	100%
5	When a glass or bottle of drinking water is taken during the process of filling drinking water			Water Pump Off	15	100%
Total			**60**		**75**	**100%**

4.7. Water Flow Sensor YF-S201 Test Result

The test was carried out to determine the comparison of the results of measuring the volume of water that came out during the filling process on the readings of the YF-S201 Water Flow Sensor and measuring teapot. This test was conducted with 4 tests, with each test carried out 30 times. Data on the test results of the YF-S201 Water Flow Sensor can be seen in Table 6, Table 7, Table 8, and Table 9.

Based on the test results from Table 6, where if given the order to turn on the water pump to the order to turn off the water pump to find out the comparison of the results of water volume readings using the YF-S201 Water Flow Sensor with the results of measuring water volume using a manual measuring instrument, namely a measuring teapot, it can be seen the average data from 30 experiments, namely an average error of 20.93 milliliters with an average error percentage of 5.39%.

Table 6. Test Results Data if Given the Order Turn on the Water Pump until Turn Off the Water Pump.

Attempt	Measurement Result (mL)			Error Percentage (%)
	Water Flow Sensor YF-S201	a Teapot	Error	
1	176	140	36	25.71
2	252	230	22	9.56
3	332	310	22	7.09
4	379	360	19	5.27
5	471	450	21	4.66
6	495	480	15	3.12
7	534	510	24	4.70

8	764	750	14	1.86
9	653	640	13	2.03
10	697	680	17	2.50
11	214	190	24	12.63
12	235	210	25	11.90
13	754	730	24	3.28
14	159	140	19	13.57
15	967	940	27	2.87
16	885	870	15	1.72
17	437	420	17	4.04
18	1503	1480	23	1.55
19	854	830	24	2.89
20	995	980	15	1.53
21	912	880	32	3.63
22	654	640	14	2.18
23	1143	1120	23	2.05
24	1421	1400	21	1.50
25	296	270	26	9.62
26	1023	1000	20	2
27	673	660	13	1.96
28	764	740	24	3.24
29	814	800	14	1.75
30	245	220	25	11.36
Average Data			**20.93**	**5.39**

Based on the test results from Table 7, where if given an order to turn on 240 milliliters will fill drinking water up to 240 milliliters and filling stops automatically. Comparison of water volume readings using the YF-S201 Water Flow Sensor with the results of measuring water volume using a manual measuring instrument, namely a measuring teapot, can be seen on average data from 30 attempts, namely an average error of 18.66 milliliters with an average error percentage of 8.51%.

Table 7. Test Results Data if Given the Order Turn on 240 mililiters Command.

Attempt	**Measurement Result (mL)**			**Error Percentage (%)**
	Water Flow Sensor YF-S201	**a Teapot**	**Error**	
1	240	220	20	9.09
2	240	220	20	9.09
3	240	210	30	14.28
4	240	230	10	4.34
5	240	220	20	9.09
6	240	230	10	4.34
7	240	230	10	4.34
8	240	220	20	9.09
9	240	210	30	14.28
10	240	220	20	9.09
11	240	220	20	9.09
12	240	210	30	14.28
13	240	220	20	9.09
14	240	220	20	9.09
15	240	220	20	9.09
16	240	230	10	4.34
17	240	220	20	9.09
18	240	220	20	9.09
19	240	220	20	9.09
20	240	230	10	4.34
21	240	230	10	4.34
22	240	230	10	4.34
23	240	220	20	9.09
24	240	220	20	9.09
25	240	210	30	14.28
26	240	220	20	9.09
27	240	220	20	9.09
28	240	220	20	9.09
29	240	230	10	4.34

30	240	230	10	4.34
Average Data			**18.66**	**8.51**

Based on the test results from Table 8, where if given an order to turn on 600 milliliters will fill drinking water up to 600 milliliters and filling stops automatically. Comparison of water volume readings using the YF-S201 Water Flow Sensor with the results of measuring water volume using a manual measuring instrument, namely a measuring teapot, can be seen on average data from 30 attempts, namely an average error of 23.33 milliliters with an average error percentage of 4.05%.

Table 8. Test Results Data if Given the Order Turn on 600 mililiters Command.

Attempt	**Measurement Result (mL)**			**Error Percentage (%)**
	Water Flow Sensor YF-S201	**a Teapot**	**Error**	
1	600	580	20	3.44
2	600	580	20	3.44
3	600	570	30	5.26
4	600	580	20	3.44
5	600	580	20	3.44
6	600	580	20	3.44
7	600	580	20	3.44
8	600	570	30	5.26
9	600	580	20	3.44
10	600	580	20	3.44
11	600	580	20	3.44
12	600	580	20	3.44
13	600	580	20	3.44
14	600	570	30	5.26
15	600	570	30	5.26
16	600	580	20	3.44
17	600	570	30	5.26
18	600	580	20	3.44
19	600	580	20	3.44
20	600	580	20	3.44
21	600	570	30	5.26
22	600	570	30	5.26
23	600	580	20	3.44
24	600	570	30	5.26
25	600	580	20	3.44
26	600	570	30	5.26
27	600	580	20	3.44
28	600	570	30	5.26
29	600	580	20	3.44
30	600	580	20	3.44
Average Data			**23.33**	**4.05**

Based on the test results from Table 8, where if given an order to turn on 1000 milliliters will fill drinking water up to 1000 milliliters and filling stops automatically. Comparison of water volume readings using the YF-S201 Water Flow Sensor with the results of measuring water volume using a manual measuring instrument, namely a measuring teapot, can be seen on average data from 30 attempts, namely an average error of 23 milliliters with an average error percentage of 2.35%.

Table 9. Test Results Data if Given the Order Turn on 1000 mililiters Command.

Attempt	**Measurement Result (mL)**			**Error Percentage (%)**
	Water Flow Sensor YF-S201	**a Teapot**	**Error**	
1	1000	980	20	2.04
2	1000	980	20	2.04
3	1000	980	20	2.04
4	1000	970	30	3.09
5	1000	970	30	3.09
6	1000	980	20	2.04
7	1000	970	30	3.09
8	1000	980	20	2.04
9	1000	980	20	2.04
10	1000	980	20	2.04
11	1000	980	20	2.04

12	1000	970	30	3.09
13	1000	970	30	3.09
14	1000	980	20	2.04
15	1000	980	20	2.04
16	1000	980	20	2.04
17	1000	980	20	2.04
18	1000	970	30	3.09
19	1000	970	30	3.09
20	1000	980	20	2.04
21	1000	980	20	2.04
22	1000	980	20	2.04
23	1000	980	20	2.04
24	1000	980	20	2.04
25	1000	970	30	3.09
26	1000	980	20	2.04
27	1000	980	20	2.04
28	1000	980	20	2.04
29	1000	970	30	3.09
30	1000	980	80	2.04
Average Data			**23**	**2.35**

5. CONCLUSION

From the test results of the tool, it can be concluded that the system designed to build can monitor the availability of water at gallons of drinking water filling stations by knowing the water height (cm) and remaining water (L) gallons and can fill drinking water according to the volume of water ordered to Google Assistant. The specified command code can be detected and the system is able to respond and the tool can work according to the commands that have been given. Google Assistant is unable to respond and detect commands given with noise interference conditions in the surrounding environment with a noise range high enough to 88 dB so that the tool cannot work. The average response time of the tool works from when the command is given to filling drinking water from all specified command codes is 2253 milliseconds. The average percentage of error obtained between the HC-SR04 ultrasonic sensor and a ruler gauge to measure water height (cm) in gallons and a measuring kettle to measure remaining water (L) in gallons is 1.8%. The success percentage of the E18-D80NK Infrared sensor for detecting drinking water glasses or bottles is 100% good performance. The average percentage of error obtained between the YF-S201 Water Flow Sensor and the measuring kettle to measure the volume of water that comes out during the drinking water filling process if given an order to turn on the water pump to turn off the water pump is 5.39%, if given an order to turn on 240 milliliters which is 8.51%, if given an order to turn on 600 milliliters which is 4.05%, if given an order to turn on 1000 milliliters which is 2.35%.

ACKNOWLEDGEMENTS

The author would like to thank the chairperson and academic community of the Faculty of Engineering, University of Tanjungpura, who always provide direction and guidance to the author. Hopefully the results of writing from this research can be useful, both for writers and for readers.

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