Vol.6 No.2 July 2021 ISSN 2502-3470 (Print) | 2581-0367 (Online)

Terakreditasi SINTA-4
(SK Kemenristek Nomor 85/M/KPT/2020)

Inform

Jurnal Ilmiah Bidang Teknologi Informasi dan Komunikasi
Scentific Journal on Information and Communication Technology

Expert System for Hydroponic Vegetable Cultivation Using Forward and Backward Chaining Inference Technique
Habil Tria Sakti, Ahmad Thoriq

Gamification in Education Context:The Intention, The Design, and The Result
Hendra Dinata

Analysis Software Engineering Team's Soft Skills Learning using Online Learning Platform with Project-Oriented Problem-Based Learning (POPBL)
Siti Dwi Setiarini, Sri Ratna Wulan

Implementation and Impact of Virtual Reality on Survival Horror Games
Hendrawan Armanto, Gregorian Anthony, C. Pickerling

Business Model Canvas for Usability Testing of E-Commerce Website Design Using SEO On-Page Technique
Isnaini Nur Pramesty, Atik Ariesta

Secret Key Establishment Using Modified Quantization Log For Vehicular Ad-Hoc Network
M. Cahyo Kriswantoro, Amang Sudarsono, Mike Yuliana

PID Control System on Brushless DC Motor for Quadcopter Balance
Mochamad Mobed Bachtiar, Fernando Ardilla, Muhammad Faiz Hasbi, Iwan Kurnianto Wibowo

Automatic Water Dispenser Based on Hand Gesture Detection Using Arduino
Yudi Kristyawan, Zahid Faizal Kholil

The Level of Student Satisfaction with the Online Learning Process During a Pandemic Using the K-means Algorithm
Talitha Syahla Janiar Arifin, Nakia Natassa, Dinda Khoirunnisa, Retno Hendrowati

E-Commerce Based Digital Marketing Using Business Model Canvas
Muhammad Naufal Akbar, Atik Ariesta

Business Models Canvas of MOOCs: an Investigation of Sustainable Practices for MOOC Universities
Erri Wahyu Puspitarini, Anastasia Maukar, Fitri Marisa

Published by:
Pusat Pengelola Jurnal, Universitas Dr. Soetomo
Program Studi Teknik Informatika Fakultas Teknik – Universitas Dr. Soetomo

INFORM	Volume	Number	Pages	Issue	ISSN 2502-3470
	6	2	69-137	July 2021	EISSN 2581-0367

Inform
Jurnal Ilmiah Bidang Teknologi Informasi dan Komunikasi
Scentific Journal on Information and Communication Technology
ISSN 2502-3470 (Print) | 2581-0367 (Online)

Terakreditasi SINTA-4 (SK Kemenristek Nomor 85/M/KPT/2020)

Vol.6 No.2 July 2021

EDITORIAL BOARD

Protector : Dean of Faculty of Engineering Faculty - Dr. Soetomo University
Chancellor : Head of Undergraduate Program in Informatic Engineering

Editor in Chief

Achmad Choiron, S.Kom.,MT., (SCOPUS ID : 57202503906), Informatic Engineering Department, Universitas Dr. Soetomo, Indonesia

Managing Editor

Anik Vega Vitianingsih, S.Kom, MT., (SCOPUS ID : 55440666500), Informatic Engineering Department, Universitas Dr. Soetomo, Indonesia

Reviewers:

1. Erma Suryani, S.T., M.T., Ph.D, (SCOPUS ID: 35073142900), Department of Information System, Institut Teknologi Sepuluh Nopember Surabaya, Indonesia
2. Dr. Rini Agustina, S.Kom.,M.Pd, (Scopus ID: 57192980983), Faculty of Sains & Technology, Universitas Kanjuruhan Malang Malang, Indonesia, Universitas PGRI Kanjuruhan Malang, Indonesia
3. Dr. I. Istiadi, ST.,MT, (SCOPUS ID: 56596736300), Department of Electrical Engineering, Universitas Widyagama Malang, Indonesia
4. Tri Afirianto, S.T., M.T, (Scopus ID: 57195557327), Informatics Department, Universitas Amikom Yogyakarta, Indonesia
5. Syahri Muharom,S.ST.,MT, (Scopus ID: 57208555633), Electrical Engineering, Institut Teknologi Adhi Tama Surabaya, Indonesia
6. Riky Tri Yunardi, S.T., M.T, (Scopus ID: 57190572734), Department of Engineering, Faculty of Vocational, Universitas Airlangga, Indonesia
7. Robert Marco., ST., MT, (SCOPUS ID : 57205738079), Informatics Department, Universitas AMIKOM Yogyakarta, Indonesia
8. Fitri Marisa, S.Kom., M.Pd, (SCOPUS ID : 57189599394), Informatics Department, Universitas Widyagama Malang, Indonesia
9. Nila Feby Puspitasari, S.Kom, M.Cs, (SCOPUS ID: 57192097100), Informatics Department, Universitas AMIKOM Yogyakarta, Indonesia
10. Titus Kristanto, S.Kom, M.Kom, (SCOPUS ID: 57215526199), Department of Software Engineering, Institut Teknologi Telkom Surabaya, Indonesia
11. Moh. Zikky, S.ST., M.T, (SCOPUS ID: 57197714501), Department of Multimedia Creative PENS, Indonesia
12. Riza Agung Firmansyah, S.ST.,MT, (Scopus ID:57208543533), Electrical Engineering, Institut Teknologi Adhi Tama Surabaya, Indonesia
13. Elta Sonalitha, S.Kom.,MT ,(Scopus ID: 57207999355), Department of Information Technology, University of Merdeka Malang, Indonesia

Associate Editors:

1. Muchamad Kurniawan, S.Kom.,M.Kom., Informatic Engineering Department, Institut Teknologi Adhi Tama Surabaya, Indonesia

2. Taufik, S.T., M.Kom., (SCOPUS ID: 57213276294), Information System Department, Universitas Airlangga, Indonesia, Indonesia
3. Tjatursari Widiartin, S.Kom.,M.Kom., (SCOPUS ID : 57205021591), Informatic Engineering Department, Universitas Wijaya Kusuma Surabaya, Indonesia
4. Rani Rotul Muhima, S.Si.,M.T., Informatic Engineering Department, Institut Teknologi Adhi Tama Surabaya, Indonesia
5. Muhammad Rofiq, ST.,MT., (SCOPUS ID : 35748000700), Computer System Department, Universitas Dr. Soetomo, Indonesia
6. Erri Wahyu Puspitarini, S.Kom., M.MT., Informatic Engineering Department, STMIK Yadika, Bangil, Indonesia
7. IGKG Puritan Wijaya ADH, S.Kom., MMSI., Institut Teknologi dan Bisnis STIKOM Bali, Indonesia
8. Andy Suryowinoto, S.Pd.,MT., Electrical Engineering Department, Institut Teknologi Adhi Tama Surabaya, Indonesia
9. Dwi Rolliawati, ST., MT., Information Systems Department, Universitas Islam Negeri Sunan Ampel Surabaya, Indonesia
10. Bertung Suryadharma, S.ST.,M.Kom., Universitas Jember, Indonesia
11. Siti Agustini, S.ST., M.T., Informatic Engineering Department, Institut Teknologi Adhi Tama Surabaya, Indonesia
12. Himawan Wijaya, S.Kom.,M.Kom., Informatics Department, Universitas Raharja, Tangerang, Indonesia
13. Rachman Arief, S.Kom., M.Kom., Informatic Engineering Department, Institut Teknologi Adhi Tama Surabaya, Indonesia

Section Editors:

1. Evy Kamilah Ratnasari, S.Pd.,M.Kom., (SCOPUS ID: 56780158000), Informatics Department, Universitas Dr. Soetomo, Indonesia
2. Dwi Cahyono, S.Kom.,MT, (SCOPUS ID : 35748000700), Informatic Engineering Department, Universitas Dr. Soetomo, Indonesia
3. Anggit Wikanningrum, ST.,MT, (SCOPUS ID: 57216741617), Informatics Department, Universitas Dr. Soetomo, Indonesia
4. Budi Santoso, ST.,MT., (SCOPUS ID : 16019988100) Informatics Department, Universitas Dr. Soetomo, Indonesia
5. Edi Prihartono, S.Kom.,MT., Informatics Department, Universitas Dr. Soetomo, Indonesia
6. Slamet Kacung, S.Kom.,M.Kom., Informatics Department, Universitas Dr. Soetomo, Indonesia
7. Syaiful Hidayat, S.Kom.,M.Kom., Informatics Department, Universitas Dr. Soetomo, Indonesia
8. Alda Raharja, S.Kom., M.MT., Informatics Department, Universitas Dr. Soetomo, Indonesia
9. Lambang Probo S, S.Kom., M.Kom., Informatics Department, Universitas Dr. Soetomo, Indonesia
10. Litafira Syahadiyanti S.Kom., M.Kom., Informatics Department, Universitas Dr. Soetomo, Indonesia

Copy Editors:

1. Hengki Suhartoyo, S.Kom.,M.Kom., Informatics Engineering Department, Universitas Dr. Soetomo, Indonesia
2. David Hermansyah, S.Kom.,MT., Informatics Engineering Department, Universitas Dr. Soetomo, Indonesia
3. M Syaiful Riza, S.Kom.,MM., Informatics Engineering Department, Universitas Dr. Soetomo, Indonesia
4. Pamudi, S.Kom.,M.Kom., Informatics Engineering Department, Universitas Dr. Soetomo, Indonesia

Inform: Jurnal Ilmiah Bidang Teknologi Informasi dan Komunikasi
ISSN 2502-3470 (Print) | 2581-0367 (Online)
Published By Pusat Pengelola Jurnal Universitas Dr. Soetomo
Managed By Program Studi Teknik Informatika, Fakultas Teknik, Universitas Dr. Soetomo
Address Jl. Semolowaru no 84, Surabaya, 60118, (031) 5944744
Website https://ejournal.unitomo.ac.id/index.php/inform
email journal.inform@unitomo.ac.id

Inform
Jurnal Ilmiah Bidang Teknologi Informasi dan Komunikasi
Scentific Journal on Information and Communication Technology

ISSN 2502-3470 (Print) | 2581-0367 (Online)
Terakreditasi SINTA-4 (SK Kemenristek Nomor 85/M/KPT/2020)
Vol.6 No.2 July 2021

TABLE OF CONTENTS

Expert System for Hydroponic Vegetable Cultivation Using Forward and Backward Chaining Inference Technique **69-74**
Habil Tria Sakti, Ahmad Thoriq

Gamification in Education Context:The Intention, The Design, and The Result **75-80**
Hendra Dinata

Analysis Software Engineering Team's Soft Skills Learning using Online Learning Platform with Project-Oriented Problem-Based Learning (POPBL) **81-86**
Siti Dwi Setiarini, Sri Ratna Wulan

Implementation and Impact of Virtual Reality on Survival Horror Games **87-92**
Hendrawan Armanto, Gregorian Anthony, C. Pickerling

Business Model Canvas for Usability Testing of E-Commerce Website Design Using SEO On-Page Technique **93-102**
Isnaini Nur Pramesty, Atik Ariesta

Secret Key Establishment Using Modified Quantization Log For Vehicular Ad-Hoc Network **103-109**
M. Cahyo Kriswantoro, Amang Sudarsono, Mike Yuliana

PID Control System on Brushless DC Motor for Quadcopter Balance **110-114**
Mochamad Mobed Bachtiar, Fernando Ardilla, Muhammad Faiz Hasbi, Iwan Kurnianto Wibowo

Automatic Water Dispenser Based on Hand Gesture Detection Using Arduino **110-114**
Yudi Kristyawan, Zahid Faizal Kholil

The Level of Student Satisfaction with the Online Learning Process During a Pandemic Using the K-means Algorithm **115-122**
Talitha Syahla Janiar Arifin, Nakia Natassa, Dinda Khoirunnisa, Retno Hendrowati

E-Commerce Based Digital Marketing Using Business Model Canvas **123-126**
Muhammad Naufal Akbar, Atik Ariesta

Business Models Canvas of MOOCs: an Investigation of Sustainable Practices for MOOC Universities **127-132**
Erri Wahyu Puspitarini, Anastasia Maukar, Fitri Marisa

Inform :JurnalIlmiahBidangTeknologiInformasi dan Komunikasi
Vol.6 No.2 July 2021, P-ISSN : 2502-3470,E-ISSN : 2581-0367

Automatic Water Dispenser Based on Hand Gesture Detection Using Arduino

Yudi Kristyawan[1]*, Zahid Faizal Kholil[2]

[1,2]*Informatics Department, Universitas Dr. Soetomo, Indonesia*

[1]yudi.kristyawan@unitomo.ac.id*, [2]zahidfaizal97@gmail.com

Received: 2021-07-05; Accepted: 2021-07-24; Published: 2021-07-31

Abstract—Water dispensers are electronic devices that are widely available in households and offices. In general, water dispensers use faucets to drain water. During the pandemic, many people avoid touching equipment used by many people. Various ways have been done so that the water dispenser can be operated automatically without touching the faucet. Previous research on water dispensers was only applied to one type of water. This study aims to make an automatic water dispenser without touching the faucet used for two types of water, namely hot water or cold water. This research is based on hand gesture detection to choose hot water or cold water. The APDS-9960 gesture sensor detects hand movements to select hot or cold water, and then a servo motor is used to open the water faucet. After that, the position of the glass is validated by the ultrasonic sensor HC-SR04, and water will flow for 30 seconds into the glass. The entire input and output process is controlled using Arduino. The results show that this automatic water dispenser can detect hand gestures at a maximum distance of 15 cm with a hand movement speed of 2 to 3.7 seconds. This automatic water dispenser can detect three kinds of glass, namely ceramic, clear glass, and plastic, at a distance of 1 to 3 cm, and the volume of water flowing for 30 seconds is 240 ml.

Keywords—Water Dispenser, Arduino, Gesture Sensor APDS-9960, Ultrasonic Sensor HC-SR04, Servo Motor.

I. INTRODUCTION

Technological innovations in various fields of life are intended to facilitate human work. The water dispenser is one of the technological innovations that functions as a drinking water storage. Apart from being a place to store water, the primary function of the water dispenser is also to facilitate access to drinking water. The water dispenser is one of the electronic equipment that is a major need at household and office scale. There are many types of water dispensers on the market. One type of water dispenser selected in this study is a water dispenser with two faucets to drain the cold and hot water.

Most people try to limit themselves from interacting with crowds during a pandemic. This is one way to prevent the spread of disease during a pandemic. Various methods are used to minimize touching objects that are widely held by others. Several technological innovations have been carried out to prevent the spread of disease during the pandemic by making hand-washing devices that are activated by footrests [1], automatic hand sanitizer [2], touchless automatic hand-washer [3], automatic faucet without turning for hand-washing [4].

Arduino is an open microcontroller module that is widely used as a controller in various fields such as control systems [5][6][7] and automation systems [8][9][10][11].

The ultrasonic sensor that is often found in the market is the ultrasonic sensor HC-SR04. This sensor works on the principle of wave reflection. The ultrasonic sensor functions to convert a sound value into an electrical value. So it is widely used to interpret the magnitude of the distance. Widely applied to various applications, including water level detection [12] [13], object detection, and water level [14]. The gesture is a non-verbal communication using body movements other than the mouth, such as hand movements, shoulders, fingers, facial expressions, etc. The APDS-9960 gesture sensor was used for hand gesture detection in this study. This gesture sensor converts physical movement information into digital information. Gesture detection has been used in previous studies as drone controllers [15], and robot controllers [16].

Servo motors are electronic devices that are often used in intelligent machines. The function of this servo motor is to push, pull or rotate an object. Servo motors are widely used in conjunction with other devices in various electronic applications [17][18].

One of the water dispensers in the Indonesian market today is a dispenser with two faucets for hot and cold water. The water will flow after the user presses the faucet according to the desired type of water.

This water dispenser with a manual faucet is considered impractical, especially during a pandemic, because users still have to press the water faucet on the dispenser so that it is prone to disease transmission. Therefore, it is necessary to do automation to prevent disease transmission through this dispenser faucet.

Previous research on the automation of drinking water dispensers such as [19], but the study is only for water dispensers with one water faucet. It uses ultrasonic sensors to detect the glass as well as a switch to drain the water. Smart dispenser research for blind people [20], but only for water dispensers with one type of water faucet and using sound detection as a switch to drain water. Clean water dispenser research [21], but only for water dispensers with one water faucet and using RFID as a switch to flow water with three

DOI : http://dx.doi.org/10.25139/inform.v6i2.4000

different glass volumes. Study on automatic drinking water filler with special glass [22], but only for one water faucet dispenser with a special glass detection as a switch to drain water.

Compared to previous research, the advantage of this research is the automatic water dispenser for type two water faucets, namely for hot and cold water. Hand gesture detection is used to select hot or cold water. So that the dispenser user can access the dispenser as needed without having to touch the water faucet. It is hoped that this design can prevent disease transmission during the pandemic.

II. METHOD

In this section, the stages of the research carried out sequentially include is problem identification, literature study, system requirements analysis, hardware design, software design, implementation, testing, and conclusions.

A. Problem Identification

The stage of identifying the problem to be solved is called problem identification. The following issues can be recognized based on the explanation in the previous sub-chapter.:

- Reducing the spread of disease during a pandemic
- In general, water dispensers use faucets to drain water
- There is an automatic water dispenser for one faucet, but there is no water dispenser for two faucets for hot and cold.

B. Literature Study

After identifying the problem, it is continued with a literature study. The literature study was conducted to study and understand everything related to this research, namely the field of electronics and microcontrollers. This research literature study comes from journals and books that are widely obtained from the internet.

C. System Requirements Analysis

System analysis is critical to the development of a system. This stage is a starting point that becomes a reference for the next development steps. If an analysis error occurs, it can result in a defective system and even system failure. Therefore, it is necessary to plan and produce a system that is as desired. The purpose of this system requirements analysis is to study and understand the weaknesses of the existing system. Then a new system will be created as a development of the old system. The system requirements analysis consists of analyzing initial conditions, the proposed system, hardware requirements, and software requirements.

1) *Initial Condition Analysis:* The object studied in this study is a water dispenser with two water faucets. Therefore, this section discusses the initial conditions of a water dispenser with two faucets (1 faucet for cold water and one faucet for hot water) according to the factory standard two faucet dispenser conditions on the market. In general, the distribution system scheme for the water dispenser can be seen in Figure 1.

2) Proposed System: As a development of the initial conditions, this water dispenser can be operated without touching the water faucet. The proposed system block diagram can be seen in Figure 2. In this study, a gesture sensor is used to pick hot and cold water. The water exit is only in one position to avoid mistakes while inserting the glass. Water will only come out if the glass is placed in a specific position. Finally, the faucet will pour water into the glass for a set amount of time. The Arduino module is used to control the input and output processes.

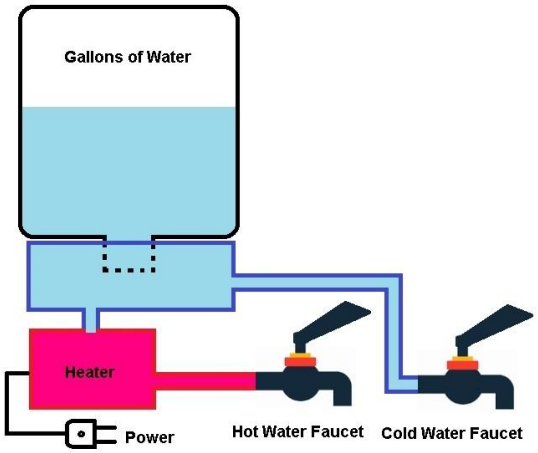

Figure 1. Water dispenser distribution scheme.

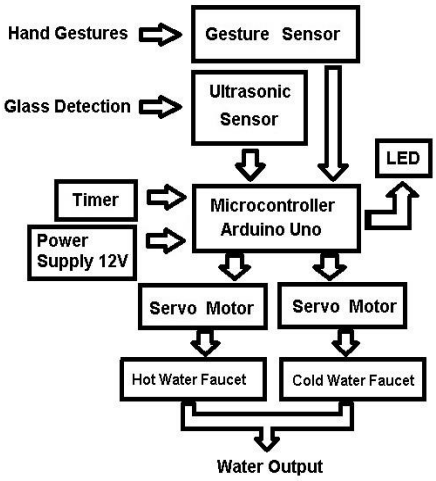

Figure 2. The proposed system block diagram.

3) Hardware Requirements: The hardware requirements can be explained as follows, based on the proposed system.:

- The minimum specifications for the computer/laptop are core2duo or equivalent to 2GB RAM and 500GB hard disk used to program Arduino as system control.
- Power Supply 12 volt 2 amperes is used to supply voltage for Arduino and other electronic devices.
- Arduino Uno module is used as the main control of the system.
- Water dispenser with two faucets.
- The APDS-9960 gesture sensor is used as a hand gesture detector.
- Ultrasonic sensor HC-SR04 is used to detect the presence of glass.
- Servo motor used as actuator drive.

DOI : http://dx.doi.org/10.25139/inform.v6i2.4000

- LEDs are used as indicators.
- Jumper cables for connection between electronic devices.
- The breadboard is used as a board for designing prototypes.
- Gear and actuator function as faucet pull the arm.
- Faucets, hoses, and pipes.

4) Software Requirements: Software with the following standards is required to support the hardware of the proposed system: Windows 7 Operating System and Arduino Software (IDE).

D. Hardware Design

As a first step, this section describes the mechanical design of an automatic water dispenser using hand gesture detection, as shown in Figure 3.

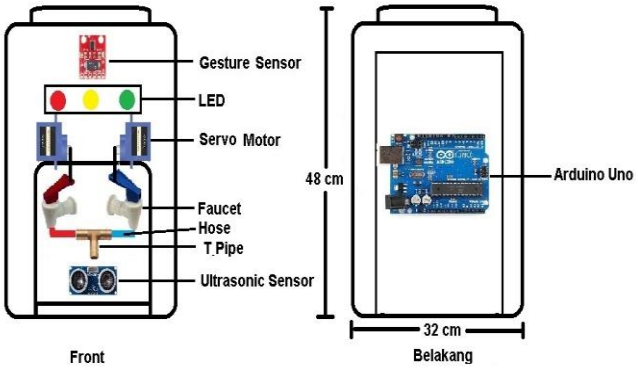

Figure 3. Mechanical system design.

Figure 4 shows the architectural design of an automatic water dispenser using Arduino-based gesture detection. This system architecture aims to explain the workflow of the proposed system. The system architecture states how to define more specific input and output components in a structured manner to show the architecture of the proposed system components.

The first time the ultrasonic sensor detects whether the glass has been placed in the correct position. If the ultrasonic sensor fails to detect the position of the glass correctly, the system will not activate the gesture sensor to detect hand movements. On the other hand, if the position of the glass is detected correctly by the ultrasonic sensor, the ultrasonic sensor will send a signal to the Arduino for processing, then turn on the LED indicator of the glass, and the gesture sensor will be activated.

Furthermore, hand gestures are detected by the gesture sensor. If the hand moves from right to left, the gesture sensor will send a signal to the Arduino for processing, and then the Arduino will turn on the hot water indicator LED and activated the servo motor to pull the hot water faucet, so hot water flows into the glass. On the other hand, if the hand moves from left to right, the gesture sensor will send a signal to the Arduino for processing, then the Arduino will turn on the cold-water indicator LED and then activated the servo motor to pull the cold-water faucet so that cold water flows into the glass.

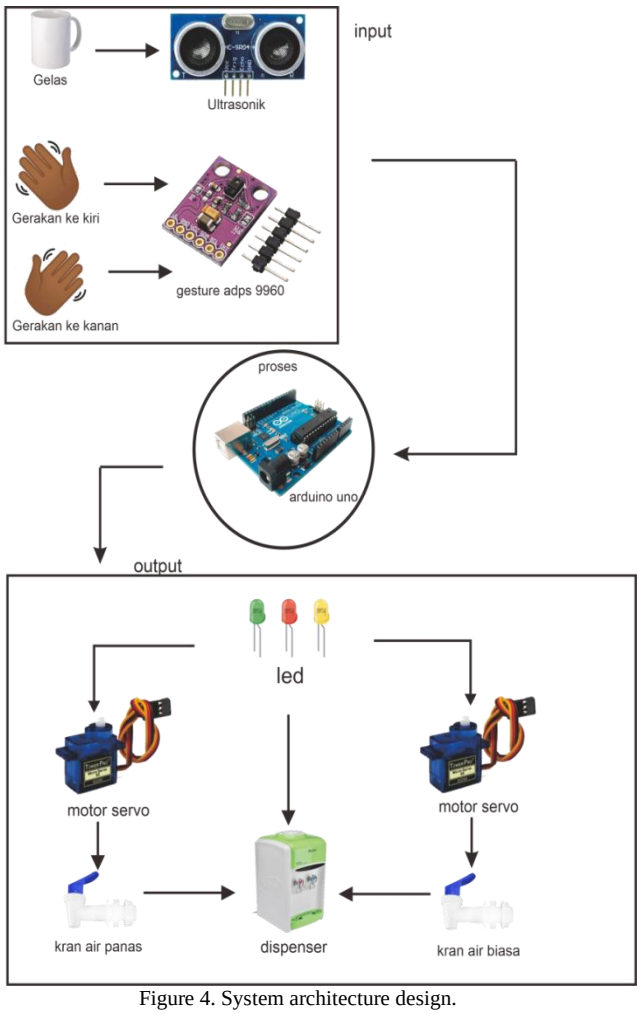

Figure 4. System architecture design.

This research is a combination of mechanical devices and electronic devices. In the previous section, the mechanical devices and system architecture have been described. An electronic device is an electronic circuit consisting of electronic components that form a unit for a particular purpose. The circuit schematic is a design map of an electronic circuit containing pictures of electronic components and connecting paths from one component to another.

This stage describes the circuit schematic, starting from the input module, output module, and overall schematic. As explained in the system architecture, the input module consists of an ultrasonic sensor module and a gesture sensor module, and the output module includes an LED indicator and a servo motor.

The schematic of the input module circuit for the ultrasonic sensor is shown in Figure 5. This circuit is used to detect the presence of glass. The HC-SR04 ultrasonic sensor module consists of 2 transmitter control pins (trig pins) connected to the Arduino microcontroller module on pin eight and as a receiver (echo pins) connected to pin 7 of the Arduino microcontroller module. In comparison, the ultrasonic sensor power supply pin is connected to the Arduino microcontroller module power supply pin.

DOI : http://dx.doi.org/10.25139/inform.v6i2.4000

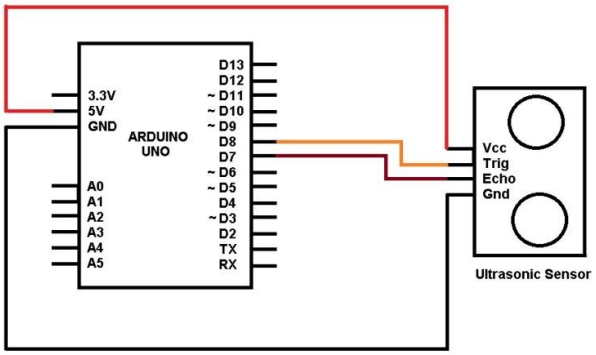

Figure 5. Schematic of input module circuit for ultrasonic sensor.

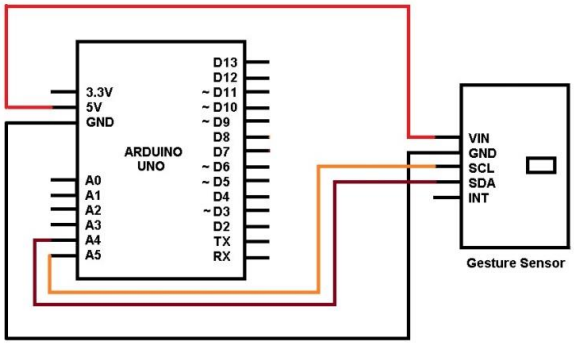

Figure 6. Schematic of the gesture sensor circuit.

Figure 6 is the circuit schematic for the APDS-9960 gesture sensor. This gesture sensor module is used for hand gesture detection. In this study, two types of motion were detected, namely hand wave motion to the right to choose cold water and hand wave motion to the left to choose hot water. The APDS-9960 gesture sensor module has six pins, consisting of pins VL, Vcc, Gnd, SCL, SDA, INT, which have a function as a positive power pin with a voltage of 3v-0.5v, a positive power voltage of 2.4v-3.6v, negative power, serial clock signal, serial data address for transmitting data and interrupt. The SDA sensor module pin is connected to the A4 pin of the Arduino microcontroller module. In contrast, the SCL module pin of the gesture sensor is connected to the A5 pin of the Arduino microcontroller module. The VCC power pin in the picture symbolized Vin is connected to the 5-volt voltage pin of the microcontroller module, and the sensor module's GND pin is connected to the GND pin of the microcontroller module.

The LED circuit schematic, as shown in Figure 7, is used as an indicator. Red LED light indicates hot water; green LED light means cold water, and amber LED light indicates the position of the glass has been detected. The negative pins of the three LED lights are connected in parallel with the GND pin of the Arduino microcontroller module. The positive pins of the red, yellow, and green LEDs are connected to pins 4, 5, and 6, respectively.

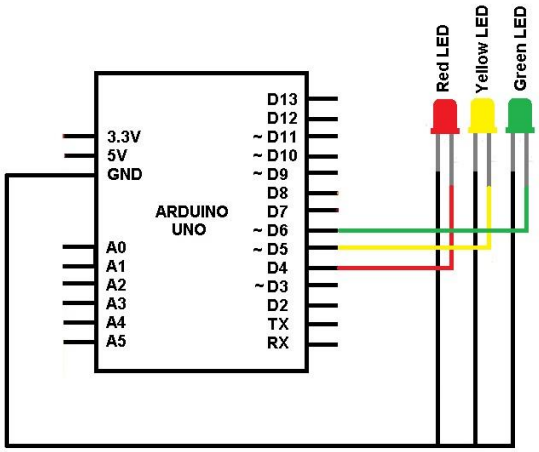

Figure 7. Schematic of the LED module circuit.

The circuit schematic for the servo motor in this study was applied as a faucet puller actuator. The actuator is assisted using a gearbox so that the servo motor can pull the water faucet. Two servo motors are needed. Each servo motor is used to pull cold and hot water faucets. In the initial condition, the faucet is closed. When the faucet is pulled with a servo motor, the valve will open, and the water will flow into the glass already available at a certain position. The servo motor will pull the water faucet for a predetermined time of 30 seconds. The servo motor will automatically return to the original faucet position so that the water faucet valve will close and the water flow will stop. The schematic of the servo motor can be seen in Figure 8.

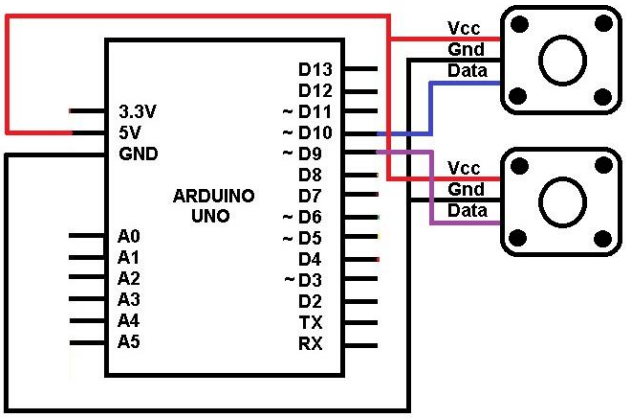

Figure 8. Schematic of servo motor.

The servo motor power pins, VCC, and GND, are connected in parallel with the microcontroller module's power pins, respectively. The servo motor is controlled by data pins that are connected to PWM pins 9 and 10 on the Arduino microcontroller module. The overall circuit schematic of this study is shown in Figure 9. This schematic is an overview of the overall electronic circuit of the system proposed in this study.

DOI : http://dx.doi.org/10.25139/inform.v6i2.4000

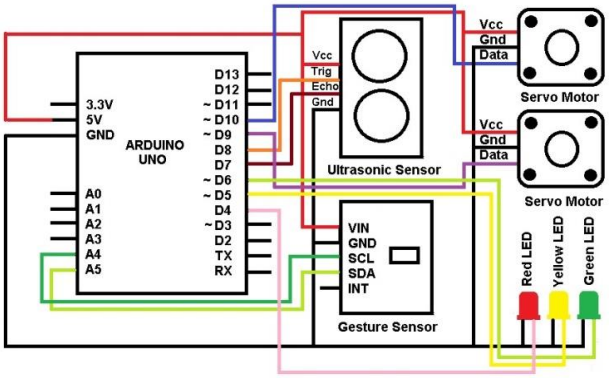

Figure 9. Schematic of the whole system.

E. Software Design

Software design is the stage of software development as a reference in program development. The main target is a representation of the software on the Arduino Uno microcontroller. Describe the functions of each component, engineering structure, data control, and control of the input-output module which is connected to the Arduino microcontroller. Software design is very important because it can affect the system's performance, durability, and maintenance. The software design is represented using a flow chart, as shown in Figure 10.

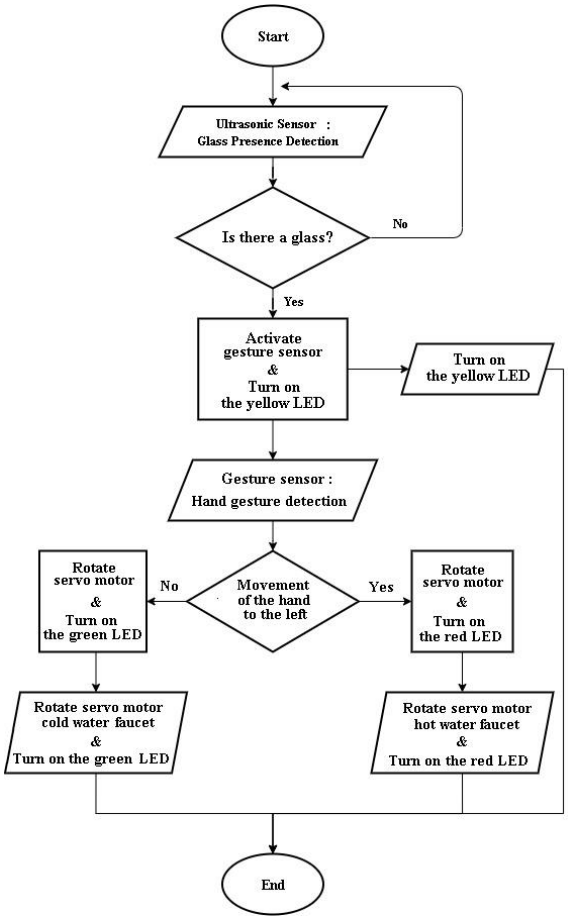

Figure 10. Software design flowchart.

III. RESULTS AND DISCUSSION

The system proposed in this study is an automatic water dispenser based on hand gesture detection using Arduino as the main control. The system is intended for the public to use the dispenser without direct contact and make it easier to use. This system is devoted to a water dispenser with two faucets, each of which is used to drain hot and cold water.

In addition, this system is made to be more sterile when placed in a public place and easier to use by everyone. This dispenser utilizes several sensors, one of which is an ultrasonic sensor that functions as a detector for the presence of glass and as a dispenser switch button.

The control system on this dispenser uses a hand gesture sensor that functions to determine hot and cold water. In principle, it is enough to move your hand in front of the gesture sensor to select the type of hot or cold water. The final result in Figure 11 of this study is an automatic water dispenser based on hand gesture detection using Arduino.

Figure 11. Automatic water dispenser based on gesture detection.

A. Glass Presence Detection Test

This glass presence detection test is intended to detect the glass in a predetermined position. The test scenario is placing the glass in various positions and testing it with various kinds of glass, namely ceramic glass, clear glass, and plastic cups. The test for detection of the presence of this glass is shown in Figure 12.

Figure 12. Glass detection test.

DOI : http://dx.doi.org/10.25139/inform.v6i2.4000

The ultrasonic sensor then detects the glass that has been placed in front of the ultrasonic sensor. When the ultrasonic detects the presence of glass, the middle led light will display a notification in the form of a yellow led light indicator. The test results for the detection of the presence of glass can be seen in Table 1.

TABLE I
GLASS DETECTION TEST RESULTS.

Glass type	Glass distance	Result
ceramic glass	1 -3 cm	detected
ceramic glass	4 - 6 cm	not detected
clear glass	1 – 3 cm	detected
clear glass	4 – 6 cm	not detected
plastic cups	1 – 3 cm	detected
plastic cups	4 – 6 cm	not detected

B. Hand Gesture Detection Test

The first test is done by waving from right to left to choose hot water. Movement speed varies from slow to fast with a duration of 1 to 5 seconds. If the hand gesture is successfully detected, the water dispenser will automatically turn on the red LED and drain water from the hot water faucet, as shown in Figure 13.

Figure 13. Test of choosing hot water.

The second test was carried out by waving from left to right to choose cold water. If the automatic water dispenser successfully detects hand gestures, the green LED will be turned on, and water will flow from the cold-water faucet as shown in Figure 14.

Figure 14. Test of choosing cold water.

Based on the two test scenarios above, the overall test results can be seen in Table II.

TABLE II
GESTURE DETECTION TEST RESULTS

Hand distance	Movement direction	Movement speed	Output water	Result
5 cm	left to right	1 second	cold	valid
5 cm	left to right	2 seconds	cold	valid
5 cm	left to right	3 seconds	cold	valid
5 cm	left to right	4 seconds	-	invalid
5 cm	left to right	5 seconds	-	invalid
10 cm	left to right	1 second	cold	valid
10 cm	left to right	2 seconds	cold	valid
10 cm	left to right	3 seconds	cold	valid
10 cm	left to right	4 seconds	-	invalid
10 cm	left to right	5 seconds	-	invalid
15 cm	left to right	1 second	cold	valid
15 cm	left to right	2 seconds	cold	valid
15 cm	left to right	3 seconds	cold	valid
15 cm	left to right	4 seconds	-	invalid
15 cm	left to right	5 seconds	-	invalid
20 cm	left to right	1 second	-	invalid
20 cm	left to right	2 seconds	-	invalid
20 cm	left to right	3 seconds	-	invalid
20 cm	left to right	4 seconds	-	invalid
20 cm	left to right	5 seconds	-	invalid
5 cm	right to left	1 second	hot	valid
5 cm	right to left	2 seconds	hot	valid
5 cm	right to left	3 seconds	hot	valid
5 cm	right to left	4 seconds	-	invalid
5 cm	right to left	5 seconds	-	invalid
10 cm	right to left	1 second	hot	valid
10 cm	right to left	2 seconds	hot	valid

DOI : http://dx.doi.org/10.25139/inform.v6i2.4000

Hand distance	Movement direction	Movement speed	Output water	Result
10 cm	right to left	3 seconds	hot	valid
10 cm	right to left	4 seconds	-	invalid
10 cm	right to left	5 seconds	-	invalid
15 cm	right to left	1 second	hot	valid
15 cm	right to left	2 seconds	hot	valid
15 cm	right to left	3 seconds	hot	valid
15 cm	right to left	4 seconds	-	invalid
15 cm	right to left	5 seconds	-	invalid
20 cm	right to left	1 second	-	invalid
20 cm	right to left	2 seconds	-	invalid
20 cm	right to left	3 seconds	-	invalid
20 cm	right to left	4 seconds	-	invalid
20 cm	right to left	5 seconds	-	invalid

C. Water Volume Test

This water volume test is carried out to measure the volume of water released by the dispenser. The scenario in this test is to set a different time duration every 10 seconds, then the volume of water is measured using a 1000 ml capacity measuring cup. This automatic dispenser drains water into the glass based on the duration of time. The longer the specified time duration, the more volume of water will be issued by the dispenser. The results of this water volume test are presented in more detail in Table 3.

TABLE 3
WATER VOLUME TEST RESULT

Duration	Water Volume
10 seconds	80 ml
20 seconds	160 ml
30 seconds	240 ml
40 seconds	320 ml

IV. CONCLUSION

Based on the test results, the automatic water dispenser in this study can detect ceramic cups, clear glasses, and glass cups at a distance of 1-3 cm and cannot detect glasses more than 3 cm. The gesture sensor on the automatic dispenser in this study can detect hand movements with movement speeds between 1 to 3 seconds and cannot detect more than 3 seconds (very slow motion). The gesture sensor on this automatic dispenser can detect hand movements with a distance between 5 cm to 15 cm. According to the user's hand gesture, the dispenser can only dispense water at a distance of 5 cm to 15 cm and hand movement speed between 1 second to 3 seconds. Other than that, it does not release water. The volume of water flowing into the glass by this automatic dispenser is on average 80 ml per 10 seconds

REFERENCE

[1] Sulaiman Ali, Syurkarni Ali, Herdi Susanto, Rita Hartati, and Zahir Raditya, "Perancangan Touchless Hand Washer Sistem Pijakan Kaki untuk Pencegahan Penyebaran COVID-19," *Jurnal Mekanova*, vol. 6, no. 2, pp. 179-186, Oktober 2020.

[2] Ari Rahayuningtyas et al., "Rancang Bangun Hand Sanitizer Otomatis Dan Sistem Monitoring Jarak Jauh Dalam Upaya Mengurangi Penyebaran Covid 19," *Jurnal Riset Teknologi Industri*, vol. 14, no. 2, pp. 320-330, Desember 2020.

[3] Suraidi , "Perancangan Sistem Pencuci Tangan Otomatis Tanpa Sentuh Untuk Mencegah Penularan Virus Covid-19," *TESLA*, vol. 23, no. 1, pp. 24-33, MARET 2021.

[4] Finsen Thomas Missa, Ichsan Fahmi, and Zet Y Baitanu, "Perancangan Keran Air Cuci Tangan Otomatis Yang Dikendalikan Oleh LDR (Light Dependent Resistor) Dengan Pencahayaan Laser," *Jurnal Spektro*, vol. 3, no. 2, pp. 7-14, November 2020.

[5] Adewasti , Emilia Hesti, Sholihin , and Sarjana , "Sistem Kendali Robot Hand Gesture Berbasis Wireless," *Jurnal Surya Energy*, vol. 3, no. 1, pp. 192-197, September 2018.

[6] Bahrin , "Sistem Kontrol Penerangan Menggunakan Arduino Uno Pada Universitas Ichsan Gorontalo," *Ilkom*, vol. 9, no. 3, pp. 282-289, Desember 2017.

[7] I. W. Parmadi Putra, I. W. Arta Wijaya, and I. N. Budiastra, "Perancangan Sistem Pemanas Air Menggunakan Sistem Kendali PID," *Jurnal SPEKTRUM* , vol. 7, no. 1, pp. 116-122, Maret 2020.

[8] Yesi Triawan and Juli Sardi, "Perancangan Sistem Otomatisasi pada Aquascape Berbasis Mikrokontroller Arduino Nano," *Jurnal Teknik Elektro Indonesia*, vol. 1, no. 2, pp. 76-83, Oktober 2020.

[9] Ari Lesmono Bangala, Lianly Rompis, and Junaidy B. Sanger, "Perancangan Sistem Otomatisasi Suhu RUangan Berbasis Mikrokontroler," *Jurnal Realtech*, vol. 14, no. 1, pp. 1-7, April 2018.

[10] Eltra E. Barus, Andreas Ch. Louk, and Redi K. Pinggak, "Otomatisasi Sistem Kontrol Ph Dan Informasi Suhu Pada Akuarium Menggunakan Arduino Uno Dan Raspberry Pi 3," *Jurnal Fisika Sains dan Aplikasinya* , vol. 3, no. 2, pp. 117-125, Agustus 2018.

[11] Zikrul Khalid, Sayed Achmady, and Poppy Agustini, "Otomatisasi Sistem Keamanan Kunci Lemari Menggunakan Sensor Sidik Jari Berbasis Arduino Uno," *Jurnal TEKSAGRO*, vol. 1, no. 1, pp. 1-11, Agustus 2020.

[12] Ryan Laksmana Singgeta and Pinrolinvic D. K. Manembu, "Rancang Bangun Dispenser Air Bersih Otomatis Berbasis Web Menggunakan Teknologi RFID," *Jurnal Teknik Elektro dan Komputer*, vol. 8, no. 3, pp. 153-160, Desember 2019.

[13] Heru Purwanto and Malik Riyadi, "Komparasi Sensor Ultrasonik HC-SR04 Dan JSN-SR04T Untuk Aplikasi Sistem Deteksi Ketinggian Air," *Jurnal SIMETRIS*, vol. 10, no. 2, pp. 717-724, November 2019.

[14] Bagas Alvando, "Dispenser Otomatis Menggunakan Arduino Sensor Gelombang Ultrasonik Dengan Internet Of Things," *Jurnal Perencanaan, sains, Teknologi, dan Komputer*, vol. 4, no. 1, pp. 766-770, Juli 2021.

[15] Syarif Hidayatullah, Gembong Edhi Setyawan, and Sabriansyah Rizqika Akbar, "Perancangan Perangkat Pengendali Navigasi AR Drone Quadcopter Berbasis Hand Gesture dengan Metode Complementary Filter," *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, vol. 2, no. 9, pp. 3321-3327, September 2018.

[16] Mohamad Fatkhan Roziqin, Koko Joni, and Miftachul Ulum, "Rancang Bangun Robot Pengambil Bola Tenis Lapangan Dengan Kendali Hand Gesture Recognition Berbasis Wifi Menggunakan Metode PID," *JTECS*, vol. 1, no. 1, pp. 33-39, Januari 2021.

[17] Yanuar Mahfudz Safarudin, Gatot Suwoto, Febry Dwi Iriyanto, and Muhammad Afif , "Rancang Bangun Pengaturan Suplai Bahan Bakar Untuk Mempertahankan Frekuensi Konstan Pada Pltd Menggunakan Motor Servo Berbasis Arduino Mega," *Jurnal Teknik Energi*, vol. 16, no. 3, pp. 109-116, September 2020.

[18] Fadhli Rahman, Faridah Faridah, Andi Ikram Nur, and Andi Nadar Makkaraka, "Rancang Bangun Prototipe Manipulator Lengan Robot Menggunakan Motor Servo Berbasis Mikrokontroler," *ILTEK*, vol. 15, no. 1, pp. 42-46, April 2020.

[19] Ryan Laksmana Singgeta and Refliano Rumondor, "Rancang Bangun Dispenser Otomatis Menggunakan Sensor Ultrasonik Berbasis

DOI : http://dx.doi.org/10.25139/inform.v6i2.4000

Mikrokontroller Atmega2560," *JURNAL REALTECH* , vol. 14, no. 1, pp. 31-36, April 2018.

[20] Asrori Firman Mawardi, Achmad Ubaidillah, and Kunto Aji Wibisono, "Rancang Bangun Smart Dispenser Untuk Penyandang Tunanetra Menggunakan Pola Pengenalan Suara (Voice Recognition) Dengan Algoritma Fast Fourier Transform (FFT) Dan Autocorrelation," *JURNAL RISET REKAYASA ELEKTRO*, vol. 2, no. 1, p. 23~30, Juni 2020.

This is an open access article under the CC–BY-SA license.

[21] Muhammad Reni Sehaffudin, Nur Indrihastuti, and Ery Gunawan, "Pengisi Air Minum Otomatis Dengan Gelas Khusus Berbasis Arduino Uno," *JURNAL CAHAYA BAGASKARA*, vol. 2, no. 1, pp. 17-23, Juli 2017.

DOI : http://dx.doi.org/10.25139/inform.v6i2.4000