

IMPROVEMENT OF SMART TOILET SYSTEM BASED ON RECYCLE GREEN CONTROL

Solly Aryza*, Siswa Pratama, Muhammad Iqbal

Electrical Engineering Department, Universitas Pembangunan Panca Budi, Indonesia

Corresponding author: sollyaryzalubis@gmail.com

ABSTRACT

Klambir 5 village is an underdeveloped area in North Sumatra in the current era of technology, technology is developing rapidly in the current era, along with the development of technology, there are impacts. Control of electronic equipment can be done with smart bathroom applications (smart badroom) controlling electronic equipment for water treatment is a very important requirement in the life of all living things, especially humans. In primary needs, water is used for drinking, washing, bathing and so on. In addition, water can also be used as a hydroelectric power plant, rice field irrigation system, transportation and others. The purpose of this study is to design a device that can control the output of water in the ablution tap and control the filling of the water reservoir. In designing this tool using Arduino Mega 2560 as data processor and keypad as well as water float sensor and Infrared Proximity Sensor as input and DC pump, relay and solenoid valve as output. With the design of this tool, it can fill the water reservoir automatically and can control the output of water in the ablution water faucet.

Keywords: Arduino Atmega 2560, Water Float Sensor, DC Pump, Relay and Solenoid Valve

INTRODUCTION

Water is a very important need in the life of all living things, especially humans. In primary needs, water is used for drinking, washing, bathing and so on. In addition, water can also be used as a hydroelectric power plant, rice field irrigation system, transportation and others. Along with the increasing population density, the need for water is increasing, considering that water is a non-renewable resource. Humans use water from various water sources, one of which is water provided from PDAM, in other words whoever uses the water must pay according to how much volume of water is used.

Recent technological developments have helped a lot in improving the quality and welfare of human life, one of which is the development of a home automation system. The design of a home automation system is no longer common among the elite. With various existing facilities, the home automation system can later make it easier for the owner to maintain and provide comfort for everyone who lives in it.

Technology that is able to monitor and control the use of electronic devices and their performance is what is needed to improve the control of electric current and time efficiency for its users, with the help of Smart Home which is a feature for a residence that has artificial intelligence to regulate electrical equipment inside. where we live. In the development of a smart toilet system, input as a command for the smart home control unit is based on sensors so that an automation system is produced in controlling home appliances with very little control or even no control at all from the user or human occupant of the house. 1 2 If humans can still exercise control over home appliances,

In several studies related to smart toilet systems and monitoring water use. So that in some studies using a PIR sensor to detect human movement in the toilet and a servo motor to move the toilet flapper. This system uses Arduino Uno as a microcontroller. Subsequent research, several studies using the ultrasonic sensor HC-SR04 as a distance detector to run automatic faucets and showers as well as an LDR sensor as an object detector that

enters the closet, the microcontroller used is Arduino Uno. The author does not use a PIR sensor to integrate automatic lights but uses a limit switch.

LITERATURE REVIEW

PIR sensor

Based on research that uses PIR sensors for research, it is said that non-contact pyroelectric infrared sensors can be used to detect changes in infrared radiation in the environment. This sensor is said to have relative sensitivity to human movement. In addition, it has other advantages such as a wide detection range, strong performance and is not too affected by ambient light. Therefore, the technology of using PIR (Pyroelectric Infrared) to detect the user has received special attention.

As described in article [3], for basic projects or products that need to detect when a person has left or entered an area, or has approached, a PIR sensor is good to use. However PIR will not tell how many people are around or how close they are to the sensor, it also often picks up certain movements and is sometimes triggered by pets. The specifications and parts of the PIR sensor are also explained as follows:

- Size: Rectangle.
- Output: Digital pulse high (3V) when motion is detected, low when no motion is detected.
- Range of detection sensitivity range up to 20 feet (6 meters) 110° x 70°
- Voltage source: 5V-12V input voltage for most modules (have a 3.3V regulator).

Microcontroller (Arduino Uno)

Microcontroller is a chip that functions as an electronic circuit controller and generally can store programs in it. Microcontrollers generally consist of CPU (Central Processing Unit), memory, certain I/O and supporting units such as Analog-to-Digital Converter (ADC) which has ISSN : 2355-9365 e-Proceeding of Engineering : Vol.3, No.3 December 2016 is integrated in it.

Unlike computer systems, which are capable of handling various application programs (eg word processing, number processing, etc.), the microcontroller can only be used for a particular application (only one program can be stored).

Based on the Arduino/Genuino function, the Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. To use it, connect it to the computer with a USB cable or with an AC-DC adapter or a power source. Arduino can be used for just about anything. If there is damage, the Arduino can still be used by replacing the chip.

Servo Motor (TowerPro MG995)

The standard servo motor (servo rotation 180°) is the most common type of servo motor, where the output shaft rotation is limited to 90° to the right and 90° to the left. In other words, the total rotation is only a half circle or 180°. The servo motor is controlled by providing a pulse width modulation (PWM) signal via a control cable. The pulse width of the given control signal will determine the rotational position of the servo motor shaft. For example, a pulse width of 1.5 ms (milliseconds) will rotate the servo motor shaft to an angular position of 90°. If the pulse is shorter than 1.5 ms it will rotate towards the 0° position or to the left (counterclockwise), while if the pulse is longer than 1.5 ms then the servo motor shaft will rotate towards the 180° position or to the right (clockwise).

Specifications:

Modulation : Digital
 Voltage : 4.8V (9.40 kg-cm)
 6.0V (11.00 kg-cm)
 Speed : 4.8V : 0.20 sec/60°
 6.0V : 0.16 sec/60°
 Weight: 1.94 oz (55.0 g)
 Dimensions: Length: 1.60 in (40.7 mm)
 Width : 0.78 in (19.77 mm)
 Height: 1.69 in (42.9 mm). [12]

Relay Module

Some researchers also use relays in their research. This relay is controlled remotely by another button or computer. Relays use the Electromagnetic Principle to drive the Switch Contacts so that with a small electric current (low power) they can conduct higher voltage electricity. For example, a Relay that uses 5V and 50 mA Electromagnets is able to move the Armature Relay (which functions as a switch) to conduct 220V 2A electricity.

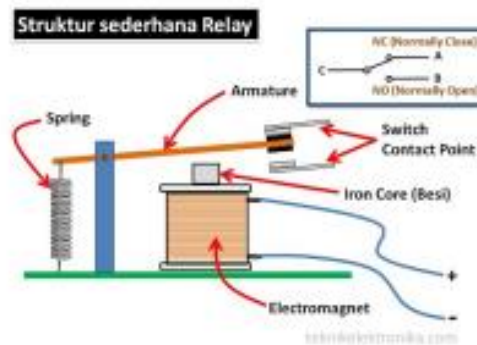


Figure 1. Basic structure of relay

Arduino Uno

According to Deni Dwi Yudhistra (2012) Arduino UNO is a microcontroller board based on the ATmega328 (datasheet). Arduino UNO has 14 digital input/output pins (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz Crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. Arduino UNO contains everything needed to support the microcontroller, it's easy to connect it to a computer with a USB cable or supply it with an AC to DC adapter or use a battery to get started.



Figure 2. Arduino UNO ATmega328

The Arduino Uno differs from all previous Arduino boards in that it does not use the FTDI USB-to-serial driver chip. In contrast, the features of the Atmega16U2 (Atmega8U2 up to version R2) are programmed as a USB to serial converter. Revision 2 of the Arduino Uno

board has a resistor that draws the 8U2 HWB line to ground, which makes it easier to put it into DFU mode. Revision 3 of the Arduino UNO board has the following new features: Pinout 1.0: added SDA and SCL pins close to the AREF pin and another two new pins placed close to the RESET pin, IOREF which allows the shields to match the voltage supplied from the board. To the future,

The second one is an unconnected pin, reserved for future purposes 6 more powerful RESET circuit Atmega 16U2 replaces 8U2 "Uno" means one in Italian and is named to denote the next Arduino 1.0 output (product). Arduino UNO and version 1.0 will be the reference for future Arduino versions. Arduino UNO is a final series of Arduino USB boards and the reference model for Arduino boards, for a comparison with previous versions,

Motion Sensor (PIR)

According to Khoirum Muslihah (2015) PIR (Passive Infra Red) motion sensor is a sensor that functions for motion detection that works by detecting differences / changes in current and previous temperatures. The motion sensor using the pir module is very simple and easy to apply because the PIR module only requires a DC input voltage of 5V which is effective enough to detect movement up to a distance of 5 meters. When no motion is detected, the module output is LOW. And when it detects motion, the output will change to HIGH. The HIGH pulse width is ± 0.5 seconds. The sensitivity of the PIR module which is able to detect movement at a distance of 5 meters allows us to make a motion detection device with greater success.



Figure 3. PIR sensor

With an output that only gives 2 logics of High and Low, we can make various motion sensor applications. For example, if we want to apply it directly to the alarm, we just need to create a series of drivers to activate the alarm. Or for example, if you want to use it to activate the lights, you just need to make a driver to provide a voltage source to the lights. The PIR motion sensor module has an output that can be directly connected to TTL or CMOS digital components and can also be directly connected to a microcontroller. The effectiveness of motion detection using this motion sensor is influenced by the placement of the PIR motion sensor. The position of the motion sensor must be placed in a location that can read all movements in the room or area monitored by the PIR motion sensor.

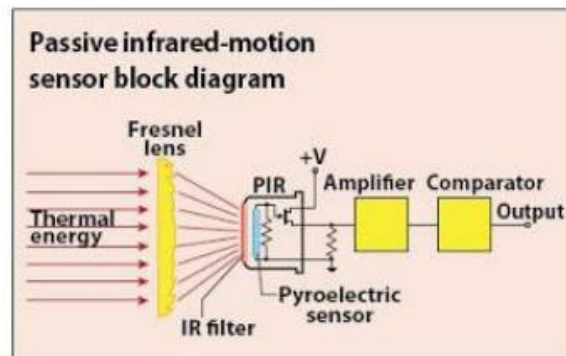


Figure 4. PIR (Passive Infra Red) Sensor Block Diagram

Sensor PIR (Passive Infrared Receiver) is an infrared-based sensor. However, unlike most infrared sensors, which consist of an IR LED and a phototransistor (Rifqy, 2008). PIR doesn't emit anything like IR LED. As the name implies "Passive", this sensor only responds to energy from passive infrared rays that are owned by every object detected by it. Objects that can be detected by this sensor are usually the human body. Inside this PIR sensor there are parts that have their respective roles, namely Fresnel Lens, IR Filter,

Pyroelectric sensors, amplifiers, and comparators. This PIR sensor works by capturing heat energy generated from passive infrared rays that are owned by every object with an object temperature above absolute zero. Like the human body which has a body temperature of approximately 32 degrees Celsius, which is a typical heat temperature found in the environment. This infrared beam is then captured by the Pyroelectric sensor which is the core of this PIR sensor, causing the Pyroelectric sensor consisting of gallium nitride, cesium nitrate and lithium tantalate to produce an electric current. Why can generate electric current? Because this passive infrared beam carries heat energy. The process is almost the same as the electric current that is formed when sunlight hits a solar cell. Why do PIR sensors only react on the human body? This is due to the presence of an IR Filter that filters out passive infrared light wavelengths. The IR Filter in the PIR sensor module is capable of filtering passive infrared light wavelengths between 8 to 14 micrometers, so that the wavelengths generated from the human body that range from 9 to 10 micrometers can only be detected by the sensor.

METHODS

The research material is based on designing and designing a recycle power tool from water in the toilet which can be used as new energy. Then perform a performance analysis of the energy output from the energy cycle of the recycled water through experiments and measurements carried out. The materials used in this study include:

1. Sensor
2. Low current
3. Scc stabilizer
4. Battery
5. Microcontroller

The research was conducted with the following work procedures or stages:

1. Preparation stage
In the preparation stage, the research team made preparations in the form of theoretical studies related to the research carried out, discussions, sharing knowledge and searching for literature were activities at this stage.
2. Implementation Stage

The implementation of the research begins by making a portable generator design and calculating the components needed in the study, then assembling the components according to the drawings that have been made, then carrying out tests and experiments on the tools that have been assembled, then taking data from the results of the experiments carried out, and analyze the data obtained and discuss it.

3. Reporting Stage

At this stage the researcher and the team make a report on the results of the research conducted to the LPPS, by making a written report of the results according to applicable standards, then attending a seminar to disseminate the research results, and writing it in a National Journal as a scientific publication.

RESULTS AND DISCUSSION

Results of Hardware Installation Systems that have completed the design stage will be installed. System installation in the form of hardware installation on the prototype and website installation. The working principle of the mechanism is very simple, that is, it only uses mechanical means (such as springs, levers, etc.) for its function. The wooden platform consists of two parts, one movable and the other fixed, both of which have pops between them. It mainly works on the principle of spring compression and expansion. When a force is applied to a spring, it will be compressed and after being released from the force, due to the stiffness of the spring it exerts a reaction force in the opposite direction.

The vertical steel pipe attached to the top of the base also moves up and down along with it. As a result, the flexible element lever mechanism attached to the end of the lever moves up across the tank handle. All settings work in tandem and provide us with automatic flushing from the tank.

The platform is nothing but a spring mass system arrangement. This is the main part of our developed project where people will sit for the toilet and thus compress the springs built into it. So when the person is lifted off the platform due to the rigidity of the platform springs it will try to return to its original position and thus allow automatic upward movement of the platform.

Tank contains handle, intake valve and float rod with float ball in end. The inlet is mainly controlled by the float ball while the outlet is controlled by the handle.

Table 1. PIR sensor testing

Pengujian ke-	Bentuk Pengujian	Hasil Yang Diharapkan
1	Mendorong pintu ke dalam	Tidak Terdeteksi
2	Membuka pintu ke dalam disertai dengan tangan	Lampu tidak menyala
3	Memasukkan hanya kaki ke dalam toilet	Lampu tidak menyala
4	Berjalan masuk ke dalam	Lampu menyala
5	Berjalan jongkok ke dalam	Lampu menyala

The first test is done by the author pushing the door from the outside in. If the PIR Sensor is working properly, the light should not turn on because the PIR Sensor will not be able to detect movement other than human movement. The 2nd test is to open the door and also put your hand in the toilet. The expected result is that the lamp will light up because the PIR

Sensor will detect hand movements. The author's 3rd test will only put feet in the toilet. With the intention of seeing the sensitivity of the PIR Sensor, can the PIR Sensor detect the presence of a user with just a foot. The 4th test is carried out in a general way, the author will walk as usual into the closet. What should happen is that the PIR sensor can detect the presence of the user. The 5th test is tried if you enter the toilet by walking squatting. To test the detection range of the PIR Sensor. With a toilet measuring 2.5 meters high, the PIR Sensor should still be able to detect the presence of users.

Flush feature testing is done by seeing if the servo motor can pull the flush valve with the tank filled with water. The full volume of the water tank in the toilet is 6 liters. Given 3 conditions to be tested, that is:

Table 2. Motor testing

Pengujian ke-	Isi Tangki	Hasil Yang Diharapkan
1	2 Liter	Terangkat
2	4 Liter	Terangkat
3	6 Liter	Terangkat

After testing the light switch, the following results were obtained:

Table 3. Switch test

Saklar	Relay	
	1	0
1	0	1
0	1	0

The condition "1" is defined as the light is on, and "0" is defined as the light is off. Thus it can be stated that the light switch is working properly.

CONCLUSION

Based on the results of the analysis and testing of the Smart Toilet Equipped with a Website-Based Monitoring System, it can be concluded that the smart toilet system has been able to carry out the main functions according to the purpose of making the system well, control lights, exhaust, and solenoid valves are automatically successfully executed according to the status of the PIR sensor, PIR sensor can detect movement at an angle of 87.2°. Wi-Fi connectivity on the NodeMCU ESP8266 will be disconnected at a distance of 83 meters without obstacles and 29 meters with obstacles in the form of walls between rooms. Smart toilets are equipped with a website-based monitoring system to monitor usage with an error tolerance of below 10%.

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