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Automatic Toilet Tool Based on Arduino Uno and Sensor Passive Infrared Receiver (PIR)

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ABSTRACT

With the development of electronic components so that it can be seen that technological progress is very rapid, the latest innovations are needed in utilizing these technological developments, this can be implemented in the technology of making automatic toilet tools that are very useful for the blind. The toilet is the place most frequented by everyone. However, there are things that are not very easy for the blind to use toiet, due to the factor of not being able to see so that they have difficulty in opening the toilet door and flushing water in the closet automatically, so there is a need for an automatic system and providing information provided in the form of audio sound that there are users of the toilet, In the manufacture of smart toilet automatic tools that can help users among the blind, called smart because it can open the door automatically and turn on the audio sound information and can release water automatically with a dc water pump motor, this is because it uses PIR and infrared sensors as a detector of the presence or absence of toilet users controlled by Arduino Uno, if there is a toilet user, Arduino Uno will process and command the audio will provide information in the form of sound and Motor DC water pump releases water automatically, then if the user has left the toilet and the infrared sensor no longer detects, then Motor DC water pump does not release water. After some analysis and testing, the results show that all functions run as expected. This smart toilet system can be implemented in an actual toilet without having to change the previous conditions at a small cost.

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1. Introduction

The toilet is the place most frequented by everyone but there are problems from blind users in using the toilet because the system is still manual, in this study a smart toilet system was made because it changed its working principle from manual to automatic, using PIR sensors and infrared sensors as detecting the presence or absence of toilet users, if there is a toilet user Arduino Uno will move the solenoid motor to open the door automatically and rule the audio will provide information in the form of sound and Motor DC water pump releases water automatically, then if the user has left the toilet and the infrared sensor no longer detects, then Motor DC water pump does not release water. In the design of the implementation of the smart toilet that is solved is to include a controller system using PIR sensor components and infrared sensors, Arduino Uno, DC Motor, Selenoid Motor and Motor water pump with hardware architecture, including electronic and mechanical devices, From the information above, realizing an effective and efficient automatic toilet,

2. Literature Review

Arduino UNO

Arduino Uno is a microcontroller board based on ATmega328 which has 14 input pins of digital output where 6 input pins can be used as PWM output and 6 analog input pins, 16 MHz crystal oscillator, USB connection, power jack, ICSP header, and reset button. To support the microcontroller to be used, it is enough just to connect the Arduino Uno Board to the computer using a USB cable. Each of the 14 digital pins on the arduino uno can be used as inputs and outputs, using the pinMode(), digitalwrite(), and digitalRead() functions. These functions operate at a voltage of 5 volts, each pin can provide or receive a maximum current of 40 mA and has a pull-up resistor of 20-50 kOhm.

Gambar 1. Modul Arduino Uno

Sensor PIR (*Passive Infra Red*)

PIR (Passive Infra Red) sensors are sensors that are specifically designed to detect signals in the form of thermal radiation at infrared wavelengths, which are produced by every living thing. The radiation in question is in the form of body temperature that is more than 0 ° C. The radiation energy cannot be seen by the naked human eye. The word passive in PIR sensors means that these sensors do not generate or radiate any energy when detecting.

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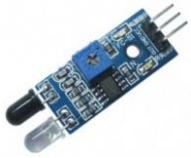
Gambar 2. Sensor PIR

Sensor infrared

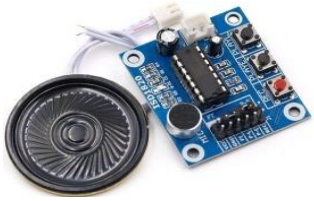
IR sensor is a sensor that can detect obstacles using infrared light reflections. When the sensor module detects an obstacle or object in front of the sensor, it will get a light reflection with an intensity that is adjusted with a potentiometer.



Gambar 3. Sensor Infra Red

ISD 1820

ISD 1820 is a voice recorder module that can record and play recorded sounds. There is a built-in mic and record button to directly record sound into the ISD1820 IC and the sound can be directly played by pressing the play button or programmed with Arduino and listen to it with speakers. this module can record sound up to 20 seconds.



Gambar 4. Modul ISD 1820

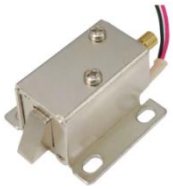
Driver Motor Shield L293D

IC L293D is an IC that is specifically designed as a DC motor driver and can be controlled by a series of arduino uno modules. In 1 unit IC L293D chip consists of 4 DC motor drivers that can be used independently with the ability to flow 1 Ampere current per driver. The use of pins from the driver only requires 2 pairs of pins to supply the left and right motors whether they are pointing forward, backward, left, or right....

Gambar 6. Modul Driver L293

Selenoid Door Lock

Solenoid Door Lock is one of the solenoids that function specifically as a solenoid for electronic door locks. This solenoid has two working systems, namely Normaly Close (NC) and Normaly Open (NO).



Gaml noid

Motor Geear Box

Components on Gear Box The rotation of the motor is forwarded to the input shaft through the relationship between the clutch/clutch, then the rotation is forwarded to the main shaft (main shaft), the torque/moment in the main shaft is forwarded to the engine spindle, due to differences in the ratio and shape of the teeth so that the rpm or spindle rotation that is released is different, depending on the desired rpm. The following is an explanation of some of the parts contained in the gearbox

Gambar 8. Motor Gear Box

Motor Water Pump

Water pump motor is a small submersible water pump motor. This mini water pump is commonly used for aquariums, fish ponds, hydroponics, robotics, and more.

Gambar 8 Motor Water Pump

3. Metode Penelitian

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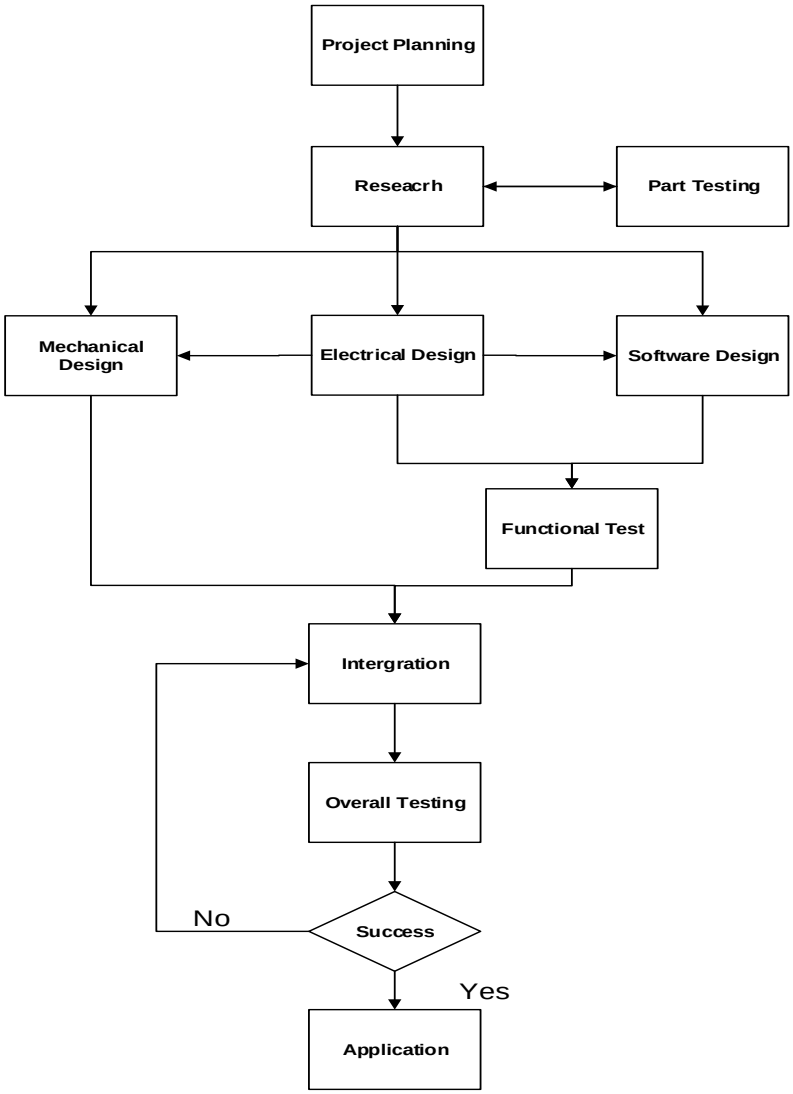
The research method used is using research methods in the field of Software and Hardware which are shown in the image below.

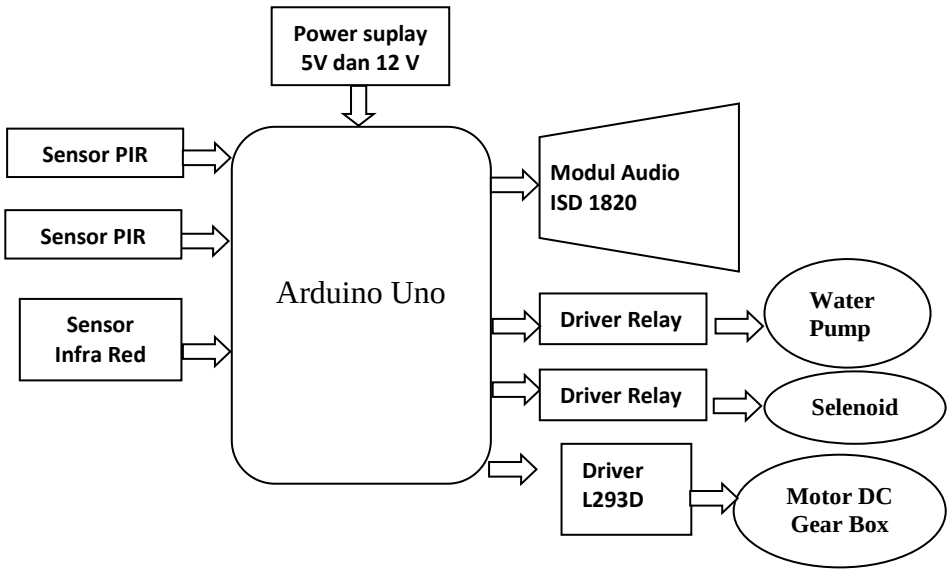


Gambar Metode Penelitian *Software* dan *Hardware*

Perencanaan Rancangan Penelitian (*Project Planning*)

When planning a research project, there are several important things that must be determined and considered, including:

1. Determine the research topic by looking at several subsequent studies
2. Look at the estimated needs for tools and materials used
3. Estimated budget used
4. Possible applications of the application that will be designed are useful.



Block diagram of a prototype automatic toilet device based on Arduino Uno and a PIR sensor

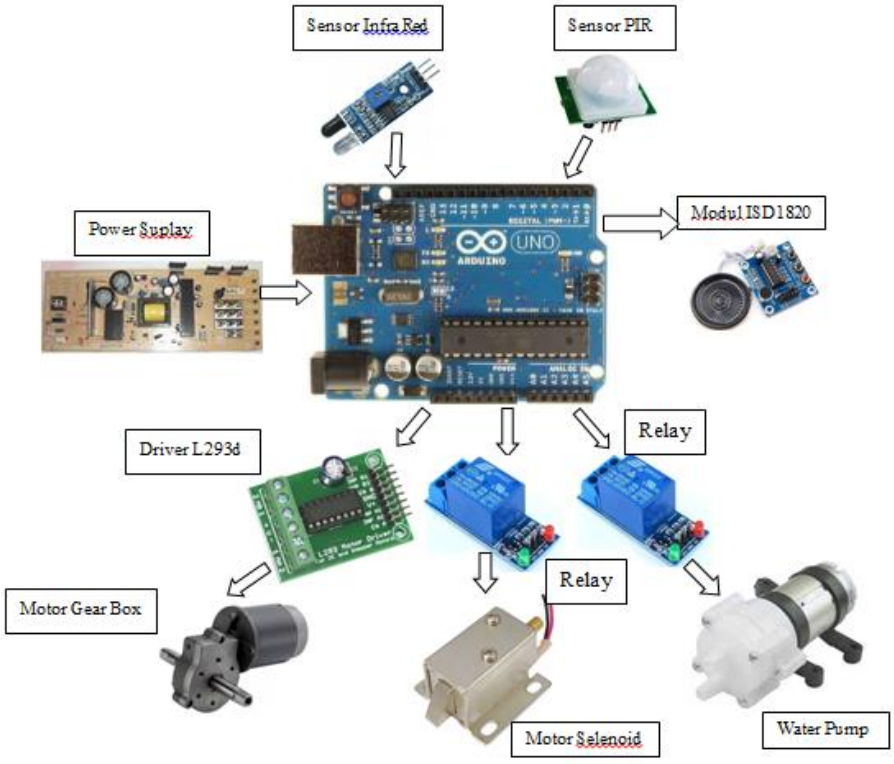


Image Based Automatic Toilet Tool components
Arduino uno and PIR sensor

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4. Results and Discussion

The results of this research are the process of the next stage for the purpose of knowing the level of assembly success, including repairing or perfecting parts that are still not functioning optimally. The final result to be achieved in testing is the condition of the tool which is ready with test result data via measuring instruments. multimeter.

PIR sensor input circuit analysis section

This is the part of the circuit that provides input to the Arduino Uno. The input circuit scheme uses two pairs of PIR sensors, the first PIR sensor will be installed on the front of the toilet door, the second sensor will be installed on the back of the toilet door.

Table of logic testing on PIR sensors

No	Input (Port A0)	Input (Port A1)	Ouput	Information
1.	1	0	1	Detect bathroom entry
2.	0	0	0	No Dectection
3.	0	1	1	Detecting exiting the bathroom
4.	0	0	0	No Detection

Table of testing voltage values on PIR sensors

No	Input (Port A0)	Input (Port A1)	Ouput	Information
1.	3,17 V	0,23 V	3,17V	Detect bathroom entry
2.	0,25 V	0,25V	0,25V	No Detection
3.	0,21 V	3,21 V	3,21V	Detect bathroom exit
4.	0,17 V	0,17 V	0,17V	No Detection

Infrared sensor input circuit analysis section

Part of the infrared sensor which functions to detect the presence of toilet users,

Table of logic testing on Infra Red sensors

No	Input (Port A3)	Ouput	Information
1.	0	1	There are closet users
2.	0	0	There are no closet users

Table of testing voltage values on Infra Red sensors

No	Input (Port A3)	Ouput	Information
1.	0,43 V	4,12V	There are closet users
2.	0,43V	0,43V	There are no closet users

Output circuit analysis section

In the analysis section, the output circuit of the ISD 1802 audio module functions to provide information in the form of sound

Logic testing table on the ISD 1802 Module

No	Input (Port 1)	Input (Port 2)	Ouput	Information
1.	1	0	1	Information in the form of no closet users
2.	0	1	1	Information in the form of closet users

Table of testing voltage values on the ISD 1802 Module

No	Input (Port 1)	Input (Port 2)	Ouput	Information
1.	3,87V	0	3,87V	Information in the form of no closet users
2.	0	3,79V	3,79V	Information in the form of closet users

L293 Driver circuit analysis section

Part of the analysis of the L293 driver output circuit which functions to control the Gear Box motor.

Logic testing table for Driver L293

No	Input (Port 4)	Input (Port 5)	Ouput	Information
1.	0	1	1	The motor rotates to the right to open the door
2.	0	0	0	Motor Stoped
3.	1	0	1	The motor rotates to the left to close the door
4.	0	0	0	Motor Stoped

Table of testing voltage values on the L293 Driver

No	Input (Port 4)	Input (Port 5)	Ouput	Information
1.	0,27 V	11,23 V	11,23V	The motor rotates to the right to open the door
2.	0,27 V	0,27V	0,27V	Motor Stoped
3.	11,21 V	0,21 V	11,21V	The motor rotates to the left to close the door
4.	0,17 V	0,17 V	0,17V	Motor Stoped

Section analysis of the motor solenoid relay driver circuit

Part of the analysis of the relay driver output circuit which functions to control the solenoid motor

Logic testing table for relay drivers

No	Input (Port 6)	Input (Port 7)	Hasil	Information
1.	1	0	1	Unlocked
2.	0	1	1	Locked

Table of testing voltage values on relay drivers

No	Input (Port 6)	Input (Port 7)	Hasil	Information
1.	4,27 V	0,23 V	4,23V	Unlocked
2.	0,27 V	4,27V	4,27V	Locked

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Water pump motor relay driver circuit analysis section

The analysis part of the relay driver output circuit which functions to control the water pump motor to provide water automatically

Logic testing table for relay drivers

No	Input (Port 8)	Input (Port 9)	Hasil	Information
1.	1	0	1	Membuka kran air
2.	0	1	1	Menutup kran air

Table of testing voltage values on relay drivers

No	Input (Port 8)	Input (Port 9)	Hasil	Information
1.	4,27 V	0,23 V	4,23V	Membuka kran air
2.	0,27 V	4,27V	4,27V	Menutup kran air

5. Conclusions and Suggestions

In preparing the writing of this research, several conclusions can be drawn from the authors, namely :

1. Using a series of PIR and infrared sensors to function as a component that detects the presence or absence of a toilet user and can move a solenoid motor to open the lock, a gear box motor to open the door automatically and a DC water pump motor to release water
2. ArduinoUno is a board module that functions as an electronic circuit controller and can be developed into other technologies.
3. With this smart toilet automatic device, it will be easy to use for the blind
4. The use of new technological components really supports the development or creation of new technology.

In writing research there are several suggestions, namely:

1. There is a need for more sophisticated development in the manufacture of automatic toilet equipment to meet needs.
2. Apart from using PIR and infrared sensors, it is necessary to add other detection tools such as Wabcame sensors
3. Can be developed on IoT (Internet of Things) based technology

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