PROJECT REPORT

ARC (Automatic Retracting Clothesline)

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1. Abstract

This project will prove that Raspberry PI can be used for the helpful purposes such as making a moving pulley that will move the laundry to the side which is not raining, this idea will hopefully help many people who are struggle to prevent laundry from getting wet by raining.

The summary should remain on a separate page and not exceed one page.

This proposal will mainly discuss more about:

- Give explanation the purposes of this project
- Expectation with explanation based on the source
- Showing what type of devices that will used for this project
- The amount of budget that will need to achieve this project
- Explain more about the purposes and how it is worked

2. Introduction

The Raspberry Pi was created in February 2012 by the Raspberry Pi Foundation, this product was useful for many people to perform a specific task to do something. This is a small computer that can do lots of things, it also provides a GPIO pin for the user to plug in to a specific device that will perform a task based on the command of Raspberry Pi.

This Raspberry Pi can also be built into custom projects such as useful tools for the automation solutions, it provides a great environment for learning programming and digital making.

Since Indonesia has 3 seasons namely seasonal climate, tropical climate, and rain climate. Indonesia has a dry season and rainy season that comes every half year. Therefore, this project would help people in Indonesia or other country that have same season to prevent from rainy season.

Many problems can be solved by this small computer by knowing an idea to make a project, this project will hopefully help people who are find it hard to do something. This project was founded to help others who are struggle to take care of the laundry from the rain, by doing that the chance of laundry can be prevent from the rain.

From there it is important to know what equipment that needed to do this project and also knowing the steps to make this project that will later be explain furthermore in this proposal

3. Problem Statement

To fully understand the purpose of the project, the problems of the topic need to be identified. For example, interpreting the idea of an automatic retracting clothesline into a prototype can be quite a challenge. More research on what sensor is capable to detect raindrops, specification of the motor, and the most suitable power supply for the prototype is further needed. Additionally, it is also crucial to study and design the inner circuit of the project, and how it should be connected, whether it is through a Printed Circuit Board (PCB) or directly connected with cables and wires. Finally, the most essential part of the project is the integration of a Raspberry Pi as the brain of the prototype device. This includes which GPIO is suitable for the input and output elements and how the program should be written in a code. Therefore, three main problem statements is formulated:

1. How to create the prototype of a clothesline that automatically retracts when rain is detected with sensors and motors?
2. How is the interconnection between the electrical elements inside the device?
3. How is the Raspberry Pi integrated to the device?

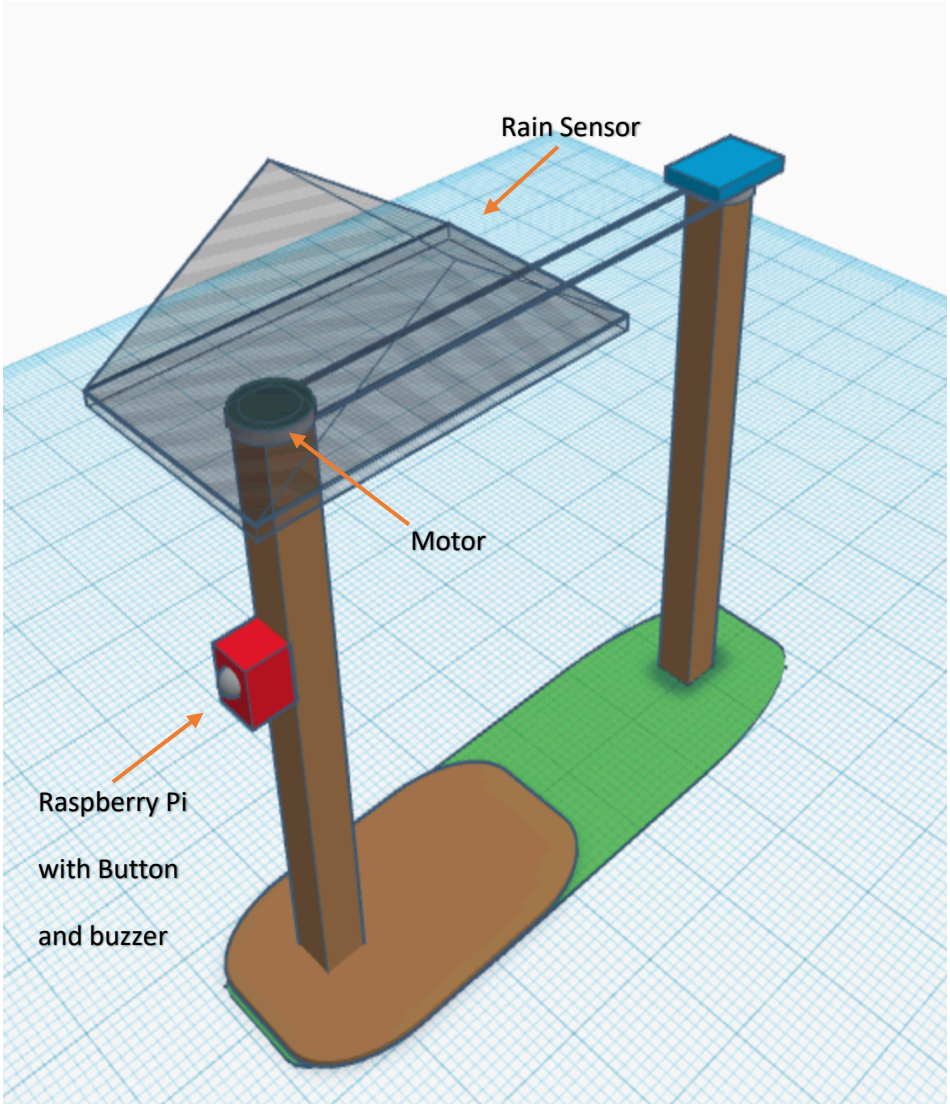
4. Objectives

The goal of this project is to build a prototype of automated clothesline. An automated clothesline is a microcontroller-based project that uses Raspberry Pi, sensors, and motor. The objective of this current study is to support a convenience and effective machine especially for young married working couple who does not have housemaid and still have to do the laundry on their own. Furthermore, the objective of this project is to comprehend the mechanism and interface between Raspberry Pi GPIO, Data, Sensors, and Circuits and then how to know how those devices can be integrated as one handy device. Hence, the objectives of this project are the following:

1. To create the prototype of an automated clothesline that retracts itself when rain is detected using Raspberry Pi, sensors and motors
2. To provide an effective and supportive environment for working couples regarding to housework which in this project is a clothesline.
3. To comprehend how is the mechanism and interface of the devices required and integrate them to one handy device
4. To assist disabled people and pregnant housewife to do housework that relies heavily on physical activity.

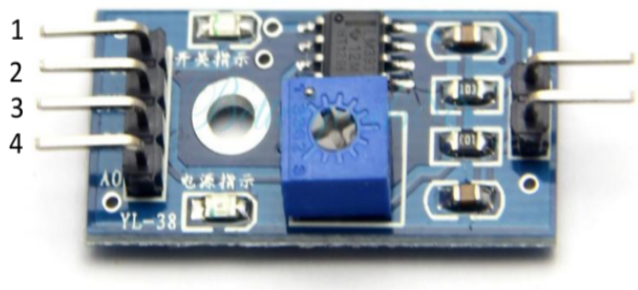
5. Design & Components

5.1. Design



5.2. Components

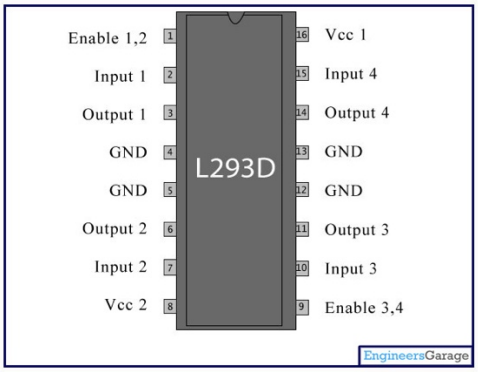
1. Rain sensor: Input detection device activated by raindrops. The output is available in digital and analog signals. When the necessity is to know whether there is rain or no it is the part of digital output; and when the volume or intensity of the rainfall it is the part of the analog output.



Pin configuration:

1. VCC: 5V DC
2. GND: Ground
3. DO : High/Low
4. AO : Analog Output

2. Buzzer: An audio signaling device, which produces a buzzing sound. It is used to indicate different stages within the whole device program. The component is connected to the **GPIO pin number 13**.
3. Motor: A component designed to convert one form of energy into mechanical energy, in a rotational motion. It is used to deploy and retract the clothesline. The component is connected to the **GPIO pin number 4 and 14**.
4. L293 (Motor Driver): A generic H-Bridge chip which allows DC motor to rotate in both clockwise and counter clockwise direction. It is connected between the motor and Raspberry Pi. Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

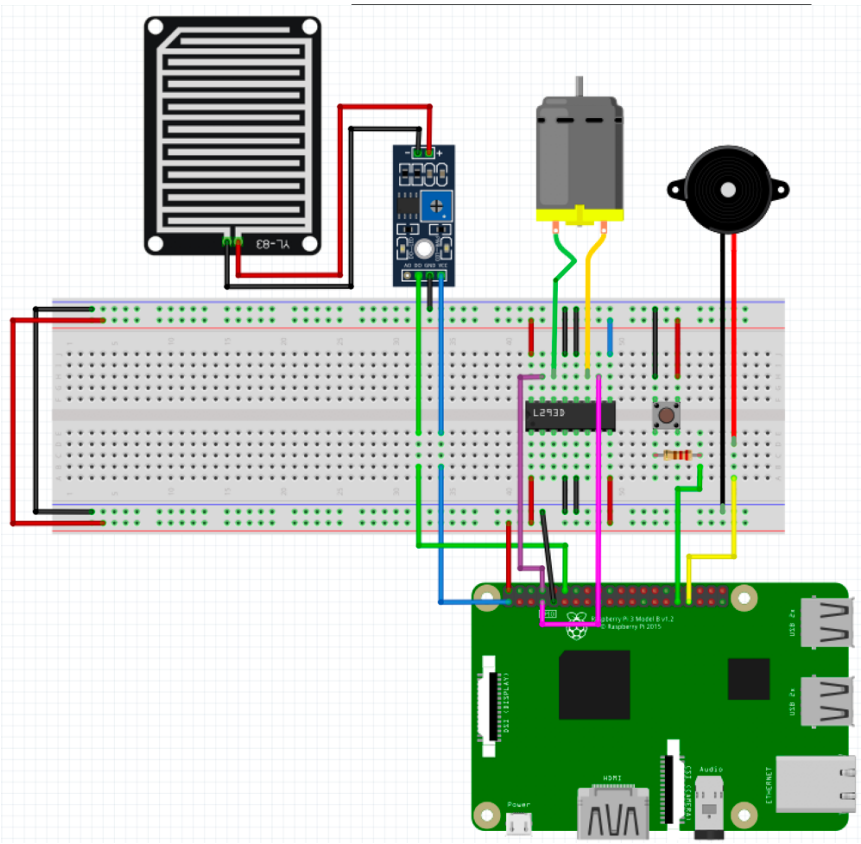


Pin No	Function	Name
1	Enable pin for Motor 1; active high	Enable 1,2
2	Input 1 for Motor 1	Input 1
3	Output 1 for Motor 1	Output 1
4	Ground (0V)	Ground
5	Ground (0V)	Ground
6	Output 2 for Motor 1	Output 2
7	Input 2 for Motor 1	Input 2
8	Supply voltage for Motors; 9-12V (up to 36V)	Vcc $_2$
9	Enable pin for Motor 2; active high	Enable 3,4
10	Input 1 for Motor 1	Input 3
11	Output 1 for Motor 1	Output 3
12	Ground (0V)	Ground
13	Ground (0V)	Ground
14	Output 2 for Motor 1	Output 4
15	Input2 for Motor 1	Input 4
16	Supply voltage; 5V (up to 36V)	Vcc $_1$

5. Push Button: : A button that is pushed to send electrical signal. It is used as the main interactive input for the user of the prototype. The component is connected to the GPIO pin number 6.
6. Raspberry Pi 3: A low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people

of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It is the central brain computer of the prototype and provides the necessary GPIO pins to control all the components directly.

7. Jumper cable: Electric cables to connect all the necessary electric components, including input, output, and Raspberry Pi. It is used to connect all the electric components in a closed circuit.
8. Bread board: A solderless device for temporary prototype with electronics and test circuit design. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making the connection through wires where appropriate. It is used to build and test circuits quickly before finalizing any circuit design.



6. Discussion

6.1. Program Flow

The prototype is running with python-based program, with the following procedure:

1. A prompt will appear and ask the user for an email address.
2. After the user entered their email, the program will display a message and wait until the button is pressed.
3. When the button is pressed, the clothesline will deploy along with the buzzer beeping once to indicate the procedure.

4. The clothesline will be deployed until rain is detected or the button is pressed.
5. If rain is detected, the clothesline will retract automatically with the buzzer beeping 5 times to indicate the procedure. A notification email will be sent to the address entered previously.
6. Alternatively, the button can be pressed while the clothesline is deployed to retract the clothesline when needed.

6.2. Program Code

Python is used as the base for operating the device. Essential modules such as Gpiozero and SMTP library are imported to control the GPIO pins and sending email. The code can be seen as the following:

```
#import necessary modules
import smtplib
from time import sleep
from gpiozero import Buzzer,Motor,InputDevice,Button
from os import system

def buzz_now(iterations):#function to activate buzzer beep, iterations determine the repetition count of the beep
    for i in range(iterations):
        buzz.on()
        sleep(0.5)
        buzz.off()
        sleep(0.5)

def mail(toaddr,msg):#function to send email, using smtplib library
    server = smtplib.SMTP('smtp.gmail.com:587')
    server.starttls()
    server.login('cscience.dreamteam@gmail.com','loveinvanos')
    server.sendmail('cscience.dreamteam@gmail.com', toaddr, msg)
    server.quit

#initialize the pin configuration for input and output with gpiozero module
buzz = Buzzer(13)
rain = InputDevice(18)
motor = Motor(4,14)
button = Button(6)

toaddr = raw_input("Please enter your email address: ")#prompt for user email address, which is used to receive notification
msg = """It's raining at your house!
Don't worry though because your laundry is already protected :)
"""#email message

while True: #main loop
    print("Hello, doing laundry today?\nPress the button to deploy your clothline...")#initial prompt
    button.wait_for_press()#wait for a button is_pressed
    _=system('clear')
    print("Sunny day to dry your laundry!\nPress the button to retract your clothline...")
    buzz_now(1)#buzz once
    motor.forward(0.5)#activates motor for 1 second, deploying the clothline
    sleep(1)
    motor.stop()
```

```
    while True:#loop when the clothline is deployed
        if not rain.is_active:#exception when rain sensor detects input, retracts the clothline, buzz 5 times, and send a notification email
            print("it's raining, get the washing in!")
            motor.backward(0.5)
            sleep(1)
            motor.stop()
            buzz_now(5)
            mail(toaddr, msg)
            break
        if button.is_pressed:#exception when button is pressed, retract the clothline, buzz 3 times
            print("Changed your mind? It's ok")
            motor.backward(0.5)
            sleep(1)
            motor.stop()
```

The code for the prototype is written in less than 60 lines, which is ideal for the device as it requires minimal memory and resource to execute. Additionally, this also guarantees the speed of program delivery to be responsive and reliable due to the simplicity of the code.

6.2.1. `gpiozero` Library – Input Devices

`gpiozero` is a library installed by default by Raspbian desktop image that provides many interfaces to many simple everyday components, as well as some more complex things like sensors, analogue-to-digital converters, full colour LEDs, robotics kits and more. In this project we use 2 input device component; Button and Rain Sensor. For button, the command used for this project is:

```
from gpiozero import Button
button = Button(6) // 6 represents the number of the pin
button.wait_for_press()
```

This command will pause the script until the device is activated, or the timeout is reached.

Parameters: **timeout** (*float*) – Number of seconds to wait before proceeding. If this is **None** (the default), then wait indefinitely until the device is active.

For the rain sensor the command used are:

```
from gpiozero import InputDevice
rain = InputDevice(18) // 18 represents the number of the pin
rain.is_active()
```

This is the extension from GPIODevice class so other common inputs will be facilitated such as rain sensors. The constructor adds `is_active` property to adjust `True` means active.

Parameters: **pin** (*int*) – The GPIO pin written according to the Boardcom numbers that the rain sensor is connected to. If this is **None** (the default), then it will become an error or `GPIODeviceError`

6.2.2. `gpiozero` Library – Output Devices

In this project there are two output devices that is also included inside `gpiozero` library and two of them are Buzzer and Motor. First it is needed to connect the negative pin to the ground and the other pin to the GPIO desired and for the command used from the library in this project are:

```
from gpiozero import Buzzer
buzz = Buzzer(13) // 13 represents the number of the pin
buzz.on() // turn on the buzzer
buzz.off() // turn off the buzzer
```

and for the Motor the command used are:

```
from gpiozero import Motor

motor = Motor(17, 18) // parameter (int, int) #first integer is for controlling forward move and
the second one is for the backward.
motor.forward()
motor.backward()
motor.stop()
```

6.3. Advantage and Disadvantage

Every project needs a goal to achieve something positive or bring benefit for people. From there it is important to set a goal that would help many people. This project included many advantages for the user in different types of scopes. There are ;

a. Efficiency

It took a lot of energy to bring back the laundry in from the clothesline when it was raining. This project would be one of the solution to resolve this type of problem by giving a feature that would provide the clothesline move inside the home by itself when it was raining. From there do not have to put up alot of energy to take control of the laundry.

b. Time

Nowadays people who does not have a housemaid to take care of the laundry would be struggle to manage their time since they are busy to work on something else. This project would bring benefit for them to save their time to prevent the laundry from the rain. From there people do not have to worry and waste their time to move the laundry from the clotheslines since our project already bring benefit to set a feature of automatic clothesline that move in and out by itself.

c. Cost

Since it is too expensive to hire a housemaid that well responsible to take care of the laundry, therefore our project only took less cost to take care of the laundry with our automous clothesline that would respond when it was raining to bring the laundry inside the house to prevent it from the rain.

d. Easy to use

Our project provide great features for the user to make it more easier to use, so everyone who are not fully understand will know better to access it with a simple steps to run a command to control the whole system with a simple button provided in this project.

For every project that have been made, they have their own disadvatages from different types of scope. In this project we also have some disadvatages for the user to use. There are ;

a. Need internet access

We need internet access to run the project devices to report the current situation there to the user through email access, so then we need wifi to run this project.

b. Precision

When there is only small raining happend it seems no need to move the clothesline in, but since our project detect the raining based on the raindrop that covers the sensors it will be a problem for the device to identify on how big is the rain.

7. Conclusion

According to the problem statement above, we have achieved to create the prototype of automatic clothesline that retracts itself when there was rain occurs using components mentioned and explained above. From this project we can conclude that Raspberry Pi can be formed into one handy equipment by integrating a Raspberry Pi to additional input and output devices with the interconnection amongst them and the source code as the operator of the system used in this project; supported by the default-installed library from Raspbian. This project also showed that ARC is a device that will make houseworks more effective and beneficial for the users.

References

[1] Nutal, Ben. 2015. Installling GPIO Zero. Sphinx

https://gpiozero.readthedocs.io/en/stable/installing.html

[2] Kushagra. 2012. L293D Module. Engineers Garage.

https://www.engineersgarage.com/electronic-components/l293d-motor-driver-ic