# Smart drain cover system with water sensor operated by Arduino

## Contents

# 1. Abstract

Recently, we thought of a new structure that combines air conditioning wings with conventional drains using a water detection sensor to solve problems such as flooding or odour in Seoul. Combining the new structure in a drain can not only solve the problem, but also create social values such as installing LEDs to lighten the distance and measuring the amount of rain by operating principle them.

# 2. Background

### Increasing of Abnormal weather phenomenon

- Global abnormalities are increasing the occurrence of dangerous weather such as typhoons, heavy rains, and heat waves.
- The damage caused by natural disasters in the last 10 years (2005-2014) in Korea is estimated to be 6.9 trillion won (6 billion dollars).
- Damage was caused by heavy rain, typhoon, and heavy snow in turn (MPSS, 2015)



**Increasing urban flood**

- A representative case of flood damage occurred in Seoul on September 21, 2010 and July 27, 2011.
- Seoul City suffered about 17.1 billion won and 30.8 billion won in damages from heavy rains in 2010 and 2011.

→ Major flooding causes : localized heavy rain, river bottlenecks, reduced natural reservoir space, poor water drainage


**Drainage problem**

- Drainage problem causes


[ Closed due to discarded garbage and soil ]


[ Shutting down due to the odour ]

- Effects of drainage problem


[ In case of heavy rain, backflow of sewage/flood ]

## 3. Problem Statement

We can see the problem by these two photo

(


First, The sewer is blocked and can not work

Second, Garbage causes damage to nearby people

## 4. Existing Solutions and Their Limitations

It just cleaned by people

(It need to clean it usually, because people throwing out the trash all day)

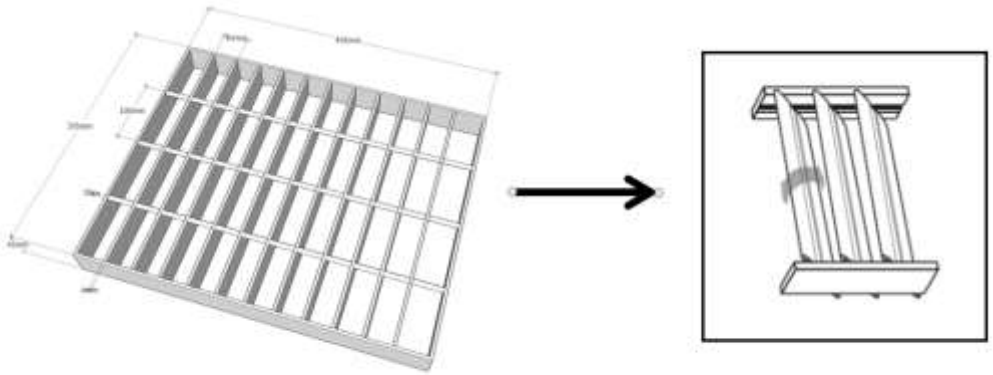
### Limitations:

There are too many sewers in Korea and a lot of manpower to clean. So the sewers often get plugged and the water does not fall.

## 5. Proposed Solution

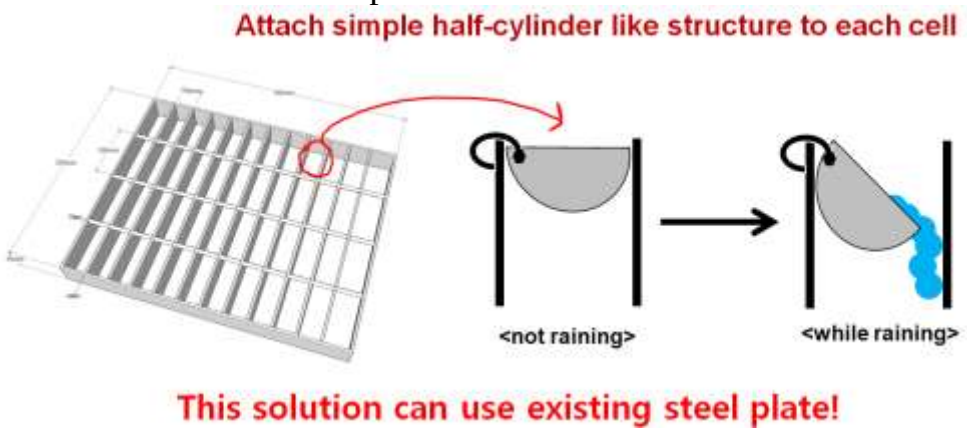
We have considered 3 solutions

Solution #1 : replace whole structure

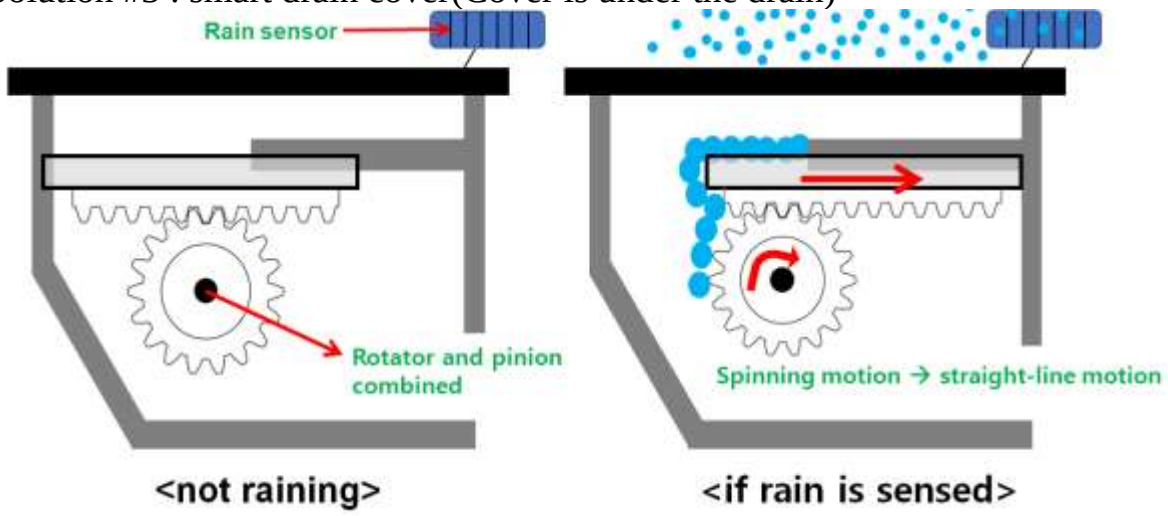


Replace the steel plates with mobile wings

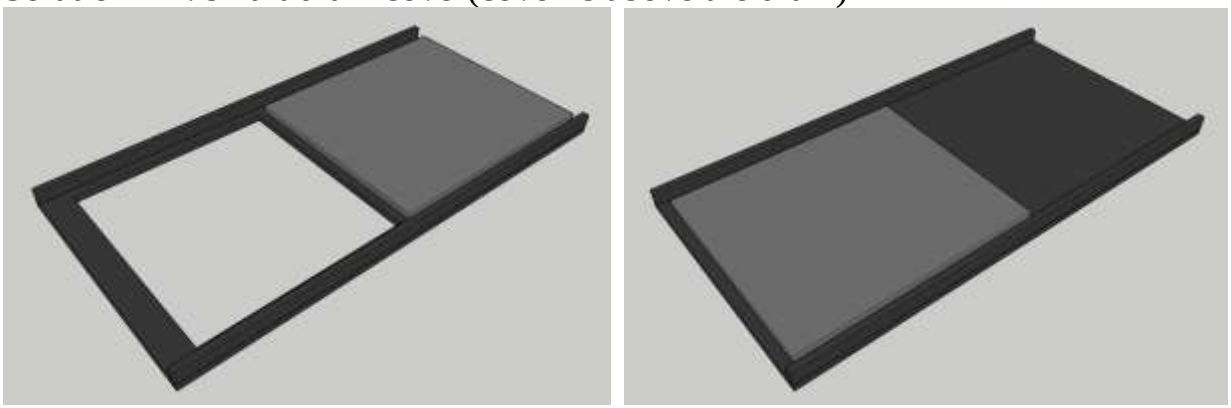
Solution #2 : attach simple structures to the cells




Solution #3 : smart drain cover(Cover is under the drain)




Solution #4 : smart drain cover(cover is above the drain)



**<not raining>** **<if rain is sensed>**

**Problem of solutions**

| | |
|---|---|
| Solution #1's problem : | 1) its cost efficiency is too bad to replace all steel plates<br>2) since the wings are exposed, impurities can interfere with the proper operation<br>3) we couldn't find out the operation mechanism of the wings which is applicable to the drain system |
| Solution#2's problem | 1) there were too many variable too make it work properly<br>2)this structure can be really hard to maintain |
| Solution #3's problem | 1)there are difficulties in installing the structure.<br>2)a lot of power is needed to drive the motor. |
| Solution #4's problem | 1)a lot of power is needed to drive the motor. |

We choose solution#4 to solve our problem. Because smart drain is efficiency, and Solution #4 is easier to make the structure than Solution #3.

## 6. Design/Principle of Operation

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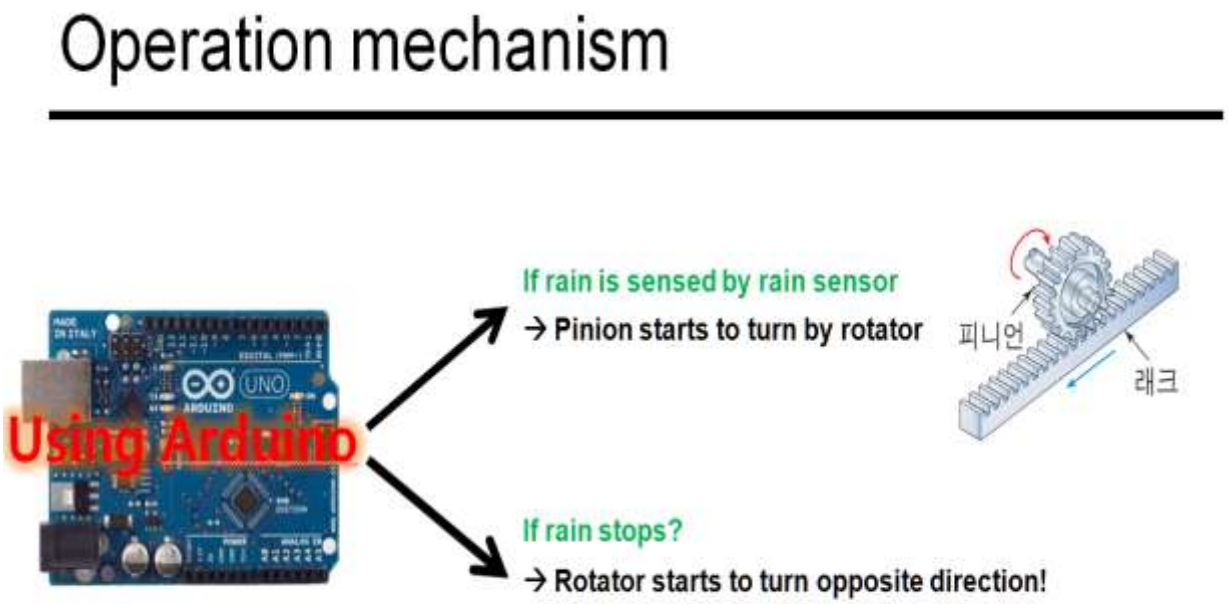
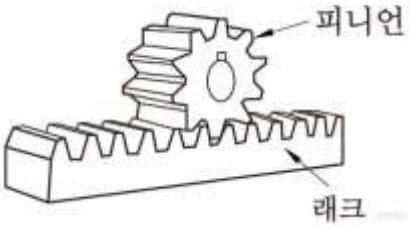
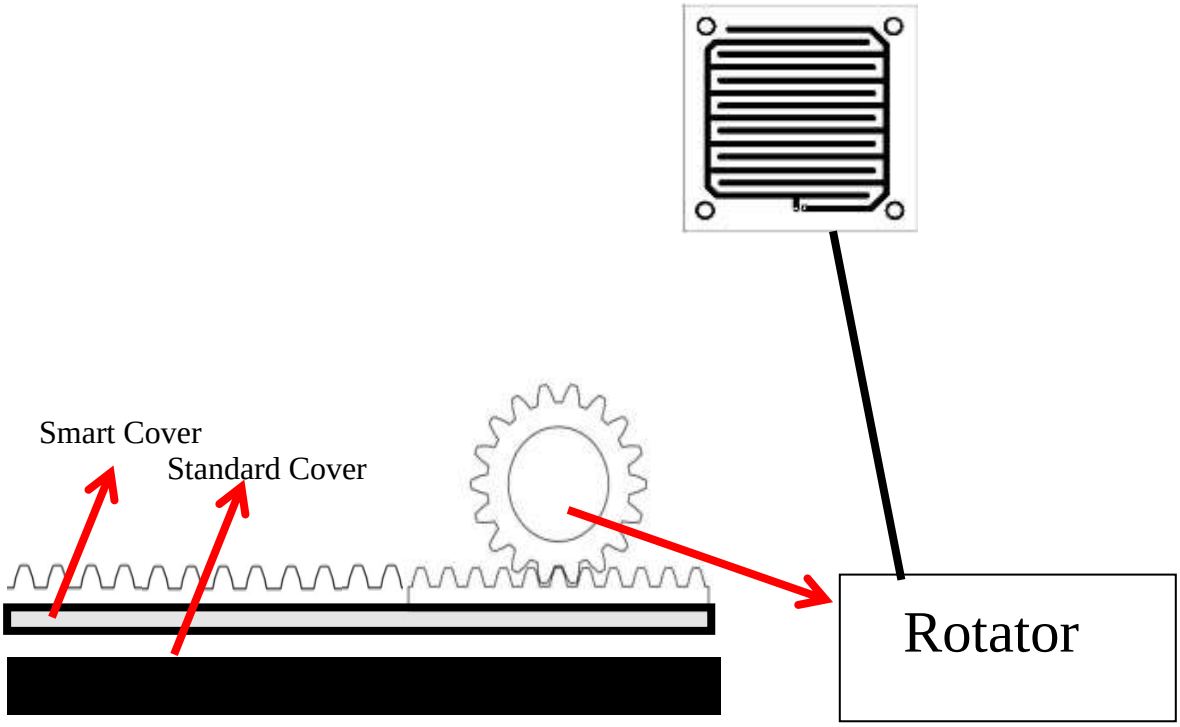




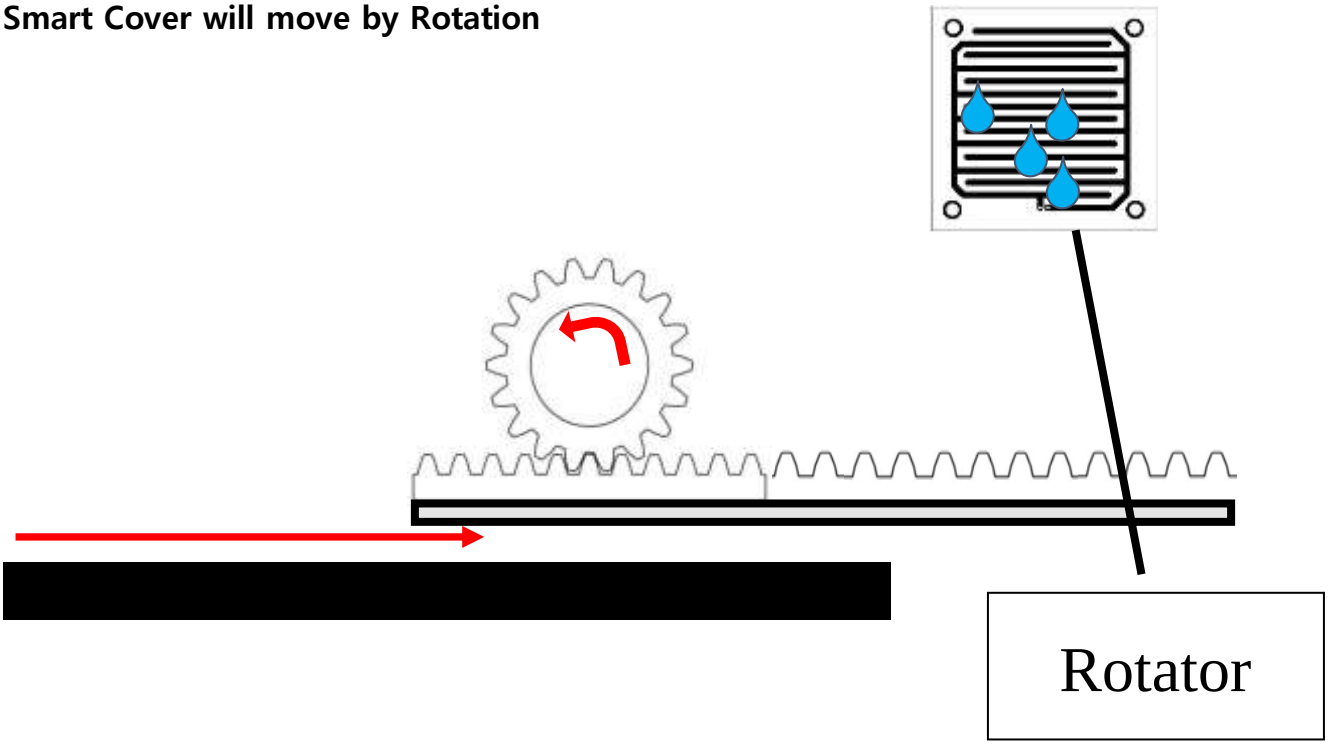

‘Rotator and pinion combined

water sensor




When it is raining, water is sensed to water sensor, and the rotator connected to the pinion rotates to open the Smart cover.

**Smart Cover will move by Rotation**

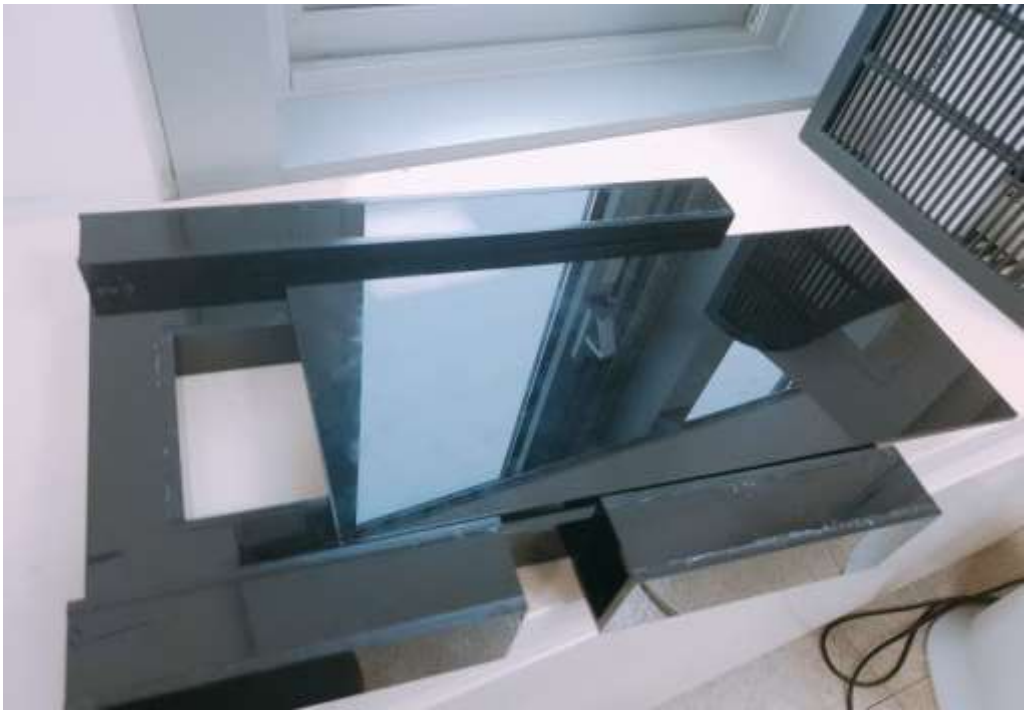


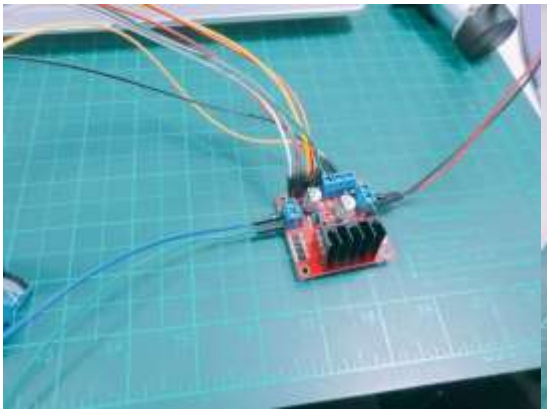

It works only when it is raining so it can function as original drainage.

## 7. Fabrication

1) Items to make smart drain cover

Main body made up of with acryl





DC driver

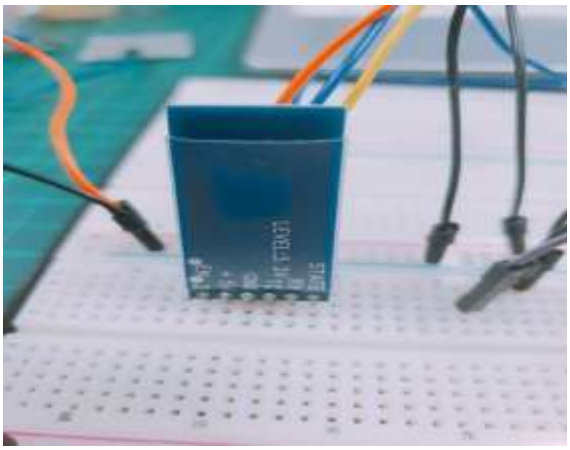
Rain sensor


UNO Arduino board

Motor to rotate pinion

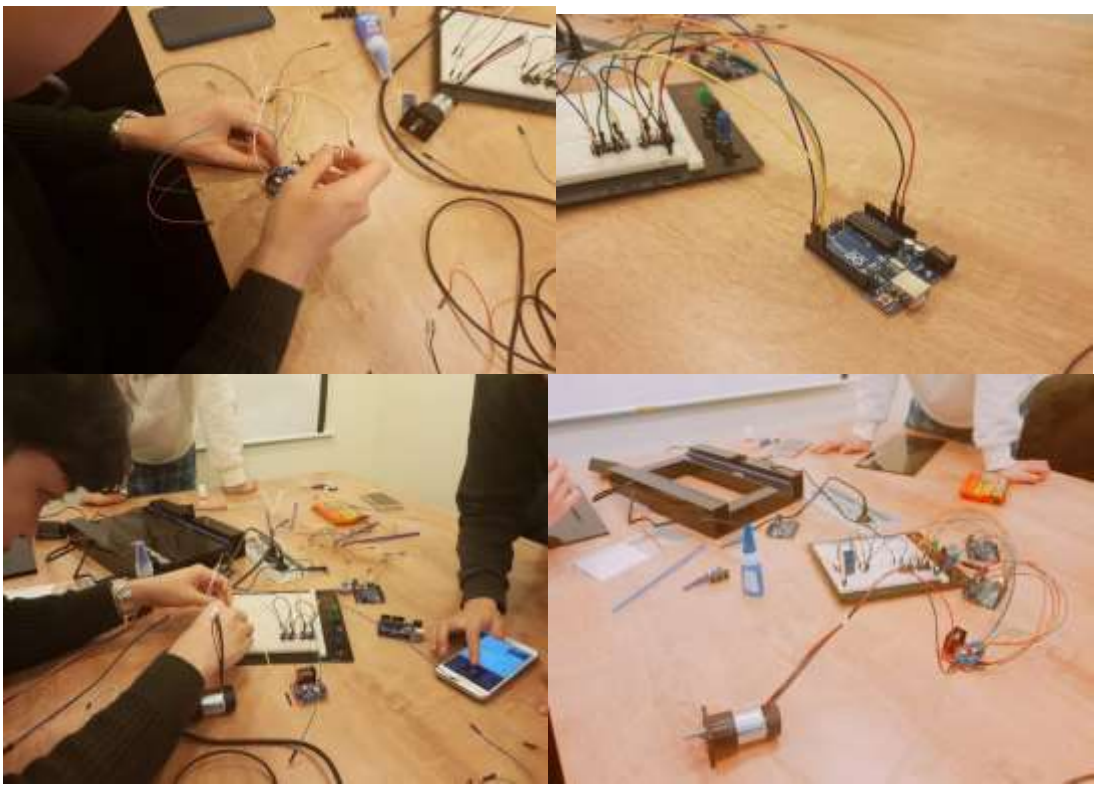
Switch to control the motor &Bread board

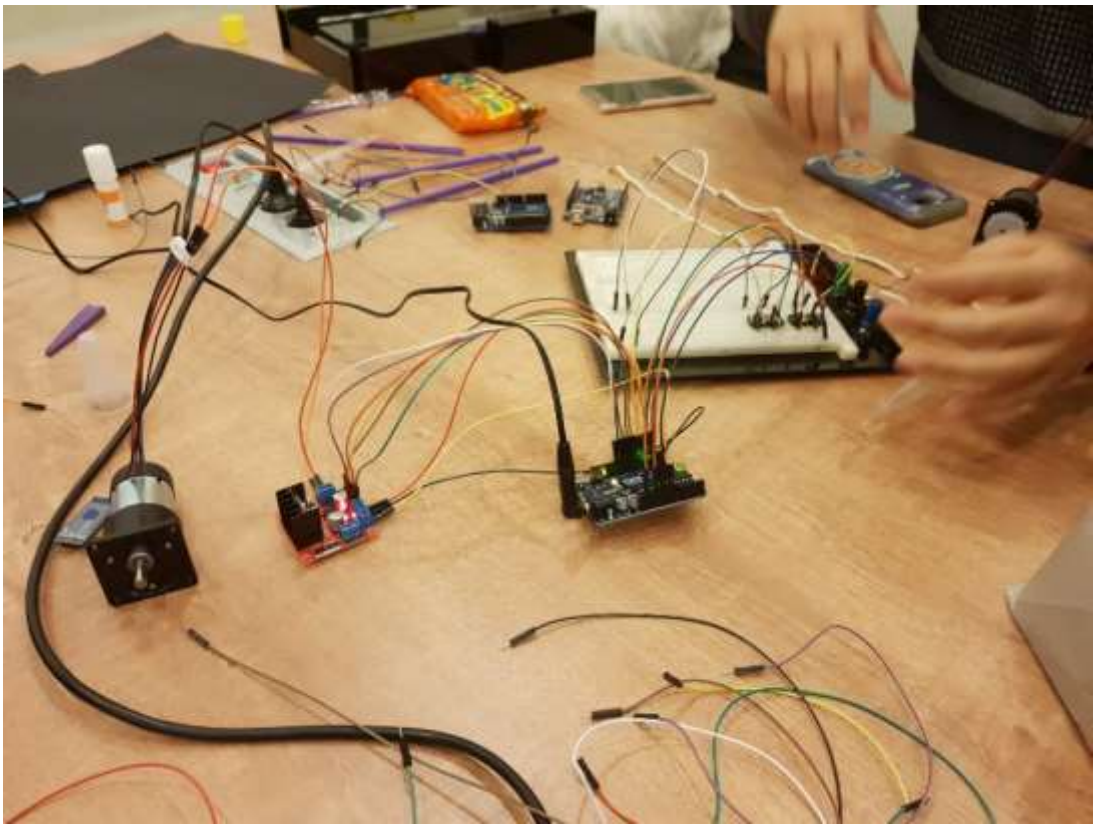
Rack and Pinion

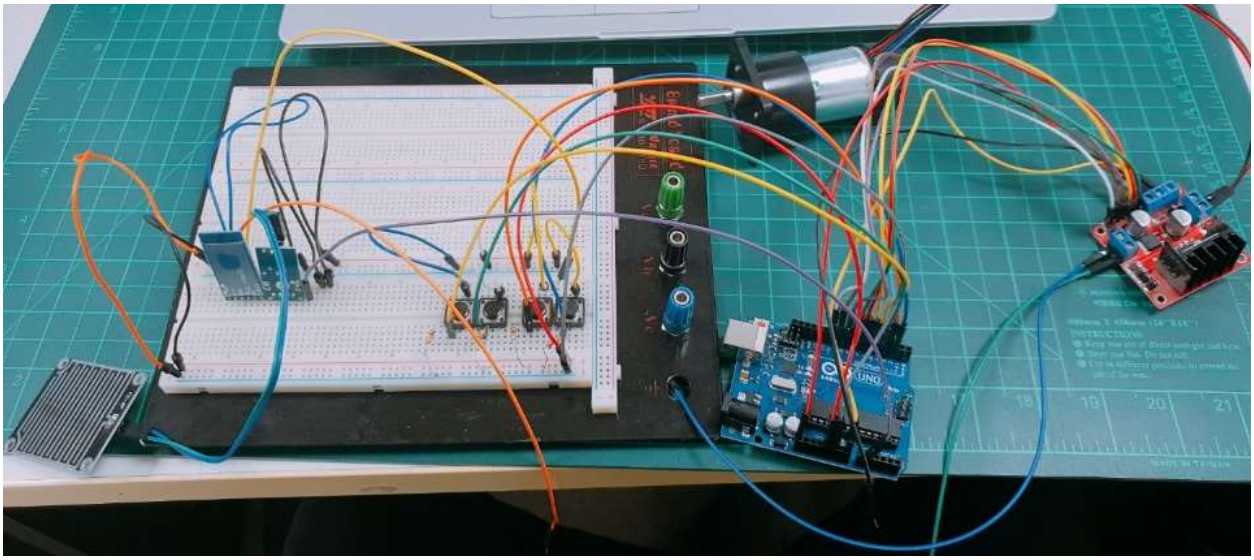


Wi-fi chip to control motor by mobile phone

2) The actual production process

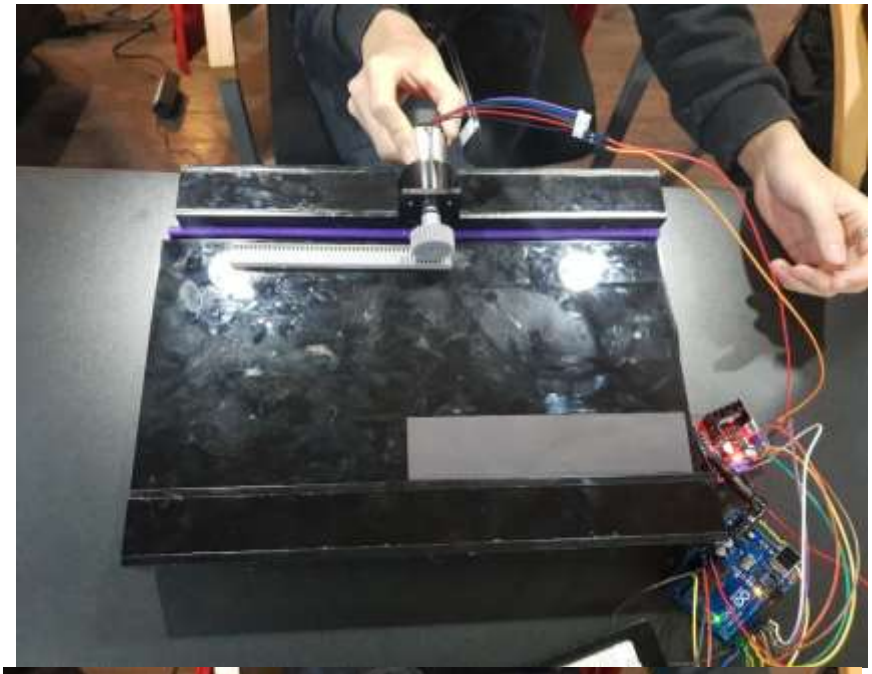


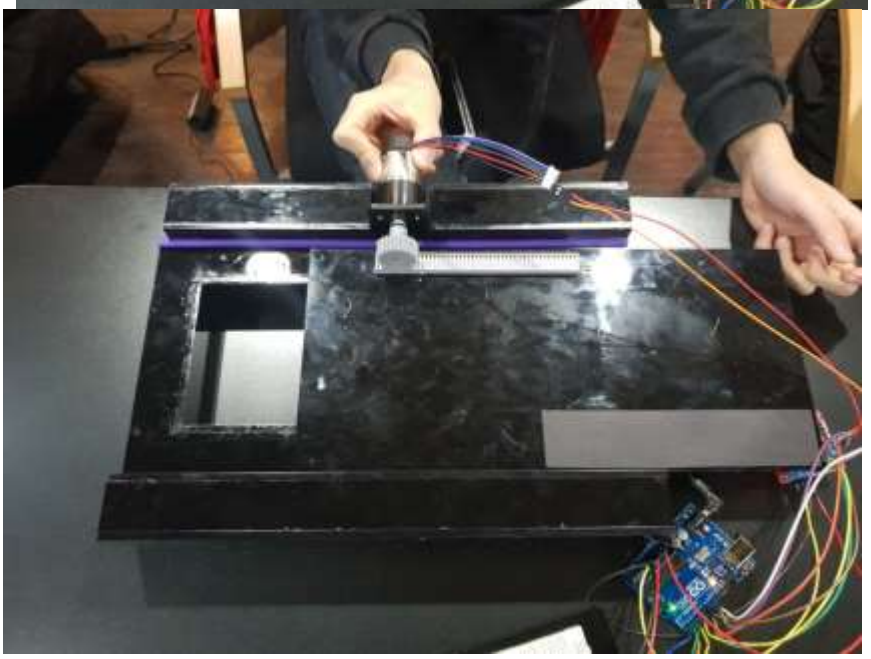




Our final circuit

# 8. Characterization and Testing





Make the water attached to the rain sensor and check the rotator is moving due to the pinion. Also, check that the switch which is put in case the rain sensor does not work is controlled.

## 9. Results

Unlike our expectation, the rain sensor did not work. But the switch works well, so our prototype is half successful and half failed. The smart drain cover was opened when one switch was pressed, and the smart drain cover was closed when the opposite switch was pressed, allowing us to control the drain as we expected. Then the mechanical tool made of wooden chopsticks did not slide well, so the drain did not move well. So we turned this material into acrylic and experimented again and it worked.

## 10. Discussion & Limitations

The rain sensor did not work as expected in our experiments. The reason for this is probably because we do not know the sensitivities or of rain sensors and so on. We are all new to Arduino and yet beginners, but this experience will allow us to create better prototypes in the future. There was also a problem with the mechanical tool. The slippery part was made of wooden chopsticks at first and did not slip well. But through this experience, we learned to use other materials, and as a result, it worked.

It is expected that we will solve the problem of the influx of dirt, garbage, and the odor and back flow if we actually apply the design we made. In addition, the risk of work to remove existing foreign substances can be reduced, and the manpower to be input can also be reduced. However, it is possible to reduce the amount of garbage that is normally introduced by closing the drain hole, but if the garbage accumulated on the cover is not removed, it will flow along with the water when the drain hole is opened. The problem can not be solved fundamentally, but it can be expected to be gradually solved through future improvements.

# 11. References


1) Aduino Maker Youtube(https://www.youtube.com/watch?v=lUKoB5XZAB0&t=73s)

2) Aduino Code in GitHub(https://github.com/SH-Shin/Arduino_Window-Blind)


# 12. Appendices

## Financial Ledger & Receipts

we discussed what we need, and the table below lists the items we need.

| Details | ₩ |
|---|---|
| Breadboard | 14,600 |
| Resistance10k x 10 | 1,000 |
| switch x 10 | 3,500 |
| L298N x 2 | 3,700 |
| CDS x 3 | 300 |
| HC-06 x 2 | 8,200 |
| Arduino UNO x 2 | 12,960 |
| Arduino UNO USB cable x 2 | 1,276 |
| GM31-2732 | 19,000 |
| RB35GM 21Type | 31,900 |
| Water Sensor x 2 | 4,900 |
| TY-035A | 15,600 |
| Wire x 120 | 9,340 |
| Rack, Pinion | 17,380 |

| | |
|---|---|
| Chopsticks x 450 | 8,840 |
| Tape x 2 | 7,000 |