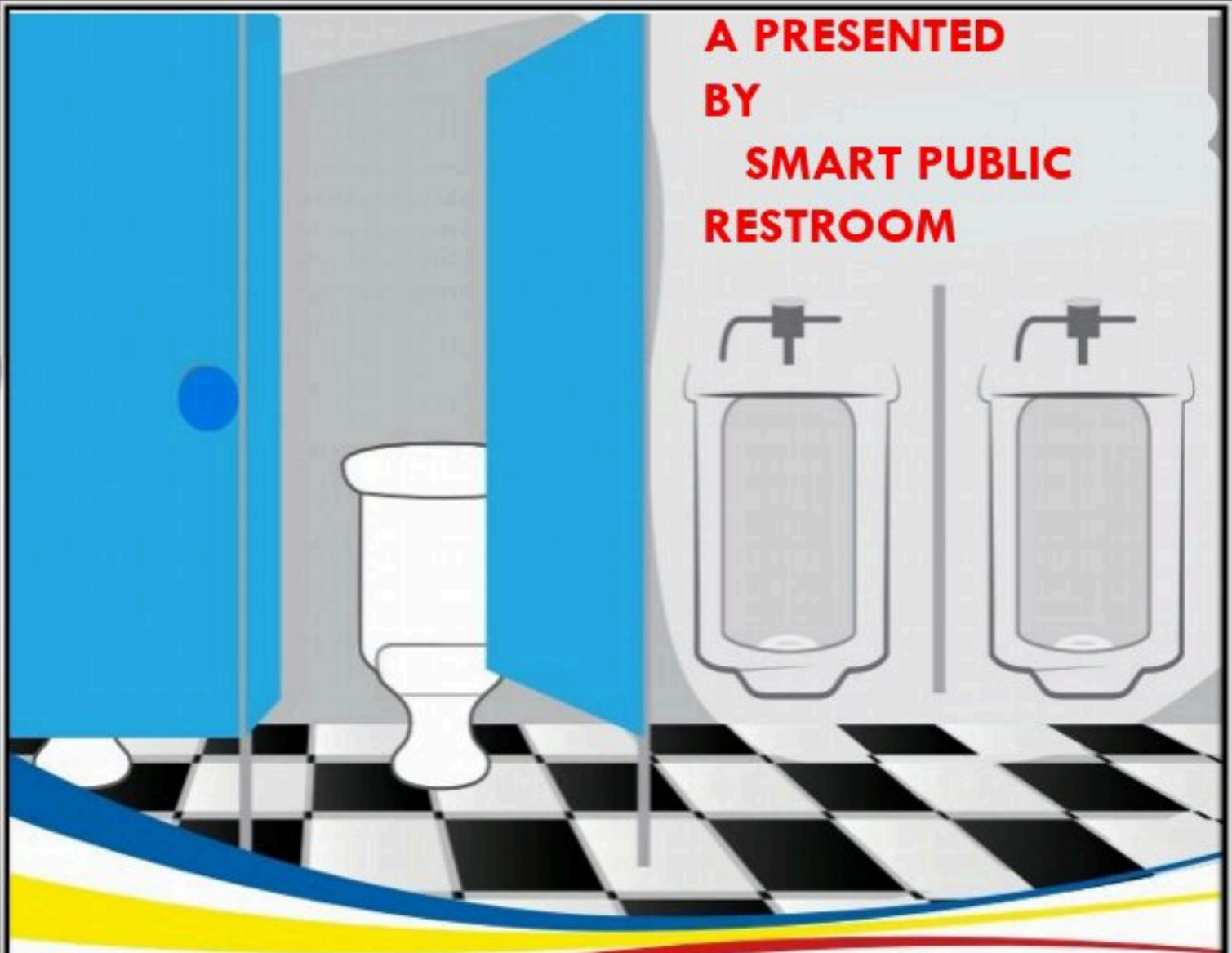

A PRESENTED BY SMART PUBLIC RESTROOM

PRESENTED BY:

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ABSTRACT

In our nation, sanitation has always been a major issue. Most significantly, this issue is not just concentrated to the rural areas but is also wide spread in urban and semi urban areas. People do not show the same level of concern when it comes to keeping the public sanitation systems clean as they show towards the ones at their homes. Right to good health and sanitation is one of the goals to be achieved as per the Millennium Development Goals of the United Nations Organisation, 2000.

However in India, the scenario of public toilets is still dismal. One of the reasons for this is that the people do not bother to clean up after they use the toilet. These places are thus the breeding grounds of bacterial germs like *Escherichia coli* and many deadly diseases. Many people sometime prefer discomfort to using these toilets.

Looking at such troubles, the decision to construct a self flushing toilet was made that simply utilizes the weight of the person using it as its working mechanism. The system consists of a platform supported on springs and the lever arrangement that flushes after use. The lever is pivoted in such a way that it will lower itself when weight is applied downward and when the load is released, this will strike the flush and hence in this way water is flushed out to clean the toilet.

The design is robust and cost effective. Sensors or any kind of electrical transducers are not required in the construction of these toilets. As the old saying goes "*cleanliness is next to godliness*", this is a public welfare project which aims to propagate a cleaner and hygienic society and hence, take our nation to the heights of glory.

INTRODUCTION

INTRODUCTION

The project **Development of a smart toilet for automatic flushing** deals with automatic cleaning of Indian toilets without requiring any human assistance. Most of the public toilets are not clean due to the irresponsible peoples who often forget to flush the toilet after using it. In India all the state and central government are allotting numerous funds for constructing public toilets. The central government under "SWACH BHARAT MISSION" has built a vast amount of new toilets to provide the citizens a healthy and hygienic environment. Therefore cleaning of public toilets is equally important as cleaning of household toilets. So we have developed a mechanism to flush the toilets automatically by utilizing the human weight. The mechanism does not require any external power or human concern. Rather, it just works mechanically utilizing the weight of the person sitting on it.

EXISTING SYSTEMS

Some automatic flushing systems do exist in the market, but they are too expensive due to their complex construction. They generally use some optical or electrical sensors to detect the presence of a person using the toilet and accordingly they operate. They are found to be used in airports, shopping malls, multiplex etc. But their use in the public toilets is not possible due to the excessive cost and frequent maintenance.

DRAWBACKS OF EXISTING SYSTEMS

- Continuous monitoring
- Battery maintenance
- Sensor requirement
- Costly

ADVANTAGES OF THE DEVELOPED MECHANISM

- No sensors or electronics involved.
- No human effort required.
- Mechanism is robust
- Economical

LITERATURE SURVEY

During the course of study, we came across various kind of toilet flushing project. The first project entitled ‘Electronic Cistern Flushing’ [1] in which the flushing is activated by electronic, pneumatic buttons or infrared sensors.

The second project entitled ‘SCPK Flushing Package’ [2] in which the flushing is activated by piezo or infra-red buttons.

The third project entitled ‘Mechanical Direct Flushing’ [3] which works without electric power but has a push button which the user may forget to press and sometimes hesitate to touch the button due to carelessness concerns.

Hence there is no such mechanical project that works complete automatically without electric power or sensor.

DESCRIPTION OF PARTS USED

DESCRIPTION OF PARTS USED

The various essential parts that make the system run are:-

- Cistern
- Platform or Base
- Supporting Stand
- Coil Compression Sofa Spring
- Bolt and Nut
- Striking Lever with a Rubber at the End

- **Cistern: -** The modern water closet or toilet utilizes a device to reserve and hold the correct amount of water required to flush the toilet bowl called cistern.

Design Considerations: Modern toilets use 6 to 9 L per flush, whereas older models were designed for flush water quantities of up to 20 L. There are different low-volume flush toilets currently available that can be used with as little as 3 L of water per flush.[4]

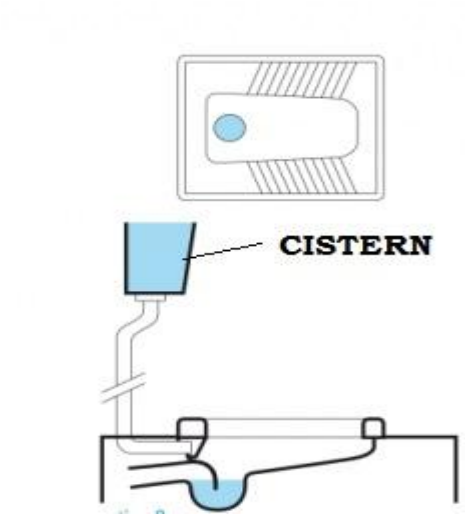
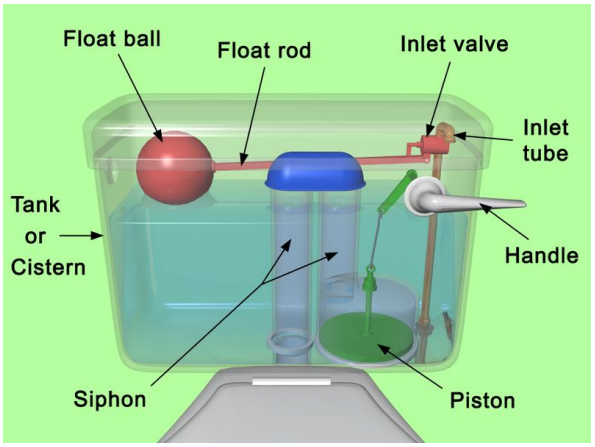


Figure 2.1: Position of Cistern above the Platform

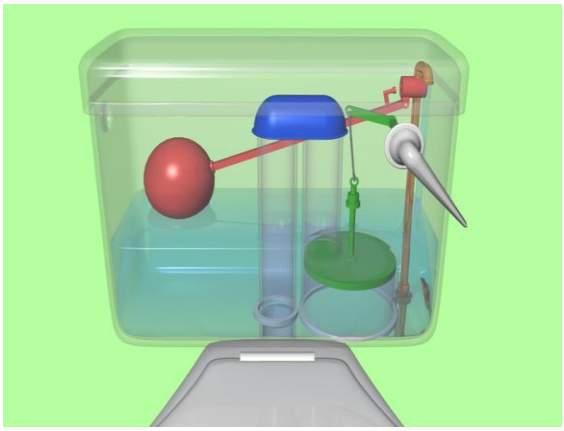
The tank contains some important parts which need to be described to understand the working [6] of a cistern.

- *Handle or button*: Its basically is a switch provided on the tank to flush when required.
- *Inlet valve:* The inlet valve controls the water supply coming into the tank. It lets water in when the tank is empty, and stops water coming in when the tank is full.
- *Float ball and float rod:* The float ball rises as the tank fills with water. As it rises, the float rod attached to it presses against the inlet valve. When the tank is full, the rod is pressing against the inlet valve hard enough to turn the water off. This stops the tank from overflowing.

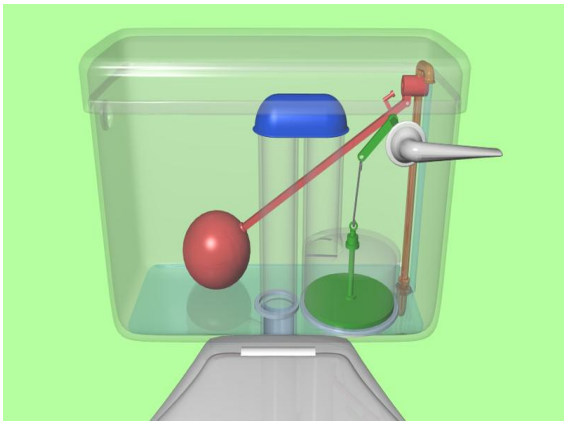
Finally the tank empties quite quickly, and the float ball floats to the bottom. That means the float rod is no longer pressing against the valve, so water begins to flow into the tank, filling it up again. The water which left the tank cleans the bowl and carries the waste with it to the septic tank.



(a)



(b)



(c)

Figures 2.2 [5]: (a) Parts of a Typically Cistern System (b) A Toilet Cistern Emptying (c) A Toilet Cistern Empty

2. **Platform or Base: -** It is a wooden base consisting of two wooden plates connected with 12 springs in 3*4 arrays. It is provided with 4 bolts and 8 nuts that constraints the platform to move only in vertical direction.

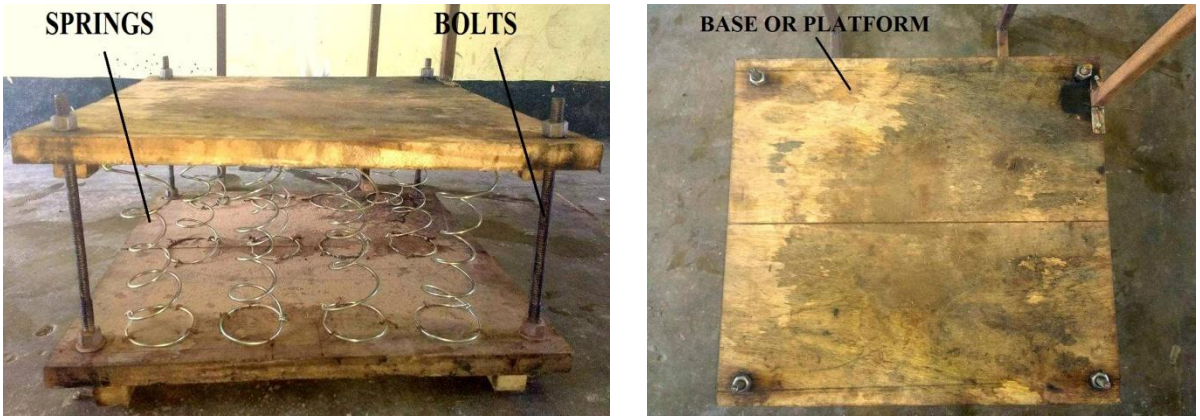


Figure2.3: Front View and Top View of the Platform

3. **Supporting Stand: -** Two square pipes that help the cistern (water reservoir) to hold 770 mm above the ground providing a potential head .This head is then converted to velocity of flow of water which is responsible for cleaning of the toilet bowl.

Figure 2.4: View of a Supporting Stand

- **Coil Compression Sofa Spring: -** The spring which is used are locally termed as sofa spring. They are selected for their physical property. They are robust in nature and have long service life. It is highly tempered steel. The following images below show the spring used and their arrangement.

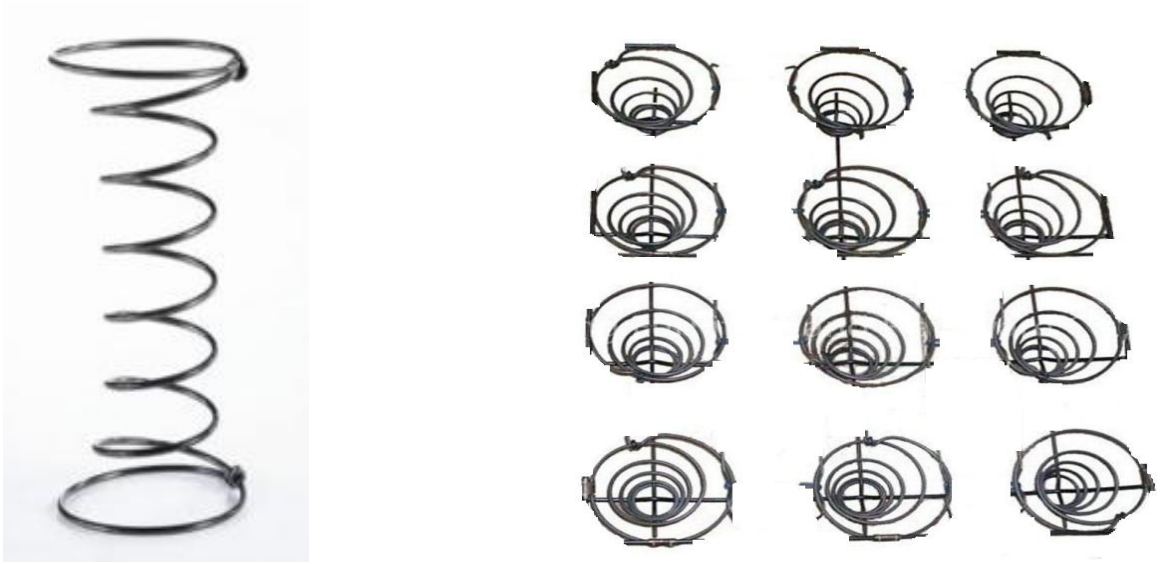


Figure 2.5: Compression Coil Spring and its Arrangement in the System

3olt and nut :- A bolt is a form of threaded fastener with an external male thread while a nut is a type of fastener with a threaded hole.There are 4 bolts used in the 4 corners of the platform to constrain the motion in one direction and nut is provided to limit the motion in upward direction.

Figure2.6: View of nut, bolt and washer in assembly

COST ANALYSIS

The total cost incurred in the model is illustrated in the table below:

Table 2.2: Cost of Model

MATERIAL	COST(Rs)
SPRING	140
CISTERN	300
BOLT	110
WOOD	500
WELDING	1000
STAINLESS STEEL SQUARE PIPES	800
MISCELLANEOUS	500
TOTAL	**3350**

CONSTRUCTION

Construction of the system is simple and efficient. It does not have any complicated arrangement. The operation of the arrangement is fully mechanical. Steps involved in fabricating are:

MAIN PARTS USED IN THE CONSTRUCTION

- Platform Making
- Cistern Fitting
- Motion Transmitting Lever

Platform Making

Platform is made of wood. It is a replica of originally used Indian toilet. In our design of platform we have used 12 numbers of springs, rectangular wood (54 x 49) cm in the figure given below. This platform is arranged by attaching 4 bolts of 9 inch length and 12 mm diameter each, these are attached at four corner of wood. In the middle of the two wood pattern springs are arranged in parallel arrangement in three rows.

Cistern Fitting

Cistern is fitted by attaching metal plate with lower part of the platform. It is given a minimum height of 760 mm. To the cistern a continuous water supply line is connected. Cistern contains a floating ball and manually pressed handle .When water in the container crosses maximum limit floating ball prevents further flowing of water in the inlet. When handle is pressed discharge of water occurs.

Motion Transmitting Lever

It is a square hollow pipe which is attached on the upper part of the platform by making a bracket and thereby screwing it up. This motion transmitting lever is connected to another small thin lever by arc welding. This thin lever is drilled and attached to the cistern frame with the help of a screw. At the end portion of the lever a synthetic rubber band is used having thickness 5 mm .The end portion of the thin lever having synthetic rubber at the end touches the handle and pressed it whenever people gets off from the platform.

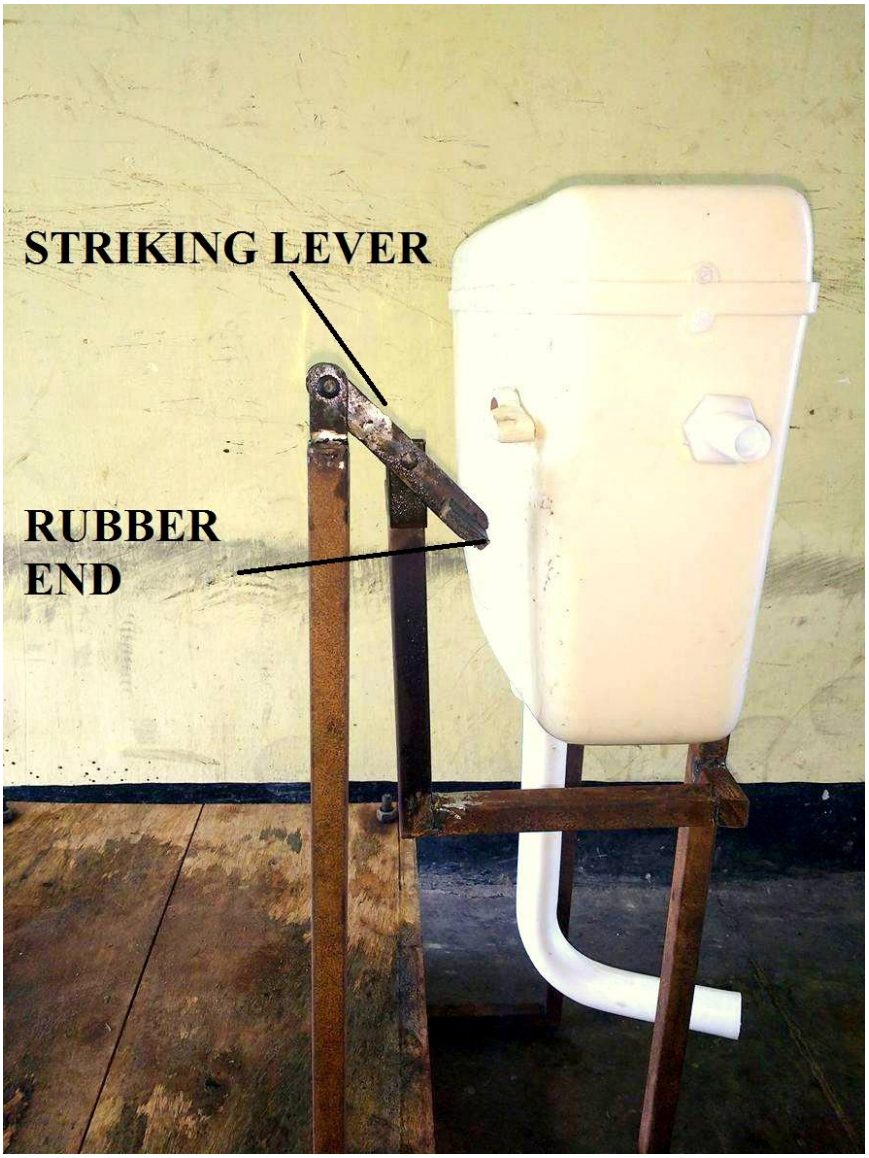


Figure 3.1: View of the Lever

WORKING OF SMART TOILET FOR AUTOMATIC FLUSHING

WORKING PRINCIPLE

The working principle of the mechanism is very simple which uses only mechanical means (such as springs, levers etc.) for its functioning. The wooden platform is consisting of two halves, one movable and the other fixed, both having springs between them. It mainly works on the principle of spring compression and expansion. When force is applied on spring, it gets compressed and after removal of the force, because of spring stiffness it provides a reaction force in opposite direction. The vertical steel pipe attached to the upper half of the base also moves up and down along with it. As a result due to lever mechanism the flexible element attached to the tip of the lever moves up crossing the cistern handle. All the arrangements work together and provide us automatic flushing from cistern.

WORKING OF EVERY ITEM USED IN OUR SYSTEM

- Platform working
- Cistern working
- Lever working

Platform Working

Platform is nothing but spring mass system arrangement. It is the main part of our developed project where people will sit for toilet and thus compressing the spring attached in it. So when the person lifts off from the platform because of spring stiffness platform will try to comeback to original position and thus allowing an upward automatic movement of the platform.

Cistern Working

The cistern contains a handle, an inlet valve and a float rod with float ball at the end. The inlet is mainly controlled by float ball whereas outlet is controlled by handle

attached on the cistern. When handle is pressed in downward direction outlet valve opens and discharge takes place.

Lever Working

There are total two levers attached on our system which do the function on the following manner:-

- *Motion transmitting lever*: Motion transmitting lever is directly attached on the upper part of platform. Upward motion of platform is first transmitted to motion transmitting lever which pushes the 2nd lever attached on it in upward direction and net effect is converted into downward direction.
- *Lever with synthetic rubber at the end*: The lever having synthetic rubber at the end is connected by bolt joint to the motion transmitting lever. The end this lever is grooved and synthetic rubber is attached which touches the handle of the cistern. Thus handle of the cistern is pushed in downward direction by rubber and providing an automatic flush from the cistern.

DIFFERENT POSTIONS OF LEVER

Following figures illustrate different load condition and their respective position of lever.

Figure 4.1: Position of Lever When Load is not applied

TABLE 5.1: Spring Stiffness Calculation

SL. NO.	FORCE (kg)	DEFLECTION (cm)	SPRING STIFFNESS(kg/cm)
1	30	5.8	5.17
2	40	7.7	5.19
3	50	9.6	5.2
4	55	10.5	5.23
5	60	11.5	5.21

Calculations:

Average spring stiffness, K_1= (5.17+5.19+5.2+5.23+5.21) ÷5 = 5.2 kg/cm

Spring stiffness of each spring, K= 5.2/12

= 0.433 kg/cm

Minimum deflection corresponding to a load of 20 kg= 20/5.2=3.85 cm

Figure 4.2: Position of Lever When Load is applied

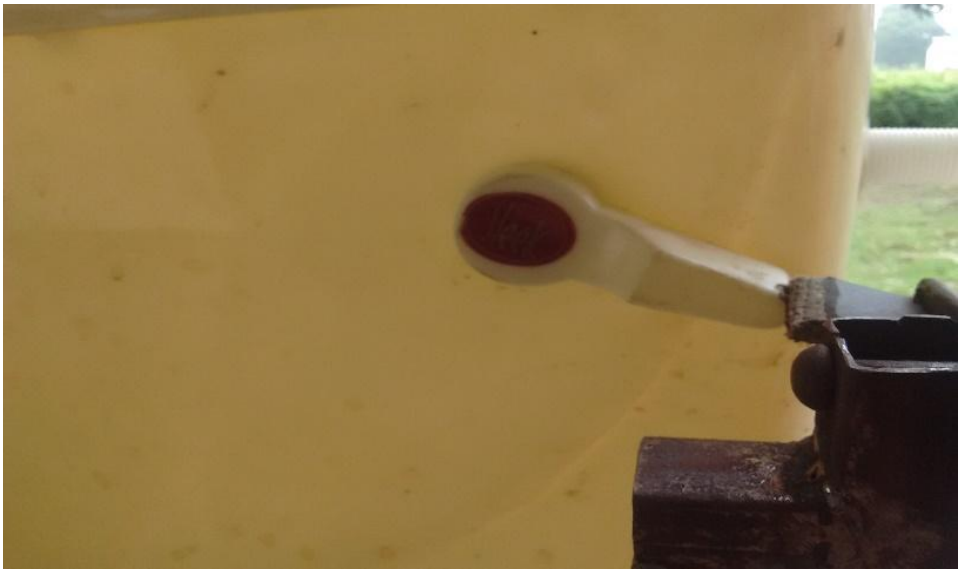


Figure 4.3: Position of Lever While the Load is removed

Flow Velocity Calculation

Table 5.2: Average Discharge Calculation

SL.NO.	DISCHARGE ($m^{3)}$	TIME TAKEN(sec)	AVERAGE TIME (sec)	RATE OF DISCHARGE(m^3/sec)
1	11×10^{-3}	12.3	60.3/5 =12.06	.000912
2		11.7		
3		11.9		
4		12.1		
5		12.3		

Cross sectional area at the outlet = $\pi/4 \times .03^2 = .000707\ m^2$

Average outlet flow velocity = Rate of discharge/Area at the outlet

= 0.129 m/s

Figure 6.2: Rear View of the Model

Figure 6.4: Left Hand Side View of the Model

REFERENCES

[1] http://www.wallgate.com/products/wc-toilet-urinal-flushing-range/electronic-cistern-flushing-range

[2] http://www.wallgate.com/products/wc-toilet-urinal-flushing-range/scpk-flushing-package-range

[3] http://www.wallgate.com/products/wc-toilet-urinal-flushing-range/mechanical-direct-flushing-range

[4] http://www.sswm.info/category/implementation-tools/wastewater-treatment/hardware/user-interface/flush-toilet

[5] http://www.sswm.info/sites/default/files/toolbox/TILLEY%20et%20al%202014%20Schematic%20of%20two%20different%20cistern%20flush%20toilets.png

[6] https://en.wikibooks.org/wiki/Wikijunior:How_Things_Work/Flush_Toilet

A brief blog for smart parking using ESP32 with camera module and some recommended a devices that makes easy to make the smart parking system

Components

Query

Process

Components

Connection

Drive API Setup

Code

Final Instruction

Search Quotes

Process

To set up a smart parking system using ESP32 with a camera module, proximity sensor, servo sensor, and display, which takes a picture of the vehicle and sends it to Google Drive and displays the available slots on the LCD, you will need to follow these steps:

Components

Gather the required components:

ESP32 board

Camera module (such as the OV7670 camera module)

Proximity sensor (such as the HC-SR04 ultrasonic sensor)

Drive API Setup

Set up the Google Drive API:

Go to the Google API Console and create a new project.

Enable the Google Drive API and create a new OAuth 2.0 client ID.

Download the JSON file with the API credentials.

Write the code: Here's some sample code that you can use as a starting point for your

Code

Copy

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```
#include <Servo.h>

#include <Wire.h>

#include "esp_camera.h"

#include <WiFi.h>

#include <HTTPClient.h>

#include <ArduinoJson.h>

#include <WiFiClientSecure.h>

#include <LiquidCrystal_I2C.h>

#define TRIG_PIN 12

#define ECHO_PIN 14

#define SERVO_PIN 27

#define LCD_ADDR 0x27

#define LCD_COLS 16
```

```
    if (!error) {

      http.beginRequest();
      http.write(request_body.c_str(), request_body.length());
      int bytes_sent = 0;
      while (bytes_sent < file_size) {
        int bytes_to_read = file_size - bytes_sent;
        if (bytes_to_read > 1024) { bytes_to_read = 1024; }
        uint8_t buffer[bytes_to_read];
        int bytes_read = file.read(buffer, bytes_to_read);
        http.write(buffer, bytes_read);
        bytes_sent += bytes_read;
      }
      http.endRequest();
      String response = http.getString();
      http.end();
    }
  }
}

void setup() {
  Serial.begin(115200);
```

```
pinMode(TRIG_PIN, OUTPUT);
pinMode(ECHO_PIN, INPUT);
myservo.attach(SERVO_PIN);
lcd.init();
lcd.backlight();
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Smart Parking");
lcd.setCursor(0, 1);
lcd.print("Initializing...");
WiFi.begin(ssid, password);
while (WiFi.status() != WL_CONNECTED) {
  delay(1000);
  Serial.println("Connecting to WiFi...");
}
Serial.println("Connected to WiFi");
camera_config_t config;
config.ledc_channel = LEDC_CHANNEL_0;
config.ledc_timer = LEDC_TIMER_0;
config.pin_d0 = 5;
config.pin_d1 = 18;
config.pin_d2 = 19;
```

```
config.pin_d3 = 21;
config.pin_d4 = 36;
config.pin_d5 = 39;
config.pin_d6 = 34;
config.pin_d7 = 35;
config.pin_xclk = 0;
config.pin_pclk = 22;
config.pin_vsync = 25;
config.pin_href = 23;
config.pin_sscb_sda = 26;
config.pin_sscb_scl = 27;
config.pin_pwdn = -1;
config.pin_reset = -1;
config.xclk_freq_hz = 20000000;
config.pixel_format = PIXFORMAT_JPEG;
if (psramFound()) {
  config.frame_size = FRAMESIZE_UXGA;
  config.jpeg_quality = 10;
  config.fb_count = 2;
} else {
  config.frame_size = FRAMESIZE_SVGA;
  config.jpeg_quality = 12;
```

```
    config.fb_count = 1;
  }
  esp_err_t err = esp_camera_init(&config);
  if (err != ESP_OK) {
    Serial.printf("Camera init failed with error 0x%x", err);
    return;
  }
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Smart Parking");
  lcd.setCursor(0, 1);
  lcd.print("Ready");
  delay(2000);
}
void loop() {
  float duration, distance;
  digitalWrite(TRIG_PIN, LOW);
  delayMicroseconds(2);
  digitalWrite(TRIG_PIN, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG_PIN, LOW);
  duration = pulseIn(ECHO_PIN, HIGH);
```

```
distance = duration * 0.034 / 2;
int available_slots = distance / 50;
if (available_slots < 0) { available_slots = 0; }
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Available slots:");
lcd.setCursor(0, 1);
lcd.print(String(available_slots));
if (available_slots > 0) {
  float angle = map(available_slots, 0, MAX_SLOTS, 0, 180);
  myservo.write(angle);
  delay(500);
  camera_fb_t* fb = NULL;
  fb = esp_camera_fb_get();
  if (!fb) {
    Serial.println("Failed to capture image");
    return;
  }
  Serial.printf("Captured image with size %u\n", fb->len);
  uploadToGoogleDrive(fb);
  esp_camera_fb_return(fb);
  delay(5000);
```

"The Ultimate Guide to Smart Parking Systems: How to Choose the Right Solution for Your Needs. Get expert advice on selecting the best parking technology for your business or municipality."

"From Parking Lots to Smart Cities: How Smart Parking Systems are Driving Sustainable Urban Development. Discover the role of smart parking in creating more livable, eco-friendly cities for the future."

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