

A PROJECT REPORT

on

"CLOUD MAKER"

submitted by

Mr. Vikas Kushwaha

Seat No :-

in partial fulfillment for the award of the degree

of

BACHELOR OF SCIENCE

in

COMPUTER SCIENCE

under the guidance of

Mrs. Swetha Iyer

Department of Computer Science



VIDYAVARDHINI'S

A. V. COLLEGE OF ARTS, K. M. COLLEGE OF COMMERCE

E. S. A. COLLEGE OF SCIENCE,

VASAI(WEST), PALGHAR-401208, MAHARASHTRA

(Sem V)

(2024-25)

ACKNOWLEDGEMENT

I would like to acknowledge my sincere thanks towards our project guide

Mrs. Swetha Iyer

for their valuable guidance and suggestions and
providing me an opportunity to do the project work in the college lab and
which made me complete the project successfully.

I am also thankful to

Head of Computer Science Department

Mrs. Srimathi Narayanan

For providing such nice guidance in form of comments and corrections.

I am thankful to and fortunate enough to get constant encouragement,
support and guidance from all teaching staff of Computer Science
which helped us in successfully completing our project work.
Also, I would like to extend our sincere esteem to all staff in laboratory
for their timely support.

By **Vikas Kushwaha,**

T.Y.BSc (Computer Science)

DECLARATION

I Vikas Kushwaha hereby declare that,

The project entitled "CLOUD MAKER" submitted in the partial fulfillment for the award of Bachelor of Science in Computer Science during the academic year **2023 - 2024** is my original work and the project has not formed the basis for the award of any degree, associate ship, fellowship or any other similar titles.

Signature of the Student:

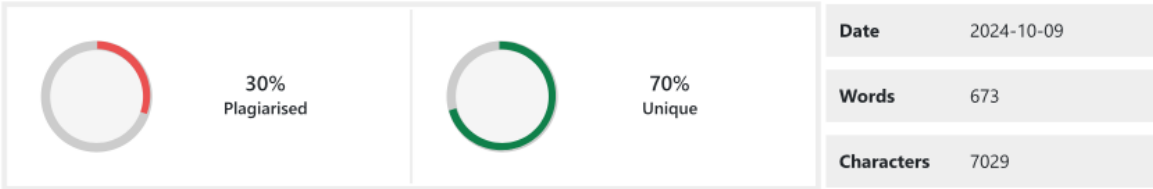
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PLAGARISM REPORT



PLAGIARISM SCAN REPORT



Content Checked For Plagiarism

```
package main

import (
    "archive/zip"
    "crypto/subtle"
    "fmt"
    "io"
    "log"
    "net/http"
    "os"
    "path/filepath"
    "reflect"
)

func processAction(w http.ResponseWriter, r *http.Request, action string) *ServerError {
    switch action {
    default: return &ServerError{nil, "Invalid Action", 400}
    case "cut": return addSelectionToBuffer(w, r, cutBuffer)
    case "copy": return addSelectionToBuffer(w, r, copyBuffer)
    case "cancel-cut": return deleteBuffer(w, r, cutBuffer)
    case "cancel-copy": return deleteBuffer(w, r, copyBuffer)
    case "cut-paste": return moveFilesFromBuffer(w, r, cutBuffer)
    case "copy-paste": return pasteFilesFromBuffer(w, r, copyBuffer)
    case "newdir": return createNewDirectory(w, r)
    case "delete": return deleteSelectedFiles(w, r)
    }
}

...
```

GANTT CHART

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INTRODUCTION

TITLE OF THE PROJECT: CLOUD MAKER

SYNOPSIS:

A cloud storage in distributed fashion.

This system is intended to be an alternative to online storage providers like Google Drive. It's a distributed model where the user physically owns the resources in his/her own house. Unlike centralised cloud providers, the user is given a small computing device, preferably an SBC like Raspberry Pi which acts as an 'Endpoint Device' and a gateway to access user's various media devices like Pen Drives, Hard Drives, Memory Cards, and any other storage media that can potentially interface with the Endpoint Device (Raspberry Pi, in our case.)

The user is intended to connect his Endpoint device using a Web Proxy which will be automatically setup acting as a Internet Gateway to his Endpoint Device. The Raspberry Pi will be primary product for the user that will act as a Cloud Storage Provider. He can access this Cloud Storage from any computer that has an Internet Connection. The user will be provided with a Web Interface from where he can view and manage all his Files and Folders.

In summary, it turns the user's own storage devices into a cloud making it convenient for the user to access his storage from anywhere in the world.

LIMITATIONS OF CURRENT SYSTEM

The cloud storage space have now become mainstream. People used store their files and data backups on External Storage Devices like Pend Drives and Hard Drives. However, these days we just upload all our content to cloud storage like Google Drive. This poses many problems and risks surrounding around Data Privacy, Security and Ownership of Data. It's now a well known fact that companies sell the User Data they harvest to other companies in exchange of profits.

There's also a problem with the costs involved. Cloud Storage Drives are extremely Expensive. Just for instance Google Cloud charges you Rs. 130 per month in India for a 100GB storage space for a single user. Assuming a year is just 10 months, it becomes Rs. 1300 for an year an Rs. 13,000 for a decade. That's actually quiet expensive for just a 100GB of storage space. A lot of people aren't really interested in spending a lot of money on such storage options as they often simply can't afford it. They will usually try to limit themselves by just using the limited storage space that is provided per account for free. 15 GigaBytes in case of Google Drive.

ADVANTAGES OF PROPOSED SYSTEM

This system tries to solve many of the problems with Cloud Storage providers, as mentioned in the previous section that revolve around data privacy and security and also costs.

Cloud Maker ensures that the data stays on user's physical medium ensuring that the user absolutely owns the data and no one else on the internet has access to it. Unless ofcourse, they had physical access to the device itself. This is incredibly useful for storing highly sensitive documents and other details that can be detrimental for the user if fallen onto wrong hands. Being distributed in nature, it also minimizes the damage of data breaches. If a hacker do succeed in any case breaching the cloud storage, they only breache one device rather than breaching the whole community. This can be quite important for Government officials storing classified documents on the storage devices

Cloud Maker also makes it feasible for users to have large cloud storage space. As the user can simply use his/her own storage devices as a cloud store. The user can buy 1 TeraByte hard drive which will usually costs around Rs. 3,000 to 5,000 and can easily last for 6+ years and even a decade. This makes the costs and scale feasible for the user. This is especially useful for professionals like Video Editors and Graphics designers that often have Adboe project files spanning over multiple GigaBytes. They can't carry their hard drive everywhere and they often have to access various of their previous workd sporadically even for new projects.

TOOLS AND TECHNIQUES

This system involves an Endpoint Server and a client computer. For the endpoint server, let's assume a Raspberry Pi Model 3B flashed with a Linux Operating System like Debian 10 for ARM. This device primarily runs two things, a web server and a set of scripts for managing storage devices. It then forwards its Web Server Port to a VPS server using SSH. This VPS server has a pre-registered domain name and acts as a proxy to the Raspberry Pi Endpoint making it accessible through the internet.

Initially, two shell scripts are started in the background – automountd and automount-clean. automountd monitors all the USB ports of Raspberry Pi and automatically mounts any storage device as soon as it's connected to it. It mounts them at a specific mount point (/media/user) which is later used by the Web Server. automount-clean monitors the mount point and cleans any dangling directories left over of unmount storage devices.

The Web Server makes the mount point accessible to other computers by providing a web interface for browsing and managing files. The Web Interface is essentially a File Manager. The Web Server is written in Go Programming Language and uses http router from standard library which provides routing functionality and html/template (Go's built-in template engine) which provides the building blocks of the web interface.

The Web Interface can be accessed through any computer or mobile device. The user can freely upload, download, or share files from his media device.

REQUIREMENT SPECIFICATION

1. Hardware Requirements:

For Endpoint Server,

- Raspberry PI Model B+ or newer
- 16GB Memory Card
- External Storage Drives of User Preferred Size

For Client Device,

- Connection to Endpoint Raspberry Pi Server (LAN / WAN)

2. Software Requirements:

For Endpoint Server,

- OS: Debian Raspi Linux
- Shell: Bash
- Programming Language: Go

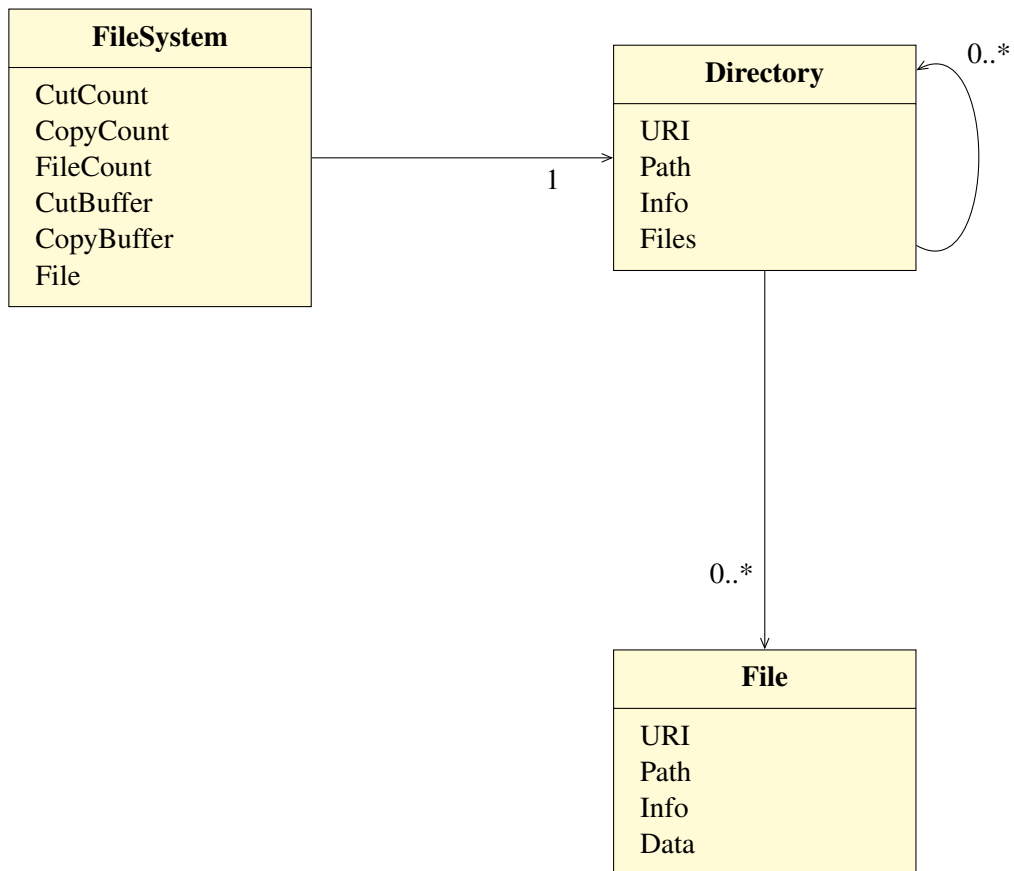
For Client Device,

- Any OS with latest Web Browser

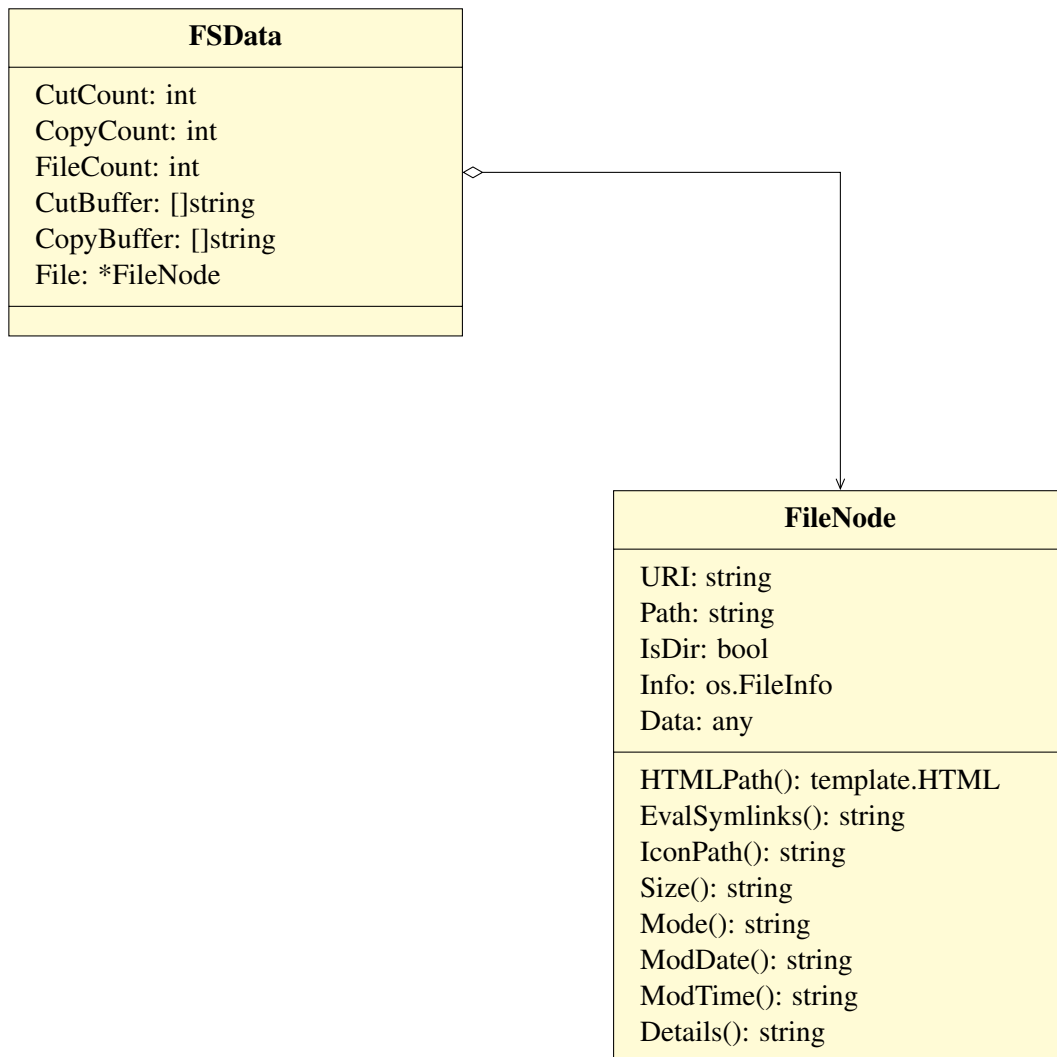
EVENT TABLE

Event	Trigger	Source	Activity	Response	Destination
Cut Files	User clicks on Cut Button	User	Files are added to Cut Buffer	Files in Cut Buffer	Endpoint Server
Copy Files	User clicks on Copy Button	User	Files are added to Copy Buffer	Files in Copy Buffer	Endpoint Server
Paste from Cut Buffer	User clicks on Paste button	User	Files are moved from Cut Buffer	Files Moved	Endpoint Server
Paste from Copy Buffer	User clicks on Paste button	User	Files are copied from Copy Buffer	Files Copied	Endpoint Server
Delete Files	User clicks on Delete Button	User	Selected Files are set to deletion	Confirm Deletion	Endpoint Server
Upload Local Files	User clicks on Upload Button	User	File Browser is opened for selection	User submits files	User
Download Remote Files	Server gets Download Requests	Endpoint Server	Server ZIPs requested file and sends to user	Compressed File recieved	User
Create Folder	User enters New Folder Name	User	New Folder is created on the system	Folder is shown	Endpoint Server

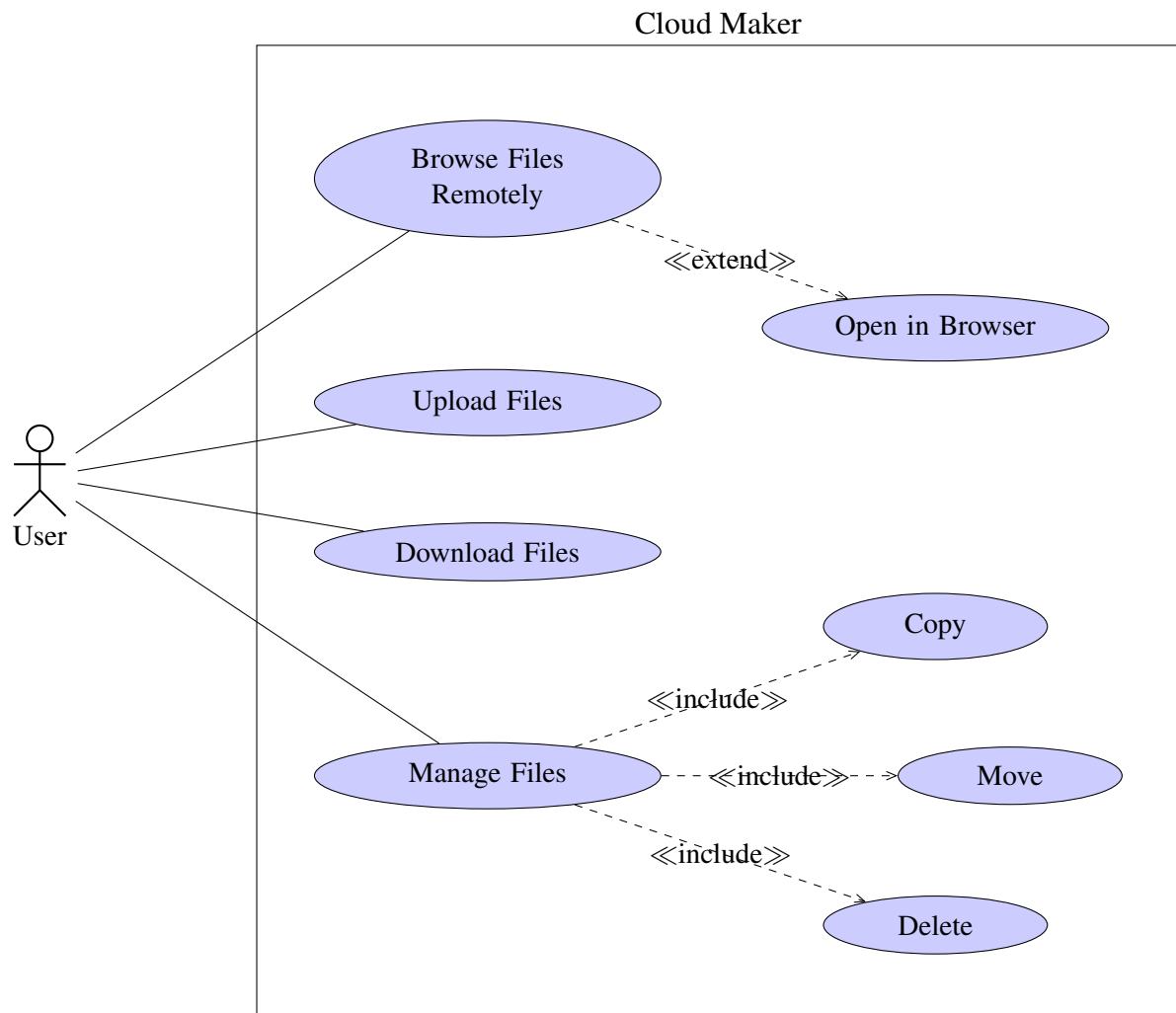
ER DIAGRAM



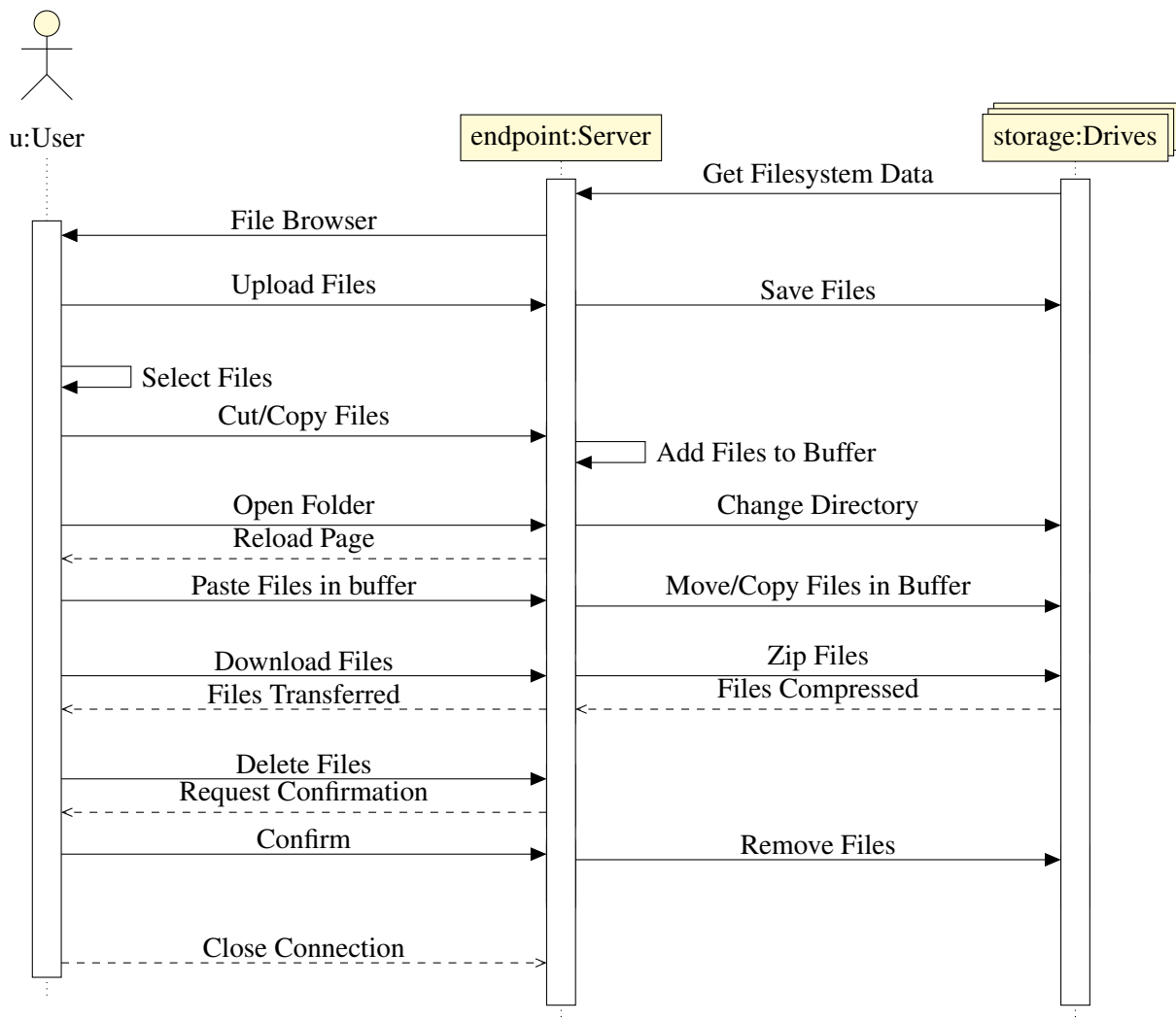
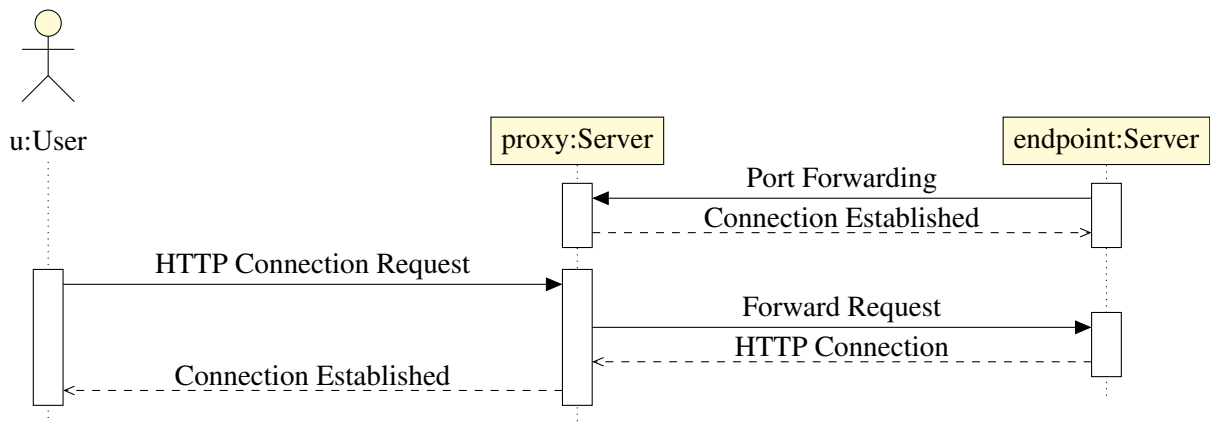
CLASS DIAGRAM



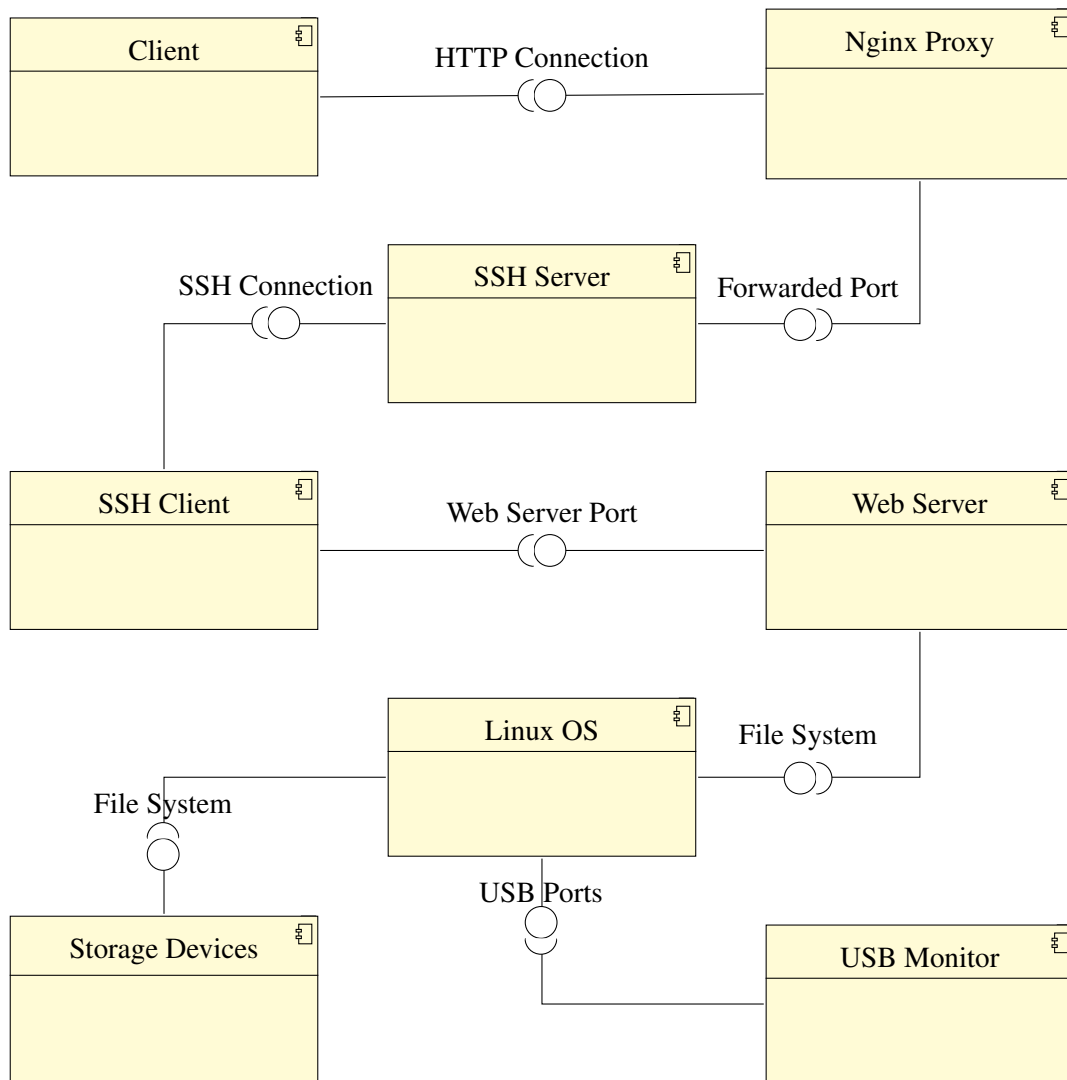
USE CASE DIAGRAM



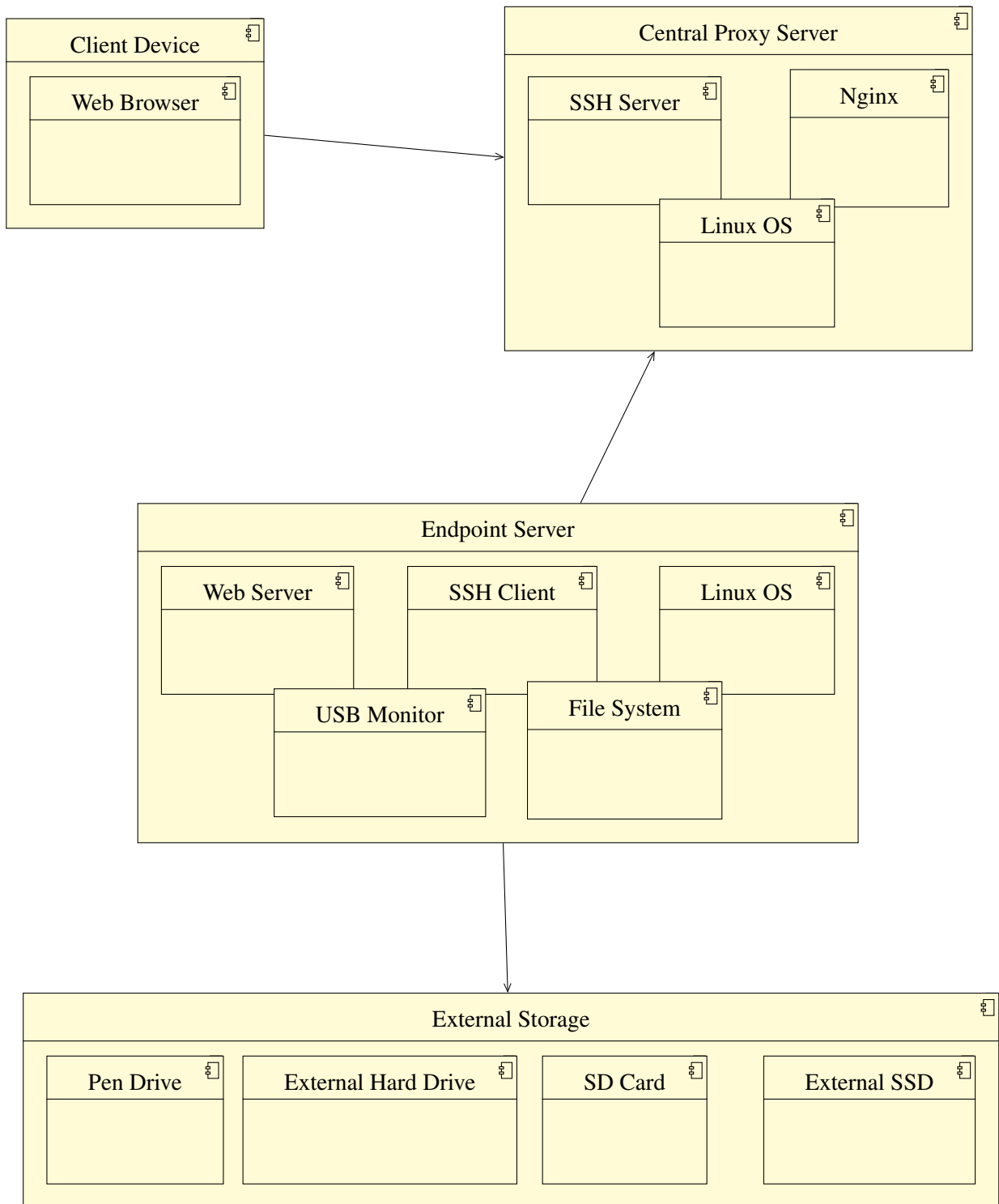
SEQUENCE DIAGRAM



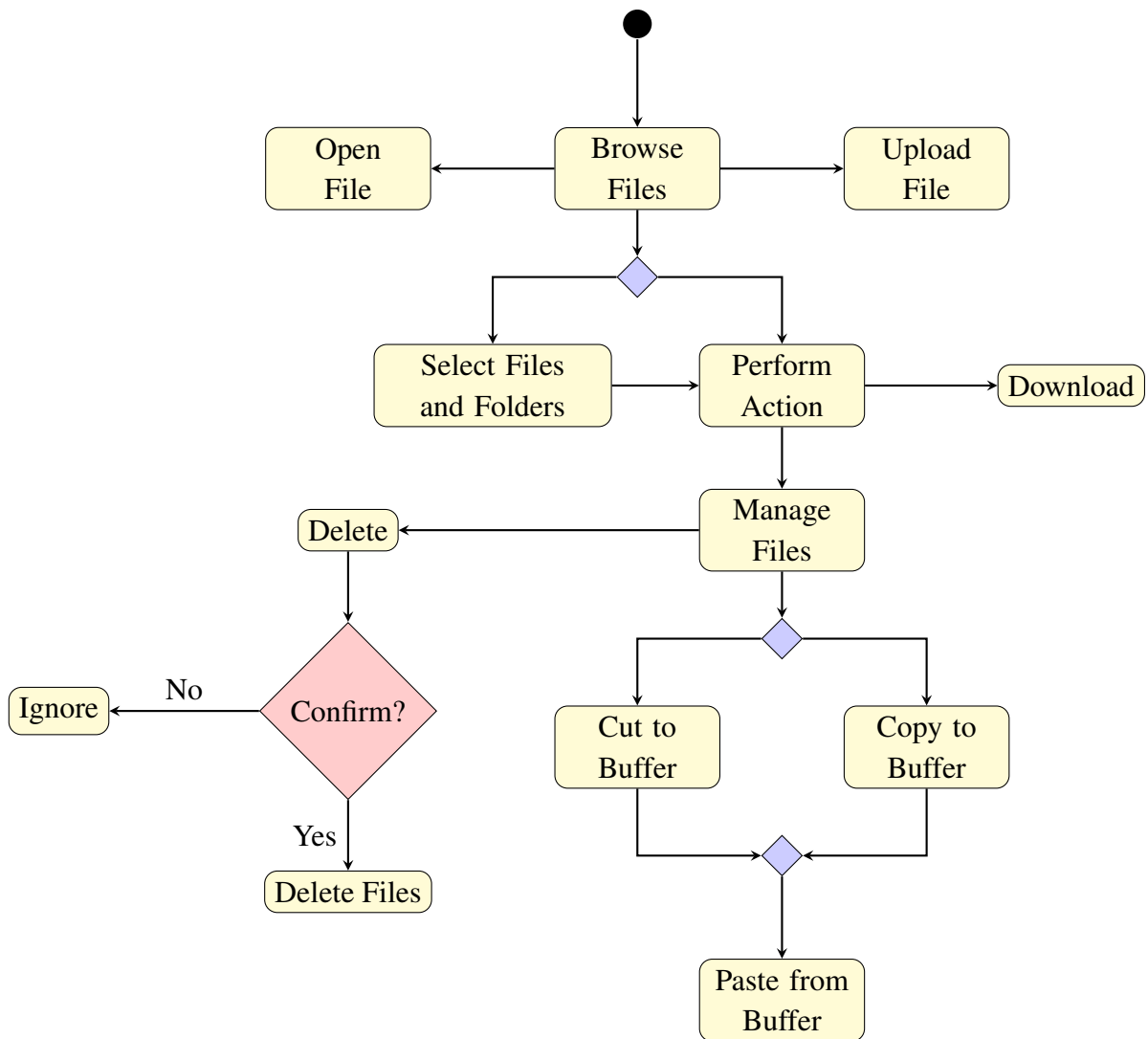
COMPONENT DIAGRAM



DEPLOYMENT DIAGRAM



ACTIVITY DIAGRAM



DATABASE

Representation of File Metadata in File System.

Attribute	Data Type	Size	Retrieval
Name	Chars	255 Bytes	Primary Key
Permissions	Octal	4 Bytes	Not Null
User UID	Integer	4 Bytes	Not Null
Group GID	Integer	4 Bytes	Not Null
Modification Time	Time	4 Bytes	Not Null

SYSTEM IMPLEMENTATION

SERVER.GO

```
package main
```

```
import (  
    "archive/zip"  
    "crypto/subtle"  
    "fmt"  
    "io"  
    "log"  
    "net/http"  
    "os"  
    "path/filepath"  
    "reflect"  
)
```

```
func processAction(w http.ResponseWriter, r *http.Request, action string) *ServerError {  
    switch action {  
        default: return &ServerError{nil, "Invalid Action", 400}  
        case "cut": return addSelectionToBuffer(w, r, cutBuffer)  
        case "copy": return addSelectionToBuffer(w, r, copyBuffer)  
        case "cancel-cut": return deleteBuffer(w, r, cutBuffer)  
        case "cancel-copy": return deleteBuffer(w, r, copyBuffer)  
        case "cut-paste": return moveFilesFromBuffer(w, r, cutBuffer)  
        case "copy-paste": return pasteFilesFromBuffer(w, r, copyBuffer)  
        case "newdir": return createNewDirectory(w, r)  
        case "delete": return deleteSelectedFiles(w, r)  
    }  
}
```

```
func viewHandler(w http.ResponseWriter, r *http.Request) *ServerError {  
    var err error  
    var serr *ServerError  
    for k, v := range r.URL.Query() {  
        switch k {  
            default: http.Redirect(w, r, r.URL.Path, 302)  
        }  
    }  
}
```

```

        case "action": return processAction(w, r, v[0])
    }
}
fileNode, serr := getFileNode(r.URL.Path)
if serr != nil {
    return serr
}
if fileNode.Info.Mode() & os.ModeSymlink != 0 {
    fileURI := fileNode.URI
    target := ""
    target, fileNode, err = fileNode.EvalSymlinks()
    if err != nil {
        if !os.IsNotExist(err) {
            return &ServerError{err, "", 500}
        }
        if len(target) != 0 {
            return &ServerError{err, fileURI+": broken link to '"+target+"'",
                404}
        } else {
            return &ServerError{err, fileURI+": Inaccessible link", 404}
        }
    }
}
}
if !fileNode.IsDir {
    http.ServeFile(w, r, fileNode.Path)
    return nil
}
dirList, err := getDirList(fileNode.Path, "name", true, true)
if err != nil {
    return &ServerError{err, "", 404}
}
cutBuf, err := readBuffer(cutBuffer)
if err != nil {
    return &ServerError{err, "", 500}
}
copyBuf, err := readBuffer(copyBuffer)
if err != nil {
    return &ServerError{err, "", 500}
}
fileNode.Data = dirList

```

```

err = renderTemplate(w, "viewDirList", &FSDData{
    CutCount: len(cutBuf),
    CutBuffer: cutBuf,
    CopyCount: len(copyBuf),
    CopyBuffer: copyBuf,
    FileCount: len( dirList ),
    File: fileNode,
})
if err != nil {
    return &ServerError{err, "", 500}
}
return nil
}

func downloadHandler(w http.ResponseWriter, r *http.Request) *ServerError {
    fmt.Printf ("%s\n", r.Form)
    fileNode, files, serr := getSelectedNodes(r)
    if serr != nil {
        return serr
    }
    if len( files ) == 1 && !files [0].IsDir {
        sendFile(w, r, files [0].Path)
        return nil
    }
    zipName := fileNode.Info.Name() + ".zip"
    target := "/tmp/cloud/" + zipName

    archive, err := os.Create( target )
    if err != nil {
        return &ServerError{err, "", 500}
    }
    defer archive.Close()

    zipWriter := zip.NewWriter(archive)
    defer zipWriter.Close()

    for _, file := range files {
        err := addToZip( file.Path, zipWriter )
        if err != nil {

```

```

        return &ServerError{err, "", 500}
    }
}
zipWriter.Close()
sendFile(w, r, target, zipName)
return nil
}

func uploadHandler(w http.ResponseWriter, r *http.Request) *ServerError {
    fileNode, serr := getFileNode(r.URL.Path)
    if serr != nil {
        return serr
    }
    r.ParseMultipartForm(65536)
    formData := r.MultipartForm

    for _, handler := range formData.File["attachments"] {
        fmt.Printf("%v\n", handler.Header)
        fmt.Println(handler.Filename, ":", handler.Size)
        file, err := handler.Open()
        if err != nil {
            return &ServerError{err, "", 500}
        }
        defer file.Close()
        filepath := filepath.Join(fileNode.Path, handler.Filename)
        fmt.Printf("Saving to %v...", filepath)
        f, err := os.OpenFile(filepath, os.O_WRONLY|os.O_CREATE, 0666)
        if err != nil {
            return &ServerError{err, "", 500}
        }
        defer f.Close()
        io.Copy(f, file)
        fmt.Println("Saved.")
    }
    http.Redirect(w, r, "/view/" + fileNode.URI, 303)
    return nil
}

```



```

func fileHandler (w http.ResponseWriter, r *http.Request) *ServerError {
    fileNode, serr := getFileNode(r.URL.Path)
    if serr != nil {
        return serr
    }
    if fileNode.IsDir {
        return &ServerError{nil, "File not Found.", 404}
    }
    http.ServeFile(w, r, fileNode.Path)
    return nil
}

```

```

func handler(w http.ResponseWriter, r *http.Request) *ServerError {
    if r.URL.Path != "/" {
        return &ServerError{nil, "Invalid URL", 404}
    }
    http.Redirect(w, r, "view", 303)
    return nil
}

```

```

type httpHandler func(http.ResponseWriter, *http.Request) *ServerError

```

```

func (fn httpHandler) ServeHTTP(w http.ResponseWriter, r *http.Request) {
    username, password, ok := r.BasicAuth()
    if !ok {
        w.Header().Add("WWW-Authenticate", "Basic realm=\"restricted\",
            charset=\"UTF-8\"")
        http.Error(w, "Basic Auth Missing.", 401)
        return
    }
}

```

```

realUsername, err := readData("username")
if err != nil {
    http.Error(w, "Couldn't retrieve username from server.", 500)
}
realPassword, err := readData("password")
if err != nil {
    http.Error(w, "Couldn't retrieve password from server.", 500)
}

```

```

    }
    usernameMatch := ( subtle .ConstantTimeCompare([]byte(username[:]),
        realUsername [:]) == 1)
    passwordMatch := ( subtle .ConstantTimeCompare([]byte(password[:]),
        realPassword [:]) == 1)

    if !usernameMatch || !passwordMatch {
        w.Header().Set("WWW-Authenticate", "Basic realm=\"restricted\",
            charset=\"UTF-8\"")
        http .Error(w, "Unauthorized", http .StatusUnauthorized )
        return
    }

    if serr := fn(w, r); serr != nil {
        if serr .Err != nil {
            fmt .Printf ("\\n\\nError Type:", reflect .TypeOf(serr .Err))
            fmt .Printf ("Error Message:", serr .Error ())
        }
        if serr .Message == "" {
            serr .Message = "Internal Server Error"
        }
        http .Error(w, serr .Message, serr .Status )
    }
}

func main() {
    fileServer := http .FileServer (http .Dir("./ static "))
    http .Handle("/", httpHandler(handler))
    http .Handle("/view/", httpHandler(viewHandler))
    http .Handle("/upload/", httpHandler(uploadHandler))
    http .Handle("/download/", httpHandler(downloadHandler))
    http .Handle("/ file /", httpHandler( fileHandler ))
    http .Handle("/ static /", http .StripPrefix ("/ static /", fileServer ))
    fmt .Printf ("\\nServer Listening on :8080")
    log .Fatal (http .ListenAndServe(":8080", nil))
}

```

HELPERS.GO

```
package main
```

```
import (  
    "errors"  
    "fmt"  
    "net/http"  
    "net/url"  
    "os"  
    "os/user"  
    "path/filepath"  
    "regexp"  
    "strings"  
)
```

```
type ServerError struct {  
    Err error  
    Message string  
    Status int  
}
```

```
func (e *ServerError) Error() string { return e.Err.Error() }  
func (e *ServerError) Unwrap() error { return e.Err }
```

```
func getFileNode(URL string) (*FileInfo, *ServerError) {  
    path, err := url.PathUnescape(URL)  
    if err != nil {  
        return nil, &ServerError{err, "", 500}  
    }  
    p := strings.Split(path, "/")  
    fileURI := strings.Trim(strings.Join(p[2:], "/"), "/")  
    filePath := filepath.Join(homeDir, fileURI)  
  
    fileInfo, err := os.Lstat(filePath)  
    if err != nil {  
        if errors.Is(err, os.ErrNotExist) {  
            return nil, &ServerError{err, fileURI+" not found", 404}  
        }  
    }  
}
```

```

    return nil, &ServerError{err, "", 500}
}

return &FileNode{
    Path: filePath,
    URI: fileURI,
    IsDir: fileInfo.IsDir(),
    Info: fileInfo,
}, nil
}

var filePattern = regexp.MustCompile(`^--file--entry--(.+)$`)

func getSelectedNodes(r *http.Request) (*FileNode, []*FileNode, *ServerError) {
    fileNode, e := getFileNode(r.URL.Path)
    if e != nil {
        return nil, nil, e
    }
    r.ParseMultipartForm(65536)
    fmt.Println(r.Form)
    var fileNames []string
    for key := range r.Form {
        if match := filePattern.FindStringSubmatch(key); len(match) > 1 {
            fileNames = append(fileNames, match[1])
        }
    }
    fmt.Printf("FileNames: %s\n", fileNames)
    if len(fileNames) == 0 {
        return fileNode, []*FileNode{fileNode}, nil
    }

    files := make([]*FileNode, len(fileNames))
    for i, fileName := range fileNames {
        fileNode, e := getFileNode(filepath.Join(r.URL.Path, fileName))
        if e != nil {
            return fileNode, nil, e
        }
        files[i] = fileNode
    }
}

```

```

    return fileInfo, files, nil
}

func sendFile(w http.ResponseWriter, r *http.Request, info ... string) {
    fmt.Printf("info: %s\n", info[:])
    if len(info) < 2 {
        info = append(info, filepath.Base(info[0]))
    }
    w.Header().Set("Content-Disposition", "attachment; filename="+info[1])
    http.ServeFile(w, r, info[0])
}

func addSelectionToBuffer(w http.ResponseWriter, r *http.Request, bufferPath
    string) *ServerError {
    _, files, e := getSelectedNodes(r)
    if e != nil {
        return e
    }
    buffer, err := readBuffer(bufferPath)
    if err != nil {
        return &ServerError{err, "", 500}
    }
    buff, err := os.OpenFile(bufferPath,
        os.O_APPEND|os.O_WRONLY|os.O_CREATE, 0600)
    if err != nil {
        return &ServerError{err, "", 500}
    }
    var fileURI string

    writeToBuffer:
    for _, file := range files {
        fileURI = strings.Trim(file.URI, "/")
        for _, line := range buffer {
            if strings.Trim(line, "/") == fileURI {
                continue writeToBuffer
            }
        }
        if file.IsDir {

```

```

        fileURI += "/"
    }
    buff.WriteString("/") + fileURI + "\r\n")
}

http.Redirect(w, r, r.URL.Path, 303)
return nil
}

func deleteBuffer(w http.ResponseWriter, r *http.Request, bufferPath string)
    *ServerError {
    err := os.Remove(bufferPath)
    if err != nil {
        return &ServerError{err, "", 500}
    }
    http.Redirect(w, r, r.URL.Path, 303)
    return nil
}

func moveFilesFromBuffer(w http.ResponseWriter, r *http.Request, bufferPath
    string) *ServerError {
    fileNode, serr := getFileNode(r.URL.Path)
    if serr != nil {
        return serr
    }
    if !fileNode.IsDir {
        return &ServerError{nil, "Cannot move file , destination is not a
            directory", 400}
    }
    buffer, err := readBuffer(bufferPath)
    if err != nil {
        return &ServerError{err, "", 500}
    }
    for _, line := range buffer {
        err := copyTo(filepath.Join(homeDir, line), fileNode.Path)
        if err != nil {
            return &ServerError{err, "", 500}
        }
    }
}

```

```

    }
    deleteBuffer(w, r, bufferPath)
    return nil
}

func pasteFilesFromBuffer(w http.ResponseWriter, r *http.Request, bufferPath
    string) *ServerError {
    fileNode, serr := getFileNode(r.URL.Path)
    if serr != nil {
        return serr
    }
    if !fileNode.IsDir {
        return &ServerError{nil, "Cannot copy files , destination is not a
            directory", 400}
    }
    buffer, err := readBuffer(bufferPath)
    if err != nil {
        return &ServerError{err, "", 500}
    }
    fmt.Printf("Buffer content: %s\n", buffer)
    for _, line := range buffer {
        err := copyTo(filepath.Join(homeDir, line), fileNode.Path)
        if err != nil {
            return &ServerError{err, "", 500}
        }
    }
    deleteBuffer(w, r, bufferPath)
    return nil
}

func createNewDirectory(w http.ResponseWriter, r *http.Request) *ServerError {
    fileNode, serr := getFileNode(r.URL.Path)
    if serr != nil {
        return serr
    }
    dirname := strings.TrimSpace(r.FormValue("newdir"))
    msg := "Requested to create directory " + dirname + " in " + fileNode.URI + "\n"
    if !fileNode.IsDir {

```

```

        msg = "Cannot create directory , the given destination is a file.\n" + msg
        return &ServerError{nil, msg, 400}
    }
    path := filepath.Join(fileNode.Path, dirname)
    isExist, err := fileExists(path)
    if isExist {
        msg = "Cannot create directory , a file with given name already exists.\n" +
            msg
        return &ServerError{nil, msg, 400}
    }
    err = os.Mkdir(path, 0755)
    if err != nil {
        return &ServerError{err, "", 500}
    }
    http.Redirect(w, r, r.URL.Path, 303)
    return nil
}

```

```

var (
    homeDir = "/media/"
    tempDir = "/tmp/cloud/"
    cutBuffer = filepath.Join(tempDir, "cut_buffer")
    copyBuffer = filepath.Join(tempDir, "copy_buffer")
)

```

```

func init() {
    err := os.MkdirAll(tempDir, 0755);
    if err != nil {
        panic(err)
    }
    mountpoint := os.Getenv("CLOUD_MAKER_HOME")
    if mountpoint != "" {
        isExist, err := fileExists(mountpoint)
        if err != nil {
            panic(err)
        }
        if isExist {
            homeDir = mountpoint
        }
    }
}

```



```

    }
    return
}

u, err := user.Current()
if err != nil {
    panic(err)
}
homeDir += u.Username
}

func blockAction(w http.ResponseWriter, r *http.Request, action string)
    *ServerError {
    msg := ""
    _, files, serr := getSelectedNodes(r)
    if serr != nil {
        return serr
    }
    msg += "The " + action + " operation is currently disabled for testing and
        security reasons.\n"
    msg += "You requested to " + action + " following files :-\n\n"
    for _, file := range files {
        msg += file.Path + "\n"
    }
    fmt.Fprintf(w, msg)
    return nil
}

func deleteSelectedFiles (w http.ResponseWriter, r *http.Request) *ServerError {
    // return blockAction(w, r, "delete")
    fileName, files, serr := getSelectedNodes(r)
    if serr != nil {
        return serr
    }
    for _, file := range files {
        if file.Path == homeDir {
            return &ServerError{nil, "Cannot delete root directory.", 400}
        }
    }
}

```

```

    fmt.Printf("Deleting: %s\n", file.Path)
    err := os.RemoveAll(file.Path)
    if err != nil {
        return &ServerError{err, "", 500}
    }
    fmt.Println("Deleted.")
}
isExist, err := fileExists(fileNode.Path)
if err != nil {
    return &ServerError{err, "", 500}
}
if !isExist {
    http.Redirect(w, r, "/view/" + filepath.Dir(fileNode.URI), 303)
} else {
    http.Redirect(w, r, "/view/" + fileNode.URI, 303)
}
return nil
}

```

FILES.GO

```
package main
```

```

import (
    "archive/zip"
    "bufio"
    "io"
    "os"
    "fmt"
    "html/template"
    "net/http"
    "path/filepath"
    "sort"
    "strconv"
    "strings"
    // "syscall"
)

```

```
type MalformedLinkError struct {
```

```

    Link    string
    Target  string
}

func (e *MalformedLinkError) Error() string { return fmt.Sprintf("%s: broken link
    to %s", e.Link, e.Target) }

type FileNode struct {
    URI      string
    Path     string
    IsDir    bool
    Info     os.FileInfo
    Data     any
}

func (fileNode *FileNode) HTMLPath() template.HTML {
    var htmlpath string
    htmlpath += '<a href="/view/' + "">' + "Home" + '</a>'
    p := strings.Split(fileNode.URI, string(os.PathSeparator))
    for i, dir := range p {
        if p[i] != "" {
            htmlpath += '> <a href="/view/' + filepath.Join(p[:i+1]...) + "">' + dir
                + '</a>'
        }
    }
    return template.HTML(htmlpath)
}

func (fileNode *FileNode) EvalSymlinks() (string, *FileNode, error) {
    var err error
    target, path, err := linkDeref(fileNode.Path);
    if err != nil {
        if os.IsNotExist(err) {
            return "", nil, err
        }
        return target, nil, err
    }
    fileInfo, err := os.Stat(path)
    if err != nil {
        return target, nil, err
    }

```

```

    }
    return target , &FileNode{
        Path: path,
        URI: strings.TrimPrefix(path, homeDir),
        Info: fileInfo ,
        IsDir: fileInfo.IsDir(),
    }, nil
}

func (fileNode *FileNode) IconPath() (string, error) {
    var icon string;
    switch fileNode.Info.Mode() & os.ModeType {
    default: icon = "file-emark.svg"
    case os.ModeIrregular: icon = "question.svg"
    case os.ModeDir: icon = "folder2.svg"
    case os.ModeSymlink:
        _, fileNode, err := fileNode.EvalSymlinks()
        if err != nil {
            if !os.IsNotExist(err) {
                return "", err
            }
            icon = "link-broken-45deg.svg"
        } else {
            if fileNode.IsDir {
                icon = "folder-symlink.svg"
            } else {
                icon = "link-45deg.svg"
            }
        }
    }
    return filepath.Join("/static/icons/bs/files", icon), nil
}

func (fileNode *FileNode) Size() (string, error) {
    var err error
    if fileNode.Mode() == "l" {
        _, fileNode, err = fileNode.EvalSymlinks()
        if err != nil {
            return "", nil
        }
    }

```

```

    }
    if fileNode.IsDir {
        return "", nil
    }
    size := float64(fileNode.Info.Size())
    if size < 100 {
        return strconv.FormatFloat(size, 'f', 0, 64) + " B", nil
    }
    units := []string{" KB", " MB", " GB", " TB", " PB", " EB", " ZB"}
    for i := 0; i < 7; i++ {
        size /= 1024
        if size < 100 {
            return strconv.FormatFloat(size, 'f', 1, 64) + units[i], nil
        }
    }
    return strconv.FormatFloat(size, 'f', 1, 64) + " YiB", nil
}

func (fileNode *FileInfo) Mode() string {
    switch fileNode.Info.Mode() & os.ModeType {
    default: return "f"
    case os.ModeDir: return "d"
    case os.ModeSymlink: return "l"
    }
}

func (fileNode *FileInfo) ModDate() string {
    t := fileNode.Info.ModTime()
    return fmt.Sprintf("%.3s %d, %d\n", t.Month(), t.Day(), t.Year())
}

func (fileNode *FileInfo) ModTime() string {
    t := fileNode.Info.ModTime()
    return fmt.Sprintf("%d:%d\n", t.Hour(), t.Minute())
}

func (fileNode *FileInfo) Details() (string, error) {
    text := "Non-Regular File"
    switch fileNode.Info.Mode() & os.ModeType {

```

```

default:
    if fileNode.Info.Size() == 0 {
        return "Empty File", nil
    }
    file, err := os.Open(fileNode.Path)
    if err != nil {
        return "", err
    }
    buffer := make([]byte, 512)
    _, err = file.Read(buffer)
    if err != nil {
        return "", err
    }
    contentType := http.DetectContentType(buffer)
    if contentType == "application/octet-stream" {
        text = "Text File"
    } else {
        text = "*" + contentType
    }

case os.ModeDir:
    text = "Folder"

case os.ModeSymlink:
    target, _, err := fileNode.EvalSymlinks()
    if err != nil {
        if !os.IsNotExist(err) {
            return "", err
        }
        if len(target) > 0 {
            text = "Broken Link to " + target + ""
        } else {
            text = "Inaccessible Link"
        }
    } else {
        text = "Link to " + target
    }

case os.ModeSocket:

```

```

        text = "Unix Socket"

    case os.ModeDevice:
        text = "Device File"

    case os.ModeNamedPipe:
        text = "Named Pipe"

    case os.ModeTemporary:
        text = "Temporary File"

    case os.ModeAppend:
    case os.ModeExclusive:
    case os.ModeSetuid:
    case os.ModeSetgid:
    case os.ModeCharDevice:
    case os.ModeSticky:
    case os.ModeIrregular:
    }

    return text, nil
}

func getDirSize(path string) (int64, error) {
    var size int64
    err := filepath.Walk(path, func(_ string, info os.FileInfo, err error) error {
        if err != nil {
            return err
        }
        if !info.IsDir() {
            size += info.Size()
        }
        return err
    })
    return size, err
}

```

```

func getDirList(path string, sortBy string, ascending bool, dirsFirst bool)
    ([]*FileNode, error) {
    entries, err := os.ReadDir(path)
    if err != nil {
        return nil, err
    }
    files := make([]*FileNode, len(entries))
    for i, entry := range entries {
        filePath := filepath.Join(path, entry.Name())
        fileURI := strings.TrimLeft(path, homeDir)
        fileInfo, err := entry.Info()
        if err != nil {
            return nil, err
        }
        files[i] = &FileNode{
            Path: filePath,
            URI: fileURI,
            IsDir: entry.IsDir(),
            Info: fileInfo,
        }
    }

    switch sortBy {
    case "name": sort.SliceStable(files, func(i, j int) bool {
        return strings.ToLower(files[i].Info.Name()) <
            strings.ToLower(files[j].Info.Name())
    })
    case "size": sort.SliceStable(files, func(i, j int) bool {
        return files[i].Info.Size() < files[j].Info.Size()
    })
    case "time": sort.SliceStable(files, func(i, j int) bool {
        return files[i].Info.ModTime().Before(files[j].Info.ModTime())
    })
    }

    if !ascending {
        for i, j := 0, len(files)-1; i < j; i, j = i+1, j-1 {
            files[i], files[j] = files[j], files[i]
        }
    }
}

```



```

    if dirsFirst {
        var dirs, notDirs []*FileNode
        for _, fileNode := range files {
            info, err := os.Stat(fileNode.Path)
            if err != nil {
                if os.IsNotExist(err) {
                    info, err = os.Lstat(fileNode.Path)
                    if err != nil {
                        return nil, err
                    }
                } else {
                    return nil, err
                }
            }
            if info.IsDir() {
                dirs = append(dirs, fileNode)
            } else {
                notDirs = append(notDirs, fileNode)
            }
        }
        return append(dirs, notDirs ...), nil
    }

    return files, nil
}

func addToZip(source string, writer *zip.Writer) error {
    return filepath.Walk(source, func(path string, info os.FileInfo, err error)
        error {
            if err != nil {
                return err
            }
            header, err := zip.FileInfoHeader(info)
            if err != nil {
                return err
            }
            header.Method = zip.Deflate
            header.Name, err = filepath.Rel(filepath.Dir(source), path)

```

```

        if err != nil {
            return err
        }
        if info.IsDir() {
            header.Name += "/"
        }
        headerWriter, err := writer.CreateHeader(header)
        if err != nil {
            return err
        }
        if !info.Mode().IsRegular() {
            return nil
        }
        f, err := os.Open(path)
        if err != nil {
            return err
        }
        defer f.Close()

        _, err = io.Copy(headerWriter, f)
        return err
    })
}

func readBuffer(path string) ([]string, error) {
    buff, err := os.OpenFile(path, os.O_RDONLY|os.O_CREATE, 0600)
    if err != nil {
        return nil, err
    }
    defer buff.Close()

    var buffer []string
    scanner := bufio.NewScanner(buff)
    for scanner.Scan() {
        buffer = append(buffer, scanner.Text())
    }
    return buffer, nil
}

```

```

func fileExists (path string) (bool, error) {
    _, err := os.Lstat(path)
    if err == nil {
        return true, nil
    }
    if os.IsNotExist(err) {
        return false, nil
    }
    return false, err
}

```

```

func copyFile(src, dst string) error {
    fin, err := os.Open(src)
    if err != nil {
        return err
    }
    defer fin.Close()

    fout, err := os.Create(dst)
    if err != nil {
        return err
    }
    defer fout.Close()

    _, err = io.Copy(fout, fin)
    if err != nil {
        return err
    }
    fin.Close()

    return nil
}

```

```

func copyTo(src, dstDir string) error {
    info, err := os.Lstat(src)
    if err != nil {
        return err
    }

```

```

    }
    dst := filepath.Join(dstDir, info.Name())

    fmt.Printf("Copying %s to %s\n", src, dstDir)
    switch info.Mode() & os.ModeType {
    case os.ModeDir:
        if err := os.MkdirAll(dst, 0755); err != nil {
            return err
        }
        if err := copyDir(src, dst); err != nil {
            return err
        }
    case os.ModeSymlink:
        if err := copySymlink(src, dst); err != nil {
            return err
        }
    default:
        if err := copyFile(src, dst); err != nil {
            return err
        }
    }
    fmt.Println("Finished Copying.\n\n")

    if info.Mode()&os.ModeSymlink == 0 {
        return os.Chmod(dst, info.Mode())
    }
    return nil
}

func linkDeref(link string) (string, string, error) {
    target, err := os.Readlink(link)
    if err != nil {
        return "", "", err
    }
    path := target
    if filepath.IsAbs(target) {
        if !strings.HasPrefix(path, homeDir) {
            return target, "", os.ErrNotExist
        }
    }

```

```

        target = strings.TrimPrefix(target, homeDir)
    } else {
        path = filepath.Join(filepath.Dir(link), path)
        if !strings.HasPrefix(path, homeDir) {
            return target, "", os.ErrNotExist
        }
    }
    return target, path, nil
}

var configDir string

func readData(name string) ([]byte, error) {
    data, err := os.ReadFile(filepath.Join(configDir, name))
    if err != nil {
        return nil, err
    }
    return data[:len(data)-1], nil
}

func writeData(name string, data string) error {
    return os.WriteFile(filepath.Join(configDir, name), []byte(data), 644)
}

func init() {
    userHome, err := os.UserHomeDir()
    if err != nil {
        panic(err)
    }
    configDir = filepath.Join(userHome, ".config", "cloud-maker")
    if err = os.MkdirAll(configDir, 0755); err != nil {
        panic(err)
    }
}

```

TEMPLATES.GO

```

package main

import (
    "net/http"
    "html/template"
)

type FSData struct {
    CutCount    int
    CopyCount   int
    FileCount   int
    CutBuffer   [] string
    CopyBuffer  [] string
    File        *FileNode
}

var templates = make(map[string]*template.Template)

func renderTemplate(w http.ResponseWriter, tmpl string, data any) error {
    return templates[tmpl].ExecuteTemplate(w, "base.html", data)
}

func init() {
    templates["viewDirList"] = template.Must(template.New(
        "viewDirList.html",
    ).ParseFiles("templates/base.html", "templates/viewDirList.html"))
}

```

AUTOMOUNTD

```

#!/bin/sh

pathtoname() {
    udevadm info -p /sys/"$1" | awk -v FS== '/DEVNAME/ {print $2}'
}

stdbuf -oL -- udevadm monitor --udev -s block | while read -r -- _ _ event
    devpath _; do

```

```
if [ "$event" = add ]; then
    devname=$(pathtoname "$devpath")
    # udiskctl mount --block-device "$devname" --no-user-interaction

    target="$(lsblk -no LABEL "$devname")"
    [ -z "$target" ] && target="$(lsblk -no UUID "$devname")"
    [ -z "$target" ] && continue
    sudo mount -v --mkdir "$devname" "/media/root/ $target"
    mkdir -pv "/media/master/ $target"
    sudo bindfs -u $(id -u) -g $(id -g) "/media/root/ $target"
    "/media/master/ $target"
fi
done
```

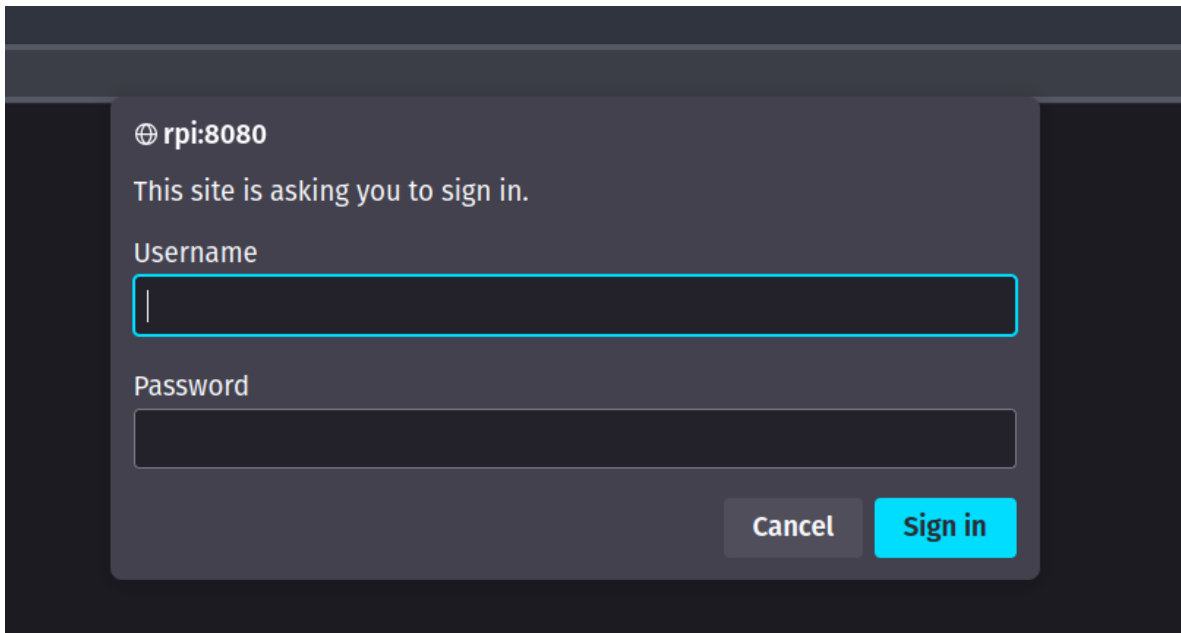
AUTOMOUNT-CLEAN

```
#!/bin/sh

while sleep 10; do
    find "/media/$USER" -mindepth 1 -maxdepth 1 -printf "%P\n" | while read -r
    mount; do
        [ -n "$(lsblk | grep -F "$mount")" ] && continue
        sudo fusermount -u "/media/$USER/$mount"
        rmdir -v "/media/$USER/$mount"
    done
done
```

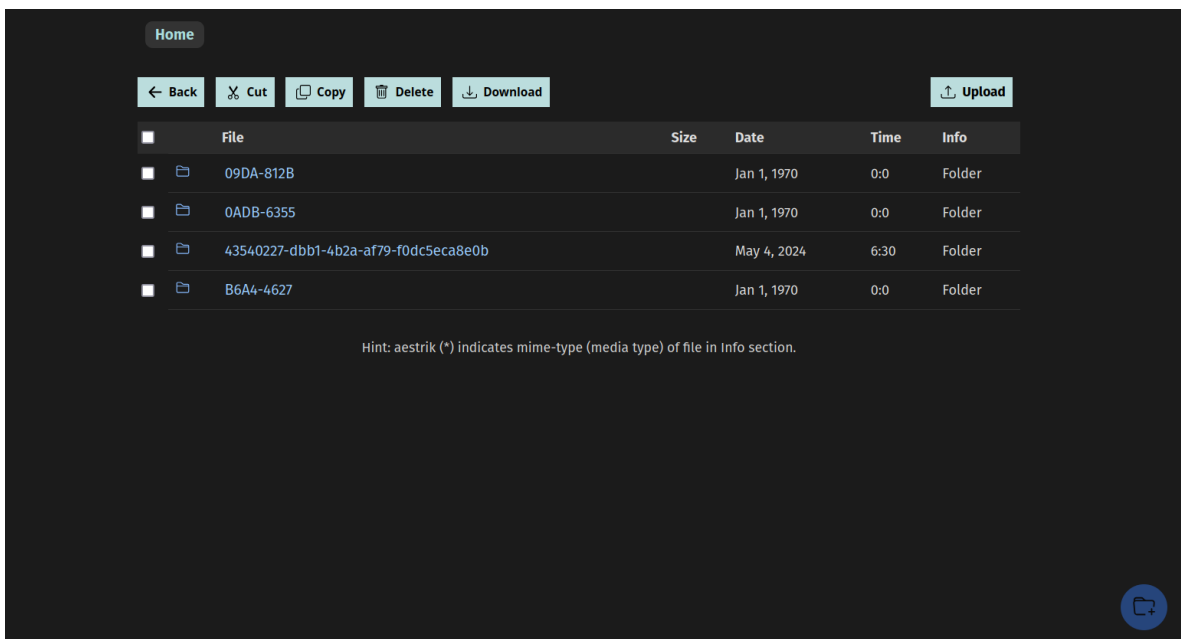
RESULTS

Connecting to Pi and loading the page asks for credentials.



A dark-themed login dialog box for the address `rpi:8080`. The text "This site is asking you to sign in." is displayed above two input fields: "Username" and "Password". The "Username" field is currently empty and has a blue border. Below the input fields are two buttons: "Cancel" and "Sign in". The "Sign in" button is highlighted in blue.

The home page will be loaded when the right credentials are entered. It contains a list of drives that are currently mounted to any of the Raspberry Pi USB Ports.

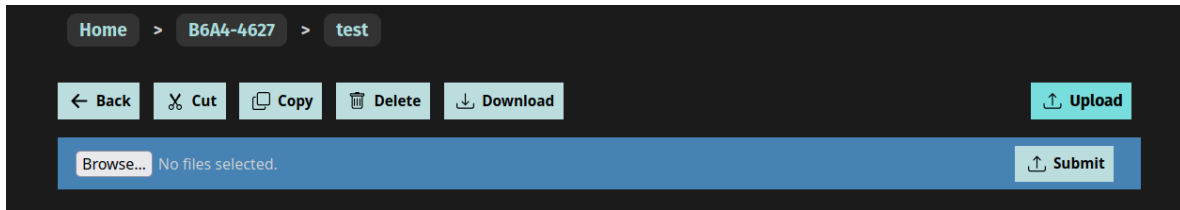


The home page interface shows a "Home" tab at the top. Below it are action buttons: "Back", "Cut", "Copy", "Delete", "Download", and "Upload". A table lists the mounted drives with columns for File, Size, Date, Time, and Info.

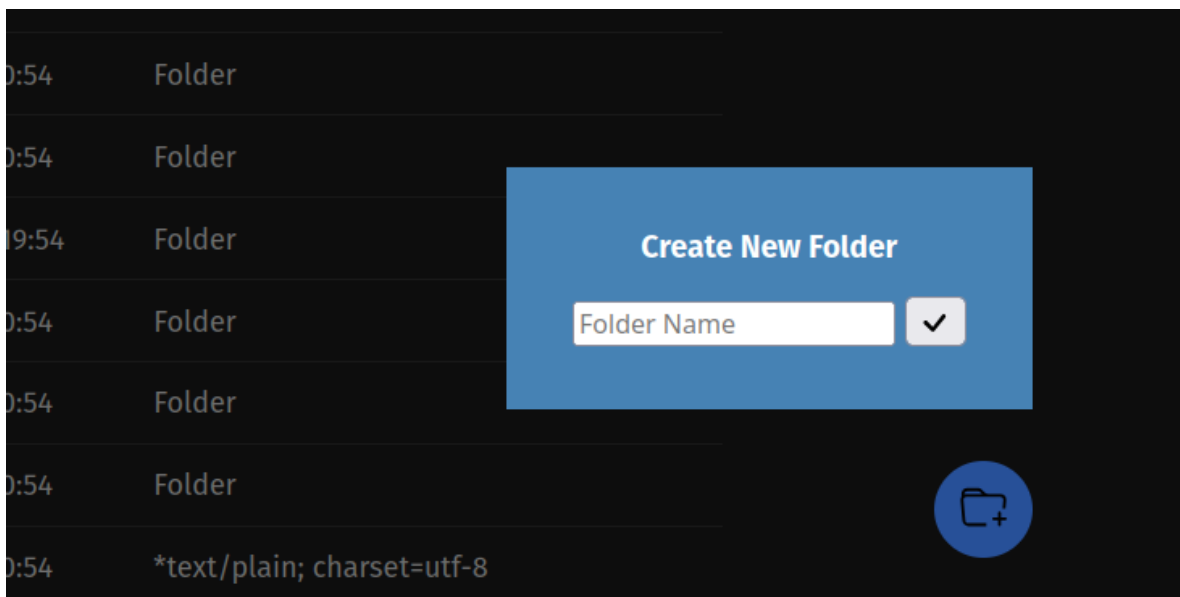
File	Size	Date	Time	Info
09DA-812B		Jan 1, 1970	0:0	Folder
0ADB-6355		Jan 1, 1970	0:0	Folder
43540227-dbb1-4b2a-af79-f0dc5eca8e0b		May 4, 2024	6:30	Folder
B6A4-4627		Jan 1, 1970	0:0	Folder

Hint: aestrisk (*) indicates mime-type (media type) of file in Info section.

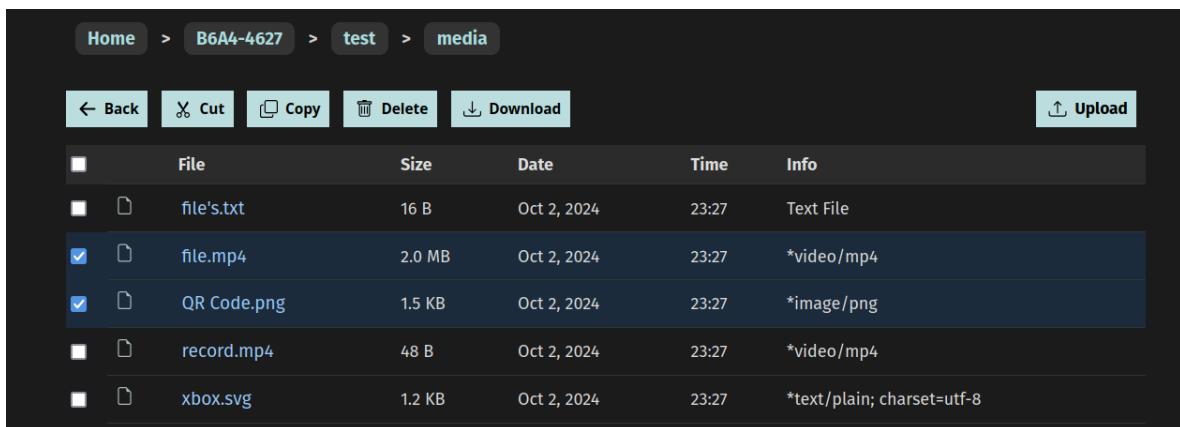
Clicking on the upload button opens a dialog which the user can use to select and upload multiple files.



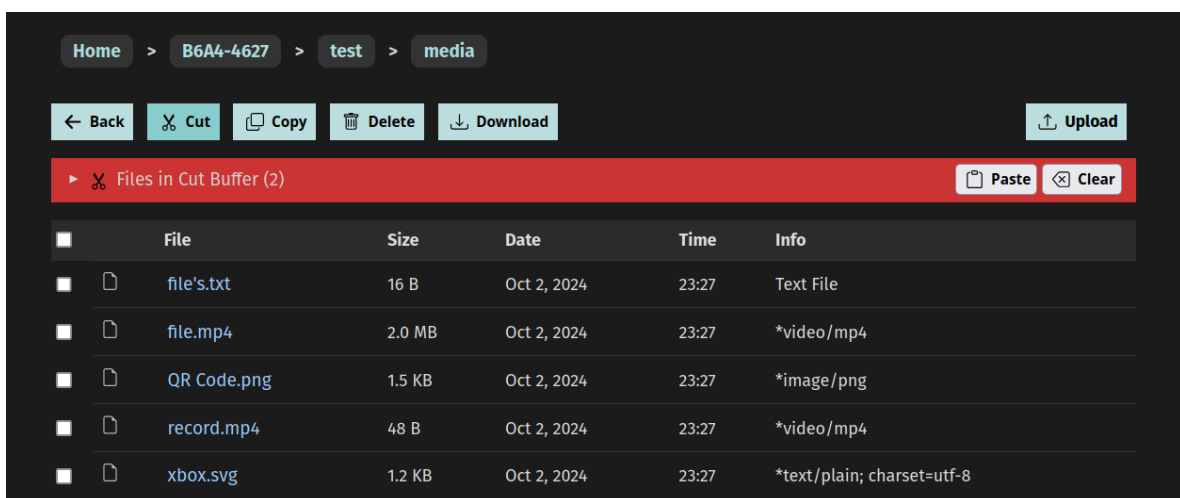
Clicking on the new folder button in lower right corner opens up a prompt that inputs a name and create a new folder.



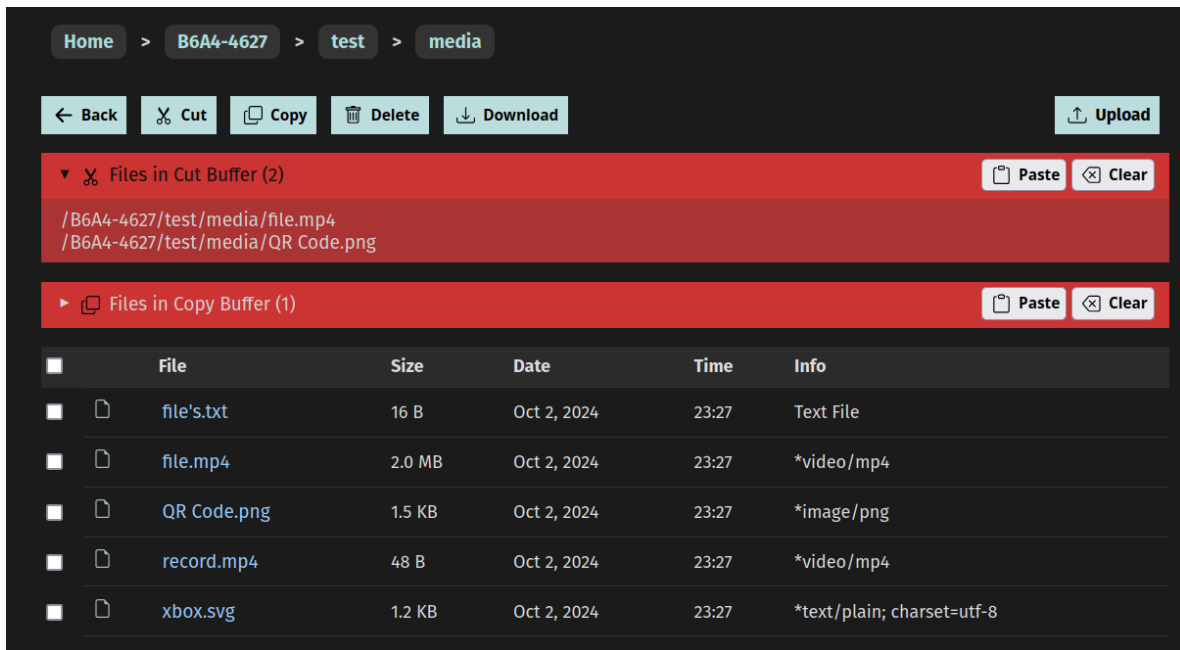
The user can also select multiple files and perform various file operations on selected files.



Here's an example of user cutting a bunch of files.

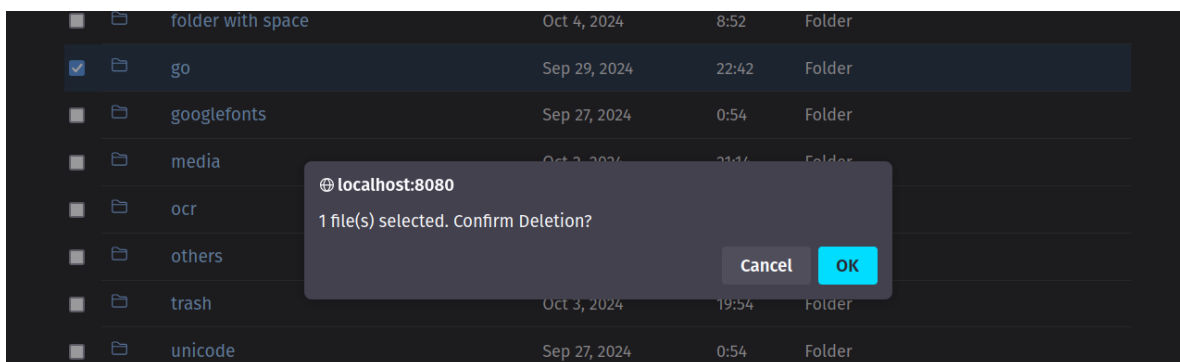


Same with copying files.



The clear button will cancel any cut/copy operations where as the paste button will paste all the files from cut/copy buffer in the directory the user is currently in. Similary the user can also downlad files using file selection.

When deleting files, the user is prompted with a confirmation dialog box with count of files that are goint to be deleted.



FUTURE SCOPE AND CONCLUSION

The Cloud Maker system proves to be a very useful tool for digital professionals and even normal users. However, this was really a minimal working demonstration of can be done with a cheap computer (like Raspberry Pi) and bunch of media devices. A lot more can be done to extend the current systems as well as make it do things that it was not intended to.

It's authentication system can be improved to include permanent logins and session managements using browser cookies. At the movement, it only supports HTTP BasicAuth and user has to login everytime they open a new browser instance.

This system can include automatic backup and sync functionality with native applications interfacing the web server. This would be the key feature for driving mass adoption by users as one of the primary view of cloud storage is of a 'backup point.' Users will also don't have to bother with manuall uploading or downloading files as they can be automatically synced in the background.

A public sharing functionality can be introduced where a user selects a folder or a bunch of files and a link is automatically generated that allows other people or non-users of the system to access those files. This will also replace the reliance on third party file sharing sites like Zapyra or ToffeeShare.

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