

Smart Waste Management System

Installation:

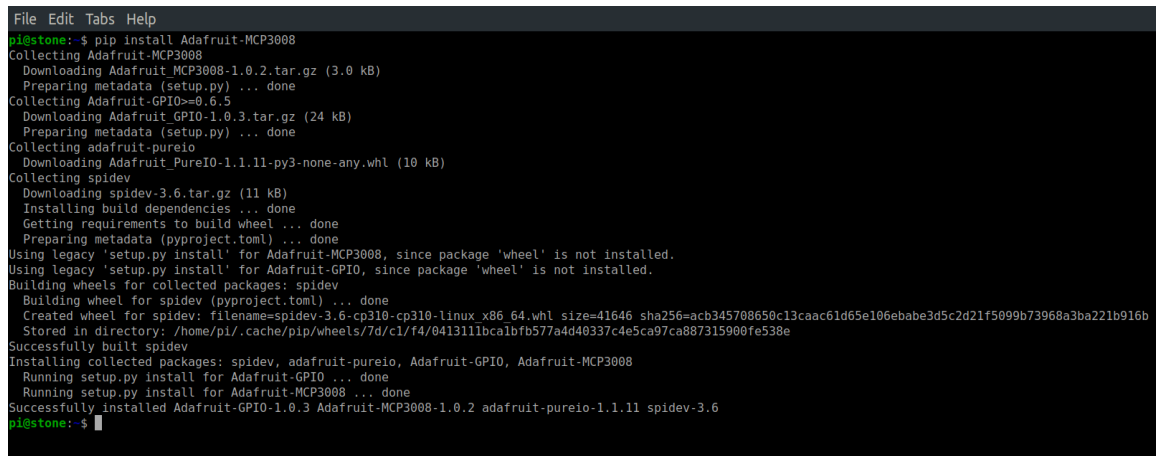
Python installation:

sudo apt install python

Required modules:

- 1) Adafruit-MCP3008 : Python code to use the MCP3008 analog to digital converter with a Raspberry Pi.

pip install Adafruit-MCP3008

A terminal window with a dark background and light green text. The prompt is 'pi@stone:~\$'. The command 'pip install Adafruit-MCP3008' has been entered. The output shows the process of collecting and installing several packages: Adafruit-MCP3008, Adafruit-GPIO, Adafruit-PureIO, and spidev. It also shows the building of wheels for these packages and the final successful installation of all four modules.

```
File Edit Tabs Help
pi@stone:~$ pip install Adafruit-MCP3008
Collecting Adafruit-MCP3008
  Downloading Adafruit-MCP3008-1.0.2.tar.gz (3.0 kB)
  Preparing metadata (setup.py) ... done
Collecting Adafruit-GPIO>=0.6.5
  Downloading Adafruit-GPIO-1.0.3.tar.gz (24 kB)
  Preparing metadata (setup.py) ... done
Collecting adafruit-pureio
  Downloading Adafruit_PureIO-1.1.11-py3-none-any.whl (10 kB)
Collecting spidev
  Downloading spidev-3.6.tar.gz (11 kB)
  Installing build dependencies ... done
  Getting requirements to build wheel ... done
  Preparing metadata (pyproject.toml) ... done
Using legacy 'setup.py install' for Adafruit-MCP3008, since package 'wheel' is not installed.
Using legacy 'setup.py install' for Adafruit-GPIO, since package 'wheel' is not installed.
Building wheels for collected packages: spidev
  Building wheel for spidev (pyproject.toml) ... done
  Created wheel for spidev: filename=spidev-3.6-cp310-cp310-linux_x86_64.whl size=41646 sha256=acb345708650c13caac61d65e106ebabe3d5c2d21f5099b73968a3ba221b916b
  Stored in directory: /home/pi/.cache/pip/wheels/7d/c1/f4/041311bca1bfb577a4d40337c4e5ca97ca887315900fe538e
Successfully built spidev
Installing collected packages: spidev, adafruit-pureio, Adafruit-GPIO, Adafruit-MCP3008
  Running setup.py install for Adafruit-GPIO ... done
  Running setup.py install for Adafruit-MCP3008 ... done
Successfully installed Adafruit-GPIO-1.0.3 Adafruit-MCP3008-1.0.2 adafruit-pureio-1.1.11 spidev-3.6
pi@stone:~$
```

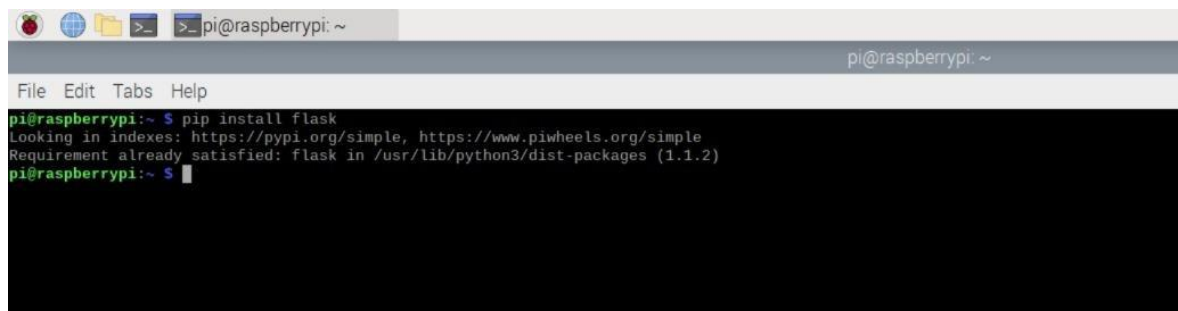
Figure 1 : Installation of Adafruit-MCP3008 module

- 2) RPi.GPIO : A module to control Raspberry Pi GPIO channels.

pip install RPi.GPIO

- 3) Flask : A simple framework for building complex web applications.

pip install flask

A terminal window with a light gray background and black text. The prompt is 'pi@raspberrypi:~\$'. The command 'pip install flask' has been entered. The output shows the package being looked up in indexes and then successfully installed from the local cache.

```
pi@raspberrypi:~$ pip install flask
Looking in indexes: https://pypi.org/simple, https://www.piwheels.org/simple
Requirement already satisfied: flask in /usr/lib/python3/dist-packages (1.1.2)
pi@raspberrypi:~$
```

Figure 2 : Installation of flask

Execution:

web application can be run by executing the following commands

cd final-site

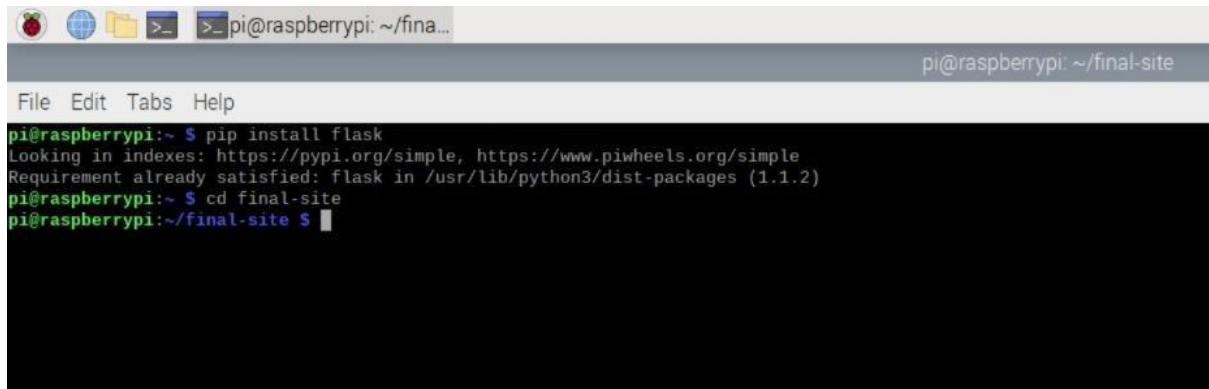
A terminal window on a Raspberry Pi. The title bar shows the Raspberry Pi logo and the path 'pi@raspberrypi: ~/final-site'. The menu bar includes 'File', 'Edit', 'Tabs', and 'Help'. The terminal text shows the user running 'pip install flask', which returns 'Requirement already satisfied: flask in /usr/lib/python3/dist-packages (1.1.2)'. Then, the user runs 'cd final-site', and the prompt changes to 'pi@raspberrypi: ~/final-site\$'.

Figure 3 : Going in to final-site directory

python app3.py

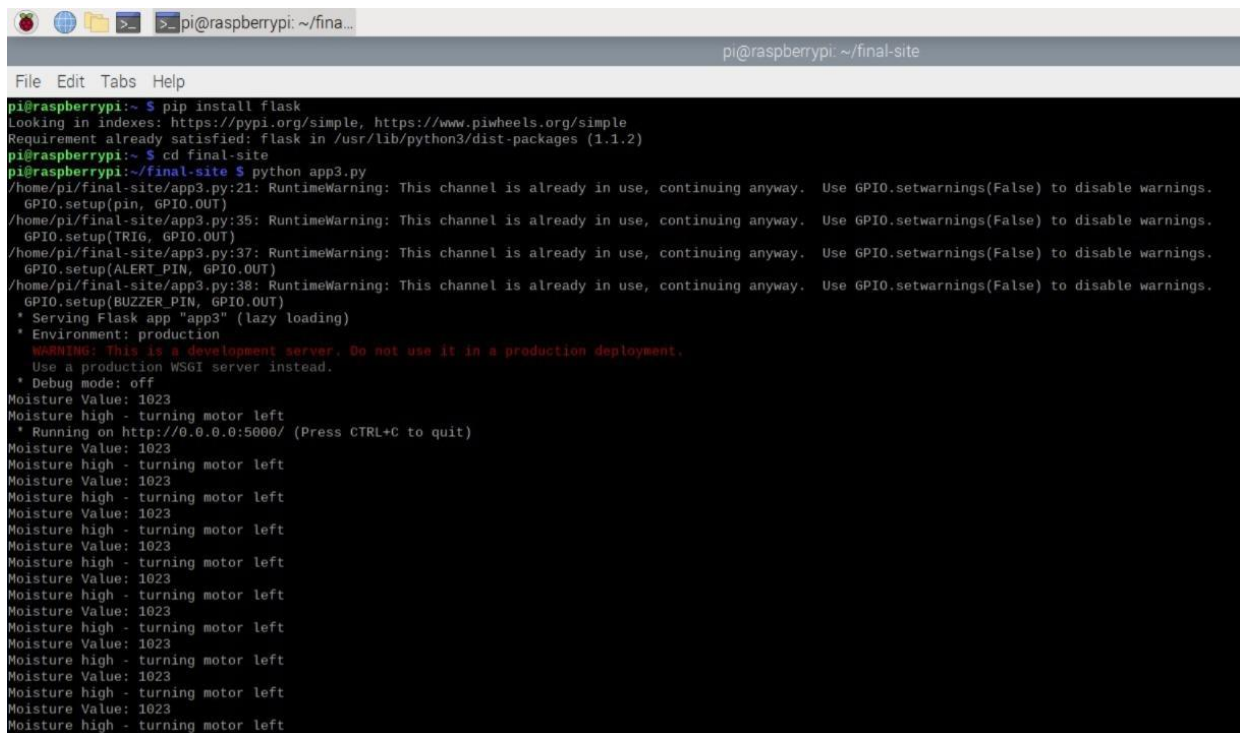
A terminal window on a Raspberry Pi, similar to Figure 3. The user runs 'python app3.py'. The output shows several 'RuntimeWarning: This channel is already in use, continuing anyway.' messages for GPIO pins 21, 35, 37, and 38. It then indicates 'Serving Flask app "app3" (lazy loading)' and 'Environment: production'. A warning states 'WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.' and 'Debug mode: off'. The terminal then displays a continuous stream of data: 'Moisture Value: 1023' followed by 'Moisture high - turning motor left' repeatedly.

Figure 4 : Running the website

Login page

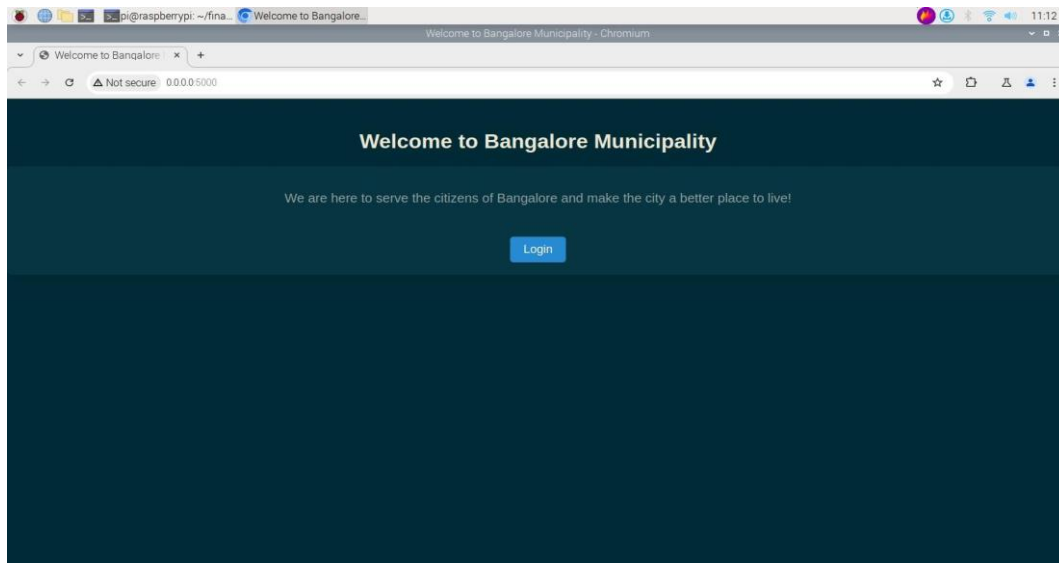


Figure 5 : Opening website and logging in

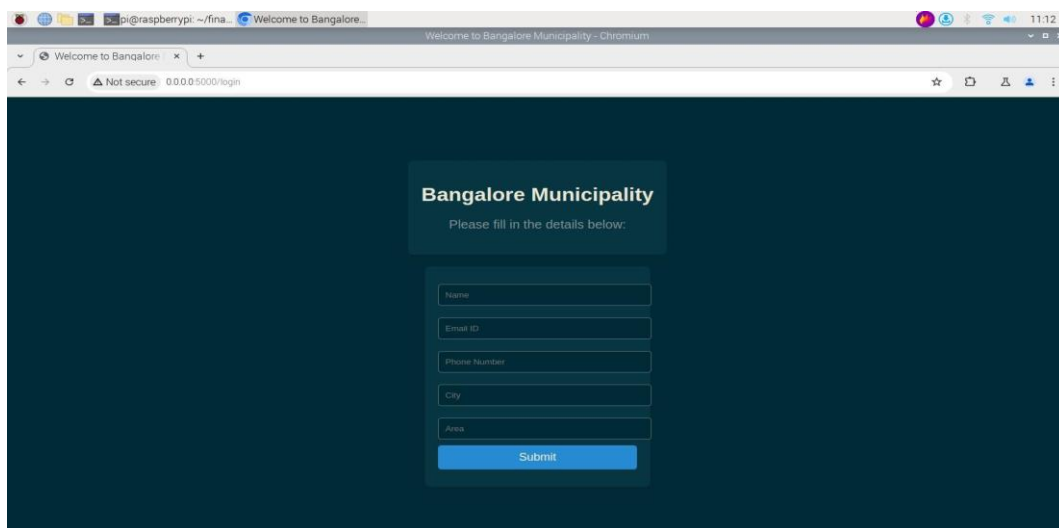


Figure 6 : Opening user form

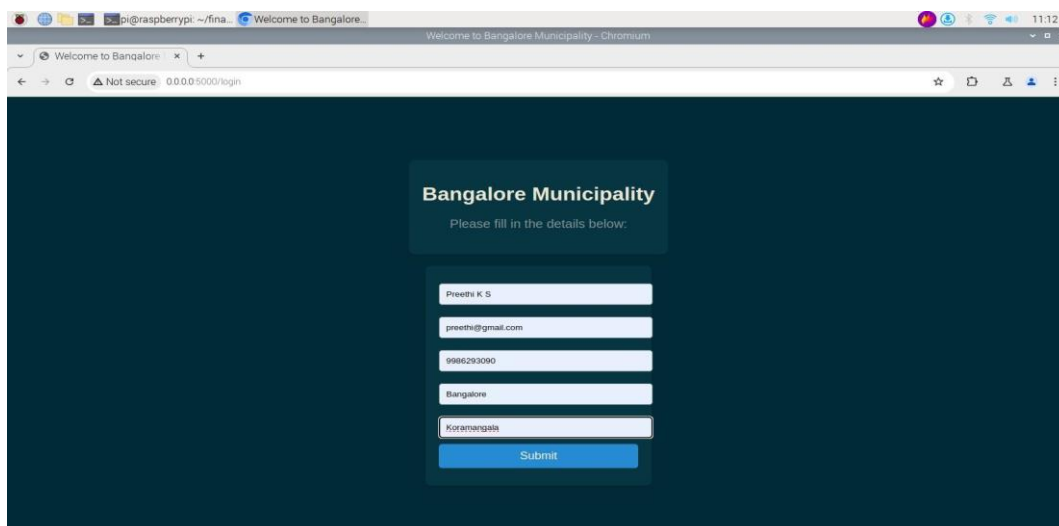


Figure 7 : Filling user form and submitting

Street Selection

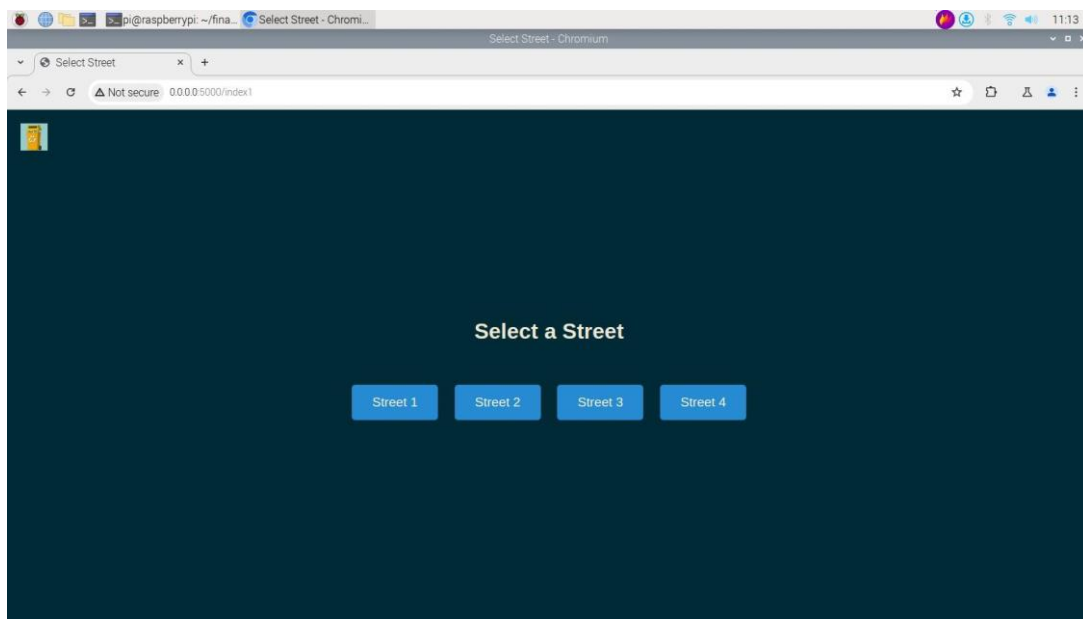


Figure 8 : Selection of streets

Bin Status

1) Dry Waste

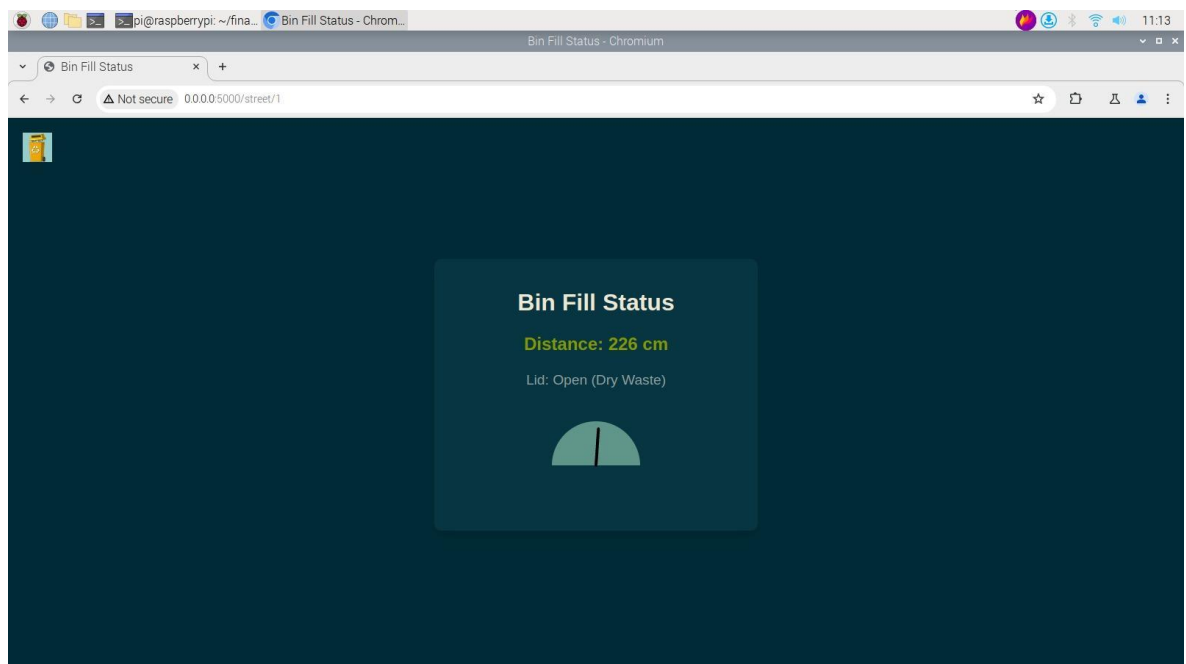


Figure 9 : Bin filled with dry waste

2) Wet Waste

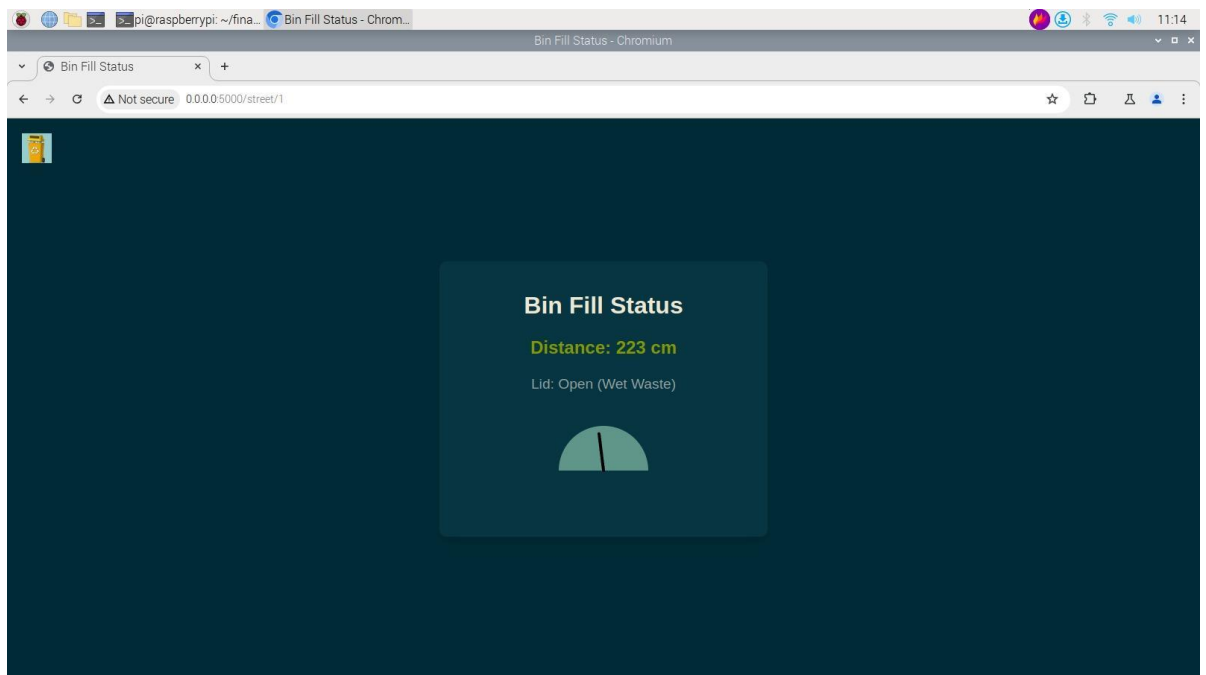


Figure 10 : Bin filled with wet waste

3) Almost filled

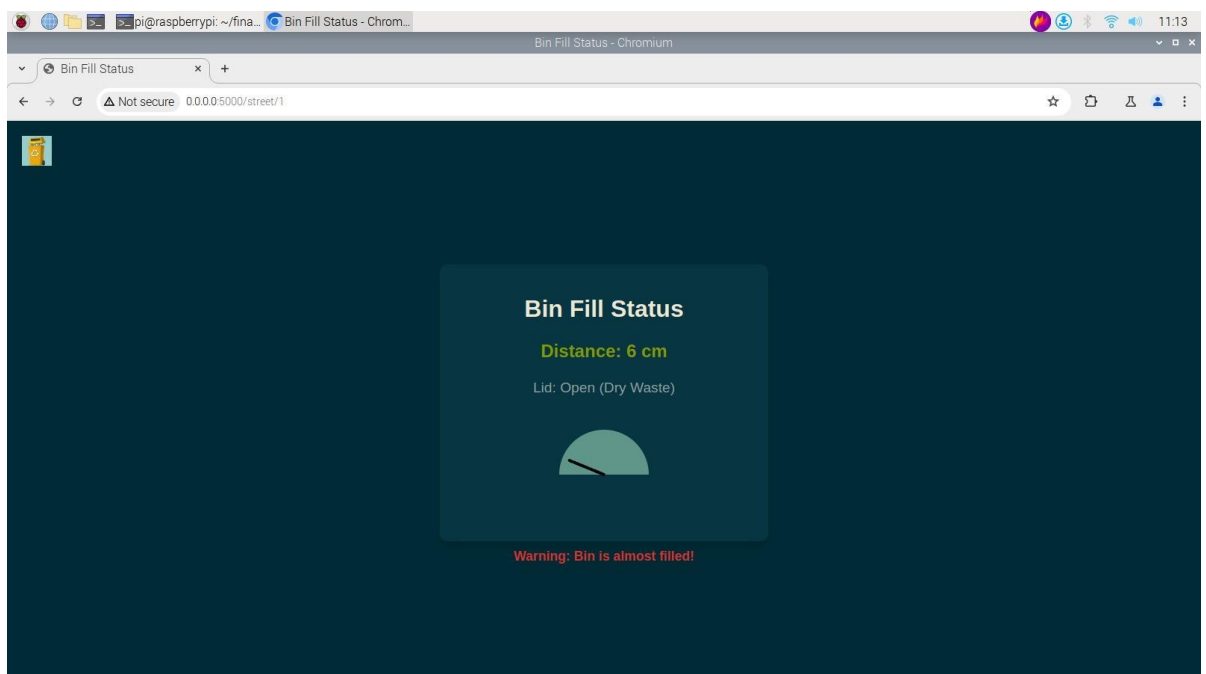


Figure 11 : Displaying alert message