PROJECT DOCUMENT(Phase5)

Noise Pollution Monitoring

OBJECTIVES:

- **Real-time Data Collection**: To continuously collect and record noise levels in various locations, enabling the creation of accurate noise maps and identifying areas with high noise pollution.

- **Environmental Impact Assessment**: Evaluate the impact of noise pollution on the environment and public health, including effects on wildlife, vegetation, and human well-being.

- **Compliance Monitoring**: Ensure compliance with noise regulations and standards by tracking noise levels from different sources, such as industrial facilities, transportation, and construction sites.

- **Early Warning and Alerts**: Provide timely alerts to authorities, residents, and businesses when noise levels exceed permissible limits, allowing for immediate action to mitigate noise pollution.

- **Source Identification**: Pinpoint the sources of noise pollution through sound source localization techniques, enabling targeted mitigation efforts.

- **Data Analysis and Trend Monitoring**: Analyze historical data to identify trends, patterns, and seasonal variations in noise pollution, facilitating long-term planning and policy development.

PROGRAM:

```python
# Initialise IMU
sda=machine.Pin(0)
scl=machine.Pin(1)
i2c=machine.I2C(0,sda=sda, scl=scl, freq=20000)
imu = MPU6050(i2c)
fuse = Fusion()


# Initialise SD Card
sd_spi = SPI(1, sck=Pin(10, Pin.OUT), mosi=Pin(11, Pin.OUT), miso=Pin(12, Pin.OUT))
sd = sdcard.SDCard(sd_spi, Pin(9, Pin.OUT))

print('Finished init of SD card')
print("Size: {} MB".format(sd.sectors/2048))
print(uos.listdir("/"))

#uos.mount(sd, "/sd") # DEBUGGING THIS STEP NOW
```

```python
# Create a file and write something to it
with open("/test01.txt", "w") as file:
    file.write("Hello, SD World!\r\n")
    file.write("This is a test\r\n")

# Open the file we just created and read from it
with open("/test01.txt", "r") as file:
    data = file.read()
    print(data)

# Experimental position calculation section
'''
def calc_position(pos_init, acc, quat, rate):
    # From https://github.com/thomas-haslwanter/scikit-
kinematics/blob/master/src/skinematics/imus.py
    # Calculate the position, assuming that the orientation is already known.

    initialPosition = pos_init
    # Acceleration, velocity, and position ----------------------------
    # From q and the measured acceleration, get the \frac{d^2x}{dt^2}
    g = 9.80665
    g_v = np.r_[0, 0, g]
    accReSensor = acc - vector.rotate_vector(g_v, quat.q_inv(quat))
    accReSpace = vector.rotate_vector(accReSensor, quat)

    # Position and Velocity through integration, assuming 0-velocity at t=0
    vel = np.nan*np.ones_like(accReSpace)
    pos = np.nan*np.ones_like(accReSpace)

    for ii in range(accReSpace.shape[1]):
        # Swap out scipy.cumtrapz for
https://numpy.org/doc/stable/reference/generated/numpy.trapz.html?
        vel[:,ii] = cumtrapz(accReSpace[:,ii],
                             dx=1./np.float(rate), initial=0)
        pos[:,ii] = cumtrapz(vel[:,ii],
                     dx=1./np.float(rate), initial=initialPosition[ii])

    return { "vel": vel, "pos": pos }
'''

# Choose test to run
Timing = True

if Timing:
    accel = imu.accel.xyz
    gyro = imu.gyro.xyz
    start = time.ticks_us()  # Measure computation time only
    fuse.update_nomag(accel, gyro) # 979µs on Pyboard
    t = time.ticks_diff(time.ticks_us(), start)
    print("Update time (uS):", t)

count = 0
while True:
    fuse.update_nomag(imu.accel.xyz, imu.gyro.xyz)
    print(str(fuse.q).replace("(","").replace(")",""))
    '''
    if count % 50 == 0:
```
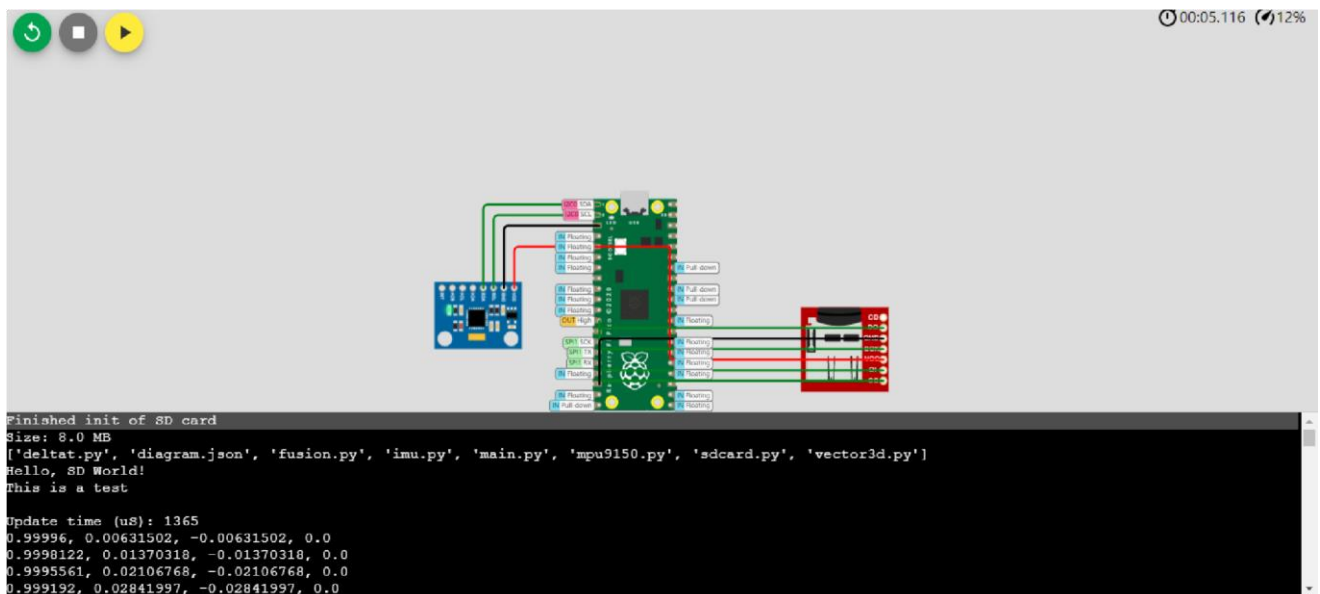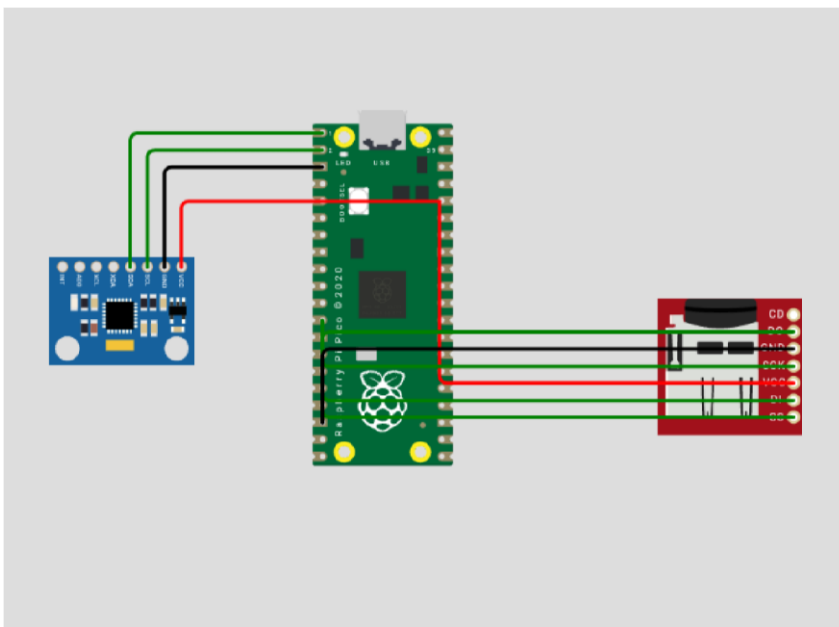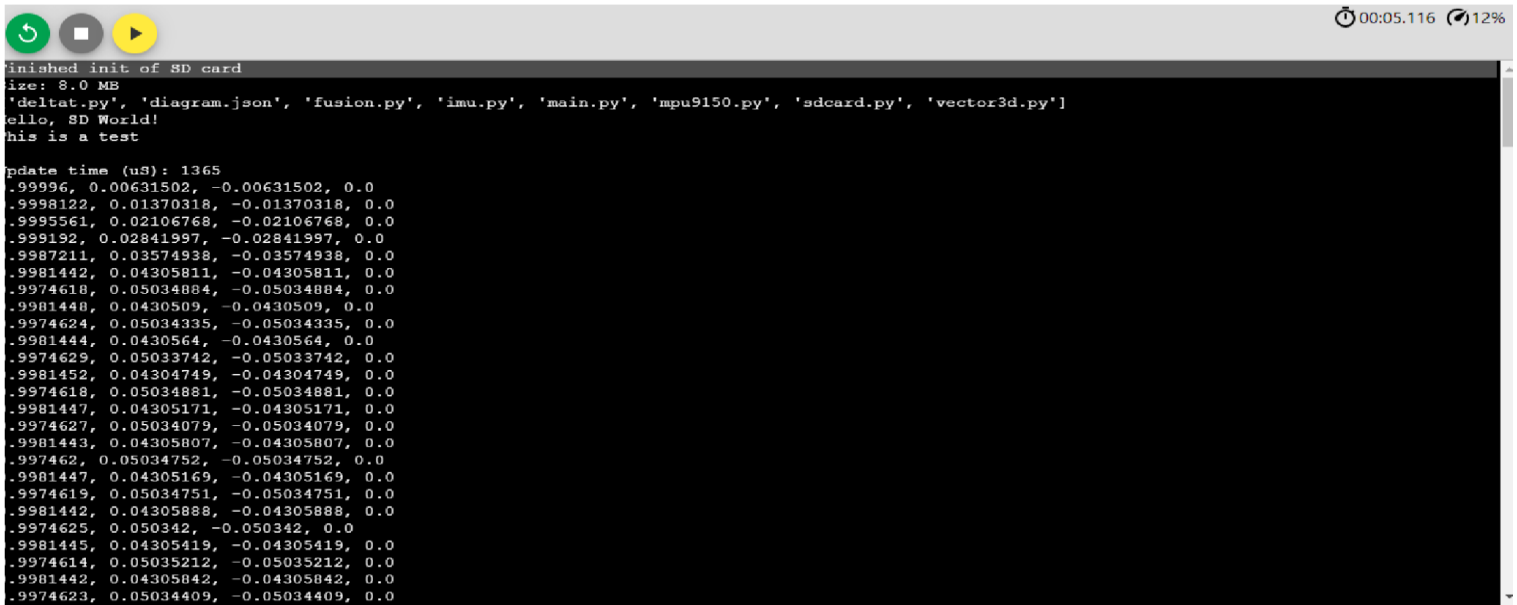
```
      print("Heading, Pitch, Roll: {:7.3f} {:7.3f} {:7.3f}".format(fuse.heading,
fuse.pitch, fuse.roll))
      print("Quarternion: " + str(fuse.q))
      print()
    '''
    time.sleep_ms(2) # Maximum 500 hZ cycle rate
    count += 1
```

CIRCUIT & OUTPUT:

```
Finished init of SD card
Size: 8.0 MB
['deltat.py', 'diagram.json', 'fusion.py', 'imu.py', 'main.py', 'mpu9150.py', 'sdcard.py', 'vector3d.py']
Hello, SD World!
This is a test

Update time (uS): 1365
.99996, 0.00631502, -0.00631502, 0.0
.9998122, 0.01370318, -0.01370318, 0.0
.9995561, 0.02106768, -0.02106768, 0.0
.999192, 0.02841997, -0.02841997, 0.0
.9987211, 0.03574938, -0.03574938, 0.0
.9981442, 0.04305811, -0.04305811, 0.0
.9974618, 0.05034884, -0.05034884, 0.0
.9981448, 0.0430509, -0.0430509, 0.0
.9974624, 0.05034335, -0.05034335, 0.0
.9981444, 0.0430564, -0.0430564, 0.0
.9974629, 0.05033742, -0.05033742, 0.0
.9981452, 0.04304749, -0.04304749, 0.0
.9974618, 0.05034881, -0.05034881, 0.0
.9981447, 0.04305171, -0.04305171, 0.0
.9974627, 0.05034079, -0.05034079, 0.0
.9981443, 0.04305807, -0.04305807, 0.0
.997462, 0.05034752, -0.05034752, 0.0
.9981447, 0.04305169, -0.04305169, 0.0
.9974619, 0.05034751, -0.05034751, 0.0
.9981442, 0.04305888, -0.04305888, 0.0
.9974625, 0.050342, -0.050342, 0.0
.9981445, 0.04305419, -0.04305419, 0.0
.9974614, 0.05035212, -0.05035212, 0.0
.9981442, 0.04305842, -0.04305842, 0.0
.9974623, 0.05034409, -0.05034409, 0.0
```

GLIMPSE:

The main intent of our project is to monitor the noise pollution in main cities, urban and sub-urban areas, to reduce the amount of noise produced.

To develop our idea, we have implemented IoT in this project to monitor it 24/7 and from anywhere we can access the device and obtain the readings. It involves the use of connected devices and sensors to collect, transmit, and analyse data related to noise levels in various environments of how it works.

1. **IoT Sensors**: The first step is to deploy IoT sensors that are equipped to measure noise levels. These sensors can be placed in urban areas, industrial zones, residential neighbourhoods, or near highways and other noisy locations.

2. **Data Collection:** The sensors continuously collect data on sound levels, including decibel levels and frequency characteristics. This data is then converted into digital format and transmitted to a central server or a cloud-based platform. This can be done via wired or wireless communication, such as Wi-Fi, cellular networks, or LoRaWAN.

3. **Data Transmission**: The collected noise data is transmitted in real-time or at regular intervals to ensure information is up tom date. Data transmission can be

either in a passive mode, where the sensors send data on a schedule, or actively triggered by certain noise threshold levels.

4. **Data Storage and Processing**: The data is stored in a central database, either on a cloud-based server or a local server, depending on the project's scale and requirements. Noise Pollution data is then processed to remove outliers and ensure data accuracy.

5. **Threshold Monitoring**: Noise pollution monitoring systems can be set up to trigger alarms or notifications when noise levels exceed predefined thresholds. This enables authorities to take timely action and address noise pollution issues.

6. **Reporting and Alerts**: The system can generate reports and alerts for relevant stakeholders, including local authorities, environmental agencies, and the public. This information can be used to enforce noise regulations and raise awareness about noise pollution.

7. **Integration with Other Systems**: Noise pollution monitoring can be integrated with other IoT systems, such as air quality monitoring or traffic management. This integration provides a more comprehensive view of environmental conditions and their interplay.

8. **User Accessibility**: The collected noise data can be made accessible to the public through web portals, mobile apps, or public displays. This promotes transparency and community engagement in addressing noise pollution issues.

9. **Privacy Considerations**: Privacy concerns are important when deploying noise monitoring systems, as audio data could inadvertently capture private conversations. Proper measures, including data checking and encryption, should be taken to protect privacy.

Hence our project on Noise Pollution Monitoring System.

Conclusion: This project will be very significant in many places such as metro cities and areas near them. Unlike India is the developing country where it is much needed to save the globe for next generation from noise pollution which will be a good initiative by us to prevent all such kind of pollution.