IoT based Industry Survellance and Air Pollution Monitoring using Drones

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Abstract - One of the most important environmental problems is air pollution. It may have harmful effects on your health, including cancer, heart disease, and a high death rate. Temperature is detected by the temperature sensor and transmitted to the receiver. The temperature will be shown on LCD and computers at the receiver. Micrograms per cubic metre (g/m3) are a unit of measurement for air quality that is determined by drone. In this project, a drone receiver is integrated into a sensor unit with a wireless module. The drone's sensor module, which is mounted to the top. using the software Wokwi, the results are verified.

I. INTRODUCTION

IoT-based industrial surveillance and air pollution monitoring using drones are two emerging technologies that are becoming increasingly popular in the industrial sector. These technologies involve the use of interconnected devices, sensors, and drones to gather and analyze data in real-time, allowing companies to optimize operations, improve efficiency, and reduce costs. Drones can also be used to collect data on air quality, identifying sources of pollution and developing strategies to reduce emissions and improve air quality. These technologies can help companies improve operations, reduce costs, and protect the environment. As these technologies continue to evolve, we can expect to see even more innovative applications emerge in the coming years.

II. LITERATURE SURVEY

Pandit N. Mulay, among the sensors used to detect drones include radars, visible-spectrum cameras, thermal infrared emission cameras, microphones, radio-frequency scanners to pick up drone and controller signals, lasers (LiDAR, LADAR), humans, and even animals. The study of thermal infrared sensors. A low-cost sensor that produces videos with only 8060 pixels is used in this work, and human categorization is used. The project uses 1920 x 1080 pixel videos along with deep learning-based recognition and tracking. (Faster-RCNN). The sensor is not described in any depth, though.

To counteract the lack of thermal data, the authors use a Cycle-GAN (Generative Adversarial Network to produce synthetic training images. A thermal camera is also used in, without further details regarding the type, field of view (FOV), or resolution. Sensors in the Visible Range are the most widespread used, combined with deep-learning methods.

The authors create artificial training images using a Cycle-GAN (Generative Adversarial Network) to compensate for the lack of temperature data. Without providing any additional information regarding the type, field of view (FOV), or resolution, a thermal camera is also employed in. The most popular sensors are those in the visible range, along with deep learning techniques.

The study compares six alternative CNN models and concludes that YOLO v2 may be the best choice given the trade-offs between speed and accuracy. YOLO v2 is frequently picked as the alternative in works. It makes use of the lighter YOLO v3, which is more modern. The usage of wide-angle sensors has also resulted from the use of pan/tilt platforms to guide cameras towards objectives. A revolving narrow-field camera is aligned using a 110° FOV camera. a Gaussian Mixture Model is used to analyse the camera (GMM).

III. PROPOSED WORK

One of the biggest reasons for the widespread use of drones is their ability to traverse and maneuver through areas that would be dangerous for humans to be in. Oil and gas refineries, pipelines, and flare stacks are examples where drones can be used to monitor the location for potential hazards and notify the relevant authorities if threatening conditions are detected. Apart from taking on dangerous tasks, drones can also monitor areas that do not necessarily pose a risk to human workers. Still, the reliance on human workers can add a considerable margin of error and accuracy. Drone automation shows potential for reducing this risk of error. For instance, the use of drones has significantly enhanced the railway inspection system. Now routine processes may be picked up on more quickly, such as fracture and defect detection, which both require close attention to effectively detect.

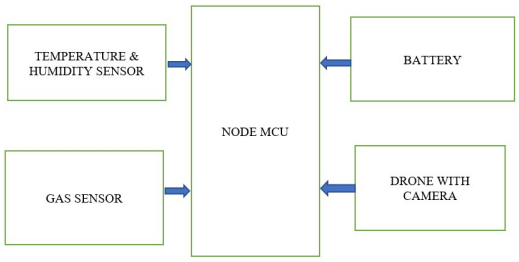

Fig 1.Block Diagram of Proposed System

IV. SIMULATION RESULTS

An online electronics simulator is Wokwi. It may be used to emulate the Arduino, ESP32, and a variety of other well-known boards, components, and sensors. Following are a few brief examples of items you can create using Wokwi: "Hello World," Arduino Uno.

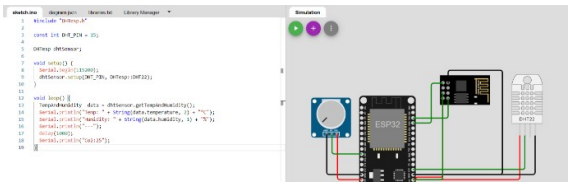

Fig 2. Programming & Component Assembling

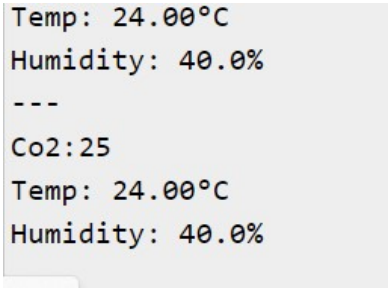

Fig 3. Simulation Output

Time	Smoke	H_2	CO	Temperature	Humidity
secs	ppm			deg C	%
2	61	78	30	26.40	44
4	62	76	32	26.10	43
6	57	75	35	26	45
8	54	76	34	26.80	44
10	55	74	37	27	45
12	56	73	40	26.60	46

Fig 4. Table Analysis

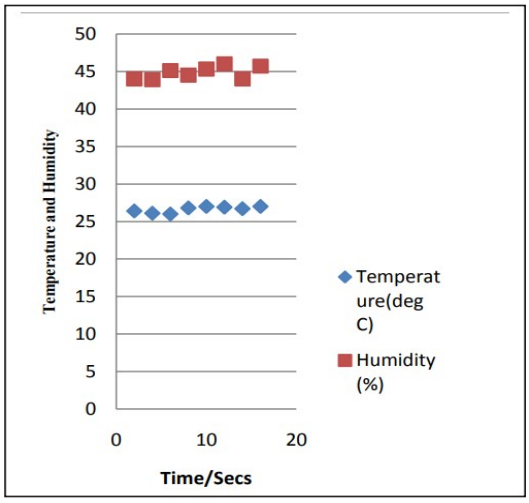

Fig 5. Temperature and Humidity variation

V. EXPERIMENTAL RESULTS

Temperature and humidity sensors, gas sensors, and 9V batteries are commonly used components in drones that are deployed for monitoring and surveillance purposes.

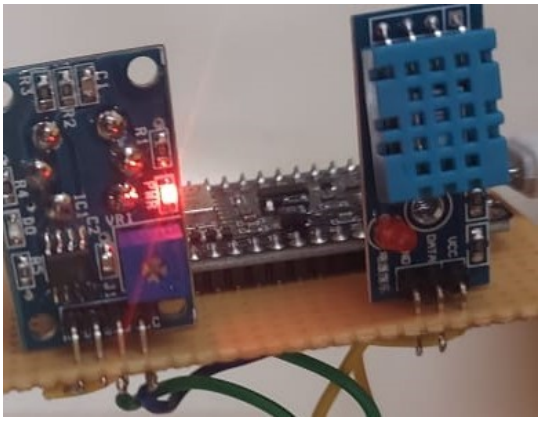

Fig 6. Hardware image of the kit

The temperature and humidity sensors measure the atmospheric conditions and provide critical data to assess the environmental conditions in real-time. Gas sensors detect the presence of hazardous gases such as carbon monoxide, sulfur dioxide, and methane. These sensors can be used to identify gas leaks and prevent hazardous situations. The 9V battery is used to power these sensors and provide the necessary energy to operate the drone. By integrating these sensors with the drone, it is possible to collect critical data on

atmospheric conditions and identify any abnormal activity or hazardous pollution levels. The drone can be programmed to collect data at regular intervals and transmit the information to a centralized cloud platform for further analysis and visualization. This approach provides a cost-effective and efficient way of monitoring industries and mitigating pollution while ensuring public safety.

VI. CONCLUSION

In the past few years, drone-borne analytical instrumentation has proven to be a useful tool for various types of atmospheric pollution monitoring and thus, air quality estimation. Indeed, when properly used, such systems can accurately measure concentration of selected pollutants in the air, produce high-quality concentration maps, localize their main sources, or even quantify the emission rates from these sources. Moreover, multiple applications of different UAV-based systems were investigated: from detection of methane leaks from thawing permafrost to assessment of odor impact in the vicinity of Wastewater Treatment Plants. These investigations clearly revealed that the data obtained from the drone-borne measurements are in good agreement with ground-based measurements, and in certain cases, may surpass them.

REFERENCES

[1] Schwikowski, M. Reconstruction of European Air Pollution from Alpine Ice Cores. In Earth Paleoenvironments: Records Preserved in Mid- and Low-Latitude Glaciers; DeWayne Cecil, L., Green, J.R., Thompson, L.G., Eds.; Developments in Paleoenvironmental Research; Springer: Dordrecht, The Netherlands, 2004; pp. 95–119. [CrossRef]

[2] Wo ´zniak, J.; Pactwa, K. Responsible Mining—The Impact of the Mining Industry in Poland on the Quality of Atmospheric Air. Sustainability 2018, 10, 1184. [CrossRef]

[3] Anenberg, S.; Miller, J.; Henze, D.; Minjares, R. A Global Snapshot of the Air Pollution-Related Health Impacts of Transportation Sector Emissions in 2010 and 2015; International Council on Clean Transportation: Washington, DC, USA, 2019.

[4] Jabło ´nska, M.; Janeczek, J. Identification of industrial point sources of airborne dust particles in an urban environment by a combined mineralogical and meteorological analyses: A case study from the Upper Silesian conurbation, Poland. Atmos. Pollut. Res. 2019, 10, 980–988. [CrossRef]

[5] Apte, K.; Salvi, S. Household air pollution and its effects on health. F1000Research 2016, 5, 2593. [CrossRef] [PubMed]

[6] Trejos, E.M.; Silva, L.F.O.; Hower, J.C.; Flores, E.M.M.; González, C.M.; Pachón, J.E.; Aristizábal, B.H. Volcanic emissions and atmospheric pollution: A study of nanoparticles. Geosci. Front. 2021, 12, 746–755. [CrossRef]

[7] Misiukiewicz, A.; Gao, M.; Filipiak, W.; Cieslak, A.; Patra, A.K.; Szumacher-Strabel, M. Review: Methanogens and methane production in the digestive systems of nonruminant farm animals. Animal 2021, 15, 100060. [CrossRef]

[8] V.Dhinesh, T.Premkumar, S.Saravanan and G.Vijayakumar," Online Grid Integrated Photovoltaic System with New Level Inverter System" International Research Journal of Engineering and Technology (IRJET), Vol.5, Issue 12, pp.1544-1547, 2018

[9] J.Vinoth, T.Muthukumar, M.Murugagndam and S.Saravanan," Efficiency Improvement of Partially Shaded PV System, International Journal of Innovative Research in Science, Engineering and Technology, Vol.4, Special issue 6, pp.1502-1510, 2015

[10] M.B.Malayandi, Dr.S.Saravanan, Dr. M.Muruganandam, "A Single Phase Bridgeless Boost Converter for Power Factor Correction on Three State Switching Cells", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Special Issue 6, pp. 1560-1566, May 2015.

[11] A.Sasipriya, T.Malathi, and S.Saravanan, "Analysis of Peak to Average Power Ratio Reduction Techniques in SFBC OFDM System" IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), Vol. 7, No.5, 2013.

[12] P.Ranjitha, V.Dhinesh, M.Muruganandam, S.Saravanan, "Implementation of Soft Switching with Cascaded Transformers to drive the PMDC Motor", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Special Issue 6, pp. 1411-1418, May 2015.

[13] C.Sowmiya, N.Mohanandhini, S.Saravanan and M.Ranjitha,"Inverter Power Control Based On DC-Link Voltage Regulation for IPMSM Drives using ANN" International Research Journal of Engineering and Technology (IRJET), Vol.5, Issue 11, pp.1442-1448, 2018.

[14] N.Yuvaraj, B.Deepan, M.Muruganandam, S.Saravanan, "STATCOM Based of Adaptive Control Technique to Enhance Voltage Stability on Power Grid", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Special Issue 6, pp. 1454-1461, May 2015.

[15] P.Manikandan, S.Karthick, S.Saravanan and T.Divya," Role of Solar Powered Automatic Traffic Light Controller for Energy Conservation" International Research Journal of Engineering and Technology (IRJET), Vol.5, Issue 12, pp.989-992, 2018.

[16] R.Satheesh Kumar, D. Kanimozhi, S. Saravanan, "An Efficient Control Scheme for Wind Farm Using Back to Back Converter," International Journal of Engineering Research & Technology (IJERT), Vol. 2, No.9, pp.3282-3289, 2013.

[17] K.Prakashraj, G.Vijayakumar, S.Saravanan and S.Saranraj, "IoT Based Energy Monitoring and Management System for Smart Home Using Renewable Energy Resources," International Research Journal of Engineering and Technology, Vol.7, Issue 2, pp.1790-1797, 2020

[18] J Mohammed siddi, A. Senthil kumar, S.Saravanan, M. Swathisriranjani, "Hybrid Renewable Energy Sources for Power Quality Improvement with Intelligent Controller," International Research Journal of Engineering and Technology, Vol.7, Issue 2, pp.1782-1789, 2020

[19] S. Raveendar, P.M. Manikandan, S. Saravanan, V. Dhinesh, M. Swathisriranjani, "Flyback Converter Based BLDC Motor Drives for Power Device Applications," International Research Journal of Engineering and Technology, Vol.7, Issue 2, pp.1632-1637, 2020

[20] K. Manikanth, P. Manikandan, V. Dhinesh, Dr. N. Mohananthini, Dr. S. Saravanan, "Optimal Scheduling of Solar Wind Bio-Mass Systems and Evaluating the Demand Response Impacts on Effective Load Carrying Capability," International Research Journal of Engineering and Technology, Vol.7, Issue 2, pp.1632-1637, 2020

[21] T.R. Vignesh, M.Swathisriranjani, R.Sundar, S.Saravanan, T.Thenmozhi," Controller for Charging Electric Vehicles Using Solar Energy", Journal of Engineering Research and Application, vol.10, Issue.01,pp.49-53, 2020

[22] V.Dhinesh, G.Vijayakumar, S.Saravanan," A Photovoltaic Modeling module with different Converters for Grid Operations", International Journal of Innovative Research in Technology, vol.6, Issue 8, pp.89-95, 2020

[23] V. Dhinesh, R. Raja, S. Karthick, Dr. S. Saravanan," A Dual Stage Flyback Converter using VC Method", International Research Journal of Engineering and Technology, Vol.7, Issue 1, pp.1057-1062, 2020

[24] G. Poovarasan, S. Susikumar, S. Naveen, N. Mohananthini, S. Saravanan," Study of Poultry Fodder Passing Through Trolley in Feeder Box," International Journal of Engineering Technology Research & Management, vol.4, Issue.1, pp.76-83, 2020

[25] C. Sowmya, N. Mohananthini, S. Saravanan, and A. Senthil kumar," Using artificial intelligence inverter power control which is based on DC link voltage regulation for IPMSM drives with electrolytic capacitor," AIP Conference Proceedings 2207, 050001 (2020); https://doi.org/10.1063/5.0000390, Published Online: 28 February 2020

[26] M.Revathi, S.Saravanan, R.Raja, P.Manikandan," A Multiport System for A Battery Storage System Based on Modified Converter with MANFIS Algorithm," International Journal of Engineering Technology Research & Management, vol.4, issue 2, pp.217-222, 2020

[27] D Boopathi, S Saravanan, Kaliannan Jagatheesan, B Anand, "Performance estimation of frequency regulation for a micro-grid power system using PSO-PID controller", International Journal of Applied Evolutionary Computation (IJAEC), Vol.12, Issue.4, pp.36-49, 2021

[28] V Deepika, S Saravanan, N Mohananthini, G Dineshkumar, S Saranraj, M Swathisriranjan, "Design and Implementation of Battery Management System for Electric Vehicle Charging Station", Annals of the Romanian Society for Cell Biology, Vol.25, Issue.6, 17769-17774, 2021

[29] A Senthilkumar, S Saravanan, N Mohananthini, M Pushparaj, "Investigation on Mitigation of Power Quality Problems in Utility and Customer side Using Unified Power Quality Conditioner", Journal of Electrical Systems, Vol.18, Issue.4, pp.434-445, 2022

[30] V Kumarakrishnan, G Vijayakumar, D Boopathi, K Jagatheesan, S Saravanan, B Anand," Frequency regulation of interconnected power generating system using ant colony optimization technique tuned PID controller", Control and Measurement Applications for Smart Grid: Select Proceedings of SGESC 2021, pp..129-141

[31] C Nagarajan, B Tharani, S Saravanan, R Prakash," Performance estimation and control analysis of AC-DC/DC-DC hybrid multi-port intelligent controllers based power flow optimizing using STEM strategy and RPFC technique", International Journal of Robotics and Control Systems", Vol.2, Issue.1, pp.124-139, 2022

[32] G Vijayakumar, M Sujith, S Saravanan, Dipesh B Pardeshi, MA Inayathullaa," An optimized MPPT method for PV system with fast convergence under rapidly changing of irradiation", 2022 International Virtual Conference on Power Engineering Computing and Control: Developments in Electric Vehicles and Energy Sector for Sustainable Future (PECCON), pp.1-4

[33] C Nagarajan, K Umadevi, S Saravanan, M Muruganandam, "Performance Analysis of PSO DFFP Based DC-DC Converter with Non Isolated CI using PV Panel", International Journal of Robotics and Control Systems' Vol.2, Issue.2, pp.408-423, 2022

[34] VM Geetha, S Saravanan, M Swathisriranjani, CS Satheesh, S Saranraj, "Partial Power Processing Based Bidirectional Converter for Electric Vehicle Fast Charging Stations", Journal of Physics: Conference Series, Vol.2325, Issue.1, pp.012028, 2022

[35] M Santhosh Kumar, G Dineshkumar, S Saravanan, M Swathisriranjani, M Selvakumari, "Converter Design and Control of Grid Connected Hybrid Renewable Energy System Using Neuro Fuzzy Logic Model", 2022 Second International Conference on Computer Science, Engineering and Applications (ICCSEA), pp.1-6, 2022

[36] C Gnanavel, A Johny Renoald, S Saravanan, K Vanchinathan, P Sathishkhanna, "An Experimental Investigation of Fuzzy-Based Voltage-Lift Multilevel Inverter Using Solar Photovoltaic Application", Smart Grids and Green Energy Systems, pp.59-74, 2022

[37] C Nagarajan, K Umadevi, S Saravanan, M Muruganandam, "Performance investigation of ANFIS and PSO DFFP based boost converter with NICI using solar panel", International Journal of Engineering, Science and Technology, Vol.14, Issue.2, pp.11-21,2022

[38] K Priyanka, N Mohananthini, S Saravanan, S Saranraj, R Manikandan, "Renewable operated electrical vehicle battery charging based on fuzzy logic control system", AIP Conference Proceedings, Vol.2452, Issue.1, pp.030007, 2022