

DAFTAR PUSTAKA

- Abdelmoneim, A.A., Al Kalaany, C.M., Khadra, R., Derardja, B. and Dragonetti, G., 2025. Calibration of Low-Cost Capacitive Soil Moisture Sensors for Irrigation Management Applications. *Sensors*, 25(2). <https://doi.org/10.3390/s25020343>.
- Agustirandi, B., Inayah, I., Aminah, N.S. and Budiman, M., 2024. Analysis comparison, calibration, and application of low-cost soil moisture in smart agriculture based on internet of things. *Telkomnika (Telecommunication Computing Electronics and Control)*, 22(5), pp.1221–1230. <https://doi.org/10.12928/TELKOMNIKA.v22i5.25703>.
- Al-Mattarneh, H., Ismail, R., Rawashdeh, A., Nimer, H., Khodier, M., Hatamleh, R., Telfah, D. and Jaradat, Y., 2025. Development of new dielectric models for soil moisture content using mixture theory, empirical methods, and artificial neural network. *AIMS Environmental Science*, 12(1), pp.137–164. <https://doi.org/10.3934/environsci.2025007>.
- Anifowoshe, Y.O., Lozada, D., Sanogo, S. and Djaman, K., 2025. *Water Management in Chile Peppers and Plant Susceptibility to Phytophthora capsici and Development of Phytophthora Blight: A Review*. *Agronomy*, <https://doi.org/10.3390/agronomy15122819>.
- Bakhshian, S., Zarepakzad, N., Nevermann, H., Hohenegger, C., Or, D. and Shokri, N., 2025. Field-scale soil moisture dynamics predicted by deep learning. *Advances in Water Resources*, 201. <https://doi.org/10.1016/j.advwatres.2025.104976>.
- Bandaru, L., Irigireddy, B.C., PVNR, K. and Davis, B., 2024. DeepQC: A deep learning system for automatic quality control of in-situ soil moisture sensor time series data. *Smart Agricultural Technology*, 8. <https://doi.org/10.1016/j.atech.2024.100514>.
- Bautista, C.J.C., Gallegos, R.K.B. and Lampayan, R.M., 2025. Machine learning and digital twins in smart irrigation: optimising water use through

- agricultural data analytics. *Digital Twin*.
<https://doi.org/10.1080/27525783.2025.2562418>.
- Bayar, J., Ali, N., Cao, Z., Ren, Y. and Dong, Y., 2025. *Artificial intelligence of things (AIoT) for precision agriculture: applications in smart irrigation, nutrient and disease management*. *Smart Agricultural Technology*,
<https://doi.org/10.1016/j.atech.2025.101629>.
- Beynon-Davies, P., Came, C., Mackay, H. and Tudhope, D., 1999. Rapid application development (Rad): An empirical review. *European Journal of Information Systems*, 8(3), pp.211–232.
<https://doi.org/10.1057/palgrave.ejis.3000325>.
- Breiman, L., 2001. Random Forests. *Machine Learning*, 45, pp.5–32.
<https://doi.org/10.1023/A:1010933404324>.
- Chen, P.Y., Chen, C.C., Kang, C., Liu, J.W. and Li, Y.H., 2025. Soil water content prediction across seasons using random forest based on precipitation-related data. *Computers and Electronics in Agriculture*, 230.
<https://doi.org/10.1016/j.compag.2024.109802>.
- Chicco, D., Warrens, M.J. and Jurman, G., 2021. The coefficient of determination R-squared is more informative than SMAPE, MAE, MAPE, MSE and RMSE in regression analysis evaluation. *PeerJ Computer Science*, 7, pp.1–24. <https://doi.org/10.7717/PEERJ-CS.623>.
- Choudhary, V., Guha, P., Pau, G. and Mishra, S., 2025. *An overview of smart agriculture using internet of things (IoT) and web services*. *Environmental and Sustainability Indicators*, <https://doi.org/10.1016/j.indic.2025.100607>.
- Custódio, G. and Prati, R.C., 2024. Comparing modern and traditional modeling methods for predicting soil moisture in IoT-based irrigation systems. *Smart Agricultural Technology*, 7. <https://doi.org/10.1016/j.atech.2024.100397>.
- Datta, D., Paul, M., Murshed, M., Teng, S.W. and Schmidtke, L., 2023. Comparative Analysis of Machine and Deep Learning Models for Soil Properties Prediction from Hyperspectral Visual Band. *Environments - MDPI*, 10(5). <https://doi.org/10.3390/environments10050077>.

- Domínguez-Bolaño, T., Campos, O., Barral, V., Escudero, C.J. and García-Naya, J.A., 2022. *An overview of IoT architectures, technologies, and existing open-source projects. Internet of Things (Netherlands)*, <https://doi.org/10.1016/j.iot.2022.100626>.
- García, L., Parra, L., Jimenez, J.M., Lloret, J. and Lorenz, P., 2020. *IoT-based smart irrigation systems: An overview on the recent trends on sensors and iot systems for irrigation in precision agriculture. Sensors (Switzerland)*, <https://doi.org/10.3390/s20041042>.
- Geng, Q., Yan, S., Li, Q. and Zhang, C., 2024. Enhancing data-driven soil moisture modeling with physically-guided LSTM networks. *Frontiers in Forests and Global Change*, 7. <https://doi.org/10.3389/ffgc.2024.1353011>.
- Han, J., Pei, J. and Tong, H., 2023. *Data Mining: Concepts and Techniques*. 4th ed. Cambridge: Morgan Kaufmann. <https://doi.org/10.1016/C2013-0-18660-6>.
- Harini, S.N., Kaliaperumal, D. and Ganapathy, T.M., 2025. Adaptive IOT-Enabled Dual-Sensor System for Optimizing Light and Moisture Levels in Ornamental Plant Cultivation. *International Journal of Engineering Research & Technology (IJERT)*, [online] 14(05). <https://doi.org/10.5281/zenodo.18104904>.
- Hercog, D., Lerher, T., Truntič, M. and Težak, O., 2023. Design and Implementation of ESP32-Based IoT Devices. *Sensors*, 23(15). <https://doi.org/10.3390/s23156739>.
- Heryani, N., Kartiwa, B., Sosiawan, H., Rejekiningrum, P., Adi, S.H., Apriyana, Y., Pramudia, A., Yufdy, M.P., Tafakresnanto, C., Rivaie, A.A., Suratman, Dariah, A., Malik, A., Yusuf and Setiani, C., 2022. Analysis of Climate Change Impacts on Agricultural Water Availability in Cimanuk Watershed, Indonesia. *Sustainability (Switzerland)*, 14(23). <https://doi.org/10.3390/su142316236>.
- Hilal, Y.Y., Khessro, M.K., van Dam, J. and Mahdi, K., 2022. Automatic Water Control System and Environment Sensors in a Greenhouse. *Water (Switzerland)*, 14(7). <https://doi.org/10.3390/w14071166>.

- Hochreiter, S. and Schmidhuber, J., 1997. Long Short-Term Memory. *Neural Computation*, [online] 9(8), pp.1735–1780. <https://doi.org/10.1162/neco.1997.9.8.1735>.
- Hodson, T.O., 2022. *Root-mean-square error (RMSE) or mean absolute error (MAE): when to use them or not*. *Geoscientific Model Development*, <https://doi.org/10.5194/gmd-15-5481-2022>.
- Hou, Y., Li, Q., Zhang, C., Lu, G., Ye, Z., Chen, Y., Wang, L. and Cao, D., 2021. *The State-of-the-Art Review on Applications of Intrusive Sensing, Image Processing Techniques, and Machine Learning Methods in Pavement Monitoring and Analysis*. *Engineering*, <https://doi.org/10.1016/j.eng.2020.07.030>.
- Ingrao, C., Strippoli, R., Lagioia, G. and Huisingh, D., 2023. *Water scarcity in agriculture: An overview of causes, impacts and approaches for reducing the risks*. *Heliyon*, <https://doi.org/10.1016/j.heliyon.2023.e18507>.
- Jannah, M. and Aulia, R., 2025. Implementation of Linear Regression Method in Light Strength Measurement Using GY-30 BH1750 Sensor. 18(1), pp.1979–276. <https://doi.org/10.30998/faktorexacta.v18i1.26062>.
- Kandamali, D.F., Kiobia, D.O., Ngimbwa, P.C., Mwitta, C.J., McLemore, A., Porter, E., Porter, W. and Rains, G.C., 2025a. Soil Moisture Prediction Using LSTM And Ensemble Learning Methods. *IFAC-PapersOnLine*, [online] 59(23), pp.297–302. <https://doi.org/10.1016/j.ifacol.2025.11.803>.
- Kandamali, D.F., Porter, E., Porter, W.M., McLemore, A., Kiobia, D.O., Tavandashti, A.P. and Rains, G.C., 2025b. Hybrid LSTM Method for Multistep Soil Moisture Prediction Using Historical Soil Moisture and Weather Data. *AgriEngineering*, 7(8). <https://doi.org/10.3390/agriengineering7080260>.
- Kumar, V., Sharma, K.V., Kedam, N., Patel, A., Kate, T.R. and Rathnayake, U., 2024. A comprehensive review on smart and sustainable agriculture using IoT technologies. *Smart Agricultural Technology*, 8. <https://doi.org/10.1016/j.atech.2024.100487>.

- Marković, M., Matoša Kočar, M., Barač, Ž., Turalija, A., Atılgan, A., Jug, D. and Ravlić, M., 2024. Field Performance Evaluation of Low-Cost Soil Moisture Sensors in Irrigated Orchard. *Agriculture (Switzerland)*, 14(8). <https://doi.org/10.3390/agriculture14081239>.
- Mitrowska, D., Kleniewska, M. and Kuchar, L., 2025. Modeling Solar Radiation Data for Reference Evapotranspiration Estimation at a Daily Time Step for Poland. *Water*, 17(22), p.3304. <https://doi.org/10.3390/w17223304>.
- Morchid, A., Et-taibi, B., Oughannou, Z., Alami, R. El, Qjidaa, H., Jamil, M.O., Boufounas, E.M. and Abid, M.R., 2025. IoT-enabled smart agriculture for improving water management: A smart irrigation control using embedded systems and Server-Sent Events. *Scientific African*, 27. <https://doi.org/10.1016/j.sciaf.2024.e02527>.
- Nalendra, A.K., 2021. Rapid Application Development (RAD) model method for creating an agricultural irrigation system based on internet of things. *IOP Conference Series: Materials Science and Engineering*, 1098(2), p.022103. <https://doi.org/10.1088/1757-899x/1098/2/022103>.
- Ogunsakin, R., Mehandjiev, N. and Marin, C.A., 2023. Towards adaptive digital twins architecture. *Computers in Industry*, 149. <https://doi.org/10.1016/j.compind.2023.103920>.
- Ortiz, B.L., Gupta, V., Kumar, R., Jalin, A., Cao, X., Ziegenbein, C., Singhal, A., Tewari, M. and Choi, S.W., 2024. *Data Preprocessing Techniques for AI and Machine Learning Readiness: Scoping Review of Wearable Sensor Data in Cancer Care*. *JMIR mHealth and uHealth*, <https://doi.org/10.2196/59587>.
- Parewai, I. and Köppen, M., 2025. A Digital Twin Approach for Soil Moisture Measurement with Physically Based Rendering Simulations and Machine Learning. *Electronics (Switzerland)*, 14(2). <https://doi.org/10.3390/electronics14020395>.
- Purcell, W. and Neubauer, T., 2023. *Digital Twins in Agriculture: A State-of-the-art review*. *Smart Agricultural Technology*, <https://doi.org/10.1016/j.atech.2022.100094>.

- Raheja, A., Sharda, R., Garg, S., Kaur, S., Das, S. and Choudhary, O.P., 2025. Designing and field calibration of low-cost microcontroller-based soil moisture sensor for subsurface drip-irrigation system. *Scientific Reports*, 15(1). <https://doi.org/10.1038/s41598-024-81288-z>.
- Rosa, L. and He, L., 2025. Global multi-model projections of green water scarcity risks in rainfed agriculture under 1.5 °C and 3 °C warming. *Agricultural Water Management*, 314. <https://doi.org/10.1016/j.agwat.2025.109519>.
- Schröer, C., Kruse, F. and Gómez, J.M., 2021. A systematic literature review on applying CRISP-DM process model. In: *Procedia Computer Science*. Elsevier B.V. pp.526–534. <https://doi.org/10.1016/j.procs.2021.01.199>.
- Sidhu, H., Kwekutsu, E., Bhowmik, A. and Sharma, H., 2025. Evaluating Water Use Dynamics and Yield Responses in Capsicum chinense Cultivars Using Integrated Sensor-Based Irrigation System. *Horticulturae*, 11(8). <https://doi.org/10.3390/horticulturae11080978>.
- Solano, J.A., Lancheros Cuesta, D.J., Umaña Ibáñez, S.F. and Coronado-Hernández, J.R., 2021. Predictive models assessment based on CRISP-DM methodology for students performance in Colombia - Saber 11 Test. In: *Procedia Computer Science*. Elsevier B.V. pp.512–517. <https://doi.org/10.1016/j.procs.2021.12.278>.
- Tace, Y., Tabaa, M., Elfilali, S., Leghris, C., Bensag, H. and Renault, E., 2022. Smart irrigation system based on IoT and machine learning. *Energy Reports*, 8, pp.1025–1036. <https://doi.org/10.1016/j.egyr.2022.07.088>.
- Taye, M.M., 2023. *Understanding of Machine Learning with Deep Learning: Architectures, Workflow, Applications and Future Directions*. *Computers*, <https://doi.org/10.3390/computers12050091>.
- Tirtalistyani, R., Murtiningrum, M. and Kanwar, R.S., 2022. *Indonesia Rice Irrigation System: Time for Innovation*. *Sustainability (Switzerland)*, <https://doi.org/10.3390/su141912477>.
- Utami, D.S., Nurrachman, Anjar Pranggawan Azhari and Afifah Farida Jufri, 2025. Respon Pertumbuhan dan Hasil Tanaman Cabai Rawit (*Capsicum frutescens* L.) Terhadap Interval Irigasi dan Aplikasi Silika di Lahan Kering

Lombok Utara. *Jurnal Ilmiah Mahasiswa Agrokomplek*, 4(1), pp.226–233.
<https://doi.org/10.29303/jima.v4i1.7075>.

- Wardani, I.K., Ichniarsyah, A.N., Telaumbanua, M., Priyonggo, B., Fil'Aini, R., Mufidah, Z. and Dewangga, D.A., 2023. The feasibility study: Accuracy and precision of DHT 22 in measuring the temperature and humidity in the greenhouse. In: *IOP Conference Series: Earth and Environmental Science*. Institute of Physics. <https://doi.org/10.1088/1755-1315/1230/1/012146>.
- Zhang, R., Zhu, H., Chang, Q. and Mao, Q., 2025. *A Comprehensive Review of Digital Twins Technology in Agriculture*. *Agriculture (Switzerland)*, <https://doi.org/10.3390/agriculture15090903>.