**Internship Proposal / Internship Proposal  
(To be returned by email to** [**contact.dniit@ac.udn.vn**](mailto:contact.dniit@ac.udn.vn) **)**

**Year: 2024**

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| **Workplace** | | S04.05, The University of Danang – University of Science and Technology |
| **Internship Category** | | IUT/Bachelor  Master1/I4 X Master2/I5 |
| **Specialty** | | IT+Electronics+Mathematics |
| **Student's name and contact information (if known)** | | 2 students: |
| **Proposal title** | | **Water Meter Reading with Camera-based Index Recognition** |
| **Description of the proposal (1 page)**   1. **Introduction**   Access to clean and potable water is a fundamental human right, and it is essential for individuals and communities to monitor their water usage accurately. In this context, the "Water Meter Reading with Camera-based Index Recognition" project represents a significant technological advancement in the realm of utility management. Traditional water meter reading methods can be time-consuming, error-prone, and often require manual intervention. This project introduces a cutting-edge solution that leverages camera-based index recognition to streamline and modernize the process of water meter reading.  Water utilities and consumers alike can benefit from a system that combines the power of computer vision and data analysis to ensure precise and efficient meter readings. By capturing images of water meters and utilizing image recognition algorithms, this project offers a more convenient and accurate means of tracking water consumption. The system not only simplifies the billing process for utilities but also empowers consumers to monitor their water usage in real-time, promoting responsible water management.   1. **Objective**   The "Water Meter Reading with Camera-based Index Recognition" project endeavors to revolutionize the way water consumption is monitored and managed, offering a forward-looking solution that benefits both water utilities and consumers. By achieving these objectives, the project aims to enhance the efficiency, accuracy, and transparency of water meter readings while promoting responsible water usage and conservation.   1. **Work to be developed in this internship.**   **A close up of a meter  Description automatically generatedA black object with a camera on it  Description automatically generated**  A black arrow pointing to a number  Description automatically generated  *Figure 1. Water Meter Reading device with ESP32-CAM*   * ESP32-CAM: Water is a precious and finite resource, and its responsible management is a global imperative. In this context, the "ESP32-CAM Water Meter Reading" project emerges as a groundbreaking solution that harnesses the power of the ESP32-CAM microcontroller and camera module to revolutionize the way we monitor and manage water consumption. Traditional water meter reading processes are often manual, labor-intensive, and prone to inaccuracies. This project introduces an innovative and cost-effective method for automated water meter reading, facilitating real-time data collection, analysis, and remote monitoring. * Image processing: The ESP32-CAM, a versatile microcontroller with integrated Wi-Fi and a camera module, offers a powerful platform for capturing water meter readings with precision and efficiency. By equipping water meters with ESP32-CAM units, this project aims to automate the collection of consumption data, eliminating the need for manual meter readings. * Machine learning for the recognition: Machine learning models, such as convolutional neural networks (CNNs), can be trained to recognize and extract water meter index readings from images captured by the ESP32-CAM. These models can learn to identify meter dials or digital displays, segment the digits, and convert them into readable values. The ESP32-CAM can use these models to interpret meter readings accurately and in real-time, reducing errors in manual interpretation. * LoRaWAN Wireless Communication: In order to tranfer data from smart water meter to the server, the system will use LoRaWAN (Low Power Wide Area Network) wireless technology for data communication. LoRaWAN is suitable for long-range, low-power communication, making it ideal for IoT (Internet of Things) applications. This LoRaWAN network server and Gateway are also provided.  1. **Specific technic tools and working conditions.**  * Hardware: Tracking device using LoRaWAN will be provided as Figure 2. * LoRaWAN network server account will be provided. * Server to run application will be provided also (Linux or window). * Grafana which is the open-source analytics & monitoring solution prefer to use to build the application.  1. **Documentation references**  * MCU programming source code: <https://github.com/nguyenmanhthao996tn/LoRaSpaceLib-STM32WL> * Application: <https://grafana.com/oss/grafana/> * <https://www.libe.net/en-watermeter> | | |