Our team's problem statement is denoted as '**Automatic regulation of valves for release of water based upon soil moisture availability in the root zone of the crop, using artificial intelligence, in a piped and micro irrigation network of irrigation system'**. This statement is primarily concerned with efficient utilization and control of irrigation resources, requiring the development of an adaptable automated system which incorporates artificial intelligence (AI). Some challenges faced here are dynamic water control, real-time data integration, algorithm selection and tuning, intelligent valve control mechanism development, while ensuring economic viability. Herein, we propose a solution to tackle these issues.

Our solution makes use of wireless communication systems employing IoT devices along with a scoring-based machine learning model interfaced with a responsive dashboard. Firstly, the soil moisture sensor is embedded in the soil layer near the roots, while the temperature, air humidity and rain detection sensor are deployed on the surface. If the farmer has utilized this system for various fields, the field number is noted for each field sensor value. These values are sampled every 30s to generate a comprehensive database. After these values are noted, they are sent to the adjacent Arduino Nano, which is powered using a battery. The module sends this data to the laptop via a XBee radio network. The XBee devices are connected to a main XBee network coordinator. Sensor data is sent via AT command frames from each field XBee. This coordinator device is connected to the control device. XBee coordinator is connected to the control device via a USB interface on a XBee adapter board
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Farmers have control over readings and manual device operation through a dashboard displaying real-time soil moisture. The dashboard also provides AI advice during manual operation. Field numbers inputted correspond to a database with specific soil metrics for each field, influencing the ML model's threshold for operation.

Input data undergoes preprocessing before being fed into the ML model. Using sensor-detected temperature and humidity, a sub-parameter is generated based on their correlation with soil moisture. The model analyzes real-time soil moisture data, calculates moisture slope, and combines this with the temperature-humidity sub-parameter in three ML models. These models determine the valve's open duration. Rainfall detection acts as a delay, momentarily halting valve operation while monitoring slope changes.

The model's output directs the microcontroller module, regulating valve operation. This ensures the valve is open for the necessary duration, preventing excessive water use. The ML model efficiently manages valve operation, optimizing irrigation practices for crop growth.