Internet of things (IoT), new ideas of connecting things and people to deliver different services, is rapidly advancing and reinforcing businesses to introduce more and more smart devices and wearables continually in the market. IoT has reached the pinnacle of inflated expectations of emerging technologies.

Different Businesses are mostly benefitted in following six ways by adopting IoT related services

1. Increase Business Opportunities
2. Enhanced Asset Utilization
3. Efficient Processes
4. Improved Safety and Security
5. Increase Productivity
6. Cost Saving

Softweb Technologies, being pioneer in introducing new technology and innovative solutions in Agro-Plantation –Forestry based Industry, has also been successful in developing few solutions to remove different types of repetitive operational hurdles and increase productivity of different companies belonging to this industry.

Brief Description of different such solutions:

1. Tea Manufacturing Process Automation & Intelligent control:

   Facilities Created in the Factory Floor:
   a. Monitoring & control of various process parameters of withering troughs, Rotorvane, CTC machines, CFM & VFBD through relevant sensors and sensing systems.
   b. Micro-controller based Gravimetric Weigh Feeder (MGWF) at Rotorvane and VFBD
   c. Intelligent Withering Monitoring and Control Systems (WMCS) for withering process
   d. LAN extension to the CFM for on-line data communication from Electronic Tasting & Monitoring System (used for quality monitoring at Fermentation and also for finished Tea) at CFM bed to CCR (Central Control Room).
Benefits:

a. Structured, authentic, current as well as historical data of the relevant tea manufacturing process (of different stages) parameters will equip and empower Tea Scientist / Factory Manager to derive different insights to produce better quality tea with optimum power consumption.

b. The information & knowledge generated out of such infrastructure will definitely assist companies to come up with new and better techniques in manufacturing Tea which may result in 1) improvement of Productivity, 2) Gain in Energy Saving, 3) Quality Improvement and 4) Improvement in Operational Efficiency.

2. Electronic Tasting & Monitoring System (for Quality Estimation of Tea):

Facilities:

a) One smart instrument is designed to detect and discriminate among complex odours using an array of sensors. This is used for Fermentation Monitoring (smell changes during the fermentation process can be reliably and repeatedly detected and thus optimal fermentation time can be arrived in). The same instrument is used for Finished Tea Classification i.e. capable of sensing the volatile compounds of the tea samples and reliably predicts Tea Taster like scores with high degree of accuracy at a much lesser time.

** One miniature version / Handheld device based system is also available for the same purpose i.e. assessment of finished tea quality, determination of optimum fermentation time for tea during manufacturing. It also provides additional test beds for Cheese Ripening, Floral (Jasmine, Rose) Extracts, quality estimation of spices & breathe analysis for Diabetes detection.

b) There is another type of system which works based on digital camera based image processing instrument and performs image capturing & feature extraction for quality analysis of Tea.

This kind of system provides:

1. End Point Detection of Fermentation by monitoring tea leaf colour
2. Mimicking Visual Inspection of Tea Taster by Electronic means
3. Quality Estimation (Tea Gradation, blackness, Fibre Detection) of Manufactured Tea at Drier Mouth

c) One more smart system is designed to Taste characterization of Tea and Monitoring aging of Tea. This consists of electrochemical cell, sensory array and appropriate pattern recognition system capable of recognizing simple or complex soluble non-volatile molecules that forms a taste of a sample. This provides PC based acquisition & control for sample handling and displays Tea Tasters’ like scores. Highly flexible software (used at the backend to process the data coming out of the system) is developed to support/meet Customers’ operational need based customization requirements.
3. **Bio-Sensing System for Pesticide Detection in Tea ::**

   Portable & standalone system. Combination of Enzyme based Colorimetric Bio-sensing System where inbuilt scanner based advanced colour analysis is done & Voltammetry based Bio-Sensing System with graphical User Interface.

   **Objective::** To detect banned pesticide in Tea as well as detect residue of other pesticides in Tea.

   **Pesticide Selected::** Monocrotophos, Quinalphos, Dimethoate & Chlorpyrifos

4. **WFMS (Wireless Firm Management System) :**

   It’s a Smart Decision Support System which furnish MIS reports based on real time field level data (physical, chemical & physico-chemical properties of Soil; Tea Leaf Surface Properties & Physiological parameters determined through Wireless Sensors) collected at source.

   **Features & Benefits::**

   ✓ Fully automated, real time, round the clock, online wireless field data collection system for Tea Plantation along with Decision Support System (DSS) software.
   ✓ Field parameters: Ambient & Soil Temperature, Soil Moisture & pH, Solar Radiation, Leaf Moisture, Humidity, Insect Invasion, Diseases etc.
   ✓ An efficient system for tea production management with quick availability of accurate data on hourly basis with repeatability.
   ✓ Provides an online Decision Support System (DSS), which includes scheduling of agronomic practices/operations at tea section and garden level
   ✓ Monitoring of field parameters by online image capturing (infra red imaging even in night) for disease detection and other associated decisions
   ✓ Computerized data acquisition enriches the database with accurate data within very short time interval
   ✓ User-friendly DSS software can handle and analyze multiple input parameters at the same time, which is difficult in a manual decision making process
   ✓ Quick and quality decision-making can enhance tea production through a robust decision making process
   ✓ Removes elaborate laboratory and field procedures and related expenses
5. **Master Taster [Green Leaf Quality Tasting (Fine Leaf Count) Tool]**: The major quality attributes of tea are flavor, aroma, color, and strength. But the final quality of tea depends upon the quality of inward tea leaves in the factory. In specialized cases high-end chemical instruments like Gas Chromatograph (GC) and High Precision Liquid Chromatography (HPLC) can be used for finding out micro-constituents present in the tea leaves but the Chemical Analysis methods are offline, time consuming, need expert manpower and elaborate sample preparation and involve costly consumables. At the user level, there exists an emergent need for some fast methodology capable of measuring the quality of the inward tea leaves. In this context, quality estimation of inward tea leaves using Smart Electronic Device named **Master Taster** was tried.

By intelligent integration of different types of non-specific sensors with advanced soft computing techniques, human taste sensory panel has been successfully mimicked in new techniques/system called **Master Taster**. But the very essence of such research and development efforts has centered on development of customized **Master Taster** solutions specific to individual applications.

A customized juice extraction technique along with **Master Taster** equipped with suitable software can be developed to quantify the percentage of fine count in inward tea leaves.