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Soil Health Monitoring System Using FRDM KL25Z

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Abstract: Healthy soil is the foundation for profitable, productive, and environment sound agriculture systems. By understanding how the soil processes that support plant growth and regulate environmental quantity are affected by management practices. Farmers are unable to understand the current situation of the soil conditions physically. To overcome this problem our project SOIL HEALTH MONITORING SYSTEM helps in testing soil in more substantial and quantifiable way is becoming more important due to increasing interest in soil health and sustainability in the past. Monitoring soil meant going out and physically testing the soil taking samples and comparing with existing knowledge banks of soil information. After monitoring soil health farmers can have a clear idea about the soil and the crop which suits the soil. Testing soil conditions will reduce the time required to produce the crop and will result in higher yield to the crop. In this manner we can avoid crop failure which is growing concern today.

I. INTRODUCTION

Agriculture as an art of raising crops and livestock flourished primarily on the fertile banks of most of the alluvial rivers of the world. With the spread of agriculture to almost all parts of the tropical and temperate world human life gradually tended to be more settled, organized and socialized. As a spontaneous but significant response to the natural environment and growing social needs, agriculture has emerged both as a major claimant of the land resources and a principal livelihood for most of the people. The overwhelming dependence on agriculture has forced people to extend their agricultural activities even to the most marginal areas creating thereby the earth's agroecosystems more diverse.

The modem agricultural practices managed through capital- 7 intensive methods of farming are basically guided by the principle of profit maximization, which has of late raised some issues relating to the sustainability of the 1 agroecosystems. An agricultural production system is said to be sustainable if it enhances or maintains the productivity and profitability of the farming system in a region over the years and conserves the integrity diversity of both the agricultural production systems and the surrounding natural ecosystems, and also enhances health, safety and aesthetic satisfaction of the consumers and producers (Rao, 2002). Sustainable agriculture is thus a system of farming having its roots in a set of values that reflect awareness of both ecological and social realities.

II. BLOCK DIAGRAM

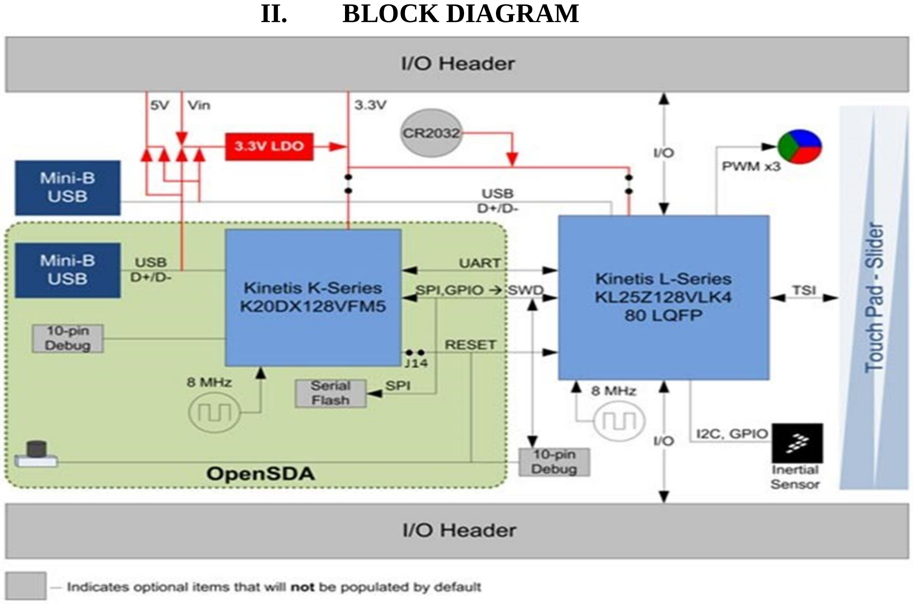

Fig 1 Block Diagram Of FRDM KL25Z

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The FRDM-KL25Z has been designed by Free scale in collaboration with mbed for prototyping all sorts of devices, especially those requiring the size and price point offered by Cortex-M0+ and the power of USB Host and Device. It is packaged as a development board with connectors to break out to strip board and breadboard, and includes a built-in USB FLASH programmer.[2]

The target microcontroller of the FRDM-KL25Z is the KL25Z128VLK4, a Kinetis L series device in an 80 LQFP package. The KL25Z MCU features include: 32-bit ARM Cortex-M0+ core - up to 48 MHz operation ,Single-cycle fast I/O access port, Memories - 128 KB flash , 16 KB SRAM , Analog peripheral - 16-bit SAR ADC w/ DMA support , 12-bit DAC w/ DMA support , High speed comparator ,Communication peripherals - Two 8-bit Serial Peripheral Interfaces (SPI) , USB dual-role controller with built-in FS/LS transceiver , USB voltage regulator Two I2C modules ,One low-power UART and two standard UART modules. The Kinetis KL25 microcontrollers feature a dual-role USB controller with on-chip full-speed and low speed transceivers. The USB interface on the FRDM-KL25Z is configured as a full-speed USB device. J5 is the USB connector for this interface.[The sole debug interface on all Kinetis L Series devices is a Serial Wire Debug (SWD) port. The primary controller of this interface on the FRDM-KL25Z is the on board OpenSDA circuit (see section 5.2). However, an unpopulated 10-pin (0.05") Cortex Debug connector, J6, provides access to the SWD signals. The Samtec FTSH-105-02-F-D or compatible connector can be added to the J6 through-hole debug connector to allow for an external debug cable to be connected.

Block Diagram Of The Project

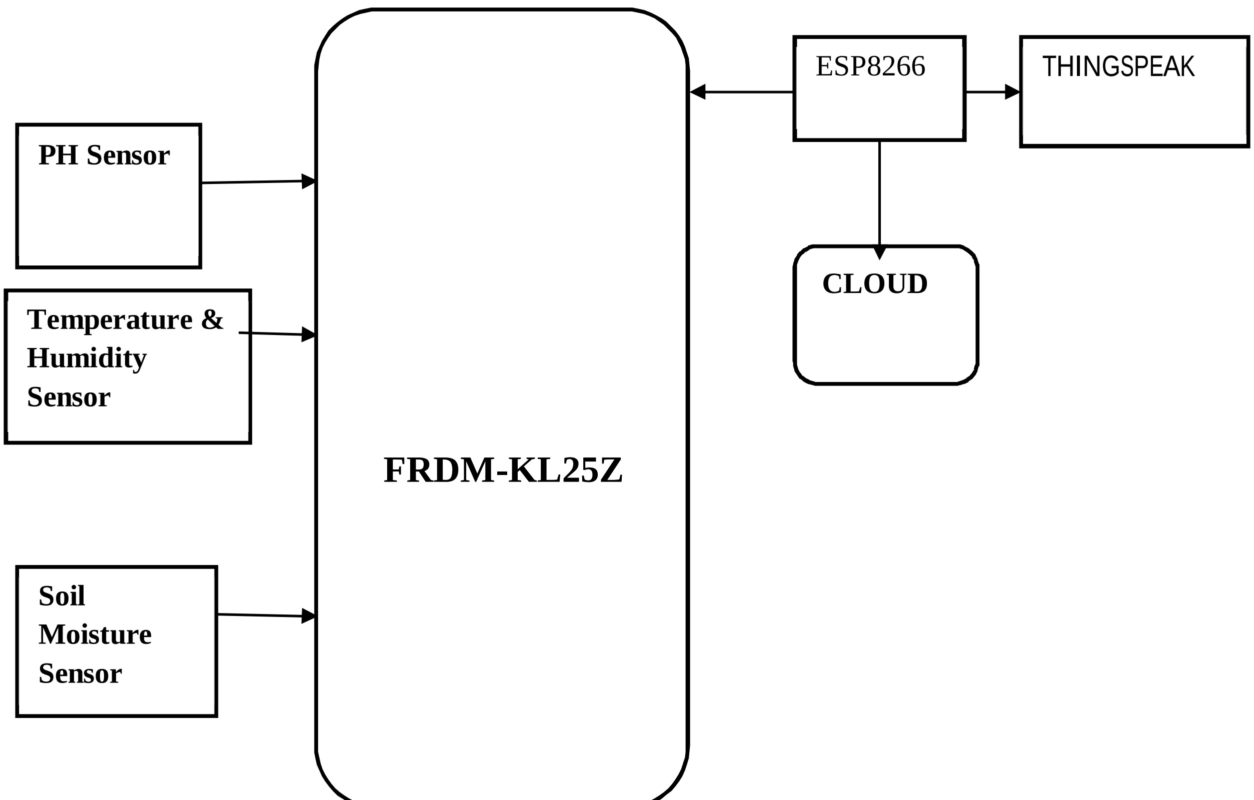

Fig. 2 Block Diagram Of The Project

DHT11 digital temperature and humidity sensor is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability. The sensor includes a resistive sense of wet components and an NTC temperature measurement device, and connected with a high-performance 8-bit microcontroller.

A pH meter is a scientific instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity expressed as pH. The pH meter measures the difference in electrical potential between a pH electrode and a reference electrode, and so the pH meter is sometimes referred to as a "potentiometric pH meter". The difference in electrical potential relates to the acidity or pH of the solution. The pH meter is used in many applications ranging from laboratory experimentation to quality control.

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Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

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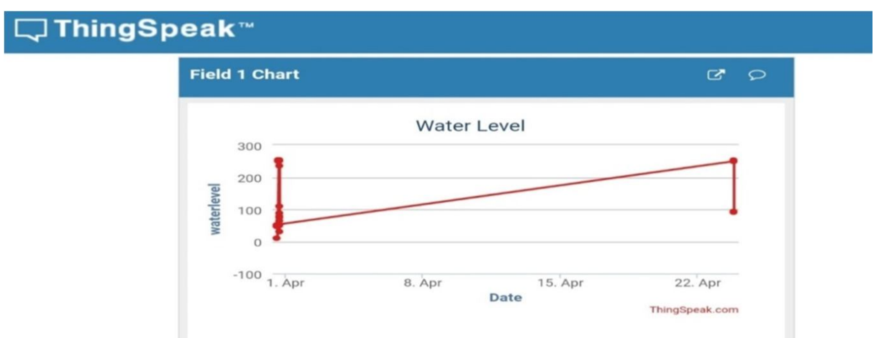
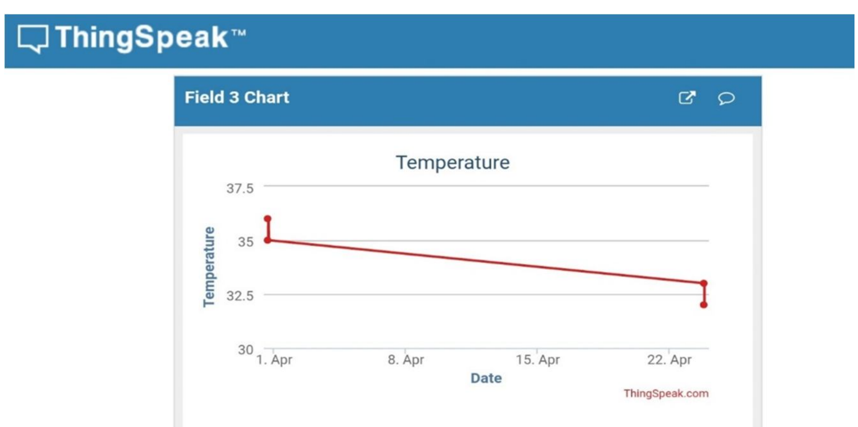
III. SIMULATION AND RESULTS

The sensors are placed to the detect the Charecterstics of Soil, all sensors are monitored and the sensor values are uploaded into the cloud i.e ThingSpeak.The sensor values are uploaded to the cloud using Esp8266 module.





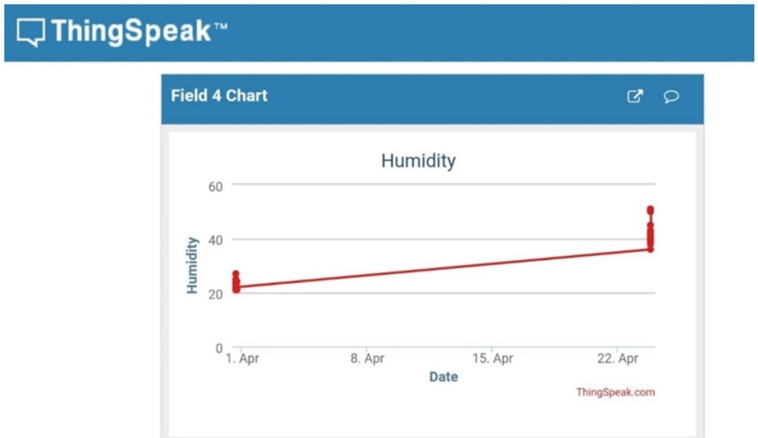


Fig. 4 Displaying The Sensor Values

IV. CONCLUSION AND FUTURE WORK

The primary goal of this thesis is to develop a wearable/handheld device for early warning in the restricted area, displaying various physical parameters like temperature, hazardous gases, sound and metal and soil moisture in the agricultural field useful for agricultural farmer by wirelessly measuring them. It will also be useful for farmers for getting all information about the environment in a single piece of device which is easily operable by anyone. This system is a reliable communication system without breakdown because of the use of Personal Area Network. All the data can be read by the smart device without interruption and delay because of the efficient use of communication algorithm in the control node. Employing embedded technology, based on FRDMKL25Z, the Wireless Sensor Nodes are designed and implemented.

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