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WIRELESS SOLUTION FOR SMART AGRICULTURE USING INTEL GALILEO (Gen 2)

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ABSTRACT: India is agriculture based country and its economy primarily depends upon the growth of agriculture sector only. Most of the cultivation activities are in row for transforming to automated system with the advent of embedded applications in agricultural activities. So in our project we planned to monitor and control some of the agricultural activities using multiple sensors based system. These sensors will constantly supervise the related ecological conditions, hydrological conditions, earth conditions and crop specific conditions in the field. Thus part of the farming works are accomplished in smart way by integrating Wireless Sensors in agriculture field. In this project the control of horizontal angle of sprinkler nozzle using stepper motor and soil moisture based closed loop control system reduce the water wastage in elegant way.Our embedded sensors are controlled by the "INTEL GALILEO"(Gen 2). Microcontroller development board.

KEYWORDS: smart agriculture, soil moisture, sprinkler, Intel Galileo.

1 INTRODUCTION

The major problem faced in many agricultural areas is that lack of mechanization in agricultural activities. In India agricultural activities are carried out by manual labor, using conventional tools. We can reduce a lot of manual work in the field of agriculture using automation. The main idea of the project is to automate the agricultural activities. So in our project we planned to monitor and control some agricultural activities using multi sensors. We also designed a device to control the usage of water for irrigation processes using soil moisture sensor [2]. If addition of a good deal of water is applied the problems arise such as plant decay, and also result wastage of water [3]. If too little water is applied different problems arise such as turf burnout. An irrigation regulator will function as automatic irrigation systems such as lawn sprinklers and drip irrigation systems

Combining all those techniques we proposed a sprinkler system that will be controlled by the servomotor. And based on the soil moisture observations, the sprinkler will rotate in angular motion [5]. We also planned to build an automatic shutter across the furrows of the field. These solutions are all meant to reduce the labour work and costs.

2 LITERATURE SURVEY

Water scarcity is the major issue faced all over the world. In India agriculture plays a vital role. There are several survey papers suggested some works related to smart agriculture.

[1] In 2015 Liu jie et al proposed a novel approach for data management for technique which will tend to decrease the packet size on the transmitter side zigbee located on the agricultural field that is intended for collection of various sensor values for light sensor, temperature sensor. The major drawback in this paper we have found was, short range of zigbee communication.

[2] In the paper Manoj H G1, Dr N G S Udupa2 2015, discussed an idea to detect the moisture level in the soil. Nowadays there is a scarce for the man power in agricultural field. To overcome this problem we introduce this device to detect the moisture level automatically There are three conditions that are possible in this field work. They are wet, normal and dry condition. In wet and normal condition the device is in on condition and it will check the moisture level in the soil at that time

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if the moisture level is enough means it will remain constant and does not work. In the dry condition the sensor senses the moisture level in the soil and it will detect that the low moisture level. And at that time the device interfaced with water pump is on and goes on until it reaches the normal or wet condition Sensors are placed and solenoid valves in all regions and check the moisture level in all the regions. For example in first region the sensor detect the moisture level and that level is normal means than the next sensor in the next field is ready to detect the moisture level in that particular field, if it gets the result as dry condition means the solenoid is triggered and which makes the device on. Until it reaches the normal condition it will going on this process. They used Arduino and soil moisture sensor controlling the irrigation system in low costs. This model is very useful to the farmers by monitoring the conditions of the field. It will always ensure the sufficient level of water in the fields. And it will not let it go on under irrigation as well as over irrigation. By having less amount of water we can able to irrigation to the vast areas The sensor used in this system is to measure the temperature, humidity and also the pressure of the soil. By using this method we can able to save larger amount of water.

[4] In 2014 P.Divya et al proposed a novel approach for effective water management in irrigation lands using wireless sensor network incorporating various mechanism that controls the operations time, numbers of sprinklers and angular adjustment in the sprinkler used for farming lands. The advantage of this method was the usage of watering database for different crops and effective use of field sensors. The only drawback found was that this method was only suitable for Pop-up sprinkler. The intention of this work is to reduce the water usage during irrigation processes. In this view, we have proposed [4] context aware wireless sensor network system for irrigation management. This multi-sensor system will continuously monitor the relevant environmental condition, hydrological condition, soil condition and crop specific condition

[5] In paper 2014, Joaquín Gutiérrez, Juan Francisco, the system to develop the automatic irrigation method to optimise the use of water was proposed. To establish this system all the sensors need to be placed in deep into the soil i.e. in root zone of the plants. The gateway will handle all the information about the sensors and sends the data collected to web page that have been created. They developed an algorithm based on threshold values of temperature & soil moisture that are interfaced with the microcontroller. This algorithm is to control the amount of water quantity need to be used. Also they used photovoltaic panels to power the sensor networks. This non conventional form of energy will have energy autonomy and of low cost implementation. This type of irrigation method suggests the cultivation process possible even in the place where the scarcity of water exists by increasing the sustainability.

[6] Nowadays qwerty mobiles plays a major role in agriculture fields as its capability of moving from different places resembles the nature of farming. Though its cost is high, its coupling power is used in too many practical applications. They are embedded with various sensors. This reveals the mobile applications that enhance the agricultural solution. Early 1500 articles shows through database based on specific aspects and then reviewed via full text results in 22 articles. The applications are based on farming functions. Those articles describe 12 farming application, 6 farm managing application 3 information systems and 4 service application. For their preparation they paper used GPS and camera. For future application, they plan to utilize other sensors to provide advance agriculture solution.

[8] In paper B. Balaji Bhanu, 2K. Raghava Rao, 2014, proposed the system of implementation of an agricultural monitoring system with the help of wireless sensor network. Temperature, humidity& carbon dioxide can be used for the productivity increases. The growth and quality in plants can get increased by these parameters. This system can measure the inner side of fields. The farmers or the agricultural experts can survive through the web. The main goal of the system is to increase the maximum crop productiveness; this can be achieved through the continuous monitoring of the environmental parameters. The main purpose is to protect the agricultural land from the weather effects, bugs and so on. Because agriculture is the backbone for all countries. So our mission is to detect and protect from our farm land from these external parameter. The alertness can be give through web. This paper also has, future work of simulation part and analyze the critical conditions of sensor nodes by solving the nodes failure and implementation of web application of data analysis.

3 PROPOSED WORK

Based on the results of the survey, in our project we have proposed a smart idea to monitor the agriculture field and also we control the irrigation process in smart way. The decisions that are taken by the motor depend on the sensors response.i.e from soil moisture sensor and humidity sensor. The smart way to do the automated irrigation process is achieved by Intel Galileo, controlled sprinkler The programmed stepper motor will command the sprinkler to rotate in an angle wise rotation. This will reduce the amount of water used for irrigation purpose.

4 INTEL GALILEO

Intel Galileo is a developer board designed to have powerful functionality and consumes less power. As a developer board, it has many peripherals for various applications [1]. The Intel board comes with default loaded Linux OS on SPI Memory like other boards which are usually used to boot the board.

Intel Galileo can be used in much application. Intel Galileo operating software can programmed through OS X, Linux, Microsoft windows. Both hardware and software of this board that can be interfaced with the Arduino screen system Intel Galileo has the Intel Quark SoC X1000 processor which is the first product from the Intel Quark technology family of low power, small-core products. Intel galileo products challenge to participate within markets such as the Wearable computing and Internet of things. It was ingenuous in Ireland, and it is a Pentium instruction set architecture, single-thread, compatible CPU, single core,32-bit,. Its working speed is capable of 400 MHz. The reason for choosing the Intel Galileo is to easily interface the multi sensors that are all required for our project.

BLOCK DIAGRAM

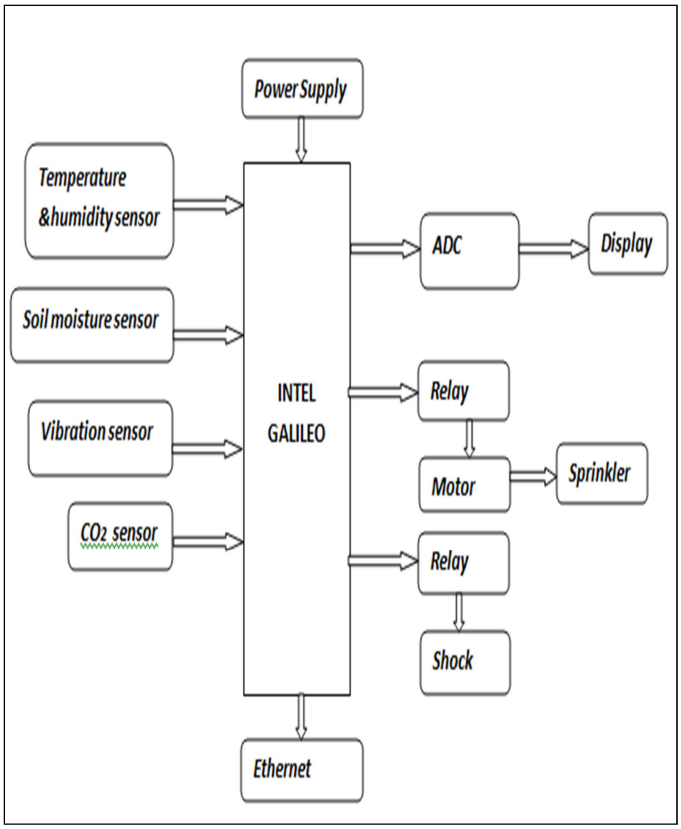

Figure 1 BLOCK DIAGRAM

A. COMPONENTS IN THE FIELD

- **TEMPERATURE &HUMIDITY SENSOR**

In our project we are using some various sensors, of those the very important sensor is temperature sensor, which will give the current temperature level. Humidity sensor is used to measure the moisture level present in the atmosphere. Measures the relative humidity in the ambient environment. It is important to measure the moisture level in the atmosphere. The current temperature &humidity readings of the field will be monitored and displayed.

- **SOIL MOISTURE SENSOR**

This sensor is used to measure the moisture level of the field. It measures the volumetric water content of the soil.Soil wetness is most important for agricultural development to help farmers for controlling their irrigation work more powerful. The perfect wet soil conditions on the fields, not only farmers are able to use less water to cultivate a crop, they are also able to enlarge the productions and the worth of the crop by enhanced managing of wet soil condition during significant growth of plants stage .

S.No	Sensor	Threshold value	Field condition	Motor condition	Door Condition
1.	Soil Moisture	<=300	Dry Soil	On	Closed
2.	Soil Moisture	<=700	Moisture Soil	Off	closed
3.	Soil Moisture	> 700	More Water	Off	Open

- **CO_2 SENSOR**

This is an electrochemical one that measures the concentration of CO_2 by oxidizing or removing it. The content of CO_2 in any place goes into the sensor through the porous membrane to the working electrode. There it is oxidized or reduced. This reaction results in an electric current that passes through the external circuit.

- **VIBRATION SENSOR**

Vibration sensor is a sensor which is used to monitor the unwanted entry of humans and cattle into the field. If the vibration sensor is disturbed slightly, then vibrations produced, then the farmers get intimated. By these vibration sensors we planned to give little sensible shock to the cattle that are entering into the field. This can be done by interfacing Relay board with the sensor.

- **SERVO MOTOR**

A servomotor is a kind of rotator or linear actuator that allows for particular rule of an angular or linear position velocity and acceleration. It coupled to a sensor for position feedback. It is a closed loop servomechanism that uses position feedback to control its motion and final position

B. CONTROLLING PART

In a system, the controller is the device which activates motion by giving a command to do something i.e. start or vary speed/position. This command is amplified and applied onto the motor. A command signal which is given by the user's interface panel comes into the servo's "positioning controller". Based on the readings of the soil moisture sensor the servo motor will turn in angle wise direction. The sprinkler with the servomotor will rotate along the direction which has been commanded by the sensor. All these controlling are all done automatically. This process can be viewed over internet through the Ethernet shield which is connected to the Galileo board.

- **RELAY**

Relays are electromechanical machines that use an electromagnet to control a pair of variable links from an unlock to a blocked position. Relay takes a moderately a small amount of power to function the relay coil. Here it is used to control the motors& lamp.

- **ADC**

An analog to digital converters is a device that converts a analog values into digital values (0 and 1).In our project all the sensors readings are analog (Temp, Pressure, etc). Hence, these signals will be converted to digital signals to be used by the Galileo quark X1000 processor.

- **ETHERNET**

Ethernet is one of the computer networking technologies commonly used in Local Area Networks(LAN). Ethernet evolved to higher bandwidth, improved media access control methods, and different physical media connected by Ethernet repeaters or switches. First you need to find which serial port your window system recognizes as connected to the Intel Galileo board. Low output ripple and noise(100mvpp),Input voltage range 36V to 57V,Overload and short-circuit protection,9V output, 1500V isolation(input to output), High efficiency DC converter, are all the features of Ethernet.

- **SERIAL MONITOR OUTPUT**

The readings that are collected by the various sensors are all fed to the Intel Galileo board, then the current level of the temperature, humidity, co2 level in air, soil moisture content in the soil, and also if there is any vibrations produced in the vibration sensor will be printed in the serial monitor of the Intel Arduino software

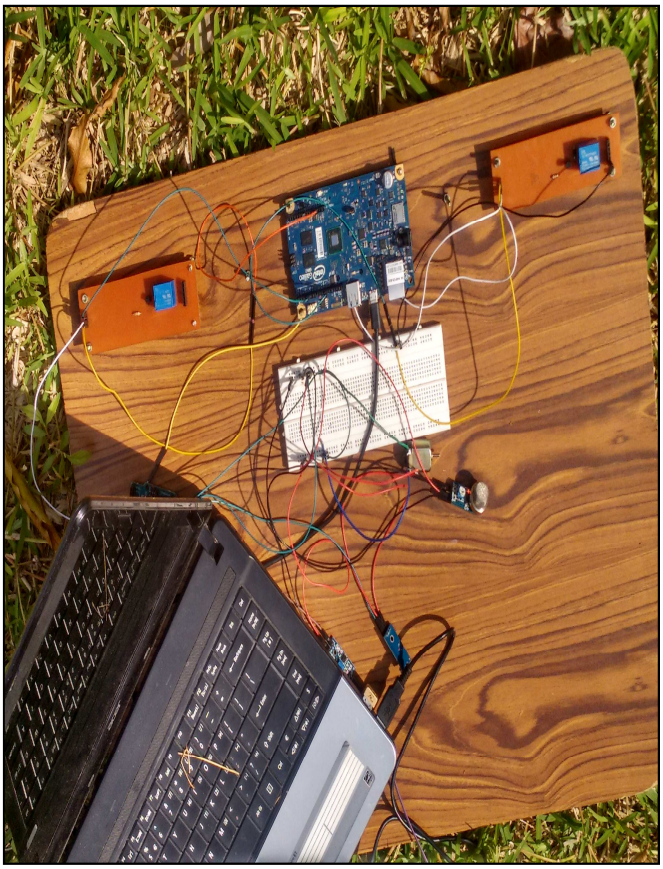

Figure 2: OUR WORK

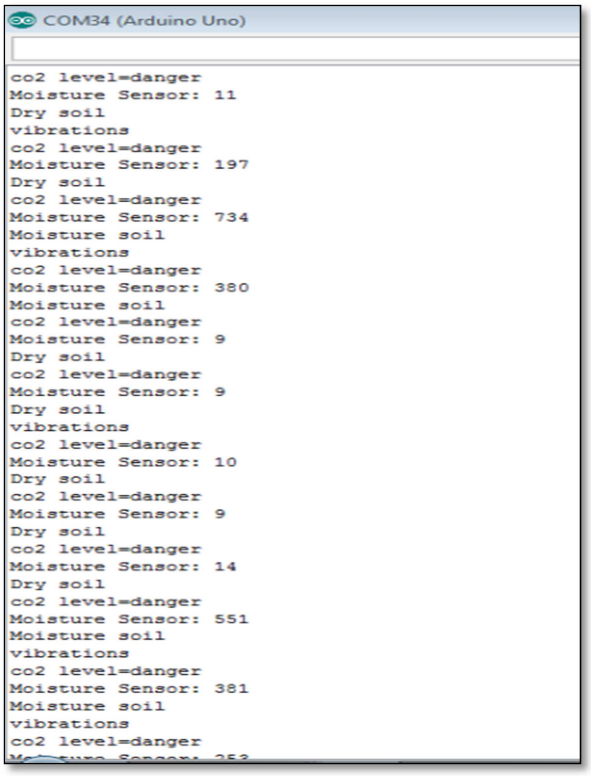

Figure 3: OUTPUT FROM THE SENSORS IN THE SERIAL MONITOR

5 CONCLUSION

This paper provides an efficient agricultural field monitoring and accurate monitoring of water usage in agriculture fields. By using vibration sensor animal entering into the crop cultivated is controlled. In future this work can also be extended with different platforms such as Lab VIEW and also additional sensors to increase the efficiency of monitoring and the parameters can also be monitored through internet with the help of HTML server.

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