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VHDL based System for Sensing NPK and PH Values in Soil and Suggesting Fertilizers for Different Crops

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ABSTRACT*: *Farming is a process which involves various steps. These steps are done manually by the farmers. Usually the process is extremely tedious when carried out manually. By applying some engineering knowledge like VHDL process many agriculture projects are carried out successfully such as drip irrigation and many more. We found that Nitrogen, Phosphorus and Potassium are very useful fertilizer in farming and it is useful for many crops and it used as a mixture in many fertilizers., many fertilizers have the same chemical compounds and are used for the same basic purposes-to supplement the essential plant nutrients in the soil And according to that we will provide fertilizers for that crop and will make a system on VHDL based. so, we analyse some soil sample from different region and take out the nitrogen, phosphorus, potassium and pH from that soil sample.

Keywords: **Nitrogen, Phosphorus, Potassium, ph value, VHDL processor.**

I. INTRODUCTION

The VHSIC Hardware Description Language (VHDL) is a formal notation intended for use in all phases of the creation of electronic systems. Because it is both machine readable and human readable, it supports the development, verification, synthesis, and testing of hardware designs; the communication of hardware design data; and the maintenance, modification, and procurement of hardware. The digital system may be a simple logic gate or it may be a complete electronic system.

Although it is generally agreed that fertilizers come in three physical forms (liquid, solid and gas), there are actually only two classes of fertilizers: liquid and solid. On the other hand ph value for soil is also necessary for farmers. The definition for ph is as follows. pH is the measurement of the hydrogen ion concentration, [H+]. Every aqueous solution can be measured to determine its pH value. This value ranges from 0 to 14 pH. Values below 7 pH exhibit acidic properties. Values above 7 pH exhibit basic (also known as caustic or alkaline) properties. Since 7 pH is the center of the measurement scale, it is neither acidic nor basic and is, therefore, called "neutral." The use of ammonium nitrate has decreased greatly in recent years, although it is a very good source of nitrogen. Solid fertilizers work like liquid fertilizers; dry fertilizers absorb water and undergo chemical reactions similar to liquid fertilizers. By these agricultural values we can make a system based on these values by optical transmitter and optical receiver based NPK device to develop a controller through VHDL controller.

II. FPGA AND VHDL

FPGA: FPGA or Field Programmable Gate Arrays can be programmed or configured by the user or designer after manufacturing and during implementation. Hence they are otherwise known as On-Site programmable. Unlike a Programmable Array Logic (PAL) or other programmable device, their structure is similar to that of a gate-array or an ASIC. Thus, they are used to rapidly prototype ASICs, or as a substitute for places where an ASIC will eventually be used [17]. This is done when it is important to get the design to the market first. Later on, when the ASIC is produced in bulk to reduce the NRE cost, it can replace the FPGA. The programming of the FPGA is done using a logic circuit diagram or a source code using a Hardware Description Language (HDL) to specify how the chip should work. FPGAs have programmable logic components called ‚logic blocks', and a hierarchy or reconfigurable interconnects which facilitate the ‚wiring' of the blocks together. The programmable logic blocks are called configurable logic blocks and reconfigurable interconnects are called switch boxes. Logic blocks (CLBs) can be programmed to perform complex combinational functions, or simple logic gates like AND and

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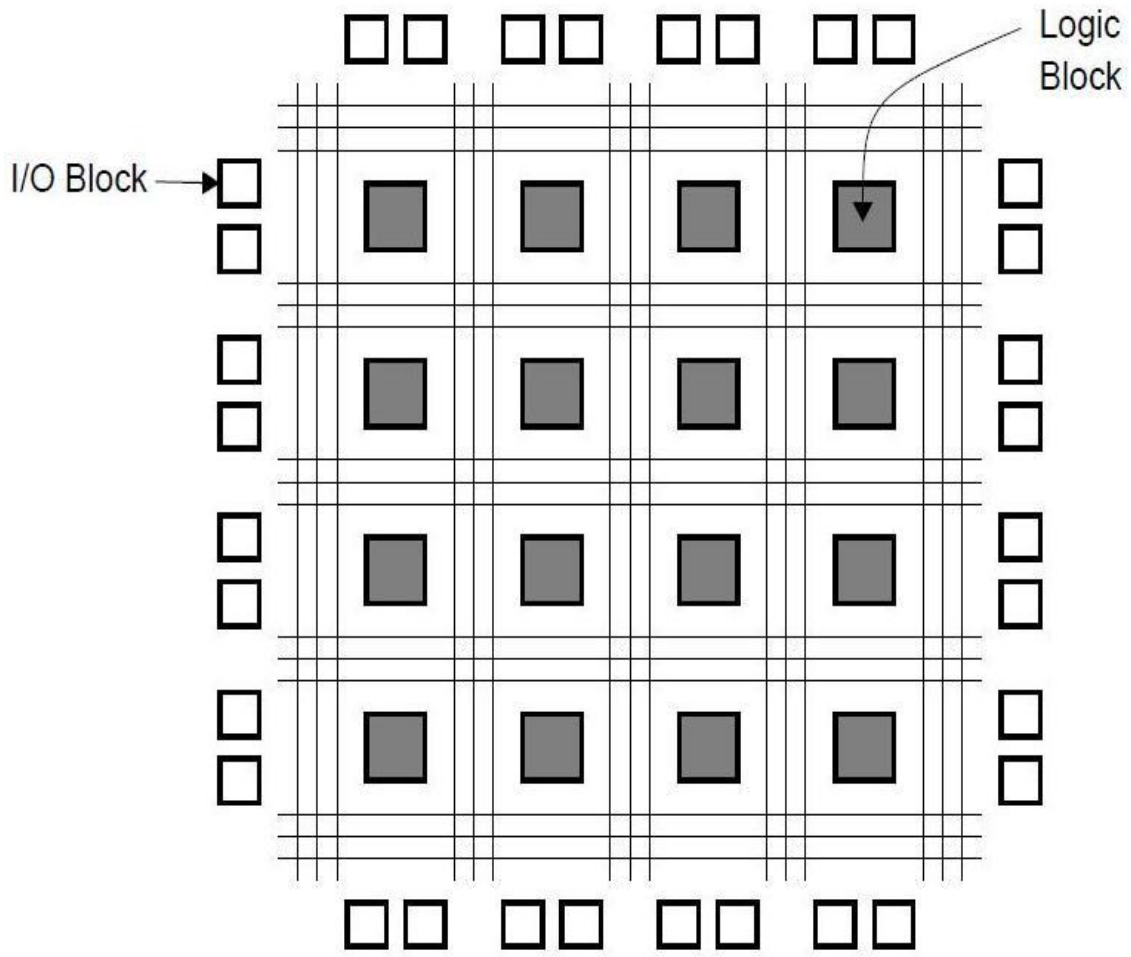
XOR. In most FPGAs the logic blocks also include memory elements, which can be as simple as a flip-flop or as complex as complete blocks of memory.

FPGA Architecture

FPGA architecture depends on its vendor, but they are usually variation of that shown in the figure. The architecture comprises Configurable Logic Blocks, Configurable I/O blocks and Programmable Interconnects. It also houses a clock circuitry to drive the clock signals to each logic block. Additional logic resources like ALUs, Decoders and memory may be available. Static Ram and anti-fuses are the two basic types of programmable elements for an FPGA. The number of CLBs and I/Os required can easily be determined from the design but the number of routing tracks is different even within the designs employing the same amount of logic.



VHDL: The VHSIC Hardware Description Language (VHDL) is a formal notation intended for use in all phases of the creation of electronic systems. Because it is both machine readable and human readable, it supports the development, verification, synthesis, and testing of hardware designs; the communication of hardware design data; and the maintenance, modification, and procurement of hardware. The digital system may be a simple logic gate or it may be a complete electronic system. A hardware abstraction of similar digital system is called an entity. An entity „A", when used in another entity „B", becomes a component for the entity „B". Therefore, every component is an entity, depending on the level at which we are trying to model. For this project we are using the SPARTEN-3E starter kit for the simulation. The diagram is given below.

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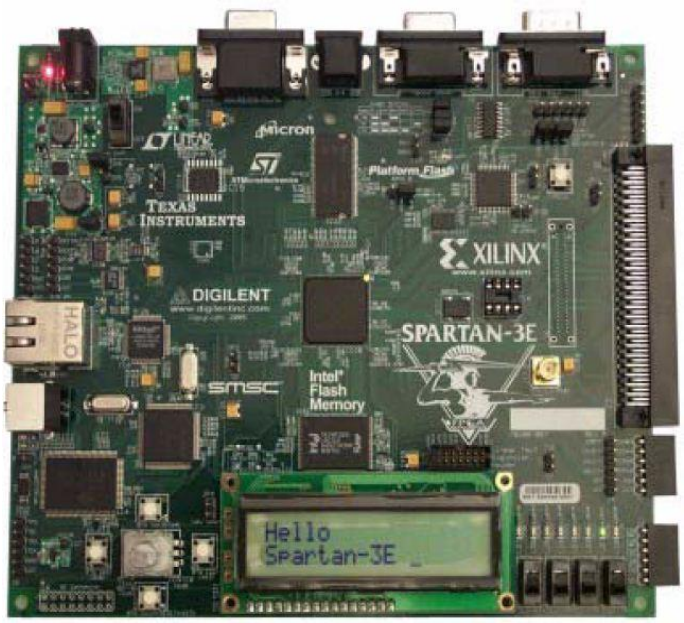

(Ref. Google)

III. NUTRIENTS

NITROGEN

N deficiency is the most common and widespread nutrient deficiency in small grains. Plants suffering from N deficiency are pale In comparison to healthy plants due to the breakdown in chlorophyll production. Specific symptoms of N deficiency first appear (as with P and K deficiencies) on the oldest leaves with the new leaves remaining relatively green. The older leaves become paler than newer leaves with chlorosis (marked yellowing) beginning at the tip and gradually merging into Light green further down the leaf. As the chlorosis spreads to other leaves the oldest leaves become totally chlorotic, changing from yellow to almost white in colour. However, necrosis (death of leaves or parts thereof) may not set in for some time in contrast to P and K deficiencies. N-deficient plants will reach an thesis and maturity before plants with an adequate N supply.

PHOSPHORUS

During the early stages of vegetative development, the most noticeable feature of P deficiency in wheat is the reduced growth and vigour of the plant. The colour of all leaves of P-deficient plants becomes a dull dark Greenwith slight mottling of the oldest leaf. Leaves appear coiled to a greater degree than normal; old leaves sometimes encase younger leaves. New growth can appear spindly and may remain folded for some time. Specific symptoms are, however, on the old leaves. Chlorosis begins at the tip of the old leaf and moves down the front of the leaf. The base of the leaf, like the remainder of the plant, stays dark green. Unlike N Deficiency, necrosis of these chlorotic areas is fairly rapid with the tip becoming orange to dark brown and Shrivelling and the remainder turning yellow. When this occurs, the second oldest leaf has generally taken on the early symptoms of P deficiency. Other common symptoms of P deficiency are delayed and irregular plant maturity and small heads.

POTASSSIUM

Specific K deficiency symptoms always appear in the oldest leaves of wheat, although growth of the whole plant can be affected prior to symptoms with all leaves having an unthrifty and spindly appearance. Under severe K deficiency, necrosis in the oldest leaves begins as a necrotic speckling along the length of the leaf, spreading quickly to the tip and the margins. As a result of this spread of necrotic tissue, an arrow of green tissue from the base upwards towards the centre canremain.Chlorotic tissues, generally seen as a mottling, turn necrotic rapidly with K deficiency in contrast to N deficiency. Complete death of old leaves is common and plants in the field may appear to have dried prematurely due to drought stress. Mg and K deficiencies in wheat also result in plants appearing unthrifty and drought stressed and in reduced 1000-grain weight. K deficiency may occur within specific areas in a field associated with deep leaching sands, livestock feedlots, and the removal of hay and other above-ground plant

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material. Crops severely affected appear drought stressed with large numbers of prematurely dead, old leaves and spindly growth.

MICRONUTRIENTS

Sr. No	Elements	Critical level in soil
1	Sulphur	10 ppm
2	Calcium	1.5 me/100 g soil
3	Magnesium	1.0 me/100 g soil
4	Zinc	0.6 ppm
5	Manganese	2.0 ppm
6	Copper	0.2 ppm
7	Iron	0.3 ppm
8	Boron	0.5 ppm
9	Molybdenum	0.2 pp

Ph: Soil pH is one of the most important measurements of soil fertility. It indicates whether a soil could contain toxic levels of aluminum and manganese, whether it may be low in bases such as calcium and magnesium, and therefore if lime is needed. The availability of other essential plant nutrients is also affected by pH. Therefore, knowing a soil's pH may help in diagnosing nutritional problems of agricultural crops and other plants. For this we take some readings from different parts of lands to know the nutrients and Ph level of that soil.

Sr. No	District	Samples			
		N	P	K	Ph
1	Sipna engg. Collage, Amravati.	248kg/hec	22 kg/hec	609kg/hec	7.8
2	Daryapur(wetland)	180 kg/hec	28 kg/hec	615kg/hec	8.2
3	Daryapur (dry land)	235 kg/hec	25 kg/hec	715kg/hec	8.5

IV. CONCLUSION

Thus from the above description and based on the FPGA platform we conclude that by using VHDL processor we can measure the nitrogen, phosphorus, potassium and Ph from soil. This system is cheap and mobile also it is useful for farmers who are economically weak.

REFERENCES

[1] A.M. Michael, Irrigation Theory and Practices, Vikas Publishing House Pvt. Ltd.1985 IETE Technical Review Vol. 20, No.3, 2003.

[2] Freney J.R., Some Observations on Nature on Organic Sulphur Compound in Soil Aust. J. Agric. Res.12:424:432. (1961)Journal of Instrument Society of India Vol. No. 36.

[3] Chesnin L. and C.H. Turbidimetric Determination Of Available Sulhates. Soil Sci. Soc. AM. Proc.15:149-151.

[4] Volnei A. Pedroni, Circuit Design With VHDL. Prentice Hall Of India Datasheet for TREXC1 Development Kit Treatise on Agro physics and Agrielectronics Edited By VSI, Pune.

[5] Douglas Perry, VHDL Synthesis and Simulation, Tata McGraw-Hill 4th Edition.

[6] R.B. Somvanshi, P.P. Kadu, B.D. Tamboli, Y.M. Patil, B.D. Bhakare, Analysis of Plant, Irrigation Water And Soil.

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[7] Bhaskar J., VHDL Primer, Pearson Education 3rd Edition Metrology Department of Dr. Pajabrao Krushi Vidyapith, Akola Shivaji agriculture collage, Amravati.