Agriculture Field Motor Controlling System

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***Abstract* —Agriculture has been practiced for ages and involves cultivating plants. Modern technology and IoT can help improve agriculture. IoT sensors can provide information about agricultural fields. The main advantage of IoT is that it can monitor farms using wireless sensor networks to collect data from different sensors and transmit it wirelessly. An IoT system can control water motors using a mobile to turn them on and off. It includes humidity and temperature sensors. The system checks the humidity and moisture levels and controls the water motor using the mobile. The sensors monitor the water level and send alerts if it goes below a certain level. The water motor can be turned on and off using the mobile.**

Keywords – Mobile, Aurdino, Temperature sensor, Moisture sensor.

I. INTRODUCTION

In ancient times, significant advancements were made in agriculture to enhance yield while minimizing resource and labor constraints. However, rapid population growth has continuously posed challenges, despite these advancements. By 2050, the global population is projected to reach 9.8 billion, necessitating a 25% increase in food production to sustain growing urban populations and meet rising demands. This includes not only food but also crops like fiber, rubber, and gum, which play crucial roles in the economy. Unfortunately, only a limited portion of the Earth's surface is suitable for agriculture due to various constraints such as temperature, climate, topography, and soil quality. Moreover, even in suitable areas, standardization is lacking. As landscapes and crop varieties adapt, new challenges emerge, including land and climate variability and population density, which threaten the availability of arable land.

II. LITERATURE SURVEY

Literature Review 1:
Kadage, A. D., & Gawade, J. D. (2009, December). Wireless control system for agricultural motor. In *2009 Second International Conference on Emerging Trends in Engineering & Technology* (pp. 722-725). IEEE.

Literature Review 2:
Grace, K. V., Kharim, S., & Sivasakthi, P. (2015, April). Wireless sensor-based control system in the agriculture field. In *2015 global conference on communication technologies (GCCT)* (pp. 823-828). IEEE.

Literature Review 3:
Ravi, K. S. (2013). A real–time irrigation control system for precision agriculture using WSN in Indian agricultural sectors. *International Journal of Computer Science, Engineering and Applications (IJCSEA) Vol, 3*.

Literature Review 4:
Pearson, T. Agriculture Field Motor Control System using Global System for Mobile Communication (GSM).

III HARDWARE REQUIREMENTS

1. Aurdino

The most common version of Arduino is the Arduino Uno. This board is what most people are talking about when they refer to an Arduino. The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. There are different revisions of Arduino Uno, below detail is the most recent revision (Rev or R3).

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

2. GSM Sensor
GSM automates and encodes the information before transmitting it via a channel including three distinct streams of user information inside each time slot. For the vast majority of the world, it is also the leading 2G digital cell phone standard. It governs how cell phones interact with the land-based tower system.

3. Temperature Sensor
A temperature sensor is a device that is designed to measure the degree of hotness or coolness in an object. The working of a temperature meter depends upon the voltage across the diode. The temperature change is directly proportional to the diode's resistance.

SOFTWARE DESCRIPTION

I. VIVADO
Vivado is a cutting-edge FPGA design tool developed by Xilinx. It provides an integrated design environment with powerful features such as synthesis, simulation, and implementation. Vivado offers a user-friendly interface, making it accessible to both beginners and experienced designers. With its advanced optimization techniques and debugging capabilities, Vivado empowers engineers to create efficient and reliable FPGA designs.

Vivado comes packed with a range of key features that enhance FPGA design. These include high-level synthesis, IP integration, system-level integration, and advanced verification. It also supports various programming languages like VHDL and Verilog, enabling designers to work with their preferred language. With Vivado's comprehensive toolset, designers can streamline the design process and achieve faster time-to-market

Vivado offers seamless integration with Xilinx's programmable devices, enabling easy programming and configuration. With Vivado's programming tools, designers can efficiently generate bitstreams and program the FPGA devices. This final step brings the design to life, allowing it to perform the intended tasks with the power of FPGA technology.

II.Verilog
Verilog is a hardware description language (HDL) used to model and design digital systems. It allows engineers to describe the behavior and structure of electronic circuits, making it an essential tool in the field of hardware design. Verilog code is used to simulate and synthesize digital circuits.

Verilog Syntax
Verilog follows a modular approach, where designs are described using modules. Each module represents a circuit component and can be interconnected to form a larger system. Verilog syntax includes keywords like module, input, output, and wire. It also supports behavioral and structural modeling techniques.

Verilog simulation
Verilog simulators allow engineers to test and verify the functionality of their designs before manufacturing. Simulation tools provide a virtual environment where the behavior of the digital circuit can be observed and analyzed. They enable engineers to catch design flaws and optimize performance early in the development process.

IV FLOW CHART

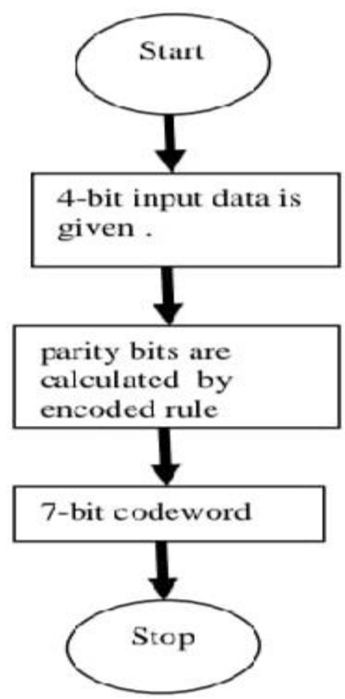

Fig 1. Flow chart for encoder

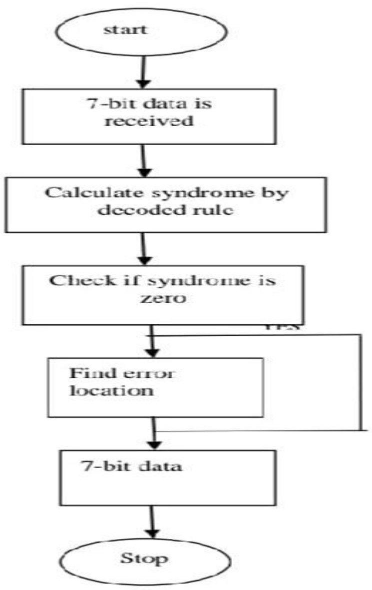

Fig 2. Flow chart for decoder

V RESULT

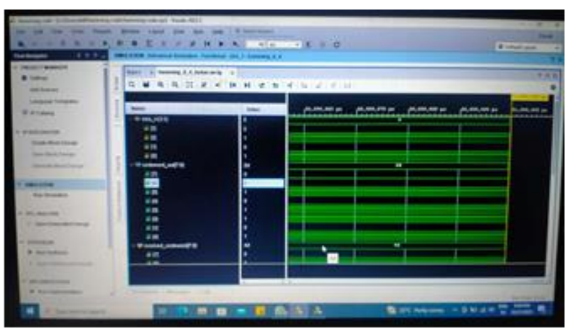

Fig 3. Simulation of Hamming Encoder

The simulation Hamming Encoder result is shown in fig. Which is active low digital system with 4 bits as information bits as inputs in [3:0]. 11-bit output data as out [7:0] which has encoded data of encoder system. fig show the example of input 4-bit data 0101 as input and 00101101 is the 8-bit encoded data.

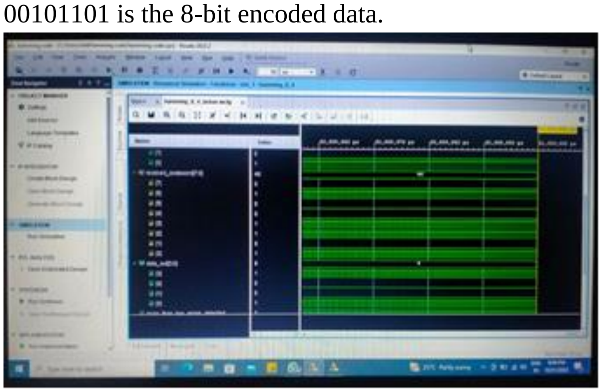

Fig 4. Received code words with parity

In the context of Hamming codes, a "code word" refers to the encoded representation of a set of input data bits. Each set of input data bits is transformed into a longer code word by adding parity bits for error detection and correction.

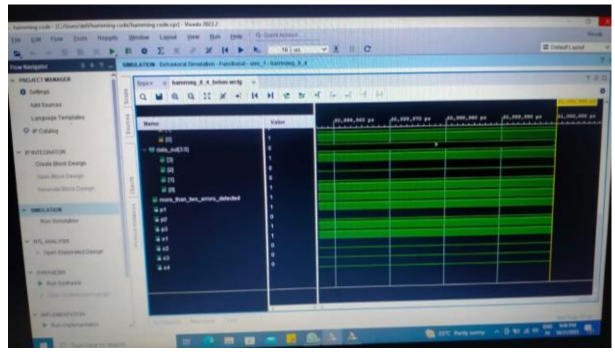

Fig 5. Simulation of Hamming Decoder

The simulation results of Hamming decoder are shown in Figure which show its active low digital system with 4-bit input data as in [7:0] and 4 bits of error corrected data in out [3:0] and another 4bit output data which holds the error bit position in received data pout [3:0]. Figure shows hamming decode with an example; received data is 01001101 and the output obtained from the decoder data is 1001, the place of error in the input data is shown as 1000.

VI ADVANTAGES

The implementation of Hamming encoder and decoder using Field-Programmable Gate Arrays (FPGAs) offers several advantages:

1. Flexibility and Reconfigurability:

- Tailored Designs: FPGAs allow for the creation of custom logic circuits, enabling the implementation of Hamming codes with specific configurations to meet application requirements.
- Reprogramming Capability: FPGAs are reprogrammable devices, allowing for easy modifications or updates to the Hamming code implementation without changing the hardware.

2. Parallel Processing:

- Parallelism Exploitation: FPGAs inherently support parallel processing, enabling efficient parallelization of Hamming code operations. This results in faster encoding and decoding processes compared to sequential implementations.

3. Resource Optimization:

- Resource Utilization: FPGAs enable efficient utilization of resources by tailoring the logic to the specific requirements of the Hamming code. This can result in a more compact and resource-efficient implementation compared to generic processors.

4. Low Latency:

- Real-Time Processing: FPGAs are capable of real Time processing, making them suitable for applications with stringent latency requirements. This is advantageous in scenarios where quick error detection and correction are essential.

5. Power Efficiency:

- Selective Power Usage: FPGAs allow designers to selectively enable/disable specific logic blocks based on the current operational requirements. This can lead to power-efficient implementations, especially in applications with varying workloads.

6. Customization for Different Hamming Codes:

Support for Various Codes: FPGAs can be programmed to support not only Hamming (7,4) but also other Hamming codes with different parameters. This flexibility is beneficial when adapting to different error correction requirements.

7. Integration with System-on-Chip (SoC):

- Integration Capability: FPGAs can be integrated into larger System-on-Chip (SoC) designs, facilitating the combination of Hamming encoder/decoder with other processing units, peripherals, or communication interfaces on the same chip.

8. Rapid Prototyping and Development:

- Prototyping Speed: FPGAs enable rapid prototyping, allowing designers to quickly implement and test Hamming code functionalities. This is particularly useful during the development and debugging phases.

VII CONCLUSION

In conclusion, our project has proven to be a valuable tool for error detection and correction in data communication. After implementing and testing the code, it’s clear that this system can enhance data reliability by identifying and fixing errors. It serves as a practical solution for ensuring data accuracy in various applications. This project reinforces the importance of error-checking techniques like Hamming encoding and decoding in modern data transmission.

VIII FUTURE SCOPE

FPGA-based implementation of Hamming Encoder and Decoder with feedback for enhanced error correction in data communication. The system employs feedback mechanisms to correct a higher number of errors, ensuring robustness and reliability in error-prone environments.

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