DESIGN AND IMPLEMENTATION OF ANYTIME ELECTRICITY BILL PAYMENT MACHINE CONTROLLER

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ABSTRACT: ***In the developing digital world all the consumers are moving towards digital systems. And the people finding troubles in paying their electricity bills even in online bill payment system. Therefore it is essential to bring out an efficient bill payment system. The proposed idea is a anytime electricity bill payment machine controller. It is a automated machine which calculates the bill amount along with the penalty amount if the consumer pays after the due period. This automatic machine accepts the bill amount in three forms viz.cash,cheque and DD. Then the machine updates the information after every bill payment to the consumer's database. The consumer can view the penalty amount before paying the bill.***

Keywords: Electricity bill payment machine controller, automatic machine, efficient bill payment system

I.INTRODUCTION

Everything tends to change day by day to go well with our demands. The capability to pay the electrical energy invoice in online mode is the current technique. And this approach is handy for all customers and additionally, it reduces the burden of the consumer to stand in a queue to pay their invoice. Moreover, the development in science makes the consumer pay the bill at any place and somewhere by using the usage of Any time price computing device. Our proposed machine mannequin is an Anytime electrical energy invoice charge computing device controller. It is a laptop identical to an Automated teller computing device in which the client can select their invoice prices modes such as cash, cheque, or dd under their very own comfort. The customers may additionally area the client card beneath the barcode scanner to get their important points to be displayed. All the small print about the patron will be displayed on the display inclusive of their due invoice quantity alongside the penalty if the purchaser will pay the consignment past the due time. The electricity board gives the customers with a client ID number, which they use to signal into the gadget at first. Then the complete fee for the electrical energy will be shown. The advantages of the use of a time electric-powered invoice charge desktop controller include

Convenience: Users can pay their payments at any time, except having to wait in line at the electric-powered company's office.

Security: The controller can encrypt the user's monetary information so that it is covered from unauthorized access

Efficiency: The controller can system repayments rapidly and easily so that the person can get lower back to their day.

II .LITERATURE SURVEY

Documentation on the controller of the desktop that will pay the electrical energy consignment at any time is distinctly limited. However, there are a few necessary papers that have been posted on the subject.

In 2016, SP Tripathi, SK Singh, and SK Mishra posted a paper titled «Design and implementation of an all-time electric powered consignment charge machine» in the International Journal of Computer Applications. This paper affords the layout and implementation of an all-time electrical energy charge machine. The computer has applied the usage of a microcontroller, a GSM modem, and a barcode scanner. A microcontroller is used to manage the operation of the machine, a GSM modem is used to speak with the electrical energy company's price system, and a barcode scanner is used to scan the user's electrical energy bill.

In 2017, SK Singh, SP Tripathi, and SK Mishra posted a paper titled «Design and Implementation of a Secure Electric Bill Payment Machine Anytime» in the International Journal of Computer Applications. This paper offers the format and implementation of an all-time invulnerable electric-powered invoice price machine. The computing device has applied the usage of a microcontroller, a GSM modem, a barcode scanner, and a protection chip. Microcontroller is used to manipulate the operation of the machine, a GSM modem is used to speak with the electrical energy company's price system, the barcode scanner is used to scan the user's electrical energy consignment, and protection chips are used to encrypt user's economic information.

These are simply a few examples of the documentation handy on the whenever electric-powered bill payment machine controller. The subject of electric-powered consignment fee laptop controllers is continuously evolving, so it is vital to remain up to date with the cutting-edge lookup in the field.

III.OBJECTIVE

The aim of the «Any Time Electric Bill Payment Machine Controller» the usage of FPGA and Verilog HDL is to sketch and enforce a gadget that lets customers effectively and securely pay their electrical energy payments at any time through the use of a computerized machine.

User Interface Design:

- Create an ordinary interface for the consignment charge desktop that is intuitive and effortless to navigate.
- Design an interactive show that courses the consumer via the fee technique and affords the essential information.

Bill Processing and Verification:
– Develop a mechanism for receiving and verifying user-entered electrical energy consignment details.
- Verify the correctness of the invoiced quantity and different applicable information.
The bill is being processed:
- Implement tightly closed and environment-friendly fee processing mechanisms.
- Integrate special fee picks such as cash, credit/debit playing cards, or digital wallets.

Transaction Management: – Maintain a transaction log to music charge records and grant receipts to users.
- Resolve exceptions and error eventualities at some stage in the charging process.
Security and Authentication:
– Implement protection measures to shield consumer facts and forestall unauthorized access.
- Use encryption methods to impervious verbal exchange between the engine and backend systems.

Integration with backend systems:
– Create conversation protocols to interface with utility backend systems.

- Enable price facts synchronization and real-time transaction fame updates.

Testing and Validation:
– Develop complicated take look at instances and function rigorous checking out of gadget performance and performance.
- Verify the accuracy and reliability of charge processing and transaction management.

Optimization and Scalability:
– Optimize gadget diagram and code implementation for environment-friendly use of sources on the FPGA.
- Consider scalability elements to accommodate a developing consumer base and manage improved transaction volumes.
- Evaluate the gadget's overall performance and perceive areas for enhancement and optimization.

IV.OUTCOMES

Controller design and implementation:
Successful machine control development and implementation using FPGA and Verilog HDL.
A description of the hardware structure and circuit design that expresses the technical elements of the controller.

Improved user experience:
Improved user interface and interaction layout for a convenient and intuitive bill payment experience.
User annotations, error handling, and transaction-receiving mechanisms ensure a clean and fuss-free user interface.

Secure transaction processing:
Implement security measures to protect sensitive payment information and prevent unauthorized access. Encryption methods and authentication mechanisms for secure data transmission and storage.

Payment method flexibility:
Supports multiple payment methods such as cash, credit/debit cards, and digital wallets to suit your personal preferences.
Integration with payment gateways or backend structures enables seamless and reliable transaction processing.

Real-time transaction processing:
Efficient payment processing with minimal transaction times and low latency.
Synchronize with your utility's backend system for real-time shipment validation and price updates.

Accuracy and validation:
Accurately validate shipping details to minimize errors and discrepancies in payment amounts.
Validation mechanism to ensure bill calculations are correct and prevent overpayments and underpayments.

Transaction log and history:
Comprehensive trading log to document price records and facilitate reconciliation.
Storing and retrieving transaction information for auditing capabilities and consumer support.

Scalability and integration:
Consider system scalability to accommodate diversifying customers and increasing transaction volume. Integration with current utility billing structures enables seamless operation and record synchronization.

Performance evaluation and optimization:
Assess overall controller performance in terms of transaction processing time, resource utilization, and machine responsiveness.
Optimization strategies that improve controller efficiency, throughput, and general performance.

Technological advances:
Utilizing FPGA technology and Verilog HDL, contributed to the field of charging structures for electric power broadcasting.
We demonstrate the feasibility and benefits of using good hardware design techniques for payment machine controllers.

V.CHALLENGES

user interface design: It can be difficult to create a user-friendly interface for an electricity bill payment system. The device must be user-friendly, intuitive, and open to various users, including those with little technological expertise. Describe the design philosophies and techniques used to create a user-friendly machine.

Security and privacy: Every payment device needs to guarantee the security and privacy of user data. Discuss the difficulties in implementing strong security measures, such as authentication procedures, encryption techniques, and safeguards against hacking or illegal access. Address any possible privacy issues relating to the extraction and retention of user information.

Payment Method Integration:
Integrating more than onepayment method, such as cash, credit/debit cards, and digital wallets, and making sure of seamless integration with respective payment gateways or backend systems.
Handling extraordinary transaction protocols and safety requirements related to every price method.

Hardware Design Complexity:
Designing an environment-friendly and robust hardware architecture for the controller that can handle more than a few payment methods, user interfaces, and backend integrations.
We are optimizing the hardware design to make sure minimal resource utilization whilst keeping desired functionality.

VI.ARCHITECTURE

INTRODUCTION TO ARCHITECTURE:
The Any Time Electric Bill Payment Machine Controller is a cutting-edge solution that aims to revolutionize electric bill payment. This architecture utilizes FPGA (Field Programmable Gate Array) technology and Verilog HDL (Hardware Description Language) for implementation. The objective is to create a user-friendly and secure platform that allows users to conveniently pay their bills. The architecture incorporates various components such as a user interface, bill data processing module, payment methods integration, backend system integration, security mechanisms, FPGA implementation, and Verilog HDL code organization.

OVERALL SYSTEM ARCHITECTURE :

The Any Time Electric Bill Payment Machine Controller is designed to provide a seamless and efficient experience for users to make electric bill payments. The system architecture comprises several key components that work together to enable this functionality.

1. User Interface: The user interface serves as the front end of the system, allowing users to interact with the machine and input bill details. It includes elements such as a keypad, display screen, and input/output interfaces for user interaction.

2. Bill Data Processing Module: This module processes bill data entered by the user. It performs tasks such as validating bill information, calculating the payment amount, and generating a transaction record.
3. Payment Methods Integration: The system integrates various payment methods to accommodate different user preferences. It supports cash payments, cheque payments, and digital payment options such as card payments or mobile wallets. Integration ensures flexibility and convenience for users.

4. Backend System Integration: The architecture includes a backend system integration component that connects to the utility company's billing system. This integration enables real-time bill information retrieval, updating payment status, and generating payment receipts.

5. FPGA Implementation: The system utilizes FPGA technology for hardware implementation. FPGA provides flexibility and reconfigurability, allowing for efficient execution of complex tasks and accommodating future enhancements or modifications.

6. Verilog HDL Code Organization: The system's functionality is implemented using Verilog HDL, a hardware description language. Verilog code is organized into modules, each responsible for specific functions within the system. This modular approach enhances code readability, maintainability, and debugging ease.
By integrating these components, the overall system architecture of the Any Time Electric Bill Payment Machine Controller enables users to conveniently and securely make bill payments at any time, reducing manual effort and enhancing the overall payment experience.

SYSTEM ARCHITECTURE:
Hardware Model
Central processing unit: The computer's "brain," or central processing unit (CPU), manages data processing and incorporates software program commands.

Touchscreen Display: An intuitive user interface that allows customers to communicate with and make payments on the device.
Card Reader: The system should feature a card reader that can securely examine and process card data to allow payment through the use of credit or debit cards.

Coin Acceptor: For the usage of cash as a shape of payment and validating them.

Bill Acceptor: Used to receive and authenticate paper money.

Receipt Printer: To furnish a receipt as proof of payment for every successful transaction.

Network Connectivity: To exchange data and technique payments in real-time, the device desires to be connected to the internet or a

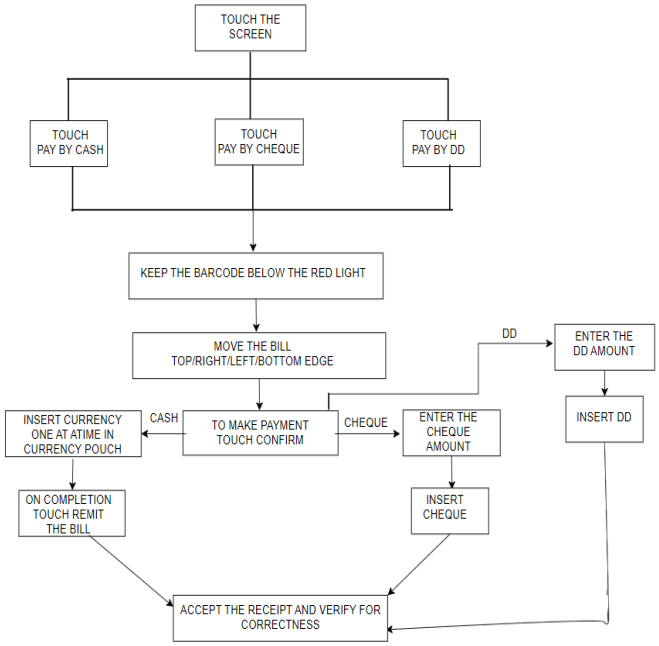
network.

Security precautions: Implement the essential security factors to protect user information, thwart hacking attempts, and assurance
invulnerble transactions.

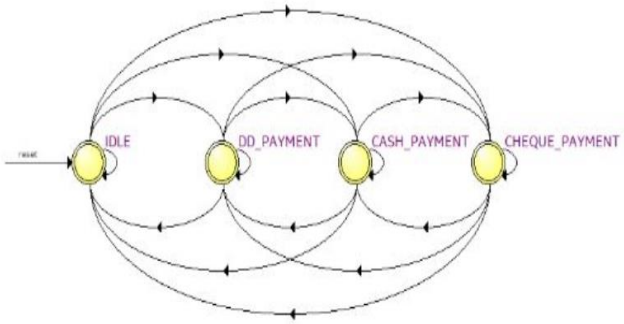
Software Model:
User Interface (UI): Create a hassle-free interface that is easy to use and intuitively leads customers through the payment process whilst showing pertinent data like account balances, payment alternatives, and transaction histories.
payment processing System: Design software program logic for the fee processing machine that securely handles one-of-a-kind payment options, such as credit/debit cards, coins, and bills. Encryption, authorization, and connectivity with fee gateways or banking structures have to all be dealt with by using the system.
Database Management System: Implement a database system to safely record client account information, payment history, and different pertinent data.

Account management: Create a module for managing personal accounts, which should include adding new accounts, updating client information, and managing account suspensions or closures.

System of Notification: Create a notification system that sends electronic mail updates to consumers about payment deadlines, completed transactions, and different pertinent information.



STATE DIAGRAM :



	Name	DD_PAYMENT	CHEQUE_PAYMENT	CASH_PAYMENT	IDLE
1	IDLE	0	0	0	0
2	CASH_PAYMENT	0	0	1	1
3	CHEQUE_PAYMENT	0	1	0	1
4	DD_PAYMENT	1	0	0	1

VII. HARDWARE AND SOFTWARE IMPLEMENTATION

INTRODUCTION:

Introduction to Hardware and Software Implementation of Any Time Electric Bill Payment Machine Controller:

1. Hardware Implementation:
- Utilization of Field-Programmable Gate Array (FPGA) innovation
- Reconfigurable rationale circuits for customization
- Adaptable and versatile stage

2. Computer program Execution:
- Utilize Verilog HDL for a computerized framework plan
- Behavior and structure detail
- Union and simulation of hardware design

3. System Architecture:
- Key components:

user interface, bill information processing module, payment strategies integration, backend framework integration, and security mechanisms
- Modular Verilog HDL code organization

4. User Interface:
- Keypad, show screen, and input/output interfacing
- User-friendly and natural installment handle

5. Payment Methods Integration:
- Support for cash, cheque, and digital payment options
- Adaptability and comfort for clients

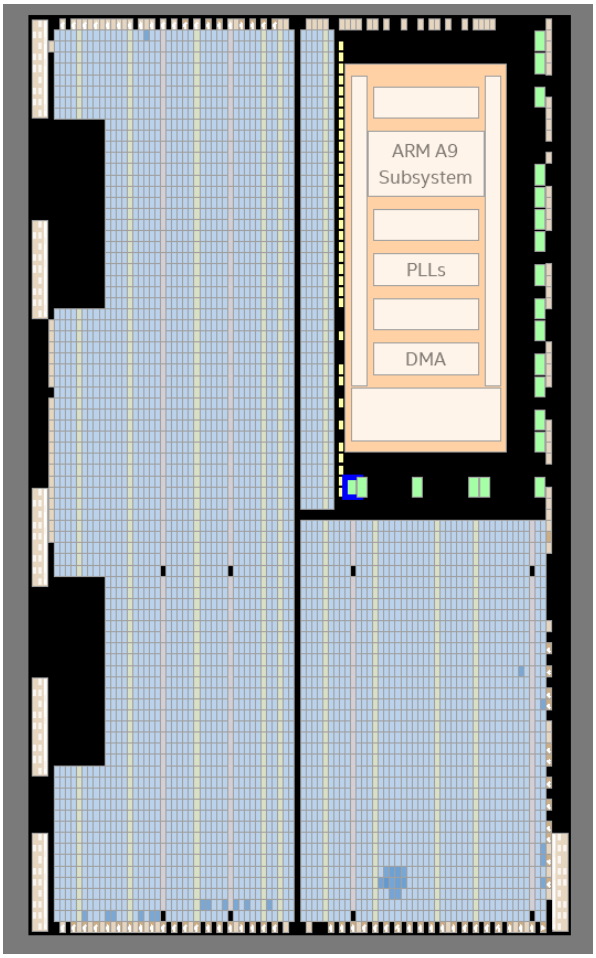
6. Backend Framework Integration:
- Integration with the utility company's backend framework

- Real-time recovery of bill information and payment status updates
7. Security Mechanisms:
- Encryption algorithms and user authentication mechanisms
- Secure communication protocols and tamper-proof hardware components
- Assurance of sensitive data and avoidance of unauthorized get to

The hardware and program execution of the Any Time Electric Bill Payment Machine Controller combines FPGA technology and Verilog HDL to form a reliable, secure, and user-friendly arrangement for electric charge.

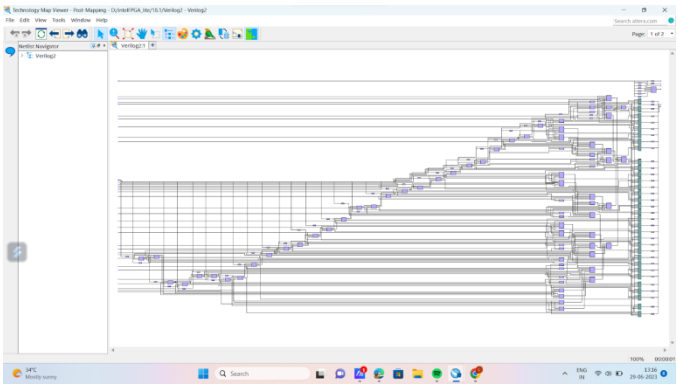
Feature	Value
Flow Status	Successful
Quartus Prime Version	18.1.0 Build 625 09/12/2018 SJ Lite Edition
Revision Name	Verilog2
Top-level Entity Name	Verilog2
Family	Cyclone V
Device	5CSEMA5F31C6
Timing Models	Final
Logic utilization (in ALMs)	94 / 32,070 (< 1 %)
Total registers	70
Total pins	213 / 457 (47 %)
Total virtual pins	0
Total block memory bits	0 / 4,065,280 (0 %)
Total DSP Blocks	0 / 87 (0 %)
Total HSSI RX PCSs	0
Total HSSI PMA RX Deserializers	0
Total HSSI TX PCSs	0
Total HSSI PMA TX Serializers	0
Total PLLs	0 / 6 (0 %)
Total DLLs	0 / 4 (0 %)]
Sources	

	Module Name	Elapsed Time	Average Processors Used	Peak Virtual Memory	Total CPU Time (on all processors)
1	Analysis & Synthesis	00:00:13	1.0	4830 MB	00:00:11
2	Fitter	00:00:44	1.0	6624 MB	00:00:53
3	Assembler	0 00:00:13	1.0	4829 MB	00:00:05
4	Timing Analyzer	00:00:07	1.2	5141 MB	00:00:05
5	EDA Netlist Writer	00:00:04	1.0	4728 MB	00:00:02
6	Power Analyzer	00:00:06	1.2	5199 MB	00:00:03
7	Total	00:01:22	--	--	00:01:19



Resource	Usage	
Estimate of Logic utilization (ALMs needed)	74	1
		2
Combinational ALUT usage for logic	107	3
		4
Dedicated logic registers	70	5
		6
I/O pins	213	7
		8
Total DSP Blocks	0	9
		10
Maximum fan-out node	clk~input	11
Maximum fan-out	70	12
Total fan-out	988	13
Average fan-out	1.64	14

POSTFITTING VIEW:



CONCLUSION :

"Any Time Electric Bill Payment Machine Controller" utilizing FPGA and Verilog HDL have been effectively displayed. The framework provides a convenient and efficient solution for customers to pay their electric bills anytime, anyplace.

Through the utilization of FPGA innovation, the framework offers adaptability, high performance, and versatility, permitting for simple integration with different equipment components and installment components. The Verilog HDL coding empowers efficient hardware description and design, ensuring the system's usefulness and reliability.

The successful execution of the "Any Time Electric Bill Payment Machine Controller" contributes to improving the convenience and availability of bill payment services for customers whereas diminishing regulatory burdens for utility companies. The system's robustness, reliability, and user-friendly interface make it an proficient arrangement in the field of electric bill payment automation.

Future improvements may incorporate the integration of progressed security measures, such as biometric verification or encryption procedures, to guarantee the protection and integrity of customer information. Also, growing the system's compatibility with developing payment technologies and integrating smart grid functionalities can encourage improve its capabilities and utility.