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Power Theft Detection Using ARDUINO

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Abstract—Electricity theft and unauthorized use of electrical power can cause revenue loss and affect accurate energy accounting. This paper presents an Arduino-based prototype for monitoring a single-phase energy meter and providing an alert when a programmed abnormal condition is detected. The system uses an Arduino Uno as the main controller. An LCD display shows the system status, while a buzzer gives an audible warning. A relay module is included for controlled switching in the prototype, and a step-down transformer is used in the low-voltage power-supply section. The proposed model demonstrates a simple approach to energy monitoring and alert generation. Its detection performance depends on the sensing method, meter interface and detection logic implemented in the final hardware.

Keywords—Power Theft Detection, Arduino Uno, Single-Phase Energy Meter, LCD Display, Buzzer, Relay Module, Step-Down Transformer.

I. INTRODUCTION

Electrical energy is essential in homes, offices and industries. Electricity theft and unauthorized consumption can lead to financial losses for electricity providers and make energy distribution less reliable. Manual inspection of consumer connections requires time and effort. An electronic monitoring system can help observe energy-related information and provide an alert when an unusual condition is identified.

The proposed project uses an Arduino Uno to process information obtained from the energy-metering section. The LCD displays relevant readings or system messages. When the programmed detection condition is satisfied, the buzzer provides an audible alert. A relay module is used as a controlled switching element according to the prototype design. The step-down transformer supports the low-voltage supply section.

II. OBJECTIVES

The main objectives are to develop a basic Arduino-based energy monitoring prototype, identify programmed abnormal conditions, display system status on an LCD, provide an audible alert using a buzzer and demonstrate controlled switching through a relay module.

III. COMPONENTS USED

1) Single-Phase Energy Meter: Measures the electrical energy consumed by a single-phase load.

2) Arduino Uno: Acts as the main controller and processes input information according to the program.

3) LCD Display: Displays readings, messages or the current system status.

4) Buzzer: Produces an audible alert when a programmed abnormal condition is detected.

5) Relay Module: Provides an electrically controlled switching interface in the prototype.

6) Step-Down Transformer: Reduces AC voltage for the power-supply section; appropriate regulation and isolation are required.

IV. WORKING PRINCIPLE

The single-phase energy meter provides energy-related information to the monitoring section. The corresponding signal is supplied to the Arduino through a suitable interface. The Arduino checks the input using the programmed logic and displays the system status on the LCD. If the defined abnormal condition is detected, the buzzer is activated. The relay module performs the switching function specified in the prototype. The step-down transformer is used in the power-supply section. The actual detection method must match the output and specifications of the selected energy meter.

V. ADVANTAGES

The system provides simple local energy monitoring, displays information clearly, gives an audible alert, uses a commonly available microcontroller and can be extended with additional monitoring features.

VI. APPLICATIONS

The prototype can be used for educational demonstrations, laboratory experiments and basic single-phase energy-use supervision.

VII. CONCLUSION

The Power Theft Detection Using Arduino project demonstrates a microcontroller-based approach to energy monitoring and alert generation. The energy meter, Arduino Uno, LCD, buzzer, relay module and step-down transformer form the main components. The system displays information and provides an alert when the programmed condition is met. Future improvements may include a clearly defined sensing interface, data logging and remote monitoring.