A research on to detect theft in power system by the microcontroller

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ABSTRACT

We know that electricity is need of life. Today electricity theft is one of the major problem faced by the government and electrical utilities. Because of some of the dishonest consumer's electricity theft is growing day by day. It causes a huge amount of money loss to the electrical utilities. To overcome this loss utilities increase the rate of electricity. This paper introduces a system which is able to detect electricity theft in power system and inform to the monitoring system. Then operator is also able to cut off the region or consumer from the distribution system without getting to the region or consumer.

Keywords: *Electricity theft, System, Monitoring and controlling, Detect, Consumer, Region.*

1. INTRODUCTION

Earlier it was a case that generally takes place in villages because they need more power requirement for their field to drive water pumps and motors. But nowadays it is not limited to villages but also industrial also as well as consumer side comes under power theft.

After studying we found that there are various methods are used by the consumers for electricity theft. Methods of electricity theft are given below:

- Direct hooking from the line.
- Injecting foreign materials into the meter.
- Drilling holes into electromechanical energy meter.
- Inserting film.
- Depositing a highly viscous fluid.
- Using strong magnets like neodymium magnets.
- Changing the incoming and outgoing terminals of the meter.

2. CONSTRUCTION

The proposed system basically depends on 'C' programming of the microcontroller. In which three parts of the system i.e. monitoring & commanding unit, Relay Control unit and End Users. Every unit has its own specifications with some basic equipment's and every unit is specified below.

Picture of hardware of the whole system

3. MONITORING AND CONTROLLING UNIT

The whole assembly consists of a controller ATmega328, Bluetooth transmitter & receiver, regulator Ic 7805, bridge rectifier, transformer etc.

A. Controller ATmega328

The ATmega328/P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega328/P achieves throughputs close to 1MIPS per MHz. This empowers system designer to optimize the device for power consumption versus processing speed. It required 16MHz clock frequency to operate. This 16 MHz frequency is supplied by a crystal oscillator. The pin diagram and description are given below.
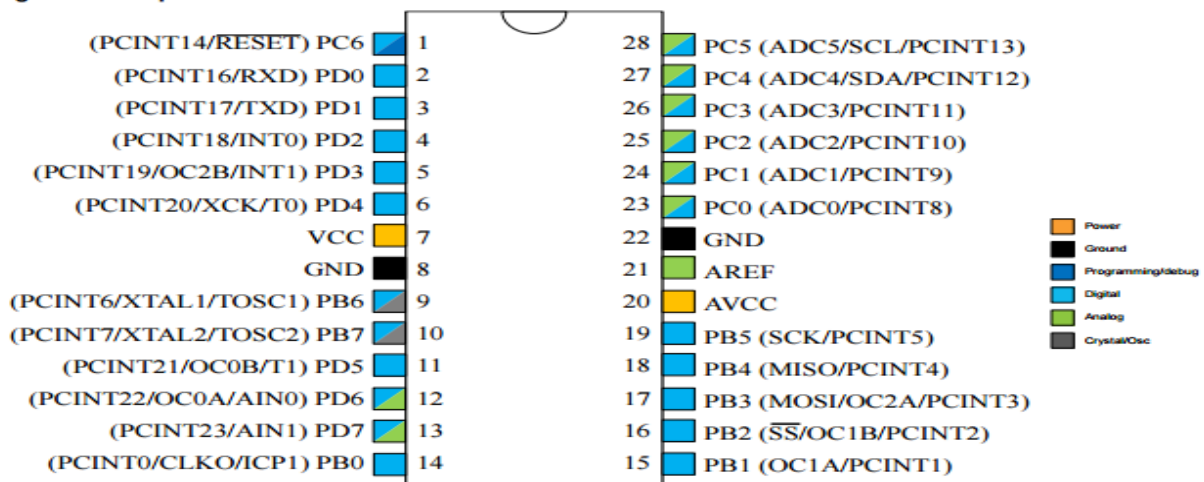

Fig.1 Pin description of controller ATmega328

B. Bluetooth (T/R) HC05

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data. This module needs to connect to the mobile with a password '1234'. Now the system is able to send or receive command**s** from the operator. This module has a range of 10 m from its installation setup.

C. Regulator Ic7805

It is a voltage regulator which is widely used in electronics equipment. Basically, regulated voltage i.e. without fluctuations & noise is very important for electronics devices for smooth and better working. It is commonly used with the controllers and processors which required smooth supply for work. It takes the input of 12v dc then gives an output of 5v dc and remaining 7v is evacuated in the atmosphere in the form of heat.

D. Bridge Rectifier

The rectifier is a device which converts AC supply into pulsating DC. Electronics devices generally work in DC so every electronic device needs rectifier with a filter. There are two rectifiers full wave and half wave, but for better conversion, full wave rectifier is used. In full wave rectifier, it also have two types one is centre tapped and another is a bridge rectifier. Bridge rectifier is most effective since its us is common. In this system, bridge rectifier convert 12v AC into 12v DC.

E. Transformer

All we know that the transformer is a static device which transfers electrical power from one form to another form without changing its frequency. In this system, controller required 5v dc supply and in domestic purpose, 230v supply is used. Since potential transformer converts 230v supply into the 12v supply. Then this supply is transferred to bridge rectifier.

4. RELAY CONTROL UNIT

The work of relay control unit totally depends on two main devices one is a relay and another is relay driver IC ULN2003.

A. Relay

The relay is a sensing device which is able to sense a small change in current or voltage of the circuit. Every system needs relays for better protection since it's an important device in every circuit. In this system, the relay is used to ON/OFF the supply of the faulty region or consumer. These relays are controlled by relay driver IC ULN2003.

B. Relay Driver IC ULN2003

Its name indicates that it is used to driving relays. This IC is interfaced with the controller IC i.e. it ON/OFF the particular relay when it got a command from the controller IC. The relay driver circuit can be realized using different integrated circuits such as ULN2003.

5. END USERS

It includes all the type of domestic use of power. Basically, theft occurs in this unit which is to be detected and controlled. For this purpose, a small electronic circuit is installed in the meters of every consumer while the meter is installing. This circuit consists of IR sensor, comparator IC LM399, current transformer etc.

A. IR Sensor

It is an **electronic** device which includes a transmitter and receiver. It is able to sense motion and light. Transmitter continuously transmits signals if any object cross, signals reflected towards the receiver in this way it works. In this system, it is used to detect meter tempering i.e. if anyone tries to open meter then it senses quickly and delivers a massage to the operator.

B. Comparator IC LM399

It consists of two independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Basically, it compares the induced voltages of the primary and secondary side of the current transformer. It helps for the detection of meter bypassing in the system.

C. Current Transformer

In this system, a current transformer is used for comparing the voltages. The primary side of the current transformer is connected to load and the secondary side is connected to meter i.e. comparator IC. Secondary side has a specific rated voltage which never changes.

6. WORKING

In normal condition, there is no disturbance in power supply and relay operation. Now according to some conditions system gives a response to the operator.

Condition: Meter Bypassing

As we say before that primary side of CT is connected with load and secondary side of CT is connected with a meter. At normal condition working is normal both primary and secondary has voltages. After bypassing the only secondary has induced voltage there is no induced voltage at the primary side. Since comparator IC is unable to compare the voltages. Then this response of bypassing is delivered to the controller.

Condition: Meter Tempering

For meter tempering, it is necessary to open or give a mechanical shock to the meter. During the process of tempering when the meter is opened then IR sensor does its work i.e. detection of electricity theft. It delivers a massage of meter tempering to the operator. It helps to detect all the types of tempering.

Above conditions gives the location of particular dishonest consumer who tries to steal electricity.
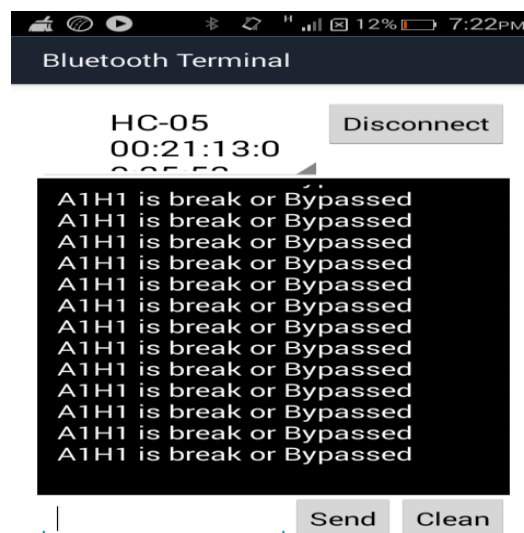
Condition: Hooking of Transmission Lines

If someone tries to steal electricity directly from transmission lines, then the specific region is get overloaded then overload relay senses the overloading and delivers the massage to the operator that a specific region having electricity theft.

These are the conditions after that operator got a massage and then the operator is able to cut off the power supply of particular region or consumer. The operator does not need to go to the consumer or region of power theft. The operator gives the command to the controller and then controller gives a response to relay driver IC. Then relay driver IC ON/OFF the particular relay of region or consumer.
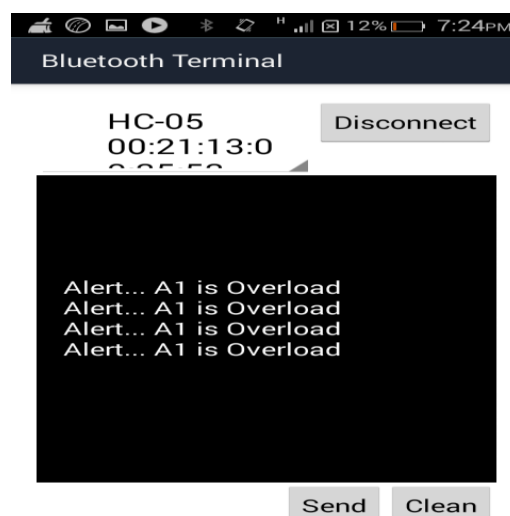
7. RESULT

In this way, we detect and control electricity theft by above system. According to theft condition result is displayed on LCD screen and mobile screen is shown in pictures below.

For condition first: which shows bypassing

Condition: Hooking transmission line

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