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TRANSFORMER MAINTENANCE MONITORING USING RFID AND GSM TECHNOLOGY

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ABSTRACT: We are living in Hi-End technological era. But even today we come across many accidents to linemen, caused during electric cable servicing. In this project, we have proposed a safe and secured power line servicing, by making use of RFID and GSM. The Radio Frequency Identification (RFID) plays the major role through its unique data handling ability. This project ensures that the power will not be ON unknowingly while the lineman is rectifying the faults on transformer or any electric posts.

Keywords: [RFID, GSM, RFID tag and reader, contactor, PIC micro-controller.]

1. INTRODUCTION

The technology that we are experiencing today has reached an unimaginable height, and will still be reaching higher. It is playing a vital role in every fields like engineering, medicine, agriculture, software, etc,. But still today, linemen have to risk their life, at times die during electric line servicing, since the power is turned ON by employees at Electric Board without knowing that their co-employee is working on live wire. And the results cost many lives or fatal injuries. To avoid such accidents in future, we have come up with a project to ensure that the power will not be turned ON while the lineman is servicing. It is achieved by implementing the concepts of RFID and GSM technology[1][9].When the transformer is under maintenance, the supply to the consumers gets deactivated and the module displays the reason in electric board and also sends it to residents via SMS[6]. So that the residents will be able to know the reason for the power cut.

2. OVERVIEW

The overall working model is that every time when fault occurs in power supply such as voltage fluctuations, transformer explosion due to sudden surge, sudden power cuts, natural disasters, etc., the Electric Board allocates a lineman for servicing. For turning OFF the mains, the line man must show his RFID card to the reader, which senses the unique ID of each card[7][2]. And now the mains are switched OFF and automatically a message keeps displaying in the LCD display at the control room indicating that the transformer is under maintenance. The lineman will receive a message from the GSM, requesting the required code [3]. Then the residents receive an SMS through GSM regarding the power cut. Meanwhile, when anyone tries to switch ON the mains, the system doesn't respond unless the previously read RFID card is shown again [8]. Thus the accidents can be avoided.

3. PROPOSED METHODOLOGY

The prototype of the system has been developed by using RFID system which includes- RFID reader and RFID tag. PIC micro-controller 16F877A, Regulators LM317 and LM7805, 20*4 LCD display, GSM module, Relay and contactor. The specifications of the components are given below:

A: BLOCK DIAGRAM

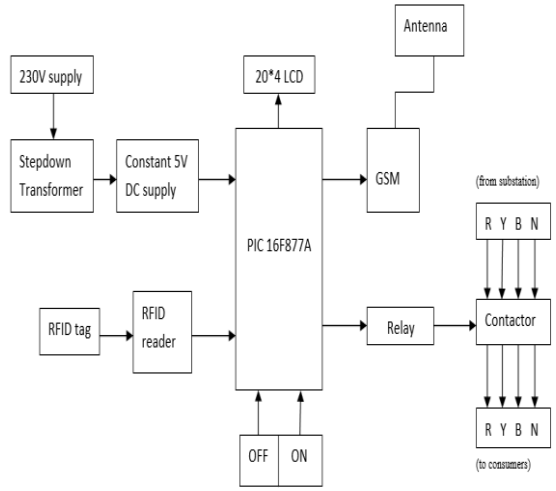

Figure.1.Block diagram of proposed model

B: CONTACTOR

A contactor is an electrically controlled switch used for switching a power circuit. A contactor is controlled by a circuit which has a much lower power level than the switched circuit.

Figure.2.Contactor

4. OPERATING PRINCIPLE

Contactors are designed to be directly connected to high-current load devices. Relays tend to be of lower capacity and are usually designed for both normally closed and normally open applications. Devices switching more than 15 ampere or in circuits rated more than a few kilowatts are usually called contactors. Apart from optional auxiliary low current contacts,contactors are designed with features to control and suppress the arc produced when interrupting heavy motor currents.

The contactor that we have used here is based on the principle of DOL starter. The control circuit is attached to any of the two phases and activated from the two phases only. Whenever we push the start switch, the current will flow through the control circuit, as well as through the contactor winding. When we push the stop button, the flow of current through the contactor will be stopped.

A: RFID READER

A Radio Frequency Identification reader is a device used to gather information from the RFID tag, which is used to track the individual objects containing unique codes. Radio waves are used to transfer data from the tag to reader. It is a technology similar to the bar codes. Here we are using EM-18 RFID reader [6].

B: RFID TAG

RFID passive tag is composed of integrated electronic chip and antenna coil that includes basic modulation circuitry and a non-volatile memory[6].These tags are energized by the reader itself, they contain no power source, typically have very long lifetime. The reader powers the tag by emitting a radio frequency. The tag then responds by modulating the energizing field. This modulation can be decoded to yield the tag's unique code, inherent in the tag. The resultant data can be passed to the micro-controller for further processing.

Parameters	Range
Power supply	4.6V-5.5V DC +/- 10% regulated
Current consumption	50 mA
RF transmit frequency	125KHz
Operating frequency	902-928MHz
Antenna Integrated Size (L*W*H)	32*32*8mm
Communication Interface	TTL serial interface, Wiegand
Communication protocol output	Specific ASCII
Supported standards	EM400164-bit RFID Tag Compatible
Read Distance	6m

Table 1: RFID chip EM-18 specifications

C: GSM MODULE

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over subscription to a mobile operator, just like a mobile phone. The uplink frequency range specified for GSM is 933 – 960 MHz (basic 900 MHz band only). The downlink frequency band 890 – 915 MHz (basic 900 MHz band only). In common, GSM – 900 is most widely used. Fewer operators like mobile communications in aircrafts use GSM – 1800.

PIC MICRO-CONTROLLER

The micro-controller is a standalone unit, which can perform functions on its own without any requirements for additional hardware like input/output ports and external memory. Various micro-controllers offer different kinds of memory such as EEPROM, EPROM, FLASH, etc., of which FLASH is the most recently developed technology that is used in PIC 16F877A[4].So that the data is retained even when the power is switched off. Easy programming and ability to rewrite are other features of PIC 16F877A.

Specifications	Values
Device	PIC 16F877
Program FLASH	8K
Data Memory	368bytes
Data EEPROM	256bytes

Table 2: Architecture of PIC 16F877A

The 16F877A micro-controller is an integrated chip that contains a small computer and some accessories such as sensors and converters (analog to digital). It is a general-purpose control and is not expensive. More advantages include low-power consumption and its control terminals can be used as input or output units. Universal Asynchronous Receiver/Transmitter (UART) is available in it. It is a serial communication interface which uses two lines for sending (TX) and receiving (RX) data.

PIN CONFIGURATION:

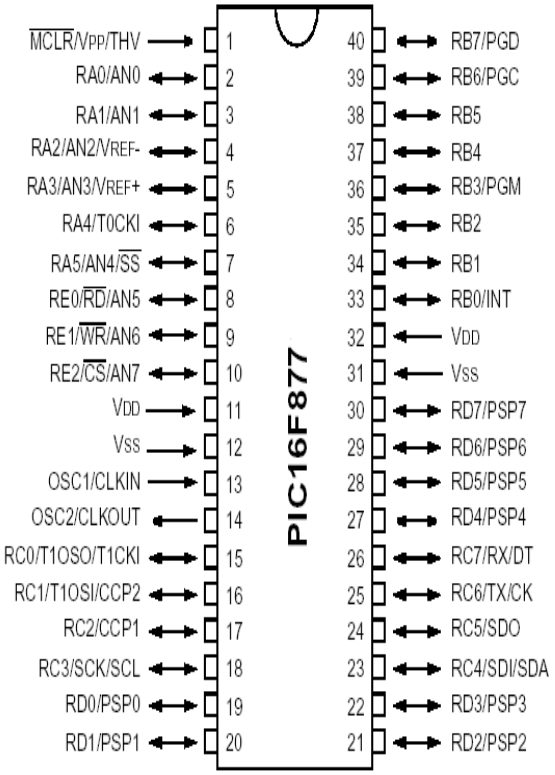

Figure.3.Pin diagram of the 16F877A-Microcontroller

The microcontroller is programmed with Embedded C, in the way that,when the OFF button is pressed by the lineman, the LCD display indicates that the system is waiting for the worker's

authentication.RFID tag is read by the RFID reader,then the transformer is turned OFF by sending the suitable code to the controller via SMS and then a message is sent to the residents such as, "Transformer is under maintenance" so that residents will be able to know that power will be ON in a short period of time.Again the same lineman presses the ON button after fault rectification and if the RFID card matches the previous one, then the contactor gets push down and the mains get turned ON.

5. FLOW CHART

The proposed model flow chart is shown in figure [4].

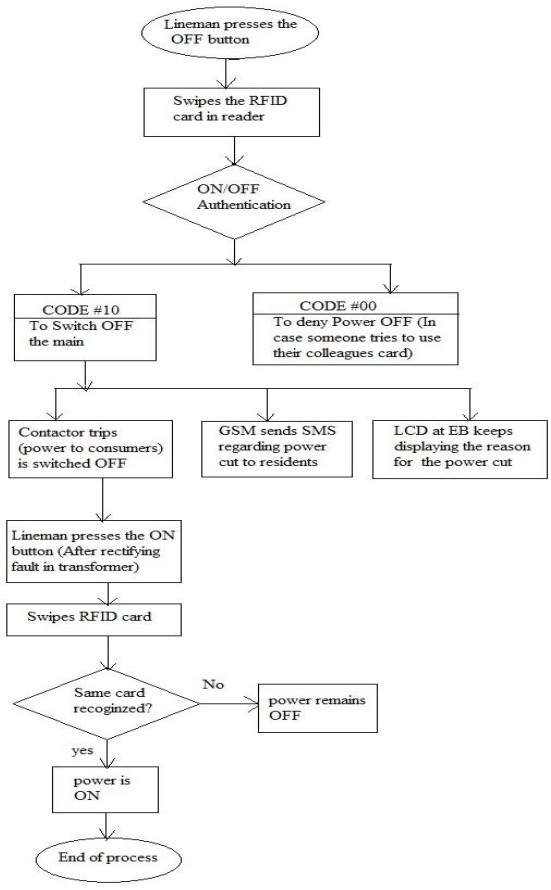

Figure.4. Flow chart of the proposed system

LCD DISPLAY

LCD screens are used in many applications because of their various advantages. It is small in size and is low power consuming. It normally operates at 5V. It is also available in many sizes. Here we are using 20*4 LCD display.

POWER SUPPLY

The power supply should be of +5V, with maximum allowable transients of 10mV. The module should not be inserted or removed from a live circuit. The ground terminal of the power supply should be isolated properly so that no voltage is induced in it. The module should be isolated from the other circuits, so that stray voltages are not induced, which may cause a flickering display.

RELAY

A relay is an electromechanical switching device which controls the ac devices through the dc power. A relay and contactor is similar in working, the only difference is that relays are used for low voltage applications, while contactors are used for high voltage applications. In this project, we are using 12V relay, which can withstand the high voltage. Here, the relay operation controls the contactor switching.

HARDWARE IMPLEMENTATION

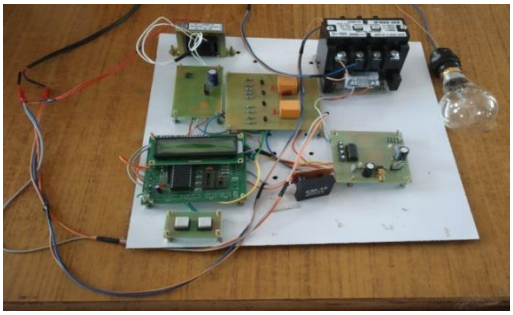

Figure.5. Hardware arrangement

The hardware is arranged in such a way that, 230 V supply is given to the step down transformer (0-9/230 V). This AC voltage is the rectified using bridge rectifier and a constant 5V is given to PIC microcontroller using LM7805 regulator. An ON/OFF keypad is connected to controller, and an RFID reader is connected between GSM module and controller. The GSM is supplied with voltage range of 3.8 - 4.2V using LM317 regulator. An LCD display is attached with controller for displaying the status of transformer. And finally, a 12V relay that receives command from pic - microcontroller controls the contactor operation.

RESULT

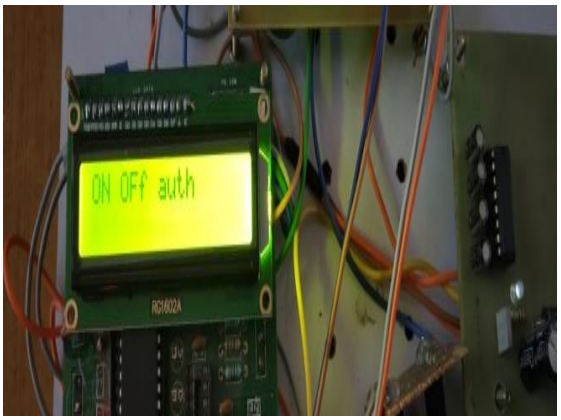

Figure.6. LCD display requesting for ON/OFF

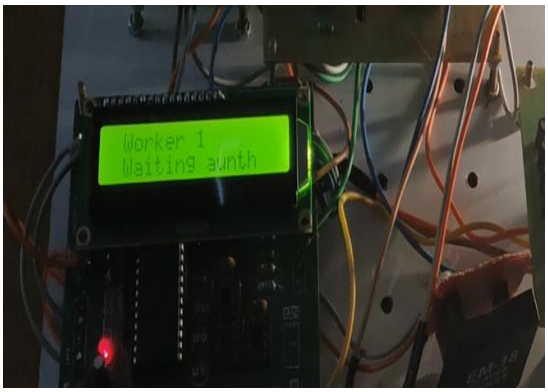

Figure.7.System waiting for Worker1's authentication

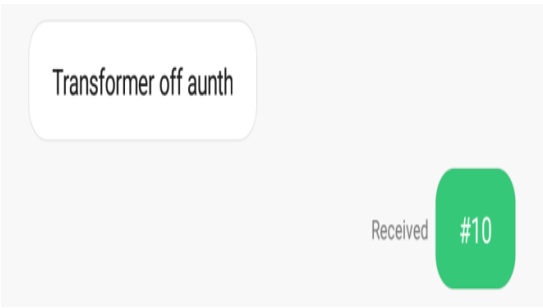

Figure.8. Code for turning the mains OFF

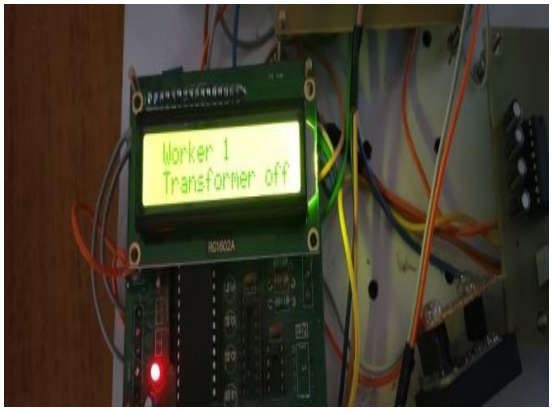

Figure.9. Mains turned OFF by worker 1

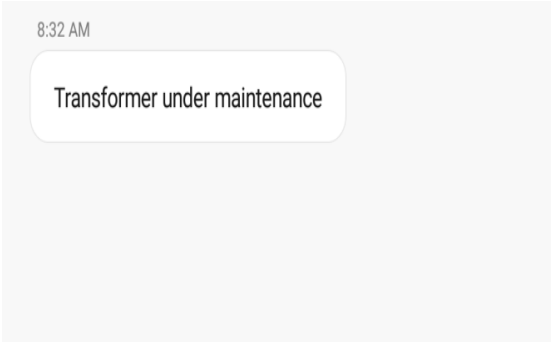

Figure.10. Residents receive SMS via GSM

CONCLUSION

In this project, we have proposed a safe and secured transformer maintenance monitoring system, which supports the linemen to work with high degree of security. The unique code sensing technology of RFID plays its major role in denying permission to turn ON the mains while a lineman is working upon the transformer. Thus this project ultimately saves the linemen from fatal injuries and even from death.

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