

A Project Report On

An automatic Load Control, Fault Detecting on, and Energy Billing System of the home appliances.

Submitted in the partial fulfilment of the requirements for the award of the Degree of

Diploma in Engineering of Electronic and Telecommunication.

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An Automatic Load
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Billing System of the
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ABBREVIATIONS

| • | GSM | Global | System | for Mobile | communication |
|---|-----|--------|--------|------------|---------------|
|---|-----|--------|--------|------------|---------------|

- GPS Global Positioning System
- PNT Phone Line Network Transceiver
- LCD Liquid Crystal Display
- **CRT** Cathode Ray Tube
- PCB Printed Circuit Board
- TDMA Time Division Multiple Access
- DC Direct Current | for Technical Education &
- AC Vocal Alternating current TEXATION OF SHAPE
- **LED** Light Emitting Diode
- **NF** No Fault
- **SMS** Short Message Service
- **TTL** Transistor-Transistor Logic
- **RX** Receiver
- TX Transmit
- CTS Clear to Send

RTS Request to send

INTRODUCTION

Our topic is the collaboration of three ideas i.e. Underground cable fault detection, Automatic electricity bill generating system and Wireless load control device using GSM module which will be helpful for domestic appliances in a safe and advance manner. In many urban areas nowadays even in rural areas, underground cabling has become very common . Underground cables are used in power system generation to distribution nowadays. In case of underground cables, sometimes fault occurs which is difficult to detect . the objective of this project is to detect underground fault and abnormalities with the help of an AT-MEGA 16 Microcontroller and GSM module. We will be having several phases of representing different underground connections and will have several switches in phase representing the distance of the fault from the base station.

The Electrical energy metering instrument technology has come a long way from what it was more than 100 years ago from the original bulky meters with heavy magnets and coils to newly invented energy meter resulted in the reduction of size and weight with improved features and specifications . The energy meter is designed for reading electrical energy consumed per unit. The data is also provided to the electrical department using GSM technology for billing purpose. Owing to high electricity cost these days it has become necessary for the consumer to know how much electricity is consumed and how to control electricity within their budget.

"Wireless Load Control Device" (WLCD) using GSM module consists of PIC18F4550, GSM module, relay circuit, keypad and LCD. PIC18F4550 is used as microcontroller to process the received data and then the output signal is sent for on/off relay switch. The users can on/off load in two ways either keypad or short message service (SMS). The WLCD can control three loads and the current status of each load is displayed on the LCD . This project describes the technology associated with the remote control of electrical load using GSM module. The main conception behind this project is receiving a coded SMS to trigger or switch home appliances through communication bet.

LITERATURE SURVEY

The currently prevailing system involves the user to go up to the EB office to manually pay his bills. The readings are taken using the analogue meter present in the customer's house. The readings are taken using an employee working at the EB office. The currently billing system have to has a appoint many middle man which may increases a lot of corruption as per data the Value of petty corruption in Electricity Services in India is \$292.17 billion per annum. Nearly 59% of households (70% of urban households and 55% of rural ones) interacted with the respective Electricity Service Departments in last one year. The amount of corruption is nearly the amount budget Finance minister Nirmala Sitharaman on Monday announced a \$3.05 trillion electricity distribution reform programme in the Union budget to help reduce losses and improve the efficiency of electricity distribution companies (discoms). The fault occurs in house took a lot of time to find it out and it leads to do a lot of work. To control the electrical load by wireless communication using GSM module, the WLCD was constructed. The WLCD is designed to provide three loads (rated of each load at 220Vac 10A). The electrical loads can be turned on/off by keypad on WLCD or SMS via GSM network as the command. A smart home incorporates sensors, actuators, middleware, and a network and has two major interacting components: a smart network and a smart load. The primary objectives of a smart home are to increase home automation, facilitate energy management, and reduce environmental emissions. Home automation can be improved through an improved communication network that involves a twisted pair power lines, radio signals, or fibre optics in a bus-based network or an internet protocol as standards. Smart home energy can be managed through the selection of efficient appliances, improvement in customers' knowledge of and experience with residential energy management, participation in demandside management (DSM) programs, and the deployment of an energy management system (EMS). Environmental emissions can be decreased through decreased dependency on fossil fuels, the adoption of renewable energy generation sources (such as wind and solar), and the control of electricity consumption.

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REQUIREMENTS ANALYSIS AND SYSTEM DIVISION

Underground cable fault detector:

Underground and high-resistance grounded industrial power systems have a great advantage; they can operate indefinitely with a ground fault on one phase, eliminating the need for an immediate shutdown. Once the fault is located, the particular circuit can be isolated and the fault cleared at a convenient time, resulting in a controlled, minimized outage. This advantage has tremendous value in many industries, where the instantaneous tripping of faulted circuits to critical processes would result in losses of production, materials, and equipment. A major problem in operating these systems is locating a ground fault when it occurs. The search may be difficult and time consuming. For one particular manufacturing site studied, approximately half of the faults were quickly located; the other faults required on average four man-hours, and a few faults took 16 or more hours. Small-magnitude fault currents flow in the faulted network due to the leakage (or grounding) capacitance and through the grounding resistor if one is present. The system leakage capacitance is distributed throughout the entire network. It acts as if it were a single lumped capacitance; however, the charging currents can be observed flowing in all branch circuits. Typical fault currents are less than 10 A.

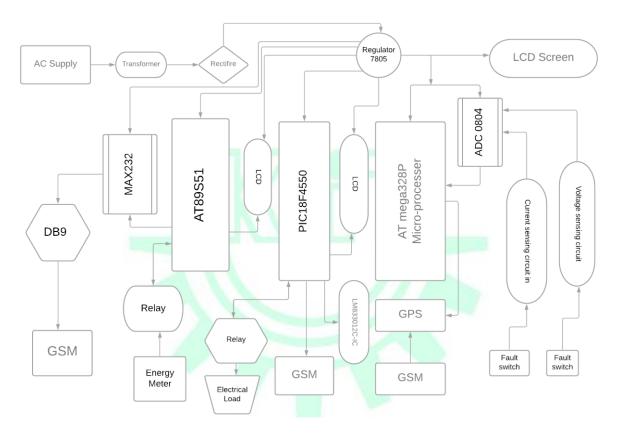
Automatic electrical billing system:

Every system around us is becoming automatic and making our lives more comfortable. Our idea is to develop an automatic electricity billing which is very essential in our daily life. At present, an employee from the electricity board visits regularly once in a month, takes the meter reading and submits these readings to the office. The office generates a bill on the basis of meter reading. The accuracy of this method is less due to human interventions. As a result, Automatic Electricity Bill concept is developed in which the collection of meter reading, processing of the reading and sending the bill to customer is done automatically. This method employs a camera which is fixed in front of the meter is used to take the snapshot. The captured image is then processed and the meter reading is extracted. The bill amount is calculated and is send to customer as SMS via GSM module. A copy of SMS is sent to the electricity board for documentation purpose.

Warless load control device using GSM modal:

This paper presents Wireless Load Control Device (WLCD) using GSM module. The WLCD consists of PIC18F4550, GSM Module, relay circuit, keypad, and LCD. PIC18F4550 is used as a microcontroller to process the received data and then the output signal is sent for on/off relay switch. The users can on/off load in two ways, either keypad or short message service (SMS). The WLCD can control three loads and the current status of each load is displayed on the LCD. A working prototype of WLCD was built to demonstrate the effectiveness and efficiency of on/off load control through the GSM network.

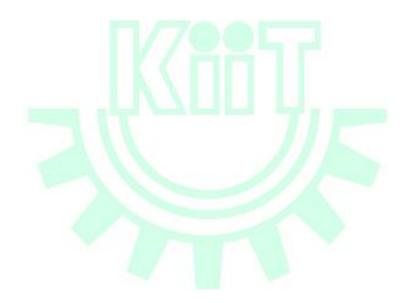
SYSTEM DESIGN, AND METHODOLOGY



The AT89S51, PIC18F4550, and AT mega328P are the micro processer/controller they are also called as PIC ("Programmable Intergraded Circuit"). The circuit is designed in such a way that so the old style wiring houses can also assemble the circuit and make their house modern, safe as well as move reliable. To implement the circuit doesn't required and removable of old wiring of the house, it will attached with the main AC phase as well as with the inverter if the person have the facility, but the circuit is not designed in such a way that it can take reading of both the thing differently. So, we decided to not to count the inverter meter reading. The fault detection of the cable will work in the principle of the relay deflation switching system in which the circuit will have two inbuilt circuitries one of them is already faulty and other is the main AC phase. When the main AC phase will found disconnected it will run the calculation and the algorithms as per designed and found the faulty zone of the AC circuit. The load controller will load by the help of both IOT and the GSM in the same time

Methodology:

The goal of our project is to automatically read the consumed energy during every month and to calculate the bill. The bill thus generated is sent to the consumers' mobile phone as an SMS via a GSM module. The project also helps in detecting fault in transmission lines and control the load with the help of the GSM.



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IMPLEMENTATION RESULT

Test Cases and Test Results:

Underground Cable Fault Detection

During the test time the faults is been created and it occurred in the circuit, the processor first detects the type of faults and the cable linked in it. The processor will send a massages to the LCD display and GSM module. It will show the location and the type of the fault. The GSM module will send the message to the mobile phone regarding the information about the fault. Likewise for different fault locations the information is displayed on the LCD Display and mobile phones.

Automatic electrical billing system

The automatic electric billing system overshadows the traditional system the proposed system works automatically to detect the number of units that has been consumed. Then the readings are displayed on the users EB box. This will help them to be aware of the power consumption and can reduce the energy if they feel that they are over using it. Since everything is automatic, human labour is reduced. An external condition which delays the readings to be taken are eliminated. Thus, there are error free values. And accuracy is being preserved.

Warless load control device using GSM modal

Testing involves troubleshooting system to detect, isolate and correct internal or external fault such as malfunction in the internal circuit, input or output shorted to ground or input or output open circuit.

Each of the component was first tested using mustimeter in order to check the state of their performance and accurate value. Then each component was connected to the alternator and tested again. This was done in other to carry out the continuity, which is meant for proper connection of the circuit and to detect any wrong connection.

Advantages:

- > Low voltage drop,
- > Low maintenance,
- ➤ Low chances of fault occurring and is very suitable in urban areas where overhead transmission lines are not easy to install
- > Real Time & Accurate **Billing** Information.
- > Reduces disputes due to billing errors.
- ➤ Useful for **energy** conservation and reduces fraudulent consumption.
- ➤ The users can on/off **load** in two ways, either keypad or short message service (SMS).
- ➤ The WLCD can **control** three **loads** and the current status of each **load** is displayed on the LCD.
- A working prototype of WLCD was built to demonstrate the effectiveness and efficiency of on/off load control Appthrough the GSM network. Technical Education &

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CONCLUSION AND FUTURE SCOPE

Conclusion:

By the project on Underground cable fault detection using AT Mega 16 Micro controller. We have proposed a low-cost solution to enhance the fault detection of underground cable. It is secure, robust and power consuming. It can be used with all types of cables so as to avoid fault occurring in the underground cables. To measure the particular distance and location an individual resister is connected between zones. Solid State relay is a sensing device it will work in a particular location of cable and intimate the fault to microcontroller and distance of fault is displayed in the LCD display.

The monopolistic power distribution market in Asia is gradually transforming into a competitive marketplace. Differentiation in service is going to be the key competitive factor to the improve market share. In the deregulated power markets prepaid meters with their advantages over conventional ones are more likely to help power distributors to differentiate. The developed GSM based energy meter reading and billing is beneficial for both, the consumers as well as the electric company. The system overcomes the drawback of traditional meter reading system and provides additional services such as power cut alert and tampering alert

This project is based on advancement in GSM based home automation saving energy by phone which is very useful and also very economical. It provides simple and easy way to control the household appliances. The main advantage is that even though the controlling can be done by the mobile based application which has safety features but in absences of a cell phone one can control it by sending a normal SMS to the GSM SIM. Electrical loads such as fans, bulbs, and computer etc. are controlled wirelessly by the WLCD. The three electrical loads can be controlled at a time in the present system. For example, when the user enters "*000#" to the WLCD using keypad, all of electrical loads will turn off and the LCD will show the current status as. Next, the user sends the SMS command "*111#" to the WLCD, the LCD will show the phone number of a user. Then, all loads are switched on and the LCD will show the current status of electrical load. After that, the microcontroller will send the current status to the user via SMS.

Future Scope:

The project proposes detection of the short circuit fault. It can also detect the open circuit faults using capacitor and measuring impedance of the AC circuit.

The automation for existing manual billing system. This involves the automatic process of taking meter reading and computing the billing by examining the number of units consumed by the user of that particular registered energy meter and sending a computerized bill to the registered mobile number of a user. Thus, automatic wireless billing involves total authentication over accessing a data form energy meter and provides accurate billing. Further the system can be extended to automatic gas and water supply services.

The future statement of the project will be very great, considering the number of resources, time and money. All these considered amount will be save, which can be used for any other work. The future of this system will be small box combined with the GSM SIM. The hardware will be self-contained and cannot be prone to electric failure. This appliance will have its own encapsulated UPS and charging system

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UNDERGROUND CABLE FAULT DETECTION

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LIST OF FIGURES

ABBREVIATIONS

| GSM Global System for Mobile communication |
|--|
|--|

- **GPS** Global Positioning System
- PNT Phone line Network Transceiver
- LCD Liquid Crystal Display
- **CRT** Cathode Ray Tube
- PCB Printed Circuit Board
- **TDMA** Time Division Multiple Access
- **DC** Direct Current
- AC Alternating current
- A LED d by Silight Emitting Diodechnical Education &
 - NF VocationNo Faultting (SCTE&VT) ODISHA.
 - **SMS** Short Message Service

INTRODUCTION

In many urban areas and nowadays even in rural areas, underground cabling has become very common. This is to ensure the safety of the cables from rainfall, snow, thunder, light etc. Overhead cables are easily prone to these types of problems. Many types of cables are laid underground like electricity cables, telephone cables, and other signal cables. Faults in these underground cables occur mainly because of construction work or some extreme weather conditions. It is difficult to know the exact location of the fault and it becomes difficult to find out that cable and fix the fault. If a fault occurs in the cables, the whole area is needed to dig out to detect and fix it. This may take a lot of time and other cables may also get affected due to which we will face problem using appliances at our homes for a long time. It will consume time and efforts unnecessarily and due to this we will face problems using the appliances. Therefore, it becomes necessary to know the exact location of the faults in the cables to avoid unnecessary digging that may affect other cables in that area. There are two types of faults which can occur in underground cables. These are open circuit faults and short circuit faults. In open circuit faults, there is an open circuit in the conductor. These faults occur due to mechanical stress and may lead to breaking of cable conductors. Short circuit faults occur due to improper insulation of the cables or when two or more conductors of same cable touches each other and come in contact with each other.

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Main features: Phubaneswar

- ➤ Distance of the fault from the base station and the type of phase which has fault will be displayed on the LCD display.
- A message will be sent to the mobile about the fault location of the cable using GSM module.
- ➤ LED light turns on corresponding to the phase which has fault.

LITERATURE SURVEY

Different literature that we have studied for the purpose of making of the project tells us about the different components that we have used and their importance. And how to connect the components so that we can connect to get the desired results. We are operating push buttons to generate fault manually and resistors as cables. We also get the idea of improvements in those projects. We came to know the background and the importance of this project. As many underground cables are difficult to fix when any kind of fault occurs in them, we need to know about the position of the fault in those cables so that fixing can become easy. We were able to understand the advantages of this project which are:

- > Less maintenance.
- > Higher efficiency.
- uncil for Technical Education & Less fault occurs in underground cables.
- > We can detect any types of faults like resistive faults, sheath faults, cable cuts, etc.

REQUIREMENTS ANALYSIS AND SPECIFICATION

Tools Description:

AT-MEGA 16 Microcontroller.

AT-Mega 16 micro-controller is an 8-bit high performance micro controller from the Atmel's Mega AVR family. At mega16 micro controller is a 16-bit 40 pin micro controller based on enhanced RISC (Reduced instruction set computing) architecture with 131 powerful instruction. AT mega 16 micro controllers can be worked on a maximum frequency 16 MHZ. The micro controller is an input supply is given to the voltage regulator also drives a solid-state relay driver which in turn controls the relays for proper connection of the Underground cable(feeder) resistor at each phase connection to each zone. It is fault occur in relay will be open, to current flow in open condition. To Intimate alarm to faulty section. Automatic displayed in cable fault at a distance in LCD display displayed in substation. To send a message using micro controller through GSM Modem in mobile phone.

GSM Module.

GSM stands for **Global System for Mobile communications**. GSM is a cellular network and is used to connect cell phones by searching for cells near it. It is widely used for communication purposes. It uses time division multiple access **(TDMA)** technique for communication purposes

A **GSM modem** or **GSM module** is a hardware device that uses **GSM** mobile telephone technology to provide a data link to a remote network. From the view of the mobile phone network, they are essentially identical to an ordinary mobile phone, including the need for a SIM to identify themselves to the network.

GPS Module.

GPS receivers use a constellation of satellites and ground stations to compute position and time almost anywhere on earth. ... With this information and some math, a ground-based receiver or **GPS module** can calculate its position and time

PCB Board.

Printed Circuit Boards (PCBs) are the boards that are used both as a physical support piece and as the wiring area for the surface-mounted and socketed components. PCBs have **copper tracks** to connect the holes where the various components are located. They are specially designed for each and every circuit and build construction very easy

Resistors.

A resistor is a **passive two-terminal electrical component** that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses

LCD Display.

LCD (Liquid Crystal Display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies. LCDs allow displays to be much thinner that cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it

Relays.

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal

A power **relay module** is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a **micro controller**. When activated, the electromagnet pulls to either open or close an electrical circuit.

Push Button

A push-button (also spelled push button) or simply button is a simple switch mechanism for controlling some aspect of machine or a process

Transformer

A transformer is a passive electrical device that transfers electrical energy from one electrical circuit to another, or multiple circuits. A varying current in any one coil of the transformer produces a varying magnetic flux in the transformer's core, which induces a varying electromotive force across any other coils wound around the same core. Electrical energy can be transferred between separate coils without a metallic (conductive) connection between the two circuits. Faraday's law of induction, discovered in 1831, describes the induced voltage effect in any coil due to a changing magnetic flux encircled by the coil.

Rectifier

A **rectifier** is an electrical device that converts **alternating current (AC)**, which periodically reverses direction, to **direct current (DC)**, which flows in only one direction. The reverse operation is performed by the inverter.

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Regulator 7805/LM7805 IC

A LM7805 Voltage Regulator is a voltage regulator that outputs +5 volts. An easy way to remember the voltage output by a LM78XX series of voltage regulators is the last two digits of the number. A LM7805 ends with "05"; thus, it outputs 5 volts

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator **IC** maintains the output voltage at a constant value. ... The xx in 78xx indicates the output voltage it provides. **7805 IC** provides +5 volts regulated power supply with provisions to add a heat sink.

ADC 0804

The ADC0804, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analogy-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique.

Input type: Single-Ended Interface type: Parallel

Analog voltage AVDD (Min) (V): 4.5

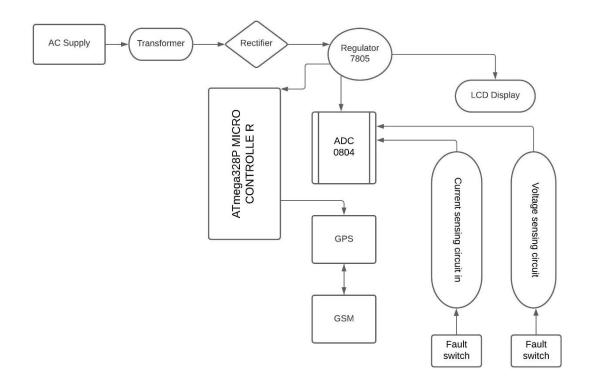
There are multiple kinds of Analog to Digital Converters (ADC) which are used to convert the signal for microprocessors or controllers. Every "ADC" has its own specification and advantages on the base of the requirement. Here we are going to discuss "ADC0804 IC" which is known as the low voltage 8-bit analogy to Digital Converter. ADC0804 is a low voltage IC use to convert the low voltage analogy signal to an 8-bit digital signal. It works with 0-5 Volts, has 1 Analog input and 8 output pins. ADC0804 comes with an internal clock but to increase or change the clock the cycle we could use the external clock. Always keep mind that conversion speed cannot be faster than 110us either we are using an internal clock or external clock.

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SYSTEM DESIGN, PROJECT DESCRIPTION AND METHODOLOGY

System Design:



The project uses the simple concept of Ohm's law where a low DC voltage is applied at the feeder end through a series resistor. The current would vary depending upon the length of fault of the cable in case there is a short circuit of LL or 3L or LG etc. The series resistor voltage drops changes accordingly which is then fed to an ADC to develop precise digital data which the programmed microcontroller would display the same in KM's. The project is assembled with a set of resistors representing cable length in KMs and fault creation is made by a set of switches at every known KM to cross check the accuracy of the same. This is proposed model of underground cable fault using microcontroller. It is classified in four parts – DC power supply part, cable part, controlling part, display part. DC power supply part consist of ac supply of 230v is step down using transformer, bridge rectifier converts ac signal to dc & regulator is used to produce constant dc voltage. The cable part is denoted by set of resistors along with switches. Current sensing part of cable represented as set of resistors &switches are used as fault creators to indicate the fault at each location. This part senses the change in current by sensing the voltage drop. Next is controlling part which consist of analogy to digital convertor which receives input from the current sensing circuit, converts this voltage into digital signal and feeds the microcontroller with the signal. The microcontroller also forms part of the controlling unit and makes necessary calculations regarding the distance of the fault. The microcontroller also drives a relay driver which in turn controls the switching of a set of relays for proper connection of the cable at each phase.

Methodology:

Our main objective in this project is to detect the faults of underground cables and their fault position from the base station using an Arduino and GSM module. The circuit consists of Arduino, GSM module, resistance measurement circuit and LCD display. We manually introduce faults in the circuit using fault switches. We have arranged these switches in 3 rows having 4 switches each. The 3 rows represent 3 different phases. The main component of the fault detection in the underground cable is the low value of resistance. The key idea in the working of this project is ohms law. When we apply a DC voltage at the feeder end based on the fault position in the cable, the value of current varies. When a short circuit fault occurs, the changed voltage value across the resistor is measured and fed to the Arduino which has in-built analogy to digital converter. Arduino, then calculate the fault in terms of distance from the base station. This value for all the three phases is then displayed at the LCD display interfaced to the Arduino and a message will be sent to the mobile phone using GSM module. Set of resistors represent the length of the cable. We can introduce faults manually by using fault switches and then can determine the fault distance

Project description:

In this project, we are detecting faults in different phases of the underground laid cables. We are creating the faults with the help of push buttons. Pressing the push buttons will create the change in current and this will activate the relays through which micro-controllers and GSM circuit will get activated and the corresponding fault distance will be displayed on the LCD and GSM will send the message about the fault to our phone.

The obvious approach to detect ground faults in such a system would then be to look for these voltage characteristics. Specifically, by connecting the phase voltages in series in a broken delta connection, the voltage at the break in the delta can be monitored. During a fault, this voltage will increase to three times the regular phase-to-neutral voltage, as shown in Equation 1 below. Accordingly, an overvoltage relay can be connected across the broken delta-connected auxiliary VTs to detect a ground fault.

VAG = VAN + VNG = 0 $VBG = VBN + VNG = \sqrt{3}VLN \angle - 150^{\circ}$ $VCG = VCN + VNG = \sqrt{3}VLN \angle 150^{\circ}$ $Vrelay = VAG + VBG + VCG = 3V0 = 3VLN \angle 180^{\circ}$

FAULT DETECTION METHODS

Online method:

This method utilizes and processes the sampled voltages and current to determine the fault points. Online method or underground cable are less common than overhead lines.

Offline method:

In this method special instrument is used to test out service of cable in the field. This offline method can be divided into two methods. They are tracer method and terminal method.

Tracer method:

In this method fault point is detected by walking on the cable lines. Fault point is indicated from audible signal or electromagnetic signal. It is used to pinpoint fault location very accurately.

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It is a technique used to detect fault location of cable from one or both ends without tracing. This method uses to locate general area of fault, to expedite tracing on buried cable.

IMPLEMENTATION RESULT

As the result, we are getting the distance of the fault from the base station for a particular phase and message is sent to the phone about the situation. LED corresponding to the phase gets turned on and remain on for some time. The circuit works correctly.

Test Cases and Test Results:

We test our circuit by introducing faults by pushing the push buttons. It will create a fault in the circuit and then a signal will be sent to the Arduino using relays. Arduino is connected to our PC where we have written the code in the Arduino software. The code will run on the Arduino and according to the created fault it will send a signal to the LCD display and GSM module. The LCD Display will then display the fault location and the phase in which the fault has occurred. The GSM module will send the message to the mobile phone regarding the information about the fault. We will create faults in the different phases likewise for different fault locations and test them if they are displaying the information in the LCD Display and mobile phones

Advantages: For Technical Education &

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- ➤ It has higher efficiency Bhubaneswar
- ➤ Less fault occurs in underground cable
- > This method is applicable to all types of cablerangiefrom1kvto500kv
- > It can detect other types of cable fault such as Short circuit fault, cable cuts, Resistive fault, Sheath faults, Water trees, Partial discharge.

CONCLUSION AND FUTURE SCOPE

Conclusion:

Thus, the project on Underground cable fault detection using AT Mega 16 Micro controller was done. We have proposed a low-cost solution to enhance the fault detection of underground cable. It is secure, robust and power consuming. It can be used to all types of cables so as to avoid fault occurring in the underground cables.

Result:

Thus, the underground cable fault using AT Mega 16 Microcontroller was identified in the underground cable from feeder end in a km. To measure the particular distance and location an individual resister is connected between zones. Solid State relay is a sensing device it will work in a particular location of cable and intimate the fault to microcontroller and distance of fault is displayed in the LCD display.

Future Scope: not for Technical Education &

In this project we have detected the short circuit fault. We can also detect the open circuit faults using capacitor and measuring impedance of the AC circuit

Calculation Of Cable Fault Location Detection Circuit Approximation

Rhuhanoswar

Cable-fault Location Circuit calculation. Loop test - (Methode, for Localing the fault in underground cable) LisMussay loop lest. 1) Mussay Loop Jed-. (overloading) first, we have to build a wheatstone bridge with some modification. Shorting Jumper (fault cable Earth fault (overloading) are, have to adjust the value, of R1 and R2, So the galvano meter shown zero neading. That is, bring the bridge to the balance. Now, (in) the Ibalanced position of wheatstone bridge

$$\Rightarrow \frac{R_1}{R_2} + 1 = \frac{R_0 + R_1}{R_X} + 1$$

As, Rg, shooting jumber and Ry can be Consider as a single cable.

Therefore; they can be consider as a Single Cable.

Now The si she vieststance of each cable
Then,
Rx+Ry+Rg=28
putting this in the above equation,

$$\frac{2}{R_1} + \frac{R_2}{R_2} = \frac{2\pi}{R_x}$$

$$\Rightarrow Rx = \frac{R_2}{R_1 + R_2} \times 2\pi$$

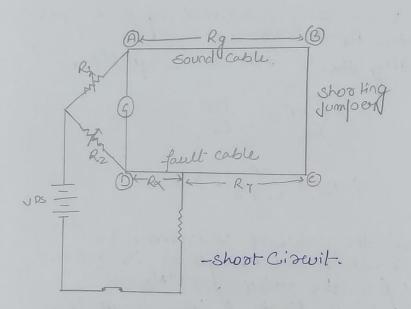
We know, that value of the tesisteme is proportional to the length of the cable.

Therefore, the value of Rx is proportional to the length of the Lx.

Therefore, Lx = R2 x2L

- a) Hurray loop Test (shoot circuit)

1) We have to build a wheatstone bridge with some modification.



We, have to adject the value of R1 and R2 so the galvanomeles shows Zero reading. That is, bring the bridge to the balance. Now, in the balanced position of wheatstone bridge, we, have.

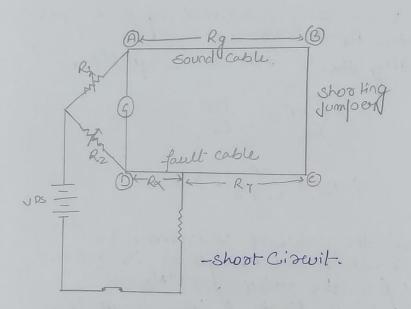
$$\Rightarrow \frac{R_1}{R_2} = \frac{R_0 + R_Y}{R_X}$$

$$\Rightarrow \frac{R_1}{R_2} + 1 = \frac{R_0 + R_Y}{R_X} + 1$$

$$\Rightarrow \frac{R_1 + R_2}{R_2} = \frac{R_0 + R_Y}{R_X} + \frac{R_X}{R_X}$$

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Ob, Rg, Shooting dumber, and Ry Cam be Consider as a single cable Therefore, Rg, shooting Jumpoer, and Ry Cam be consider a single cable.

Hen, Rx + Ry + Rg = 28

Putting this in the above equation,

=> R1 + R2 = 28

> Rx = R2 x 28

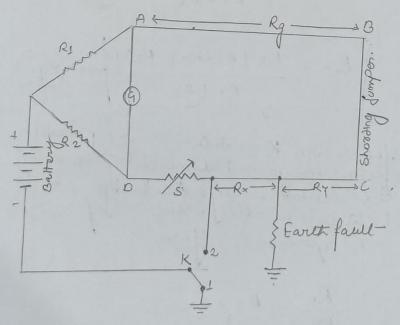
We know, the value of resistance is proportional to the Length of the cable Therfore, the value of Rx is proportional to length of the length lx.

Therefore, $Lx = \frac{R_2}{R_1 + R_2} \times 2L$

Varley loop Jest

varley loop lest is also for locating short— Circuilly and earth fault in undergloound cable. The lest also employs the point principle of whealstorn briefle. However, the difference between Murray loop test and varley loop test is that is that is that, in varley loop test resistance R1 and R2 are fixed, and at variable resistor is inserted in that faulted leg. If the fault resistance is high, the sensileg. If the fault resistance is high, the sensidivity of Murray loop test in reduced and varley loop test may be more suitable.

--- varley loop dest for earth fault.



Resistor, R1 and R2 are fixed and the resistor & & S is variable. In this fest, the switch is if first through to the position 1. Then the varief first variable resistor s is varied III galvanome ter show Jew deflection (i.e bridge is balanced). Let say, the bridge is balanced for the value of S equal to S1 Then,

$$\frac{R_1}{R_2} = \frac{R_9 + R_Y}{R_x + S_1}$$

$$1et_1 R_9 + R_Y = R_3$$

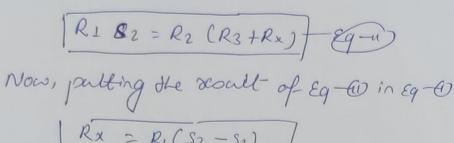
$$\frac{R_1 + R_2}{R_2} = \frac{R_3 + R_x + S_1}{R_x + S_1}$$

$$R_x + S_1 = \frac{R_2(R_3 + R_x + S_1)}{R_1 + R_1}$$

$$R_{x} = \frac{R_{2}(R_{3}+R_{x})-R_{2}S_{1}}{R_{1}+R_{2}}$$

How, the switch K is thoow to the position.

$$\frac{R_1}{R_2} = \frac{R_3 + R_4}{S_2}$$



 $Rx = R(S_2 - S_1)$ $R_1 + R_2$

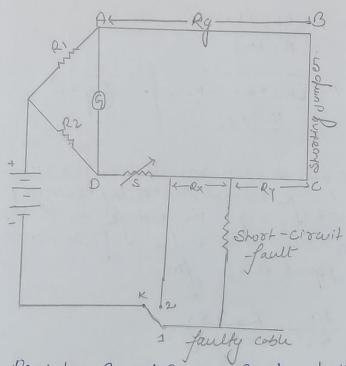
Since, the value of RI, RZ, S, and SZ are know, Rx can be calculated. when Rx is known, the distance from the test end to the fault point lx can be calculated os,

Lx = Rx/8

tohere, R = resistance of cable per meter.

on &

-> Warley loop test for short circuit



Resistor, R, and R2 are fixed and the resistor s
is variable. In this test the switch K if
frost through to the fosition I. Then the variable
resistor s is variable resistor s is varied till
galvanometer show zero defination Ci.e bridge
is balanced). Let say, the bridge is
balanced for the value of s vegual to
S! Then,

 $\frac{R_1}{R_2} = \frac{R_0 + R_Y}{R_X + S_1}$

$$\Rightarrow Rx + S_1 = \frac{R_2(R_3 + Rx + S_1)}{R_1 + R_2}$$

$$\Rightarrow | R_{X} = \frac{R_{2} (R_{3} + R_{X}) - R_{1}S_{1}}{R_{1} + R_{2}} - \underbrace{(R_{3} + R_{X}) - R_{1}S_{1}}_{R_{1} + R_{2}}$$

The Switch & is throw to the position 2 and bringe is balanced by varying the resistors say, the bridgel in balanced at the value of resistor 8 is equal to Sz. Then,

$$\Rightarrow \frac{R_1}{R^2} = \frac{R_3 + R_x}{32}$$

Now, palting the result of Eq. 10 in Eq. 10

$$R_{X} = \frac{R_{1}(S_{2}-S_{1})}{R_{1}+R_{2}}$$

(0)

Since, the value of R, 1 Rz, s, and Sz are know, Rx Com be calculated when Rx is known, the distance from the test end to fault point Lx can be calculated as,

Lx = Rx/8

Whou, R= resistance of cable per meter.

Automatic Electricity Bill Generating

Approved by Ste Council for Technical Education & Vocation System DISHA

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- ➤ MAX232
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LIST OF FIGURES

ABBREVIATIONS

• **GSM** Global System for Mobile communication

• LCD Liquid Crystal Display

PCB Printed Circuit Board

• **DC** Direct Current

AC Alternating current

• **LED** Light Emitting Diode

• **NF** No Fault

• **SMS** Short Message Service

• **TTL** Transistor-Transistor Logic

RX Receiver

TX Transmit

• CTS Clear to Send

• RTS Request to send

INTRODUCTION

The Electrical metering instrument technology has come a long way from what it was more than 100 years ago. From the original bulky meters with heavy magnets and coils, there have been many innovations that have resulted in size & weight reduction in addition to improvement in features and specifications. Resolution and accuracy of the meter have seen substantial improvements over the years. Introduction of the digital meter in the later part of last century has completely changed the way Electrical parameters are measured. Starting with Voltmeters & Ammeters, the digital meter has conquered the entire spectrum of measuring instruments due to their advantages like ease of reading, better resolution and rugged construction of particular significance is the introduction of the Electronic Energy Meter in the mid-eighties. Now a day, the energy consumption and energy distribution has become a big subject for discussion because of huge difference in energy production and consumption. In this regard, energy consumers are facing so many problems due to the frequent power failures; another important reason for power cuts is due to the un-limited energy consumption of rich people. In this aspect, to minimize the power cuts and to distribute the energy equally to all areas, some restriction should have over the power consumption of each and every energy consumer, and according to that the Government should implement a policy, by introducing Automatic Energy Meters everywhere in domestic sector. Hence, the need has come to think on this line and a solution has to be emerged out.

Main feature: Approved by State Council for Technical Education &

Today the metering instrument technology grown up significantly, such that the Consumed energy can be calculated mathematically, displayed, data can be stored, data can be transmitted, etc. Presently the microcontrollers are playing major role in metering instrument technology. The present project work is designed to collect the consumed energy data of a particular energy consumer through wireless communication system (without going to consumer house), the system can be called as automatic meter reading (AMR) system. The Automatic Meter reading system is intended to remotely collect the meter readings of a locality using a communication system, without persons physically going and reading the meters visually.

LITERATURE SURVEY

Power is one of the basic components of infrastructure that defines the country's economic development and the quality of life of an individual. Power is the most visible form of energy that is generally known as electricity. Out of all the power resources available for consumption in India, thermal sources counted 67 percent of power production capacity, 14 percent Hydel power, and 2 percent nuclear power

The State Electricity Boards (SEBs) incurred losses of more than Rs.500 million because of improper transmission of electricity, wrong pricing, and other incompetence. Few scholars have come to the conclusion that the main reason for the losses is the circulation of power to farmers (they have to only pay minimum chargers or is free), electricity is stolen, that result in losses under the account of SEBs.

When it comes to power and energy, the private sector does not play any part or there are any foreign investors. The public sector is almost having a monopoly in the power generation sector.

- SEBs which distributes electricity incurred losses, they are not able to pay a bill of the electricity purchased by them.
- > In 2007-08, these boards suffer a loss of Rs. 21391 Crore, which has reduced to Rs.624.6 Crore in 2014.
- > This was due to
 - Transmission and distribution losses,
 - Theft of electricity
 - Wrong pricing of electricity
 - Other operational inefficiencies.

REQUIREMENTS ANALYSIS AND SPECIFICATION

Tools Description:

AT89S51 micro-controller

The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of In-System Programmable Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with In-System Programmable Flash on a monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters, a five-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next external interrupt or hardware reset.

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Transformer

A **transformer** is defined as a passive electrical device that transfers electrical energy from one circuit to another through the process of electromagnetic induction. It is most commonly used to increase ('step up') or decrease ('step down') voltage levels between circuits

Rectifier

A rectifier is an electrical device that converts alternating current, which periodically reverses direction, to direct current, which flows in only one direction. The reverse operation is performed by the inverter. The process is known as rectification, since it "straightens" the direction of current.

Regulator

A voltage regulator is a system designed to automatically maintain a constant voltage. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components.

LCD Display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of colour or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other. In this paper we use a 16x2 LCD, means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

Approved by State Council for Technical Education & DB9 Connector (SCTE&VT) ODISHA

The term "DB9" refers to s common connector type, one of the D- Sub miniature or D-Sub types of connectors. DB9 has the smallest "footprint" of the D-Sub miniature connectors and houses 9 pins (for the male connector) or 9 holes (for the female connector). DB9 connectors were once very common on PCs and servers .DB (connectors are designed to work with the EIA/TIA 232 serial interface standard, which determined the function of all nine pins as a standard, so that multiple companies could design them into their products. DB9 connectors were commonly used for serial peripheral devices like keyboards, mice, joysticks, etc. Also, they are used on DB9 cable assemblies for data connectivity. Today, the DB9 has mostly been replaced by more modern interfaces such as USB, PS/2, Fire wire, and others. However, there are still many legacy devices that use the DB9 interface for serial communication.

MAX232

The MAX232 is an integrated circuit that converts signals from an RS-232serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15V, and changes TTL Logic 1 to between -3 to -15V, and vice versa for converting from RS232 to TTL.

GSM Module

GSM stands for Global System for Mobile communications. GSM is a cellular network and is used to connect cell phones by searching for cells near it. It is widely used for communication purposes. It uses time division multiple access (TDMA) technique for communication purposes

A GSM modem or GSM module is a hardware device that uses GSM mobile telephone technology to provide a data link to a remote network. From the view of the mobile phone network, they are essentially identical to an ordinary mobile phone, including the need for a SIM to identify themselves to the network.

Energy meter

An energy or electric meter which is a device that measures the amount of electrical energy consumed by a residence, business, or an electrically-powered device. Electric meters are typically calibrated in billing units, the most common one being the kilowatt hour.

Relays

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal

ASM/C Program/Kiel compiler

Kiel an ARM Company makes C compilers, macro assemblers, real-time kernels, debuggers, simulators, integrated environments, evaluation boards, and emulators for ARM7/ARM9/Cortex-M3, XC16x/C16x/ST10, 251, and 8051 MCU families. Compilers are programs used to convert a High-Level Language to object code. Desktop compilers produce an output object code for the underlying microprocessor, but not for other microprocessors

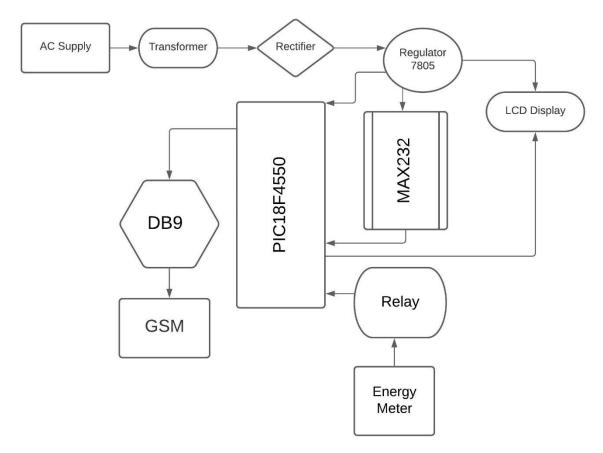


KIIT POLYTECHNIC

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SYSTEM DESIGN, APPLICATION AND METHODOLOGY.

System Design:



were present for the submitting graphs at the severy research at their

In our proposed system we use Relay, GSM, display device, microcontroller LPC 2138, GSM and IOT web server. A relay is attached through on bulb any other application in the customer home any other places Microcontroller will count that pulses and decrement the balance count which is added by the SMS send through GSM by MSEB by paying appropriate amount, when the balance count becomes less (threshold value) it sends a message "Balance is less" to the display device, and customer can recharge their account by recharging their account for uninterrupted energy source and if customer didn't recharge their account and balance count becomes zero microcontroller will turn off the relay in the meter and energy supply will interrupted to the customer. This system displaying the information about the energy consumed in terms of units, about the bill and if any theft occurs that will be displayed in the website. Hence every user can check the information anywhere globally. Thing speak web page is used for displaying the information of the system. The hardware components used in the proposed system as - ARM7-LPC2138, USB TO TTL CONVERTER, GSM, Relay and LCD

Methodology:

Internet of Things is not the result of a single novel technology; instead, several complementary technical developments provide capabilities that taken together help to bridge the gap between the virtual and physical world. These capabilities include:

- Communication and cooperation
- Addressability
- Identification
- Sensing
- Actuation
- > Embedded information processing
- Localization
- User interface

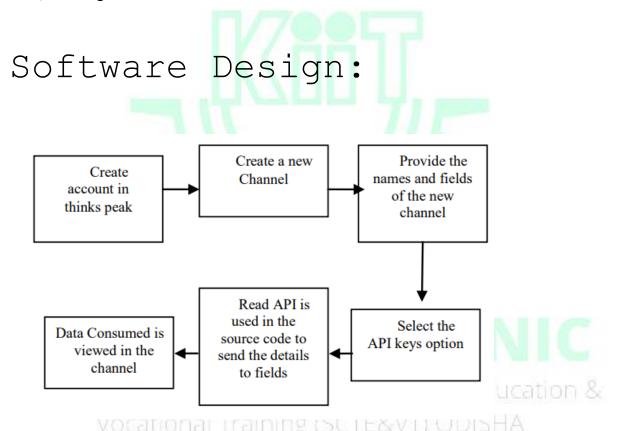
Application:

- Residential and commercial building in a public energy supply system
- Municipal corporation
- Public power sources
- ➤ MSEB
- Govt. Energy plant

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IMPLEMENTATION

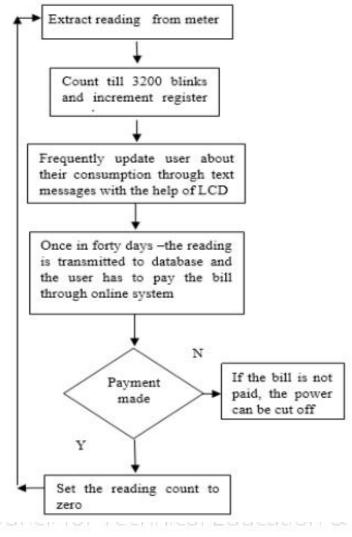
The implementation details about the proposed system are given below. The system proposed measures the energy consumed at each house automatically and the readings are being displayed in the LED present at their EB box. This is very useful because it helps the commons to be aware of their usage and can reduce if they are over using the resource available to them. The readings and bill are transferred to the EB database via Wi-Fi module. Thus, reducing human labour



The working of the software module part in depicted in figure, the consumer readings are transmitted to the cloud with the help of the Wi-Fi module. The readings along with the cost will be displayed in the cloud platform. Every forty days the consumer can pay their bill at the local EB station and the data can be reset. The final system developed

Extraction and Processing of data:

The energy meter connected to the load starts to measure the energy consumed by the load once the switch is turned on. The energy meter has a LED bulb which blinks 3200 times per unit consumed. Now this is counted by the Arduino and the bill is generated. The bill generated and the unit consumed is displayed in the LCD panel and then transmitted to the cloud. The user can now log into their account to verify their unit consumed or just check the LCD panel connected to the meter.



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SYSTEM IMPLEMENTATION:

The main objective is to develop an energy meter that informs the consumer the exact consumption and billing that the load consumes through SMS. The blinking LED as seen on the front panel is directly proportional to the power consumed. More the power drawn faster becomes the LED blinking pulses. One sensor is placed above such blinking LED to derive the real time units consumed whose output goes to an 8051 microcontroller. Whenever the LED blinks, it then gives an interrupt signal to the microcontroller of the 8051 family and thus the program of the microcontroller counts the pulses and displays the reading on the LCD duly interfaced to the microcontroller for every minute / daily / weekly or monthly as programmed which is sent to the cell phone of the user by an SMS through a GSM modem, which is interfaced to the microcontroller via a levelshifter IC and RS232 link. The desired cell number is auto saved on the microcontroller over a missed call by the user for sending SMS to that number only. The Prototype of the system. The power supply consists of a step-down transformer 230/12V, which steps down the voltage to 12V AC. This is converted to DC using a bridge rectifier and it is then regulated to +5V using a voltage regulator 7805 which is required for the operation of the microcontroller and other components.

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IMPLEMENTATION RESULT

Test cases and test result:

The operating experience and practice indicated: the meter reading system has the benefits, such as, transmission speed is quick, the reliability is high, real time is strong and the operating cost is low. From the experimental results we have observed that the automatic electric billing system overshadows the traditional system of taking the readings by many factors. The proposed system work is to automatically detect the number of readings that has been consumed. These readings are then displayed to the user at their EB box. This helps the commons to be aware of the power and can reduce the energy if they feel that they are over using it. Since everything is automatic, human labour is reduced. An external condition which delays the readings to be taken are eliminated. Thus, there are error free values. Hence accuracy is been preserved. The future. The future work is to modify the propose system for the detection of illegal use of electricity.

Advantages:

- To reduce wastage of energy.
- Prevent electricity shortage during dry seasons.
- Make every customer a self-interested guardian of the power (energy) supply.
- Real time bill monitoring

> Time reduced receiving bill. Vocational Training (SCTE&VT) ODISHA

Conclusion:

The monopolistic power distribution market in Asia is gradually transforming into a competitive marketplace. Differentiation in service is going to be the key competitive factor to the improve market share in the deregulated power markets prepaid meters with their advantages over conventional ones are likely to help power distributors to differentiate and offer value —added services to consumers. Encourage consumers to opt for prepaid meters on a voluntary basis and offering tariff or non-tariff incentives to those consumers who prepaid their power changes would help the utilities to implement this system

Result:

The developed GSM based energy meter reading and billing is beneficial for both energy service providing utility and consumers. The system overcomes drawback of convention meter reading system and provides additional services such as power cut alert and tampering alert

Future Scope:

The project propose automation for existing manual power billing system. The involves the automation process of taking a meter reading and computing the billing by examining the number of units consumed by the user of that particular registered energy meter and sending a computed bill to the registered mobile number of a user. Thus, automated wireless power billing involves total authentication over accessing a data form energy meter and provides accurate and time billing. Further the system can be extended to automate the gas and water supply services

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Wireless Load Control Device using GSM Approved by Module Education & Vocat Module ISHA

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 - > Future scope

LIST OF FIGURES

ABBREVIATIONS

• **GSM** Global System for Mobile communication

• LCD Liquid Crystal Display

• PCB Printed Circuit Board

• **DC** Direct Current

AC Alternating current

• **LED** Light Emitting Diode

• **SMS** Short Message Service

• TTL Transistor-Transistor Logic

• **RX** Receiver

• TX Transmit

• **CTS** Clear to Send

• RTSed by St Request to sendechnical Education &

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INTRODUCTION

Electrical appliances power consumption tends to grow in proportion to the increase in the number of large-sized electric home appliances. Remote Control of Electrical Loads Using GSM Module" implements the emerging applications of the GSM technology. Using GSM networks, a control system has been proposed that will act as an embedded system which can control appliances and other devices locally using built-in input and output peripherals. Remotely, the system allows the user to effectively control the house/office appliances and equipment via the mobile phone set by sending commands in the form of SMS messages and receiving the appliances status. The main concept behind the project is receiving the sent SMS and processing it further as required to perform several operations. The type of the operation to be performed depends on the nature of the SMS sent. The principle in which the project is based is fairly simple. First, the sent SMS is stored and polled from the receiver mobile station and then the required control signal is generated and sent to the intermediate hardware that we have designed according to the command received in form of the sent message.

Mobile phones have become one of the most popular communication devices among most of the people around the world, and the Short Message Service (SMS) is popular among mobile phone users as a cheap and convenient method of communicating. Therefore, SMS technology is a common feature with all mobile network service providers. Since the use of SMS technology is a cheap, convenient and flexible way of conveying data, researchers are trying to apply this technology in many different areas that are not covered by service providers at present

LITERATURE SURVEY

GSM is a global system for mobile communication GSM is an international digital cellular telecommunication. The GSM standard was released by ETSI (European Standard Telecommunication Standard) back in 1989. The first commercial services were launched in 1991 and after its early introduction in Europe; the standard went global in 1992. Since then, GSM has become the most widely adopted and fastest-growing digital cellular standard, and it is positioned to become the world's dominant cellular standard. Today's second-generation GSM networks deliver high quality and secure mobile voice and data services (such as SMS/ Text Messaging) with full roaming capabilities across the world. GSM platform is a hugely successful technology and as unprecedented story of global achievement. In less than ten years since the first GSM network was commercially launched, it become, the world's leading and fastest growing mobile standard, spanning over 173 countries. Today, GSM technology is in use by more than one in ten of the world's population and growth continues to sour with the number of subscribers worldwide expected to surpass one billion by through end of 2003. Today's GSM platform is living, growing and evolving and already offers an expanded and feature-rich 'family' of voice and enabling services. The Global System for Mobile Communication (GSM) network is a cellular telecommunication network with a versatile architecture complying with the ETSI GSM 900/GSM 1800 standard. Siemen's implementation is the digital cellular mobile communication system D900/1800/1900 that uses the very latest technology to meet every requirement of the standard.

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REQUIREMENTS ANALYSIS AND SPECIFICATION

Tools Description:

AT-Maga328p-AVR micro-controller

A microcontroller (PIC18F4550) is used as an interface device (input command, LCD and the electrical load driver). It is a 40-pin dip, low power consumption and high-speed FLASH/EEPROM technology. It consists of 256 bytes EEPROM memory, 35 Input/output, two external clock modes (up to 48MHz), 13 channels of 10-bit analogy to digital converter, and a capture/compare/PWM functions. 7805 voltage regulators are used to convert 12Vdc to 5Vdc and the output is then given to the microcontroller and GSM module. The electrical load driver, keypad and LCD are connected with microcontroller at port A, B and D, respectively.

LCD Display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of colour or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other. In this paper we use a 16x2 LCD, means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

GSM Module

GSM stands for Global System for Mobile communications. GSM is a cellular network and is used to connect cell phones by searching for cells near it. It is widely used for communication purposes. It uses time division multiple access (TDMA) technique for communication purposes

A GSM modem or GSM module is a hardware device that uses GSM mobile telephone technology to provide a data link to a remote network. From the view of the mobile phone network, they are essentially identical to an ordinary mobile phone, including the need for a SIM to identify themselves to the network.

Relays

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal

LM8330I 2C-Comapatible keypad controller

The LM8330 I/O - Expander and Keypad Controller is a dedicated device designed to unburden a host processor from scanning a matrix-addressed keypad and to provide flexible and general purpose, host programmable input/output functions. Three independent Pulse Width Modulation (PWM) timer outputs are provided for dynamic LED brightness modulation. It communicates with a host processor through an I²C-compatible ACCESS. Bus serial interface. It can communicate in Standard (100 kHz) and Fast-Mode (400 kHz) in slave Mode only. All available input/output pins can alternately be used as an input or an output in a keypad matrix or as a host-programmable general-purpose input or output. Any pin programmed as an input can also sense hardware interrupts. The interrupt polarity ("highto-low" or "low-to-high" transition) is thereby programmable. The LM8330 follows a predefined register-based set of commands. Upon start-up (power-on) a configuration file must be sent from the host to set up the hardware of the device. The LM8330 is available in a 25-bump lead-free DSBGA package size 2.0 mm x 2.0 mm x 0.6 mm (0.4 mm pitch). The LM8330 has integrated ASIP (Application Specific Integrated Passives) on the KPX [7:0] and KPY [10:0] pins. These pins are designed to tolerate IEC61000-4-2 level 4 ESD: ±8 kV direct contact.

Transformer

A **transformer** is defined as a passive electrical device that transfers electrical energy from one circuit to another through the process of electromagnetic induction. It is most commonly used to increase ('step up') or decrease ('step down') voltage levels between circuits

Rectifier

A rectifier is an electrical device that converts alternating current, which periodically reverses direction, to direct current, which flows in only one direction. The reverse operation is performed by the inverter. The process is known as rectification, since it "straightens" the direction of current.

Regulator

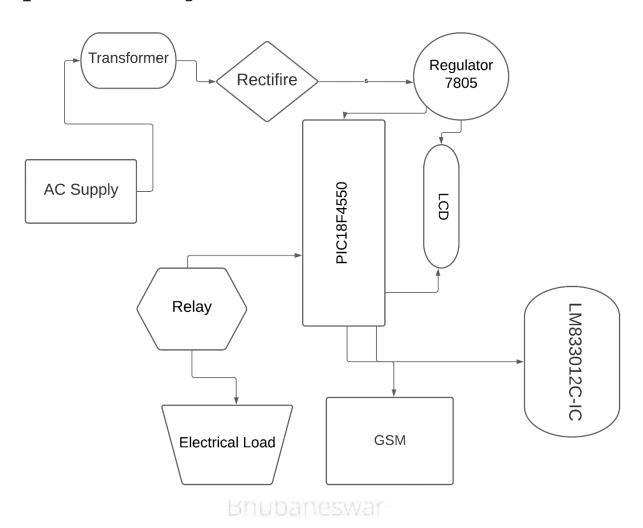
A voltage regulator is a system designed to automatically maintain a constant voltage. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components.

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SYSTEM DESIGN, APPLICATION AND METHODOLOGY.

System Design:



Methodology:

The control system will include two separate units: the cellular phone, and the control unit. There will therefore be two operating environments. The cellular phone will operate indoors and outdoors whereas the control unit will operate indoors within the temperature and humidity limits for proper operation of the hardware. Assuming that the control unit is powered and operating properly, the process of controlling a device connected to the interface will proceed through the following steps;

The remote user sends text messages including commands to the receiver.

GSM receiver receives messages sent from the user cell phone.

GSM receiver decodes the sent message and sends the commands to the microcontroller.

Microcontroller issues commands to the appliances and the devices connected will switch ON / OFF.

Application:

- Continuous process to home appliances control system without any supervisor
- > To provide hands on skills in hardware and software designing
- Using the PIC programming as a program to control system.
- > Design the circuit using combination SIM Module and circuit control system.
- > To co-ordinate appliances and other devices through Short Message Service

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IMPLEMENTATION

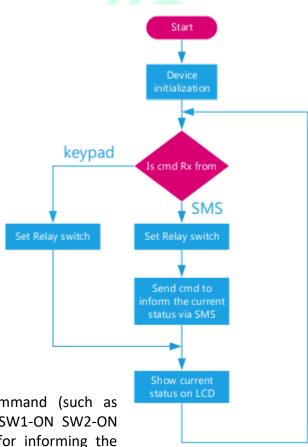
The new age of technology has redefined communication. Most people nowadays have access to mobile phones and thus the world indeed has become a global village. At any given moment, any particular individual can be contacted with the mobile phone. But the application of mobile phone

Cannot just be restricted to sending SMS or starting conversations. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as Infra-red, Bluetooth, etc. which has developed in recent years goes to show the very fact that improvements are in fact possible and these improvements have eased our life and the way we live. GSM control management of several home and office appliances is a subject of growing interest and in recent years we have seen many systems providing such controls.

Software Design:

According to the hardware circuit design features, WLCD controlling program flowchart is introduced. First, the system initializes each module, and then turns off all electrical loads. Then, started already, the microcontroller sends the command of AT + CMGD = 2 for clearing the second data storage space in the SIM card of GSM module. When the user sends the short messages to WLCD, GSM module will send that command to the microcontroller. After that the microcontroller will turn on/off load according to the received command and show the current status on the LCD.

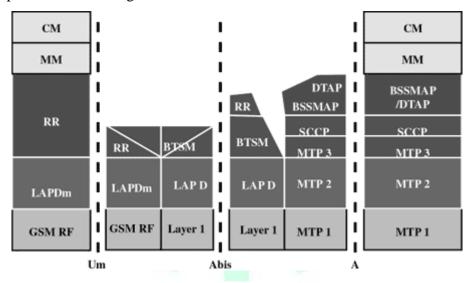
The microcontroller sends a command (such as AT+CMGS="+66868273639" and "SW1-ON SW2-ON SW3-OFF") to the GSM module for informing the current status to the user. In the other way, when the received command is sent from the keypad, the WLCD will operate to on/off the electrical load and show the current status of each electrical load on the LCD module.



Extraction and Processing of data:

GSM architecture is a layered model that is designed to allow communications between two different systems. The lower layers assure the services of the upper-layer protocols. Each layer passes suitable notifications to ensure the transmitted data has been formatted, transmitted, and received accurately.

The GMS protocol stacks diagram is shown below:



MS Protocols

Based on the interface, the GSM signalling protocol is assembled into three general layers:

- Layer 1: The physical layer. It uses the channel structures over the air interface.
- Layer 2: The data-link layer. Across the Um interface, the data-link layer is a modified version of the Link access protocol for the D channel (LAP-D) protocol used in ISDN, called Link access protocol on the Dm channel (LAP-Dm). Across the A interface, the Message Transfer Part (MTP), Layer 2 of SS7 is used.
- Layer 3: GSM signalling protocol's third layer is divided into three sublayers:
 - > Radio Resource Management (RR),
 - ➤ Mobility Management (MM), and
 - Connection Management (CM).

ALGORITHM

- 1. Start
- 2. Microcontroller configuration
- 3. Interrupt Configuration
- 4. GSM module configuration
 - A. UART initialization
 - B. Baud rate negotiation
 - C. Issue Disable command echo
 - D. Set message type as TXT
 - E. Delete all messages (if any)
- 5. Blink the LED for
- 5 times
 - A. Read EEPROM for any saved number
- 6. Copy the saved number to microcontroller RAM
- 7. Begin infinity loop
- 8. Read if any message Received from GSM module
- 9. If "PWD" received as message
 - A. Blink led for 7 times
 - B. Copy the phone number that sent the "PWD" message to RAM of the microcontroller
 - C. Also saved the number to the EEPROM of the microcontroller.
 - D. Send Acknowledge MSG to the phone number.
- 10. If motion detected
 - A. LED off
 - B. SECURITY LIGHT is ON
 - C. If the last message is over 30 seconds or thereabout send SMS message
 - D. Delay 10 seconds e. LED is ON f. SECURITY LIGHT is OFF
- 11. End an Infinity loop
- 12. End

MS to BTS Protocols

The RR layer is the lower layer that manages a link, both radio and fixed, between the MS and the MSC. For this formation, the main components involved are the MS, BSS, and MSC. The responsibility of the RR layer is to manage the RR-session, the time when a mobile is in a dedicated mode, and the radio channels including the allocation of dedicated channels.

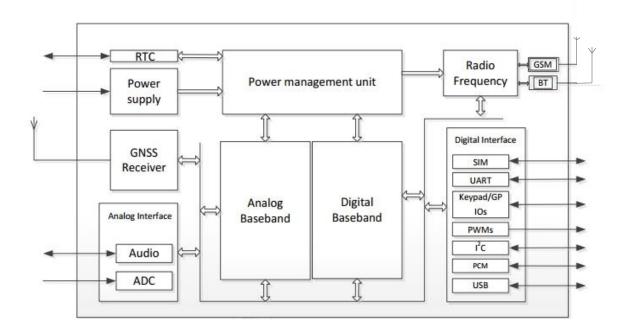
BSC Protocols

The BSC uses a different set of protocols after receiving the data from the BTS. The Abis interface is used between the BTS and BSC. At this level, the radio resources at the lower portion of Layer 3 are changed from the RR to the Base Transceiver Station Management (BTSM). The BTS management layer is a relay function at the BTS to the BSC.

MSC Protocols

At the MSC, starting from the BSC, the information is mapped across the A interface to the MTP Layers 1 through 3. Here, Base Station System Management Application Part (BSS MAP) is said to be the equivalent set of radio resources. The relay process is finished by the layers that are stacked on top of Layer 3 protocols, they are BSS MAP/DTAP, MM, and CM. This completes the relay process. To find and connect to the users across the network, MSCs interact using the control-signalling network. Location registers are included in the MSC databases to assist in the role of determining how and whether connections are to be made to roaming users.

SIM800 functional diagram



AT commands.

AT commands are instructions used to control a modem. AT is the abbreviation of Attention. Every command line starts with "AT" or "at". That's why modem commands are called AT commands. Many of the commands that are used to control wired dial-up modems, such as ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state), are also supported by GSM/GPRS modems and mobile phones. Besides this common AT command set, GSM/GPRS modems and mobile phones support an AT command set that is specific to the GSM technology, which includes SMS-related commands like AT+CMGS (Send SMS message), AT+CMGS (Send SMS message from storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages)

We are using AT commands for interfacing with Arduino. AT commands used for massaging are as shown:

Message

To use SMS service following AT commands are used.

| Command | Description | Response |
|--|------------------------------|---|
| AT+CMGF= <index> index- 0: PDU 1: Text</index> | Select message format | OK |
| AT+CMGS="9881xxxxxx" | Send message | >" Type message here" press 'ctrl+z' to end 'MSG' or 'ESC' to exit without sending OK |
| AT+CMGR= <index></index> | Read message at that index | +CMGR: "Message Header" Message Body OK |
| AT+CMGD= <index></index> | Delete message at that index | OK (if present at that index) |
| AT+CMGDA=" DEL ALL" | Delete all SMS | OK |

IMPLEMENTATION RESULT

Test cases and test result:

It is paramount important to establish a highly efficient testing techniques in other to minimize cost. Testing involves troubleshooting system to detect, isolate and correct internal or external fault such as malfunction in the internal circuitry, input or output shorted to ground or input or output open circuited.

- 1. Each of the component was first tested using mustimeter in order to check the state of their performance and accurate value
- 2. In the connection of each component to the alternator was then tested. This was done in other to carry out the continuity, which is meant for proper connection of the circuit and to detect any wrong connection.
- 3. After the proper testing, (a to f), of the peripherals and found to be working perfectly

The processes of controlling home electrical appliances are tested. The system control proceeds through the following steps;

- 1. The remote user sends text messages including commands to the receiver.
- 2. GSM receiver receives messages sent from the user cell phone.
- 3. GSM receiver decodes the sent message and sends the commands to the microcontroller.
- 4. Microcontroller issues commands to the appliances and the devices connected will switch ON/OFF.

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Advantages:

The working of the project is dividing into two parts which are home automation and home security. For the home automation we have designed an android application through which we can control the home appliances. This application is used to send a SMS to GSM SIM used in our project. It will read the SMS and send to the microcontroller. The microcontroller will extract the message from the received SMS and control the relay module. The relay will turn on or turn-off the appliances as ordered by the owner. The advantage of project is if owner has an android phone and download apps of SMS automation then owner free of cost can send and received SMS. For the home security system, we can use sensors which will check the distance between the two points. If some intruder passes between the two points, then the distance between two points would decrease. The feedback of the distance is sent back to the microcontroller. The microcontroller would send a feedback SMS to the owner through GSM SIM and will also ring an alarm. The advantage in using security system is that the certain range at which the alarm rings and SMS is sent to owner.

Conclusion:

Our project on advance in GSM based home automation saving energy in home by android phone which is very useful and also very economical. It provides simple and easy way to control the household appliances with a single SMS or by using an android application. The main advantage is that even though the controlling can be done by the android application which has safety features but in absences of an android cell phone one can control it by sending a normal SMS to the GSM SIM. Also, the safety and security system can be easily installed in the house and used. It informs the owner in case of turning on the loads even when the owner is not at the home.

Result:

Electrical loads such as fans, bulbs, and computer etc. are tested and controlled wirelessly by the WLCD. When starting up the program, the LCD. Then, three electrical loads can be controlled at a time in the present system. For example, when the user enters "*000#" to the WLCD using keypad, all of electrical loads will turn off and the LCD will show the current status as shown in Fig. 4 (b). Next, the user sends the SMS command ("*111#") to the WLCD, the LCD will show the phone number of a user. Then, all loads are switched on and the LCD will show the current status of electrical load. After that, the microcontroller will send the current status to the user via SMS.

Future Scope:

The future statement of the project will be very great, considering the number of resources, time and money. All these considered amount will be save, which can be used for any other work. The future of this system will be small box combining the GSM SIM. The hardware will be self-contained and cannot be prone to electric failure. This appliance will have its own encapsulated UPS and charging system

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