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UNDERGROUND CABLE FAULT DETECTION

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ABSTRACT: This is proposed a model of underground cable fault distance locator using a microcontroller. It is classified in four parts DC power supply part, cable part, controlling g part, display part. DC power supply part consist of a supply of 230 v is step- down using a transformer, bridge rectifier converts AC signal to dc & regulator is used to produce a constant dc voltage. The cable part is denoted by a set of resistors along with switches. Current sensing part of cable represented as a set of resistors & switches is used as fault creators to indicate the fault at each location [6]. This part senses the change in current by sensing the voltage drop. Next is controlling part which consists of an analog to digital converter which receives input from the current sensing circuit, converts this voltage into a digital signal and feeds the microcontroller with the signal. The microcontroller also form s part of the controlling g 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[7]. The display part consists of the LCD display interfaced to the microcontroller which shows the status of the cable of each phase and the distance of the cable at the particular phase, in the case of any fault.

AIM: The main aim of this project is to locate the fault in underground cable.

1. INTRODUCTION

EMBEDDED SYSTEMS:

An embedded system is a system which is going to do a predefined specified task is the embedded system and is even defined as combination of both software and hardware. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious. All embedded systems are including computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer. The very simplest embedded systems are capable of performing only a single function or set of functions to meet a single predetermined purpose. In more complex systems an application program that enables the embedded system to be used for a particular purpose in a specific application determines the functioning of the embedded system. The ability to have programs means that the same embedded system can be used for a variety of different purposes. In some cases a microprocessor may be designed in such a way that application software for a particular purpose can be added to the basic software in a second process, after which it is not possible to make further changes. The applications software on such processors is sometimes referred to as firmware.

The simplest devices consist of a single microprocessor (often called a "chip"), which may itself be packaged with other chips in a

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hybrid system or Application Specific Integrated Circuit (ASIC). Its input comes from a detector or sensor and its output goes to a switch or activator which (for example) may start or stop the operation of a machine or, by operating a valve, may control the flow of fuel to an engine.

As the embedded system is the combination of both software and hardware.

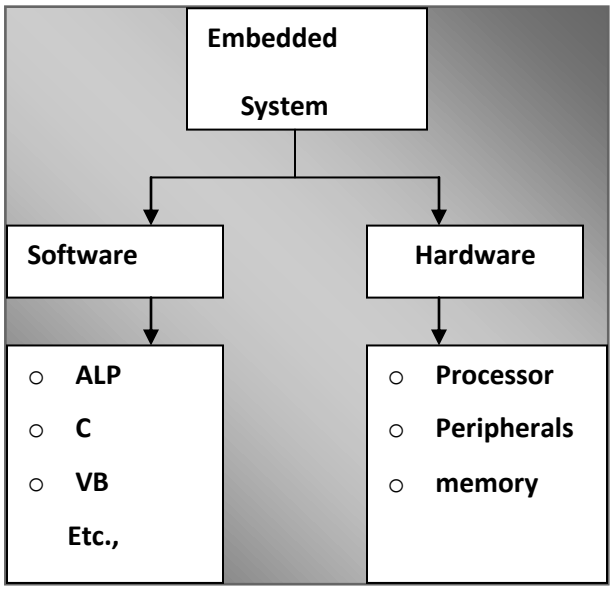

Figure 1.1 Block diagram of Embedded System

Software deals with the languages like ALP, C, and VB etc., and Hardware deals with Processors, Peripherals, and Memory.

Memory: It is used to store data or address.

Peripherals: These are the external devices connected

Processor: It is an IC which is used to perform some task

FEATURES OF EMBEDDED SYSTEMS

The versatility of the embedded computer system lends itself to utility in all kinds of enterprises, from the simplification of deliverable products to a reduction in costs in their development and manufacture. Complex systems with rich functionality employ special operating systems that take into account major characteristics of embedded systems. Embedded operating systems have minimized footprint and may follow real-time operating system specifics. The special computers system is usually less powerful than general-purpose systems, although some expectations do exist where embedded systems are very powerful and complicated. Usually a low power consumption CPU with a limited amount of memory is used in embedded systems. Many embedded systems use very small operating systems; most of these provide very limited operating system capabilities. Since the embedded system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance.Some embedded systems are mass-produced, benefiting from scale. Some embedded systems have to operate in extreme environment conditions such as very high temperature & humidity. For high volume systems such as portable music players or mobile phones, minimizing cost is usually the primary design consideration. Engineers typically select hardware that is just "good enough" to implement the necessary functions.For low volume or prototype embedded systems, general purpose computers may be adapted by limiting the programs or by replacing the operating system with a real-time operating system.

APPLICATIONS OF EMBEDDED SYSTEMS

Some of the most common embedded systems used in everyday life are

Small embedded controllers: 8-bit CPUs dominate simple or no operating system (e.g., thermostats).

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Control systems: Often use DSP chip for control computations (e.g., automotive engine control).

Distributed embedded control: Mixture of large and small nodes on a real-time Embedded networks (e.g., cars, elevators, factory automation).

System on chip: SIC design tailored to application area (e.g., consumer electronics, set-top boxes).

Network equipment: Emphasis on data movement/packet flow (e.g., network switches; telephone switches).

Critical systems: Safety and mission critical computing (e.g., pacemakers, automatic trains).

Signal processing: Often use DSP chips for vision, audio, or other signal Processing (e.g., face recognition).

Robotics: Uses various types of embedded computing (especially Vision and control) (e.g., autonomous vehicles).

Computer peripherals: Disk drives, keyboards, laser printers, etc.

Wireless systems: Wireless network-connected "sensor networks" and "Motes" to gather and report information.

Embedded PCs: Palmtop and small form factor PCs embedded into Equipment.

Office Telephones, computers, security systems, faxmachines, microwave, copier, laser printer, colorprinter, paging.

Auto Trip computer, engine control, air bag, ABS,instrumentation, security system, transmissioncontrol, entertainment, climate control, cellularphone, keyless entry.

Fault location methods can be classified as:

1. Online method: This method utilize & process the sampled voltages& current to determine the fault points. Online method for underground cable are less than overhead lines.
2. Offline method: In this method special instrument is used to test out service of cable in the field. There are two offline methods as following

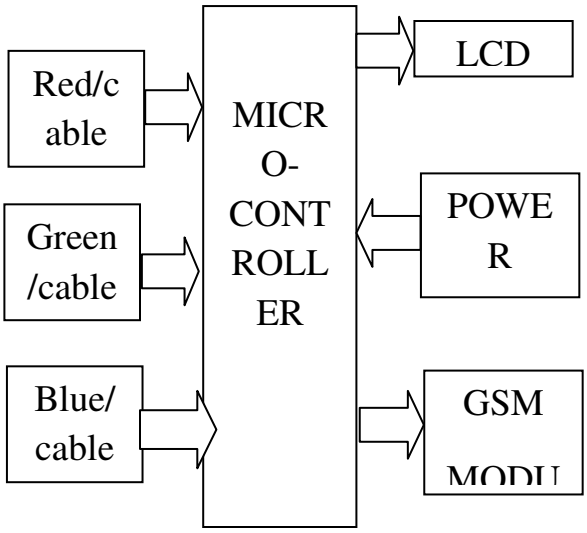
1. Tracer method: In this method fault point is detected by walking on the cable lines. Fault point is indicated from audible signal or electromagnetic signal. It is used to pinpoint fault location very accurately.

Example:
1) Tracing current method
2) Sheath coil method

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

Example:
1) Murray loop method
2)Impulse current method

BLOCKDIAGRAM:



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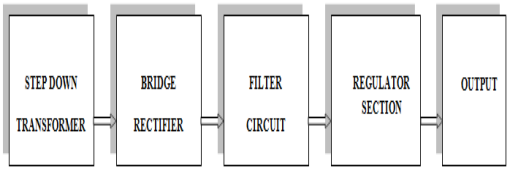
POWER SUPPLY:



HARDWARE COMPONENTS:

- MICROCONTROLLER
- POWER SUPPLY
- LCD
- GSM MODEM
- SWITCHES

SOFTWARE TOOLS:

- COMPILER
- PCB EDITOR
- SCHEMATIC EDITOR'S
- PROGRAMMER
- **Power supply:**

In electronics generally we use D.C power. In our micro-controller circuits we use 6volts power supply. Normally in domestic power we get 230volts A.C Power. Using some circuits we convert this A.C Power into required D.C Power.

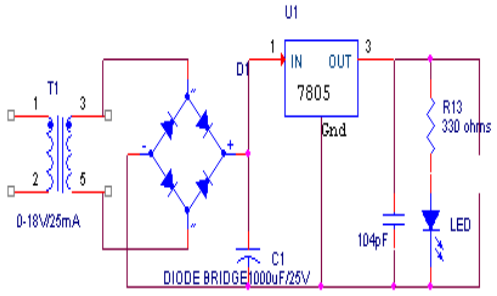


Fig: Power supply circuit diagram

Steps involved in power supply circuits:

- Step down transformer
- Rectifier circuit
- Filter circuit
- Regulator circuit
- Indicator circuit

Step down transformer:

First step involved in the power supply circuit is to reduce the 230A.C.Power into 9v A.C. for this purpose we use 9-0-9 step down transformer. This transformer is called center tapped transformer.

- Primary
- Secondary

Primary:

Primary is the input of the transformer. Primary consists of two wires. One is connected to phase and other is connected to neutral of the domestic A.C. Power.

Secondary:

Secondary is the output of the transformer. Secondary consists of three wires. The middle wire is ground terminal and the other two wires are 9v A.C terminals. When the input is connected to the 230v A.C power, we get 9vA.C

The symbol for the Transformer:

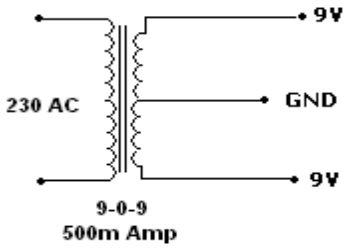


Fig. Center tap transformer

Rectifier circuit:

The output for the step down circuit is 9v A.C power. For our micro-controller circuit we need 6v D.C power. So we introduce the rectifier circuit. The rectifier circuit is the only circuit used to convert the A.C. Power into D.C Power.

Basically there are three types of rectifier circuits, half wave rectifier, full wave rectifier and bridge rectifier. Here we use full wave rectifier circuit. In rectifier circuits diodes

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are used as rectifiers. Diodes conduct only when the electrons flow in the forward direction. It does not conduct when the electrons flow in the reverse direction. Two diodes are used in the full wave rectifiers. These diodes are connected directly to the secondary of the transformer.

Operating principle for the Full Wave Rectifier:

A full waverectifier is a circuit, when converts an AC voltage into a pulsating DC voltage using both half cycle of the applied AC voltage. It used two diodes of which one conducts during one half cycle while the other conducts during the other half cycle of the applied AC voltage.

During the positive half cycle of the input voltage, diode D1 becomes forward biased. Hence D1 conducts and D2 remains OFF. The load current flows through D1 and the voltage drop across R_l will be equal to the input voltage. During the negative half cycle of the input voltage, drop D1 becomes reverse biased and D2 becomes forward biased. Hence D1 remains OFF and D2 conducts. The load current flows through d2 and the voltage drop across $R\ l$ will be equal to the input voltage. The diode conducts when the transformer secondary voltage becomes more than the diode voltage. Until the transformer secondary voltage again increases to a value greater than the capacitor voltage.

The symbol for the rectifier:

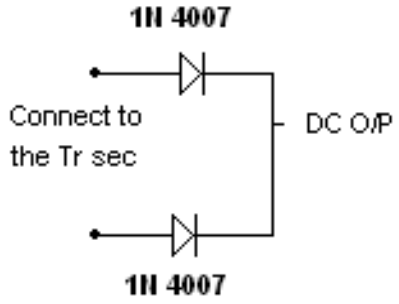

Fig. Rectifier circuit

Filter Circuit (capacitor filter):

The output of the Full wave Rectifier contains both AC and DC components. A majority of the application, which cannot tolerate a high value ripple, necessitates further processing of the rectifier output. The undesirable AC components i.e. the ripple, can be minimized using filters.

A Capacitor filter connected directly across the load is shown above. The property of a capacitor is that it allows AC component and blocks DC components. The operation of the capacitor filter is to short the ripple to ground but leave the DC to appear at output when it is connected across the pulsating DC voltage. During the positive half cycle, the capacitor charges up to the peak vale of the transformer secondary voltage, VMand will try to maintain this value as the full wave input drops to zero. Capacitor will discharge through RL slowly period, which depends on the capacitor voltage. Until the transformer secondary voltage again increases to a value greater than the capacitor voltage.

The diode conducts when the transformer secondary voltage becomes more than the diode voltage. This is called the cut in voltage. The diode stops conducting when the transformer voltage becomes less than the diode voltage. This is called cut out voltage. In this circuit a 25v and1mf capacitor is used.

Regulator circuit:

This circuit is a small +5V power supply, which is useful when experimenting with digital electronic. Small inexpensive wall transformer with variable output voltage are available from any electronics shop and supermarket. Those transformers are easily available, but usually their voltage regulation is very poor, which makes then not very usable for digital circuit experimenter unless a better regulation can be achieved in some way. This circuit can give +5V output at about 150mA

current, but it can be increased to 1Amp when good cooling is added to 7805regulator chip. The circuit has overload and terminal protection.If you need other voltage than +5V, you can modify the circuit by replacing the 7805 chip with another regulator 78×× chip family. The last numbers in the chip code tells the output voltage.

RESULT:

Hence by designing of this project we can automate the Irrigation process without any man power by sensing land's dry state with the help of soil sensor and automatically switch on the water pump.

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