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GPS Based Cable Fault Detector with Wireless Monitoring Station

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ABSTRACT: The system developed here is aimed to identify the short circuits in the running under ground laid cables. The portable unit which is intended to identify the fault in the cable is known as portable field unit, this unit carried along with the cable is equipped with RF communication system and GPS unit can locate the fault where exactly occurred, and this information in the form of Longitude & Latitude values (global position) will be transmitted to the monitoring station.

KEYWORDS: Cable signal pick-up circuit designed with pick-up coil, audio amplifier circuit, speaker, RF transmitter, RF receiver, Data transmitting circuit and data receiving circuit both are constructed with 89c2051 microcontroller chips, GPS module, LCD, UM66 musical tone generator, power amplifier, power supply unit.

I. INTRODUCTION

The cable fault detector designed to detect the short circuit in a cable, is quite suitable for the Telecom department, this same instrument also can be used for identifying the faults in concealed electric wiring. With the help of this kind of system the exact location where the fault is occurred can be identified accurately. Generally telephone cables are laid under the ground, covered in largest areas (kilometers together) and it is quite difficult to find out problems like short circuits or open circuits. To find out the open circuit fault, echo signal transmitters are utilized to locate the break in wire. Here in this project work much care is taken to find out short circuit in a specific location, to find out the problem, initially faulty cable to be identified and it should be separated from the junction box. As we know, for every telephone two wires are required from telephone exchange to the subscriber. These wires are connected through junction boxes / location boxes. Hence we can see lots of cables are to be laid from one place to other. Therefore we need proper test equipment for testing the healthiness of the cable. In olden days, as the number of cables was less, people used to check continuity of the cables with a multimeter and lay the cables. But, while laying the cable, if any breakage or shortening occurs, there is no tool to detect the online performance. With the advancement in the technology, the need has arisen to evolve some testing method to detect the cable fault. Thereby this instrument is designed, which serves the purpose of the telecom department to analyse and to solve the problems in underground cables. The advantage of this instrument is, it serves not only during the time of installation of cables, and the healthiness of cables can be monitored periodically.

Description of pick up coil: A pickup coil is a transducer that captures or senses mechanical vibrations produced by sound vibrations and converts them to an electrical signal that is amplified using an instrument amplifier to produce musical sounds through a loudspeaker in a speaker enclosure. The permanent magnet creates a magnetic field; the motion of the sound vibrations disturbs the near field, changing magnetic flux and inducing an electric current through the coil. The pickup is then connected to an amplifier which amplifies the signal to a sufficient magnitude of power to drive a loudspeaker.

Description of pick-up amplifier: The output of the pick-up coil is fed to the pre-amplifier circuit designed with 4 transistors. Here the output must be amplified stage wise. The emitter-base junction of the first transistor in the pre-amplifier circuit is forward-biased, by which the input impedance is low. On the other hand, the base-collector junction is reverse-biased; here the output impedance is high. This voltage drop will be generally greater than the input signal voltage variations and the input signal will appear as an amplified voltage in the output circuit. Here the output of the pre-amplifier is fed to the medium power amplifier to increase the signal strength further.

Description of GPS: Global Positioning System satellites transmit signals to equipment on the ground. GPS receivers passively receive satellite signals; they do not transmit. GPS receivers require an unobstructed view of the sky, so they are used only outdoors and they often do not perform well within forested areas or near tall buildings. **Determining Position;** A GPS receiver "knows" the location of the satellites, because that information is included in satellite transmissions. By estimating how far away a satellite is, the receiver also "knows" it is located somewhere on the surface of an imaginary sphere centered at the satellite. It then determines the sizes of several spheres, one for each satellite. The receiver is located where these spheres intersect.

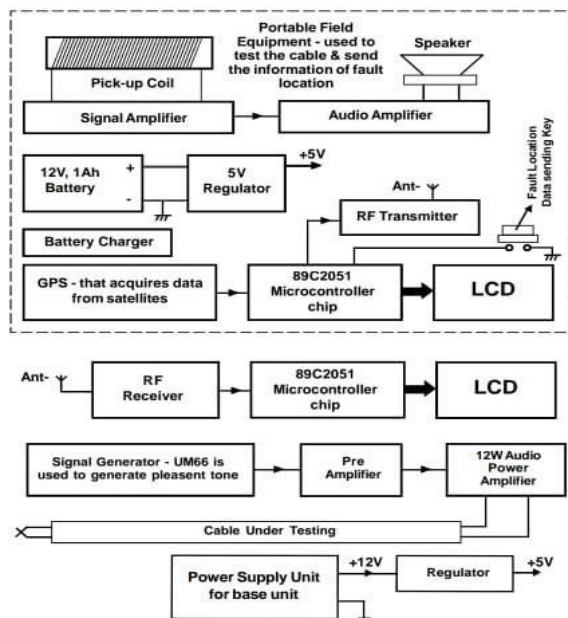
Description of RF communication : The RF transmitter that is used here is intended to transmit the digital data acquired from the GPS module, this device is interfaced with 89c2051 microcontroller. Now this controller acquires data from GPS which will be decoded and displayed through an LCD panel. The main function is to transmit this data through an RF transmitter that is interfaced with the same controller as an output device. The RF module used here can able to transmit any type of digital information as it is, the information that is to be transmitted is known as message signal. This signal can be either in the form of digital or analog.

Description of musical tone generator: This circuit is designed with UM66 IC and this chip generates melody music continuously when it is powered. As this chip contains a fixed length of duration for storing audio signals and where as it can not be erased, repeated tones will be produced continuously. The output of UM 66 IC is amplified to obtain high-level signal strength, because the signal transmitted through the cable has to reach up to kilo-meters together.

Description of Microcontroller: The processing unit is designed with Atmel 89c2051 microcontroller chips, here two chips are used to construct data transmitting module and data receiving module. The main function of this processor is to decode the values obtained by the GPS, and display the same through LCD. The idea of selecting this chip is that it is very easy to program. Microcontrollers are increasingly being used to implement communication systems.

Block diagram:

Working : The High volume of the audio signal is fed to the faulty cable and this signal travels through the length of the

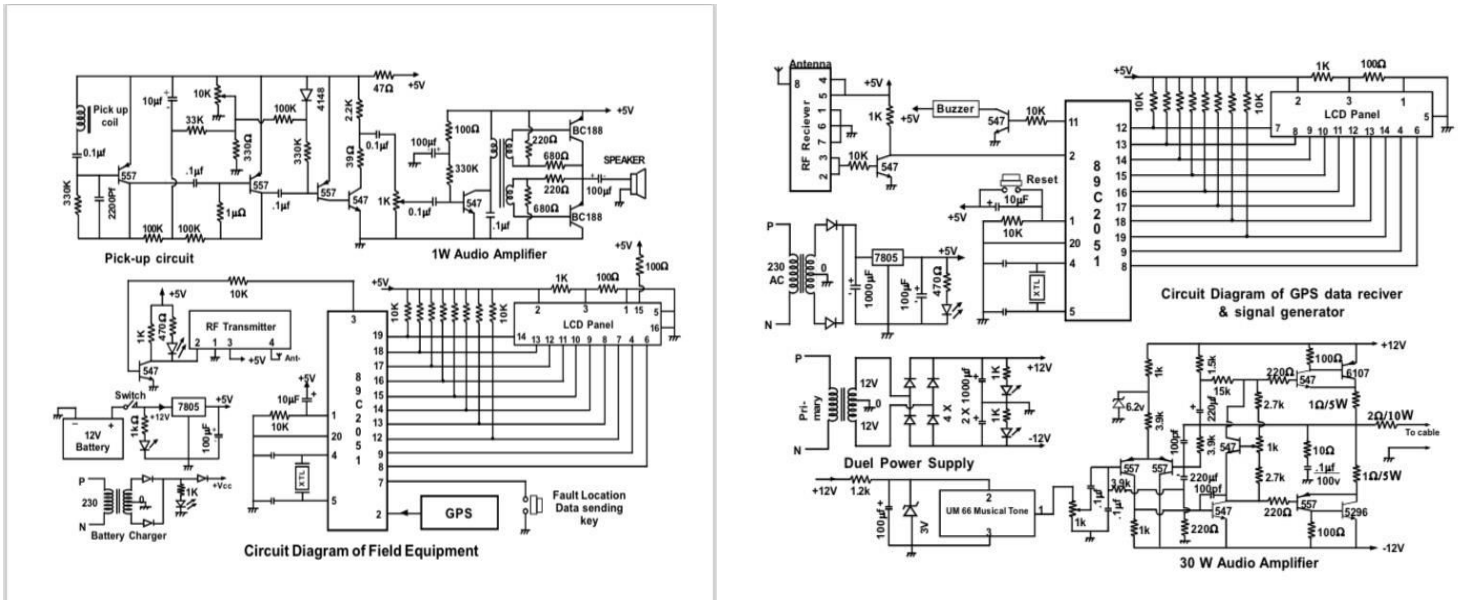


entire cable and returns to its destination from the fault point of cable. Now the portable unit that contains pick-up coil and its amplifier acquires signal from the cable which can be heard clearly through a small speaker connected at the output of amplifier. As long as the cable is healthy, audio sound in the form of melodious musical tone will be heard, but once the pick-up coil crosses the short circuit point signal will not be heard by which exact location of the fault occurred point can be identified. Once the fault is located, GPS data must be transmitted by activating the key by which location data will be

transmitted through RF transmitter. UM66 is used to generate Musical tone and its output is amplified through a solid state power amplifier.

Circuit Diagram:

Result: A High volume of audio signal is fed into the faulty cable and this signal travels through the length of the entire cable



and returns its destination from the fault point of cable. UM66 is used to generate musical tone as long as the cable is healthy, audio sound is in the form of melodious musical tone will be heard, but once the pick-up coil crosses the short circuit point signal will not be heard by which exact location of the fault occurred point can be identified. Once the fault is located, GPS data must be transmitted by activating the key by which location data will be transmitted through RF transmitter.



Fig1 when the connections are given.

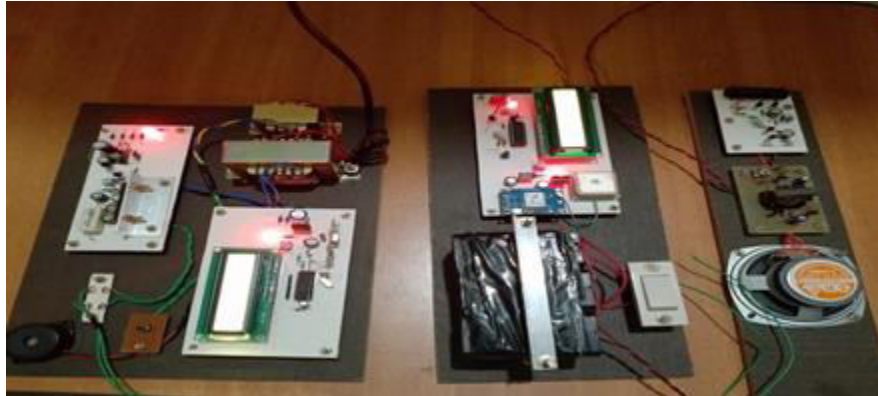


Fig2 when a musical tone is sent into the fault cable

II. CONCLUSION

The project work “GPS based cable fault detector with wireless monitoring system” was completed successfully. Results are found satisfactory, during the testing we have used 100 meters cable, this is a twin wire cable and we have shorted the cable at different places to create fault. Since it is a prototype module, only a 30-Watts power amplifier is designed, but for the real applications power amplifier capacity should be increased to the required level, so that by increasing the signal strength of amplifier cable testing range can be increased and any length of cable can be tested effectively. This kind of instrument is quite suitable for the telephone department and electrical departments.

Presently the portable unit is equipped with an RF communication system for transmitting the GPS values collected from the fault location, meaning where exactly the cable is shorted. Since the range of this communication system is restricted to less than 50 metres, for real applications this range is not sufficient, to enhance the range to any distance, GSM technology can be implemented such that there won't be any range restriction. Regarding trenched cables, different types of faults may occur like open circuits, weak points, insulation breakdown, short circuits, etc. but in this project work, we have focused on short circuits only. With this experience, in our future work, we will focus on other cable faults.

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