Android based broken wire detector using EMF Technique

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Abstract –
The system to include an android based broken wire detection which works by detecting the electromagnetic field around a live cable is proposed. The transmission cables undergo stress and strain as they are under the ground. This may lead to short circuits or various kinds of snapping in the wire. If these faults are not treated, it may cause an interruption in the power supply and permanent damage. The proposed method distinguishes the short circuit fault in the underground links. The existing and traditional techniques for detection are reviewed and only the methods for spotting the short circuit error are included. Thus, the proposed system provides a cost-efficient way of detecting the short circuit shortcomings in current conducting cables.

I. INTRODUCTION
In today’s world electricity has become a major part. Considering the development in the past years, it is known that this world has evolved a lot as new technologies came up and the old and basic ones were upgraded. For all these we supply power using insulated wire where it is covered by the PVC covering for the protection purpose of the user, but some time it becomes a problem. Over the long period some wires would get damaged inside the PVC, which means there will be break down of the wire and stops functioning so here we can replace the wire but sometimes it would be costlier to replace so we need a device to point the exact location of the wire.

II. OBJECTIVE
Our aim is to build a circuit to detect the exact location of breakage of wire inside the PVC cover. This circuit can easily and quickly detect a broken/faulty and its breakage point in 1-core, 2-core, and 3-core cables without physically disturbing wires. To attach our detector circuit to the Bluetooth controlled RC car which can be controlled by our mobile phone.

III. BLOCK DIAGRAM AND GENERAL DESCRIPTION
The coil in the circuit it looks like a coil but it acts as a one side plate oh a capacitor. So, if we increase the area of its surface then there will be more EMF is collected and it works as we increase the surface area.

Fig(a)
The live voltage is reference to the earth and there is a very tiny straight capacitance between the earth which can be or the contact with the body to the circuit and with the capacitance between the antenna and the live wire so, here the circuit closes and it can pick up the live voltage. But the transferred EMF to the is very low. So, in order to detect this very low energy voltage source we need to draw a extremely small current from the detector coil. Take a closer look on the Fig(b). We could notice the power source, four 18650 batteries connected to the 12V power pin of L298 Motor Drive and ground of Motor Drive and Arduino UNO. This supplies essential power to the circuit. A total of 5 volts is being supplied to this system, where the maximum permissible amount is 12 volts. Digital wires of Arduino are connected with the input1, input2, input3 and input4 of the motor drive. Motors are connected to the both side of Motor Drive which are the outputs terminals. To complete the power source circuit, 5V of Motor Drive is connected to Vin power pin of Arduino UNO.

Followed by this, HC05 Bluetooth Module’s vcc is connected to 5V pin of Arduino UNO, which supplies power to Bluetooth Module. Ground to Ground connections are also made. Transistor Transistor logic pins, Transmitter (TX) and Receiver (RX) of Arduino UNO are connected to RXD and TXD of HC05 respectively. The program is uploaded to Arduino before connecting the Bluetooth module.

The transistor that we have used in the detector circuit is BJT (bipolar junction transistor). basically, in this type of transistor the current into the collector side is $\beta$ (beta) times larger than the current into the base side (may be $\beta$ value can be more the hundreds). According to the NPN transistor configuration $\beta$ is called as the DC current gain and it is ratio of collector current $I_C$ and base current $I_B$.

That is $\beta$ is given by $\Rightarrow\beta = \frac{I_C}{I_B}$

Therefore, we get collector current as,

$I_C = \beta \times I_B$

Here $\beta$ is also known as the $H_B$ which is constant that can be high value (may be in hundreds value). Which means we can start a much larger collector to emitter current? Now from our detector circuit we have the pair of transistors $Q_1$ And $Q_2$ these types of pair connection are called as Darlington pair. so, if we need a specific range of output current, we need $\beta$ times of current in $Q_1$ and another $\beta$ times current $Q_2$. 

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**Fig (B)**

**Fig (C)**

**BJT NPN Transistor**
Darlington pair

Fig (D)

According to Darlington pair circuit in fig(D) the base current from the transistor Q1 is equal to $\beta$ times of emitter current.
So, we can write it has:

$$I_1 = \beta \ast I_2 \Rightarrow \text{equation}(1)$$

And the $I_2$ which is the emitter current of $Q_1$ is interconnected to another emitter that is transistor $Q_2$. So, the current $I_2$ is equal to the $\beta$ times of $I_1$
So, we can write it has:

$$I_2 = \beta \ast I_3 \Rightarrow \text{equation}(2)$$

From equation (1) and equation (2) we can write it has

$$I_3 = \beta^2 \ast I_1$$

By observing the above equation say that to turn on the capacitor $Q_3$ we need a supper smaller base current from transistor $Q_1$ which is base current $I_1$.

Finally, the combination of $Q_1$ and $Q_2$ works as an amplifier and $Q_3$ transistor works as a switch.

IV. CERCUIT DIAGRAM

Fig (E)

Above circuit diagram represents our detector circuit
**Abbreviations and Acronyms**

Define abbreviations and acronyms the first time they are used in the text, even if they have been defined in the abstract.Abbreviations such as IEEE, SI, MKS, CGS, ac, dc, and rms do not have to be defined. Do not use abbreviations in the title unless they are unavoidable.

**D. Equations**

1) DC current gain

\[ \beta = \frac{I_C}{I_B} \]

where

\[ \beta = \text{DC current gain} \]
\[ I_C = \text{collector current} \]
\[ I_B = \text{base current} \]

2) collector current

\[ I_C = \beta * I_B \]

According to Darlington pair circuit

So, we can write it has:

\[ I_1 = \beta * I_2 \Rightarrow \text{equation(1)} \]

\( I_2 \) which is the emitter current of Q₁ is interconnected to another emitter that is transistor Q₂. So, the current \( I_2 \) is equal to the \( \beta \) times of \( I_1 \).

So, we can write it has:

\[ I_2 = \beta * I_1 \Rightarrow \text{equation(2)} \]

From equation (1) and equation (2) we can write it has

\[ I_3 = \beta^2 * I_1 \]

By observing the above equation say that to turn on the capacitor Q₃ we need a supper smaller base current from transistor Q₁ which is base current \( I_1 \).

Finally, the combination of Q₁ and Q₂ works as an amplifier and Q₃ transistor works as a switch.

**V. HARDWARE IMPLEMENTATION**

As shown in Fig, there is a probe which is connected to the Transistor BC057. This probe is made out of copper metal and acts as an antenna in receiving the signals from the cable. These signals are electromagnetic radiations emitted to the surroundings from the cable.
According to the requirement if the frequency of the emitting cable is low the length and thickness of the probe are to be adjusted and made higher. Fault detection makes it easy for tracing the exact fault location and distance. It is more compact and reliable thus helps in saving time. As mentioned earlier, it is cost-efficient. Therefore, it helps in reducing unnecessary expenses. Also, it requires low maintenance and operating cost as the damage rate is low. For experimental purposes, the cable kept below the detector unit as shown in Fig 1 and 2-meter cable was used. The cable is made as open after 1.5m. The cable was connected with the power line and the LED will turn ON.

For other experimental purposes, the cable kept below the detector unit as shown in Fig 2 and 2-meter cable was used. The cable is made as open after 1.5m. The cable was connected with no power line and the LED will turn OFF.

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