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Industrial Wiring Fault Detection System

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Abstract: In our daily lives, we tend to use a variety of electronic devices using a variety of complex electronic components. All modern appliances have their electrical wires covered with a PVC jacket to protect both the wires and the user from electric shocks. However, sometimes this protection also causes problems for users. Whenever an internal wire breaks, the device is rendered inactive and the user cannot easily find out why. Video cameras, halogen floodlights, hand drill bits, grinders and cutters are powered by connecting a two or three-core cable to a main power supply. Due to long-term use, the wires of power cables are subjected to mechanical stress and strain, which may lead to internal breakdown at any point. In three-core cables it seems almost impossible to detect the broken wire and the point of fracture without physically breaking all three wires hidden inside the PVC casing. Thus, a circuit is designed which can simply detect the exact location of a broken wire, thus reducing the unnecessary costs for the user.

Keywords*: PVC Jacket, Video Cameras, Hand Drillers, Halogen Floodlights, Hand Drillers, 3 Core Cables, Broken Wire E.T.C.*

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I. INTRODUCTION

Invisible Broken Wire Detector or Industrial Wiring Fault Detection System Design- which is used to check broken or disconnected wires inside the walls and it detects the broken wire by sleuthing the presence of AC voltage within the wire. It is terribly troublesome to find the correct location of the broken wire. So to find the accurate opposition of broken wire this device "Broken wire detector" comes very handy which detects broken wire by detecting the emf generated by alternating current in the wire. With this requirement, this project is an example of complex engineering problem.

➢ *Historical Background:*

In previous days there are so many researches were done on this project. In those researches, the project was designed only to detect the electrical leakage and broken wire by using LED. But there were no applications for detecting the exact location of broken wires.

- **Earlier Research:** Recently in 2017, some researchers from University of Nairobi, College of Architecture and School of Engineering worked on this project. The project was designed with pMOS and nMOS[1].

Invisible broken wire detector project by Nehru College of Engineering and Research Centre. In their project, they incorporate both the invisible broken wire and a short circuit checker [2].

Invisible broken wire detector project by K. Udhaya Kumaran. iWire: A portable wire detector for small devices project by Jeevan S/O Chandrasagaran, University Technical Malaysia Melaka [3].

Invisible broken wire detector by Dr. Himani Goyal Sharma, R.Venu, D.Sandeep, U.Sahithi, Chandan Singh; International Journal of Advanced Research in Science, Engineering, and Technology (IJARSET) [4].

- **State of the Art Technology:** Broken Wire Detector is eligible for a number of industrial application including hospitals, shopping malls, restaurants, regional retailers, multinational companies, etc. There are some of the practical importance of this project that seems most likely be applicable in the future.

An inverter can be used in between the LED and the oscillator so that it will turn on the LED only when the broken point is detected and keeping it off when the wire is not broken. By making this change the detector will be more user-friendly and it will show the broken point directly.

A microprocessor can be used in the project to identify the exact location of broken wires. For this feature, we need to use a proper code into the microprocessor for detecting the leakage. Which will be helpful for future applications.

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➢ *The Objective of this Work*

The basic aim of this project is to locate the exact position of breakage in wires without damaging the property physically. Thus we can reduce the wastage of times as well as resources.

➢ *The Secondary Objectives of this Project are:*

- Including a LED on this project for the detecting purpose of the breakage in the wire system and leakage of electricity.
- Including a microprocessor to show the exact location of breakage in wire systems on the LED display

➢ *Comparison with Traditional Method*

There are some differences between our project and traditional methods.

- **Risk Factor:** The traditional method is riskier than our project because in this method human laborer has to work on this problem to solve and they can be injured by the electricity flow. So it is quite risky for the human laborer.
- **Cost Factor:** Basically the cost of traditional method is quite high. With this project, there will be less property loss than traditional method.
- **Limitations:** There are less limitations for detecting the wiring fault location by this project than the traditional method.
- **Effectiveness:** In the case of movement traditional method is effective than this project.

➢ *Impact of Project on Society*

Nowadays breakage in the wiring system and electrical leakage is one of the major problems in our country. For this problem people like us feel risky to live in a building or work in the industry.

For solving this problem, we designed this project named the 'Industrial wiring fault detection system'. To find the effect on our project on the society we conducted a survey. For making the survey more effective we gave some project related information in the survey. We have categorized the survey responders by asking for their general information. There is total of nine survey questions and we have gotten data from 58 samples. For evaluating the questions, we have used Likert scale rating and have for options such as yes, no, maybe, no comment with each question. At the beginning of our survey, we asked the names of the responders who responded our survey.

➢ *Project Management*

The project management predicates major tasks and milestones of our project. The following tasks are followed for the management of our project.

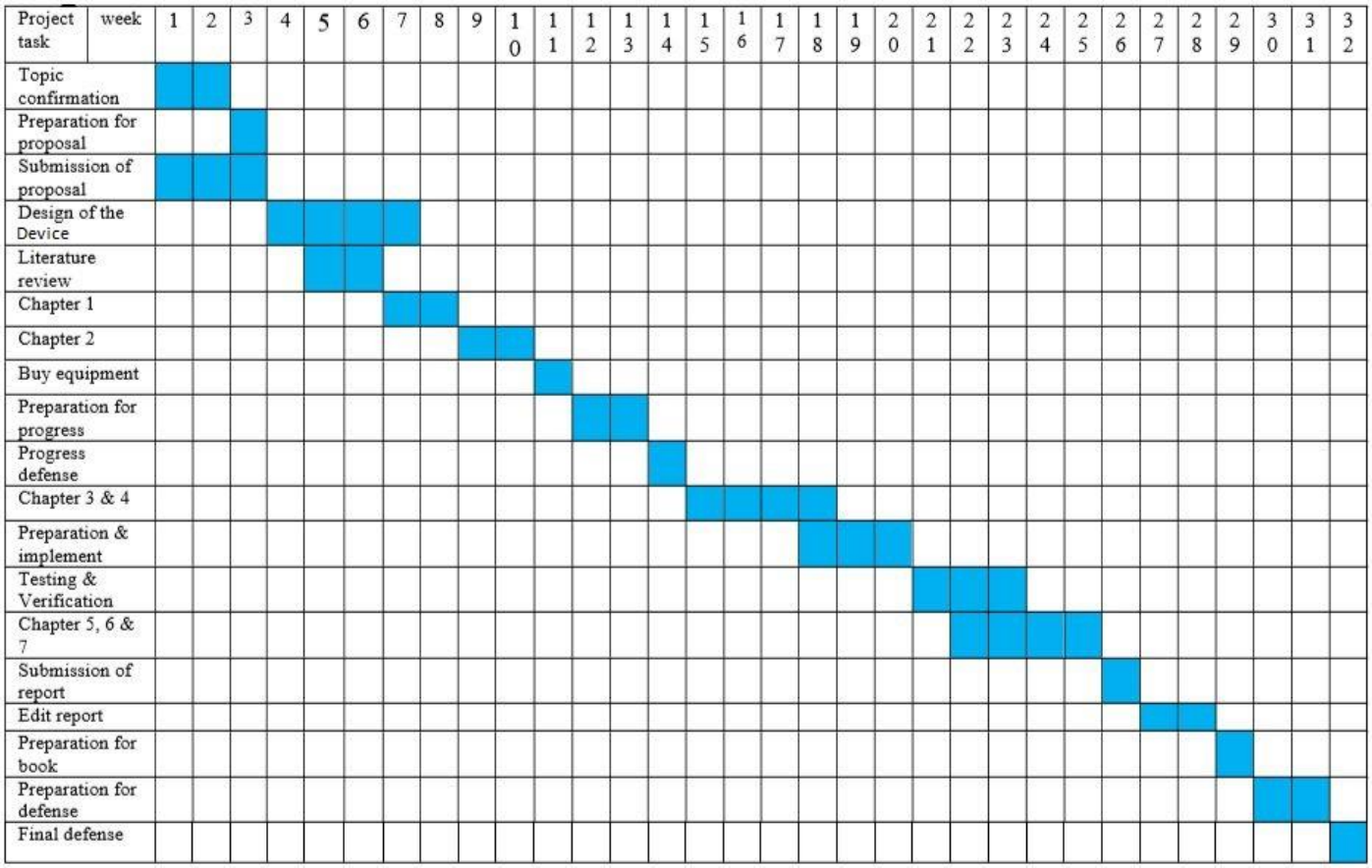

Fig 1: Gantt Chart of Project Management

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➢ *Organization of Book Chapters*

Our project book is in six chapters. These six chapters are structured as follows:

- Chapter-1 is entitled "Introduction". It represents overture, historical background, objective of this work, Comparison with traditional method, impact of project on society, project management, and organization of book chapters
- Chapter-2 is designated "Literature Review" with the in-depth investigation". It represents relevant information regarding previous works and development related to the project.
- Chapter-3 is entitled "Methodology and Modeling". It represents methodology regarding the project and the steps involved in completing the project.
- Chapter-4 is entitled "Implementation of Project". It represents required equipment for the project, block diagram, simulation, and system implementation.
- Chapter-5 is entitled as "Results Analysis and Critical Design Review". It represents technical data, calculation, flow chart and working process of the project
- Chapter-6 is entitled as "Conclusion". It represents the total summarization of all the previous chapters, suggestions for future works for further improving the project, project finance, limitation of the work and ethical concern.

II. LITERATURE REVIEW WITH IN-DEPTH INVESTIGATION

Wiring fault detection system has been an attractive subject for researchers in recent years. Our project's aim is to detect the exact location of breakage in wiring system in architectural places like industries, hospitals, buildings, etc. But in recent years researchers worked on similar projects like our project in a different way. These similar projects are such as underground fault detection system, overhead fault detection system, wiring fault detection system using pMOS and nMOS, etc. The technological development of the wiring fault detection system has been reviewed here with an in-depth investigation.

The technological development of the wiring fault system has been reviewed here with an in-depth investigation. The topic divided into three subparagraphs.

The first subparagraph consisted of a brief history of the underground fault detection system. Various Types of equipment are described briefly in this section. Such as:

- Coaxial Power Cable with Neutral Bridges Over the Splices
- Single-Phase PILC Cable with Bonded Grounds in Conduit
- Megger

The second subparagraph is about the overhead fault detection system. Only one equipment named 'Sentinel' is described briefly and reviewed in this section. The third subparagraph of this topic was all about the outcomes of these equipment and their way of works and about their successful outcomes on different sections.

III. METHODOLOGY AND MODELING

This chapter is predicated on methodology and modeling of the project. This chapter includes working steps involved to complete this project and also brief discussion about the equipment used in this project.

A. Methodology of the Project

The idea and design of our project have been collected from many sources like books, papers, journals, different websites and online tutorials. The idea of our project Industrial Wiring Fault Detection System has been inspired by the concept of broken wire detection system based projects. After choosing the idea we made a circuit diagram of our project. Then we began component sourcing with reliable prices to reach our goal. After sourcing the component, we implemented the complete project after many trials and errors.

B. Required Equipment for the System

Different types of equipment are used for the implementation of the project. And the brief discussion about all the equipment is discussed here.

- UTC CD4069
- BC 547 Transistor
- Buzzer
- 9V Battery
- LED's
- Resistors
- 47k Variable Resistor
- 1N4148 Diode
- Capacitors

In this chapter the methodology and the modeling of the project are summarized respectively. To complete this project what types of working steps were involved and what equipment are used in this project were also included with brief description

IV. IMPLEMENTATION OF PROJECT

This chapter is predicated on hardware implementation. We have used various types of components to complete the implementation of our project. In this chapter the implementation of the hardware, block diagram, circuit diagram, flow chart and simulation process will be shown step by step with brief description. Also the step by step process of system implementation will be shown.

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A. Block Diagram of the Designed System

In our project we have used a nine-volt battery as power supply. The power supply is connected to the switch through PCB. For switching we have used the transistor BC 547. The PCB is connected with the diode 1N4148 and the inverter circuit CD 4069. The inverter circuit is connected to the capacitor, diode and transistor. Wires which are used as sensor in this project are connected with the diode, through which it is connected to inverter circuit. The signal system is represented by LED into the system which is connected to the switch.

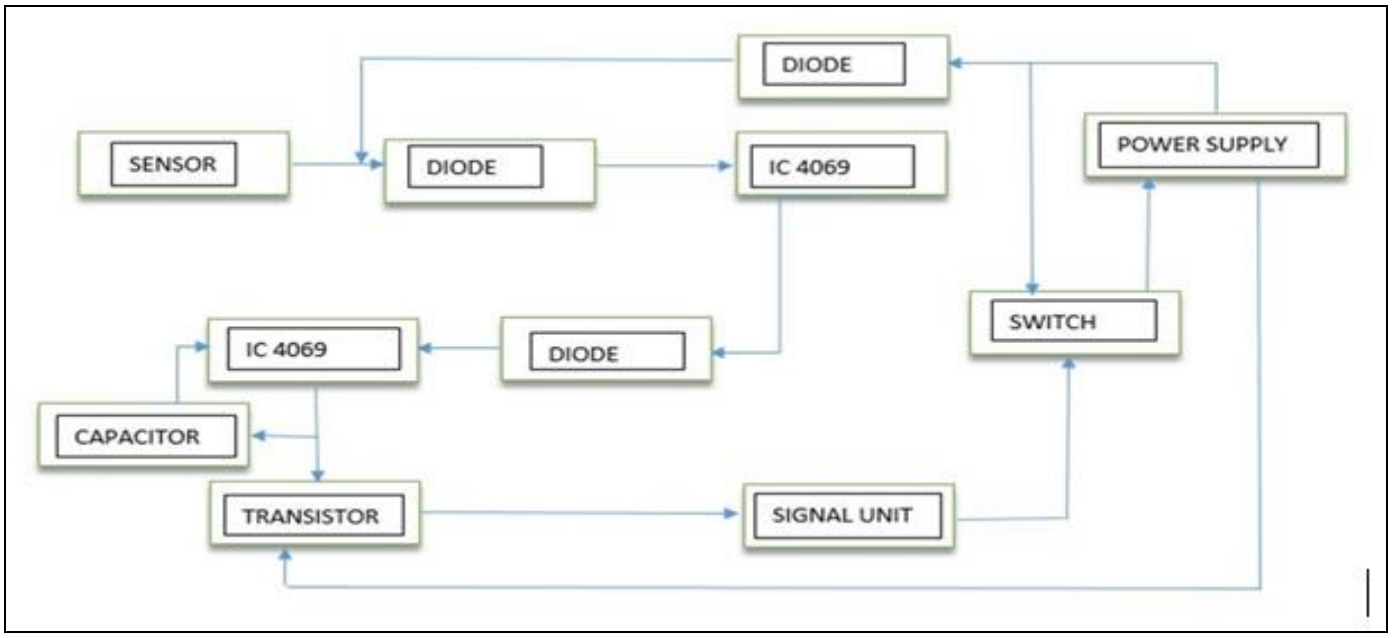

Fig 2: Block Diagram of the System

B. Circuit Diagram of Designed System

This whole circuit system of this system is connected to a Power Distribution Board (PCB). There is an inverter circuit CD 4069 connected into the middle of PCB. A battery of 9-volt is used as a power supply as shown into the diagram. There are 7 types of resistor which has different values are connected to this system. Transistor BC 547 is used as switch as shown in figure. The sensor is represented by wires with the inverter circuit. The diode 1N4148 has been connected with the input voltage and the other diode has been connected to the ground as shown in figure. The buzzer has been connected with the ground and the LED has been connected to the input through diode.

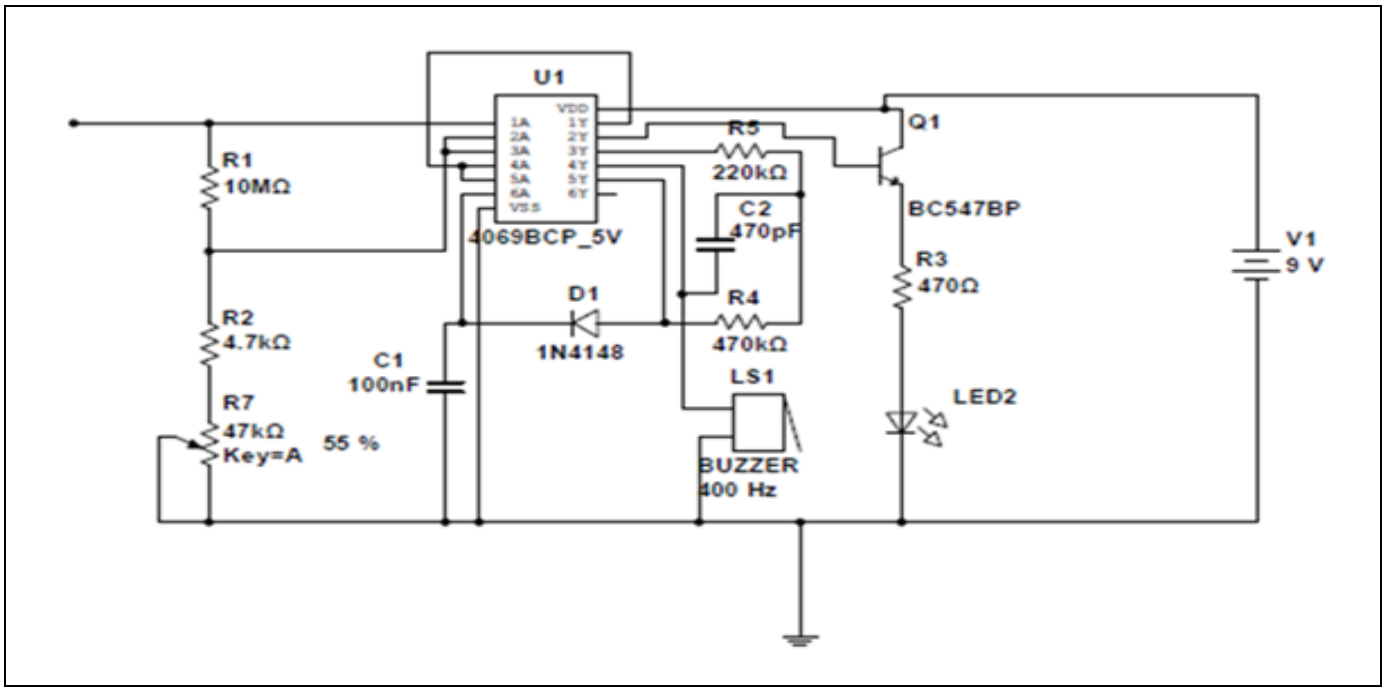

Fig 3: Circuit Diagram of the System

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C. Simulation of the Designed Circuit

The circuit simulator software "Proteus Design Suite Version 8.9" have been used to design the simulation of this system. The full circuit of the detection system is designed with Hex inverter, one nine-volt battery which supplies DC power. The pin 1 into inverter circuit has been connected with the sensor as input. Pin number 10 is set with the buzzer as output. When the simulation is running, we have changed the frequency using potentiometer to detect error time by time.

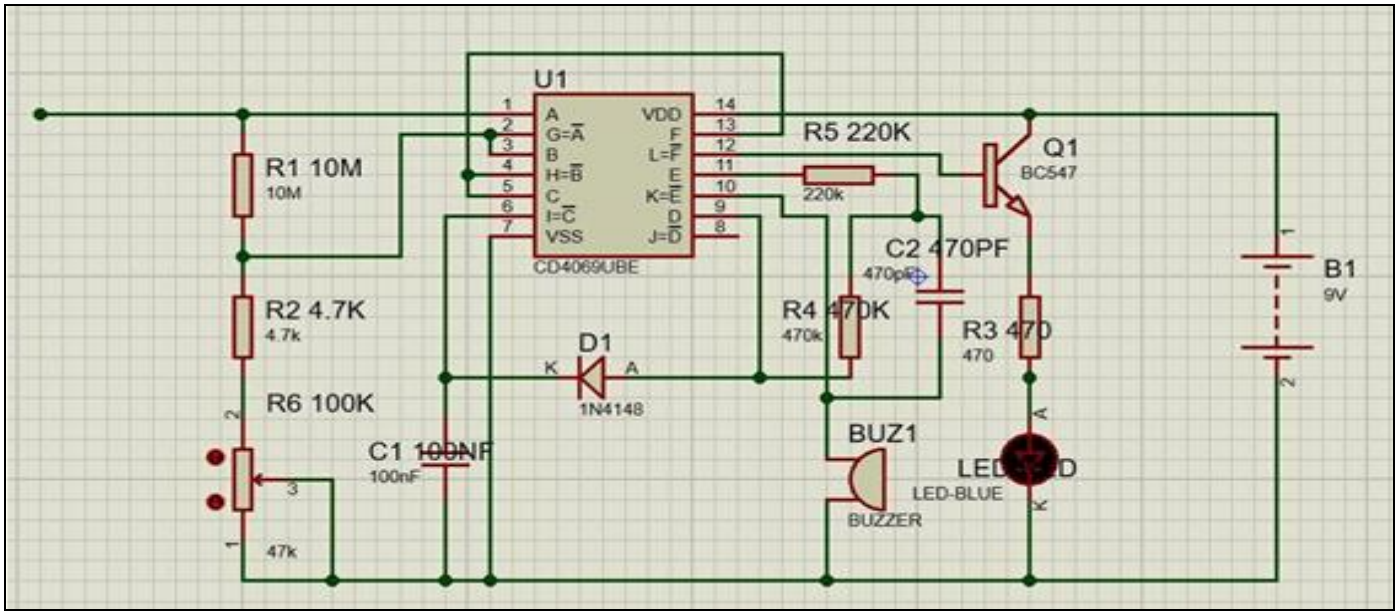

Fig 4: Simulation of the Designed Circuit

D. System Implementation

Many steps had been taken during the system implementation. The final implemented project industrial wiring fault detection system is given below:

Fig 5: Total Implemented System

The chapter is predicated on hardware implementation. Step by step implementation of the hardware has been shown in this chapter with brief description. The system design comprises a sensor to sense the error through inverter circuit. The block diagram, flow chart, simulations has been shown on this chapter to represent work function of this project.

V. CONCLUSION

The industrial wiring fault recognition system developed in this project effectively deals with the challenge of localizing electrical wiring breakage without causing physical damage. Traditional methods for identifying faults are often time consuming, costly and form a significant risk to human labor. By using components such as LEDs and sensors, our systems improve efficiency, accuracy and safety when detecting wire errors.

This project illustrates the practical implementation of an invisible stock market cable detector that uses modern electronic components and methods to provide a cheap and reliable solution. Through simulation and hardware implementation, we verified the effectiveness of designs in a variety of industrial applications, including buildings, hospitals, and factories.

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