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Smart Gloves for Electrical Workers

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ABSTRACT: Smart gloves for electricians are specialized gloves equipped with sensors and electronics that provide electrical safety and performance monitoring features. These gloves are designed to protect electricians from electrical hazards, while also improving their work efficiency and accuracy. Smart gloves can detect electric fields, temperature changes, and other environmental factors that can affect the safety and performance of electricians. They can also provide haptic feedback and remote communication features that allow electricians to interact with digital systems while keeping their hands free. Overall, smart gloves for electricians have the potential to enhance safety and productivity in the electrical industry.The wearables are usually insulated and tested apart under various testing conditions, thus electrician gloves are designed to withstand 11KV of voltage. This paper focuses on building a device which monitors the health of the electrician and which composes of measuring instruments which measures the voltage, ampere. The health monitoring system and the measuring instruments are integrated on the insulated electrical gloves.

KEYWORDS: Smart gloves, Personal protective equipment, Electrician, Sensors, Potential hazards.

I. INTRODUCTION

Smart gloves for electricians are a recent development in the field of personal protective equipment (PPE) that aim to improve safety and efficiency during electrical work. Electricians and other professionals who work with live electrical circuits are exposed to significant risks of electrical shock, burns, and other hazards, making it crucial for them to have reliable and effective protective gear. Smart gloves are designed to address these challenges by integrating advanced technologies that enable the user to detect potential hazards and respond quickly to prevent accidents.

Smart gloves for electricians are equipped with sensors and microcontrollers that can detect changes in electrical current and voltage, as well as temperature and pressure. These sensors are connected to a wireless system that provides real-time feedback to the electrician, alerting them of any potential hazards and enabling them to take appropriate measures to avoid accidents. In addition to enhancing safety, smart gloves can also improve productivity and accuracy by providing better dexterity and comfort, allowing the user to work for longer periods without experiencing hand fatigue or discomfort. The use of smart electrician gloves is essential for ensuring the safety of electricians while they work, particularly when working with high-voltage electrical equipment. These gloves also provide convenience and efficiency by allowing electricians to work with tools and devices without having to remove their gloves constantly.
Overall, smart gloves for electricians represent an important advancement in workplace safety and technology. They allow electricians to work more safely and efficiently, while also providing them with valuable data and insights about the electrical systems they are working on.

II. PROBLEM STATEMENT

The electricians who climb electric poles often carry a variety of electronic tools and equipment to help them with their job, which can be cumbersome and make it difficult to perform their tasks safely and efficiently. This can be particularly challenging when working at height, where the risk of injury is high. To address this problem, a solution could be the development of smart gloves that integrate various electronics parameters into a single wearable device. These gloves would allow electricians to access information and tools hands-free, reducing the need to carry multiple devices and minimizing the risk of accidents.

Electricians who climb poles to perform their job tasks may have certain health conditions that can make it difficult or dangerous for them to perform their duties. For example, an electrician with a heart condition may be at risk of a heart

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attack or other cardiac event while climbing a pole or working at heights. Similarly, an electrician with a back or joint injury may experience pain or discomfort while performing tasks that require physical exertion.To address this problem, a solution could be the development of smart gloves that integrate a health monitoring system into the wearable device. Also connecting measuring equipment to the line requires more time and improper connection of the measuring devices will lead to serious accidents and also equipment damage.

III. METHODOLOGY

The gloves are made of specialized materials that can withstand high voltages and currents, providing a protective barrier between the electrician's hands and the electrical current. The Arduino uno is used as a controlling unit of the system. The gloves incorporate various sensors such as electrical current and voltage sensors that can detect electrical activity and provide real-time information to the wearer. The data can be delivered via wireless communication or Bluetooth to a smartphone or tablet for analysis. Smart gloves for electricians come equipped with touch screen compatibility, allowing the wearer to use their smartphone or tablet without removing the gloves.

Figure 1 shows the block diagram of Smart gloves which include Pulse oximeter sensors that monitor vital signs, such as heart rate, body temperature, and blood oxygen levels. These sensors could be embedded into the gloves. The data from the health sensors would be transmitted wirelessly to a smartphone or tablet, where it can be analyzed in real-time to detect any abnormalities or warning signs. The gloves could also include a GPS module that tracks the electrician's location, and fault detection also becomes easier. This could be particularly useful in emergency situations, allowing rescue personnel to locate the electrician quickly.

IV.BLOCK DIAGRAM

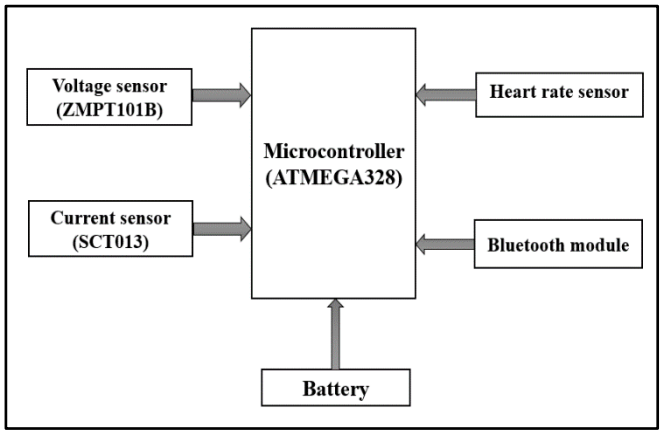

Fig 1. Block diagram of Smart gloves

V.FUNCTIONAL DISCRIPTION

Arduino uno: Arduino Uno is a microcontroller board that typically operates at a voltage rating of 5V, with a maximum current draw of 20mA per I/O pin. The specific type and ratings of the Arduino Uno used in smart electrician gloves will depend on the specific application and design requirements.

Voltage sensor:A voltage sensor used in smart gloves for electricians is a device that can detect the presence of electric current or voltage and alert the user if there is a potential hazard. These sensors are typically integrated into gloves worn by electricians and other professionals who work with electrical equipment. A capacitive voltage sensor placed in the fingertips of the smart gloves, capable of detecting high voltage up to 30kV with an accuracy of +/- 5%.

Current sensor:A current sensor is a crucial component in smart gloves for high voltage electricians. This sensor measures the electric current flowing through the circuit and detects any abnormalities, enabling the system to provide real-time alerts and prevent hazards. A flexible Rogowski coil current sensor placed in the wrist of the smart gloves, capable of measuring currents up to 1000A and transmitting the data wirelessly to a monitoring system.

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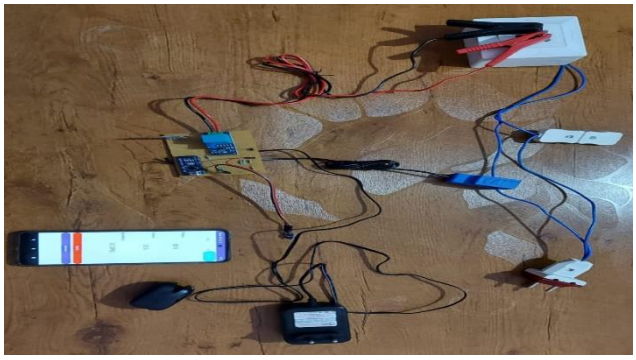

Heart rate sensor:A Heart rate sensor in smart glovesmeasures oxygen saturation level and pulse rate in real-time, ensuring safety and well-being. It features high-quality sensors and advanced algorithms, providing accurate and reliable measurements, and has a long battery life for extended use. A wireless pulse oximeter embedded in the wrist of the smart gloves, capable of continuous monitoring and transmitting the data to a smartphone app or a cloud-based platform.

Bluetooth module:A low-energy Bluetooth module (Bluetooth 5.0 or higher) are integrated it this model.This technology could allow the gloves to communicate with other devices, such as smartphones, tablets, or other smart devices, without draining the battery life of the gloves quickly. With this technology, the smart gloves could connect wirelessly to other devices and transfer data, such as real-time health monitoring information, GPS tracking.
The low energy Bluetooth model would allow the gloves to maintain a reliable connection with other devices while minimizing power consumption, thus extending the battery life of the gloves. Moreover, the electricians could use their smartphones or other devices to control the smart gloves, enabling them to access and analyse the data collected by the gloves, such as voltage and current readings or other sensor data, without physically interacting with the gloves.
This could further improve the safety and efficiency of their work, as they could access important information hands-free and without any distractions. Overall, the integration of a low energy Bluetooth model into smart electrician gloves could provide a valuable tool for electricians, improving their safety, efficiency, and productivity on the job.

Battery: The battery used in smart gloves for electricians is a crucial component, as it provides the necessary power for the various sensors, modules, and features. It is designed to be lightweight and compact, ensuring that it does not add unnecessary bulk to the gloves. The battery must also have a long lifespan to support extended use in hazardous environments. A rechargeable lithium-ion battery with a capacity of 1000mAh and a voltage of 3.7V is used, providing up to 8 hours of continuous use on a single charge.

VI.RESULT

Smart gloves for electricians with voltage and current detection, health monitoring system, communication system, location module, etc., can improve the safety and efficiency of electricians by detecting electrical hazards in real-time, tracking vital signs, providing communication and location updates, and alerting the electrician in case of any health issues, enhancing productivity, reducing accidents and injuries, and ensuring the safety and well-being of electricians and also it requires no time to connect the measuring equipment to the line and there are no chances of improper connection, hence it is safe to use.
Fig 2. Prototype of smart gloves

VII.CONCLUSION

A smart glove for electricians is equipped with advanced features such as voltage and current detection, health monitoring, communication system, and location tracking, providing real-time updates and facilitating quick response in case of an emergency. These gloves can significantly improve the safety and efficiency of electricians, reducing the risk of accidents and injuries, and enhancing productivity. Smart gloves for electricians are an important innovation that can benefit the electrical industry, ensuring the safety and well-being of electricians on the job.

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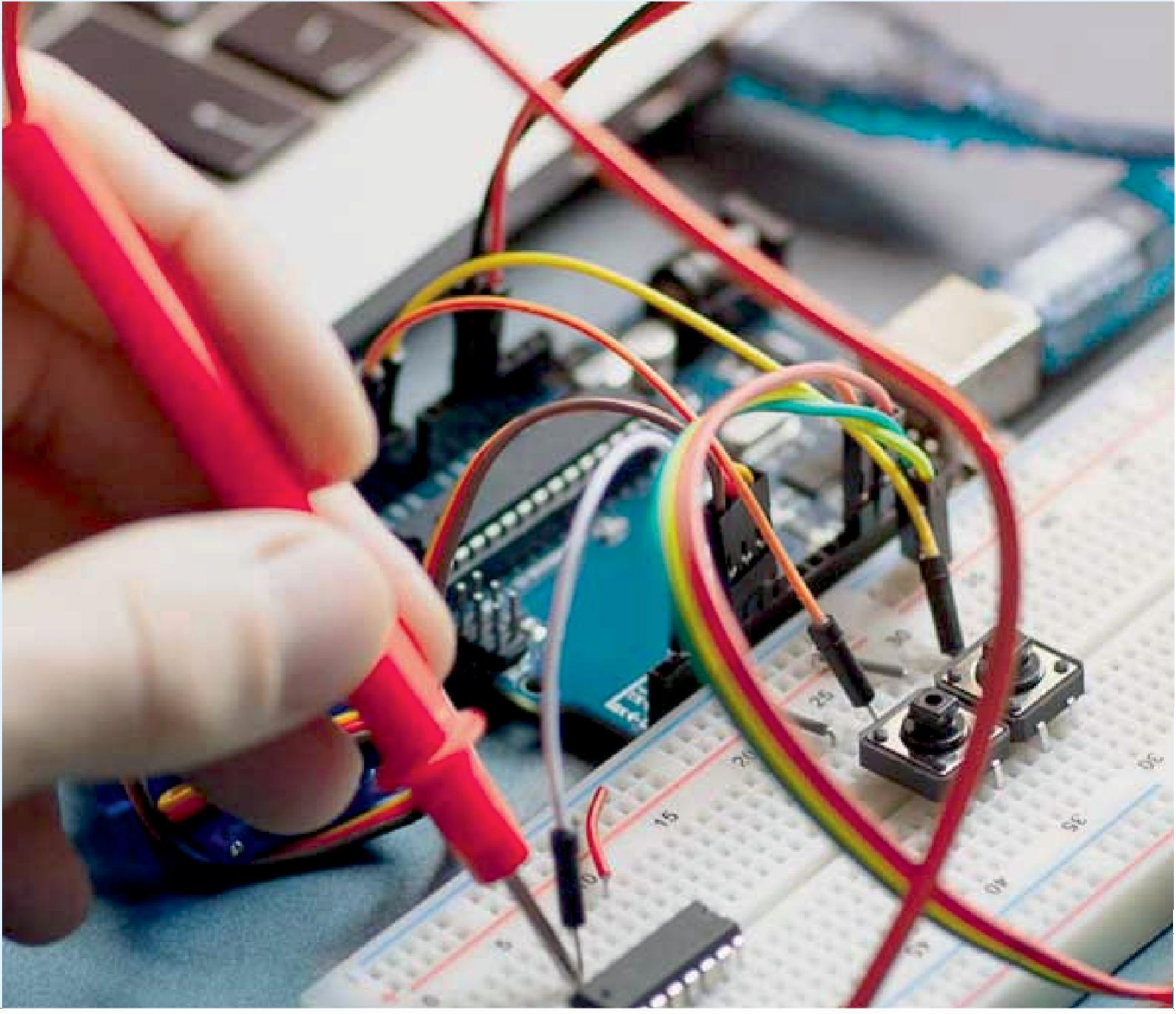

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