SMART STEP: IOT SMART SHOE FOR DIABETIC PATIENTS

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Abstract—Smart Step is an innovative IoT-based solution designed to enhance the safety and well-being of diabetes patients through a smart shoe equipped with advanced functionalities. The project focuses on addressing three main tasks crucial for diabetes management: fall detection, energy generation during walking, and step count monitoring.Firstly, Smart Step incorporates fall detection technology to promptly alert caretakers or emergency services in the event of a patient falling. Using integrated sensors, the system can accurately detect falls and trigger an immediate alert message to predefined contacts, ensuring timely assistance and intervention.Secondly,Smart shoe's eco-friendliness, autonomy, and dependence on external power are all improved by using kinetic energy to create electricity.Furthermore, With the use of a mobile app, patients may measure their activity and help with exercise management and individualized therapy thanks to Smart Step's real-time count of steps monitoring feature.Overall, With its creative integration of IoT into footwear for the treatment of diabetes, Smart Step empowers patients and reassures caregivers for better living whileguaranteeing sustainability, safety, and activity tracking.

I. INTRODUCTION

Diabetic is a chronic illness that needs to be carefully managed in order to avoid complications and preserve health. Fall prevention, managing one's energy, and tracking activity are three important issues that need to be addressed among the difficulties faced by diabetics.

Innovative solutions have evolved to address these issues, such as Smart Step, which uses IoT technology to offer complete support to people with diabetes.

An innovative Internet of Things (IoT) product called Smart Step is intended to improve the general well-being and safety of diabetics. This project covers three essential tasks necessary for efficient diabetes management: step count tracking, generating electricity during walking, and fall detection—all of which are accomplished by incorporating sophisticated functions into a smart shoe.

In order to provide quick assistance in emergency circumstances, Smart Step seamlessly incorporates technology for fall detection. It does this by using integrated sensors to quickly recognize falls and notify emergency services or specified contacts. Additionally, it promotes environmental sustainability and lessens reliance on other sources of power by utilizing creative harvesting methods to collect kinetic energy.

Furthermore, Smart Step's real-time step count monitoring gives important information about patients' levels of activity. This feature makes it easier for individuals, family members, and healthcare professionals to precisely monitor physical activity, which helps them make well-informed decisions about diabetes treatment techniques. Smart Step: Integrated technology within shoes for security, mental wellness, sustainability, and active life; promising for diabetes treatment.

II. LITERATURE REVIEW

The research conducted by Ramaiah, V.S., Singh, and Mohammad, M.N., Kumari offers the significant perspectives on the creation of Internet of Things-based solutions for individuals with diabetes, with a specific emphasis on smart shoes.Research uses technology to treat diabetes and encourages investigation of IoT shoes. IoT technology helps cure diabetes by offering real-time monitoring, customized feedback, and remote involvement through applications, smart systems, and sensors.

According to Muhammad et al. (2019), these shoes have the ability to improve mobility, identify issues early, and provide individualized interventions. The integration of sensors and connection features into smart shoes has the potential to improve healthcare outcomes, especially with regard to diabetes control.

From the research conducted by Padmini, G. R., et al. (2021) we have concluded that the layout and evaluation of an 8-bit rippled carry adder employing a nine-transistor full-adder structure are the main objectives of this work. Although this research primarily focuses on sophisticated communication and computing systems, it provides insightful information about how to design effective digital circuits.

Dr. K. Raju and others concluded that the IoT smart shoes focuses on accuracy and robustness might be pertinent when it comes to sensor the processing of information and falling detection algorithms. The integration of resilient and precise data processing methodologies in IoT intelligent footwear can guarantee dependable efficacy in fall detection and patient activity tracking.

III. PROPOSED METHODOLOGY

The Smart Step project employed a NodeMCU Wi-Fi module, step count monitoring, and piezo sensors to produce electricity and the process is shown in Fig.2. During the design process, a prototype shoe was constructed using these components is shown in the Fig.1. The software development project focused on developing algorithms for fall detection, step count tracking, and a smartphone's data visualization application. A series of simulated falls were used in the testing methods to evaluate the fall detection algorithm's accuracy. The energy acquiring efficiency was assessed by recording the production of electricity while walking using piezo sensors. Step count monitoring was verified by comparing Smart Step's information with that of traditional pedometers. Ethical considerations took precedence over regulatory compliance and patient privacy throughout the research procedure.

A. Block Diagram of the proposed device:

The development of a smart shoe tailored for diabetic patients represents a significant advancement in wearable health technology. By integrating piezo sensors into the shoe's sole, the device can detect subtle changes in pressure distribution and gait patterns, enabling the identification of potential falls. Powered by the piezoelectric effect, the shoe generates electricity as the wearer walks, ensuring continuous operation without the need for external power sources.

By utilizing a NodeMCU microcontroller, the system processes sensor data in real-time, triggering alerts upon detecting a fall through sophisticated

algorithms. Additionally, the inclusion of a vibrating motor which is shown in Fig.1 enables the shoe to provide therapeutic massage to the wearer's foot during periods of rest, enhancing circulation and promoting comfort. Through a user-friendly interface, individuals can monitor their activity levels, receive alerts, and control massage settings, ensuring a personalized and proactive approach.
The workingof each component which are mentioned in the Fig.1 for designing a prototype is explained below.

Microcontroller:
An inexpensive WiFi microchip with microcontroller functionality and integrated TCP/IP networking software is the ESP8266. Microcontrollers may establish basic TCP/IP connections and switch over a Wi-Fi network with the help of this little module using Hayes-style instructions.

Piezo Sensor:
By converting changes in acceleration, temperature, strain, force, and pressure into an electrical charge, a piezoelectric sensor measures these changes. Because the piezoelectric effect is reversible, an electrical charge is produced at the output when mechanical stress is applied to the piezoelectric material.

IR Sensor:
An photoelectronic component that is radiation-sensitive and has a spectral sensitiveness in the infrared spectrum with a wavelength range of 780 nm to 50 µm is called an infrared sensor (IR sensor). Nowadays, IR sensors are frequently seen in motion detectors. IR sensors use their interaction with infrared radiation to detect infrared energy that things release

BC-547 Transistor:
BC-547 transistor is used to regulate the speed of a motor or actuator in some of your projects. Additionally, this transistor can be utilized as a switch, making it simple to turn on or off a DC device.Typically, BC547 tends to be used for pulse-width modulation (PWM), fastswitching, and current amplifier and its gain value is 110 to 800.

DC Motor:
A DC motor is a type of electrical motor that generates mechanical force by means of direct current (DC). With an extensive range of voltage values that are readily available, they are incredibly robust, simple to operate, and easy to control. These motors have two-way rotational motion and allow for speed adjustment.

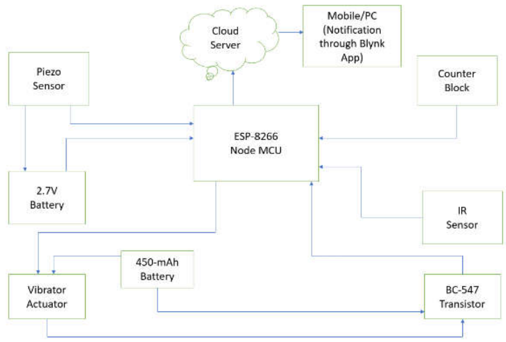

Fig.1: Block Diagram of smart shoe using IOT

B. Work flow model of the proposed device:

An infrared (IR) sensor and the Internet of Things platform Blynk are combined in the given Arduino code to determine whether a person has fainted and it is shown in Fig.2. The output of the sensor is continuously monitored within the main loop. The sensor captures the current time when it finds an item. Awarning is triggered in the event that no item is identified for a predetermined amount of time, suggesting a possible fainting incidence. The Blynk app and serial communication are used to transmit this warning, with messages written to the terminal widget on Blynk as well as the serial monitor. Furthermore, Blynk creates an event record that allows for situational monitoring from a distance. With the help of this connections shown in Fig.2, it is easy for users to monitor in real-time for fainting episodes and receive fast notifications.

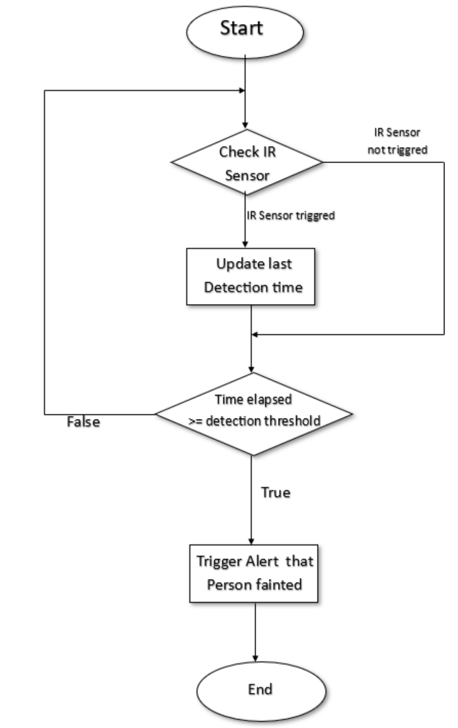

Fig.2: Flowchart for the working process of smart shoe.

IV. RESULT AND DISCUSSION

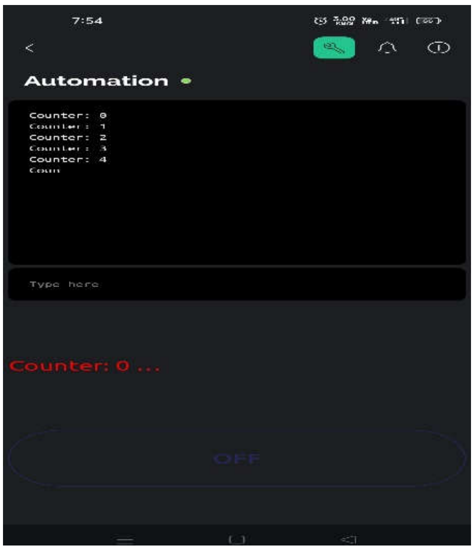

Fig.3. count values in smartshoe

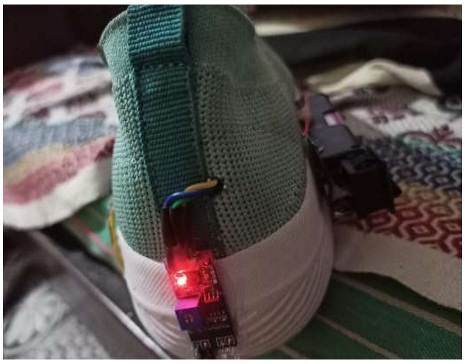

Fig.4.Smart shoe

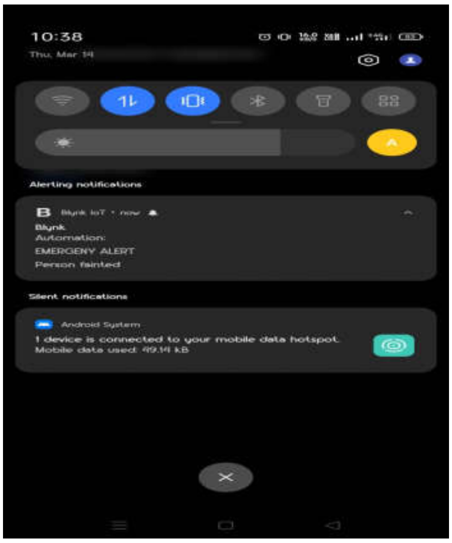

Fig.5.Alert message when person is fainted

Theproject is focused on developing algorithms and prototype of smart shoe Fig.4. for fall detection, step count tracking which is shown in Fig.3 and a smartphone's data visualization application which is mentioned in Fig.5 that the alert message will be generated when the person is fainted. A series of simulated falls were used in the testing methods to evaluate the fall detection algorithm's accuracy. The energy acquiring efficiency was assessed by recording the production of electricity while walking using piezo sensors. Step count monitoring Fig.3 was verified by comparing Smart Step's information with that of traditional pedometers.

Overall, IoT-enabled smart shoes have great promise for reducing diabetic foot issues and augmenting the standard of living of individuals with diabetes.

V. CONCLUSION

In conclusion, IoT smart shoes are a revolutionary advancement in the treatment of diabetes, providing early intervention and continuous monitoring through alert messages. These shoes enable patients and healthcare practitioners to proactively treat diabetic foot concerns by giving continuous information on foot health factors. Even if issues like data privacy, there are a lot of potential advantages to these creative solutions. IoT smart footwear have the potential to completely transform diabetic treatment by enhancing patient outcomes and elevating the quality of life for those who have the disease, if they are further developed and widely used.

VI. REFERENCES

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