**IOT BASED SMART BANDAGE USING RFID**

**ABSTRACT**

Many countries, such as India and China, have become an aging society. Domestic health-care systems to provide elders long-term health monitoring are required in the aging society. This paper proposes a novel wearable platform for long term health monitoring --- the smart-clothes platform. Utilizing the emerging electronic textiles, the smart-clothe is embedded with five types of sensors for health monitoring. The platform includes Based on the smart-clothe, a computing platform utilizing embedded gateway, smart-phone, and back-end cloud servers are designed for long-term sensors data collection and diagnosis. The platform enables wide-range of applications for health service based on smart-phones and cloud services..

**CONTENTS**

1. **INTRODUCTION.**
2. **LITERATURE SURVEY.**
3. **EXISTING SYSTEM.**
4. **PROPOSED SYSTEM.**
5. **APPLICATIONS.**
6. **PROBLEM STATEMENT.**
7. **OBJECTIVES.**
8. **BLOCK DIAGRAM.**
9. **METHODOLOGY.**
10. **HARDWARE AND SOFTWARE REQUIREMENTS.**
11. **CONCLUSION**
12. **REFERNECES**

**INTRODUCTION**

This paper proposes a novel wearable device and computing platform for long-term health monitoring --- the smart-clothe platform. Utilizing the emerging electronic textile technology, the smart-bandage is a bandage embedded with various sensors for monitoring health condition. A gateway embedded with the smart-clothe transmits sensors signals to a smart-phone for signal processing. Various applications can be developed on the smart-phone for health monitoring, diagnosis, and emergency condition processing. Moreover, the smartphone connects the smart-clothes to the back-end cloud service platform for long-term sensors data collection. Data mining on long-term sensors data can be applied for advanced medical research and diagnosis. This paper presents the application scenario and prototyping of the smart-bandage platform. The use of smart bandages or 'modern dressings' helps not only reduce the period of treatment of patients but also to make it more comfortable and convenient. This medical asset creates the right conditions for dynamic and complex wounds to heal quicker, and safer. The Internet of Things (IoT) is changing the way we live, making us more efficient and making our lives easier. The Internet of Things can be beneficial for businesses, increasing efficiency and collecting more consumer data.

**LITERATURE SURVEY**

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| TITLE | DESCRIPTION | ADVANTAGES | DISADVANTAGES |
| Battery Free Smart Bandage based on NFC RFID Technology– 2020- Yi Li;  Neil Grabham;  Abiodun Komolafe;  John Tudor | We have realised a wireless battery free smart bandage for home and hospital use to monitor skin wound temperature and humidity. The smart bandage is powered wirelessly by Radio Frequency (RF) energy based on Near-Field Communication (NFC) Radio-Frequency Identification (RFID) technology which also communicates the measured temperature and humidity data. A smart bandage in this form provides simple wound monitoring for the user at home and healthcare professional to monitor groups of patients. Investigations have been undertaken on antenna design, circuit design and bandage system integration. Fabrication is based on photolithography and etching of a copper coated Kapton. | * Easy to use system design. * Portability due to battery source. | * Remote locations without power source to recharge the battery can lead to shutting down of system. |
| An Ultra-High-Frequency Wirelessly-Powered Smart Bandage for Wound Monitoring and Sensing Using Frequency -2021-  Dieff Vital;  John L. Volakis;  Shubhendu Bhardwaj | In this paper, a battery-less and wireless smart bandage is proposed, where the RF and sensor circuit are wirelessly powered, and the sensor data is modulated and wirelessly collected. The sensor is designed with minimalistic electronics to interface to tri-electrode electrochemical sensors. The RF electronics, power telemetry and data-communication antennas are realized via conductive thread embroidery on fabric substrate. The wireless power transmitter operates at frequencies between 350 MHz to 573 MHz, while the return communication signal path is designed to be around 915 MHz. The bandage electronics feature a rectifier for RF-to-DC conversion of received RF power, used for driving a voltage-controlled oscillator (VCO) and electrochemical sensor. It is demonstrated that restored wound, emulated by a resistive load, yields a modulated frequency of 845 MHz, which is tunable based on value of resistive load and wirelessly collected by a remote receiver at 3 ft. away from the bandage. This modulated frequency corresponds to a tuning voltage of 0.1 V for the VCO. The VCO consumes a total DC power of less than 6 mW. | * Effective regulation of physical and chemical conditions within the wound site. * Low cost design. | * Inability to provide information about the healing status |
| A Wireless Flexible Smart Bandage For Wound Monitoring -Wen Lv;  Xiyu Chen;  Yongwei Zhang;  Wenjing Quan;  Xinwei Chen;  Chao Fan;  Jia Shi;  Jianhua Yang;  Min Zeng;  Zhi Yang  -2022 | A low-cost wireless flexible smart bandage with simple structure for wound monitoring has been developed in this work. The smart bandage was composed of a commercial bandage and a wireless temperature sensor fabricated by facile process on flexible substrate. The smart bandage showed a favorable performance under different mechanical deformations and a maximum coupling distance of 12 mm. The bandage yielded a sensitivity of up to 0.818 MHz/°C in 20–42 °C with a response and recovery time of 24.2 and 28.2 s and with a resolution of 0.5 °C, showing a great promise of the smart bandage as a fast and accurate temperature monitor in wound healing. | * Optimized wound healing with less tissue manipulation. * Reducing the risk of infection. | This can lead to increased skin irritation and pain for the patient. |
| Zero-power Flexible RFID Sensor for Pressure Monitoring of Elastic Compression Bandages-  C. Miozzi;  N. D’Uva;  F. Camera;  S. Nappi;  S. Amendola;  C. Occhiuzzi;  G. Marrocco-  2021 | Compression therapy is now recognized as the main treatment for both the preventive and therapeutic care of venous disease, but its incorrect application may provoke severe injuries to the patient. Following the paradigm of e-Health, this paper presents a flexible, soft and battery-less wireless pressure sensor for the next-gen of smart/interconnected compression therapy kits. The sensor is manufactured with biocompatible latex foam and its softness reduces the risk of pressure sores. Moreover, the size of the sensor (30 mm of diameter) allows a great comfort of the user and the possibility of deploying multiple sensors in different locations of the medical treatment. The electromagnetic performance of the sensor is numerically optimized and experimentally validated, with a maximum achievable reading distance up to 17 cm, suitable for the requirement of through-the-bandage data reading. Finally, the pressure sensor is characterized through a preliminary mock-up emulating the compression of the bandages, demonstrating a linear correlation between pressure and tightening. | * Storage and recording of useful wound care data helps wound care providers analyze patient wound healing progress. | * Cannot hold fluids or bacteria in the damage and can also fall off at any time. |
| Corrugated Compliant Capacitor towards Smart Bandage Application-  Han Liu;  Simon Laflamme;  Eric M. Zellner;  Sarah A. Bentil;  Iris V. Rivero;  Thomas W. Secord;  Ali Tamayol  -2021 | The focus of this study is to characterize a soft elastomeric capacitor (SEC) capable of monitoring large levels of deformation towards smart bandage applications. The SEC is a highly compliant, low cost, and scalable strain gauge, designed to transduce strain into a measurable change in capacitance. Early work on the SEC was conducted on untextured versions, where the dielectric was sandwiched between two flat electrodes. It has been shown that the use of currugated surfaces significantly improves the sensor's sensitivity, linearity, and resolution, and that the sensor could be used to effectively monitor elongation in intact (i.e., unwounded) canine skin. In this paper, work on the SEC technology is extended to evaluate the use of corrugated SEC as a smart bandage capable of monitoring strain and reducing stresses on soft tissue. A series of experimental tests is conducted on two corrugated patterns, namely a reentrant hexagonal honeycomb pattern (auxetic pattern) and a symmetric diagonal grid pattern, to further characterize the signal of the corrugated sensor under various levels of localized strain resembling an opening wound. After, prior numerical investigations on canine skin are extended to study opportunities in leveraging corrugation to improve stress distribution around a wound. Results show that corrugation significantly improves both the signal and stress distribution onto soft tissue, with the auxetic pattern exhibiting best performance, therefore demonstrating the promise of the corrugated SEC as a smart bandage. | * Easy to use multifunctional wearable devices, with no wires hanging around. * Shortening hospitalization time. | Low energy capacity compared to batteries. |

**EXISTING SYSTEM**

Current wound dressings are mainly designed to keep the injury site sealed and protected. Diagnosis and treatment of chronic wounds is challenging, and medical staff often rely on physical inspections of the wound in order to provide treatment. This method requires frequent trips to the hospital that are time consuming and expensive.

**PROPOSED SYSTEM**

The smart bandage is part disposable and part reusable. The sensors used to detect temperature, oxygen level and external pressure on the wound are located on a disposable bandage whereas the electronics on the flexible tape can be detached and reused multiple times. Data is then stored on IOT cloud to monitor and analyse.

**APPLICATION**

* **House Patient Monitoring.**
* **Factories Employees Status Monitoring.**
* **Consumer healthcare**
* **Hospitals and long term remote health care**

**PROBLEM STATEMENT**

Wound healing is a crucial physiological process through which damaged tissues repair themselves. A pressure bandage may be used to help control bleeding and allow the blood to clot. It's important for a pressure bandage to not be too tight. Stiff bandage material is not easy to handle. Most untrained persons apply inelastic bandages with too low a pressure.

**OBJECTIVES**

* To monitor the condition of the wounded patient regularly.
* Checking any pressure is being applied on the wound to prevent further damage to wound.
* Checking temperature to notice any fever or inflammation.
* Using IOT storing data from sensor to keep track of recovery.

**BLOCK DIAGRAM**

**THINGSPEAK IOT**

**ARDUINO**

**TEMPERATURE SENSOR**

**SPO2**

**WI-FI MODULE**

**PRESSURE SENSOR**

**RFID READER**

Fig: Block diagram of system.

**METHODOLOGY**

An Arduino is an open hardware development board that can be used to design and build devices that interact with the real world. Arduino Uno is a microcontroller board based on the ATmega328P. The system is monitoring the temperature of the patient using Temperature sensor. If any pressure is put on the wound then the pressure sensor detects it and sends data to Arduino microcontroller. RFID cards are issued to patients for identification purpose. RFID reader is used to read the data in RFID cards. Oxygen level and heart rate are read by the SPO2 sensor. ThingSpeak IOT is used to store all the sensory data. This data can be analysed and sent to other places for references. Wi-Fi module is interfaced with Arduino microcontroller to establish a connection with wireless network.

**HARDWARE AND SOFTWARE REQUIREMENTS**

**HARWARE REQUIREMENTS:**

* **Arduino Uno.**
* **Pressure Sensor.**
* **SPO2 Sensor.**
* **Temperature Sensor.**
* **ESP8266 Wi-Fi Module**
* **RFID Reader.**

**SOFTWARE REQUIREMENTS:**

* **Arduino IDE.**
* **Embedded C Programming.**
* **ThingSpeak IOT.**

**CONCLUSION**

This paper shows a novel approach to establish health monitoring system for the upcoming aging society. In summary, a flexible and conformable smart bandage is presented for wireless strain and temperature sensing. Both strain and temperature sensors were integrated with an Arduino microcontroller. Through the prototyping of smart-bandage and the energy-efficient gateway, the infrastructure enables health-service applications on smart-phones and cloud computing. Based on the smart bandage platform, various application programs are smart phones can be developed to diagnose and monitor one’s health condition. Moreover, the smart-clothes platform connects wearable sensors to cloud servers for long-term health data logging without interfering one’s daily life.

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