VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belagavi -590018

A PROJECT REPORT ON

"SMART BANDAGE USING NFC ENABLED RFID "

Submitted in the partial fulfillment of the requirement for the award of the degree of

BACHELOR OF ENGINEERING

In

COMPUTER SCIENCE & ENGINEERING

Submitted By

SANSKAR DROLIA (1RR19CS130)

SHIBIN C REJI (1RR19CS137)

SHRITI SINGH (1RR19CS144)

YASHI BILTHARIYA (1RR19CS179)

Under the Guidance of

Dr. KAMALRAJ T

Associate Professor

Dept .of CSE, RRCE

DEPARTMENT OF COMPUTER SCIENCE&ENGINEERING

RAJARAJESWARI COLLEGE OF ENGINEERING

MYSORE ROAD, BANGALORE-560074

(An ISO 9001:2008 Certified

Institute)(2022-23)

RAJARAJESWARI COLLEGE OF ENGINEERING

MYSORE ROAD, BANGALORE-560074

(An ISO9001:2008Certified Institute)

(Affiliated to Visvesvaraya Technological University, Belagavi)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CERTIFICATE

Certified that project work entitled

" SMART BANDAGE USING NFC ENABLED RFID"

Carried out by

SANSKAR DROLIA (1RR19CS130)

SHIBIN C REJI (1RR19CS137)

SHRITI SINGH (1RR19CS144)

YASHI BILTHARIYA (1RR19CS179)

The students of **"RajaRajeswari College of Engineering"** in partial fulfillment for the award of **Bachelor of Engineering in Computer Science & Engineering** of the Visvesvaraya Technological University, Belagavi during the year **2022–2023.** It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The mini project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the Seventh semester.

……………................	……………………………	……………………………
Signature of guide	**Signature of HOD**	**Signature of Principal**
[Dr. Kamalraj T]	**[Dr. Usha S]**	**[Dr. Balakrishna]**
Dept of CSE,	Prof.& HOD,	Prof.& Principal
RRCE,	Dept of CSE	RRCE,
Bengaluru	RRCE, Bengaluru	

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..

ACKNOWLEDGEMENT

We express our deep sense and gratitude to Dr. Blakrishna , Principal, Department of Computer Science & Engineering, Rajarajeswari College of Engineering, Bangalore, for providing me an opportunity to undertake this mini project work and his invaluable guidance and help.

We are very proud and thankful to Dr. Usha S, Professor & HOD, Department of Computer Science and Engineering for his valuable advice and ideas at various stages of this work.

We would also thank our guide Dr. Kamalraj T, Associate Professor, Department of Computer Science & Engineering, Rajarajeswari College of Engineering, Bangalore and all the staff members of the department for their cooperation and guidance which was very helpful in successful completion of this project work.

And finally, we are very much thankful to God and my parents for their moral support and inspiration, without which this project work would not be completed successfully.

SANSKAR DROLIA (1RR19CS130)
SHIBIN C REJI (1RR19CS137)
SHRITI SINGH (1RR19CS144)
YASHI BILTHARIYA (1RR19CS179)

INDEX

CHAPTER 1 : 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.

CHAPTER 2 : LITERATURE SURVEY

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.

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.

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.

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.

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.

CHAPTER 3 : 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.

CHAPTER 4 : 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 andanalyse.

CHAPTER 5 : APPLICATION

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

CHAPTER 6 : 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 inelasticbandages with too low a pressure.

CHAPTER 7 : OBJECTIVES

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

CHAPTER 8: DESIGN AND ARCHITECTURAL MODEL

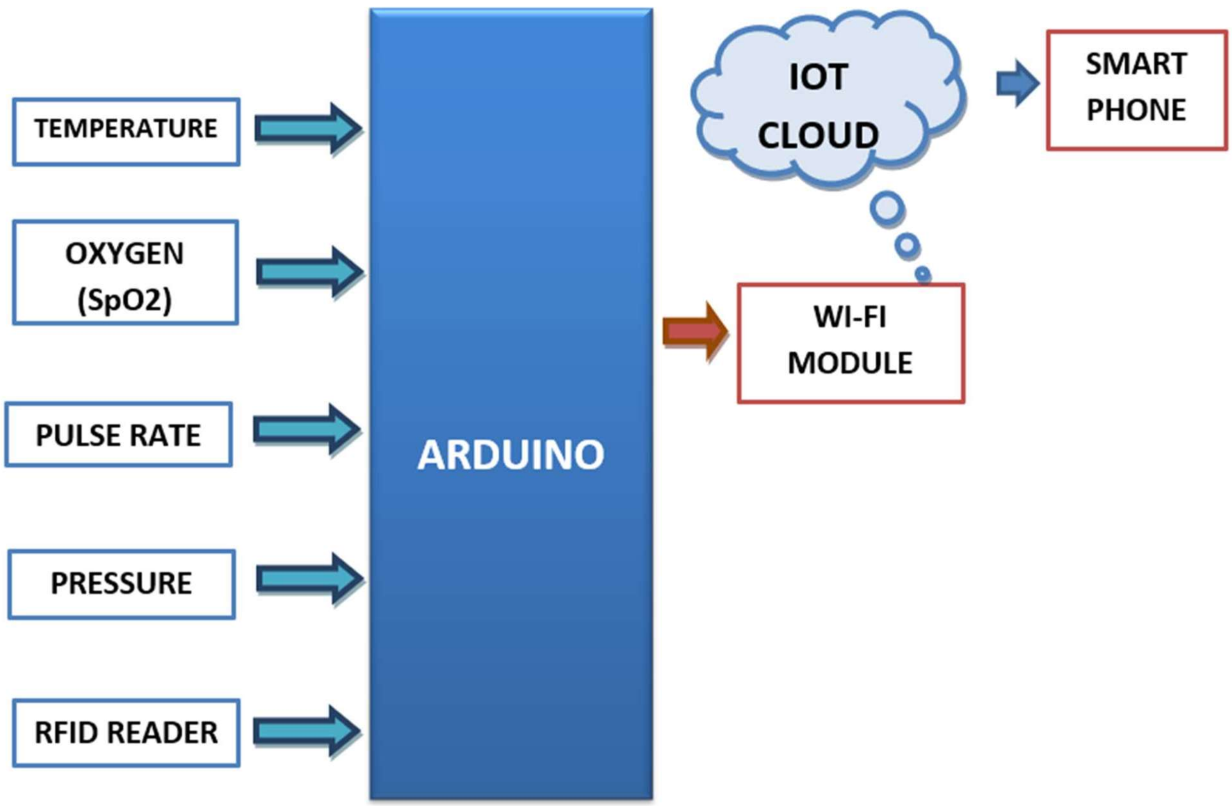

Fig: Block diagram of system.

CHAPTER 9 : METHODOLOGY

An Arduino is an open hardware development board that can be used to design andbuild 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 andsent to other places for references. Wi-Fi module is interfaced with Arduino microcontroller to establish a connection with wireless network.

CHAPTER 10 :

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.**

CHAPTER 11 :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.

CHAPTER 12 : REFERENCES

[1] P. Mostafalu, W. Lenk, M. R. Dokmeci, B. Ziaie, A. Khademhosseini, and S. R. Sonkusale, “Wireless flexible smart bandage for continuous monitoring of wound oxygenation,” Oct. 2015.

[2] B. K. Ashley, M. S. Brown, Y. Park, S. Kuan, and A. Koh, “Skininspired, open mesh electrochemical sensors for lactate and oxygen monitoring,” Biosens. Bioelectron., May 2019.

[3] E. S. Hosseini, L. Manjakkal, D. Shakthivel, and R. Dahiya, “Glycine–chitosan-based flexible biodegradable piezoelectric pressure sensor,” 2020.

[4] W.-J. Deng, L.-F. Wang, L. Dong, and Q.-A. Huang, “LC wireless sensitive pressure sensors with microstructured PDMS dielectric layers for wound monitoring”, June. 2018.

[5] W. Gao, H. Ota, D. Kiriya, K. Takei, and A. Javey, “Flexible electronics toward wearable sensing,” , 2019.

[6] S. Nasiri and M. R. Khosravani, “Progress and challenges in fabrication of wearable sensors for health monitoring,”, Sep. 2020.

[7] I. Sim, “Mobile devices and health,” 2019.

[8] M. S. Brown, B. Ashley, and A. Koh, “Wearable technology for chronic wound monitoring: Current dressings, advancements, and future prospects,” Apr. 2018.

[9] P. Sharma, X. Hui, J. Zhou, T. B. Conroy, and E. C. Kan, “Wearable radio-frequency sensing of respiratory rate, respiratory volume, and heart rate,”, 2020.

[10] D. P. Cuthbertson and W. J. Tilstone, “Effect of environmental temperature on the closure of full thickness skin wounds in the rat,” , 1967.

[11] S. O. Blacklow, J. Li, B. R. Freedman, M. Zeidi, C. Chen, and D. J. Mooney, “Bioinspired mechanically active adhesive dressings to accelerate wound closure,”, 2019.

[12] R. Agha, R. Ogawa, G. Pietramaggiori, and D. P. Orgill, “A review of the role of mechanical forces in cutaneous wound healing,” J. Surg. Res., 2011.