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***Research Article** (Open Access)*

RASPBERRY PI BASED MILITARY SURVEILLANCE SYSTEM USING NFC AND IOT

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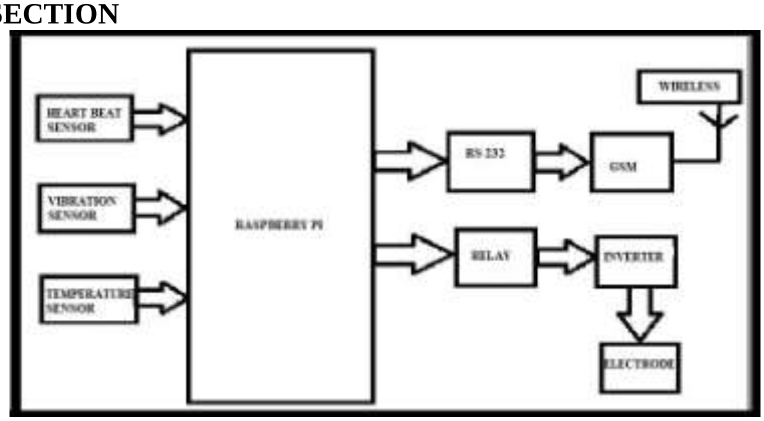
ABSTRACT
The textile-based wearable electronics that can be used into military protective clothing system is developed . Bullet proof technology is selected as one of the most promising and safe protective methods. A working of this cotton will produce heat while we are giving a current to this cloth based on the atmospheric temperature our cloth will vary the heatness of the cloth by vary current rating using microcontroller .In addition to this, in the battle field if our soldier shooted by enemy it will sense by piezoelectric sensor then automatically sends a message to our army office. By using this idea we can easily found the soldier status in battle area. If soldiers strength is not enough to against enemy's strength then we sends extra force to the battle area. It is very easy to save our country. And we added some of the biomedical sensor to monitoring heart beat.

***Key Words:** Electronic textiles, military, finding location, heart beat sensor, IoT, NFC*

INTRODUCTION
A new type of military coat that it contains cotton fiber inside and we placed wired type electrode over the fiber and we give ac 230V supply to the cotton fiber so the ions spread all over the fiber. It generates heat in the cotton. So the coat will get worm. Then we provide piezo electric crystal over the coat, it is used to sense the vibration. whenever the soldiers are in duty for watching border area, if anybody attacks our soldier, then the piezoelectric sensor get vibrates so it produce some voltage it is sense by the microcontroller inbuilt ADC.. and heart beat, respiratory sensor to measure health condition by the microcontroller send the signal through base station by using wireless network and also it send the exact location of our soldiers using GPS which is interface to microcontroller using RS232 communication.

SYSTEM OVERVIEW
In this system we are introducing a new way of getting warm condition which makes the soldiers to feel better in the battle field which is actually a cooling area. Also by using GSM techniques we use to find the location of the soldiers and also we added a sensor to measuring our heart beat rate.

MATERIALS AND METHODS
TRANSMITTER SECTION



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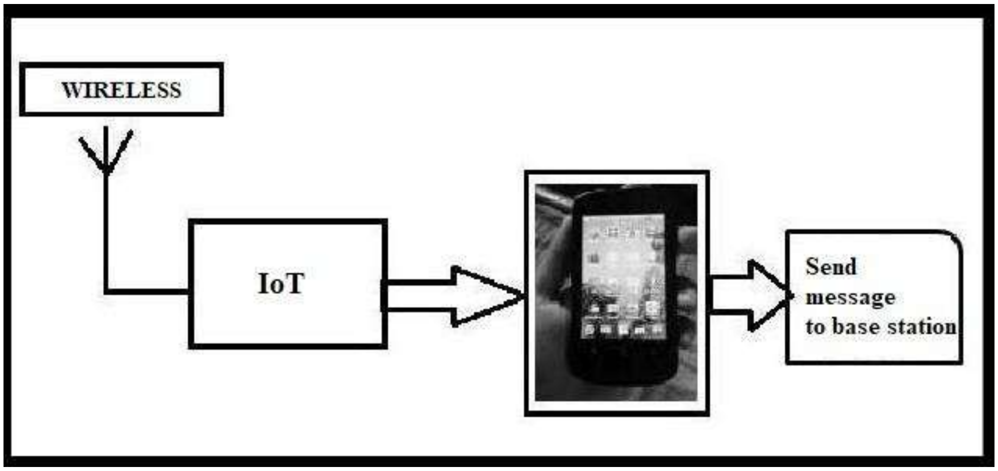
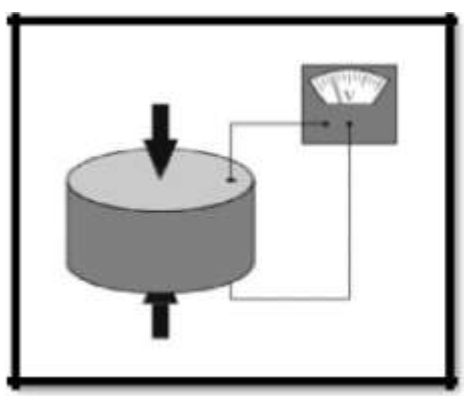


HEART BEAT SENSOR

The Heart Beat Sensor provides a simple way to study the heart's function. This sensor monitors the flow of blood through Finger. As the heart forces blood through the blood vessels in the Finger, the amount of blood in the Finger changes with time. The sensor shines a light lobe (small High Bright LED) through the ear and measures the light that is transmitted to LDR . The signal is amplified, inverted and filtered, in the Circuit .By graphing this signal, the heart rate can be determined, and some details of the pumping action of the heart can be seen on the graph.

VIBRATION SENSOR



A **piezoelectric sensor** is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical charge. Piezoelectric sensors have proven to be versatile tools for the measurement of various processes. They are used for quality assurance, process control and for research and development in many different industries. Although the piezoelectric effect was discovered by Pierre Curie in 1880, it was only in the 1950s that the piezoelectric effect started to be used for industrial sensing applications. Since then, this measuring principle has been increasingly used and can be regarded as a mature technology with an outstanding inherent reliability. It has been successfully used in various applications, such as in medical, aerospace, nuclear instrumentation, and as a pressure sensor in the touch pads of mobile phones.

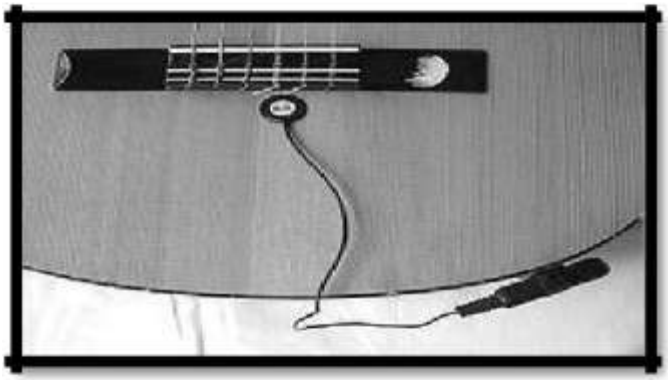


Figure: Piezoelectric disk used as a guitar pickup

In the automotive industry, piezoelectric elements are used to monitor combustion when developing internal combustion engines. The sensors are either directly mounted into additional holes into the cylinder head or the spark/glow plug is equipped with a built in miniature piezoelectric sensor (Abdelsalam et al., 2011). The rise of piezoelectric technology is directly related to a set of inherent advantages. The high modulus of elasticity of many piezoelectric materials is comparable to that of many metals and goes up to 10^6 N/m^2.Even though piezoelectric sensors are electromechanical systems that react to compression, the sensing elements show almost zero deflection. This is the reason why piezoelectric sensors are so rugged, have an extremely high natural frequency and an excellent linearity over a wide amplitude range. Additionally, piezoelectric technology is insensitive to electromagnetic fields and radiation, enabling measurements under harsh conditions. Some materials used (especially gallium phosphate (Bhatnagar M and Baliga B J 1993) or tourmaline) have an extreme stability even at high temperature, enabling sensors to have a working range of up to 1000 °C. Tourmaline shows pyroelectricity in addition to the piezoelectric effect; this is the ability to generate an electrical signal when the temperature of the crystal changes. This effect is also common to piezoceramic materials. One disadvantage of piezoelectric sensors is that they cannot be used for truly static measurements. A static force will result in a fixed amount of charges on the piezoelectric material. While working with conventional readout electronics, imperfect insulating materials, and reduction in internal sensor resistance will result in a constant loss of electrons, and yield a decreasing signal. Elevated temperatures cause an additional drop in internal resistance and sensitivity. The main effect on the piezoelectric effect is that with increasing pressure loads and temperature, the sensitivity is reduced due to twin-formation. While quartz sensors need to be cooled during measurements at temperatures above 300 °C, special types of crystals like $GaPO_4$ gallium phosphate do not show any twin formation up to the melting point of the material itself.

However, it is not true that piezoelectric sensors can only be used for very fast processes or at ambient conditions. In fact, there are numerous applications that show quasi-static measurements, while there are other applications with temperatures higher than 500 °C.

Piezoelectric sensors are also seen in nature. The collagen in bone is piezoelectric, and is thought by some to act as a biological force sensor.(Bhatnagar M and Baliga B J 1993) (Elasser et al., 2003).

Principle of operation

Depending on how a piezoelectric material is cut, three main modes of operation can be distinguished: transverse, longitudinal, and shear. [4]

Transverse effect

A force is applied along a neutral axis (y) and the charges are generated along the (x) direction, perpendicular to the line of force. The amount of charge depends on the geometrical dimensions of the respective piezoelectric element. When dimensions *a*,*b*,*c* apply,

$C_x = d_{xy} F_y b / a$,

where *a* is the dimension in line with the neutral axis, *b* is in line with the charge generating axis and *d* is the corresponding piezoelectric coefficient.[3]

Longitudinal effect

The amount of charge produced is strictly proportional to the applied force and is independent of size and shape of the piezoelectric element. Using several elements that are mechanically in series and electrically in parallel is the only way to increase the charge output. The resulting charge is

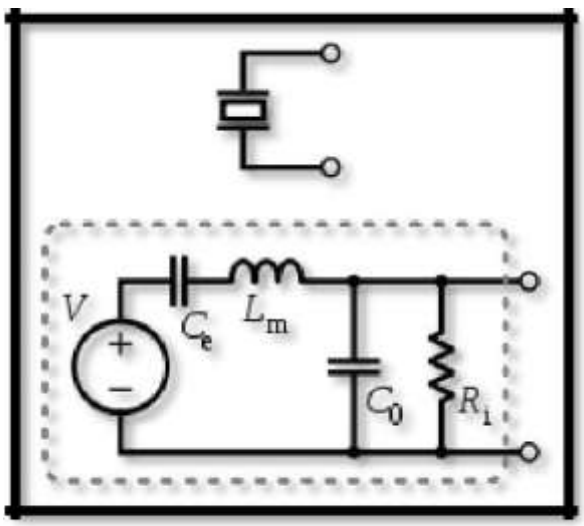
$Cx = dxxFxn$,

where *dxx* is the piezoelectric coefficient for a charge in x-direction released by forces applied along x-direction (in pC/N).

Fx is the applied Force in x-direction [N]

and *n* corresponds to the number of stacked elements force applied and the element dimension.

Electrical properties

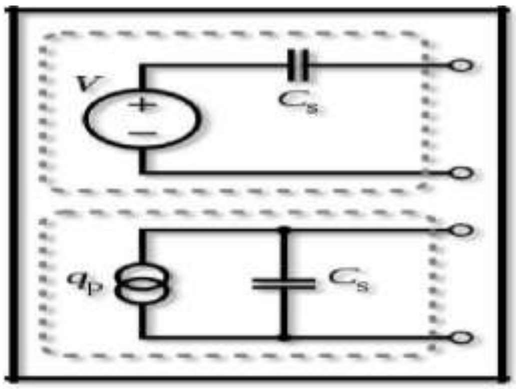


A piezoelectric transducer has very high DC output impedance and can be modeled as a proportional voltage source and filter network. The voltage *V* at the source is directly proportional to the applied force, pressure, or strain. [5] The output signal is then related to this mechanical force as if it had passed through the equivalent circuit. Frequency response of a piezoelectric sensor; output voltage vs applied force.

A detailed model includes the effects of the sensor's mechanical construction and other non-idealities. The inductance *L*m is due to the seismic mass and inertia of the sensor itself. *C*e is inversely proportional to the mechanical elasticity of the sensor.

*C*0 represents the static capacitance of the transducer, resulting from an inertial mass of infinite size. *R*i is the insulation leakage resistance of the transducer element. If the sensor is connected to a load resistance, this also acts in parallel with the insulation resistance, both increasing the high-pass cutoff frequency.

In the flat region, the sensor can be modeled as a voltage source in series with the sensor's capacitance or a charge source in parallel with the capacitance For use as a sensor, the flat region of the frequency response plot is typically used, between the high-pass cutoff and the resonant peak. The load and leakage resistance need to be large enough that low frequencies of interest are not lost. A simplified equivalent circuit model can be used in this region, in which *C*s represents the capacitance of the sensor surface itself, determined by the standard formula for capacitance of parallel plates. [6][7] It can also be modeled as a charge source in parallel with the source capacitance, with the charge directly proportional to the applied force, as above. [5]



Sensor design

Metal disks with piezo material, used in buzzers or as contact microphones based on piezoelectric technology various physical quantities can be measured; the most common are pressure and acceleration. For pressure sensors, a thin membrane and a massive base is used, ensuring that an applied pressure specifically loads the elements in one direction. For accelerometers, a seismic mass is attached to the crystal elements. When the accelerometer experiences a motion, the invariant seismic mass loads the elements according to Newton's second law of motion $F = ma$.

The main difference in the working principle between these two cases is the way forces are applied to the sensing elements. In a pressure sensor a thin membrane is used to transfer the force to the elements, while in accelerometers the forces are applied by an attached seismic mass.

Sensors often tend to be sensitive to more than one physical quantity. Pressure sensors show false signal when they are exposed to vibrations. Sophisticated pressure sensors therefore use acceleration compensation elements in addition to the pressure sensing elements. By carefully matching those elements, the acceleration signal (released from the compensation element) is subtracted from the combined signal of pressure and acceleration to derive the true pressure information.

Vibration sensors can also be used to harvest otherwise wasted energy from mechanical vibrations. This is accomplished by using piezoelectric materials to convert mechanical strain into usable electrical energy

Sensing materials

Two main groups of materials are used for piezoelectric sensors: piezoelectric ceramics and single crystal materials. The ceramic materials (such as PZT ceramic) have a piezoelectric constant / sensitivity that is roughly two orders of magnitude higher than those of the natural single crystal materials and can be produced by inexpensive sintering processes. The piezoeffect in piezoceramics is "trained", so unfortunately their high sensitivity degrades over time. The degradation is highly correlated with temperature. The less sensitive 'natural' single crystal materials (gallium phosphate, quartz, tourmaline) have a much higher – when carefully handled, almost infinite – long term stability. There are also new single crystal materials commercially available such as Lead Magnesium Niobate-Lead Titanate (PMN-PT).

TEMPERATURE SENSOR

Features

- Calibrated directly in ˚Celsius (centigrade)
- Linear +10.0 mV/˚C scale factor
- 0.5˚C accuracy guaranteeable (at +25˚C)
- Rated for full -55˚ to +150˚C range
- Suitable for remote applications
- Low cost due to wafr level trimming
- Operates from 4 to 30 volts
- Less than 60µA current drain
- Low self-heating,0.08˚C in still air
- Nonlinearity only ±1/4˚C typical
- Low impedance output,0.1 Ohm for 1mA load
- **Size:** TO-92 package (about 0.2" x 0.2" x 0.2") with three leads
- **Price:** $2.00 at the Adafruit shop
- **Temperature range:** -40°C to 150°C / -40°F to 302°F
- **Output range:** 0.1V (-40°C) to 2.0V (150°C) but accuracy decreases after 125°C
- **Power supply:** 2.7V to 5.5V only, 0.05 mA current draw

Inverter (electrical)

An **inverter** is an electrical device that converts direct current (DC) to alternating current (AC) [1]; the converted AC can be at any required voltage and frequency with the use of appropriate transformers, switching, and control circuits.

Solid-state inverters have no moving parts and are used in a wide range of applications, from small switching power supplies in computers, to large electric utility high-voltage direct current applications that transport bulk power. Inverters are commonly used to supply AC power from DC sources such as solar panels or batteries.

The inverter performs the opposite function of a rectifier.

Grid tie inverter

Main article: Grid tie inverter

A **grid tie inverter** is a sine wave inverter designed to inject electricity into the electric power distribution system. Such inverters must synchronise with the frequency of the grid. They usually contain one or more Maximum power point tracking features to extract the maximum amount of power, and also include safety features.

When main power is restored, a rectifier supplies DC power to recharge the batteries.

Induction heating

Inverters convert low frequency main AC power to higher frequency for use in induction heating. To do this, AC power is first rectified to provide DC power. The inverter then changes the DC power to high frequency AC power.

HVDC power transmission

With HVDC power transmission, AC power is rectified and high voltage DC power is transmitted to another location. At the receiving location, an inverter in a static inverter plant converts the power back to AC.

Variable-frequency drives

Main article: variable-frequency drive

A variable-frequency drive controls the operating speed of an AC motor by controlling the frequency and voltage of the power supplied to the motor. An inverter provides the controlled power. In most cases, the variable-frequency drive includes a rectifier so that DC power for the inverter can be provided from main AC power. Since an inverter is the key component, variable-frequency drives are sometimes called inverter drives or just inverters. **Electric vehicle drives**

Adjustable speed motor control inverters are currently used to power the traction motors in some electric and diesel-electric rail vehicles as well as some battery electric vehicles and hybrid electric highway vehicles such as the Toyota Prius and Fisker Karma. Various improvements in inverter technology are being developed specifically for electric vehicle applications. [4] In vehicles with regenerative braking, the inverter also takes power from the motor (now acting as a generator) and stores it in the batteries.

The general case

A transformer allows AC power to be converted to any desired voltage, but at the same frequency. Inverters, plus rectifiers for DC, can be designed to convert from any voltage, AC or DC, to any other voltage, also AC or DC, at any desired frequency. The output power can never exceed the input power, but efficiencies can be high, with a small proportion of the power dissipated as waste heat.

APPLICATION & ADVANTAGES

Specially designed for temperature resist Automatic alert system for solder attack

NEAR FIELD COMMUNICATION

It is a set of communication protocol used for exchanging the data between two devices, here it is not needed to be paired for every time. Normally, if Bluetooth is turned ON it is always looking for nearby devices for every certain interval of time, by using this technology, when the users NFC band comes into the range Bluetooth will identify the band, by identifying the state we just turned ON the devices.

IoT

The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to- human or human-to-computer interaction The definition of the Internet of things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smart phones and smart speakers. There are a number of serious concerns about dangers in the growth of IoT, especially in the areas of privacy and security, and consequently industry and governmental moves to begin to address these.

How IoT works

An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data. The connectivity, networking and communication protocols used with these web-enabled devices largely depend on the specific IoT applications deployed. IoT can also make use of artificial intelligence (AI) and machine learning to aid in making data collecting processes easier and more dynamic.

IoT standards and frameworks

There are several emerging IoT standards, including the following: IPv6 over Low-Power Wireless Personal Area Networks (*6LoWPAN)* is an open standard defined by the Internet Engineering Task Force (IETF). The 6LoWPAN standard enables any low-power radio to communicate to the internet, including 804.15.4, Bluetooth Low Energy (BLE) and Z-Wave (for home automation). ZigBee is a low-power, low-data rate wireless network used mainly in industrial settings. ZigBee is based on the Institute of Electrical and Electronics Engineers (IEEE) 802.15.4 standard. The ZigBee Alliance created Dotdot, the universal language for IoT that enables smart objects to work securely on any network and understand each other. LiteOS is a Unix-like operating system (OS) for wireless sensor networks. LiteOS supports smart phones, wearables, intelligent manufacturing applications, smart homes and the internet of vehicles (IoV). The OS also serves as a smart device development platform.OneM2M is a machine-to- machine service layer that can be embedded in software and hardware to connect devices. The global standardization body, OneM2M, was created to develop reusable standards to enable IoT applications across different verticals to communicate. Data Distribution Service (DDS) was developed by the Object Management Group (OMG) and is an IoT standard for real-time, scalable and performance M2M communication Advanced Message Queuing Protocol (AMQP) is an open source published standard for asynchronous messaging by wire. AMQP enables encrypted and interoperable messaging between organizations and applications. The protocol is used in client-server messaging and in IoT device management. Constrained Application Protocol (CoAP) is a protocol designed by the IETF that specifies how low-power, compute-constrained devices can operate in the internet of things. Long Range Wide Area Network (LoRaWAN) is a protocol for WANs designed to support huge networks, such as smart cities, with millions of low- power devices.

RESULTS AND DISCUSSION

In this project, we present a new type of military coat that produces a warm condition automatically by using an electrode which is placed in cotton fiber inside the coat. This system has an advantage that it is used to find the exact location of the soldiers by using NFC and IoT and automatically sends a message to base station through GSM. Also it can be used to monitoring our heart beat rate by using a sensor called heart beat sensor.

In this project we have presented a military coat that can easily make our soldiers to feel better in a warm condition, done to monitor physiological parameters such as heart beat rate. A prototype was successfully developed and tested to establish the proof of concept. The algorithms were tested and found to be accurate and reliable at this developed/development stage. The novel aspect of the design is its low cost. This is an enormous improvement over existing commercial products. It is very easy to save our country.

REFERENCES

[1] **Abdelsalam A K, Massoud A M, Ahmed S and Enjeti P N (2011).** High Performance adaptive petrub and observe MPPT techniques for photovoltaic-Based microgrids,*IEEE Trans. Power Electron*, **26**(4)1010-1021.

[2] **Bhatnagar M and Baliga B J (1993).** Comparison of 6 H - SIC, 3 C-SIC, and Si for ower devices, *IEEE Trans. Electron Devices,* **40**(3) 645–655.

[3] **Elasser A, Kheraluwala M H, Ghezzo M, Steiger wald R L, Evers R L, Kretchmer J and Chow T P (2003).** A comparative evaluation of new silicon Carbide diodes and state-of-the-art silicon diodes for power electronic applications, *IEEE Trans. Ind. Appl.*,**39**(4) *915–921.*

[4] **Fang Y, Ma X (2010)**, A novel pv micro inverter with coupled inductors and double-boost topology, *IEEE trans.power electron.,* **25**(12) *3139-3147.*

[5] **Hsieh Y C, Hsueh T C and Yen H C (2009).** An interleaved boost converter with zero- voltage transition, *IEEE Trans. Power Electron* , **24**(4) 973– 978.

[6] **Ji Y H, Jung D Y, Kim J G, Kim J H, Lee TW and Won C Y (2011).** A real maximum power point tracking method for mismatching compensation in PV array under partially shaded conditions, *IEEE trans.power electron,* **26**(4) *1001-1009.*

[7] **Jung D Y, Ji Y H, Park S H, Jung Y C and Won CY (2011).** Interleaved Soft - switching boost converter for photovoltaic power-generation system, *IEEE Trans.Power Electron,* **26**(4) 1137–1145.

[8] **Miwa B A, Otten DM, Schlecht ME (1992).** High efficiency power factor Correction using interleaving techniques‖,*IEEE APEC* 557 – 568.