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Use of MEMS Technology in Human Health Monitoring System

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ABSTRACT: As the populace is expanding around the world, tremendous need emerges to give appropriate social insurance administrations. With the approach of current advancements the need-hole might be enlarged. Sensor is one such innovation which can be utilized to empower Internet of Things based medicinal services checking framework. In this framework, usage of such a framework is depicted. In an ongoing wellbeing checking framework, there are numerous sensors joined with a neighborhood information preparing unit through a mutual channel having an altered data transmission. These sensors have a wide assortment of channel access necessities. The entrance to the channel ought to be discrete, so that every single sensor profits the required data transmission and delay in the common channel. In this framework, a booking method is proposed for the IoT based framework, which invalidates impedance among various sensors and resulting thesis of valuable wellbeing information. Usage of this strategy in our model social insurance checking application is talked about in this framework.

KEYWORDS: Wireless Sensor Network, Internet of Things, Periodic Scheduling, Sensors, Healthcare Monitoring

I. INTRODUCTION

Most creating nations have exceptionally poor medicinal services base. There are not very many healing centers in correlation to the blasting populace. Those couple of healing facilities are deficiently prepared, not very many specialists are available there and all the more critically, the fundamental symptomatic types of gear for the conclusion of life debilitating infections are missing. Presently, assembling new healing facilities, outfitting them with hitech instruments and selecting specialists in those doctor's facilities are entirely costly and long drawn techniques. However, in the event that we could construct an ease compact wellbeing detecting gadget, including a few wearable sensors, fit for measuring the crucial traits of a human body, and can correspond with the Cloud, we could achieve a vast populace and give them quality restorative guidance.

The medicinal administration is given after one of the pro specialists from a gathering of specific specialists display everywhere throughout the globe assesses those wellbeing parameters on the Cloud. In this manner, we can conceivably advantage an expansive populace. A study on Wireless Sensor Network in human services is given. In addition, if the wellbeing detecting gadget is made to correspond with a convenient PC such as a tab or a cell phone which has the default capacity of speaking with Cloud, then the entire framework would be a great deal more savvy.

This is on the grounds that these days the vast majority have entry to these convenient specialized gadgets, and these gadgets have turned out to be very shoddy. The framework can likewise be made IoT (Internet of Things) empowered and M2M (Machine to Machine) good. In this framework, usage of such a social insurance observing framework is displayed. In a human services checking framework, every sensor has changing prerequisites as far as information length or estimate and examining rate. It needs to gauge the wellbeing parameter to get a dependable and reliable result. Information gathering from various sensors all the while is testing one. In a common channel of altered transmission capacity, exchange of the sensor information to the information processor must be made discrete in a suitable way.

For the human services observing framework to be dependable, every sensor ought to opportune measure the information taking after the endorsed examining rate of the parameter, and the information ought to be sent to the

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information processor with no misfortune or cover. In this framework, a booking method is proposed which get rid of any obstruction among various sensors and resulting information misfortune. The two things that are imperative while choosing sensor information booking are - (i) The testing rate required for measuring a parameter and (ii) The size or the information length per test required for measuring a parameter. Parameters like Electrocardiogram(ECG), Electroencephalogram(EEG), Electromyogram (EMG),Respiratory Rate(RR) and other diagram based parameters require higher inspecting rate however have low information length per test, and parameters including pictures (pupal pictures and other infinitesimal pictures) and monitoring require significantly less examining rate yet every specimen has a lot of information. In this way, our target while sending wellbeing information over shared channel would be to give every parameter approach need and hold an opening in time for each parameter. In the event that the parameter information does not fit between time openings of other sensor parameters, then the information must be partitioned into a few sections which fit between time spaces of different parameters.

A. Wearable Smart Sensors

There have been a few effective situations where advancements have moved out of the center to screen patients going about their everyday life over amplified periods. Maybe the most remarkable of these is the position observing framework. Wearable sensor frameworks [1] are logically turning out to be not so much prominent but rather more intense, allowing checking of patients for more timeframes in their ordinary surroundings. Current industrially accessible frameworks are conservative, encased in strong bundling, and use either convenient neighbourhood stockpiling or low-power radios to transmit information to remote servers [1][6][11].

The advancement and refinement of novel creation methods, economical force sources, reasonable capacity limit and more effective correspondence techniques are basic to proceed with this pattern towards "wear and overlook" [11]. Sensors are essentially used to screen three sorts of signs: movement, physiological and natural. Information from these sensors can be gathered, investigated and made accessible to the wearers, parental figures, or medicinal services experts with the objective of enhancing the administration and conveyance of consideration, connecting with patients and empowering free living [6].

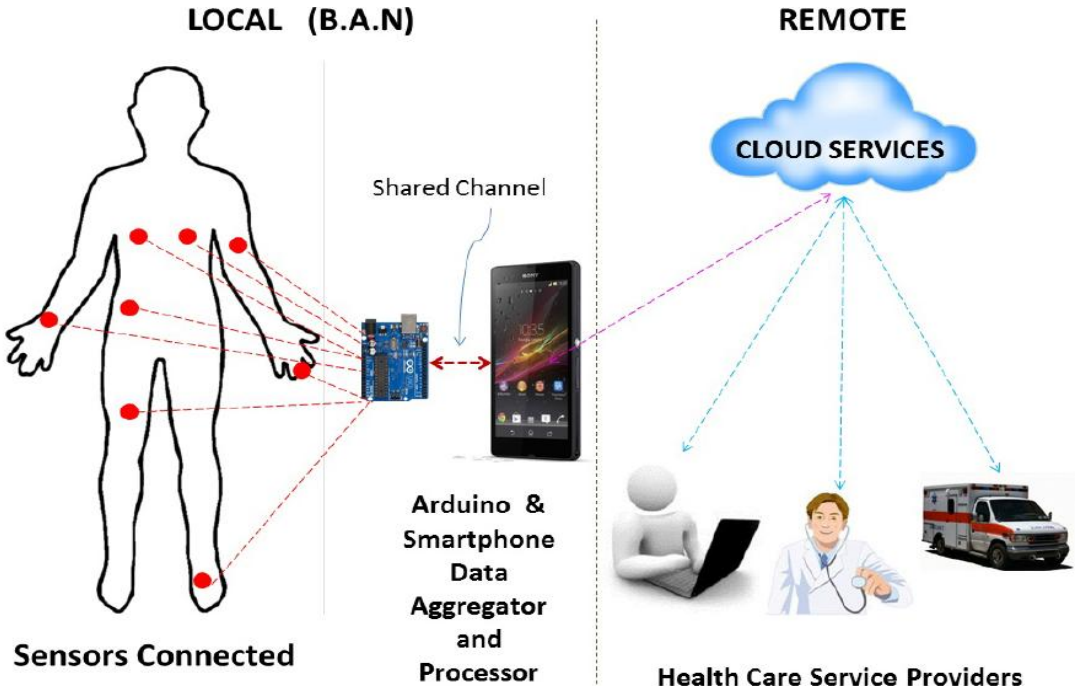

Fig.1. Health Care Monitoring System – Architectural Design

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As appeared in Figure 1, notwithstanding latent observing, interfacing with these sensors through nearby data and correspondence systems can be advantageous for drawing in the wearer and might fundamentally affect selection. For neighbourhood info, adaptable multi-touch sensors have been produced which can be sliced to any wanted shape while for readout, a scope of innovations from natural light emanating diodes (OLED) gadgets to electro-chromic shows and thermo-chromic markers have been exhibited on a basic level. The development of body sensor systems, individual zone systems, and also low power correspondence conventions including ZigBee, Z-Wave, and Bluetooth [6] [11] have rearranged the systems administration of sensors and the gathering of multi-parameter datasets to give a more extensive perspective of the neighbourhood environment of the wearer.

Adaptable sensors, no more compelled to planar geometries, can possibly be one of the key advances in acknowledging omnipresent medicinal services. The improvement of elastomeric and electrically-conductive polymers, ultrathin inorganic and natural semiconductors has empowered adaptable, stretchable electronic frameworks that can fit in with everyday life. It is the similarity of these adaptable sensors with everyday life and the straightforwardness with which they interface with other data correspondence innovations that has driven the far reaching experimentation and examination of their utilization for human services. Utilizing cutting edge manufacture methods, substrates and circuits drawing nearer 1 μm in thickness, twisting radii under 10 μm and weighing under 1 mg/cm2, electronic gadgets can possibly be really indistinct. Audits portraying these advances in manufacture have been as of late distributed.

Non-intrusive adaptable medicinal services gadgets fall into two principle classifications: 1) electronic skins (e-skins) that stick to the body surface and 2) attire based or adornment based gadgets where nearness is adequate. Notwithstanding lightweight adaptable gadgets, fast advances in material science have opened ways to other potential advantages including optically straightforwardness, self-mending gadgets, light recognition and collecting and bio-electrochemically fueled sensors. Albeit showed exclusively, large portions of these advances have yet to be coordinated into a completely practical gadget that has been tried in a non-controlled human environment [1].

B. Activity Monitoring System

The investigation of development can give numerous bits of knowledge into prosperity, restoration and wellness. Non-contact gadgets, for example, pedometers have been broadly accessible for a long time. The idea of 10,000 stages speaking to the action vitality use to adjust the normal calorific admission has been produced and refined in the course of recent decades and grasped by a few general wellbeing efforts. In any case, it has been the improvement of minimal effort inertial sensors using micro-electromechanical systems (MEMS), and complex programming for precisely recognizing steps that has brought about an emotional ascent in the accessibility and utilization of the individual action screens.

Case in point, numerous individual electronic gadgets, including some cell phones, music players and electronic pedometers can track development with some level of affectability. The most precise sensors under perfect circumstances, and aligned for solid grown-ups, are normally exact to +/−3%.

The joining of numerous sensors including accelerometers, spinners, goniometry, power sensors and weight sensors can give more nitty gritty knowledge into development attributes, for example, walk, falls, tremor and dyskinesia. Various late audits have been distributed depicting the innovation included in these gadgets, arrangement contemplations, the estimations which they are prepared to do, and the approval of these estimations. The convergence of adaptable hardware and movement checking gives a rich zone of exploration opportunity. The change of mechanical to electrical vitality utilizing adaptable polymers might demonstrate appealing for vitality reaping, however vitality thickness, solace and solidness are difficulties for making completely self-supported frameworks. Nanotechnology, as fiber strain-gages and carbon nano-tubes for recognizing strain can be promptly included into apparel and other conformal plans, and can be arranged in straightforward structures.

On the other hand, catching the full scope of human movements in a stretchable, non-restrictive outline and consistent reconciliation with other framework segments are difficulties that should be tended to. One zone of awesome guarantee is the joining of symptomatic and restorative frameworks into theranostic gadgets.

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As of late a multifunctional wearable gadget has been created that records muscle action and is incorporated with a controlled transversal conveyance framework for discharging nano particles. There are additionally numerous captivating advances being created that might affect future gadget plan. Shower on sensors, and self-recuperating polymers are two illustrations of advances that might address a percentage of the difficulties with existing methodologies in the more drawn out term. In any case, in the shorter term, the center will possibly stay on mix and solidness of innovations, enhanced calculations for movement location and acceptance of results against different advancements.

C. Physiological Monitors

For some social insurance use cases, it is exceedingly alluring to have sensors prepared to do specifically observing the physiology of the wearer progressively. These sensors can gauge organic, substance or physical marvels to evaluate physiology when in contact with the skin. The innovation test is the manner by which to keep up predictable contact for expanded periods and under various conditions, while the human services difficulties are the way to accomplish a high affectability and specificity for identifying strange occasions progressively. Keeping up predictable contact with the body is a critical test when presented to the changing states of day by day life, and there are distinctive techniques to attempting to accomplish this.

Generally cement based and flexible band approaches have been successful much of the time; however epidermal gadgets and provisional tattoo methodologies are progressively being researched. At the point when a sensor is in long haul contact with the body, various physical and electrical estimations can be made, including heart rate, breathing rate, blood oxygen immersion, ballistocardiography, circulatory strain, electroencephalography (EEG), electrocardiography (ECG), electromyography (EMG) and skin temperature.
For EEG, ECG and EMG capacitive sensors are regularly used to quantify bio-possibilities, while for key sign estimations, for example, heart rate, breath rate and pulse, optical location systems, for example, photoplethysmography or piezoelectric strain sensors are for the most part utilized. The business accessibility of patch-based wearable sensors speaks to a critical progression in individual observing gadget outline, usefulness and wear time. Cases incorporate HealthPatchTM and MetriaTM, which are patch-based wearable biometric sensors that stick to the client's skin and constantly accumulate physiological, way of life data, and different pointers for up to seven days.

D. Environment Monitors

Natural observing is basic both for adding setting to action and physiological estimations, and also checking risks. Wearable sensors that can distinguish introduction to contaminants, for example, explosives, viral DNA, radioactivity or high centralizations of poisonous gasses like carbon monoxide, and observing of toxins, for example, overwhelming metals, allergens, for example, dust, and natural conditions, for example, exceptional bright light could fundamentally enhance wellbeing and security. Sensors can likewise be utilized to screen and enlarge faculties, for example, following eye developments, improving somatosensory criticism, and sifting foundation clamor.

Natural wellbeing observing, especially for work force included in high hazard exercises, has been effectively sought after for quite a few years, however the approach of adaptable and incorporated electronic gadgets has significantly extended their capacities. Multi-parameter sensors are presently being created for torrential slide salvage, crisis responders, and space fly out and are liable to wind up more universal. The investigation of Volatile Organic Compounds (VOCs) in breathed out breath tests can possibly give important data in regards to the movement of a few diseases. While the vast majority of the innovation included in unstable compound discovery techniques is cumbersome and costly, the improvement of miniaturized scale and nano-scale innovation has significantly expanded the inspecting capacities of these sensors, with the potential that they can be utilized as a feature of an omnipresent social insurance framework. Various more point by point audit articles have been composed as of late.

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II. RELATED WORK

In [1], "Wireless sensor networks for healthcare: A survey", the authors "H. Alemdar, C. Ersoy", quoted as Becoming mature enough to be used for improving the quality of life, wireless sensor network technologies are considered as one of the key research areas in computer science and healthcare application industries. The pervasive healthcare systems provide rich contextual information and alerting mechanisms against odd conditions with continuous monitoring. This minimizes the need for caregivers and helps the chronically ill and elderly to survive an independent life, besides provides quality care for the babies and little children whose both parents have to work. Although having significant benefits, the area has still major challenges which are investigated in this paper. We provide several state of the art examples together with the design considerations like unobtrusiveness, scalability, energy efficiency, security and also provide a comprehensive analysis of the benefits and challenges of these systems.

In [2], "Enabling Smartphone as Gateway to Wireless Sensor Network", the authors "Sourav Kumar Dhar, Suman Sankar Bhunia, Sarbani Roy, Nandini Mukherjee", quoted as The communication between Wireless Sensor Nodes and the Internet would require a gateway as these two network works on different standards. Mobile phone may be utilized to bridge this gap [8]. It may act as a gateway for Wireless Sensor Nodes to connect with Internet and vice versa. Also this approach allows the smartphone to enrich the data collected from the Wireless Sensor Nodes before sending it to the Internet. In this paper, a low-cost solution is presented with open-source software and hardware that allows a wide range of smartphones to connect with sensors in a pervasive manner.

In [3], "Health Internet of Things: Metrics and methods for efficient data transfers" the authors "Mersini Paschou, Evangelos Sakkopoulos" quoted as The rapid development of modern Information and Communication Technologies (ICTs) in recent years and their introduction into people's daily lives worldwide, has led to new circumstances at all levels of the social environment. In health care in particular, sensors and data links offer potential for constant monitoring of patient's symptoms and needs, in real time, enabling physicians to diagnose and monitor health problems wherever the patient is, either at home or outdoors. However, the use of Internet of Things concepts in the health domain does not come without extra data and therefore a data transfer cost overheads. To deal with these overheads, novel metrics, and methods are introduced in an attempt to maximize the capabilities and widen acceptance/usage provided by the Internet of Things. Without losing its generality, the method discussed is experimentally evaluated in the paradigm of the Health domain. The focus is on the need for an overview of available data formats and transmission methods and selection of the optimal combination, which can result to reduction/minimization of costs. An analytic methodology is presented backed with theoretical metrics and evaluated experimentally.

In [4], "e-Health monitoring applications: What about Data Quality?", the authors "C. C. G. Rodrguez, M. Riveill" quoted as Data quality analysis remains a difficult issue on several domains (e.g. geographic, software, databases, etc.). This is particularly the case on e-Health monitoring applications for chronic patients, where the need of data quality to ensure correct decision making is very important. Patients monitoring refers to a continuous observation of patient's condition (physiological and physical) traditionally performed by one or several body sensors. In fact, significant actions and decisions are based on data coming from such sensors (e.g. remote diagnosis, consultations, hospitalization…). Providing high data quality helps to guarantee a correct processing and interpretation of information, as well as the appropriate intervention of medical services. In this paper, we explore the principles and issues of data quality in this particular domain providing primary research clues and motivation about this subject. We underline the necessity of the analysis of data quality on e-Health applications, especially concerning remote monitoring and assistance of patients with chronic diseases.

In [5], "Internet of Things (IoT): A vision, architectural elements, and future directions", the author "J. Gubbi et al" quoted as Ubiquitous sensing enabled by Wireless Sensor Network (WSN) technologies cuts across many areas of modern day living. This offers the ability to measure, infer and understand environmental indicators, from delicate ecologies and natural resources to urban environments. The proliferation of these devices in a communicating-actuating network creates the Internet of Things (IoT), wherein sensors and actuators blend seamlessly with the environment around us, and the information is shared across platforms in order to develop a common operating picture (COP). Fueled by the recent adaptation of a variety of enabling wireless technologies such as RFID tags and embedded sensor and actuator nodes, the IoT has stepped out of its infancy and is the next revolutionary technology in transforming the

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Internet into a fully integrated Future Internet. As we move from www (static pages web) to web2 (social networking web) to web3 (ubiquitous computing web), the need for data-on-demand using sophisticated intuitive queries increases significantly. This paper presents a Cloud centric vision for worldwide implementation of Internet of Things. The key enabling technologies and application domains that are likely to drive IoT research in the near future are discussed. A Cloud implementation using Aneka, which is based on interaction of private and public Clouds is presented. We conclude our IoT vision by expanding on the need for convergence of WSN, the Internet and distributed computing directed at technological research community.

In [6], "A cooperative Internet of Things (IoT) for rural healthcare monitoring and control", the authors "V. M. Rohokale, R. P. Neeli, R. Prasad", quoted as Internet of Things (IoT) concept enables the possibility of information discovery about a tagged object or a tagged person by browsing an internet addresses or database entry that corresponds to a particular active RFID with sensing capability. It is a media for information retrieval from physical world to a digital world. With cooperative wireless communication, the wireless node entities can increase their effective quality of service (QoS) via cooperation. In developing countries the death rates due to lack of timely available medical treatments are quite high as compared to other developed countries. The majority of these deaths are preventable through quality care. This paper proposes a cooperative IoT approach for the better health monitoring and control of rural and poor human being's health parameters like blood pressure (BP), hemoglobin (HB), blood sugar, abnormal cellular growth in any part of the body, etc.

III. SYSTEM ANALYSIS

A. Existing Work

- ✓ Data loss while converting Analog to Digital
- ✓ Accuracy is less.
- ✓ Delay in Real time Data transmission.

B. PROPOSED SYSTEM

- ✓ Compact size
- ✓ Long Range communication
- ✓ Multiple Sensors are used
- ✓ Monitor body temperature, positions and motion parallely.
- ✓ Achieving high efficiency

IV. BLOCK DIAGRAM

A. Master Block Diagram

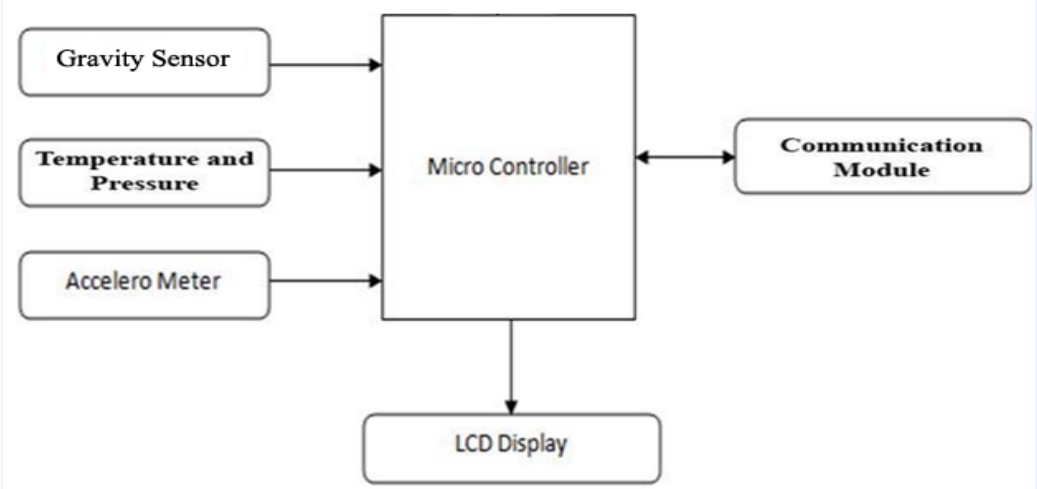

Fig.2. Master Block Diagram

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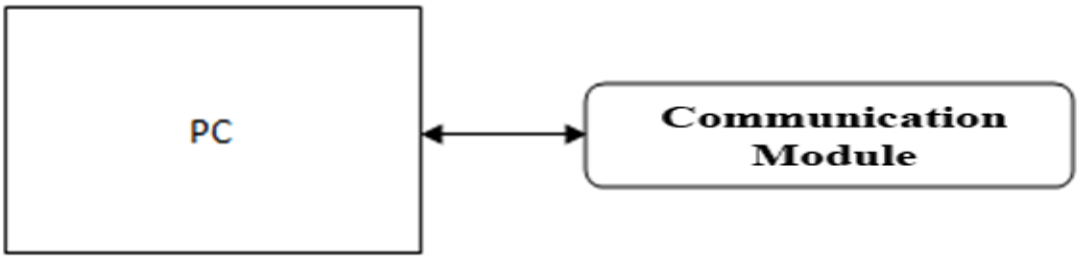

Fig.3. Slave Block Diagram

V. CIRCUIT DIAGRAM

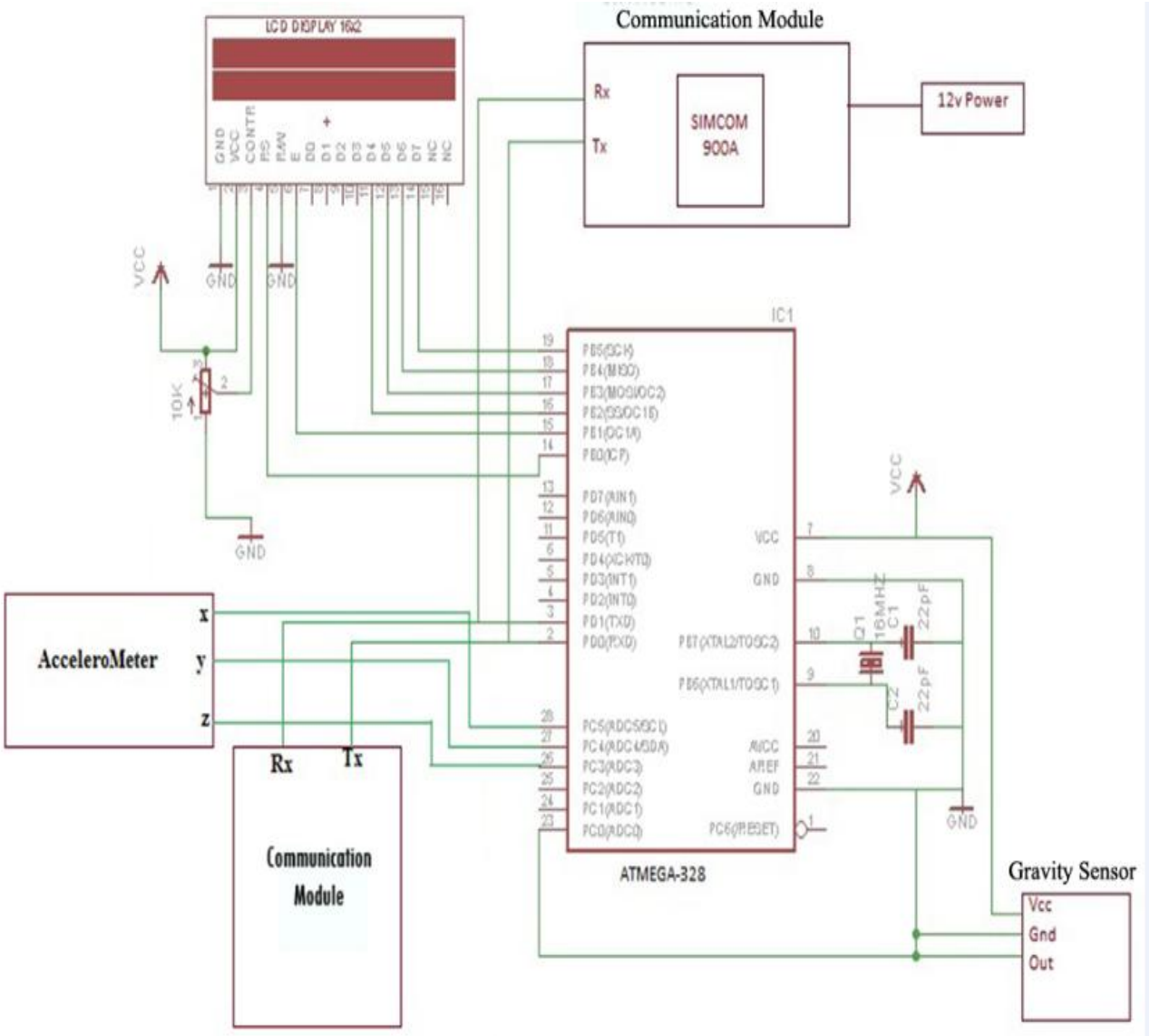

Fig.4. Circuit Diagram

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VI. EXPERIMENTAL RESULTS

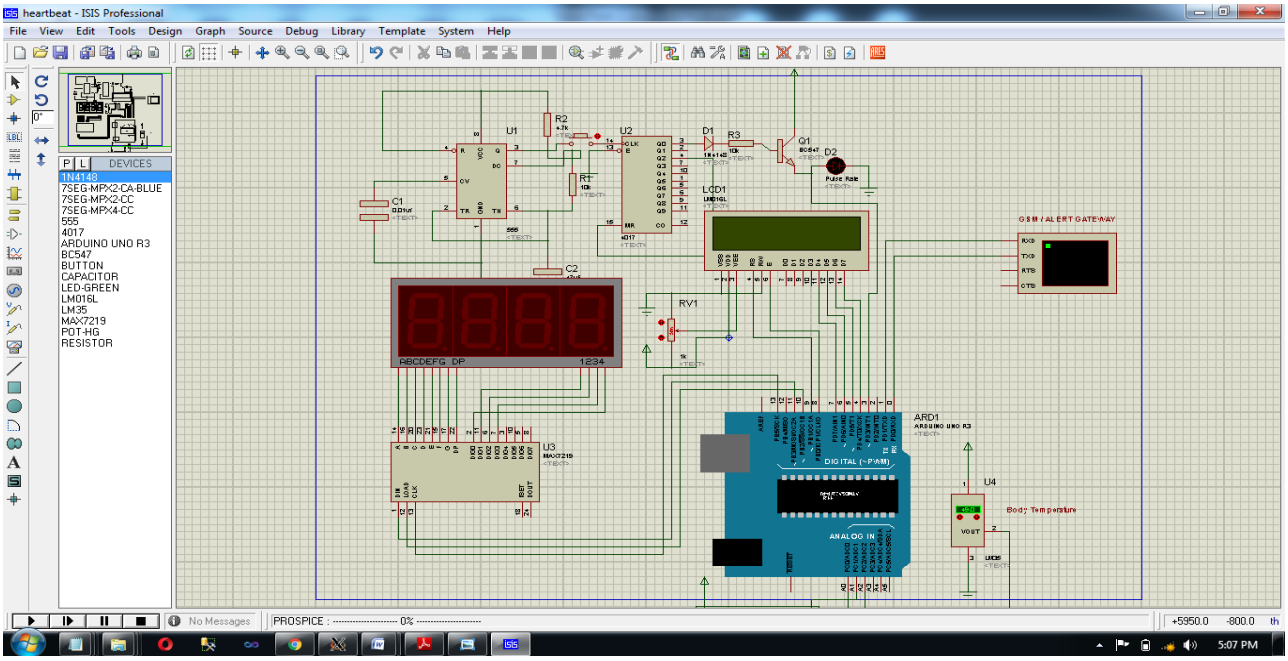

Fig.5. Overall Design

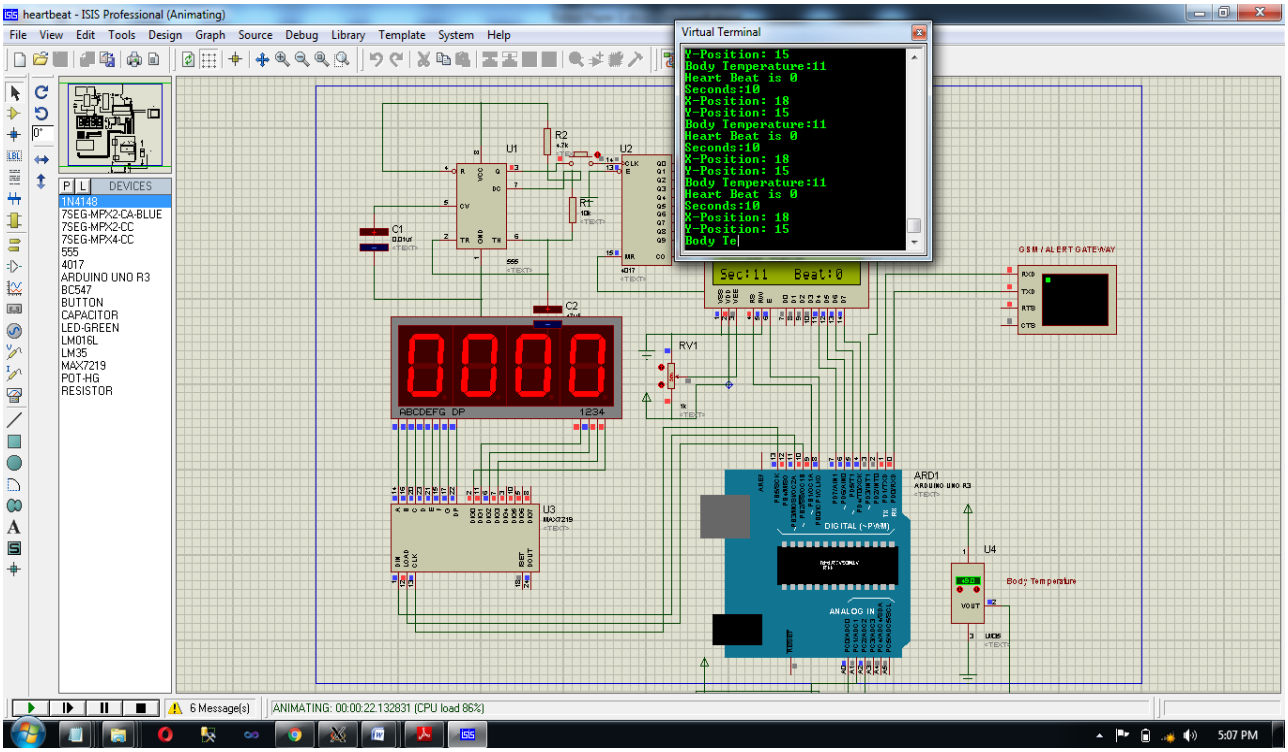

Fig.6. Events Manipulation

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VII. CONCLUSION

For wellbeing checking framework to work appropriately keeping up the testing body positions and postpone necessity of every sensor of the observing framework is essential. As, transfer speed is constrained, we should plan every sensor in a suitable way as specified in this framework, such that the examining positions and temperature is kept up and nature of information is great. We have demonstrated that by interleaving the information as indicated by the required inspecting rate and separating bigger information with greatest permitted information size, we can keep up the testing rate for a few sensors at the same time guaranteeing quality information exchange with productive use of transmission capacity.

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