Fitness Tracking System

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***Abstract*--** The body temperature of the patient must be closely monitored in the hospital.

By observing the temperature, heart rate and keeping track of these parameters, doctors and other paramedical personnel continuously monitor the patient's body temperature. In the case with overcrowded medical sectors, and hectic health workers schedules, this process can be unpredictable and difficult to handle. The key goal of our wireless patient fitness tracking system is to control a patient's body's temperature and pulse rate and wirelessly relay the information captured on the LCD display unit to the doctor's office. At the receiving end, the receiver module is used to gather the information collected and the doctor will analyze the data at any time. To constantly display the patient's body temperature and heart rate wirelessly, the receiver device is kept in the doctor's office. A spectator may be at the end of the receiver and may know when the patient's temperature or heart rate is below or above the usual human threshold of 37°C and 60 beats per minute. The findings obtained show a good way to provide the doctor with details on the emergency care of patients. With this system, emergency departments increase productivity and at the same time increasing the quality of patient care.

***Keywords*-** *Health Pulse rate, Arduino Uno, LM35 Temperature Sensor, Virtual Terminal, RF Module, RFID Technology, LCD Display.*

I. INTRODUCTION

Technology is ruling humanity in the new digital age. A small investment from one would carry the planet to a higher standard of living that makes it easier for them to afford almost anything. In updating itself to current technology and inventions, the planet is at its most serious. The medical sector is now on its way to upgradation in order to offer quality medical treatment to all groups of people. Most hospitals are searching for more reliable strategies for efficient long-term treatments. A good patient management system is critical for such effective treatment. The method of fitness monitoring is a widely integrated application for handling and regulating of varying metrics of human health. It is an excellent monitoring product designed for consumers and doctors to provide precise health/activity tracking along with body temperature. Some of our human health criteria include temperature, heartbeat, blood pleasure, pulse rate, etc. There is a need for constant monitoring of every patient and updates from duty physicians.

Although the available common current systems allow the patient's vital signs to be monitored closely, these systems enable the sensors to be placed on bedside monitors or PCs which does not allow the patients move freely from their beds. This proposed scheme does not require patients to stay at their beds all the time, in fact they can move without any hassle, even within a defined distance. This is because outside this range, the data collection approach will be unfeasible.[6] When considering the importance of human health, it is important to move knowledge in a correct and rapid manner in order to efficiently administer first aid to the patient. It would be easy to recognize patients with the RFID card they hold and to quickly process the previously reported information about that patient by using RFID technology as incorporated with the patient information systems. A combination of sensor networks, modern Radio Frequency Identification (RFID) and Vital Sign Monitoring technology is used to detect vital signs simultaneously [2]. The use of wireless technologies enables the system to be installed in our homes and associated with numerous hospitals. Radio frequency waves will travel through walls and materials, transmitting to a central tracking unit information about vital signs and location through a transmitter network at the end of the patient. The benefits of wireless technology are already evident: portability, comfort, ease of travel, cost-effectiveness, and installation [4]. So, the main aim of our system is to accurately assess and track the significant changes of a patient’s body and send those data to the clinicians.

II. LITERATURE REVIEW

Since we use several I/O devices to reliably sense the data of the patient, process the data and send the data at the end of the recipient, through multiple inquiries, we need to get knowledge of the components and their functionality. In his study "Wireless sensor network for e-health system based on radio-active and radio-passive positioning," Anliker U., J. A. Ward et.al [1] developed A wearable device of patient tracking and alarm for people at risk of heart and respiratory disease. However, routing on wireless sensor networks differs in various ways from conventional fixed network routing. No facilities are available, wireless links are unstable, sensor nodes can malfunction, and routing protocols must follow strict energy saving requirements. With this project, our objective is to ensure the secure and using the requisite sensors and control boards and to provide a flexible fitness tracking technology by the continuous transmission of information.

Alexandros, Pantelopoulos et.al [3] considered symptom ambiguity and causal relationships between various disorders and symptoms to derive a thorough estimation with a certain degree of confidence.

III. METHODOLOGY

The proposed device consists of an electricity supply, a temperature sensor, a pulse sensor, an Arduino uno (microcontroller), an LCD and an RF antenna, which is the transmitter of the RF link. The power supply is a device which provides electrical energy to the whole system. When a finger is placed on it, the pulse sensor in the transmitter is programmed to give a digital heartbeat output. When the heart beat detector is working, the beat LED flashes in sync with each pulse. This digital output can be directly connected to the Microcontroller to measure the Beats per Minute (BPM) rate via program code. This functions on the theory of light modulation at each pulse by the finger on blood supply. The temperature sensor is connected to a patient whose temperature needs to be monitored for well-being. Its values are represented in millivolts (mV) sent to the Microcontroller of Arduino uno. These are received between 0-1024 as analog signals and are mapped by written software codes to 5V. The Arduino scales and translates the value to a digital value sent to the antenna of the RF transmitter and displays it on the Liquid Crystal Monitor of the transmitter. These values are transmitted to the receiver section by the RF link transmitter antenna.

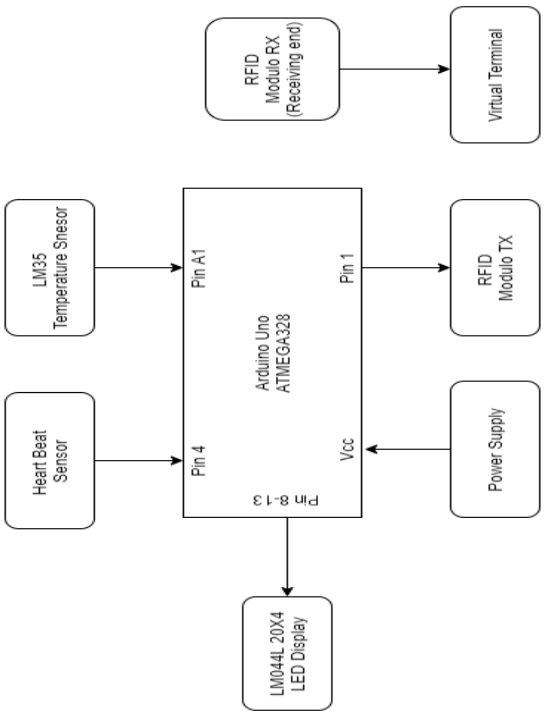

Fig 1: Block Diagram of Fitness Tracking

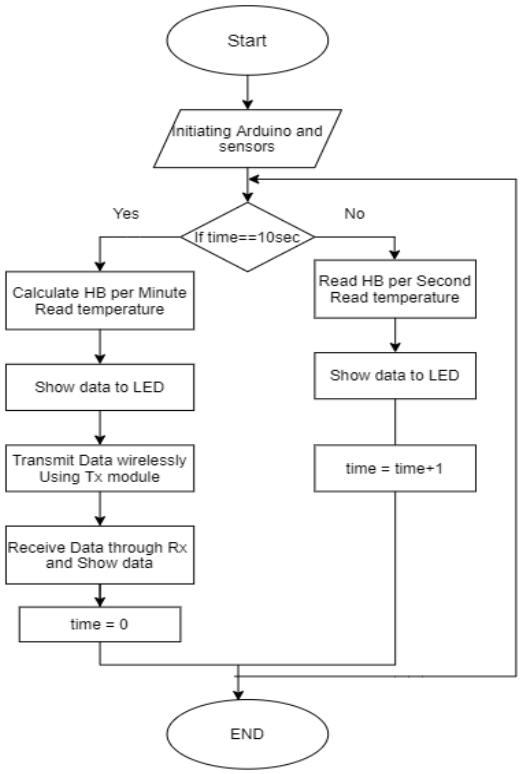

Fig 2: Data flow diagram of Fitness Tracking System

A. LM35 Temperature Sensor: This is a temperature measurement sensor that has a temperature-proportional analog output voltage. In Centigrade, it provides output voltage (Celsius). Any external calibration circuitry is not required. LM35's sensitivity is 10mV/degree Celsius. Output voltage also increases with rising temperature. E.g., 250 mV means 25°C.It is a 3- terminal sensor used to calculate temperatures ranging from -55 °C to 150 °C in the area. LM35 provides a more reliable temperature output than the thermistor output.

Fig 3: LM35 Temperature Sensor

B. Digital Heart Rate Sensor: When a finger is placed on it, the Heart Beat Sensor is programmed to provide digital output of the heartbeat. When the Heart Detector starts working, for every pulse, the topmost LED will start blinking. To calculate the heartbeat per minute (BPM)

rate, it is possible to directly link the output of this sensor to the microcontroller. It works on the theory of regulation of light through blood flow at any pulse through the nerves of the finger. The module output mode is simple, the digital output mode is easy to understand, and the serial output is precise.

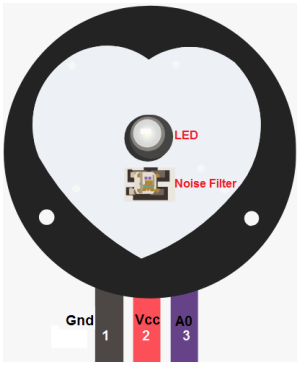

Fig 4: Digital Heart Rate Sensor

C. RF Module: An RF module (short for radio frequency module) is a (normally) small electronic unit used for the transmission and/or reception of radio signals by two devices. Communicating wirelessly with another computer is often useful for an embedded system. This module will be used to relay pulse rate and temperature measurements from the Arduino's receiving end.

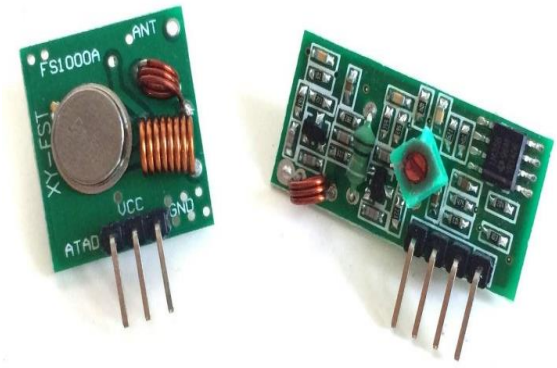

Fig 5: RF Module

D. RFID: The advances of science and technology in the healthcare sector have increased the quality of the lives of people. Barcode technology was used prior to the introduction of RFID technology in the area of healthcare. In order to instantaneously Identify tags attached to items and register them, radio-frequency identification (RFID) uses electromagnetic fields. RFID is going to be used as our system's protocol.

Fig 6: RFID technology

E. Arduino MCU: A microcontroller board based on the ATmega328 is the Arduino Uno. It has 14 digital input or output pins, six of which can be used as PWM outputs, six analog inputs, a 16 MHz crystal oscillator, a USB port, a power jack, a reset button and an ICSP header. Using Arduino Uno, we can process the pulse rate and temperature values and display them on LCDs and virtual terminals.[3]

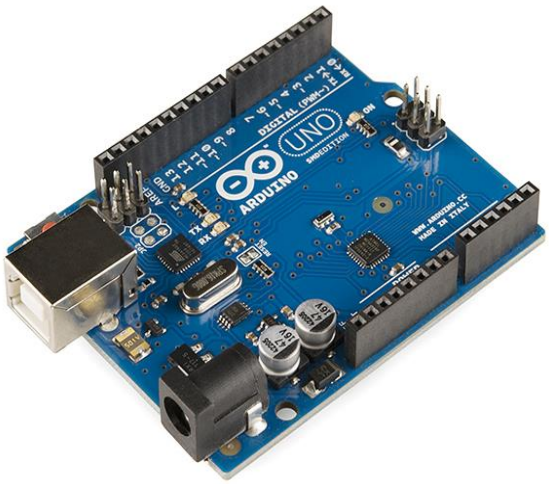

Fig 7: Arduino MCU

F. LCD Display: The LCD is known as a diode that produces images using small cells and ionized gases. On the modulating property of light, the LCD operates. The modulation of light is the method of transmitting and receiving the signal via the light. A small amount of energy is absorbed by the liquid crystal, since it is the reflector and the light transmitter. Typically, it is used for seven segmental displays.

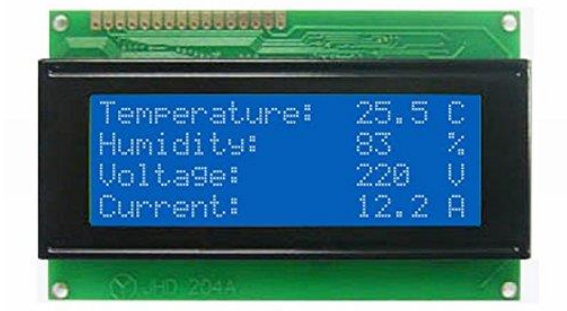

Fig 8: LCD display

We have wired the LM35 temperature sensor in our project to the Arduino analog input pin (A1). After that, the heartbeat sensor is attached to the Arduino digital input pin (4). Then, a push-down button is attached to the Arduino Digital Pin (2). At last, the transmitting RF module is attached to the Arduino digital pin (1). Digital I/O pins are also being used to join the LCD display to the Arduino. On the LCD display, when simulate the proteus file, we get to see the analog temperature output transformed into real life value. For 10 consecutive seconds, a counter is being applied for measuring the heartbeats per second when the push down button is pressed.

The counter is then multiplied with 6 so that it can calculate the heart rate per minute. The calculated BPM will be shown on the LCD. Finally, the output is also sent via radioactive frequency by the RF transmitting module to the receiving module and by connecting a virtual terminal here, we can observe that the sending data is properly received by the recipient end.

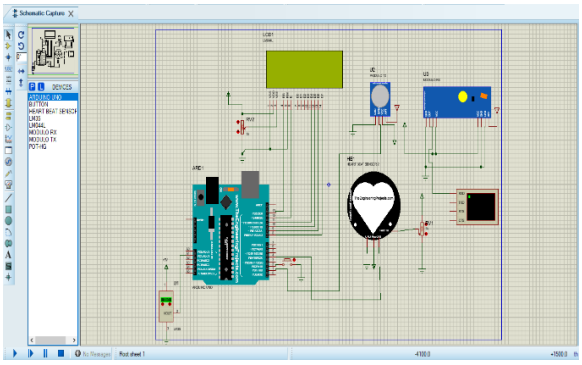

Fig 9: Schematic Diagram of the system using Proteus Software

IV. DESIGNING 3D MODEL

The first stage in the process of digital manufacturing is design. We explored the approach of a designer to the phase of design and development, from the idea to the 3D model. We also tried to build our 3D model by thinking about knowing user needs, and then as we dived deeper into Autodesk Fusion 360 modeling, we explored design requirements. Using Autodesk Fusion 360, we have made a 3D version. Here, the 3D model proposed is shown as below.

Fig 10: 3D model of the proposed system using Autodesk Fusion 360

V. RESULT

After considering all the variables, we can come across numerous decisions. Our proposed system is relatively inexpensive and has considerations such as economic feasibility and scalability in the context of our economy, as well as portability. With such a low expenditure, it can be used in both medical sectors and households. In addition, in terms of precision, LM35 is used by several projects for finding A temperature that gives +-1 precision. We've done proper calibration, which will produce more reliable performance, and because we're using a 5V power supply that is effective for this device. We use a

hand-based heart rate sensor that does not produce the most accurate performance. But with calibration, we can get better results from it, and we can calculate a person's real heart rate.

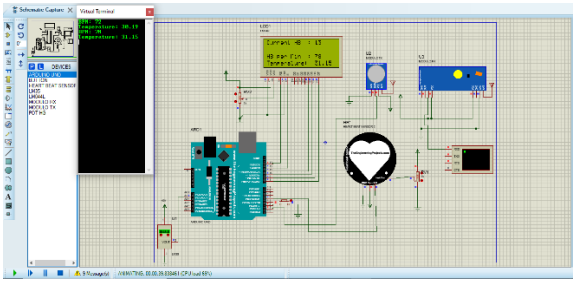

Fig 11: Simulation of the Fitness Tracking System using Proteus Software

VI. CONCLUSION:

Much of the appeal of fitness trackers that makes them useful tools for enhancing personal fitness stems from turning it into a game and from the social component of social media sharing and resulting rivalry. Our built device may serve as a means of identification with a group along with healing treatment, extends to wider involvement. In our proposed DSD project, we have placed in place a fitness tracking

system that can measure human body temperature and heart rate using a home-built computer from a distant place and can collect this information in hospitals. This device can make patients, as well as doctors, very easily aware of the state of the patient, and it is not. Essential for users to be in the hospital all the time.[7] We have proposed an efficient and highly calibrated system. The problems described above can be addressed and a stronger fitness tracking system can be assured.

In the future version of RFID fitness tracking, the capability of accessing medical records of patients from other databases of health care providers via the internet can be explored. The functionality for remotely accessing and updating patient records by medical professionals or consultants using devices such as smart phones can also be created. [5]

VII. REFERENCES:

[1] V.Akhila et al, International Journal of Research in Information Technology, Volume 1,Issue 1, November 2017.

[2] Edward, H, G., G, M., T, W., & K, M. (2005)," A Wireless Health Monitoring System". International Conference on Information Acquisition (pp. 247-252). Hong Kong: Stony Brook Publisher.

[3] Fatusi, D. (2013). Health Sector Reforms and Poverty. Ife: University of Ife Press.

[4] Andrews ,Ford, Haas,Safford (2015,March 27),” SAM Fitness: An Android Wellness Application” ,WORCESTER POLYTECHNIC INSTITUTE

[5] Pai, D'souza, Acharya, Chaitra,(2017)”Healthcare Monitoring using RFID”,Department of Computer Science Engineering, St. Joseph Engineering College, Vamanjoor, India

[6] IEE System Journal(2015,June) ,”RFID-Based Automatic Scoring System for Physical Fitness Testing”

[7] S M A S Masohor, (2020).” Tracking System using RFID for Hiking Activity with IoT Technology”