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Healthcare Management Based on Digital Twin Using IOT (Internet of Things)

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ABSTRACT: This Project proposes real-time health data monitoring with Digital Twin with Augmented Vision for the ICU emergency treatment patients, suggesting that this symptom could be used as screening tool to help identify people with potential high-risk cases who could be recommended to treat immediately. For faster treatment in a hospital, it generates a scannable Augmented Vision (AV) code print. Also, the wearable bio-medical sensor data's also uploading to server system by IoT. the AV code with all patients AV code using android app scanner available, immediately the DT vision Software System fetch the respective persons biomedical sensor values from the server also according to the biomedical sensor values and database data's the DT vision

KEYWORDS: IOT, sensors, digital twin, and electronic health record.

I. INTRODUCTION

The fourth industrial revolution has changed the world completely as it directed the world into an age of automation and digitization. It was an era of digital transformation that took the industries, healthcare, communication, homes, and offices by storm. Various technologies help in achieving our daily tasks. The industrial revolution took decades as the First Industrial Revolution was started in 1850 and the Fourth Industrial Revolution term was coined by Klaus Schwab in 2015. First utilized the power of water and steam to mechanize production. The Second look toward electrical power for mass production. Third, made use of electronics and information technologies for automated production. The fourth revolution is the fusion of different technologies that are blurring the lines between the physical, digital, and biological spheres. Industry 4.0, is also known as Fourth Industrial Revolution, is a hit rather than hype. At heart, Industry 4.0 is the trend towards automation and data exchange. It is the combination of the IoT, big data, CPS, and Artificial Intelligence (AI). These technologies have changed Modern medicine faces multiple challenges related to the increasing need of the population for healthcare services. The demand for solutions from this area is driven by the growing volume of patient data, increasing technological capabilities, and the demand for fast and efficient healthcare processes and systems. The evolving concept of healthcare deviated from focusing solely on the illness towards primary healthcare and health promotion. Healthcare became a multi-level multifaceted complex. In addition to the change in defining what is 'health', the complexity in healthcare resulted from the interaction of different factors such as the specialties in medicine, communication channels, the health system, and the context in which all of these operate. This complexity has undermined the adoption of digitally-enabled innovations in healthcare and often led to resistance in adaptation or failure in application the emergence of evidence-based medicine helped to 'regulate' the clinical decision process by healthcare professionals to achieve optimal treatment. In principle, this requires regular development and updates to clinical guidelines based on research findings. However, the guidelines could not replace the human factor in terms of the physicians' experience, and the patients' input.

II. LITERATURE REVIEW

Miruna-Elena Ihuta proved that a digital twin based approach in healthcare based on EHR data and DT processed on services for the users and services architecture.

SAGHEER KHAN proved that Digital Twin Perspective of Fourth Industrial and Healthcare Revolution.



III. METHODOLOGY

Principle Diagram

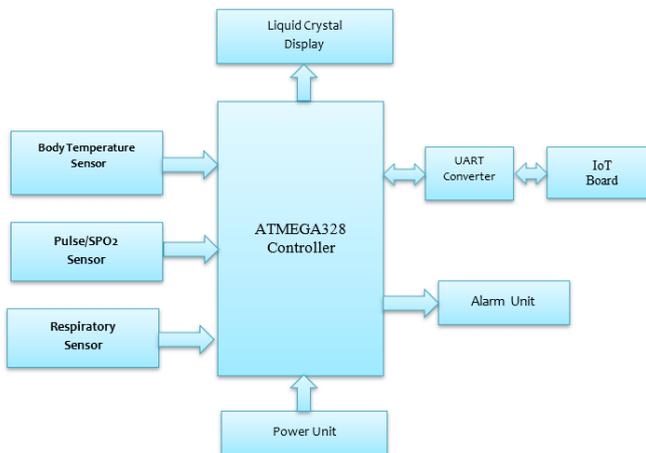


Fig 1: Block Diagram Of The Project Depend On Our Work.

Hardware Requirements

1. ATmega328 controller
2. Body Temperature Sensor
3. Sound (Cough) sensor
4. IoT – NodeMcu
5. LCD
6. Buzzer

Software Requirements

1. Arduino IDE
2. Embedded C language

Digital Twin Functions	Technologies	Applications
Collect and store / monitoring	Digital health devices / sensors	Healthcare monitoring
	IT Cloud	Medicine control
	Mobile Internet technologies	Emergency warning
	Healthcare databases	Treatment plan making
Analyze responsiveness /	Artificial intelligence	Drug development
	Big data analytics	Optimal drugs and treatment dosage
Vizualize and prediction /	Vizualization tools	Medical device design
	AR/VR	Personalized medicine

Table no:1 Used Components On The Our Project

ATMega328 controller:

The high-performance Microchip 8-bit AVR® RISC-based microcontroller combines 32 KB ISP Flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable

USART, a byte-oriented Two-Wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

Body Temperature Sensor:

A high body temperature, or a fever, can indicate an immune response to a foreign intruder in the body such as bacteria. To compensate for this increased internal body temperature, blood vessels dilate, or get wider, to dissipate excess heat. Another way to compensate for higher temperatures is sweating. The evaporation of moisture cools the skin as the body releases heat. Low body temperature can indicate intense environmental effects, such as extreme cold, as well as shock or alcohol poisoning. When the body is unable to produce enough heat to maintain its homeostasis relative to the outside temperature, blood vessels contract, or narrow, to conserve heat. This contraction is not uniform and affects the extremities of the body first. This results in less blood flowing outwards and concentrates heat at the core, where the majority of vital organs are located. Because body temperature is a measure of internal thermal energy, the most accurate measurements involve invasive methods, such as putting a temperature sensor into the esophagus or urinary tract. However, this is neither favorable nor feasible, so peripheral methods are used to estimate the internal body temperature. A few ways that provide reasonable estimations are through the rectum, ear, forehead, armpit, and mouth.

IoT – NodeMcu:

The NodeMCU development board is a powerful solution to program microcontrollers and be part of the Internet of Things (IoT). The NodeMCU development board, based on ESP8266EX, is a cute module with a microcontroller, integrated Wi-Fi receiver, and transmitter. NodeMCU supports several programming languages; hence, it is very easy to upload programs from any computer over a micro-USB port. I have been playing with the NodeMCU for quite a while now and, I have to say, it is a lot more fun than the other available IoT modules. When it comes to prototyping — just another perfect, relatively cheap, easy-to-learn, and user-friendly minuscule magic module.

LCD:

The main components of an LCD include the liquid crystals, the backlight, the color filters, and the electrodes. The liquid crystals control the light passing through them, the backlight provides the light source, the color filters produce the different colors, and the electrodes apply the electric current to manipulate the crystals.

Buzzer:

Electronic component that generates sound through the transmission of electrical signals. Its primary function is to provide an audible alert or notification and typically operates within a voltage range of 5V to 12V. There are various types of these modules that differ in their sound generation mechanisms, operating principles, and applications.

Arduino IDE:

Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment.

A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more. Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

Embedded C Language:

An embedded system is a combination of computer hardware and software—and perhaps additional parts, either mechanical or electronic—designed to perform a dedicated function. A good example is the microwave oven. Almost every household has one, and tens of millions of them are used every day, but very few people realize that a computer processor and software are involved in the preparation of their lunch or dinner.



Fig 2: Output of Digital Twin Health Care in Normal Condition



Fig 3: Output of Digital Twin Health Care in Abnormal Condition

IV. RESULTS

The DT **vision Software System** will show us the details in real-time images as shown in fig (2) and fig (3) for normal datasets i.e **green DT images** for normal stage of and **Red DT images** the organ severe affected Persons with the IOT data sets respectively.

By screening with this the doctor can identify the immediate treatment needed priority people in order, i.e **RED persons** as immediate next for the **orange DT images** peoples and then can check for **the greed DT images** peoples. Such that doctor can save the life of the emergency patients in a sequence treatment order one by one.

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