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AN ECHIP-BASED HEALTHCARE SYSTEM

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ABSTRACT: In order to protect people from threats like COVID-19 infections and aging populations, we need a better medical monitoring system. Problems exist in the present healthcare system due to the lack of a standardized method of linking patients' medical records from different facilities. An IoT health system may be implemented, but it will not provide secure connections to all hospitals and clinics. In our suggested system, people's medical records might be scanned into a computer using an electronic chip-based HMS. There are three parts to this project: a personal electronic chip module, a hospital scanning module, and a web page for storing medical records. A QR display device, for showing the QRcode in the clinic, is included within the digital chip. A camera-based scanned device used in scanning modules reads the digitalchip and compiles Echip data. Data collected from patients' test results will be stored online and updated in real time. You may get the information by scanning the special QR code at any location with a scanner. If you're looking for an economical and workable alternative to the current healthcare system, this is it. The used system will be interoperable with state-of-the-art networking architectures and available worldwide, allowing for better patient care and diagnosis.

Keywords: Healthcare system, electronic chip & QR.

I. INTRODUCTION

No matter what kind of technical progress humanity achieves, concerns about health always surface. The recent outbreak of the Corona virus exemplifies the significance of health concern has evolved into. In areas were the virus has spread, it is best to keep an eye on these people by means of remote health monitoring devices. The best way to incorporate electronic technology into healthcare systems is through the use of QR codes.

Large volumes of patient information are collected constantly by hospitals. With these data, a preliminary diagnosis for the patient may be made. Keeping track of all these hard copies of information is a tedious and time-consuming process. Data retrieval itself is a laborious process. We propose a paperless approach to wellness facilities as an alternative to the current manner of record keeping. Here, we show off a system that takes input from users via a graphical interface they may tweak to their liking.

Existing healthcare systems do not record patients' medical histories online, and even if they did, this information would not be transferable to other hospitals. Patients at various facilities sometimes have the fortitude to go through medical examinations that last far longer than necessary, putting unnecessary strain on staff and wasting valuable resources. Because of the importance of maintaining patient privacy, medical facilities will not share the information they collect with outside parties. The frequent hospital visits of a patient with no identifiable medical history might lead to misdiagnosis. The physician and doctor will be able to make a more precise diagnosis with access to the patient's medical history. Having a complete history of the patient's medical tests already on file helps speed up and improve the quality of care.

More records from this project outline the current healthcare infrastructure and the efforts made to improve it through technological advancements. In this article, we'll discuss how to go about scanning each chip, and then using that information to create an online space that has everything a doctor would need to properly care for a patient. The basic system block diagram is

processed to generate the next concept for the project. Once we had a good model of the block diagram, we could see the E chip being put into action. Informed scans to web pages are a process that we can analyze. Taking note of the project's underlying concepts and its future applications, this study investigates all aspects of an e-chip based smart healthcare system.

II. LITERATURE SURVEY

We provide an in-depth analysis of HMS, covering its fundamental features, services, and processing methods for observing and identifying people's actions.

The primary goal of this research is to use cryptographic techniques to safeguard medical data encoded in QR codes [1]. To prevent unwanted access to QR code data, they combined electronic signatures, data encryption, and accessibility control methods into a safe, real-time label generator and scanner system. The results show that the suggested technique may generate trustworthy and practical QR codes for protecting sensitive healthcare data in a variety of contexts.

The creation of Android applications is the main focus of this project [2]. In order to gather data from those who have completed the Covid'19 exam, this app makes use of QR codes in a questionnaire style. In order to collect data from users and assist stop the spread of this disease, this app uses contactless and wireless technology. People may access their data and outcomes in the apps they use by scanning QR codes.

This method employs Quick Response (QR) codes to provide medical warnings and an in-hospital identifying system for patients. In order to improve medical identification alerts, a special QR Code Tag is given to every member of the medical system. Whenever a patient is on hospital property, they must be wearing their QR Code Identity bracelet. These wristbands have a QR code that, when scanned with a smartphone or dedicated QR code scanner [3], leads to the extensive QR Code Identity website.

QR codes will be incorporated into the plan as a means of providing data accessibility across several platforms. Complete, up-to-date patient records will be transmitted via incremental data updates. [4] This article will also showcase the model's software prototype's structural and graphical user interface design. The efforts increase the availability of patient information throughout their lifetimes, which in turn helps to streamline the sharing of entire patient records shared across medical facilities.

With this setup [5], there are two types of users. The first group consists of administrative personnel, which may include officials from the health ministry, while the second group consists of medical professionals and research facilities. The administrative user has full authority over the system. Every aspect of each patient's situation may be documented and referred to at any moment by the doctor. Users can be anyone, from patients to doctors to pharmacists to scientists. Participants who register and provide required information will be issued a personal health identifier.

Here, we'll discuss how we eliminated the need for traditional paper pamphlets by replacing them with QR codes, so that patients could quickly get the details they required from the comfort of their own mobile devices. since of its contactless nature, it is favored since it reduces the likelihood of spreading viruses. Our results show that QR codes are favored over paper booklets because they are easy to use and are already recognizable to patients. [6] In the post-COVID-19 era, the findings and procedures may help other units enhance infection control.

In this article, we learned about Medi Quick [7], a personal management application that combines QR code technology with Blockchain technology to build a secure virtual smart knowledge of each hospital and provide quick, easy access to that database. In addition to making doctor's appointments, patients may use it to look up health information and buy medicines recommended by their physicians.

The purpose of this research is to provide the underlying theoretical framework for making medical records easily accessible [8]. To provide platform-agnostic access to the concept's informational anchors, the QR code system will be employed. Incremental revisions to data will be utilized to communicate complete, up-to-date information about the patient's lifespan. This article will also showcase the model's software prototype's structural and graphical user interface design. The initiative contributes to enhancing access to permanent patient records, which in turn promotes comprehensive data interchange across healthcare providers.

Establishing a full medical history outside of a hospital setting is possible in several developed nations using methods like: Having authorized professionals (e.g., paramedics, firemen, or police) access more in-depth patient information through the use of technological equipment like smartphones or an independently operated QR code scanner [9] is made possible by the use of QR code wristbands, in earrings, ID cards, and bracelets. On the other side, a patient's prognosis is adversely affected by miscommunication between themselves and their healthcare professional.

In this piece, we'll go through the nuts and bolts of what makes up a PPHM system, or pervasive patient health

monitoring.[10] The PPHM platform utilizes a combination of cloud computing and the Internet of Things. To show how well the planned PPHM infrastructure works, a case study of real-time ECG monitoring for a patient with heart failure that is congestive is provided. The suggested PPHM architecture has been empirically evaluated, and the results indicate that PPHM is a versatile, scalable, and energy-efficient tool for remotely monitoring patients' health.

This article [11] details the process of creating a ZigBee microcontroller-based wireless ecg and temperature monitoring system. The enormous, hospital-specific monitoring system can only be used while the patient is lying in bed. It's designed for patients who aren't in imminent danger but still need to be monitored regularly by a medical professional or loved one while they're at home.

Using the Internet of Things (IoT), the authors of this study [12] presented a novel HMS that monitors vital signs including heartbeat, blood pressure, and electrocardiogram in real-time. Sensors for blood pressure, heart rate, and electrocardiogram (ECG) are automatically monitored by an Arduino UNO, and a Pi camera attached to a Raspberry Pi is used to record video. The Raspberry Pi receives sensor readings from the Arduino UNO and sends them through Wi-Fi to the server's database. After that, the internet connection sends new information to the page every 2 minutes. The internet has made it possible for doctors all around the world to examine patient records and provide textual input.

Healthcare data annotation and analysis, as well as electronic storage and numerous tenant access control, are covered in [13]. At the data storage layer, we employ a multiple-tenant entry mechanism to safeguard patient privacy. The data annotation layer makes use of linked publicly available data to semantically enhance health data interoperability. Individualized treatment plans are better chosen with the help of the process mining approach and the similarity calculation methodology in the data analysis layer. Data storage, processing data, and data analysis are the three basic roles of health monitoring, and they are all provided by this trio of modules. Finally, we consider how our method may be applied to monitoring the distribution of antibiotics.

The suggested hardware design uses low- energy Bluetooth (BLE) and a microcontroller with just a single chip (RFduino) to reduce hardware size and power consumption. [14] A new mechanism called "Smart Case"Lab-tested to ensure quality. We built a 3D-printed smartphone cover to test the efficacy of the technology as well. The outcomes showed that the suggested system was on par with professional medical gear.

III. AN ECHIP BASED HEALTHCARE SYSTEM

As medical science and medicine progress, people have more reason to worry about their wellbeing. Regardless of the coronavirus, it is impossible for any medical professional to provide proper treatment to a patient without a complete medical history. The goals of our health monitoring program are to enhance clinical performance, reduce costs, and improve care for patients. The IT system of the hospital can now collect safepatient data and make it available to other hospitals anywhere in the world thanks to this integrated solution. Thus, medical professionals have ready access to the accurate information they need to make well-informed treatment decisions. A high-quality health monitoring system can only be provided by cutting-edge technology.

Ubiquitous tracking of health with a secure backup either the medical records of the patient is made possible by a surveillance architecture consisting of a chip module, a scanner module, and a website. Using the patient's QR code, the current module may access their authorized medical history. The required output will be generated quickly and accurately using a mix of electronic chip and website technologies.Problems arise when international visitors or patients seek medical care at a facility that requires them to undergo a new battery of tests as part of an entry security check. Regardless of a hospital's or clinic's efforts, there is no standardized method of tracking a patient's medical records beginning at birth history. Because various institutions have varying standards, accuratelydiagnosing a patient's ailment may be delayed or mister ed due to a lack of prognosis.

This project comprises four different modules

- Electronic CHIP module for the public.
- Scanner unit for all the hospitals.
- webpage for the medical sectors.

In order to check in patients at the hospital's entrances, the electronic chip incorporates a controller with a QR display unit. The QR code is read by the status checking unit's esp 32 camera chip when the user flashes it in front of the unit's wireless receiver. Everyone who has ever gone to the hospital should use the status updater website to keep their medical information

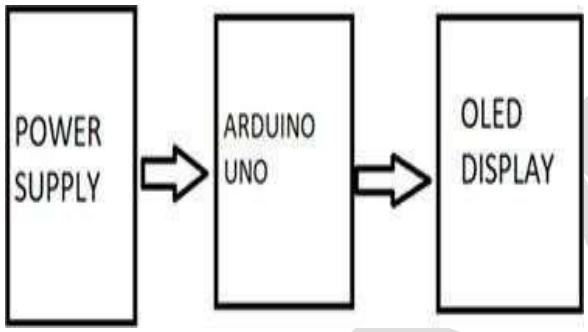
current.

This project will necessitate many components, as seen in the block diagram. Depending on the chosen interface, a microcontroller will save the scanned data, and a second user interface, such as a laptop or tablet, will display the cloud data. To display the QR code, a microcontroller is coupled with an OLED display module. In order to scan the QRcode, the microcontroller receives it from the oled and sends it to the camera. The qr code is quickly decoded by the camera and the ide's screen shows the correct location. As soon as the microcontroller receives permission, it sends the data to the web server, where it may be accessed by any user via any interface. All data is automatically backed up on a regular schedule, and it is easy to keep it up-to-date by inputting new information into a website. Microcontrollers, such as the ardiuno and the esp 32 camera, constitute the backbone of both the electronic chip module and the scanner module.

A. ECHIP module

Key elements of the semiconductor chip module are the CPU, power supply, and OLED. The OLED on the chip module should show the specific code for QR codes, making it easy to scan the text and send the data off to the scanning device. This project uses an Arduino Uno as its microcontroller.
The QR code will be shown on the display module once the chip is activated. All of the information that needs to be shown online about a certain patient can be stored in a QR code on the patient's individual electronic chip module. This smart chip module may be carried by the patient easily to any healthcare facility.
Fig 3.1. Block diagram of ECHIP module

B. Scanner unit



There are primarily three parts that make up the units that check the status: the microcontroller, the power supply, and the TTL module. A microcontroller with built-in Wi-Fi is required for web connectivity. A easy authentication of the code may be achieved if the current status checking module's interface projection module can project the essential information from the display and upload it to the web page. A microcontroller's status monitoring module relies on data gleaned from an interface scanner, which requires the wifi module to be active and paired with its user interface at all times. This compact check-in station is ideal for use in the waiting areas of hospitals or at doctors' offices, but it may be placed virtually anywhere for convenient access to patient information.

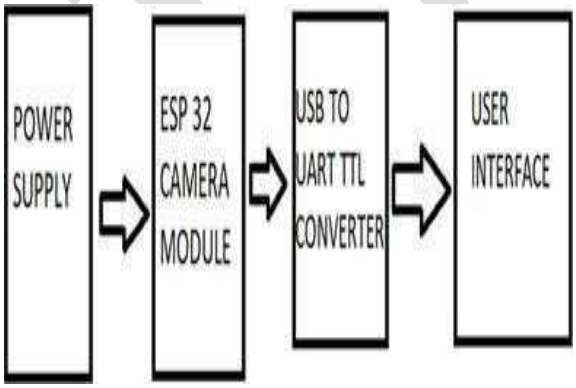


Fig 3.2. Block diagram of Scanner unit

C. HARDWARE ANS SOFTWARE REQUIREMENTS

(ii). ESP 32 Camera Module

Small and affordable, the ESP32-CAM module is a camera module built on the ESP32-S2 electronics. It is equipped with a 2 MP camera, WiFi, Bluetooth, and a microSD card slot. For projects that need for a small, inexpensive camera module that also supports wireless communication, the ESP32- a CAM module is a common DIY choice. It has several potential applications, including but not limited to home security, distant monitoring, robots, and others.

(ii). (ii). Arduino uno microcontroller

Arduino Uno is a free, publicly available, and ATmega328P-based microcontroller board. Its ease of use and adaptability have made it a go-to board for many people working with the Arduino platform.The Arduino uno microcomputer has a number of different pins for different purposes. These include power, memory, I/O, communication, and reset.

(iii). Organic Light Emitting Diode (OLEDs)

When referring to a technique that uses LEDs to generate light from organic molecules, the acronym "OLED" is commonly used. OLED screens offer superior picture quality with vivid colors, smooth transitions, and, most importantly, striking contrast. Particularly, genuine blacks (which LCDs can't produce) because to the lightening). The OLED design's simplicity also makes it easy to produce bendable and transparent screens.

(iii). Power supply

Transformers, rectifiers, and electronic filters make up the bare bones of every ac adapter. To begin with, the transformer takes the high-voltage electrical current from the wall outlet and reduces it to a safer, more manageable level. After passing through a rectifier, the alternating current becomes direct current.

(iv). Jumper wires

To activate or deactivate a circuit element, tiny metal connections known as "jumpers" are used. You can link an infinite number of devices to their system and have them control it. The gear, including the motherboard, was installed by them. The motherboard, it is assumed, incorporates some form of security. A resistor's capability to perform a given task is switchable.

(iv). USB TO TTL converter

Connecting a total time to serial transmission device to a computer through a USB micro connection, the Adapter Chip is a popular choice. This converter module's output voltage may be set to one of many levels using the board's jumper. TheFT232RL USB to TTL Serial Bridge Module allows you to connect any old equipment to a modern USB port.

(v). Introduction to Arduino IDE

Arduino is a free, software- and hardware-based prototyping platform. It consists of a microcontroller (programmable electrical component) and the Arduino Integrated Development Environment (IDE), which is used to write and upload programs to the board.

(vii). Introduction to Visual Code studio

A code editor is what the code editor Visual Studio Code is for programmers. To paraphrase the official description, Visual Studio Code, as the name suggests, is a "free interface that helps professionals write code, test it, or improve it using the intel- feel methodology." To put it more simply, it facilitates code development.

(ix). Introduction to HTML

HyperText Markup Language is what we shorten it to as HTML. It is a markup language used to design websites. Hypertext is the glue that holds websites together. Markup languages are used to define the document's text within the tag, which in turn defines the web page's structure. To make text machine-readable and manipulable, this language serves to annotate it with special instructions

(ix). .Introduction to CSS

Cascading Style Sheets, or CSS, is a basic programming language developed to streamline the aesthetic development of websites.

Web pages may be styled with Cascading Style Sheets. More importantly, CSS makes this possible without requiring knowledge of the HTML used to create individual web pages. It covers the layout of a website down to the colors, fonts, and spacing.

(x). Introduction to Quick Response

DENSO WAVE of Japan's auto sector came up with the QR code (Quick Reply code) in 1994. It's a two-dimensional matrix code. The four standardized encoding methods used by QR codes—numerical, alphanumeric, byte/binary, and kanji—allow for far more efficient data compression than is possible with traditional barcodes.The "open source," or free, nature of the technology contributed to its rapid adoption. QR Codes provide several advantages over standard barcodes, including a larger data capacity and greater fault tolerance

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IV. RESULTS AND DISCUSSION

A. Hardwareimplementatin

(i). ECHIP module

The device we are utilizing has four terminals and uses the I2C protocol to talk to the Arduino. Some variations have an additional RESET pin. SPI is used to connect a wide variety of additional OLED displays. The I2C connector standard used by the OLED display makes wiring quite straightforward. Following this table, connect the I2C pins on the Arduino Uno. After all the wires are connected, the Arduino software is used to write the code, which is then uploaded to the microcontroller. The echip module's excat connections are listed below.

Pin	Wiring to uno
Vin	5V
GND	GND
SCL	A5
SDA	A4

Table 4.1. Connections of ECHIP module

When you're done with the wiring, launch the IDE for Arduino and you're ready to begin writing code. Make sure the code is compiled before sending it in. If no problems are found, you can send the program directly to the microcontroller. After submitting the code, plug the Arduino to the USB port on your computer, choose the appropriate COM port, and post the program. If you followed the steps accurately, your OLED display should now have a QR code and be ready for use. The OLED will instantly activate and start showing the QR code. You can see how the connections operate and what the OLED looks like when it's switched on in the image below.

Fig 4.1: Connections of Echip module.

(ii).Scanner module

There is no programmable chip on the PCB. Therefore, this board may be programmed with any USB-to-TTL Module. Whether you're looking for a module built around the CP2102, CP2104, or another chip, FTDI has you covered. Join the FTDI Module's 5V and GND pins with the ESP32's. Put the Tx into the UOR jack and the Rx into the UOT. Most importantly, you must connect the IO0 pin to the GND pin. This action initiates programming mode for the device. The wiring diagram for an esp 32 to ftdi converter is shown below.

ESP32-CAM	**FTDI Programmer**
GND	GND
5V	VCC
U0R	TX
U0T	RX
GPIO0	GND

Table 4.2. Connection of scanner module

Now is the time to compile and upload the code to the The ESP32 is CAM Board. There are, however, recurring steps that must be taken before an upload may be completed.Before you hit the upload button, you'll need to short the IO0 pin to ground.If you see any dots or dashes during uploading, you should cancel the process and try again.Once the code has been uploaded, disconnect the I01 pin off Ground and hit reset again.Repeatedly pressing the reset button may be necessary if the Interface monitor is still not producing any signal.When you're done with the code, you may check the results in the serial monitor. In the diagram below, you can see how the hardware for the status tracking device is set up.

Fig 4.2. Connections of scanner modules

B.Software implementatin(i). Website

Website is a group of interconnected web pages and other online resources that may be accessed by a specific URL. A web presence is a virtual location where people, businesses, and other groups can be found online and communicate with one another and with their customers.

Steps to follow to make a website;1.Plan the layout of the website

2. Get the boilerplate code
3. Create the elements
4. Fill in the HTML code
5. Fill in the CSS code

6. Add more specific styles
7. Add colors and background settings

(ii). ECHIP module

To begin, open the Arduino IDE and download the required libraries.

Get the libraries by searching for "ssd" and "gfx" in the Arduino IDE's library browser.

1. Make a Bitmap version of the QR code

Go to Tools -> image2cpp on any website of your choosing to transform the QR image into a HEX array.

Select the image, adjust the image parameters, preview the image, and then output the image.

Just cut and paste the image bitmap into your program. When you're done with the program, plug the Arduino into a USB port on your computer, choose the appropriate COM port, and press the Upload button. If you completed the instructions carefully, the OLED display you built should be able to show a QR code. The OLED display will automatically display the QR code in the hardware deployment, displaying the code's result. The results of the software deployment are shown in the graphic below.

Fig4.3: Output of Echip module

(ii). Scanner unit

First, get the Arduino ide going by opening the File menu, selecting Preferences, and then downloading the necessary libraries. The second step is to begin coding when you have installed the necessary libraries. Once you're done coding for the ESP32 CAM Board, build and send the code to it. There are, however, recurring steps that must be taken before an upload may be completed. Before pressing the upload button, check that the IO0 pin has been attached to ground. If you see any dots or dashes during uploading, you should cancel the process and try again. Once the code has been uploaded, disconnect the I01 pin off Ground and hit reset again.Repeatedly pressing the reset button may be necessary if the Serial meter is still not producing any signal. Now that you know the code can be uploaded, try doing it with some other QR codes and see what happens.

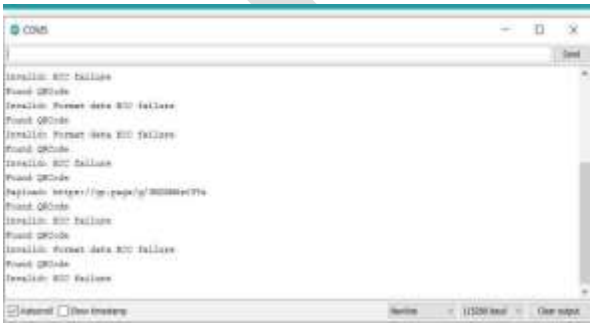

Fig 4.4. Output in the serial monitor

C. DISPLAYING THE OUTPUT

After finishing the necessary hardware and software, you may now provide the inputs to get the desired results. Obviously, getting the website up and running is the first order of business.

HTML and CSS were used in its development to ensure its functionality and aesthetics. Get a domain name and hosting for your website when you've finished making it. Create a QR code for the address of the website you want to visit.

Once you have the QR code, you may convert it into a digital bitmap and add it to the echip module's code so that it displays on the OLED. The output of incorporating the QR code into the hardware is as follows

Fig 4.5. output of ECHIP module

Now, hold the echip module at a right angle in front of the scanned module module to accurately identify the QR code on the OLED module.

Fig 4.6. Output of Scanner unit.

The status checking unit, which is linked physically to the Arduino IDE's serial monitor, will immediately recognize the qr code on its OLED screen and send back the address's output payload. The results appear in the serial tracker as,

Fig 4.7. Output of the scanner unit in IDE

The serial port with the discovered address can then be accessed. The webpage detailing the patient's basic information and subsequent medical history is revealed upon entering the address.

In addition to the main page, there are also "about us" and "home" sections on the website. Website results can be shown as,

Fig 4.8: Main page of website.

Fig 4.9.: Details page of website.

Fig 4.10: Home page of website

Fig 4

fig 4.11: About us page of website

V. CONCLUSION AND FUTURE SCOPE

Technology challenges such health data interchange and interoperability are essential to achieving decentralization and generalization in diagnostics. This research provides an electronic chip-based system to deploy HCS for distributed diagnosis, with a particular emphasis on the storage and utilization of individual patients' health records.
New generations of advancement in several fields are on the horizon as a result of the merging of internet networks & electronic chips.Using technically-sound hardware (Arduino, ESP 32 Microcontroller) and services (websites, android applications), the suggested method identifies the deficiencies in our traditional health system as the nation ages and remedies them.

We can make the complete electronic chip unit into a chip or miniaturizing the unit into a very little chip, This teeny chip can then beput used in two ways, and while the current method is helpful for remote medical treatment, it has room for improvement.
In the same ways as Avr chips on credit and debit cards are attached to the card, these microchips might be attached to another type of card. The chip would need to be altered to resemble a QR code, and then the card would need to be manufactured with the chip inside. A digital health record (E-card) can be generated from this.
We could develop the chip so tiny and safe they could one day be directly utilized under the layer of skin in the future, when the merger of science and biology occurs for a much more advanced human race. As a result, the data will be safer and simpler to track.

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