Automated Laboratory Solution on Cloud Computing Technology for a Pandemic Situation

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Abstract. Testing for COVID is necessary for the battle against the pandemic, especially considering the most recent outbreak. Testing for COVID is carried out in enclosures that provide a safe setting for the operation. Due to the enormous number of samples brought in for testing, this is a time-consuming process involving numerous manual processes and is susceptible to human mistakes. As a result, the system uses the Internet of Things (IoT) to offer a solution that automates around 70% of the work that people perform to enter data and offers a quick and single-point COVID testing method. An operating circuit and a controller power our RFID and speaker combination system. A keypad and buttons on the controller serve as the system's interface with the test participant. The system completely separates the testing patient from the viewer, making the procedure quick and error-free by streamlining the enrolment process. There is no need for further registration because the system has an RFID tag and reader for quick Aadhaar card scan registration. Using the given keypad, the test person inputs the individual's specimen from within the booth.

Keywords: Covid testing, Cloud computing, Laboratory method, IoT, Cloud server, Raspberry pi, RFID.

1 Introduction

During the covid-19 outbreak, the need for rapid testing methods to identify the virus' presence in an individual arose. The widespread use of smartphones and internet-connected devices in healthcare settings has made possible the development of new testing methods through the internet of things (IoT) [1-2]. The worldwide spread of Covid-19 is a major concern throughout the world. The pandemic has had a huge impact on how healthcare is delivered. The pandemic has also brought attention to the effects of the Network of Things on the healthcare sector [3]. The Internet of Things, an emerging technology, has the potential to raise the quality of treatment for many people by enhancing patient safety, analytical techniques, and the efficiency of healthcare delivery [4].

The use of technologies such as the IoT has led to a new generation of smart devices and devices that collect and analyze data in real time [5]. Current smart devices

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such as IoT hubs and smart appliances can be used to collect data from multiple sources and combine them with sensor and machine learning technology to generate valuable insights [6-7].

There are different ways of using IoT to develop novel strategies for detecting covid-19 in the body. One of the most common is the use of imaging technologies such as CT scans, MRI scans, and ultrasounds [8] . These tests can help detect disease or abnormalities such as a brain tumour or a lung infection. They are also useful in determining whether a patient has pneumonia or other lung infections [9].

Internet of Things (IoT) and sensor technologies are increasingly being applied to the development, deployment, and management of Covid-19 testing strategies [10]. As testing coverage is extended to such a large population, it can understand the impact of the testing strategy on the COVID-19 pandemic, and the subsequent mitigation of the Covid-19 pandemic [11].

IoT, or the Internet of Things, is a rapidly developing technology. A collection of practical objects or things that are combined with circuits, algorithms, detectors, and networking capabilities is known as the Web of Things [12]. This technology enables these objects to collect and share data. In this study, the study shows the building a method that will rapidly test a person with covid using a contactless testing booth [13-14].

Contact tracking entails identifying and alerting those who have contact with positive COVID-19 patients. Manual contact tracing approaches are ineffective at controlling viral transmission [15]. Even though this technology has the potential to eliminate human contact monitoring inefficiencies, there have been significant privacy issues. One of the key issues that hospital authorities are presently dealing with is the ongoing monitoring of patient health metrics. Monitoring should be accurate, precise, and real-time [16].

Traditional Covid testing methods are numerous and vary, but they are all performed to check for the presence of Covid-19 in the body. Covid tests are performed using swabs, blood, and nasal swabs, and are tested in either a lab or by a doctor [17]. In this investigation, an onboard computer—also known as a microcontroller—is employed. The study's core idea is this. This onboard computer can easily be reached by the input and output modules that are currently in use. The controller's internal memory may include the code. Using this memory, the controller is programmed with a set of assembly instructions. These assembly instructions are also required for the controller to operate [18].

Because linking the RFID reader and GSM to the microcontroller is delicate, the design of this system should be done with extreme caution. Therefore, when building the interface circuit, each tiny detail must be carefully considered since, depending on how many components are used in a specific area, it may not be possible to make a single-sided board without hopping over traces with wires. [19].

An Automatic Testing Centre must be established to minimize the spread of the Corona Virus. This automation of the Contactless Test Centre decreases virus dissemination as well as labor requirements. It minimizes the amount of time required to wait for results and handles faults [20]. It is a completely automated system with a

microcontroller interface that connects to the button, sensors, and IOT module. It makes the outcomes more manageable.

2 Literature Review

Standard SARS-CoV-2 testing requires a nasopharyngeal or oropharyngeal swab, but is constrained by low sensitivity, the necessity for medical personnel and personal protective equipment, and the potential for transmission while being transported to or at the testing site. To expedite case detection and mass testing, innovative testing approaches are badly needed [21].

Technology based on the Internet of Things, such as frictionless thermometer detection, masking identification, and interpersonal separation verification, is targeted at enhancing COVID-19 interior safety. A Microprocessor with a camera handles mask detection and intergroup conflict checks, while the noninvasive temperature measurement subsystem is driven by an Arduino Microcontroller and a light detector or a thermal webcam [22-23].

The current epidemic makes covid testing essential to the fight against the pandemic. To conduct covid testing in a safe setting, covid testing booths are used. The testing process is now involving the subsequent steps. manually entering the individual's name and contact details [24]. getting a sample of the person's swab. Including the person's registration details with the swab sample number. delivering the data together with the samples to the lab. manual notification of the result to the patient (by phone or SMS) . In this article, the system summarized knowledge regarding the COVID-19 causal pathogen and several diagnostic procedures in this pandemic to help readers understand the limitations and complexities of viral testing for COVID-19 [25].

3 Proposed Methodology

This model's main goal is to use IoT to deliver a stable, scalable, and efficient solution for the quick and precise detection of infectious diseases, such as COVID-19. The goal of this model is to use cloud computing to create an automated laboratory solution for a pandemic crisis. The paper uses IoT devices and cloud computing technology to automate the entire testing process, from sample collection to result reporting. The agreement will be designed to be open, giving medical care workers the freedom to do tests in an environment free from any potential danger while restricting the risk of openness to enticing specialists.

The design may be implemented as follows: Because the system uses RFID devices to detect Aadhar card scan register data in real time, there is no need for individual enrolment. The test subject sends the sample from inside the booth using the RFID tag that is provided. When the patient's testing is over, a bell signals that it's time for the next individual to use the device. The data is instantly transmitted to the lab by the IOT device till a new candidate is found. Through the Wi-Fi module, the lab manager may analyze the number of test samples instantaneously and publish sample test results on the IOT website.

A new generation of intelligent devices and gadgets that gather and analyze data in real-time has emerged because of the adoption of technologies like the Internet of Things (IoT). Smart appliances and IoT hubs can be used to gather data from various sources, combine it with sensor and machine learning technologies, and produce insightful results. Figure 1 shows the testing unit.

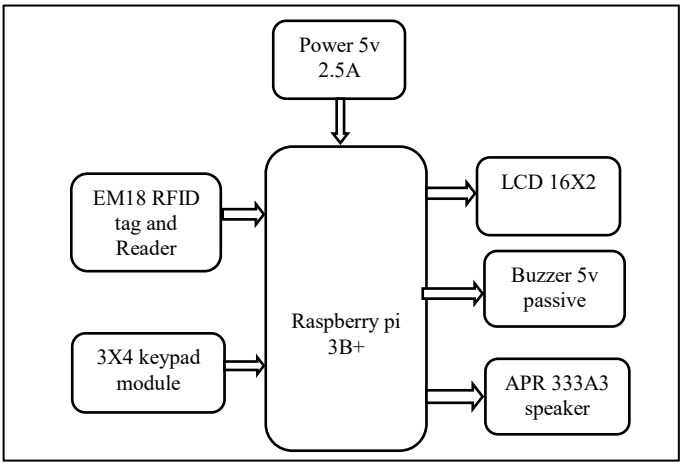

Fig. 1. Test Patient Unit.

Once the facility in-charge modifies a sample's screening test, the device will send a Text to the relevant people via GSM modem. Therefore, the proposed work completely automated the Covid booth evaluation, significantly faster, cleaner, and error-free, letting us to more effectively combat the pandemic. The specimen collecting unit is seen in Figure 2.

This study makes use of an onboard computer, sometimes known as a microcontroller. It serves as the heart of the system. This integrated processor can effectively communicate with the intake and destination devices. The controller has some internal memory to store the code.

The Raspberry Pi is a credit-card sized computer that costs only a few dollars, and it is equipped with everything you need for a solid programming experience: a microprocessor, memory, operating system, and various peripherals. It is a lot like a supercomputer, except that it is much smaller, cheaper, and easier to use.

The Raspberry PI is a general-purpose microcontroller board designed by the Raspberry Pi Foundation. It is a single-board computer that plugs into the Raspberry Pi's 40-pin GPIO header and provides a standardized interface for developers to access the microcontroller's peripherals. The Raspberry Pi is available in different models, each with different features and specifications, and priced accordingly. The model B+ is the bestselling and includes additional features such as a camera, wireless LAN, and Bluetooth.

One of the most common ways to identify people and things today is through a technology called Radio Frequency Identification (RFID). An RFID tag is a tiny device that contains a chip that stores information. An RFID reader is a device that reads the information stored on an RFID tag. There are two main types of RFID tags: passive and active.

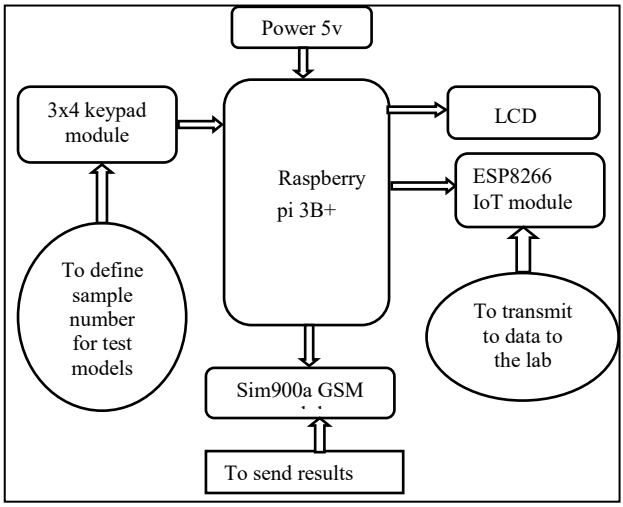

Fig. 2. Sample Collector Unit.

RFID (radio-frequency identification) technology uses small tags attached to objects to identify them and track their movements. These tags are usually embedded in plastic cards, which are used to identify people, products, and other objects. RFID technology is used in a wide range of applications, including access control, inventory management, and supply chain management. A Receiver, also known as a radiofrequency identifying viewer, is a device used to gather information from RFID tags, which are used to track specific items. Radio frequency waves are used to transmit information gathered by the tag to the reader. The RFID tag must be readable by an RFID reader for it to function. RFID technology enables speedy object scanning so that even when a product is surrounded by other goods, it can still be swiftly and easily identified.

RFID tags are available as passive, active, or passive with battery assistance. An active tag that broadcasts its ID signal regularly is powered by an on-board battery. An RFID reader's proximity causes a small battery inside a battery-assisted passive (BAP) to switch on. A passive tag is less expensive and smaller since it uses the reader's radio energy rather than a battery. However, a passive tag requires illumination at a power level that is nearly a thousand times higher than that required for signal transmission to function. Interference and radiation exposure are affected by this.

The SIM 300 GSM module is a module that allows the user to use a GSM SIM card in a GSM phone. A SIM card is a small device that is used to store information about a mobile phone provider and their mobile phone numbers.

The SIM 900 is a GSM module that is often used on mobile phones to provide a mobile phone number to a phone. This is often found in unlocked smartphones and is frequently used by companies to give their employees a mobile phone number that is easy to remember, and to provide a common phone number for all of the employees of the company.The Keypad module is a small digital circuit board with a single button and a numeric keypad. It is most often found in small remote-control devices, such as garage door openers and alarm systems. The module is typically used to control a single function such as locking the garage door or turning on/off the lights.

Our solution consists of a speaker and RFID combination that is powered by an operational circuit and controller. For the benefit of the test subject, a keypad and buttons that are interfaced with the controller are used. The solution streamlines the enrolment process to totally segregate the testing patient from the viewer while also facilitating a speedy and error-free procedure. The system features an RFID tag and reader for rapid Aadhaar card scan registration, therefore further registration is not required. The Test person enters the subject's specimen from inside the booth using the provided keypad. This study aims to assess how IoT apps are used as smart tools for gathering Covid-19 symptoms, tracking the virus's propagation, managing contact tracing, computing results using edge analytics, etc. Additionally, it will discuss IoT validation, Covid-19 detection using IOT DSN and D2D, and Internet of Medical Things geared to tackle various waves of infectious diseases. Figure 3 shows the workflow of the system.

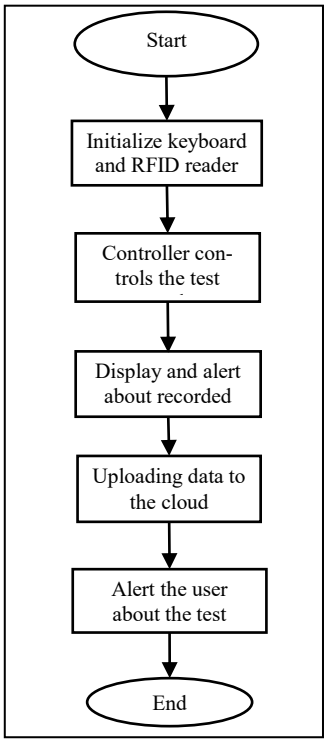

Fig. 3. Workflow of the System.

At first the system the patient needs to put their name and ID via keypad on patient's side. After the entry the data with id is stored in server. The lab person must update the item with their corresponding keypad module. The results are updated in a server and give an alert message to the patients via SMS.

4 Results And Discussion

Because there are so many samples submitted for testing, traditional testing is a time-consuming process with numerous manual steps that could result in human error. As a result, this study offers an IOT-based solution that automates around 70% of the human entry work while also enabling a single point and quick covid testing system. Figure 4 shows the circuit diagram.

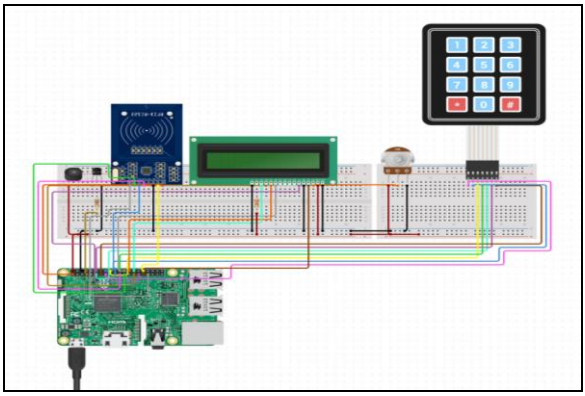

Fig. 4. Circuit Diagram.

Our solution consists of an RFID and speaker combination that is controlled by a Raspberry Pi-based controller and functional circuitry. A keypad and button interfaced with the controller is employed for the comfort of the test subject. The technique is made simple and error-free by streamlining the registration process, which also totally differentiates the test participant from the consumer. The patient must first input their name and ID into the system using the keypad on their side. Data with an ID is kept on the server after entry. The lab worker must update the object with the appropriate keypad module. An alert message is sent to the patients through SMS after the results are updated on a server.

The basic idea is to develop a fully mechanized rapid non-invasive COVID testing booth solution that analyses individual data using RFID technology, as seen in Figure 5. It is utilized to ensure the user's personal information, such as name and Aadhaar scan-specific information, through which the system completely distinguishes the test individual from the users and makes the entire procedure quick and error-free by streamlining the enrollment process.

Our solution consists of an RFID and speaker combo that is driven by a working circuit and controller. A keypad and buttons that are interfaced with the controller are employed for the advantage of the test subject. In addition to supporting a quick and error-free approach, the solution streamlines the enrolment process to separate the testing patient from the viewer. Further registration is not necessary because the system has an RFID tag and reader for quick Aadhaar card scan registration. Using the given keypad, the Test person enters the subject's specimen from inside the booth.

Fig. 5. Testing Results.

Once the facility in-charge modifies a sample's screening test, the device will send a Text to the relevant people via GSM modem as shown in Figure 5. Therefore, the system can completely automate the Covid booth evaluation, significantly faster, cleaner, and error-free, letting us to more effectively combat the pandemic.

5 Conclusion

This concept evolved into a fully automated instant contactless COVID scanning screen system that tracks personal information using RFID technology. Before the next individual comes, the IOT ESP8266 Wi-Fi module quickly uploads the data gathered up to that point to the lab. The lab manager may monitor the number of samples being analyzed in real-time and change sample test results on the IOT server using the Wi-Fi module. When a sample is looked at, the system uses a GSM modem to send an SMS to the right person. It simplifies diagnosis. The device also maintains the patient's convenience by eliminating the need for traditional cables and instrument control tools. Also, wireless communication makes it easy to send and share data quickly, which helps many patients get immediate answers to problems in real-time. Consequently, the work can completely automate the COVID-booth evaluation, make it better and healthier, and let us more effectively combat the pandemic.

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