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# Iot-Enabled Automated Contactless COVID-19 Testing For Real-Time And Safe Diagnostics

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**ABSTRACT**

Covid testing is critical for disease control in light of the present outbreak. The development and implementation of a real-time COVID-19 testing cubicle system that is fully automated, contactless, and RFID-based is the major objective of this project.For the purpose of this project, a microcontroller is utilized. It is the focal point of the initiative that is being undertaken. It is possible to establish a connection between the operational I/O modules and the onboard computer, which will enable efficient communication.One can acquire the assembly instructions by making use of the memory that is contained within the controller. Immediately after the microcontroller has received data from the RFID reader, it will immediately send an SMS message to the phone number that has been chosen. This message will contain the specifics of the gathered samples, the results of the tests, and the information about the tags.In conclusion, the system makes use of a liquid crystal display (LCD) and an alarm to alert users of any incidents.
In the event of a pandemic, it is not possible to prevent the spread of the infectious virus without first conducting testing for COVID-19. Despite this, the manual testing approach has a number of drawbacks, and it is essential to keep in mind that this type of Covid testing is only accessible at facilities that are specifically designed for providing Covid testing.The reason for this is because, despite the significant quantity of samples that were obtained, certain tests are still susceptible to human error due to the fact that they are carried out for a longer period of time and the delays that these tests cause.
**Keywords:** RFID tag; RFID reader; KVR microcontroller; power supply; Wi-Fi ESP8266 module; Powersupply; RFID tag; RFIDreader; Wi-FiESP8266module; GSMmodern

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## 1.INTRODUCTION

The exponential expansion of the Internet of Things (IoT) has fundamentally transformed the way physical items interact and exchange data. The Internet of Things (IoT) is a network of interconnected devices that can gather, process, and transmit data via the internet. These items are outfitted with sensors, integrated software, electronics, and communication technologies. This technology is relevant across various areas, including agriculture, healthcare, industrial automation, and intelligent communities. Throughout the COVID-19 pandemic, the Internet of Things (IoT) played a crucial role in the advancement of contactless services, remote monitoring, and automated healthcare solutions, leading to diminished human interaction and enhanced public safety.

The aim of the proposed project is to create a contactless COVID-19 testing terminal utilizing Internet of Things (IoT) technology. This terminal is engineered to eliminate physical touch between patients and healthcare personnel, while concurrently enabling autonomous testing. The system is engineered to automate the comprehensive testing procedure, encompassing user identification, registration, sample collecting directives, and result dissemination. The testing kiosk employs automation and IoT technologies to deliver a more reliable, efficient, and secure approach to performing COVID-19 tests, especially in healthcare facilities and public environments.

A microcontroller functions as the central processing unit (CPU) of the system, facilitating communication among all physical components. It oversees the overall functionality of the testing terminal, processes data with embedded software housed in its internal memory, and receives inputs from many modules. The microprocessor connects with input/output devices including the RFID reader, GSM module, display unit, and sensors to guarantee the accurate execution of programmed instructions and facilitate seamless communication. Effective hardware design and meticulous circuit implementation are crucial for attaining dependable system performance in a confined environment.

The system utilizes RFID technology to securely obtain users' identification information and authenticate them. To diminish manual data entry and eliminate human error, the user's identity may be authenticated upon registration by employing information linked to an Aadhaar card or RFID-based identification. After authentication is completed, the microcontroller interfaces with the GSM module to send SMS notifications to the registered mobile number. These communications provide consumers an efficient and contactless means of communication. The documents encompass the conclusive COVID-19 test results, sample collecting protocols, appointment details, and testing guidelines.

The main aim of this project is to create a fully automated, contactless COVID-19 testing terminal, thereby improving safety, efficiency, and accuracy in pandemic situations. The suggested methodology incorporates IoT, RFID, GSM connectivity, and embedded technologies to minimize the need for direct human intervention while improving the reliability and efficiency of testing operations. The system is an essential asset for contemporary healthcare settings, as it guarantees the secure administration of patient information, accelerates the testing procedure, and mitigates the risk of infection.

## 2.LITERATURE SURVEY

The COVID-19 pandemic has generated an urgent demand for advanced solutions that can guarantee safety in indoor settings, such as hospitals, offices, educational institutions, shopping centers, airports, and public facilities, while minimizing physical contact. Internet of Things (IoT)-based security systems have emerged as a feasible option through the integration of sensors, embedded controllers, wireless communication technologies, and cloud computing. These gadgets autonomously track essential health metrics, such as social distancing, body temperature, and face mask utilization. IoT-based solutions enhance public health management and reduce the danger of disease transmission by minimizing the necessity for human intervention. The proposed economical IoT security solution entails the amalgamation of diverse technologies to facilitate real-time monitoring and act as a viable alternative to human screening methods.

An infrared temperature sensor or thermal imaging camera is integrated with an Arduino Uno microcontroller to create a contactless temperature monitoring subsystem. This arrangement enables the technology to accurately gauge an individual's body temperature without physical contact. The device promptly activates an alarm and restricts access to the premises if the observed temperature exceeds the established threshold. A Raspberry Pi equipped with a camera executes computer vision tasks, including face mask identification and social distancing analysis. The Raspberry Pi analyzes interpersonal distance and precisely assesses mask usage in real time through image processing and machine learning methodologies. The apparatus produces visual or aural alerts to inhibit the transmission of infectious diseases in cases of safety protocol breaches. The automated approach alleviates the burden on security personnel while concurrently providing constant surveillance throughout the day.

The inclusion of IoT technology also enables remote monitoring and centralized data management. Sensor readings, attendance records, health data, and images can be transferred to cloud servers over wireless communication networks. Administrators can remotely oversee the system via online or mobile applications, allowing them to produce reports, maintain digital records, and swiftly address potential health concerns. The system offers a cost-effective solution for educational institutions, healthcare facilities, companies, and governmental organizations by employing inexpensive hardware such as Raspberry Pi and Arduino Uno. The system is versatile and appropriate for numerous applications because of the scalability of IoT technology, allowing for the integration of supplementary sensors and modules to meet changing demands.

The research titled "Non-Pharmaceutical Measures for Pandemic Influenza in Non-Healthcare Settings: Personal Protective and Environmental Measures" by Jingyi Xiao and associates investigated the efficacy of preventive strategies, such as environmental sanitation, respiratory etiquette, hand hygiene, and facial masks, in mitigating the spread of respiratory viruses. Their research demonstrates that non-pharmaceutical interventions are crucial in the early phases of a pandemic, especially when immunizations or antiviral treatments are not accessible. The study analyzed many scientific articles and public health guidelines to assess the effectiveness of these preventive methods in controlling infections in non-healthcare settings.

The authors determined that respiratory infections can be mitigated by following respiratory etiquette, maintaining proper hand hygiene, utilizing face masks, and disinfecting commonly touched surfaces. They underscored the significance of environmental sanitation, as viruses may persist on contaminated surfaces for hours or even days, contingent upon the environment. Consistent sanitation of communal spaces and the use of personal protective equipment substantially reduce the likelihood of indirect virus transmission. Biological evidence strongly endorses these interventions, while hand cleanliness and face coverings did not consistently exhibit statistically significant decreases in influenza transmission across fourteen randomized controlled investigations. The incongruous results were attributed to fluctuations in ambient circumstances, participant adherence, and study methodology. Consequently, these preventive actions remain endorsed by international health organizations as vital elements of pandemic preparedness programs.

Dr. Sujitharaa Sampath, an Indian physician, has offered an extensive elucidation on the transmission of respiratory viruses, including COVID-19. Her research indicates that SARS-CoV-2 predominantly infiltrates the human body via the nose, mouth, and eyes upon the inhalation of virus-laden droplets or aerosols. Respiratory droplets released during coughing, sneezing, talking, or inhalation might infect nearby individuals, especially in crowded indoor environments with inadequate ventilation. The study indicates that the virus may be transferred indirectly when healthy persons touch their faces after coming into contact with contaminated objects, like elevator buttons, door handles, workstations, or electronic devices. These findings emphasize the necessity of upholding proper hygiene standards and limiting physical contact to reduce the risk of infection.

As a result, automation technologies have become crucial for averting disease spread. Motion sensors reduce the necessity for superfluous interaction with electrical switches by autonomously turning lights on or off when individuals enter or exit a room. Similarly, automatic doors, voice-activated devices, touchless attendance systems, and contactless access control systems diminish the frequency of contact with commonly utilized surfaces. These innovations improve the safety of indoor environments and raise hygiene standards. IoT-driven automation improves public safety by integrating sensing, communication, and intelligent decision-making functionalities into a unified platform.

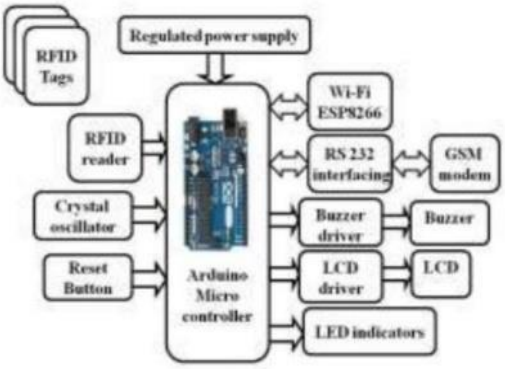
Georgios Eftychios Christoforou performed an extensive analysis of medical teleoperated robotic systems developed from 2004 to 2015. His study concentrated on the advancement, implementation, and application of robotic equipment that facilitate remote treatments for medical professionals. The technologies investigated included artificial intelligence, human-machine interfaces, communication networks, computer vision, robotic manipulators, and imaging systems. Medical telerobotics has gained prominence due to substantial health hazards linked to direct patient-provider interactions.

Throughout the COVID-19 pandemic, teleoperated robotic equipment were widely utilized for temperature screening, ultraviolet disinfection, sample transportation, medication dispensing, patient monitoring, and remote consultation. These robotic gadgets minimized healthcare personnel's exposure to infected patients while ensuring uninterrupted medical services. The review covered prospective advancements in autonomous navigation, cloud computing, 5G communication, and artificial intelligence. Notwithstanding ongoing obstacles including cybersecurity, communication delays, implementation costs, and regulatory constraints, it is anticipated that further technological innovations will improve the reliability and effectiveness of medical robotic systems. This study's concepts offer significant direction for creating intelligent, contactless healthcare solutions, such as automated COVID-19 testing kiosks, remote patient monitoring systems, and advanced hospital infrastructures.

## 3.IMPLEMENTATION

**IOT INSTANT CONTACTLESS COVED TESTING BOOTH AUTOMATION**

**Blockdiagram**




The action plan for executing the suggested system is as follows. The system aims to optimize and automate the COVID-19 testing procedure by including RFID, Wi-Fi, GSM connection, and a microcontroller-based control unit utilizing Internet of Things (IoT) technologies. The system aims to improve the efficiency of sample collection and management, minimize human errors, and facilitate real-time monitoring of testing processes by removing manual intervention.

The registration process is expedited by the utilization of Radio Frequency Identification (RFID) technology. The RFID-enabled Aadhaar card or RFID device linked to the registration details of each individual undergoing testing is utilized for identification purposes. The system promptly accesses the patient's information from the database upon scanning the RFID card, thus obviating the need for human data entry. This markedly diminishes the waiting period, averts data duplication, and ensures that each individual is uniquely identified during the testing process. The microcontroller handles identification data and readies the system for sample collection by interfacing directly with the RFID reader.

The testing personnel assign a distinct sample number to the individual following successful registration. The RFID-enabled device situated in the testing cubicle is utilized to enter the sample number. The patient's identification information in the database is promptly correlated with this sample number. The system produces an audible alert to inform the subsequent individual that the current testing procedure has concluded and that they may securely enter the testing cubicle following the successful collection of the sample. This automated notification ensures continuous operation by eliminating confusion, maintaining an orderly workflow, and averting avoidable delays.

The ESP8266 Wi-Fi module swiftly transmits the collected sample data, together with the patient's identification, timestamp, and testing status. The ESP8266 is a communication module that facilitates reliable wireless connectivity between the laboratory server and the testing cubicle, enabled by the Internet of Things (IoT). Each patient's test data is automatically transferred to the central laboratory database before the subsequent patient enters the testing booth. This real-time connectivity obviates the need for manual record transmission and ensures that laboratory experts may swiftly access sample information for subsequent analysis.

The laboratory management system employs the IoT server to incessantly monitor all incoming sample data. Authorized laboratory workers can remotely monitor the quantity of collected samples, their current processing state, and the advancement of testing activities via a web-based dashboard, as the ESP8266 transmits information in real time. Moreover, the IoT platform retains past data, enabling report generation, analysis of testing trends, and maintenance of precise documentation. This centralized monitoring capacity improves the efficiency of healthcare operations and facilitates coordination between testing sites and laboratories.

Authorized workers update the test result on the IoT server after completing the laboratory analysis. The system continuously scans the database to identify any changes in the status of the samples. The microcontroller automatically activates the GSM communication module when a laboratory technician or authorized healthcare official updates a patient's sample outcome. The GSM module transmits an SMS notice to the patient's registered mobile number, advising them of the update to their COVID-19 test result. The message may also encompass essential information, including the sample identification number, the status of test completion, or directives for accessing the whole report via the healthcare portal. This automated notification system enables swift communication without requiring manual phone calls or extra administrative work.

The suggested system's central processing unit is a microcontroller that oversees the whole testing booth. The microcontroller interfaces with all hardware components, including the RFID reader, ESP8266 Wi-Fi module, GSM module, alarm unit, display module, temperature sensor (if present), and other input/output devices. It oversees the functioning of each linked module, executes programmed instructions stored in its internal memory, and continuously accepts input signals. The embedded software of the microcontroller orchestrates every phase of the testing procedure, encompassing patient identification, sample registration, data transmission, and result notification.

The operational instructions for the system are permanently recorded in the microcontroller's flash memory. This document outlines the systematic order of operations, encompassing RFID identification, sample registration, IoT server communication, laboratory update monitoring, and SMS generation through the GSM module. The microcontroller guarantees reliable system performance with minimal processing latency by consistently and accurately executing these instructions. Its real-time processing capabilities enables the simultaneous management of several hardware peripherals while providing dependable communication with cloud-based applications.

The suggested IoT-based COVID-19 testing cubicle markedly enhances the entire testing workflow by automating specific tasks usually conducted manually. Automation diminishes the probability of transcribing errors in patient registration and sample monitoring, decreases paperwork, and minimizes human involvement. Real-time synchronization between the testing booth and laboratory facilitates expedited sample processing, while automated SMS notifications enhance patient-provider contact. The centralized IoT platform offers administrators comprehensive oversight of testing activities, enabling efficient resource management, system performance monitoring, and the generation of accurate statistical data for informed decision-making.

A reliable, efficient, and intelligent COVID-19 testing solution is developed by the integration of RFID technology, ESP8266 Wi-Fi connectivity, GSM messaging, IoT cloud services, and an embedded microcontroller system. The proposed solution guarantees secure administration of patient information, improves operating efficiency, accelerates reaction times, increases data accuracy, and facilitates remote monitoring. An automated testing system is crucial in managing large-scale pandemic crises by offering a more organized, secure, and expedited testing process, thereby alleviating the burden on medical workers.

## 4.CONCLUSION

All of the hardware components that are made and employed by Arduino are compatible with the most recent version of the software. The presence of each module has been thoroughly investigated and arranged in a logical fashion. Consequently, we are making a big contribution to the evolution of the most effective operating system for "IOT Instant Contactless Covid Testing Boot Optimization."

Through the utilization of cutting-edge integrated circuits and developing technologies, the project was finished to the highest possible standard. As a direct consequence of this, the phases of the project that dealt with design and testing were extremely fruitful.

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