



# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 8.699**

**Volume 14, Issue 4, April 2025**

# Automated Primary Health Screening System

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**ABSTRACT:** The thermal imaging system uses the flexibility of a Raspberry Pi in integration with an infrared camera for revolutionary patient monitoring technology in the health sector. This is based on an RFID reader, which offers reliable, efficient, and precise identification of the patients while making sure that all information about them automatically enters the system. Subsequently, thermal images are captured from the scanning across the entire patient's body with the aid of an infrared camera. This is one of the great features that would sense any condition of health, like an infection or an inflammation before it may appear naked to the human eye since temperatures of all of these could never have gone unobserved ever before. This added weight-measuring capability automatically captures the patient's weight with a scale attached by the system to it and saves the value as the system processes it along with the thermal images. The Raspberry Pi is the central processing unit of the system. The convergence of these technologies provides an allinclusive health monitoring solution wherein patient identification, temperature monitoring, and weight measurement are integrated to allow for better medical assessment and record-keeping. This system not only makes the process of data collection easier but also keeps the data safe and retrieves it easily for the medical professionals. This will provide Real-time accurate health metrics-This integrated system plays an important role in enhancing the health monitoring aspect combined with timely interventions based on precise and detailed health data makes patient care a more proactive approach.

**KEYWORDS:** Thermal image processing, Healthcare Data Automation, Contactless Temperature Measurement, RFID Patient Identification, weight sensing.

## I. INTRODUCTION

The development of healthcare toward high dependency on technology opens avenues to novel systems of improving diagnosis with greater care toward the patient. The paper develops an Automated Primary Health Screening System, an integration of advanced technologies meant to revolutionize settings for primary healthcare. It utilizes the computing ability of a Raspberry Pi at its core to actually orchestrate functionalities such as RFID-based patient identification, infrared thermal imaging for body temperature monitoring, and weight measurement. The overall integrated platform ensures an easy efficiency in the collection and processing platform for critical health metrics, assured with higher diagnostic accuracy and improved record-keeping. The system begins with the RFID reader, which allows for secure and efficient patient's identification. The entry of the patient information through RFID technology is automatic and thus leads to proper and timely identification. An infrared camera captures thermal images of the patient for the system, which shows abnormal changes in body temperatures that may lead to health problems such as infections or inflammations. This ability is very critical since it can determine symptoms that are not so observable to the naked eye, thus, it gives health monitoring in an early approach. In addition to thermal imaging, the system has the weight



measurement feature, which connects to a digital scale to automatically measure a patient's weight. The weight measurement data combines with the thermal imaging results to form the health profile of the patient. The Raspberry Pi is the central processing unit that will process the collected data in real time and save them securely for further analysis. Thus, it can be said that this system ensures timely and accurate health metrics to the medical professionals and provides them with a reliable record of a patient's history which would otherwise be tedious and time-consuming to retrieve or fetch. The implementation into one system has several advantages. First, data collection and processing through automation reduces the chances of human errors. Thus, overall dependability of a health assessment is enhanced. In addition, the thermal imaging and automated weigh measurements have increased the level of diagnostic information available to healthcare providers, so they can decide more effectively. record-keeping is made efficient, making patient data stored safely and accessibly, leading to better care delivery. Such a system works well in many healthcare settings, it can apply to clinics, hospitals, or remote medical sites. Its compact and cost-effective design ensures scalability, making it an ideal solution for addressing the growing demand for accessible and accurate health monitoring tools. The Automated Primary Health Screening System, by harnessing advanced technology in a very integrated system, shows promise as a means through which the care quality of a patient can improve and timely intervention can be received based on good, precise health data. The proposed system is a giant leap in healthcare technology. It integrates secure patient identification, thermal imaging, and weight measurement into an automated platform, making it a holistic approach to health screening. Such integration not only streamlines diagnostic processes but also enhances the accuracy and reliability of medical assessments, thereby contributing to better health outcomes.

## II. LITERATURE SURVEY

[1] Bhargavi Haripriya, et al Thermography is a technique with high portability and pose little to none risk of contact and has helped with many patient monitoring systems. These monitoring systems have helped to diagnose disease like foot ulcers in diabetic patients. Enhancements made in computation power, computer based algorithms, processing software, and higher resolution has resulted in the cost of cameras increasing. This has raised the need for a low-cost system. This system is developed to make the process of monitoring inexpensive, portable and easy to use. It can be used for wide applications such as skin cancer detection, monitoring thyroid disorders, identifying diabetic foot ulcers and fever screening. This device can be made accessible and affordable to local clinics and houses, which makes it a viable option for detecting abnormalities of temperature distribution over the human body. [2] Ranjit Singh Sarban Singh, et al Developing an Analytic Face Thermal Recognition System integrated with Email Notification for Detection of Fever—Common Symptom of COVID-19. It employs a Raspberry Pi Zero Wireless, Pi Camera, and AMG8833 Thermal Camera Sensor for face recognition and measurement of facial temperatures along with sending notifications via email if a high temperature is found. The software uses Python with OpenCV and DLIB libraries for the efficient detection and storing of data. This innovation provides early fever detection without the risk of human detection, hence it is beneficial for public health monitoring in buildings or premises. [3] Yuxin Wu, et al investigates the use of a low-cost, low-resolution thermal camera (MLX90640) for predicting thermal comfort based on skin temperature measurements. Traditional methods for assessing thermal comfort rely on expensive high-resolution thermographic cameras or single point thermistors, which lack comprehensive skin temperature data. The study utilized a climate chamber where participants were exposed to varying temperatures, and skin temperature data was collected at multiple body points. The MLX90640 camera, with 32x24 pixel resolution and  $\pm 2^\circ\text{C}$  accuracy, provided comparable accuracy in predicting thermal sensation scores (TSV) to that of more costly methods, achieving an accuracy similar to a high-precision air temperature sensor ( $\pm 0.1^\circ\text{C}$ ). The results support the potential of low-cost thermal imaging for accessible, individualized thermal comfort assessment. [4] Fatma Aydin Akgun, et al It is proposed to develop a noncontact body temperature monitoring system using thermal, distance, humidity, and temperature sensors. The prototype, integrated with a mobile application, notifies the emergency responders or the family members if the body temperature is hazardous and does not necessarily need to be in the environment of the patient. The system includes a cloud server layer, which provides microservice API to handle the data, and an internet layer of connecting devices, applications, and IoT platforms. The IoT-based system is designed for use in healthcare settings, public areas, and individual monitoring. It provides an instant alert, helps to reduce negligence, facilitates early intervention, and lowers healthcare costs. Unlike other solutions, it monitors the entire body through no camera use and applies machine learning to correct data. [5] Grisha Spasov, et al presents an economical wireless sensor device for the purpose of infrared cameras replacement, usable in Ambient Assisted Living (AAL), healthcare, and smart home security systems. Employing the MLX90640 infrared array sensor and an open-source hardware board equipped with Wi-Fi, the device gathers, processes, and transmits data to internet-enabled devices. The flexible, low-cost IoT solution brings along many

applications, mainly related to smart home where the employment of traditional Cameras are impeded by issues of privacy. The paper concentrates on the The sensors offer high precision and wide range applications, including human detection, occupancy tracking, activity recognition, and thermal monitoring. The MLX90640 design allows for non-contact temperature measurement, intrusion detection, thermal comfort control, and smart home integration that provides early alerts to enhance safety. [6] Jack Humphreys, et al A low-cost thermal imaging tool was created for remote monitoring of electronic systems targeted towards the danger of fire in an industrial environment. This consignment is a Raspberry Pi 4B with 2GB RAM and the Pimoroni MLX90640 thermal camera, coded in C++ and Python. Compared to the Etekcity Lasergrip 1080 IR gun, the product showed a temperature fluctuation of  $\pm 1.9^{\circ}\text{C}$ , verifying reliability. Though portable and remote, the prototype is limited to a Raspberry Pi board and a thermal camera with 768 sensors, showing a temperature range of  $-40$  to  $300^{\circ}\text{C}$  with accuracy  $\pm 1^{\circ}\text{C}$ , and an optional servo motor for directional aiming of the camera. The system runs on a starter kit with a 32-GB microSD card, a Pi 4 case, and other peripherals. Software comprises Raspberry Pi OSS, Pimoroni's Python library, and Gheny IDE, among others, such as GUI and GPIO control. VNC Viewer facilitates remote observation of output. It is offered at low costs, thereby providing a real-life alternative to commercial thermal imaging instruments in an industrial environment. [7] Yuan Yang, et al The system is designed to accurately measure body temperature within a 2-meter radius using a Raspberry Pi, MLX90640 thermal sensor, and HC-SR04 ultrasonic sensor. For privacy reasons, it encrypts images, timestamps, and temperature into a secured form. Measuring errors of less than 1%, contactless operation, and enhanced hygiene make it suitable for crowded places. This system costs 33,000 yen and offers a reliable, non-intrusive alternative to expensive thermometers. The MLX90640 sensor ( $-40$  to  $85^{\circ}\text{C}$ ,  $\pm 1^{\circ}\text{C}$  error,  $32 \times 24$  resolution) guarantees the accurate processing of smoothed temperature data.[8] M. Abedi, et al The focus is on occupancy detection in smart buildings using Doppler Radar Sensors (DRS) and Infrared Thermal Array (ITA) sensors. This sensors very cheap and they spare occupant privacy and supports energy aware buildings. Using Deep Neural Networks (DNN) for data analysis helps in achieving very high accuracy without the need for specialized feature extraction. PIR based and video based occupancy detection have higher error rates and privacy issues, respectively. According to this study, DRS that detects motion and ITA that can pick up small body movement are reliable alternatives. Sensor for occupancy detection needs that the prices available under 50. To maximize the perform of the ITA sensors, study implements DNNs to independently process data from the sensor without manual extraction and enhance accuracy. As smart buildings become increasingly popular, vocs, noise, and co2 alternative sensors have been researched to help improve the robustness of the occupancy detection system. These sensors (drs, ita and mess) together allow for different approaches for environmental applications. [9] Abdallah Naser, et al Thermal imaging has recently been used widely to measure high human body temperature. This is normally achieved by very expensive high-resolution thermal cameras. This system provides empirical calibration of low and high-resolution thermal techniques for low-resolution Thermal Sensor Array(TSA) , resulting in better visible outputs, accuracy and stability. This system also assesses the privacy preserving feature of TSA by validating the possibility of revoking the human identity from TSA's output. [10] Aly Metwaly, et al. A low-resolution thermal camera-based embedded AI solution is developed to estimate occupancy in intelligent buildings for optimizing HVAC systems with the objective of saving energy. It overcomes privacy and accuracy issues that are usually encountered in traditional methods. It reaches 98.9% accuracy with very few computational resources and latency. The local processing of data on microcontrollers enhances the privacy and real-time performance. Different architectures of neural networks are tested and outperform the existing methods in terms of accuracy and efficiency. It focuses on the prospect of embedded AI for energy management and aims to extend datasets and further optimize.[11] Andres David Suarez-Gomez et al presents a system for monitoring solar PV panels using TinyML and Edge Computing, combining low-cost thermal sensors and lightweight machine learning models. This approach enables real-time anomaly detection, reduces costs, and enhances energy efficiency by processing data locally. The best model achieved 87.7% accuracy in identifying faults like hot spots and cracks. While promising, challenges remain in validating with real-world data and scaling deployments. The solution aims to improve solar panel efficiency and longevity, supporting renewable energy adoption and sustainability efforts. [12] Benjamin Rafatianet, et al The paper develops an occupancy estimation system based on low-cost, lowresolution thermal cameras, integrated into a DT platform capturing images above doorways to count how many people enter and exit the space while preserving privacy through nongroupable data. The approach then applied in the paper was blob detection and image tracking for the thermal camera data processing. The outcomes are presented in real time on a DT-enabled dashboard. This solution optimizes building energy management, enhances security, and manages shared resources efficiently. Conceptually effective, the study pointed out several drawbacks including distinguishing human heat signatures from nonhuman sources. Future work may address the improvement of advanced detection algorithms, better accuracy, and wider applications in smart building management.

### III. METHODOLOGY

The Automated Primary Health Screening System is designed to provide a quick and contactless health assessment using RFID, a load sensor, an MLX9060 thermal camera, and a Raspberry Pi. The process begins with user identification through an RFID module, which retrieves the individual's health records from a database. Next, the load sensor measures the user's body weight, and the MLX9060 thermal camera captures their body temperature to detect fever. The Raspberry Pi acts as the central processing unit, collecting and analyzing the data in real-time. The results are displayed on an LCD screen or a web interface and can be stored for further medical evaluation. This system enhances efficiency in health screening by automating data collection and minimizing human intervention.

This system can be deployed in hospitals, workplaces, airports, and public spaces to facilitate early detection of health issues. By integrating IoT and automation, it reduces the need for manual screenings, making the process faster and more accurate. If abnormal health parameters are detected, the system can trigger alerts for further medical evaluation. Additionally, the collected data can be stored in a cloud-based system for monitoring trends and generating health reports. With its compact design and real-time processing capabilities, this automated screening system offers a scalable and cost-effective solution for primary health assessments.

### IV. EXPERIMENTAL RESULTS

The MLX90640 thermal camera successfully captured and processed the thermal images. The most relevant findings are taken from the output as below:

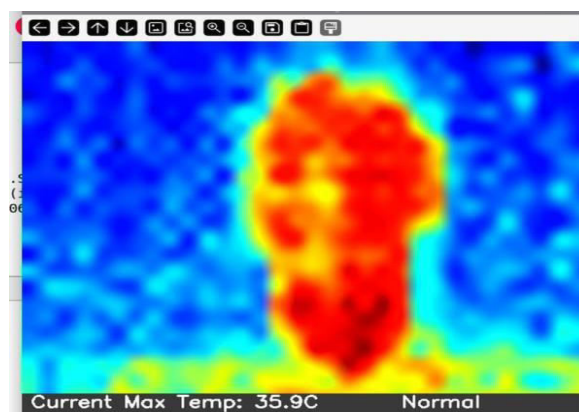


Fig. 1. Thermal Camera Temperature Plot

Thermal Imaging Output generated thermal image is given which effectively shows temperature distribution in red for warm and blue for cold areas. An image shows that the outline of the heat signature of a subject is quite visible. Maximum Temperature Detection: The system detected a maximum temperature of 35.9°C, which falls within the normal human body temperature range, hence validating the accuracy of the temperature measurement. Data Presentation and Categorization. The system can classify the status of temperature as "Normal" efficiently, and it can correctly infer the thermal measurement in the live environment. Refresh Rate Performance: The camera refresh rate is always 3 FPS, which is good enough for periodical monitoring and data collection. These results confirm the ability of this system to detect and display temperature data, as it is certainly appropriate for use in basic patient monitoring applications.

The system utilizes a load cell with a Wheatstone bridge configuration for accurate weight measurement. The load cell consists of strain gauges that change resistance when weight is applied, causing an imbalance in the bridge circuit. This generates a small voltage difference, which is then amplified and converted into digital data for precise weight determination. The Raspberry Pi processes this data and links it to the patient's profile, allowing healthcare providers to monitor weight trends over time. This system ensures high accuracy, stability, and reliability, making it ideal for clinical and home-based health monitoring. By integrating weight sensing with RFID-based identification and thermal

imaging, the system provides a comprehensive, automated health screening solution, improving efficiency and patient care.

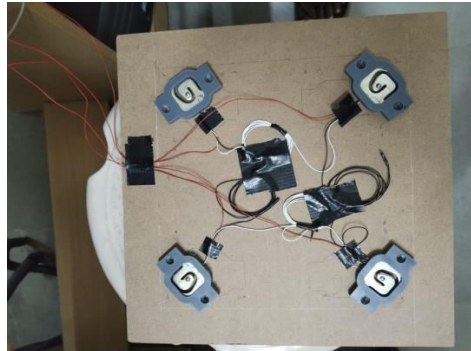


Fig. 2. Weight Sensing Apparatus

All collected health metrics RFID identification, temperature readings, and weight measurements are systematically logged into the database for future reference. The Raspberry Pi serves as the system's central processing unit, ensuring that patient records are securely stored and easily accessible. This automated data logging facilitates long term health monitoring and aids healthcare professionals in diagnosing conditions based on historical trends. Additionally, the ability to retrieve past records enables better informed medical decisions and continuity of care.

	A	B	C	D
1	Patient Name	temperature	Weight	Date and Time
2	657DB302	38.37408318	53.67	2025-03-27 12:03:27
3	657DB302	36.51144154	61.56	2025-03-27 12:06:41
4	A3170021	36.26320436	56.57	2025-03-27 12:10:23

Fig. 3 Data logging in to google spreadsheet

## V. CONCLUSION

The automated primary health screening system integrates RFID-based patient identification, thermal imaging for temperature monitoring, weight sensing, and secure data logging to provide an efficient, contactless, and accurate health assessment solution. By leveraging a Raspberry Pi as the central processing unit, the system ensures seamless data collection, storage, and accessibility, minimizing human error and enhancing healthcare efficiency. The combination of these technologies enables early detection of potential health issues, such as fever and weight fluctuations, allowing for timely medical intervention. This system not only streamlines routine health monitoring but also offers a cost-effective and scalable solution for clinics, hospitals, and home-based healthcare applications. The non-invasive and automated nature of the system enhances patient safety and reduces the burden on healthcare professionals. With real-time data tracking and historical record retrieval, the system aids in personalized healthcare management and long-term patient monitoring. Overall, this innovative approach contributes to improved patient care, making preventive healthcare more accessible and effective.

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