Body Temperature Monitoring And Alert System

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Abstract-Our project proposed a secured Temperature Monitoring system using a deep learning algorithms and SMTP for improved communication. Usual Temperature monitoring systems do not contain the alert feature for immediate warning. If a child having a fever after entering school he or she may lack of knowledge to tell the teacher. So our proposed system supports the continuous temperature monitoring along with an alert system. This project deals with the developing of a prototype that can detect the abnormal temperature and alerting the individual through mail using SMTP. We have described a deep-learning approach to achieve this function. Although deep-learning based method requires more computing power and time than traditional image processing methods, it can overcome uncontrolled and complex environments in practical applications (i.e., in bedtime condition or some heat sources in background)Keywords— IoT, Adriano Mega, Domotics, API

I. INTRODUCTION

IOT refers to the collection of different types of daily life appliances and gadgets used in different sectors that are broadening the aspect of the internet. The IOT is a giant network of connected things and people all of which collect and share data about the way they are used and about the environment around them. That includes an extraordinary number of objects of all shapes and sizes from smart microwaves, which automatically cook your food for the right length of time, to self-driving cars, whose complex sensors detect objects in their path, to wearable fitness devices that measure your heart rate and the number of steps you've taken that day, then use that information to suggest exercise plans tailored. IOT devices can be used to enable remote health monitoring and emergency notification systems. These health monitoring devices can range from blood pressure and heart rate monitors to advanced devices capable of monitoring specialized implants, such as pacemakers, Fit bit electronic wristbands, or advanced hearing aids Industrial IOT (IIOT) refers to the application of IOT technology in industrial settings, especially with respect to instrumentation and control of sensors and devices that engage cloud technologies. Recently, industries have used machine-to-machine communication (M2M) to achieve wireless automation and control. But with the emergence of cloud and allied technologies (such as analytics and machine learning), industries can achieve a new automation layer and with it create new revenue and business models. IIOT is sometimes called the fourth wave of the industrial revolution, or Industry 4.0. IOT is an advanced automation and analytics system which deals with artificial intelligence, sensor, networking, electronic, cloud messaging etc. to deliver complete systems for the product. Thus, IoT in the 21st century has become an essential requirement in different sectors all around the world. Things like home appliances, thermostats, and even vehicles can be included in this network and the ramifications of this change are far reaching.

II. BASIC CONCEPTS

In this section basic concepts like Internet of Things IOT in health care outline of the project, characteristics and applications are discussed.

Internet of Things (IOT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment. In the upcoming years, IOT-based technology will offer advanced levels of services and practically change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a very few of the categorical examples where IOT is strongly established.

IOT is network of interconnected computing devices which are embedded in everyday objects, enabling them to send and receive data. Over 9 billion 'Things' (physical objects) are currently connected to the Internet, as of now. In the near future, this number is expected to rise to a whopping 20 billion.

Main components:

- **Low-power embedded systems:** Less battery consumption, high performance are the inverse factors that play a significant role during the design of electronic systems.
- **Sensors:** Sensors are the major part of any IOT applications. It is a physical device that measures and detect certain physical quantity and convert it into signal which can be provide as an input to processing or control unit for analysis purpose.

There are two ways of building IOT**:**

1. Form a separate internetwork including only physical objects.
2. Make the Internet ever more expansive, but this requires hard-core technologies such as rigorous cloud computing and rapid big data storage (expensive).

IOT IN HEALTHCARE

Internet of Things (IOT)-enabled devices have made remote monitoring in the healthcare sector possible, unleashing the potential to keep patients safe and healthy, and empowering physicians to deliver superlative care. It has also increased patient engagement and satisfaction as interactions with doctors have become easier and more efficient. Furthermore, remote monitoring of patient's health helps in reducing the length of hospital stay and prevents re-admissions. IOT also has a major impact on reducing healthcare costs significantly and improving treatment outcomes.

IOT is undoubtedly transforming the healthcare industry by redefining the space of devices and people interaction in delivering healthcare solutions. IOT has applications in healthcare that benefit patients, families, physicians, hospitals and insurance companies.

Figure 1: IOT in health care

Devices in the form of wearable's like fitness bands and other wirelessly connected devices like blood pressure and heart rate monitoring cuffs, glucometer etc. give patients access to personalized attention. These devices can be tuned to remind calorie count, exercise check, appointments, blood pressure variations and much more. IOT has changed people's lives, especially elderly

With the development of computer network technology and e-commerce, the health care has got extensive popularization with the characteristics offering high-quality 24 hours treatment for Patients. Nowadays, using the thermometer which provides patients with the convenient temperature analysis is very common. However, the outbreak of many deadly diseases rises repeatedly in recent years; a lot of unnamed disease costs lots of life over the past years. Once the disease spreads body temperature is an early warning sign of infection. Fever is one of the body's first reactions to infection and is a common symptom in many illnesses. How to detect the disease from the people becomes the focus in current circle. Traditional systems authenticate generally by using the thermometer, the method has some defects. Using thermometer cannot identify the patient's temperature continuously. This paper describes a new method combining with the traditional method. Here Raspberry pi and thermal camera is used to improve the detection of the core body temperature continuously. It is a capable little device that enables people of

all ages to explore computing, and to learn how to program in languages like Scratch and Python. It reads the temperature by sensing and it also manages to read temperature from the group of people. The MLX909614 is used to improve the detection in different environmental conditions like day light and fog. The purpose of embedded systems is to control a specific function within a device. They are usually designed to only perform this function repeatedly, but more developed embedded systems can control entire operating systems. An embedded system is a reactive component, designed only to operate if it receives a specific signal in real-time. It communicates with the other components around it using sensors and actuators and will only perform its designated function if it receives the right response

III. EXISTING SYSTEM

The existing temperature System was built for the manual detection and not a continuous. The current clinical standard-of-care method for monitoring a patient's body temperature is to periodically take a measurement every few hours. In an outpatient setting, the frequency of temperature measurements is typically even more infrequent. At present, most of the contact methods are used to measure body temperature (e.g., medical thermometers and thermistors), but this method not only requires labor, time and consumables, but also increases the workload of the care workers and causes a waste of resources.

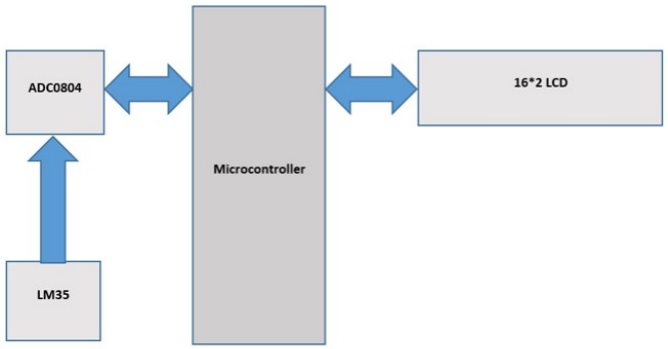

Figure 2: Existing System

In addition, for the accuracy in the measurement process, the subject's activities will be limited, and the process may also cause discomfort. The most cutting-edge temperature monitoring devices available right now are IOT-enabled sensors. IOT technology is an important innovation in the sensor field because it makes the data collection functionality of sensors available for remote tracking. Wireless temperature sensors have found over a dozen real-world applications within industrial IOT.

Temperature can be measured by using different types of sensors. These sensors come in different forms such as thermocouples, thermistors, resistance temperature detectors (RTD), and integrated circuit (IC) sensors. The temperature sensor produces analogy output voltage which is proportional to the temperature. The temperature sensor requires analogy to digital (A/D) converter so that the analog output voltage can be converted to digital form. The output of the temperature sensor is connected to the Port A of AT MEGA328RPU Adriano Uno. The Adriano Uno processes this data and displays it in LCD as well as sends it to the receiving end for displaying at the remote place.

- The thermometer may need to be let in place a long time to obtain an accurate measurement.
- Environmental temperature and noise is not considered
- Least stability, nonlinearity, low voltage, required reference, sensitivity.
- They can be affected by environmental changes and contamination, e.g., a gas that they are measuring can affect the performance of the sensor .
- Thermocouples, when badly insulated, are vulnerable to corrosion .Infrared frequencies are influenced by hard articles (for example dividers, entryways), smoke, dust, haze, daylight and so on Thus it doesn't work through dividers or entryways..

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IV.MATERIALS AND METHODS

In contrast to the contact methods, non-contact body temperature measurement uses infrared (IR) techniques that do not require any contact with skin tissue during the procedure. Two types of infrared systems are mainly used, IR thermometers and thermal cameras. In this work, we chose the thermal camera to visualize the body temperature as an image, and measure the temperature at many points over a specific area. A high quality 8 megapixel camera is also used to analyse the individual to keep the records and alert using SMTP (Simple Mail Transfer Protocol) is used.

To detect the temperature continuously and alerting the person can be done using the SMTP (Simple Mail Transfer Protocol) in the raspberry pi with the face detection and tracking algorithms. The temperature can be detected using the thermal imaging so detection of abnormalities in the crowded situation also possible. Environmental conditions such as gas , daylight can be neglected while detecting the temperature because of thermal imaging using MLX909614.The regular SMTP server supports both inbound and outbound email delivery. The users can have a dedicated server if needed. It supports bulk mailing. Low cost and extended area coverage. Provide options for tracking emails. Reliable and quick email delivery is the main advantage of using SMTP.

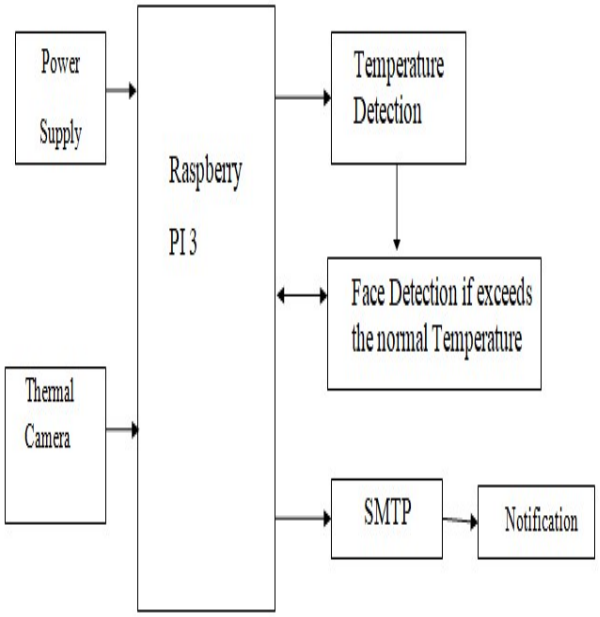

Figure 3: Block diagram.

The working of the system is shown in Figure 3. As shown, initial requirement is the Internet connectivity to give the alert message. The normal camera is used to retract the image after evaluation using face detection algorithm. The thermal readings obtained can be fed in to the pi for evaluation. Once the temperature exceeds the predetermined threshold, system captures the image of a person with the help of camera connected to it .The SMTP protocol is used to send the image of a person whose body temperature is above the threshold.

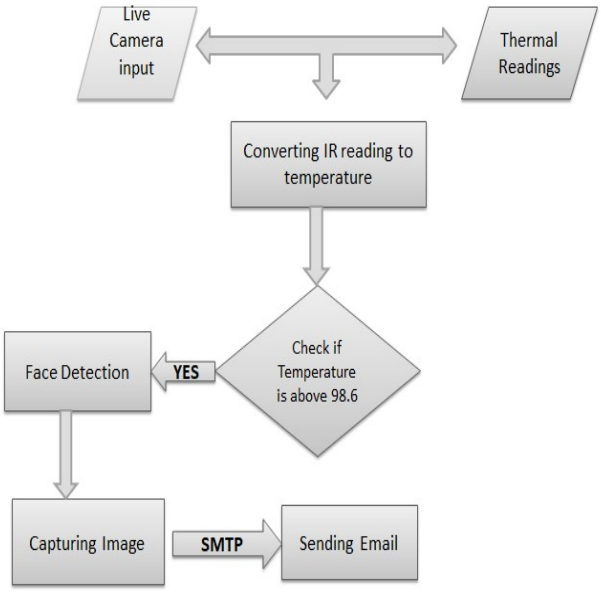

Figure 4: Flow chart

The Raspberry Pi 3 Model B uses a Broadcom BCM2837 Sock with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache. The Model A+ and B+ are 1.4 GHz. The Raspberry Pi 3 is equipped with a quad-core 64-bit Broadcom BCM2837 ARM Cortex-A53 Sock processor running at 1.2 GHz, making it about 50% more powerful than the Pith great innovation in this third version is undoubtedly the addition of a Wi-Fi chip and Bluetooth Low Energy. This not only saves space (you no longer need to connect Wi-Fi and Bluetooth dongles), but also frees up more USB ports for connecting other devices.

Raspberry Pi has Broadcom processor having Broadcom Serial Controller (BSC) which is a master, fast-mode (400Kb/s) BSC controller. The BSC bus is compliant with the Philips I2C bus. It supports both 7-bit and 10-bit addressing. It also has BSC2 master which is dedicatedly used with HDMI interface and should not be accessed by user.I2C bus/interface is used to communicate with the external devices like RTC, MPU6050, Magnetometer, etc. with only 2 lines. We can connect more devices using I2C interface if their addresses are different.

The MLX90640 module is a 24×32-pixel infrared array sensor with a total of 768 measurement pixels, small size, and low power consumption[2].The chip measures a wide temperature range, the normal working temperature range is -40 ~ 300 °C, the temperature measurement range is -40 ~ 85 °C, and the temperature measurement accuracy can reach ±1 °C. This camera comes in standard (55°) and wide-angle (110°) versions. It consists wide-angle model as the camera monitors a large living room, but take into account that both have the same resolution (32x24 pixels), so the wider angle comes with the cost of a lower spatial resolution. If you want to use a different thermal camera there's not much we need to change, as long as it comes with a software interface for Raspberry. For non-contact infrared temperature measurement modules, an important concept is the "field of view (FOV)". The MLX90640 has two field of view (FOV) options, a BAA version with a FOV of 110° ×75° and a BAB version with a FOV of 55° × 35°.）

The BAA version is more in line with the experimental requirements. With a maximum frame rate of 16 Hz (the theoretical limit is 32Hz but we were not able to practically achieve it), It's perfect for creating your own human detector or mini thermal camera. We have code for using this sensor on an Adriano or compatible (the sensor communicates over I2C) or on a Raspberry Pi with Python. Using a Raspberry Pi, the MLX90640, and Python, a real-time temperature map was developed that operates at roughly 3-8 frames per second. The frame rate is limited by the CPU and GPU on the Raspberry Pi 4, where the upper limit of 8fps corresponds to a smaller figure display on the RPI. The thermal camera was further improved by interpolating pixels to240x320, resulting in a smoother depiction of the temperature map..

Raspberry Pi programming is the process of writing computer code to control the Raspberry Pi, a small credit-card sized computer. It's a great way to learn programming, and can be used for a range of projects from simple home automation to complex robotics. The Raspberry Pi has a variety of programming languages available, including Python and Scratch. Python is the most popular language for Raspberry Pi programming, and is a great choice for

beginners. It is relatively easy to learn and versatile, allowing you to create a range of projects. Scratch is a visual programming language designed for children, and is a great way to get started with programming..

The Raspberry Pi can be used for a variety of projects, from learning how to code to building robots. Programming for the Raspberry Pi can be done in a variety of languages, including Python, Java, C, and Assembly. Additionally, the Raspberry Pi can be used for hardware projects, such as controlling lights and motors, or interfacing with sensors. With the Raspberry Pi, you can create projects such as a home security system, a media centre, or a weather station. Python is a beginner-friendly programming language that is used in schools, web development, scientific research, and in many other industries. This guide will walk you through writing your own programs with Python to blink lights, respond to button pushes, read sensors, and log data on the Raspberry Pi . Python is a high-level, general-purpose programming language. Python is a dynamic, interpreted (byte code-compiled) language. There are no type declarations of variables, parameters, functions, or methods in source code. This makes the code short and flexible, and you lose the compile-time type checking of the source code. Python tracks the types of all values at runtime and flags code that does not make sense as it runs. Its design philosophy emphasizes code readability with the use of significant indentation.

Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured, object-oriented and functional programming. Python is a dynamic, interpreted (byte code -compiled) language. There are no type declarations of variables, parameters, functions, or methods in source code. This makes the code short and flexible, and you lose the compile-time type checking of the source code. Python tracks the types of all values at runtime and flags code that does not make sense as it runs.

Python can be used to control hardware components connected to a Raspberry Pi, such as LEDs, motors, and sensors. It can also be used for programming web applications, software applications, and games. Python can also be used to create scripts that can automate tasks on a Raspberry Pi.

RESULTS

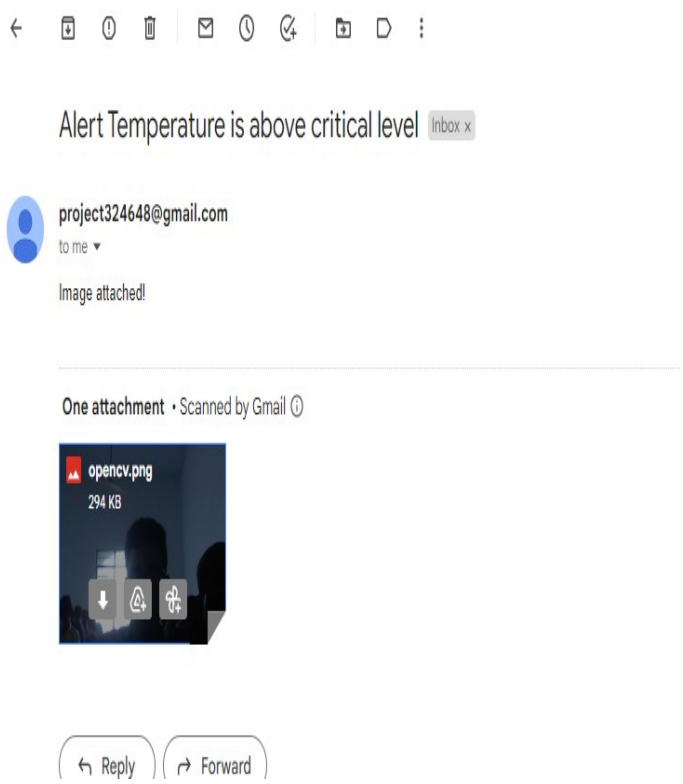

Figure 6: Alert

IV .CONCLUSION AND FUTURE IDEAS

This project designs a non-contact body temperature detection and identification system based on image registration, which realizes the temperature extraction of the area of interest and the multi-person face detection and face recognition through debugging, and finally realizes the mapping of infrared images to visible images on the basis of affine transformation, which effectively solves the problems of low detection efficiency and limited detection range of traditional temperature measurement systems, and has strong engineering significance and application prospects.

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