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TEMPERATURE AND MASK SCAN ENTRY SYSTEM

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ABSTRACT

Due to the COVID-19 pandemic, wearing a mask is mandatory in public spaces, as properly wearing a mask offers a maximum preventive effect against viral transmission. Body temperature has also become an important consideration in determining whether an individual is healthy. In this work, we design a real-time deep learning model to meet current demand to detect the mask-wearing position and head temperature of a person before he or she enters a public space. In this experiment, we use a deep learning object detection method to create a mask position and head temperature detector using an Arduino and temperature sensor. We implement an RGB camera and temperature sensor to generate input images and capture a person's temperature, respectively. The output of these experiments is a live video that carries accurate information about whether a person is wearing a mask properly and what his or her head temperature is. Our model is light and fast, achieving a confidence score of 81.31% for the prediction object and a prediction speed below 0.1s/image.

Keywords *- Python, OpenCV, Raspberry pi.*

1. INTRODUCTION

The main aim of the project is to build a Raspberry pi based safety device for covid-19 safety rules to reduce the disease spread. We focus on most common indoor measurement system to allow the people. This project makes a use of MLX90614 contactless temperature sensor to detect the body temperature and USB camera which detects whether the person is wearing a mask or not. We introduce an affordable COVID-19 indoor safety system. All modules and sensor are interfaced to the raspberry pi processor.

The temperature sensor measures person's temperature using contactless IR sensor. The persons pass one by one. In case that person's temperature exceeds average human body, and then raspberry pi processor generates signal to lock the door and gives the audible alert through buzzer. Otherwise, the door is opened to let the person in.

For implementation of mask detection using an OpenCV and camera interfaced to the Raspberry Pi. When the user switches on the kit then camera capture the images, In case that image does not contain mouth and nose, it means that person wears mask properly and corresponding door will be opened. However, if the person not wear a mask then raspberry pi processor generates signal to lock the door and also gives the audible alerts through buzzer.

The main controlling device of the project is Raspberry pi processor. Here we are using DC motor as door. The SD card is a key part of the Raspberry Pi; it provides the initial storage for the Operating System and files. The status of the project will be displays on LCD module. Here we are using two LEDs for working indication of the project.

2. LITERATURE REVIEW

Beginning in December 2019, the sudden new type of coronavirus pneumonia (COVID-19) quickly raged across the country and even the world [1]. As of July 15, 2020, more than 13.65 million confirmed cases have been reported in more than 220 countries and regions around the world, and more than 580,000 patients have died. At present, it is still continuing to spread on a large scale [2]. The new type of coronavirus is highly infectious. It can be spread through contact, droplets, aerosols and other carriers in the air, and it can survive for 5 days in a suitable environment [3]-[4]. The "Guidelines for the Prevention of New Coronavirus Infection Pneumonia" issued by the National Health Commission emphasized that when individuals go out to public places, seek medical treatment and take public transportation, they need to wear medical surgical masks or N95 masks to prevent the spread of the virus. Therefore, it is everyone's responsibility to wear masks in public places during the epidemic, but this requires not only the conscious compliance of the individual, but also the adoption of certain measures to supervise and manage. At present, although there is no algorithm specifically applied to face mask wearing detection, with the development of deep learning in the field of computer vision [5-7], neural network-based target detection algorithms are used in pedestrian target detection, face detection, and remote sensing image targets. Detection, medical image detection and natural scene text detection are widely used in fields [8]-[11]. Face recognition algorithms rely on a high degree of recognition accuracy, and have huge application potential in classroom attendance, identity authentication, access control systems, login and unlocking, and social media platforms [12].

At present, face recognition devices on the market have relatively single functions and have relatively high requirements on faces. When the face is in a state of large-area occlusion, the recognition accuracy drops rapidly. Especially in the face of the current epidemic situation where all people wear masks, the capabilities of traditional face recognition systems appear to be stretched. Considering that we will try our best to resume production and work while ensuring people's safety, we have designed a smart detection and recognition system for mask wearing. The system is mainly composed

of face mask detection algorithm and face recognition algorithm. The main functions of the system can be divided into three parts: face mask detection, face recognition, and voice prompts. When multiple pedestrians pass by the camera, the camera equipped with this algorithm will first detect the pedestrian's face mask. When the pedestrian wears the mask normally, it will not give a voice prompt. When a pedestrian wears a mask incorrectly, the voice will announce to remind him to wear the mask correctly. When a pedestrian is not wearing a mask, the system will trigger the face recognition module to speak his name and remind him to wear a mask. The system can be used in high-speed rail stations, subways, shopping malls and other crowded areas. Through researching related target detection algorithms, it is found that the deep learning model used for face detection can be applied to the task of mask wearing detection. In this paper, the more accurate face detection algorithm RETINAFACE [13] is used as the basic algorithm for mask face detection, and on this basis, the network structure of the RETINAFACE algorithm is improved, and the attention mechanism is introduced to meet the needs of new functions; In this system, we calculate the mask and the key point positions of the face, and the confidence that the mask is worn on different faces is returned to determine whether the person wears the mask in a standard manner. The calculation is fast and accurate, and the algorithm is stable and efficient; for the current popular ones For the face recognition method, we use the DEEPFACE [14] algorithm. The algorithm divides the face recognition problem into several related sub problems.

3. EMBEDDED SYSTEM

An embedded system is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today.

Embedded systems are controlled by one or more main processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task, which may require very powerful processors. For example, air traffic control systems may usefully be viewed as embedded, even though they involve mainframe computers and dedicated regional and national networks between airports and radar sites. (Each radar probably includes one or more embedded systems of its own.)

Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

Physically embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

In general, "embedded system" is not a strictly definable term, as most systems have some element of extensibility or programmability. For example, handheld computers share some elements with embedded systems such as the operating systems and microprocessors which power them, but they allow different applications to be loaded and peripherals to be connected. Moreover, even systems which don't expose programmability as a primary feature generally need to support software updates. On a continuum from "general purpose" to "embedded", large application systems will have subcomponents at most points even if the system as a whole is "designed to perform one or a few dedicated functions", and is thus appropriate to call "embedded". A modern example of embedded system is shown in below fig.

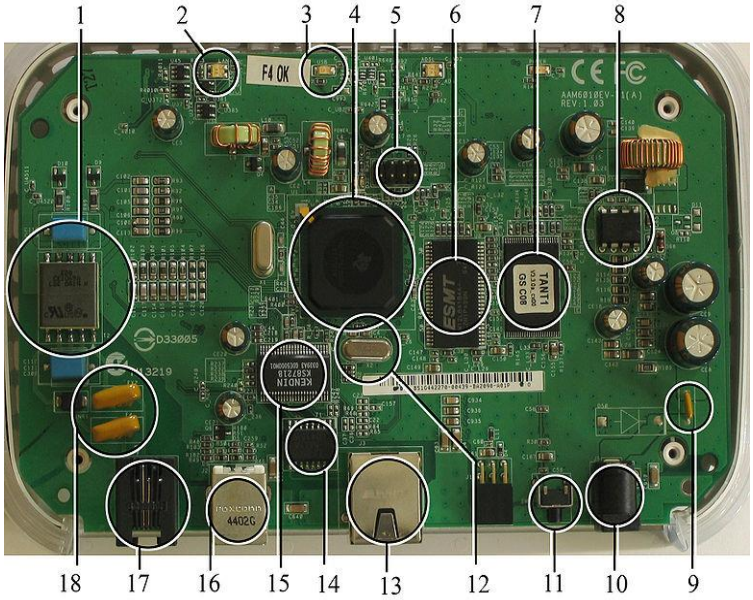

Fig : A modern example of embedded system

Labeled parts include microprocessor (4), RAM (6), flash memory (7).Embedded systems programming is not like normal PC programming. In many ways, programming for an embedded system is like programming PC 15 years ago. The hardware for the system is usually chosen to make the device as cheap as possible. Spending an extra dollar a unit in order to make things easier to program can cost millions. Hiring a programmer for an extra month is cheap in comparison. This means the programmer must make do with slow processors and low memory, while at the same time battling a need for efficiency not seen in most PC applications. Below is a list of issues specific to the embedded field.

Need For Embedded Systems:

The uses of embedded systems are virtually limitless, because every day new products are introduced to the market that utilizes embedded computers in novel ways. In recent years, hardware such as microprocessors, microcontrollers, and FPGA chips have become much cheaper. So when implementing a new form of control, it's wiser to just buy the generic chip and write your own custom software for it. Producing a custom-made chip to handle a particular task or set of tasks costs far more time and money. Many embedded computers even come with extensive libraries, so that "writing your own software" becomes a very trivial task indeed. From an implementation viewpoint, there is a major difference between a computer and an embedded system. Embedded systems are often required to provide Real-Time response. The main elements that make embedded systems unique are its reliability and ease in debugging.

4. PROPOSED ARCHITECTURE

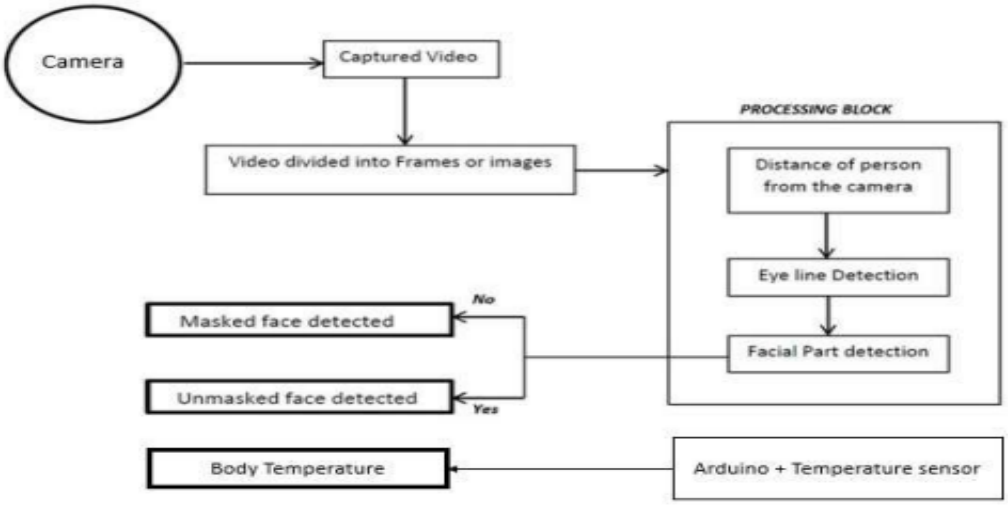

Fig : System Architecture

5. HARDWARE DESCRIPTION

In this chapter the block diagram of the project and design aspect of independent modules are considered. Block diagram is shown in below figure:

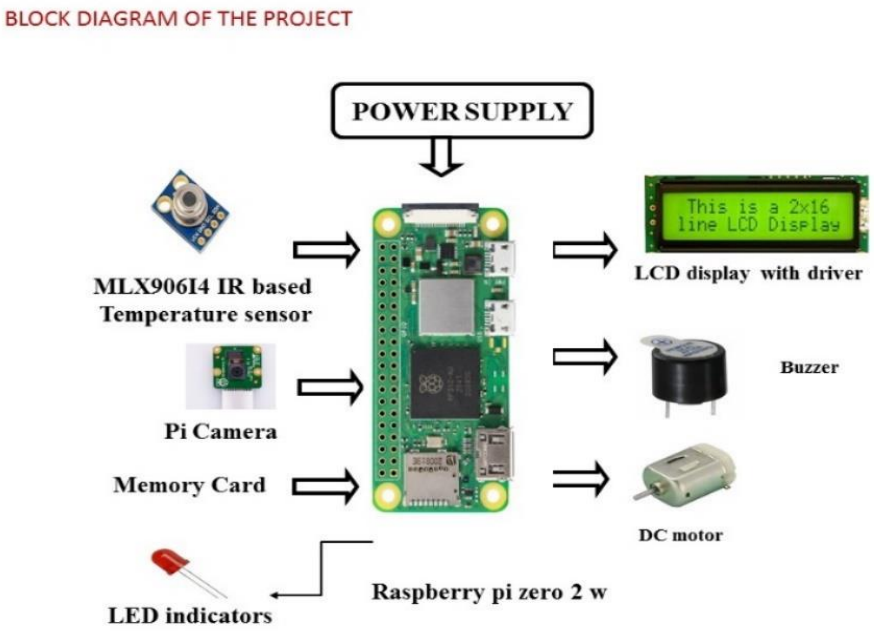

FIG : Block diagram of Temperature and Mask Scan Entry System

The main blocks of this project are:

1. Raspberry pi ZERO 2 W.
2. pi camera.
3. MLX90614 (IR based Temperature sensor)
4. DC motor.
5. Buzzer
6. LCD display.
7. LED indicators.

6. PROJECT DESCRIPTION

In this schematic diagram and interfacing of Raspberry pi zero microprocessor with each module is considered.

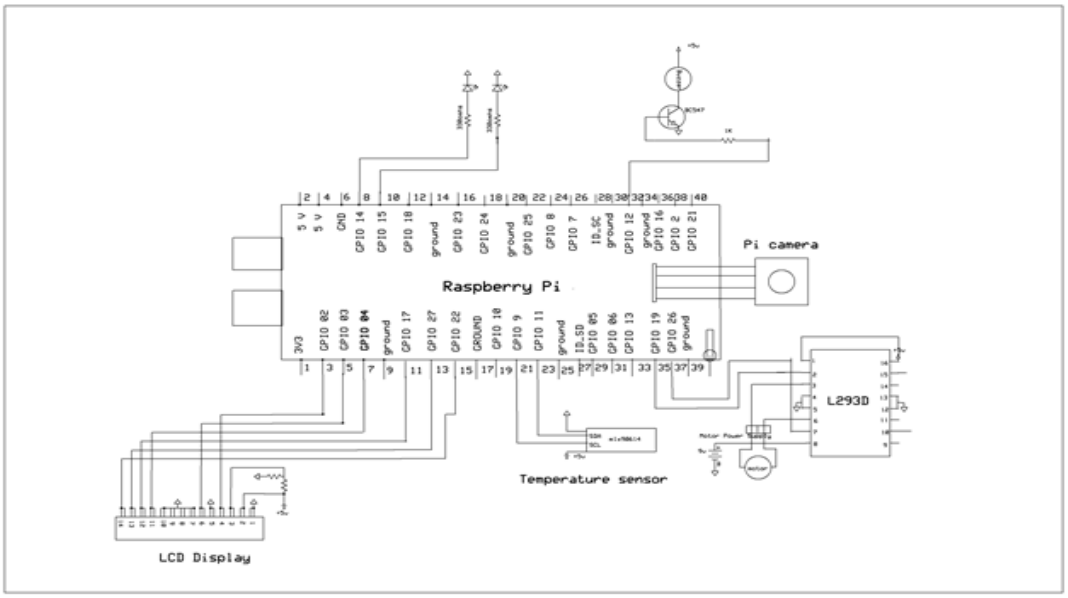

Fig: schematic diagram of Temperature and Mask Scan Entry System

7. ADVANTAGES AND DISADVANTAGES

Advantages:

- Real-time contactless body temperature measurement system.
- Design a facemask detection system.
- Using openCV, pi camera to detect the mask.
- Using raspberry pi to achieve this task.
- Visible alerts using LCD display.
- Audible alerts using Buzzer.
- Efficient design.
- Higher accuracy.
- Low power consumption.
- Design an indoor measurement system to allow the people.
- By using this project we can reduce the corona-virus exposure risk.

Disadvantages:

- Interfacing sensors to ARM-11 processor is highly sensitive.

Applications:

- Real-time monitoring system.

8. SOFTWARE DESCRIPTION

LINUX OPERATING SYSTEM:

Introduction:

Linux is a Unix-like and mostly POSIX-compliant computer operating system assembled under the model of free and open source software development and distribution. The defining component of Linux is the Linux kernel, an operating system kernel first released on 5 October 1991 by Linus Torvalds. The Free Software Foundation uses the name GNU/Linux, which has led to some controversy.

The Linux Standard Base (LSB) is a joint project by several Linux distributions under the organizational structure of the Linux Foundation to standardize the software system structure, including the file system hierarchy used in the GNU/Linux operating system. The LSB is based on the POSIX specification, the Single UNIX Specification, and several other open standards, but extends them in certain areas.

PYTHON

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. An interpreted language, Python has a design philosophy that emphasizes code readability (notably using whitespace indentation to delimit code blocks rather than curly brackets or keywords), and a syntax that allows programmers to express concepts in fewer lines of code than might be used in languages such as C++or Java. It provides constructs that enable clear programming on both small and large scales. Python interpreters are available for many operating systems. CPython, the reference implementation of Python, is open source software and has a community-based development model, as do nearly all of its variant implementations. CPython is managed by the non-profit Python Software Foundation. Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object-oriented, imperative, functional and procedural, and has a large and comprehensive standard library.

OpenCV:

OpenCV is a programming library/package that has been created especially for allowing programmers to enter the world of Computer Vision. The primary developer of the OpenCV package is Intel Corporation, and the package was released to the public during the year 1999-2000.
OpenCV stands for Open-Source Computer Vision (Library). It is the most commonly used, popular, and well-documented Computer Vision library. It is open-source, which means that one does not require a license to utilize the software.

As one may know, most Machine Learning Algorithms require inputs to be quantitative in nature, i.e., numerical. OpenCV allows us to apply Machine Learning techniques to images, however, oftentimes we are required to preprocess and prepare the raw images for them to be transformed into features (columns of data) that are useful and usable by our Machine Learning Algorithms.

9. CONCLUSION

Result:

The project “Temperature and Mask Scan Entry System” was designed an indoor measurement system to allow the people such as body temperature and face mask detection. Raspberry pi based contact less body temperature measurement and face mask detector which detects whether the person is wearing a mask or not using Pi camera and OpenCV.

Conclusion:

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC’s with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

Future Scope:

We can extend this project by adding some health sensors such as heartbeat, oxygen, respiration and IOT technology. The systems can include monitoring sensor data in IOT platform via wireless; the system can display sensor parameter on LCD. The system workout on COVID-19 to identify the number of COVID-19 cases in a region then we can classify as red, orange or green zone. Moreover, timely and effectively by using this project we can manage the COVID-19 outbreak and reducing viral transmission.

In future, it is planned to experiment with various deep learning and computer vision frameworks for object detection on Raspberry Pi in order to achieve higher frame rate. Moreover, we would like to extend this solution with environment sensing mechanisms for adaptive building air conditioning and ventilation airborne protection in order to reduce the spread of corona virus indoors, especially during summer.

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