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Raspberry Pi-based Vehicle Starter on Face Detection with Image Processing and IoT

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ABSTRACT

Normally vehicle key is the only way to start the vehicle or to provide ignition to the engine. In this project, the face recognition-based vehicle starter system replaces the vehicle ignition by replacing the key with a specific user face. The user's face is utilized to authenticate the vehicle starting process. This smart vehicle starter system is powered by a raspberry pi circuit. The face recognition system makes use of a camera and raspberry pi as the brain of a system to capture images and store this data into its database. While in real practice when the user comes in front of the camera system starts scanning, when the face is detected by the camera the system compares the given face with the images in the database and authorizes the person, if the person is already registered then it starts the vehicle or else identifies the person as an invalid user and the buzzer goes on and access is denied and the solenoid value remain off. To clear data, we need to use the clear option to clear the entire data.

Keywords - Face registration, Face recognition, Ignition, database, Image processing

I. INTRODUCTION

With the advancement in Embedded technology in recent years, various components and tools are created to make design and exploration at the next level. It has created knowledge and application for various domains of engineering. In our day-to-day life, we all use vehicles as an integral part of our life. So, vehicle security and its analysis are a constant process of improvement. To match the challenges of all possible issues, occur with vehicle security we are plotting a face recognition-based vehicle starter concept. Vehicles themselves come up with many safety features but still sometimes due to some mechanical and manual processes vehicles are targeted by thieving. So, we must consider vehicle security programs sensible, competent, and reliable. So, to prevent vehicle stealing from thieves, owners of vehicles try to opt for an antirobbery scheme for their vehicle safety. But many of them are not available to avoid these incidents before happening the robbery. If we implement a human-machine interaction system to detect faces from camera and process to identify the genuine owner of the vehicle and avoid other people to accessing the vehicle from us, we can make use of image processing technique with the help of

standard computer machine and camera and alert mechanism to avoid the stealing of vehicle by thieves. So, we need a robust and efficient face detection algorithm and dataset to design a system model to achieve high detection accuracy and protect a vehicle.

II. EXISTING SYSTEM

In existing method does not embed with RF communication. They do not exist the camera in the previous case. In the existing method, the Arduino platform was implemented. In this system, monitoring is only applicable. Data is not stored in the system. The Existing system does not include with RF communication method. It does not exist the camera in the old structure. The recent method, the Arduino is added as a computing platform in implementation. In this system only, basic monitoring with sensors is applied but. Real-time authentication and data storage, as well as processing, is not applicable.

III. PROPOSED SYSTEM

To overcome the existing system, we are providing the standard security level face recognition is used in this project along with a buzzer. Face recognition is a biometric device. And all the processes will be carried out by the raspberry pi 3. The system comprises of Raspberry pi, camera, buzzer and uses a secret knocking pattern that can be viewed only by the owner of a vehicle for security purposes. person's face is also detected through the camera if face detection matches the car or bike will unlock and if any unknown person tries to start vehicle system will display a message on the screen and a loud buzzer will beep to give alert the owner of that vehicle.

IV. HARDWARE DESCRIPTION

Raspberry Pi 3 b+

Raspberry pi is a pocket personal computer with Linux operating system on it. This is great cheap to encourage young people for learning, programming, experimenting and for making innovation. Resembling like motherboard, raspberry pi has all the components to connect inputs, outputs, and storage. Model A has all of the same features as model B minus one of the USB plugs, the Ethernet port, and half of the RAM. An SD card inserted into the slot on the board acts as the hard drive for the Raspberry Pi.

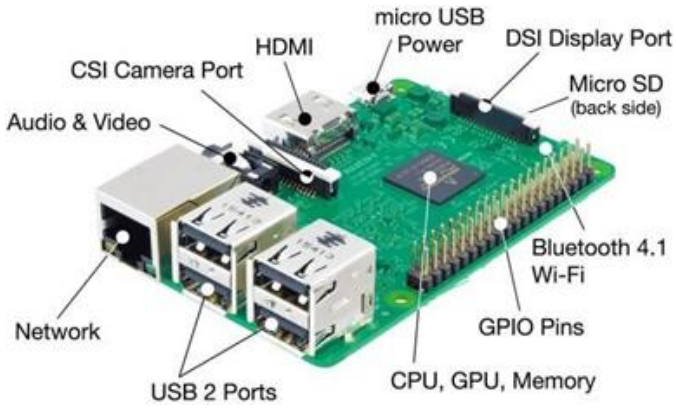

Fig – 1: Raspberry pi 3b+

Solenoid Lock

The circuit diagram for Raspberry Pi Solenoid Door Lock is very simple as you only need to connect the solenoid door lock to Raspberry Pi. Solenoid Lock needs 9V-12V to operate and Raspberry Pi GPIO pins can supply only 3.3V, so a 12V external power source is used to trigger the lock with the help of a relay.

Buzzer

Wwe use a 5V active buzzer. With a Python script running on your Raspberry Pi, we make the buzzer produce a repeated beep. When you have completed this tutorial, you will be able to connect an active buzzer to your Pi via the GPIO pins

V. SOFTWARE DESCRIPTION

Raspbian OS

Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. An operating system is the set of basic programs and utilities that make your Raspberry Pi run. However, Raspbian provides more than a pure OS: it comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation on your Raspberry Pi.

The Raspberry Pi lines of micro-computers are impressive machines with endless possibilities. As a result. The Linux community has created dozens upon dozens of special Linux operating systems for it. Everything from Linux-powered server operating systems, to media centers, console emulation kits, and more; there's just so much to choose from. Raspbian is a Debian-based computer operating system for Raspberry Pi. There are several versions of Raspbian including Raspbian Stretch and Raspbian Jessie. It has been officially provided by the Raspberry Pi Foundation as the primary operating system for the family of Raspberry Pi single-board computers. Raspbian was created by Mike Thompson and Peter Greenasan Independent paper. Raspbian is highly optimized for the Raspberry Pi line's low-performance ARM CPUs. Raspbian uses PIXEL, Pi Improved X windows Environment, Lightweight as its main desktop environment as of the latest update. The scripts and files created are run on the Raspbian OS. It is an ARMHF port of the popular open-source operating system with one key difference: Raspbian builds differently than Debian, to support hardware floating-point.

Python

Python is an interpreted high-level general-purpose programming language. Its design philosophy emphasizes code readability with its use of significant indentation. Its language constructs as well as its object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

VI. ALGORITHM

HAAR-like features and rectangle sum

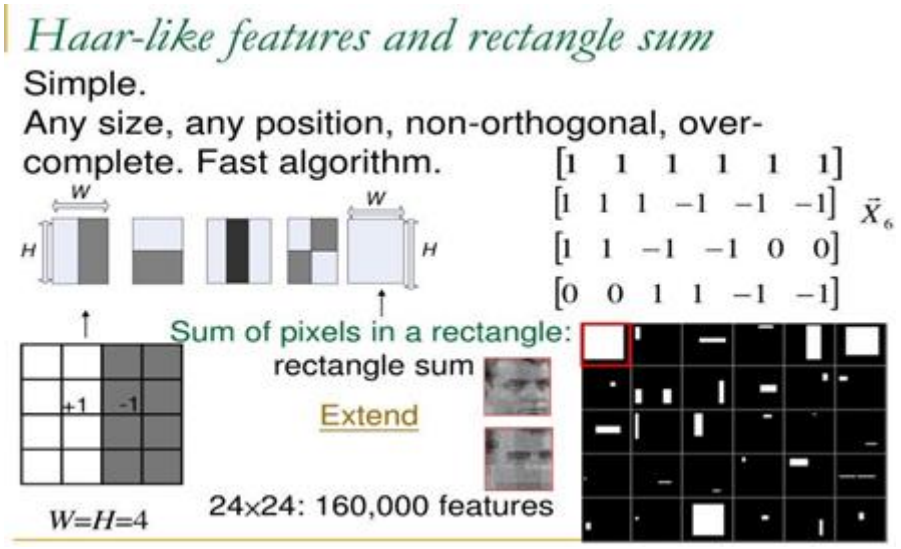

Fig – 2: HAAR-like features and rectangle sum

Haar-like features are digital image features used in object recognition. A Haar-like feature considers the adjacent window, sums up the pixel intensities in each region, and calculates the difference between these sums. The difference is then used to categorize subsections of an image. For example, with a human face, it is a common observation that among all faces the region of the eyes is darker than the region of the cheeks. Therefore, a common Haar-like feature for face detection is a set of two adjacent rectangles that lie above the eye and the cheek region. The algorithm uses edge or line detection features. A simple rectangular Haar-like feature can be defined as the difference of the sum of pixels of areas inside the rectangle, which can be at any position and scale within the original image. This modified feature set is called the 2-rectangle feature.

Extended HAAR-like features

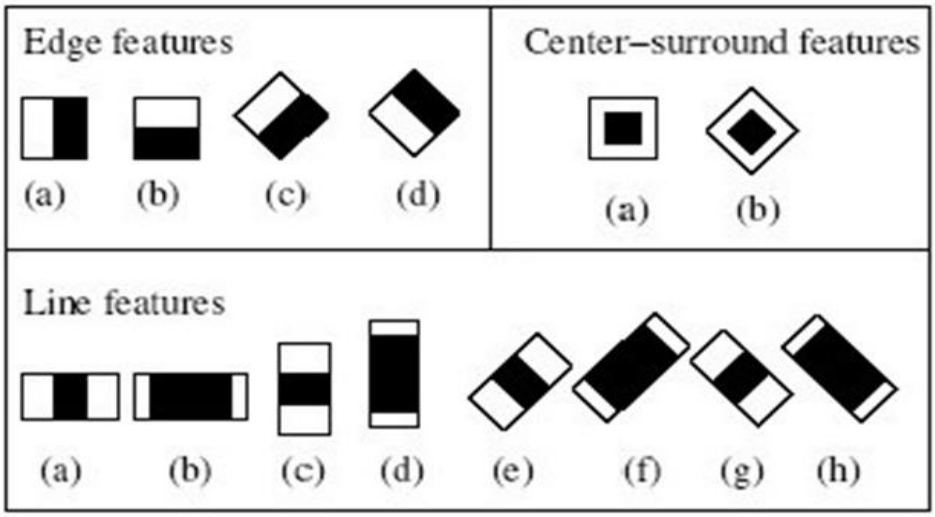

Fig – 3: Extended HAAR-like features

If you look at a photograph showing a person's face, you will see the eye region is darker than the bridge of the nose. The cheeks are also brighter than the eye region. A simple way to find out which region is darker or lighter is, to sum up, the pixel values of both regions and compare them. The sum of pixel values in the darker region will be smaller than the sum of pixels in the brighter region. This can be accomplished using the Haar-like feature.

HAAR-like features – application

Face recognition

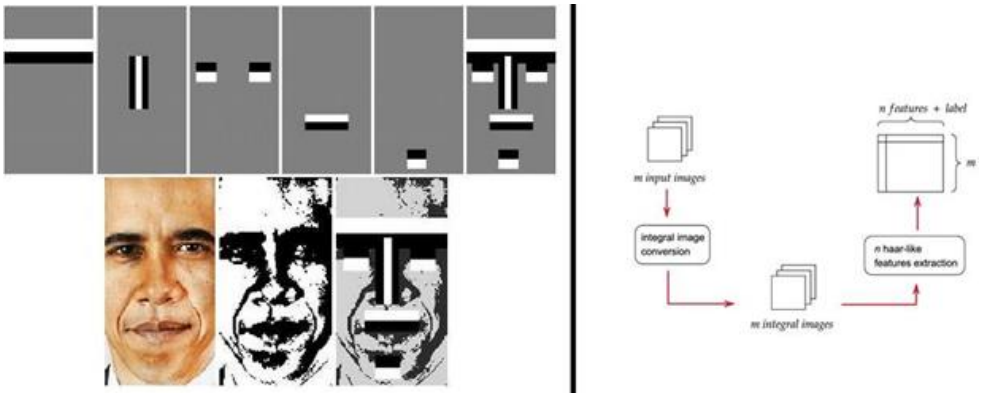

Fig – 4: HAAR-like features-application

In the process of face detection, place random feature rectangles on the image in turn. The difference between the sum of the pixel of the white region and the sum of a pixel of the black region serves as a feature. If the rectangle contains faces, the eigenvalue serves as a facial feature. Otherwise, the eigenvalue serves as a non-face feature. Different sizes of rectangles on different positions of the image provide large amounts of features. After input images are detected by multiple strong classifiers, it can be confirmed that the image is a face.

Flowchart

To create a complete project on Face Recognition, we must work on 3 very distinct phases:

- Face Detection and Data Gathering
- Train the Recognizer
- Face Recognition

The camera gathers the images of the face in the dataset folder. The datum of each face is fed to the recognizer i.e., Haar cascade. During recognition, the camera captures the image of a face and checks with the stored images.

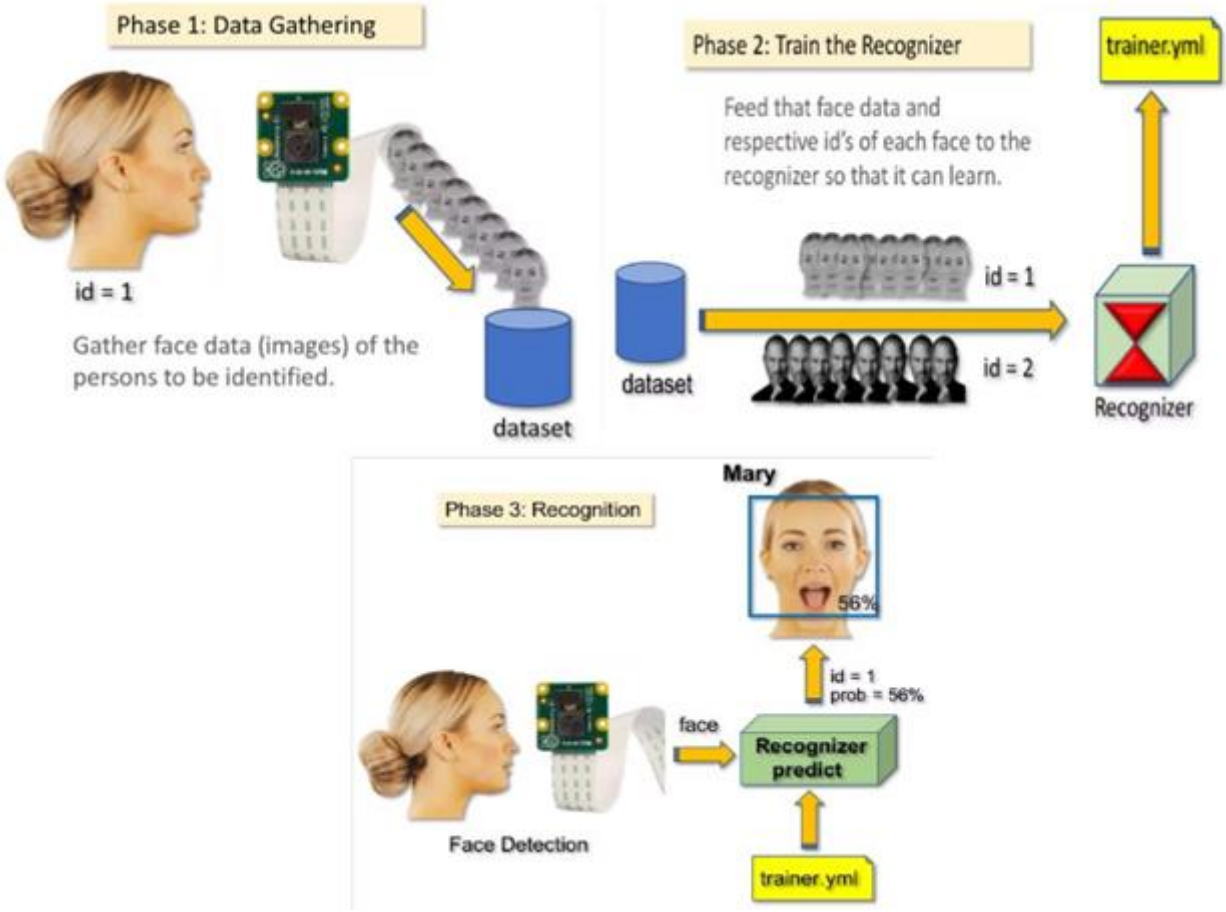

Fig – 5: Flowchart

Block diagram of the paper

Block diagram consists of Raspberry pi 3 B+, 5-megapixel camera, relay module, power supply, monitor, SD card, solenoid lock. The SD card loaded with Raspberry pi OS is booted in Raspberry pi, Pi camera is configured.

A trained dataset is created. The relay is interfaced to activate the switch or solenoid lock as an output indicating the vehicle start mechanism.

The system is powered ON and the camera module is started to take live video of a person in front of it. The system captured multiple frames and store them in memory. The dataset is utilized to predict face to authenticate the user to allow him to access the vehicle as the vehicle starts automatically after face recognition by the system. This system is completely automatic with no physical interface with a vehicle to start the vehicle. So, achieve more accuracy and security. Give more reliability with an alert mechanism so thieves can stay away or if try to engage with vehicle forcefully, can get caught as alarm start sounding and people nearby get alert that someone tries to capture vehicle without permission or to catch the robbery of the vehicle.

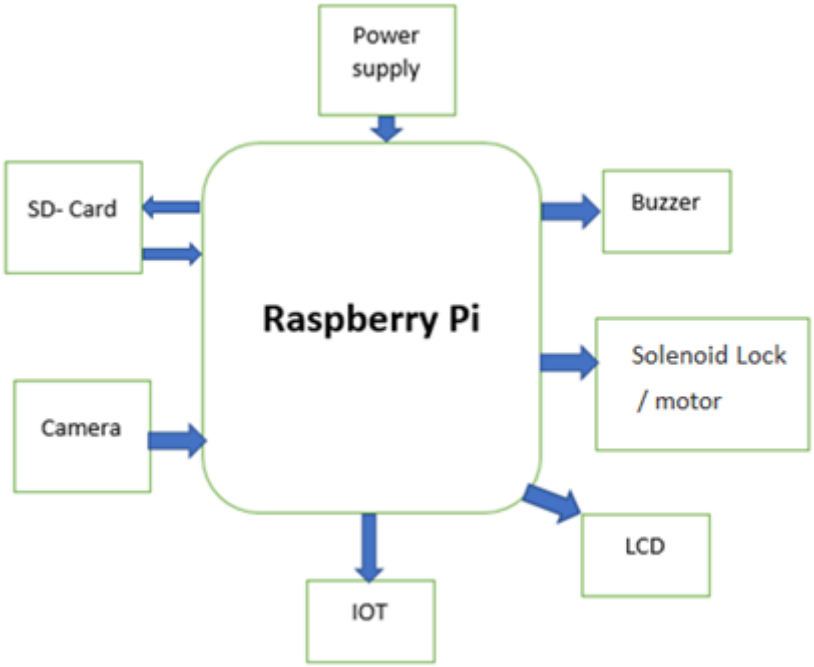

Fig – 6: Block diagram

VII. RESULTS

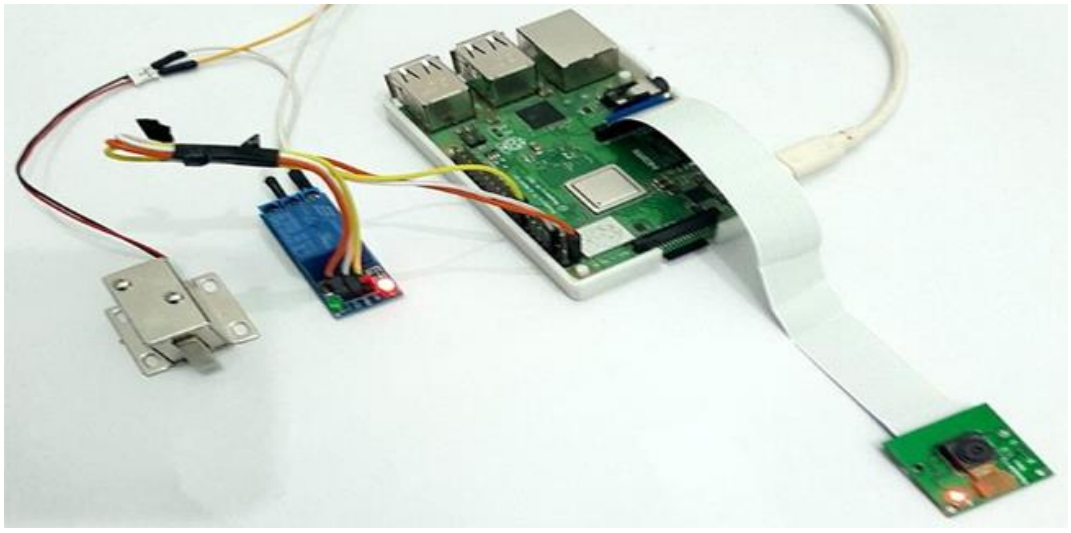

Fig – 7: Hardware Output

The above image is the final hardware output of this paper.

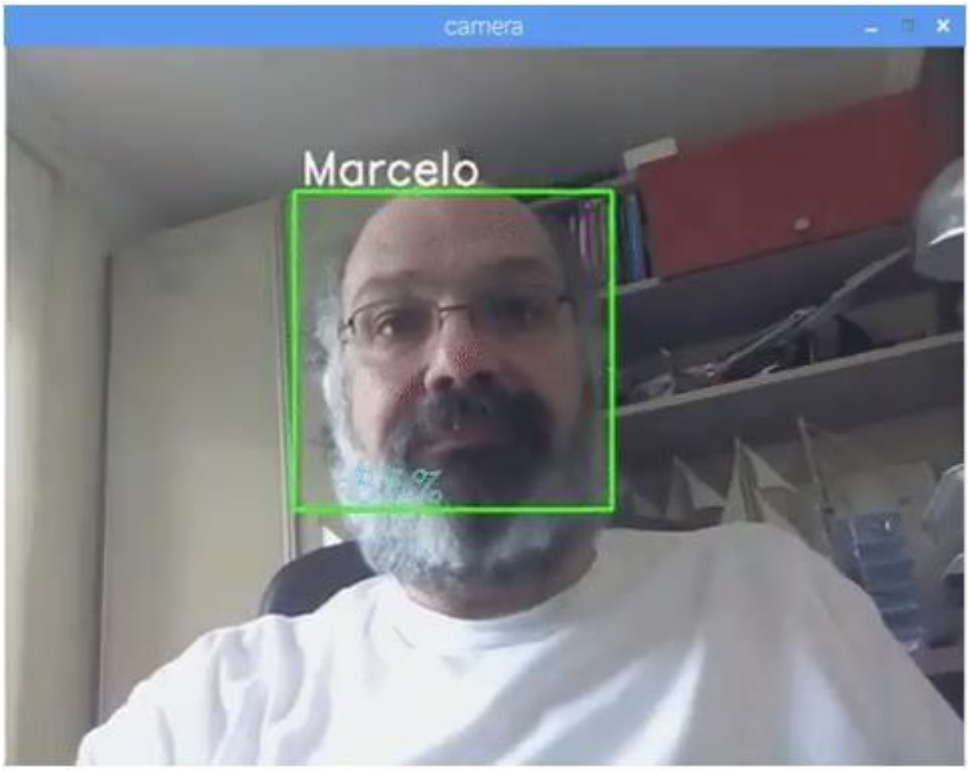

Fig – 8: Raspberry Output

VIII. CONCLUSION

From the results obtained in the demonstration, it is clear the system provides faster face detection and recognition for owner authentication. Ignition is provided immediately, after owner authentication, for starting the vehicle engine. All the sensors of the black box are excellent at performance and provide adequate data to the system for monitoring and accurate information about the status of the vehicle is provided to the owner and family. This means that the system fulfills all the expected results and it is fruitful for the user.

IX. FUTURE SCOPE

As the actual implementation of the system for a commercial purpose is taken into the consideration the system can be upgraded with advanced components. For improving system Performance, the best and advanced versions of the components used can be included in the system Advance version refers to Orange-pi for faster processing, high-resolution cameras, higher accuracy digital sensors, etc.

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