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Realtime Security System

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Abstract: Security is a major concern even after rapid development in electronic surveillance and emergency response systems. A major part of the concern comes from the owner(s) being kept informed about the security status in real time. Another problem which causes delay in law enforcement after a breach occurs is presentation of reliable proof of breach. The proposed system could solve these problems by providing real time alerts to the owner using the internet, and to solve the identification problem through the use of computer vision to build up and log a comprehensive face database based on access and breaches into the property.
Keywords : Security, Real Time Computer Vision, Open CV

I. INTRODUCTION

With the advent of new equipment, the house breaching capabilities of intruders have vastly increased. As a countermeasure, passive security systems have been implemented by home owners and corporate offices. While these systems provide adequate security, they fail to differentiate between potential intruders and permitted individuals. Commercial systems lack in reporting the activity of area under surveillance in real time to the user, when the user is remotely located away from the property.

The aim is to design an automated security system which leverages the combined capabilities of available security modules and computer vision libraries. The privacy and the security have become the cornerstone of peaceful life in urban areas, which still needs a greater level of development and tighter integration of available modules. The status of the security system will be reflected in email being sent to the property owner and other concerning individuals. A Raspberry Pi will be used for handling image processing and password authentication part of the security system. An ATmega 328 microcontroller is responsible for Radio-frequency identity card (RFID) authentication and controlling the state of ambient lights. The system will get information about human presence from passive infra-red (PIR) module. A comprehensive storage structure has been implemented to store entry logs.

An automatic presence detection system comprised of passive infra-red sensor and one or more camera modules has been implemented. The processing circuits have switching devices for handshaking with each other through general purpose input output pins. A display monitor displays data about the overall system status.

II. BACKGROUND

A. Need of the System

In the real estate sector, security plays a pivotal role in determining value of property as well as level of safety available to the user. The security solutions available involve continuous storing of large amounts of data, most of which is never required. Also, most of the solutions available in the domestic market lack decision making skills when the prime owner is away. This presents a need for a smarter system that can think and make decisions by itself and store and provide filtered and corrected data regarding the property to the owners and concerned security services like guards, police etc operating in the region. This requires tight integration and well defined interlinking of physical identity checking devices and proper image processing on the incoming camera feed, which is found to be lacking in available systems and has been implemented in the project. As a solution to the mentioned problems a new system has been devised and implemented.

B. Field of Invention

The system relates to an automatic home monitoring system, particularly, but not exclusively, for monitoring the house or any designated building to provide an indication or alarm when the security of an area is breached based on constraints determined by the state of sensors placed on or under doors, windows etc. and area scanned and monitored by the passive infrared sensor array. It is pointed out that the automated security system of present invention can include a plurality of presence sensing passive infrared sensors and photo capturing as well as video recording cameras associated with a plurality of buildings requiring security, and is not necessarily restricted for use with only buildings.

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III. PROPOSED SYSTEM

The hardware design is made using four main modules along with some allied circuitry. The main modules are: 1) Image processor and microcontroller 2) Radio frequency identity card reader and checker 3) Password entry membrane keyboard module 4) Image capturing device. The image processor handles the image capturing devices and the microcontroller handles the rest of the hardware consisting of authentication devices.

A. Functional Units

Raspberry Pi model 3BThe raspberry pi is the heart of proposed embedded system. It performs image processing over the Open CV computing platform. Microprocessors are used in autonomous devises so they can perform complex processing tasks in short amount of time. The ATmega 328 is the second most important processing device of the proposed system. Micro controllers are used in automatically controlled products and devices such as automobile engines control systems, medical devices, office machines, power tools etc.

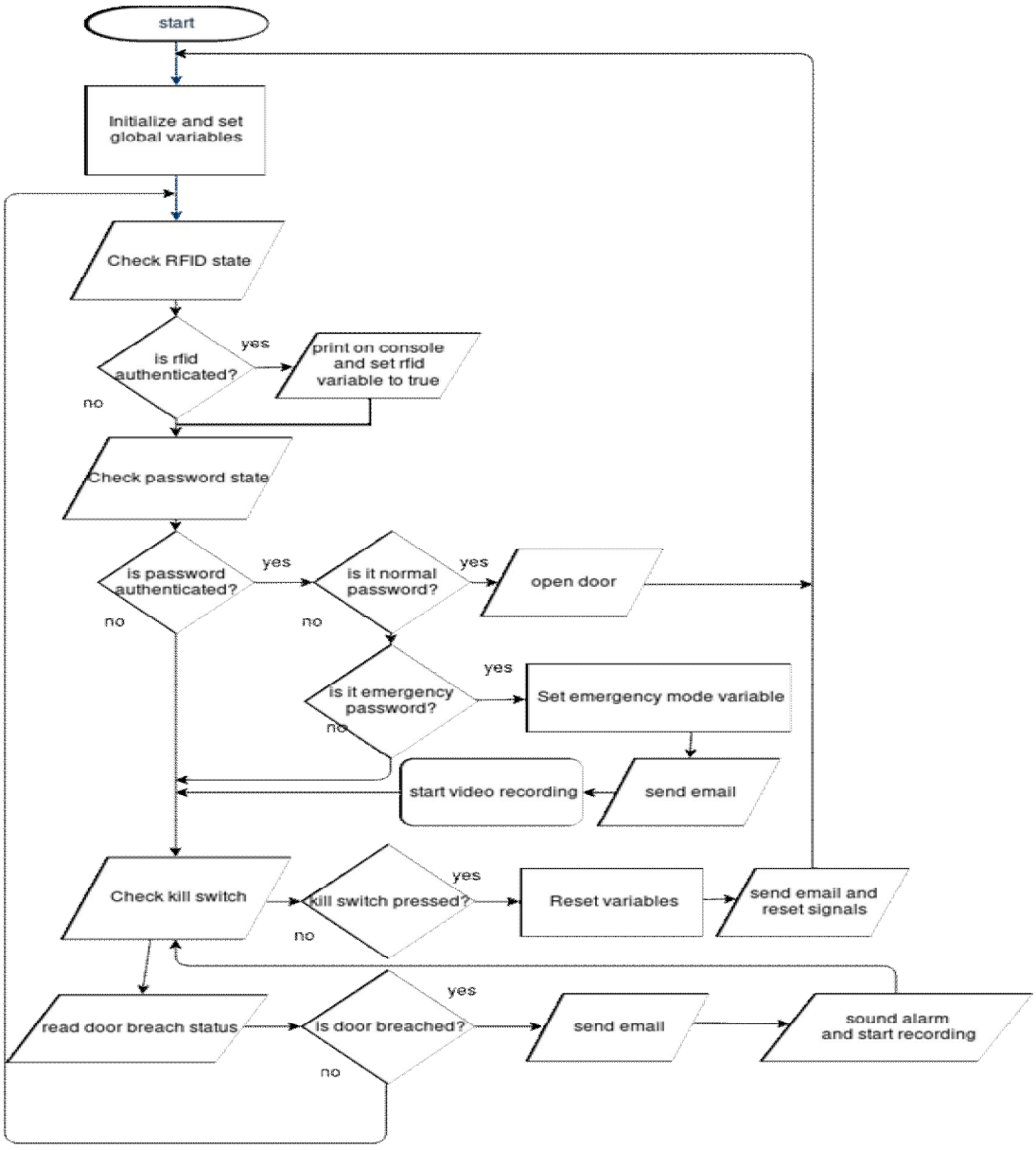


Fig. 1 Raspberry Pi Logic Flowchart

by reducing the size and cost compared to a design that uses microprocessor, memory and input and output devices, micro controllers

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make it economical to digitally control even with more devices and processors. A buck converter (step-down converter) is a DC to DC power converter which steps down voltage (while stepping up current) from its input (supply) to The output (load). It's a class of Switch mode power supply (SMPS) contain at least two semiconductors (a diode and a transistor although modern buck converters frequently replace the diode with a second transistor used or synchronous rectification) and at least one energy storage element, capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter). Switching converters (like buck converters) are characterized by the greater power efficiency as DC-to-DC converters than linear regulators, which are simpler circuits that lower voltages by dissipating power as heat, but do not step up output current. It can be made very much efficient

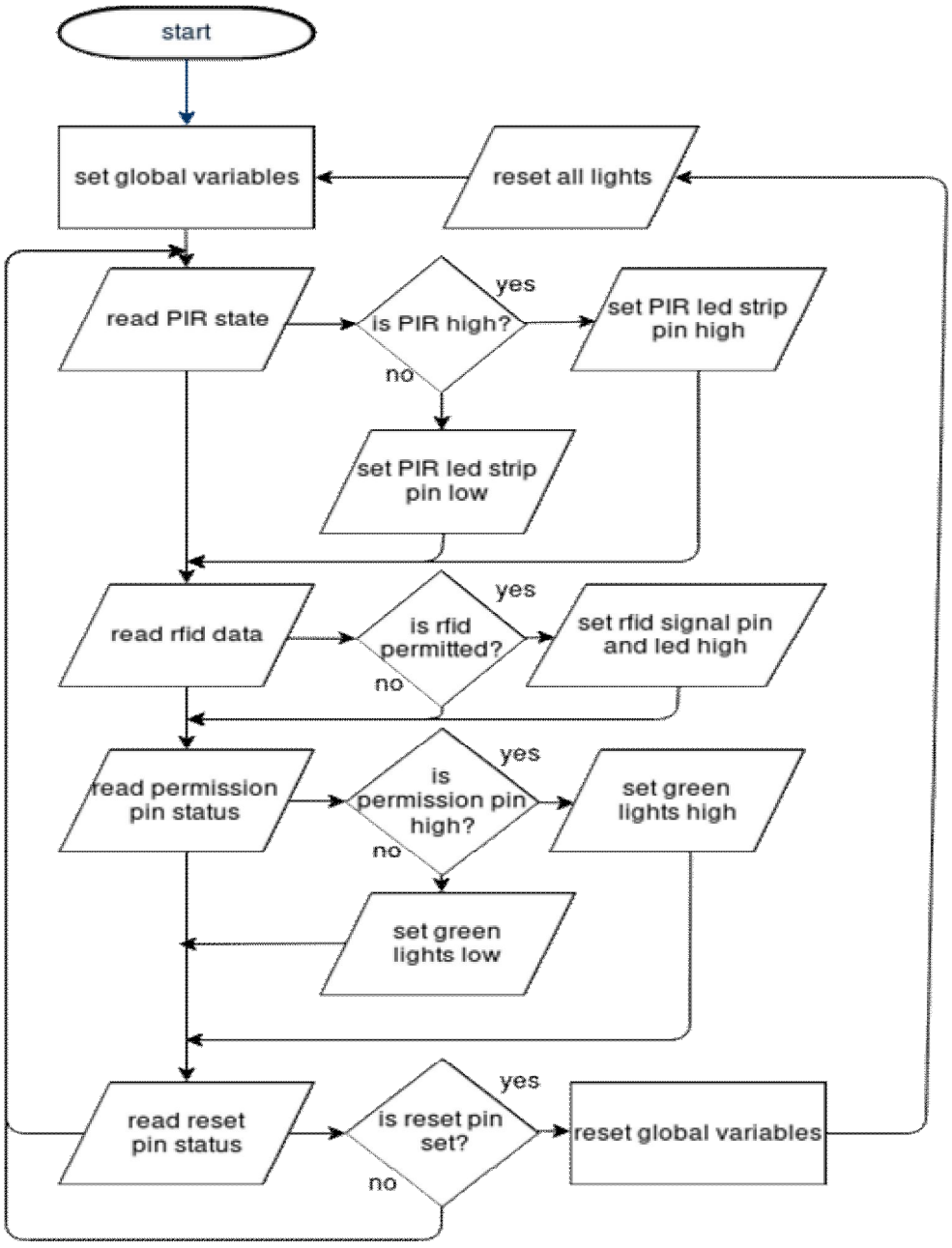


Fig. 2 ATmega 328 Logic Flowchart

(often higher than 90%), making them very useful for assign tasks such as converting a computer's main (bulk) supply voltage (often 12V) down to lower the voltages that's needed by microcontrollers, central processing units (1.8V or less),etc.

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IV. WORKING METHODOLOGY

The higher level processor(in case of proposed system, raspberry pi) is responsible for video and image acquisition and its processing. The same microprocessor or other supplementary microcontroller can be used for authentication purposes through the use of security based modules like radio frequency tag readers fingerprint scanners etc as required. Breach is detected using intrusion detection modules like reed switch, passive infrared sensor etc. In case of breach, the microprocessor system is to be used to acquire and transmit images for alert purposes to the property owners or the law enforcement services operating in the area. The internet based alert trough emails solves the problem of lack of a timely alerting system to send warnings and alerts to concerned authorities. The open computer vision library is used to detect and crop faces into a local face database, which can later be used for identification purposes. The major problem solved by this methodology is the remote identification of intruder in the property without the actual need of visiting and physically obtaining a copy of stored media. Also, the visual data, being pre-processed and the same coming with accurate timestamps, can be directly used as proof of intrusion as later required without any need of further data filtering.

V. RESULT

The average face detection response time on the Raspberry Pi Model 3B using a single core was found to be average around 3.5 seconds at a resolution of 1920x1080. The video capture frame rates achieved were 40 frames per second with a single camera and 21 frames per second for 2 cameras recording simultaneously. The performance can be further enhanced by using more cores available on the Raspberry Pi Model 3B through parallel processing. Results can also be enhanced by working completely on gray scale, in which case, frame rates of over 65 frames per second for single recording camera and over 35 fps for two cameras recording simultaneously were achieved. The system can be used to monitor and prevent intrusion and breaches into buildings if the incoming individual does not fulfil predefined criteria.

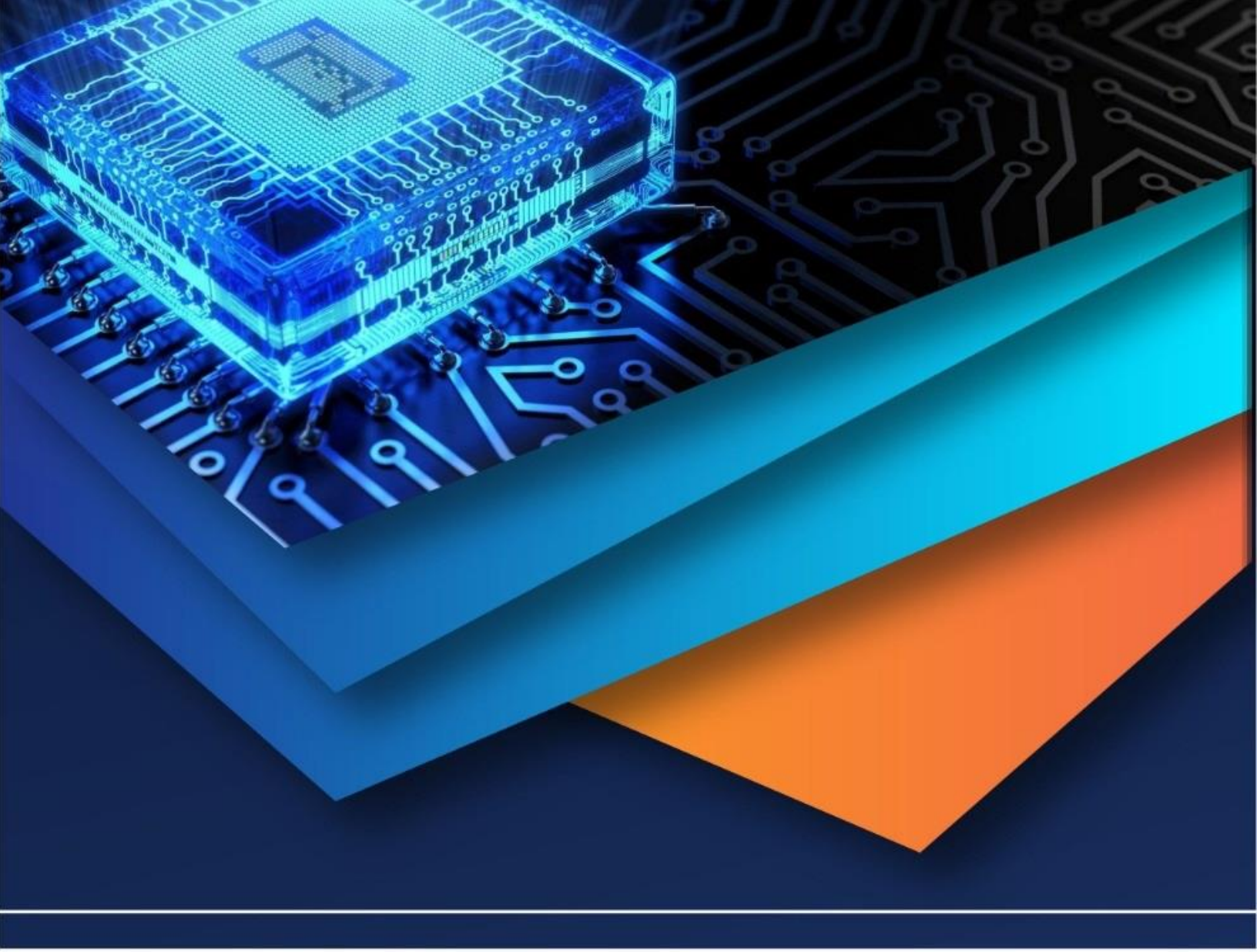
VI. CONCLUSION

This paper presented a solution for autonomous home security using computer vision, radio frequency identity cards, keyboard based password entry panel and passive infra-red sensors. The radio frequency card identification and ambient lighting state processing was done on the ATmega 328 and image processing, password authentication and email alert system was processed on Raspberry Pi Model 3B.

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