State-of-the-Art Security System with Image Capture and Trigger Mechanism in a Home Environment

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Abstract: This paper proposes a modern security system which involves capturing an image of the person at the entrance of an office, a house, an industry or any secure facility for that matter, action can be taken accordingly with a trigger. First, the presence of a person at the entrance is checked with a PIR sensor and if the outcome is positive, an image is captured with a webcam and is sent as an email to the owner/authorised person. That owner checks his phone for email notification on phone (which can be easily implemented these days by adjusting the settings in the email). A triggering statement is sent to the GSM module present in the circuitry at the entrance such that the door can be opened if the person at the entrance is known and if not a message can be displayed with an LCD panel. We have implemented this technique on a home environment.

Keywords: Raspberry pi b+, AT89S52 Microcontroller, PIR sensor, EEPROM, GSM module, L293D, LAN/Router.

I. INTRODUCTION

Security is a serious concern now-a-days and the cost of implementing it day by day is increasing at an unprecedented level. A separate security staff needs to be employed at work places and industries/firms which in turn leads to an investment in such a trivial thing which does not generate income for a firm and even with such a security staff, there is a possibility of malicious entry into most of the secure facilities and a higher chance of crime which can be overcome with the proposal that we make.

Our method of implementation as described briefly in the abstract, involves an AT89S52 microcontroller which checks for the presence of a person using a PIR sensor, if the sensor detects a person, an image is captured with a webcam and is sent through email via LAN/Router (wirelessly) through Raspberry pi b+ module which can be verified by the authorised person even in the absence of that person and an SMS from that person (a trigger) would unlock/lock the door depending on the SMS sent by the authorised person using a GSM module which is interfaced to a motor via a microcontroller.

II. DISCRIPTION

The proposed system can be divided into two sections.
Section I:
 1) Includes the process of detecting a person with the help of a PIR sensor.
2) The PIR sensor sends a signal to the Atmel AT89S52 microcontroller.
3) After receiving this signal, the microcontroller sends an acknowledgement to the Raspberry Pi b+.
4) The Raspberry pi b+ captures images through a webcam.
5) The captured image is sent to the owner/authenticated User of the system through email.

Section II:

1) The user gets a notification on his/her phone and an action can be taken accordingly.

2) If the user wants the person at the entrance to enter, he sends one type of SMS from his phone to a GSM module located at the system, if not he sends another SMS which is displayed on the LCD panel present at the door.

A. Implementation of Section I
To detect a person at door we either require a viewing device or a more efficient and cheap sensing device which can detect that person. Detecting a person really becomes difficult and luckily enough, human body radiates Electromagnetic waves (typically heat) which can easily be picked up by any Infrared sensor and so we try and use an Infrared sensor which can detect a change in the radiation level in terms of heat around the sensor itself and for this factor a PIR sensor best suits our purpose.
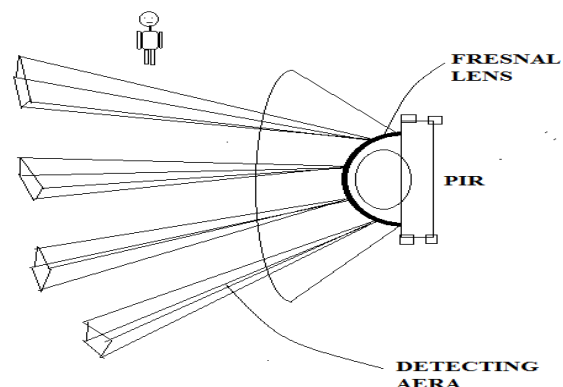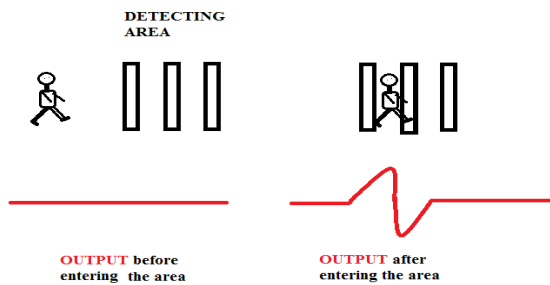

Fig.1.Passive infrared sensor

Fig.2.Output Signal

A Passive Infrared (PIR) sensor is an electronic device that measures infrared (IR) light radiating from objects in its field of view. It is highly sensible and reliable; whose lock time is 0.2 sec which implies that it only requires 0.2 seconds to lock on a target and process it further. Temperature compensation is its main advantage. Its operating temperature varies from -15 to 70 degrees Celsius. Because of its low power and low cost, it is used in many applications. It has a 110 degree scope. Using PIR is reliable than light and temperature detecting sensors because it detects the human radiation levels in its scope of range and produces the output better than the others just mentioned above in fig 1 and 2. This produced output is then sent to a microcontroller AT89S52 which is an 8-bit controller where in a program is written in software called Keil and dumped into the microcontroller which sends a command to the Raspberry Pi b+ module to take a picture. The program should be written in such a way that whenever the PIR sensor detects a change, it has to send an acknowledgement to the AT89S52, the webcam that is connected to the Raspberry Pi should take a picture. As the Raspberry Pi has a Broadcom BCM 2835 system on chip with ARM117652f, a 700 MHz Processor with video core and 1V GPV. It can store and process high quality images. The processed image is emailed to the authorised person. The software code that is required to make all of this happen is written in python language (which is also used in building games and in turn a game essentially consists of a series of frames of images appearing at a constant rate). This Raspberry Pi b+ module houses an in-built LAN port that is used to send the email to the authorised person.

B. Implementation of Section II
To check the email whenever a person is at the owner's entrance, the user has to set the settings in his email account which sends a message to the phone of the user whenever an email is received from a specific email id which in this case will be that email id which contains the image. Since all the new cellular phones can access internet at very cheap rates, one can easily access web connectivity and open that email and check whether the person at door is known or not and then proceed further.
The triggering action can be achieved by sending a particular SMS from the owner's/ authorized user's cellular phone to either unlock the door or to display a text denying access. This entire action can be set in such a way that only the owner can access the system at the door i.e., an EEPROM stores the registered number of the owner

which is checked with the incoming text from a particular number. If both the number and the registered number in the EEPROM match then action of opening or closing the door is taken.

This receiving of texts can be done with a GSM module which is interfaced to the AT89S52 microcontroller. The text we receive is of the form "*text#". The control SMS can be set by changing the text region with either open, which opens the door with motor mechanism which is managed by the microcontroller Which in turn is interfaced to an L293d motor driver IC which takes care of both the clockwise and anti-clockwise motion of the motor or a small text stating that access is denied to the person if he/she is unknown.
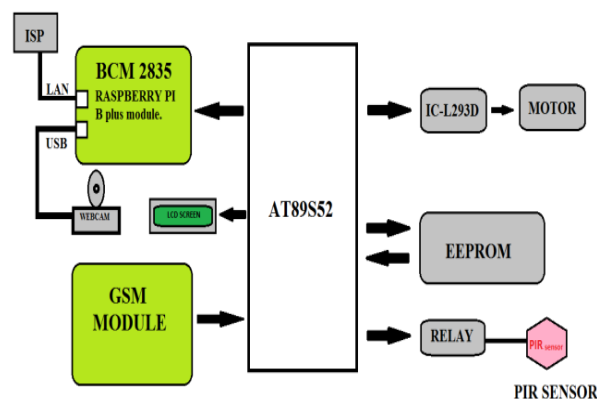
III. FLOW CHART
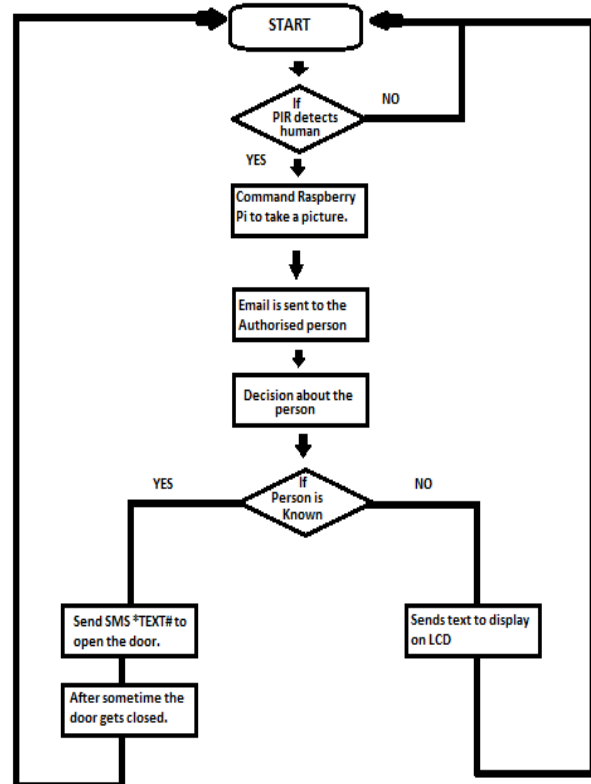
IV. BLOCK DIAGRAM

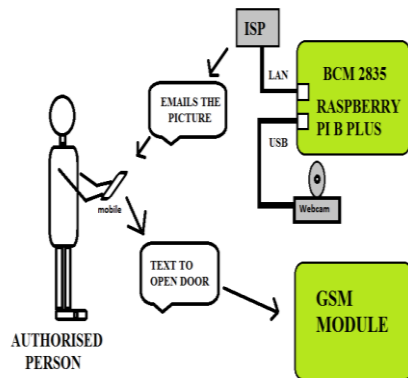Fig. 3. Home environment version of the proposed system.

Fig.4 .Authorised person/Owner responding to the email and sending an SMS accordingly.

V.WORKING MODEL

Fig. 5. Working prototype of the proposed system

VI. MERITS

The designed system is highly cost effective because of the cheaper and daily components that are used in the system. The system consumes least space and can be embodied into a small package which can be of a size of a brick. The system can be regarded to a fit and forget system which means the owner can install the system and need not worry later about it. High Definition images can be captured by Raspberry Pi b+ module at a very low cost PIR sensor that we have used in the system is highly tolerant and sensitive to effectively detecting human presence.PIR sensor doesn't unnecessarily detect other changes in the surroundings of it.

VII. LIMITATIONS

The system is limited to the internet connectivity. It also is not compatible in surroundings where there is no coverage of a cellular SIM because it is installed in the GSM module. Raspberry Pi is not capable of processing a 64-bit instruction.

VIII. CONCLUSION

The proposed system "State-of-the-art Security System with Image Capture and Trigger Mechanism in a Home Environment" is cost effective, very simple to implement and helps the owner of a house or an official at an office or

in an industry in keeping an eye on who is coming/entering the facility and is a novel method in setting up security at such a low cost with basic components like Raspberry Pi b+, GSM module, Webcam, microcontroller etc. This system provides the ability to operate on its own without anyone's help and acts as a barrier to unknown persons and intruders.

REFERENCES

[1] Bhargav B. Patel, Keyur Chauhan ,E&C dept,GTU University Suchita B. Patel ,M.Sc IT dept,S.P University, Wireless Visual Visitor Verifier for Home Security Using Smart Phone, IJARCSSE, Volume 5, Issue 1, January 2015, pp. 748-753.
[2] Manav Chandra, Nishant Tyagi, Rahul Singh, Dr. Arvind Rehalia, BVCOE,Case Study: RASPBERRIES Pi B+, IJARCSSE, Volume 5, Issue 8, August 2015, pp. 458-461.
[3] TarunAgarwal. Chief Customer Support Officer at Edgefx Technologies Pvt Ltd, Home Security System with GSM Using 8051 Microcontroller.

BIOGRAPHIES

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