

# Raspberry Pi based home door security through 3g dongle

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**Abstract-**The system is being developed to connect any door with the internet, and USB camera will be fixed in front of the door. Here we using PIR sensor for human detection. In a case that one is sitting inside the home and a visitor is at his door steps, if the visitor pressing the alarm switch (pushbutton) PIR sensor will be enable and sense the human entry at nearby the door, at that time USB camera will be turn on for 10sec and records the human's face at nearby the door. Then the captured video will be transmitting to the authorized person's system by using 3G dongle. that 3G dongle has a unique IP address, by using that IP address the authorized person will access that 3G dongle from anywhere/any system for receiving the captured video. So after that person seen the visitors face via web and if he willing to allow the visitor inside the home he can press the pushbutton for open the door.

**Keywords:** Raspberry Pi, USB Camera, 3G Dongle, PIR Sensor, Human Detection

## 1. Introduction

Now a day's mobile devices are integrated with our everyday life. The security and remote surveillance system is increasingly prominent feature on the mobile phone. The modern home is integrated with many automation technologies. The user can control door lock, light, air conditioner and other devices using remote control In this modern world crime has become ultra modern tool. In this current time a lot of incident occurs like robbery, stealing unwanted entrance happens abruptly. So the security does matters in this daily life. People always remain busy in their day to day work also wants to ensure their safety of their beloved things. Sometimes they forget to look after their necessary things like keys, wallet, credit cards etc. Without these, they are unable to access their home or any place they want. To prevent such incidents many scholars came into action and tried to prohibit them.

According to Kaur[1], The access control system used to allow only authorized members while the user away from their house. When the system gets wrong password in three times than it signals to the door alarm. But this technology is very effective when using internet capable mobile devices. Developments in cloud computing and mobile technology allow internet communication in automation and security systems to improve flexible and fast communication. According to YanboZhao ; ZhaohuiYe [3]GSM/GPRS based wireless home security system but the system is not cost effective as the GSM/GPRS charges a fixed amount from each sms /call or data transfer. Then Hassan,H. ; Bakar,R.A.; Mokhtar,A.T.F[4] proposed face recognition based on auto-switching magnetic door lock system using microcontroller but face recognition means complex algorithms and sometimes the system may be unable to detect the visitors identification correctly and keeps a computer chip busy for longer time.

Lots of paper work has been done so far. In this paper, a new system is designed which would control the door through the internet without any complexity. It's very convenient and serves as a plug and play system. The user can see from anywhere in this world that who is at his door steps. The system keeps a picture of the visitor as evidence that would be needed if any unwanted situation occurs like stealing, robbery etc.

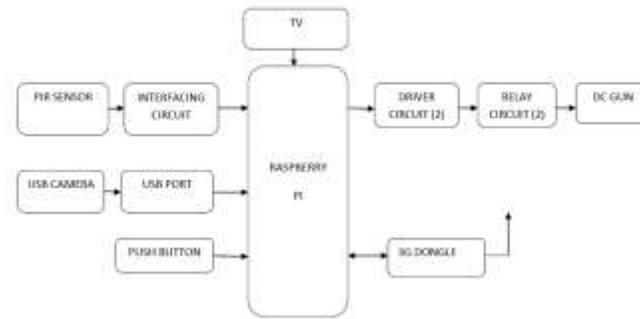
## 2. Overall Project Outline

In this project with a minicomputer raspberry pi different input and output is interfaced. In input section there is calling bell, PIR sensor & wireless camera. In processing section a minicomputer raspberry pi is used. Raspberry pi is equipped with 3G dongle.

Nowadays to manage the security concerned issues in a cost effective way. The system is being developed to connect any door with the internet, and USB camera will be fixed in front of the door. Here we using PIR sensor for human detection. In a case that one is sitting inside the home and a visitor is at his door steps, if the visitor pressing the alarm switch (pushbutton) PIR sensor will be enable and sense the human entry at nearby the door, at that time USB camera will be turn on for 10sec and records the human's face at nearby the door.

Then the captured video will be transmitting to the authorized person's system by using 3G dongle. that 3G dongle has a unique IP address, by using that IP address the authorized person will access that 3G dongle from anywhere/any system for receiving the

captured video. So after that person seen the visitors face via web and if he willing to allow the visitor inside the home he can press the pushbutton for open the door. In this project we using DC gun for open the door/close operations.



*Figure 1. Block diagram of Project*

### 3. Hardware Prototype

#### 3.1. Raspberry Pi

The Raspberry-pi is the system on chip which is a small computer, which runs using embedded C program. The controller gets the pulses from the sensor through the controllers Input, output ports known as I/O ports. The received data are used to calculate the distance.



*Figure 2. Raspberry-pi.*

Heart of this project is raspberry pi minicomputer. 3G dongle is connected through USB port. The 3G module scans for the available network and connects to the network with password. Calling bell is connected with GPIO of raspberry pi. Whenever someone come to home and press button the calling bell starts to transmit music's. A resistor is connected to calling bell and whenever music plays it generates 5v signal. This causes an interrupt to raspberry pi. PIR sensor is also connected to GPIO. The pin is pulled down and pir sensor also generates a high voltage whenever it detects presence of any human. Raspberry pi is always scanning for pir sensor input or calling bell input. Here is also an indication which generates a special alert.

In the algorithm it is defined that if any visitor comes in and press the bell means both the interrupt happened it is a common situation and indicating that a visitor has arrived. But if only one interruption happens like human motion then it indicates that a thief or robber might have come. An individual interrupt of calling bell indicates pir sensor has gone out of order. When the system received both the interrupts raspberry pi take a snapshot /video of the person through camera. Here the camera is connected with raspberry pi through wifi network. Raspberry pi stores the snapshot/ video itself. And also we can see whenever it possible.

But if only PIR sensor generates the interrupt then it generates an instant alarm that might have someone is trying to have unauthorized access or break into the house. It takes several video, it helps user in any emergency situations occur.

#### 3.2. 3G dongle

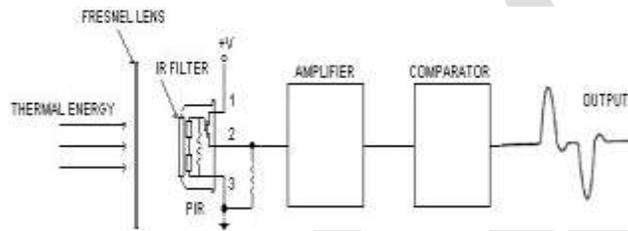
A 3G dongle uses the 3G mobile/cellular phone network connection to connect the internet. It is useful when travelling on a train. In some remote areas of the UK no internet connection is available but cellular network are which it makes mobile dongles useful. A USB

camera will be connect in front of the door it will be directly communicate with a controller. and transmitting the captured picture or video will be bidirectional communicate with a 3G dongle.

### 3.3. Passive Infra Red Sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves.



**Figure 3.** Typical Configuration of PIR.

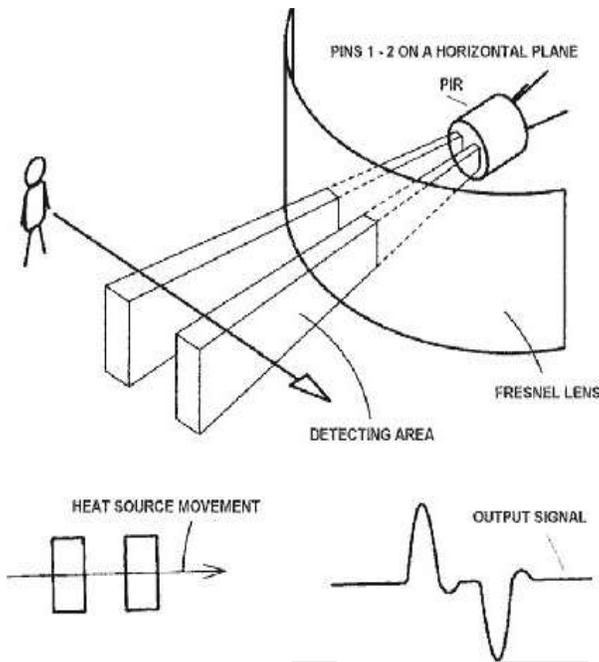
The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

Along with the pyroelectric sensor is a bunch of supporting circuitry, resistors and capacitors. It seems that most small hobbyist sensors use the This chip takes the output of the sensor and does some minor processing on it to emit a digital output pulse from the analog sensor.

#### 3.3.1. Working Principle of PIR

The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors.

When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a *positive differential* change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a *negative differential* change. These change pulses are what is detected.

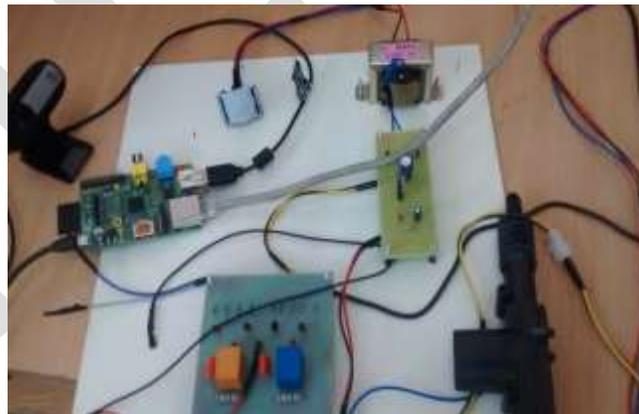


*Figure 4. Working principle of PIR.*

#### 4. Hardware Implementation

Here the figure of the implemented hardware is given. All the components are connected according to the main circuit diagram. When the PIR sensor is interrupted then the USB camera takes a snapshot/Video and E-mail that attachment to the respective E-mail account. The user can then see the visitor either from web from anywhere in the world by USB camera.

Raspberry pi is equipped with 3G dongle. In a case that one is sitting inside the home and a visitor is at his door steps, if the visitor pressing the alarm switch (pushbutton) PIR sensor will be enable and sense the human entry at nearby the door, at that time USB camera will be turn on for 10sec and records the human's face at nearby the door. Then the captured video will be transmitting to the authorized person's system by using 3G dongle. that 3G dongle has a unique IP address, by using that IP address the authorized person will access that 3G dongle from anywhere/any system for receiving the captured video. So after that person seen the visitors face via web and if he willing to allow the visitor inside the home he can press the pushbutton for open the door. In this project we using DC gun for open the door/close operations.

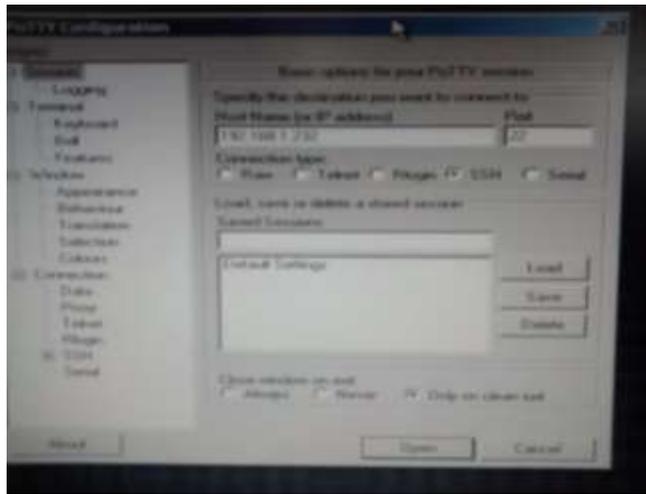


*Figure 5. Image of the Project.*

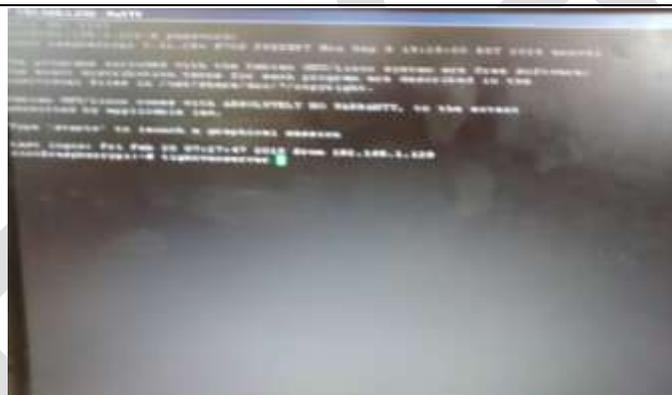
#### 5. Output of the System

When the PIR sensor faces obstacles or detects human or the visitor rings the bell the camera takes a snapshot and send it via

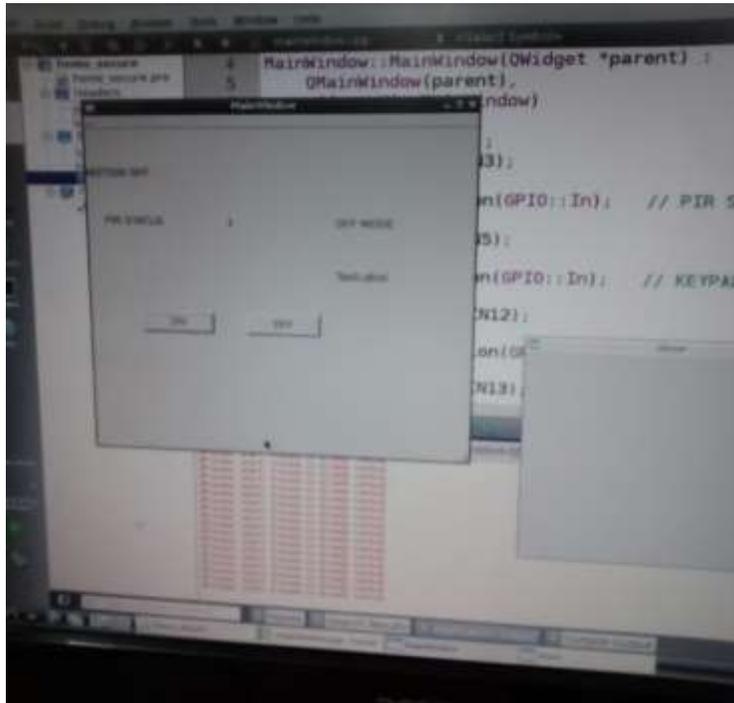
Email to the users account.



*Figure 6* putty configuration software



*Figure 7* Raspbian wheezy software



*Figure 8 PIR status*

*Figure 9 Output of the system*

#### **Advantages**

- Dramatically reduce the hazard of unauthorized entry .
- Evidence can be given to the security department if any robbery issue occurs.

#### **6. Further Applications**

- Internet of households where we can attach other devices of house with internet.
- Industrial automation and control through internet.
- Automated fire exit systems can be build
- Improvement in the security issues in highly re-restricted areas

#### **7. Conclusion**

The system can be used in several places like banks, hospitals, labs and other sophisticated automated systems, which dramatically reduce the hazard of unauthorized entry. Evidence can be given to the security department if any robbery issue occurs. But the system needs to be monitor always that the internet bills are paid in due time to keep connected with own home. Future work would include the design and building of a battery backup system. This project could also be expanded to multiple doors and windows. It can be coupled with existing home automation devices to add thoroughness and completeness to the system.

## ACKNOWLEDGMENT

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## REFERENCES:

- [1] Kaur, I., "Microcontroller based home automation system with security," International Journal of Advanced Computer Science and Applications, vol. 1, no. 6, pp. 60-65, 2010.
- [2] Wong, E.M.C., "A phone-based remote controller for home and office automation," IEEE Transactions on Consumer Electronics, vol. 40, issue 1, pp. 28-34, 1994.
- [3] Yanbo Zhao ; Zhaohui Ye "A low cost GSM/GPRS based wireless home security system" IEEE Transactions on Consumer Electronics, (Volume:54 , Issue: 2 )
- [4] Hassan, H. ; Bakar, R.A. ; Mokhtar, A.T.F. "Face recognition based on auto-switching magnetic door lock system using microcontroller" IEEE-International Conference on System Engineering and Technology (ICSET), 2012
- [5] Assaf, M.H. ; Mootoo, R. ; Das, S.R. ; Petriu, E.M. ; Groza, V. ; Biswas, S. "Sensor based home automation and security system" Instrumentation and Measurement Technology Conference (I2MTC), 2012 IEEE International
- [6] Ibrahim, R. ; Zin, Z.M. "Study of automated face recognition system for office door access control application" IEEE 3rd International Conference.
- [7] Sarijari, M.A.B., Rashid, R.A., Rahim, M.R.A., Mahalin, N.H., "Wireless Home Security and Automation System Utilizing ZigBee based Multi-hop Communication," National Conference on Telecommunication Technologies, pp. 242-245, 2008.
- [8] Saliyah Kahar, Riza Sulaiman, Anton Satria Prabuwono, Mohd Fahmi. "Data Transferring Technique for Mobile Robot Controller via Mobile Technology" in Pattern Analysis and Intelligent Robotics, International conference. pp 103-108, 28-29 June 2011
- [9] Xichun Li, Abudulla Gani, Rosli Salleh, Omar Zakaria. "The Future of Mobile Wireless Communication Networks". In communication software and networks, 2009 International Conference, pp 554-55 , 27-28 Feb. 2009.
- [10] Jae Hoon Lee ; Yong-Shik Kim ; Bong Keun Kim ; Ohba, K. ; Kawata, H. ; Ohya, A. ; Yuta, S. "Security Door System Using Human Tracking Method with Laser Range Finders", IEEE- International Conference on Mechatronics and Automation 2007. ICMA 2007