

A PROTOTYPE OF CHILD MONITORING SYSTEM AND MOTION DETECTION USING RASPBERRY PI

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Abstract—In United States, a survey conducted by the department of health and human services found that 3.6 million children are victims of child abuse. Not only in U.S child abuse also occurred all over the world especially in high children population. In the era, monitoring children became a popular and important. The use raspberry pi for monitoring the children using motion and authentication. It is used to deterrent to crime and prevent burglary. In order to monitor the children, we use evolutionary prototype using raspberry pi. This method can help parents to monitor the children easily by online with authentication feature. Parents can monitor their children with live video streaming and motion detection. If the motion is detected, this system will identify with red box. We also use PIR sensor for sensing Motion Detection. If motion is detected, SMS will send to your mobile.

Index Terms — Raspberry Pi, Motion Detection, Evolutionary Prototyping, Video Streaming, Website, Authentication, Monitoring Children, PIR sensor, Sending SMS.

I. INTRODUCTION

In the cases of violence occurred on nov2014 in U.S, Wilson – Brotten is a professor of day care is kicking a 20 month old baby. Wilson also stick a bandage to is mouth to keep baby from crying. Another case in Indonesia, aug2014, Lisa, 30 years old, unbelievable shock. His son who was 14 months of torture barrage when deposited in child care. Childcare or day care as one of the places of children with high population, is not merely a day care, but should provide the facilities as well as programs that are structured that allows children to explore safely.

The monitoring system is a useful tool for parents who work away from a day care. Surveillance can provide a good relationship for day care providers with parents by helping to eliminate misunderstandings on certain events. Day care should have a pleasant and positive atmosphere. In order to keep it that way, security cameras should be installed in day care to ensure the safety of children.

They conducted interview to child psychologist and parent to get the data about our project. In an interview with the child

psychologist, they told that parents need to monitor their children, because children nowadays are having many threats. It could come from the neighborhood and internet, sexual harassment, and lack of social skills. If there is a system or tool that can assist parents in monitoring child remotely, it capable of providing security and comfort the parents. While doing interview with parent, it concluded that parent needs to monitor children, but parents now need to come directly to the place where the child is to be able to do the monitoring. It becomes difficult for the parents themselves who have been busy with work and the workplace are often away with the child's location. Countries all over the world use video surveillance, focusing its use mostly on public transport and public areas. 39% of the installation of the international monitoring system serves as a deterrent to violent crime and prevent burglary . Monitoring technology to provide comfort and a sense of security to parents. Innovations and developments in the field of computers have arouse rapidly over time and getting more sophisticated, from small to large in size. One of the results of computer development is Raspberry Pi. Raspberry Pi is a computer with a small size, the size no larger than a credit card, and with low power, 5V. Motion is an application that is capable of monitoring the video signal from a camera and detect changes in the video footage. Motion works fully in text mode and does not have an interface. Motion was first developed by Jeroen Vreeken and then followed by Folkert van Heusden and Kenneth Lavrsen. Applications motion itself is written using C language and has an output in the form of a .jpg image or video .mpg . Based on the data above, a prototype of child monitoring system deal with the real-time video streaming and motion detection is required. We are using the Raspberry Pi microcomputer which installed with motion module, a prototype of child monitoring system can fulfill the parent needs to monitor their children. In order to make parents easy access to monitor their children and prevent misapplication by unauthorized people, We can view the output via online through website and authentication features.

SOFTWARE COMPONENTS

S.no	Software components
1.	Python
2.	PuTTY
3.	Tight VNC Server
4.	PHP,HTML,CSS
5.	Custom login plugin

HARDWARE COMPONENTS

S.no	Hardware Components
1.	Raspberry pi
2.	USB camera
3.	Ethernet/LAN cable
4.	PIR Sensor
5.	Power Supply 5V 2.0 A and micro SD 16GB

II. RELATED WORKS

M. Naveenkrishna, Dr. S. Jayanthi, has proposed Beaglebone Black Webcam Server for Security , in this project they implement BeagleBone Black to do video streaming and video is saved in the server and the client can download the video using proper authentication. But, this project does not have a motion detection feature. Prof. Pramod Ganjewar, Shailesh Bandle, Prasad Waghmare, has proposed Wireless Automated Video Surveillance System Using Motion Detection Method . The motion detection method using cross correlation and the system can be deployed rapidly in emergency and can be a useful supplement of traditional monitoring system. The system using J2ME technology. But, this project still using microcontroller and there is no specific website to view the live events happening at site. To overcome the drawbacks of previous research projects from related works, child monitoring system is designed to monitor children with three main features, first is to monitor children with video streaming media, and second is motion detection that will be identified with red-box, and the third is parents can access easily with online through specific website with authentication feature.

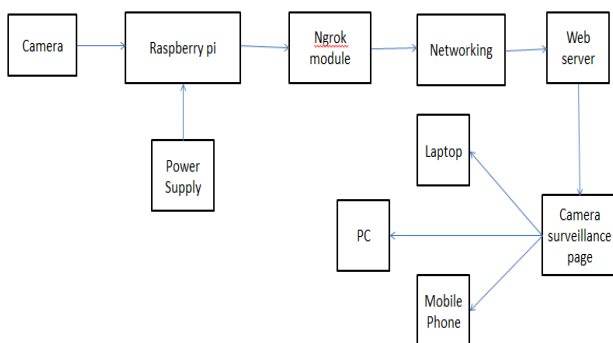
III. PROBLEM STATEMENT

The purpose of this work is to build a prototype system of child monitoring system with video streaming media and motion detection using Raspberry Pi that can be accessed online through website with authentication feature, this system is used to help parents to monitor their children. We use evolutionary prototyping method in consideration of creating child monitoring system. This method consists four stages; Identify User Needs, Develop a Prototype, Determine if Prototype is Acceptable, and Use the Prototype.

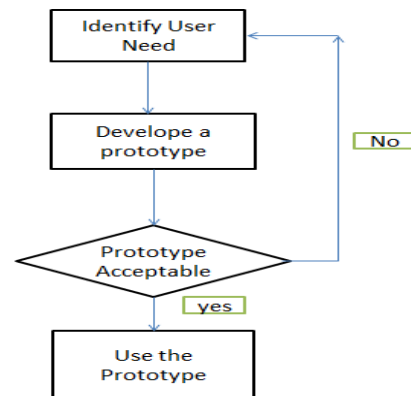
A. Identify User Needs

In this first stage, we begin with identify the needs of the user. To know the needs of user, we conducted interviews, observation, literature study and analysis. First, we interview parents and child psychologist. As we interview parents the result is most of parents are need to monitor their children, consider that many parents are working. Presuming that there is a child monitoring system that can be accessed remotely online, it definitely assist parents in monitoring the child. Moreover, many parents are now working and not having much time to get in touch with the child.

BLOCK DIAGRAM



Fig(1.1)block diagram of child monitoring system



Fig(1.2)Evolutionary Prototyping

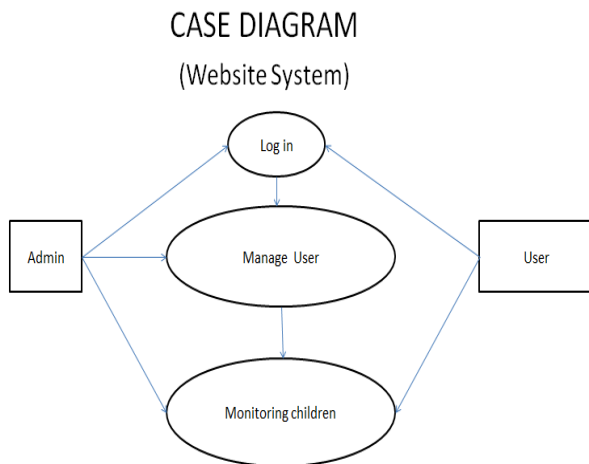
After that, we analyzed the running system and proposed system that we suggest to overcome the needs of parent to monitor their children.

From the proposed system, explained that web camera will capture images continuously and send the images to Raspberry Pi. Then, images will be processed by the Raspberry Pi into a real time video streaming. Not only Raspberry Pi can streaming video, but also detect movement and identify it using red-box. Both of these processes are done with tools named motion module that previously installed to the Raspberry Pi. The results of the process images into video streaming and image motion detection will be stored on local storage Raspberry Pi. We use ngrok module in order to manufacture a system that can be accessed online. Ngrok creates a secure public URL (<https://appname.ngrok.io>) to a local webserver on the machine. To facilitate the user in accessing the system, we create a website with responsive page. So users can see the results of monitoring children with any device as long as there is a browser and an internet connection.

B. Develop a Prototype

This stage is defined as a system design that will be created as the first phase to develop a prototype. This design consists of Application System Design, User Interface Design and Encode System. In the design of the application system phase, we use UML as the method in making of child monitoring systems.

On the next stage, we conducted the design of user interface system. The design was conducted on each page contained in a web-based system



Fig(1.3)Case diagram of Web system

On the last stage, we translates the prototype into the program code which will run a monitoring system with video media streaming and motion detection and that have authentication features. In this case, we use motion module and ngrok module. Motion module works by comparing the intensity of pixels of the new image with

the reference image (the old image). In this comparison process colors in an image is not required and only black and white images taken alone. Applications motion features include (1) Live Streaming Webcam, (2) Capture images when motion is detected, (3) Motion Detection, and (4) Control of Threshold.

(1) Live Streaming Webcam; webcam produce streaming video in JPEG format. In the term using this feature, we have to set up the webcam_maxrate and webcam_quality, because it is an important choice to limit the load on the server and link. It is not recommended to set the value too high, unless we just want to use it on local host or on the internal LAN. Webcam_quality options equivalent to the level of quality for .jpeg pictures.

(2) Capture images when motion is detected; this section, motion module control how the produce images when it detects motion.

(3) Motion Detection; this section, motion module uses to detect a motion. By using this feature there are several controls to detect motion. In this research project, we use the controls on the detection area. Detect area on motion detection is in the center as the default setting, but we set up to all area to detect motion. As the motion module detect a moving object or motion in area this prototype will identify the motion with red-box. A script (on_area_detected) started when the movement is detected in one given area.

(4) Control of Threshold; threshold for declaring motion. The threshold is the number of changed pixels counted after noise filtering, masking, despeckle, and labelling. The 'threshold' option is the most important detection setting. When motion runs it compares the current image frame with the previous and counts the number of changed pixels after having processed the image with noise filtering, masking, despeckle and labeling. If more pixels than defined by 'threshold' have changed we assume that we have detected motion. By using the motion module as tools that run features on the system. Here are the steps in build the prototype system:
a. Install motion module on Raspberry Pi. To get the motion module, we can download at https://sourceforge.net/projects/motion/?source=typ_redirect. For installation, we need to type the command:

b. After installation, we need to configure on motion module with PuTTY by typing this command:

That command is used to make modifications in the configuration file. To stream video takes a few modifications to daemon on, framerate 100, width 640, height 480, stream_port = 8081, and stream_localhost off.

c. After making the modifications in accordance, we need to start streaming video using motion by typing this command:

d. In order to make the system easy to access, we make tunneling with ngrok. This tunneling has the ability to change the local IP on Raspberry Pi into a public IP, so that the local addresses can be converted to a URL address that can later be accessed via internet by anyone and anytime.

e. In order to prevent misapplication by unauthorized people, the system which can be accessed online through the website has an authentication feature. This feature applied in the login form on the website. We use a tool named Custom Login Plugin which installed on the website to customize the admin login page.

C. Determine if Prototype is Acceptable

At this stage, we educate the user in prototype use and provides an opportunity for becoming familiar with the system. We conducted a feedback from user and also conducted tests using black-box testing. This testing is done to ensure that the system able to work well when being used. Additionally, the system can be accessed easily from website. From its feedback, we can summary that the prototype is satisfactory and ready for next step.

D. Use the Prototype

Once the monitoring system succeed through the testing phase, the system is ready to be used for monitoring children. In this case we tried testing this monitoring system of children with streaming media and video-based motion detection Raspberry Pi at home.

IV. PIR SENSOR

We are aiming that to do is to wire up a basic passive infrared (PIR) motion detector to the pi and python have it tell us when movement is detected. That's easy enough. If the motion is detected, by using python program, send the SMS to a particular mobile phone. PIR sensor, it is a electronic sender that measures infrared light radiating from object in its field of view. Human body emits infrared radiation. we can't see the radiation ,because it is in infrared wavelength.

If you are not in online or unable to use online or there is any network problems, this module send an sms to your mobile phone. We use raspberry pi and python for sending sms. First, we have to connect the PIR sensor to GPIO pins of Raspberry pi. By giving power supply, if there any motion is detected, SMS module program will start and send the SMS as "Motion is Detected".

First, we have to register the mobile number and credit setup in aTextlocal server.By using the library file urllib in python,the sms will send to the server,again it send to our mobile number.



Fig(1.4)PIR Sensor Setup

V. RESULTS

We use Raspberry Pi as a tool or the brain of the system which being developed, these tools are processing all the necessary activities in child monitoring. Raspberry Pi requires USB camera to perform capturing image, which is then processed by the motion module to produce video streaming and motion detection. In the effort of making the system accessible online, we use LAN cable and ngrok module that previously installed beforehand on the Raspberry Pi. Power source with 5V micro USB 2.0A is required to provide power to the Raspberry Pi so that it can be turned on and the process of monitoring work well.

The main features on this child monitoring system are monitored with video media streaming and motion detection. Users can perform this monitoring system after the user accesses the website, log in, and then the user selects the menu Live Surveillance Camera. In this menu the user can monitor and view video streaming, motion detection will show the system in the form of red-box. We conducted the testing inside rooms of 6m x 3m, and with pretty good exposure. We use 5 MP USB camera to capture an image that is placed in the middle of the room with a height of about 1.5 m. Lack of camera that we use is not support HD and still have a blind-spot about 0.5 m. However, monitoring is done by the camera with the aid of motion modules can capture images and motion detection for the camera is still within reach.

The process of streaming video and motion detection works well on the condition that internet connection was also good. Because the streaming process requires a large bandwidth to be able to run well. We use the connection with 6 Mbps bandwidth in testing. We also set the location of detection at all angles, so that wherever they occur the movement will be detected by the system and marked with red-box.

Motion Detection and Marked with Red-Box Before users can access the child monitoring systems,

users need to access the system by entering the address dcaresmonitoring.byethost18.com

The Raspberry can be accessed with Tight VNC, which is a software that can be used to control the computer remotely. This software acts as a remote control that allows the execution of tasks from anywhere.

Access Raspberry Pi with Tight VNC To remote Raspberry Pi with Tight VNC, we need to input IP address that used in Raspberry Pi. If it is already connected, we can access Raspberry Pi desktop. For example, On Figure 16 we can watch a video streaming that has been saved in local storage of Raspberry Pi remotely with Tight VNC.



Fig(1.6) Motion detection and Marked with Red-box

VI. CONCLUSIONS

Thus we design Child Monitoring System with Raspberry Pi to assist parents in monitoring children with video streaming media and motion detection that can be accessed through the website that has authentication feature. This work presents the efforts to preserving the safety of children and provide comfort and a sense of security to parents. First, we utilize Raspberry Pi as a tool of the system which are processing all the necessary activities in child monitoring. Second, we use ngrok in order to make the system can be accessed online through website. In this paper, we introduce our preliminary system overview and survey of related works that connects to our proposed work. As of future works, we want combine what we have done in our previous works to develop a system that can be deployed in places with many children population to support the safety of children. We envision that such a system can act as a

catalyst to realize useful application that can protect children and reduce worries from parent who works and away from children.

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