TMP-21-050

Sri Lanka Institute of Information Technology

Project Topic Assessment – 2021

Topic

Harmful Child Activity Detection and Prevention Assistance

Abstract:

The issue of children household accidents, kidnapping, and getting injured due to harmful child activities has raised significant concerns of public interest. The advancement of artificial intelligence (AI) technology, particularly in image classification and object detection, could be applied to overcome the current flaws of the harmful child activities detection devices that often failed to serve as a triggering system to guardians.

A real-time harmful child activity Detection and Prevention Assistance system that consisted of cameras, sensors as an input medium, a classifier to detect the presence of a child and a triggering system in audio and visual forms was established. Monitoring systems on children's behavior in closed spaces is possible to recognize their activity by the sensors (IOT devices) and cameras in the environment, collect data, and then use learning algorithms. In this paper, a deep learning algorithm to recognize and classify children's activity in smart homes is proposed with data collected from sensors and CCTV cameras in a smart environment.

Research Area/Group: Select the area by referring to the document uploaded to the Courseweb

Data Science

Supervisor should fill this part

Supervisor: I certify here that co-supervisor and myself can guide this student to acquire required knowledge skills and attitudes pertaining to above sub domains of his/her specialization.

Supervisor: **Mr. Prasanna Sumathipala** Signature

Continuation of Previous Year Project? ☐

If yes, state the Project ID

and year

Co-Supervisor: **Ms.Lumini Wickramasinghe** Signature

Team Members:

Student Name	Student ID	Specialization
Leader: **Hettiarachchi G D H P**	IT18006308	DS
Member 2: **Kodikara K A O V**	IT18110708	DS
Member 3: **Jayakody J M A M S**	IT18255720	DS
Member 4: **Prathapa D M J**	IT17167710	DS

Research Problem:

Nowadays human lives accelerate at an unbelievable speed forcing everyone living in this generation to live with the pressure of engaging in numerous activities within a time frame of 24 hours narrowing down one's leisure time to a negligible figure. The role of a working mom is no brainer but an obvious victim of the explained situation as her life is sandwiched between the two roles: role of a mom and a wife's role. Due to the pandemic situation most of the corporates changed their rosters and working plans to work from home. It is given that with the current situation, safety plays a huge role but due to the current working arrangement followed by most offices, mothers are forced to balance office work along with balancing the two roles mentioned earlier which can be hectic.

Given the scenario is such, a babysitter sounds like a good idea but then again leaves us with a question mark on how safe it is. As a solution to the issue explained above, we as data science students agreed to address this with proper amenities as our research project.

As the research project it is proposed to implement a solution as "harmful unsafe child activity detection and prevention assistance, and quick reporting surveillance system "to manipulate the hardest role that is the role of a mom by taking care of her toddler or pre-school kid. Features of communicating the monitored behavior modified to capture even a single move that is performed and reported real time would make the system outperform and provide promising results structuring a secure environment for end users and their minors.

[1] P. A. Dhulekar, S. T. Gandhe, A. Shewale, S. Sonawane, and V. Yelmame, "Motion estimation for human activity surveillance," *2017 Int. Conf. Emerg. Trends Innov. ICT, ICEI 2017*, pp. 82–85, 2017, doi: 10.1109/ETIICT.2017.7977015.

[2] P. K. Singh, R. Saxena, U. Dubey, A. Raj, B. M. Sahoo, and V. Bibhu, "Smart Security System Using IOT," *Proc. Int. Conf. Intell. Eng. Manag. ICIEM 2020*, pp. 392–395, 2020, doi: 10.1109/ICIEM48762.2020.9160144.

[3] Y. Xia, B. Zhang, and F. Coenen, "Face occlusion detection based on multi-task convolution neural network," *2015 12th Int. Conf. Fuzzy Syst. Knowl. Discov. FSKD 2015*, pp. 375–379, 2016, doi: 10.1109/FSKD.2015.7381971.

[4] G. Mathur and M. Bundele, "Research on Intelligent Video Surveillance techniques for suspicious activity detection critical review," *2016 Int. Conf. Recent Adv. Innov. Eng. ICRAIE 2016*, vol. 2016, pp. 21–28, 2016, doi: 10.1109/ICRAIE.2016.7939467.

[5] M. Bashir, E. A. Rundensteiner, and R. Ahsan, "A deep learning approach to trespassing detection using video surveillance data," *Proc. - 2019 IEEE Int. Conf. Big Data, Big Data 2019*, pp. 3535–3544, 2019, doi: 10.1109/BigData47090.2019.9006426.

Solution proposed:

Activities performed specifically by a child are captured using surveillance cameras and touch sensors. Here we aim for children on and below 5 years of age. Computer vision is used in identifying the following.

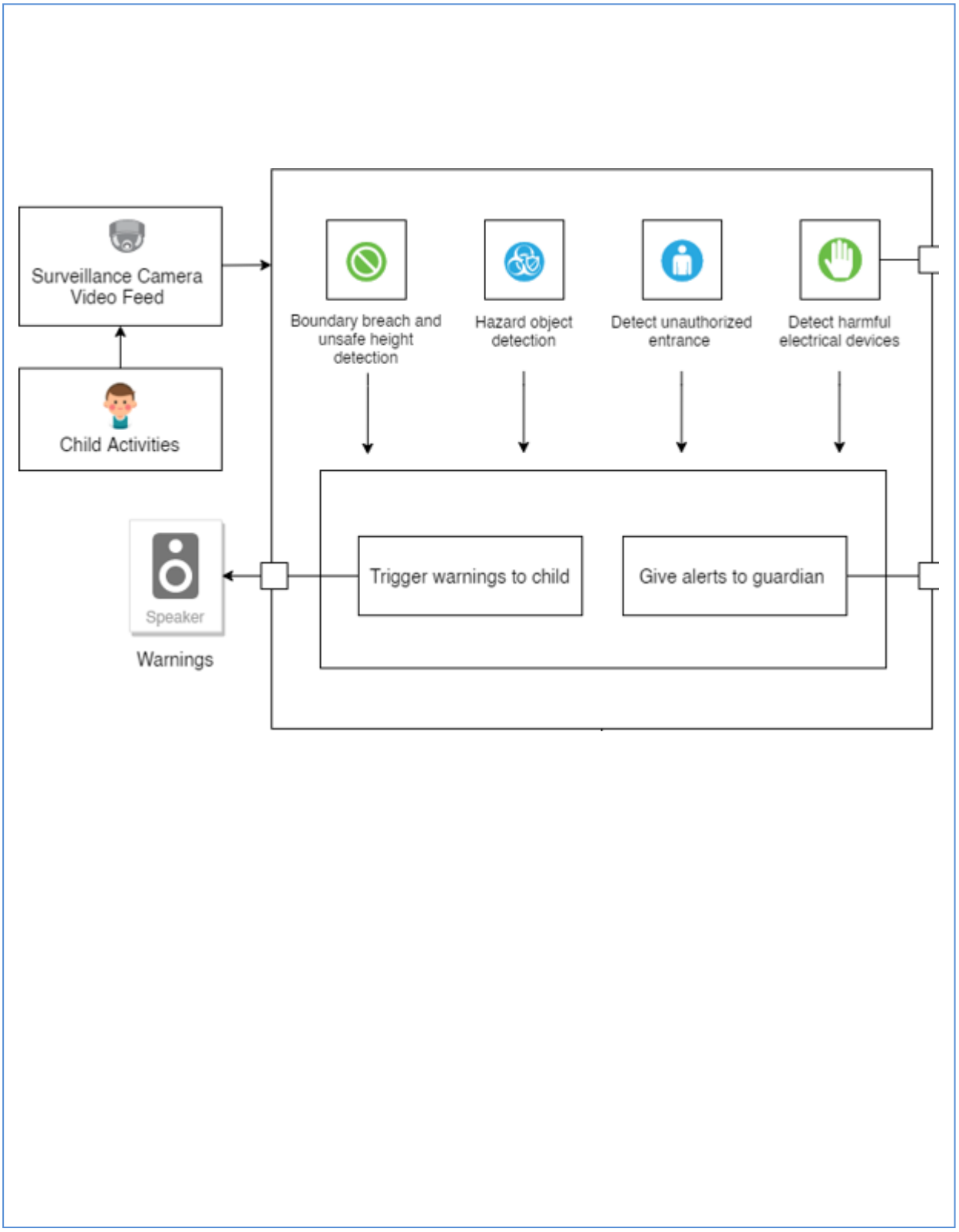
- Child climbing to a dangerous position or leaving the safe zone boundary of the room.
- Presence of sharp objects in the room and the child is holding or using them.
- Unauthorized person entering the room and attempts to kidnap.
- Child is operating electrical extension cords or touching plug points in the room.

Convolutional neural networks and classification techniques are used to recognize the harmful objects that the child can be in contact with and the entrance of unauthorized people are identified using recurrent neural networks.

Once a hazardous activity is noted, a notification will be sent to a wearable Bluetooth hand band that the guardian or carer of the child can wear. In the case of kidnapping an emergency siren will be wailed for prompt action. At the end of the day a report of the child's activities is mailed to the parent.

Mainly computer vision and image processing are used to capture the above-mentioned details. Image data is obtained from the USC-SIPI Image database. Target detection and recognition in video images will also be used to identify heights and activities. The videos are converted into frames. Then from the obtained frames, humans are detected from the video using a background subtraction method.

System Overview Diagram for the solution proposed.



Objectives:

Main Objective:
Capturing harmful events (child hazardous events) and objects (dangerous objects) effectively and accurately and taking prompt responsive actions to avoid the danger.

Objective 1:
Capture safety zone boundary breach and spot unsafe heights from the current position.

Objective 2:
Identify injurious sharp objects within reach and detect its usage closer to the body.

Objective 3:
Identify unauthorized entrance and take immediate action to stop possible kidnap.

Objective 4:
Recognize harmful electrical devices in the area and notify when such device is in contact.

Task divided among the members.

Member 1:

- Mark the safe zone boundary of the room.
- Detect safe zone boundary breach.
- Measure height from ground to the current position of the child.
- Give sound warning through a speaker.

Member 2:

- Detect knives, forks and scissors in the room.
- Detect the child holding these objects in hand.
- Measure the distance from the object in hand to the body.
- Alert the guardian/carer by a wearable Bluetooth band.

Member 3:

- Differentiate the child and adults in the room.
- Detect unauthorized persons.
- Identify a person touching the child.
- Activate siren.

Member 4:

- Detect extension cords and electrical plugs in the room.
- Attach Sensor (IOT device) to the electrical devices.
- Identify the person who touched the sensor (IOT device).
- Perform Alert based on the identified person.

Technologies to be used:

Python3
TensorFlow
Yolo
OpenCV
JavaScript/HTML/Bootstrap4

<u>This part will be filled by the Topic Screening Panel members</u>

Acceptable: Mark/select as necessary

Acceptance/ Rejection	Correction State	
	Minor Correction	Major Corrections
Accepted	☐	☐
Resubmit	☐	☐
Rejected	☐	

Corrections (if necessary)

Any other Comments:

_____

_____

_____

Approved by the review panel:

Member's Name	**Signature**

Important:

1. According to the comments given by the panel, do the necessary modifications and get the approval by the **same panel**.
2. If the project topic is rejected, find out a new topic and inform the CDAP Group for a new topic pre-assessment.
3. A form approved by the panel must be attached to the **Project Charter Form**.

Appendix 1

2021-Reg-Topic Assessment from TMP-21-050 for Supervisor Mr. Prasanna Sumathipala Endorsement

Prasanna Sumathipala 12:33 PM (4 hours ago)
to CDAP, Kodikara, Prathapa, Jayakody, me

Dear RP Team

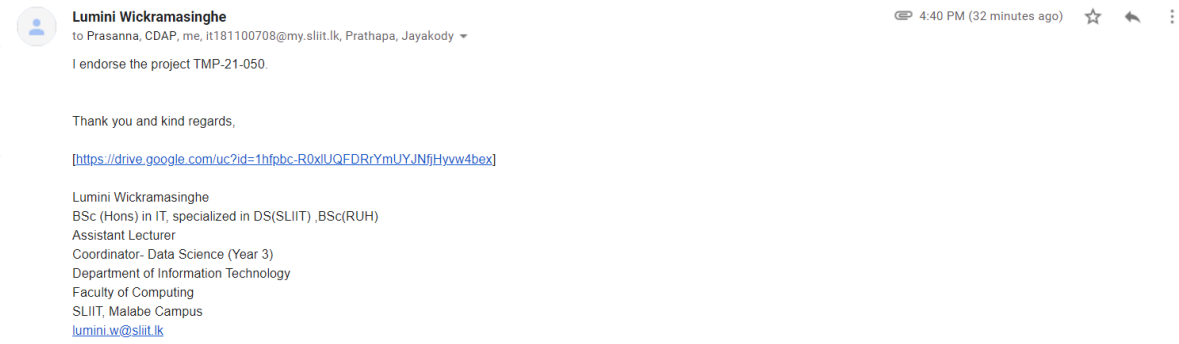
I recommend this project.

Regards
Prasanna

From: it18006308 Pramodya Hettiarachchi <it18006308@my.sliit.lk>
Sent: Saturday, January 23, 2021 11:56 AM
To: Prasanna Sumathipala <prasanna.s@sliit.lk>
Cc: Kodikara K.A.O. V. it18110708 <it18110708@my.sliit.lk>; Prathapa D.M.J it17167710 <it17167710@my.sliit.lk>; Jayakody J.M.A.M.S it18255720 <it18255720@my.sliit.lk>
Subject: 2021-Reg-Topic Assessment form of TMP-21-050 for Supervisor Mr. Prasanna Sumathipala Endorsement

Appendix 2

2021-Reg-Topic Assessment from TMP-21-050 for Supervisor Ms. Lumini Wickramasinghe Endorsement



Lumini Wickramasinghe 4:40 PM (32 minutes ago)
to Prasanna, CDAP, me, it181100708@my.sliit.lk, Prathapa, Jayakody

I endorse the project TMP-21-050.

Thank you and kind regards,

[https://drive.google.com/uc?id=1hfpbc-R0xlUQFDRrYmUYJNfjHyvw4bex]

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