HARMFUL CHILD ACTIVITY DETECTION AND PREVENTION ASSISTANCE

Project ID: 2021-115

Project Proposal Report

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Specializing in Data Science

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DECLARATION

We declare that this is our own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
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The supervisor/s should certify the proposal report with the following declaration. The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

……………………………   …………………..

Signature of the supervisor: Date

Abstraction

The issue of Children's family mishaps, kidnapping, and getting harmed because of unsafe kid exercises has raised huge worries of public interest in nowadays. The progression of Artificial Intelligence (AI) innovation, especially in image classification, computer vision and object detection, could be applied to defeat the current imperfections of the unsafe child activities recognition devices that regularly neglected to fill in as a triggering system to their guardians. This paper introduces a tracking system capable of detecting various dangers, particularly those related to dangerous electrical devices in the presence of children, while also attempting to overcome the limitations of current systems. The system is made up of two modules: a parent module and a toddler module. When a children's safety violation is observed, a particular sensor with in child module will activate and Trigger child distraction siren in order to prevention from the danger. In response to the growing security risks faced by children, this paper proposes and introduces a child monitoring system based on sensors and surveillance video footages to assist guardians in determining whether or not their children are safe.

Key words: Artificial Intelligence, Computer Vision, Image classification, Pose estimation

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1. INTRODUCTION

1.1   Background & Literature review

The system is intended to assist parents in tracking their children when they are away from childcare. Because most parents nowadays work and are unable to be with their children at all times, the majority of parents place their children in daycare. Security cameras have been deployed in childcare to ensure the safety of the children. Parents must keep an eye on their children because today's children face numerous dangers. In here developing a child tracking system that can be accessed online through a website with authentication features and that uses IOT technology to track the current floor position of children in daycare or at home in this proposed system. The design and implementation of a real-time child tracking system with real-time characteristics is the subject of this paper. The main objective of this project is to create a real-time child tracking system using surveillance cameras and the Internet of Things (touch sensors) technology. The proposed system is designed to assist parents in remotely caring for their children and to significantly decrease child injuries.

Object detection in visual platforms has been studied for a long time. It can be used for human detection[1], gender classification[2][3], age classification. Classification of child and adult is useful for the domestic security in that it makes it much easier to catch harmful child activities based on the detected physical traits. However, when it's come to real time harmful child activity detection It is critical to watch children yet keeping eyes on them all the time is hard for guardians. A few guardians utilize general CCTV to screen infants, yet it cannot tell guardians of emergencies. For classification, several studies of classification between child and adult have been introduced. For significant distance classification which is between 2 meters and 10 meters from the CCTV camera, biometric data is entirely relevant compared to other techniques. In this paper along these lines, another strategy for human classification with biometric data is proposed. In this paper we are going to use the skeleton ratios

to detect the child efficiently. The statistical information/formulas is used to decide the threshold for classification in different spots in the scene.

Figure 1.1

In this research we identify the electrical switch boards in the environment and attach sensors in top of the switch boards. Once the sensor has triggered the system need to detect whether the sensor touched person child or adult. Based on the results (child or adult) alerting system will trigger.

These days' people are utilizing innovation to change their domestic community emphatically. Many of them were able to understand usefulness of the information technology and also now the technology has rapidly grown to the smart global environment. From this smart global concept child security has become major concern.

Many of the researchers have been implemented to detect child, based on their facial features[4].in this paper[4] the algorithm of children classification from adults have been proposed. The most important part of this algorithm was to have a facial parameter as shown in Figure 1.3. Once they have applied the face parameters as the immediate next step they have applied LDA, Euclidian functions to the model in order to build the model.
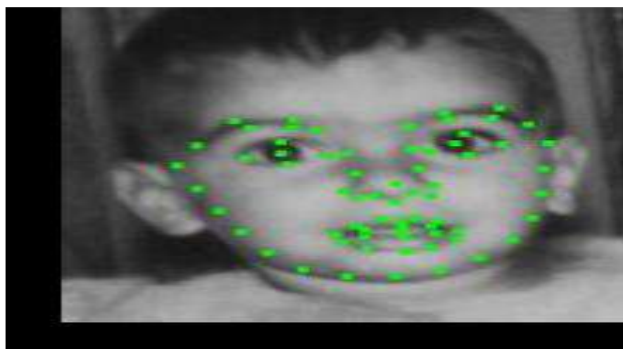
Figure 1.2

Some of the existing paper authorities have proved the detection of child could implemented using ratio of the head and body height[5]. The main objective of this paper was to identify adult and child separately in digital images. The methodology of this paper was clear. As per the paper they detect the head and full body and take relative measurements. Then they performed proportioning head size to body size of people. Haar cascades have used as object detection techniques according to this paper. As the results of this paper, they have achieved considerable amount of efficiency, but they clearly mentioned the method can be improvable.

When we come to another research paper they performed to classify children from adults a robust system based on LDA and using minimum distance classifier for children recognition[6].In this paper they have increase considerable amount of accuracy of the existing research project. In order to achieve that goal they used several techniques such as Active Appearance model, linear discriminant analysis and minimum distance classifier. Rapid advancement of the technology of child security has become one of the major concerns in now days. Geometric feature-based child age classification techniques has implemented as well[7]. According to this paper[7] they have proposed to test geometric feature of nose and mouth location as per the figure 2 and 3.. Once identifying biometric features of human body like eyes, nose, mouth have been correctly located and Take the distance between these feature points. According to this paper[7] Once Calculation has finished based on the distance between biometric feature points the age group of the image has decided.
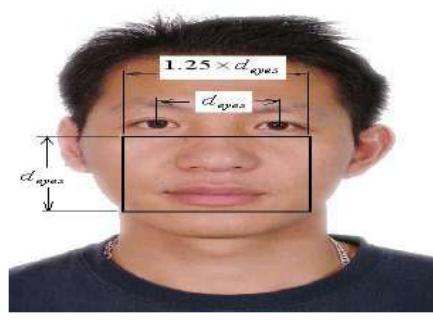
| *Figure 1.*3 | Figures 1.4 |

On the other hand several research papers have implemented child tracking system with the help of image processing and IOT[8]. In this paper[8], which is used for proper protection and tracking the operation of babies by their busy parents, a non-contact-based baby monitoring device using image processing is suggested. The Haar classifier is used to train the face detection algorithm for positive face images and negative non-face images. This system would help minimize the chances that the baby will fall from the mattress.

On the other hand there was several research papers have been implemented child tracking methodology based on raspberry pi and beacon technology[9].

Figure 1.5

This paper suggests a secure and safe infant tracking method that can be accessed online by approved parties through a website. Mainly they have used to identify the present floor position of the kids in the environment; a Bluetooth-based iBeacon technology with an Android app has been introduced.

Figure 1.6

However this research proposal [9] unable to track only children and haven't use any alert triggering method in order to prevention from unsafe activities.

1.2 Research Gap

As mentioned above, although many of the current systems and researches have individual implementation of the proposed system, they have still not been able to effectively deliver a complete detection and prevention assistance system for harmful child activity consisting of all the proposed features. In this propose system we mainly focused on,

- Detect child accurately in the environment (Without detecting adults).
- Trigger an alarm accurately based on sensor touched person.

Many of the researches includes child tracking system based on,

- Face recognitions
- Geometric features of face
- Alerting system (Emailing system) based on the GPS tracking.

According to the existing researches [2]-[8] and resources there are several researches developed on the smart child tracking system but they still were not being able to tracking only children based on the Above mentioned feature considerations. However in this proposed system will overcome following issues,

- Sometimes child could be under the CCTV camera. Hence CCTV could be capturing only the head part of the child. Because of that type of issues child tracking can be challenging.
- Sometimes we will not be able to tracking a child because of the obstacles such as chairs, Tables etc.. .
- Trigger alarm system without considering the person who touch the sensor.
- Sometimes child could be faced opposite to the CCTV camera while doing an action. The proposed system will overcome above mentioned issues by using various types of algorithms, tools and technologies.

Following table shows summary comparison of features in the proposed system against existing systems and approach.

The table shows a tabularized format of the explanation.

Project	Head/body ratio	Object detection	Geometric features of face	Pose estimation	Alerting System using touch sensor
Children Detection[4]	Not available	**available**	**available**	Not available	Not available
Child and Adult Classification[5]	**available**	**available**	Not available	Not available	Not available
An Image-Based Adult, Child classification[6]	Not available	Not available	**available**	Not available	Not available
Geiometric face feature based age classification[7]	Not available	Not available	**available**	Not available	Not available
Facial features based age groups Classification[10]	Not available	Not available	**available**	Not available	Not available
Proposed System	**available**	**available**	**available**	**available**	**available**

Table 1.1 Comparison chart

1.3   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. Due to the pandemic situation Most of the parent's routines have been changed. Safety plays a huge role but due to the current working arrangement followed by most working places, 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.

From the many of the existing researches fail to accurately detect child from the specific environment. Many of the existing projects have being implemented age classification techniques [2][3][7] using different kind of techniques. However many of them were not being able to tracking a child from the camera. In this proposed system will address this issue very effective manner.

In this proposed system, we are going to implement another main function which is child based alerting/child distraction method based on IOT sensor touched person. The research question is how to trigger a siren only when child touching the sensor. The proposed system must need to address all the mentioned issues effectively.

2 OBJECTIVE

2.1 Main objective

In this paper we are going to address one of the common problems in the domestic society. Identifying harmful child activities, objects, and the child effectively and accurately and trigger real time alert, based on the sensor touched person. As Main o

1. Detect child accurately in the environment (Without detecting adults).

- Sometimes child could be under the CCTV camera. Hence CCTV could be capturing only the head part of the child. Because of that type of issues child tracking can be challenging.
- Sometimes we will not be able to tracking a child because of the obstacles in the environment such as chairs, Tables etc... .
- Sometimes child could be faced opposite to the CCTV camera while doing an action.

2. Trigger an alarm accurately based on sensor touched person.

- Alarm should be triggered only when child touch the sensor. Simply the alarm system should work only for the child.

2.2 Specific objective

In this paper primarily focusing on the efficiently child detection and trigger and alerting based on the person who touched the sensor. To achieve these specific objectives has to mainly identify proper Touch sensors and CCTV camera. In this paper proposed solution is to recognize child effectively through the geometric features of skeleton. In order to achieve this goal as first step required to make skeleton image of the person. Then the based on the distance between skeleton points proposed to classify adult over child.

In this paper primarily focusing on the efficiently adult and child classification using image processing techniques. To achieve these specific objectives has to mainly identify proper Touch sensors and CCTV camera. In this paper proposed solution is to recognize child effectively through the geometric features of skeleton. In order to achieve this goal as first step required to make skeleton image of the person. Then the based on the distance between skeleton points proposed to classify adult over child.

Figure 2.1

1. Identify proper sensor, camera and verify the configurations.

   As hardware component mainly needs to setup camera and sensors. Configure sensor, camera with software pipeline in case of receiving inputs.

2. To optimize the data capturing and processing.

   To ensure the data consistency required to setup and configures both touch sensor and surveillance camera.

3. Analyze the data and train the model.

4. Hardware and software configurations.

5. System integration.

3 METHODOLOGY

This Section carries out the research methodologies how it will be going to implement out. The research works to build to detect kid using biometric characteristics based on image processing techniques. In order to continue this research needed to satisfy several prerequisites.

> ➤ **Pre requirements**

- OpenCV3 package installation.
- Test the Camera
- Test touch sensor

> ➤ **Data preprocessing**

Under this phase following steps has to follow

- Read image
- Resize image
- Remove noise data
- Segmentation
- Smoothing

> ➤ **Implementation**

Object detection

In this segment main object is to determine whether the activities were the result of an adult or a toddler. YOLO will be used to capture each video frame and perform object detection in order to perform the previously described segregation.

Child Tracking

In this step required track children using different kind of methods such as pose estimation method, haar cascade classifier. To ensure data consistency required to track child from multiple frames.

Prevent from object disruption

Actions might be not captured as it is because of the obstacles such as chairs, tables etc.. .In that type of cases action only trigger from the touch sensor signal. It will be not enough to make sure the action was done by the adult or child. To overcome this situation can use Kalman filter implementation and concrete parametrization for image space filtering.

Alerting

In this step required to ensure touch sensor properly configured or not. Based on the sensor touched persons the event/siren should be triggered.

> **Testing**

Testing phase required integrated system (Model, Camera and Touch Sensor) in order to test the module. Data should be captured and successfully need transfer to software components. Object detection testing, Child body feature detecting testing, and Sensor and camera data pipeline configurations required test in order to implement the system.

3.1 System Diagram
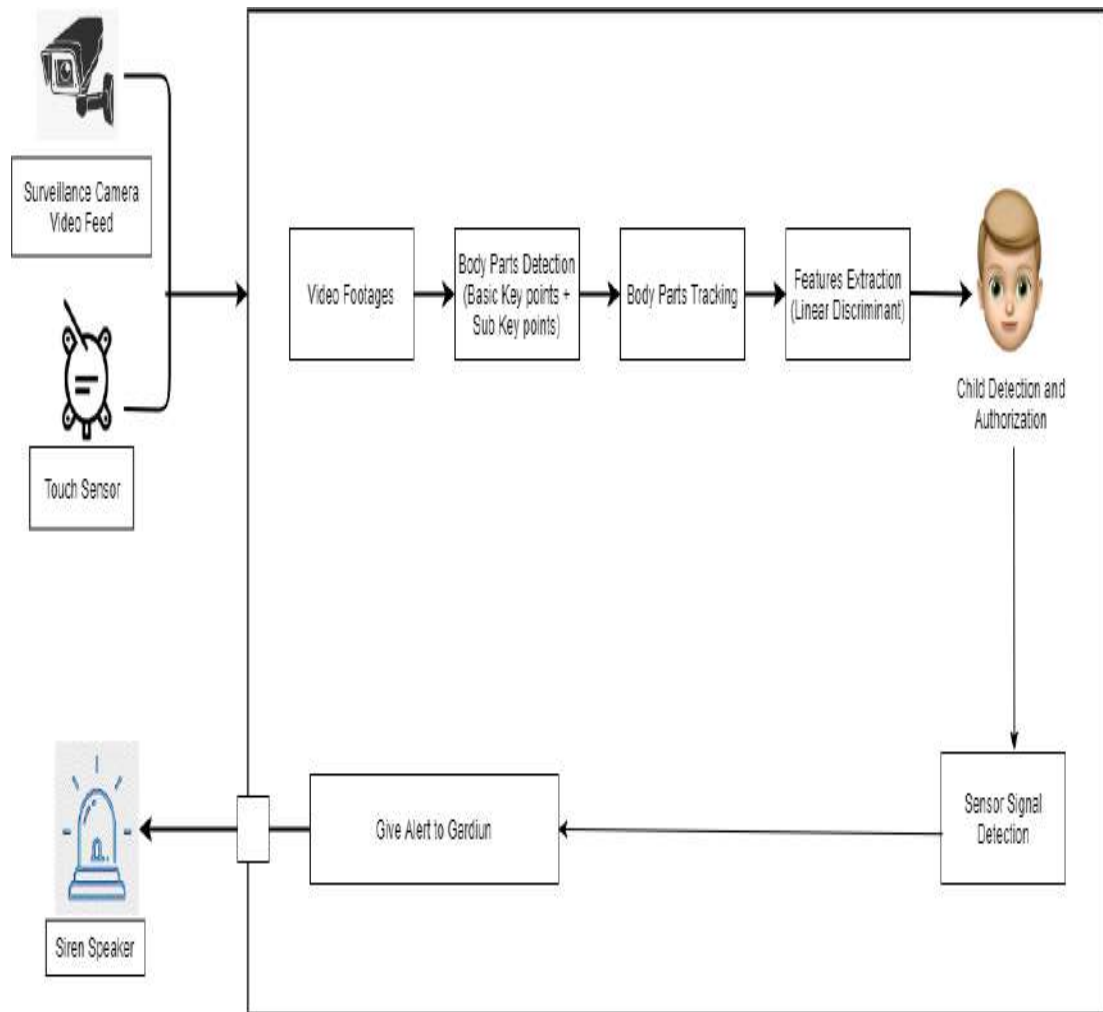
Figure 3.1 System diagram

3.2 Tools & Techniques

The following technology domains will be used for this proposed system implementation.

- Computer Vision
- Machine Learning
- Deep Learning

The technologies that we would be utilizing for the implementation of our system are given below.

- TensorFlow

Figure 3.2

TensorFlow is an open-source machine learning robust platform. It has a robust ecosystem of tools, libraries, and community resources that enable researchers to advance the state-of-the-art in machine learning and developers to quickly create and execute ML-powered applications..

- OpenCV

Figure 3.3

OpenCV is a high-performance machine vision tool that can be used in both C++ and Python. OpenCV comes preloaded with all of the methods and algorithms needed to perform a variety of image and video processing tasks.

3.2.1 Technologies

- Python 3

Figure 3.4

Python is a programming language that is high-level, interpreted, interactive, and object-oriented. Python is intended to be a very readable language.

- JavaScript/HTML/Bootstrap4
- Yolo

3.3 Work Breakdown Structure
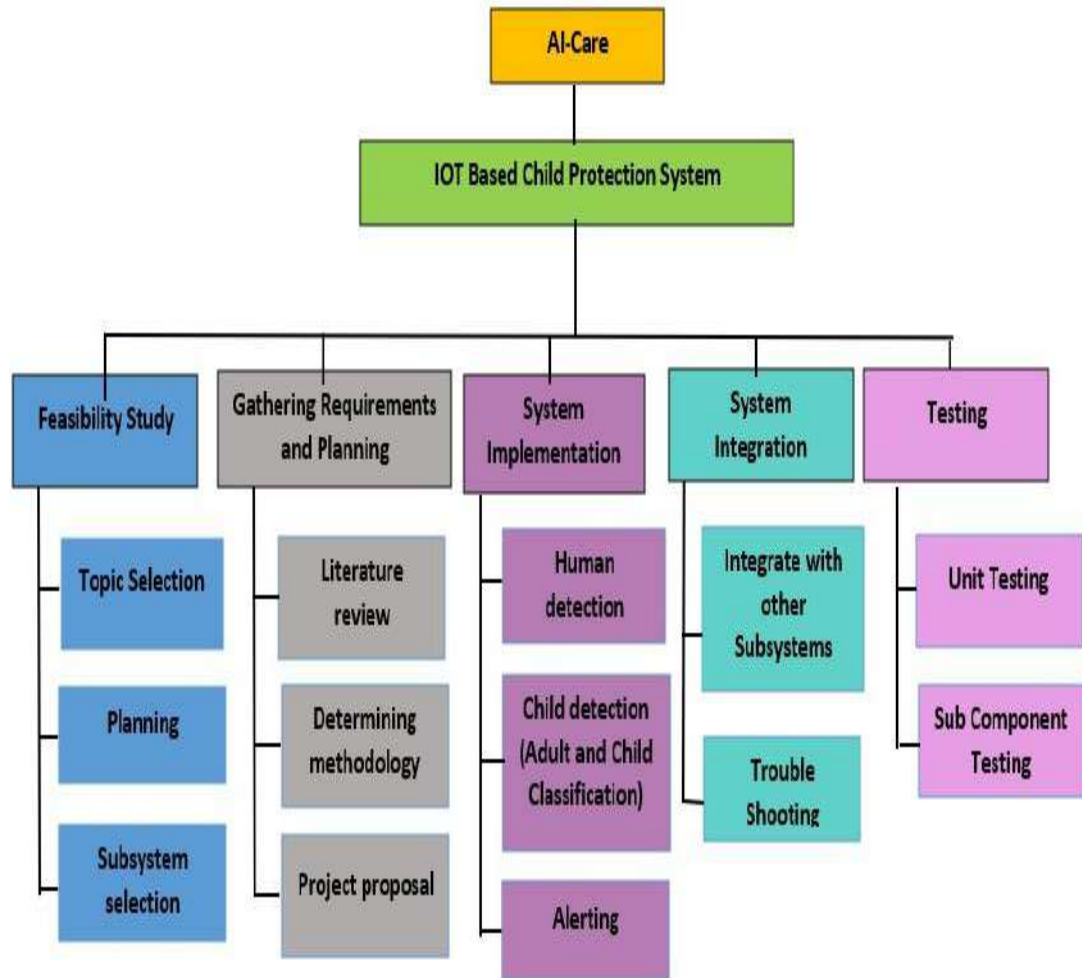
Figure 3.5

3.4 Functional & Non-Functional requirements

Functional Requirements

- Should have a method to detect the human in the specific environment
- Should have a method to classify whether Child or adult.
- Should have a method to communicate with the IOT device.
- Should have a method to Trigger an alert to the parents.

Non-Functional Requirements

- Response time and net processing time.
- Efficiency
- Availability
- Maintainability
- Capacity
- Serviceability: the system should be able to fulfill its function adequately
- Usability: The system has to be user-friendly and easy to use

Personal Requirements

- Parent/Guardian should be available.
- Child should listen to the warnings.
- Parent/Guardian should react to the alerts.

Hardware Requirements

- There should be a way to configure the speaker to the system.
- There should be a way to configure the camera to the system.
- There should be a way to configure touch sensor to the system

4 BUDGET AND BUDGET JUSTIFICATION

- Surveillance camera – Capture real time video footages
- Speaker – When Child is interacting with unsafe electrical devices such as electrical switch boards then speaker/siren needs to setup in order to distract child from the danger.
- Touch sensor – To capture whether child interact with the electrical devices.

Hardware Resources	Quantity	Estimated Price
Surveillance Camera	1	Rs.7000
Speaker	1	Rs.1000
Touch Sensor	1	Rs.300
Total	3	Rs. 8300

Table 4.1 budget

5 COMERCILAZATION

Children are being left to grow up on their own in a country where both parents are working. The timeframe between the ages of one and five years is the most critical, since a child requires a lot of paternal attention. As a result, AI Care has the potential to become the next big thing in childcare in the next ten years. The ability to provide real-time protection assistance to a child while parents are at work increases an employee's average working time. Working from home limits the number of sick days that an employee may take. Because of the high return on investment AI Care delivers, we believe it will be a top solution for organizations to invest in caring for their workers.

6 TIME LINE

MEMBER FUNCTION

Realtime children detection while touching the electrical device(Classify Children and gardian)

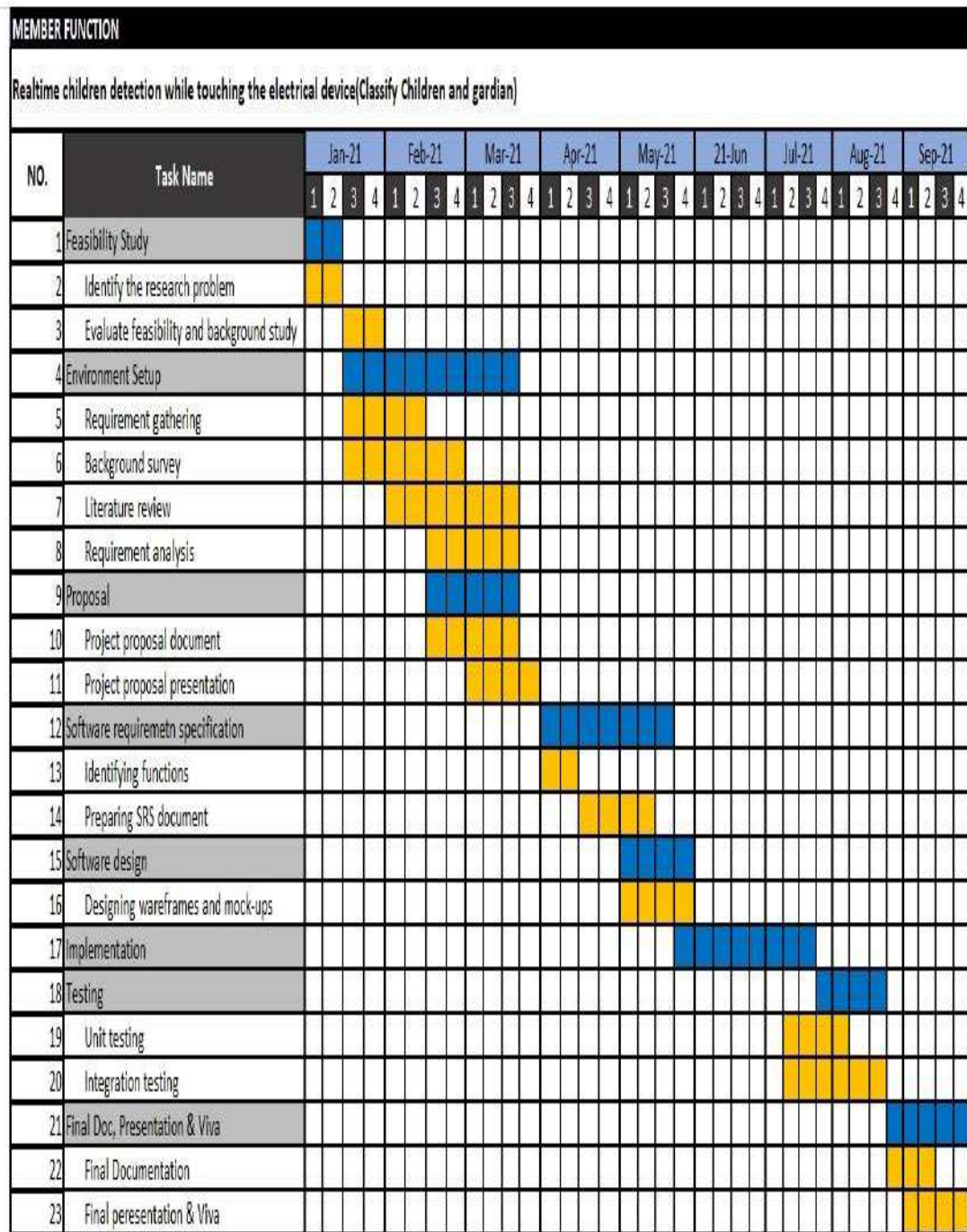| NO.	Task Name	Jan-21				Feb-21				Mar-21				Apr-21				May-21				21-Jun				Jul-21				Aug-21				Sep-21			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Feasibility Study	█	█																																		
2	Identify the research problem	█	█																																		
3	Evaluate feasibility and background study			█	█																																
4	Environment Setup			█	█	█	█	█	█	█																											
5	Requirement gathering			█	█	█																															
6	Background survey			█	█	█	█																														
7	Literature review					█	█	█	█																												
8	Requirement analysis						█	█	█																												
9	Proposal							█	█	█	█																										
10	Project proposal document							█	█	█																											
11	Project proposal presentation									█	█	█																									
12	Software requiremetn specification													█	█	█	█	█																			
13	Identifying functions													█	█																						
14	Preparing SRS document															█	█	█																			
15	Software design																	█	█	█																	
16	Designing wareframes and mock-ups																	█	█	█																	
17	Implementation																					█	█	█	█	█	█										
18	Testing																													█	█	█					
19	Unit testing																											█	█	█							
20	Integration testing																										█	█	█	█							
21	Final Doc, Presentation & Viva																																	█	█	█	█
22	Final Documentation																																	█	█		
23	Final peresentation & Viva																																		█	█	█

Figure 5.1 Time Line

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8 APPENDICES

Appendix-A Turnitin Report

Turnitin Originality Report

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