

## SAFETY GADGET FOR CHILD SAFETY MONITORING & NOTIFICATION

### **R.SWETHA**

Department of Electronics  
and Communication  
Engineering,  
Panimalar Engineering College.

### **M.JYOTHI**

Department of Electronic  
and Communication  
Engineering,  
Panimalar Engineering  
College.

### **P.THIRUPUGAZHI**

Department of Electronics  
and Communication  
Engineering,  
Panimalar Engineering College.

### **R.SANDHIYA**

Department of  
Electronics and  
Communication  
Engineering,  
Panimalar Engineering  
College

Nowadays, crime rate associated with children keeps increasing due to which draws peoples' utilizing IoT technology. Online questionnaire and semi-structured interview are methodologies used to collect data. The online questionnaire gains feedbacks by sending questions electronically, where answers need to be submitted online. In the semi structured interview, researcher meets and asks respondents some predetermined questions while other being asked are not planned in advanced. Through information obtained, a smart band have been proposed to monitor the safety of children. By this, parents ttention regarding child safety. This research is conducted to propose a child security smart band know what is happening remotely and can take actions if something goes wrong. The future improvements of this device will be adding functions and software to make it works like a phone such as messaging, gallery, Google, YouTube, meanwhile, adding more child security features so that child safety is guaranteed. **Keywords: Child security system, Child monitoring system, Internet of Things (IoT), IoT device, Smart band**

## **2. RELATED WORK**

**2.1 Internet of Things (IoT)** Internet of things (IoT) refers to networked interconnection of objects featured with ubiquity intelligence [3] [28]. In IoT, objects are connected via internet for communication, interaction, exchanging data and making decisions automatically at anywhere and anytime. Thus, introducing the hyper connectivity concept meaning individuals and organizations able to communicate with each other effortlessly and remotely [15]. Revealed by [17] and [15], IoT is a revolution in advancing technology causing transformation in information technology, humans' lifestyle, and in businesses processes. The advancements of IoT make it possible to be used in organizations for automating and monitoring business processes [6] [37-38]. In term of society, IoT can be used for simplifying daily tasks, creating smart homes, smart cities, devices or application which improves the quality of life. However, security and privacy are the main challenges of IoT [15] [33-34] which need to be solved as it gathers much personal data capable of revealing sensitive information.

### **2.2 Sensor**

Sensor known as a device measuring physical value and converts it into data. Common sensors like the temperature sensor measures heat of an object. Proximity sensor used to detect nearby objects. For the pressure sensor, it calculates pressure applied. Optical sensor able to sense the light intensity [12]. Humidity sensor will detect the presence of water vapor in the air [10]. Micro sensor is designed to collect and relay information about the environment [10]

### **2.3 Cloud**

Cloud computing means shared computing resources (networks, servers, storages, applications, services) are delivered as a service [18] [30-31] over the Internet from cloud to customer. According to [7], cloud is an interconnected network of servers providing services for people or businesses. In fact, cloud supports real-time operation, processing, analyzing, connecting, managing and securing IoT devices as well as applications [5] [35- 36]. In addition, it reduces cost since users are paying based on usage without building the physical infrastructure. Furthermore, it allows developers to create projects faster [7]. Organizations can also access Big Data from the cloud [7]. Discovered by [16], the core concept of cloud is to reduce processing burden on users. Consequently, different devices like PC, laptop, smart phone able to access various utility programs, storage and application development platform over the internet.

### **2.4 SafetyDevice**

The safety device protects individuals from potential harms and dangers. A research done by [1] proposed the child safety wearable device using raspberry pi 3. The raspberry pi 3 gathers data from pi camera, pulse sensor and sound sensors. Then, send collected data to parents' smartphones by SMS using GSM shield. Images captured from pi camera and children's location detected by GPS will also be sent to parents' devices. In another study, [2] designed a wearable smart watch for women security. Sensor inside the smartwatch senses the heartbeat of a child or woman who wears it [11]. When he/she is exposed to attacks, heartbeat rate will be high [11]. When this is detected, alarm sound will be triggered [11]. It will then automatically make calls to registered contact and to the nearest police station [11]. Based on the location provided by GPS, police will arrive soon at the correct destination.

## 2.5 Similar System



Figure 1 Gator Smart Watch Source:

<https://cdn3.volusion.com/hvgjb.rxjoy/v/vspfiles/photos/MyGator-Watch--6.png?v-cache=1605859659>

Gator, a kid's smartwatch from Gator Group Co. It comes with a SIM card and the free app is available on Play Store and Apple App Store [19]. Gator supports calling features up to 13 different numbers, enables two-way voice messages from the app and watch. The location tracking is based on GPS tracking when children are outdoors and Wi-Fi tracking when children are indoors. Notification will also be sent to parents when children leave the geofences. Pedometer sensor is included and the SOS alarm is supported which automatically calls 3 emergency contacts when pressed for 3 seconds. Other than that, school mode is available for setting up schedules to prevent callings during the school time. Not only that, Gator is splash proofing, enables remote voice monitoring and records historical routes.

Figure 2 Explora Go Source: <https://images-na.ssl-imagesamazon.com/images/I/610FHcb9fJL. AC SL1383 .jpg>

Explora Go, a waterproof watch phone for children branded Explora which includes pedometer, alarm clock and stopwatch. It possesses an app available at Playstore and Appstore. With GPS and multiple services, Explora Go shows children's' location and supports the setup of safety zones. Meanwhile, it contains a SIM card and acts like a phone enables voice calls from 10 pre-saved contacts. Similar to a phone, Explora Go can send and receive text messages, emojis, images and voice messages. It is also equipped with the SOS button that children can press to notify emergency contacts of their location. Beyond that, Wi-Fi and Bluetooth are available in Explora Go. It also supports the schedule function in which school schedules can be specified during which watch will only display time and make emergency calls.



The table below shows comparison between systems:

Table 1: Comparison between Gator Smart Watch, Explora Go and the proposed system. Gator Explora Go Proposed System Wifi✓✓✓ Phone Calls ✓✓✓ Waterproof X ✓✓ Camera X ✓✓ Video Record X X✓ Text Messages X ✓ X Schedule ✓✓ X GPS ✓✓✓ Safety Zones ✓✓✓ Emergency Button ✓✓✓ SOS Light X X✓ Altimeter X X✓ Blood Pressure Sensor X X✓ Emotion Detector X X✓ Heart Rate Sensor X X✓ Motion Sensor X X✓ Pedometer ✓✓✓ Respiratory Sensor X X✓ Sleep Quality Sensor X X✓ Temperature Sensor X X✓

Based on the table, Gator and Explora Go does not support much sensors like the proposed system to obtain children's data regarding their actual conditions. Thus, if abnormal situations occurred, Gator and Explora may not be able to realize quickly, easily and inform parents at once. Due to that, parents are less informed about children's conditions and in case the child is in danger, actions are not able to be taken immediately. Furthermore, both systems do not record video and send it to parents during an emergency situation. Besides, SOS light function is not available in both systems but supported by the proposed system which will light up when the emergency button is pressed. In fact, Gator and Explora Go are emphasized in introducing mobile products for kids who are too young to use mobile phones. Because of that, they are less focusing on the child security aspect. On the other hand, the proposed system is more focused on tracking children's conditions that are suitable for child safety purposes

## **2.6 The Proposed System**

An IoT based wearable smart band for children is proposed in this research for child security purposes. The smart band is waterproof, chargeable and equipped with sensors. Heart rate sensor measures pulse rate and BPM. Sleep quality sensor obtains children's sleep quality, cycle and positions. Altimeter detects changes in height and sense whether children are going down a slope or climbing stairs, thereby measuring calorie count. On the other hand, pedometer is used for counting steps. The motion sensor is applied to determines whether children are jogging or running. Blood pressure sensor used to measure blood pressure. In addition, the respiratory rate sensor detects breathing patterns and respiratory rate. Furthermore, the temperature sensor is used to detect body temperature. Besides, by using the emotion detector the emotional state, pressure and anxiety levels can be gained. Apart from that, this smart band contains GPS for tracking, identifying children's location and setting geofences. Via the smart band, children can also contact parents. Emergency button, a feature in which will automatically record video and automatically call 4 emergency contacts when it is pressed. An alert message along with the video clip is sent to parents' devices. The alarm and SOS light will be activated by parents through their devices. As the diagram shows, sensors are connected through the internet. They detect and capture different kinds of data. These collections of data will then be sent to the cloud over the internet for securely process, analyze, monitor, store, access and retrieve data remotely. After that, the information indicating children's status, along with reference values will be sent to parents' devices with the app installed. If children's actual data is not within the range of reference value, alert notification and some suggestions will be sent to parents' devices. Also, when children leave geofences, notification will be sent to parents' devices.

## **3. METHOD**

Research methodology, a method for identifying, collecting, processing and interpreting data using some techniques, then drawing conclusions to address the problem. It is a significant section since it allows readers to evaluate overall validity and reliability of the research paper [20]. For this research, online questionnaire and semi-structured interview are employed. Online questionnaire serves as quantitative research to measure users' attitude, behavior and factors influencing their acceptance towards the child security system. After that, a semi-structured interview is conducted as qualitative research helping in understanding trends, users' preferences, opinions and thoughts about current condition and IoT-based child security system. Besides, 50 parents nursing one or more children at most 12 years old are participating in this research. The data gathered will be used to prove the severity of current situation and the need to use IoT-based child security system.

The section mainly discussed about significant of the research and why this study needs to be carried out. The child security system benefits parents as well as children. Since it aids in locating children, monitoring child's condition and security status instantly at anyplace and any time, parents who often tied up in work or neglect their children are gaining advantages from it. Through the proposed system, immediate actions can be taken forthwith in case the child is threatened. Thus, child security is guaranteed, crime rate related to children is reduced and eventually, parents can rest assured. In fact, reduction of crime rate brings about long-term positive effects such as improving country's reputation and quality of life [26], increasing community security, safety, and cohesion as well as generating economic benefits for individuals, committee and taxpayers [23]. Besides, the proposed system makes ample use of IoT, proving IoT is evolving which can be included in multiple areas comprising the child security field.

## 5. CONCLUSION

Throughout the research, it is clearly explained the IoT concept, child safety issues and the need of using child security system. Some previous studies have been included for designing the IoT-based child security smart band. It assists parents to monitor their children remotely. In case situations happen, notifications will be sent to parents so that actions can be taken. Through this, child safety can be ensured and crime rate will be reduced. However, the proposed device is not robust enough and does not contain sufficient functions to operates like amobile phone. Hence, the future enchantments will be adding more features, software, applications, hardware to make the proposed system capable of working more intelligently, meanwhile guarantee the safety of children.

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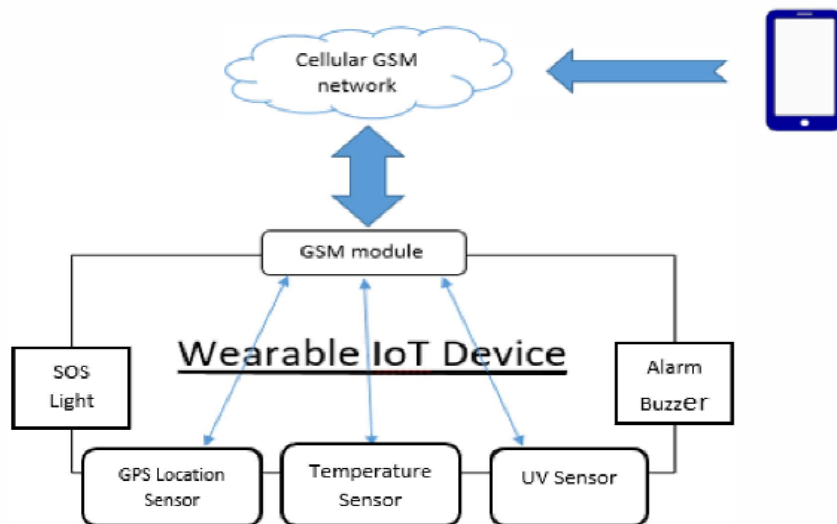
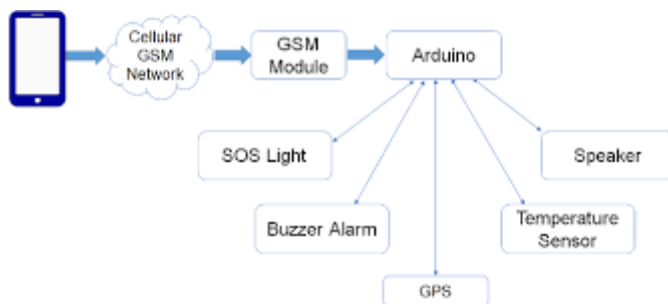


Fig 1. System overview of the wearable device.



## Child Safety Tracker App Features

