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TECHNICAL SEMINAR (18CSS84)
ON

CHILD SAFETY WEARABLE DEVICE

Submitted in partial fulfillment of the requirements for the award of degree

BACHELOR OF ENGINEERING
IN
COMPUTER SCIENCE AND ENGINEERING

BY
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B.N.M. Institute of Technology

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2021 - 2022

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CERTIFICATE

This is to certify that the Technical Seminar (18CSS84) on Current Trends entitled **'Child safety wearable device'** is carried out by, **Ms. MS Nagajyothi(1BG18CS066)** a bonafide student of VIII semester in partial fulfillment of the requirements for the degree of Bachelor of Engineering in Computer Science and Engineering of the Visvesvaraya Technological University, Belagavi, during the year 2021-22. All corrections/suggestions indicated during Internal Assessment have been incorporated in the report deposited in the department Library. The report has been approved as it satisfies the academic requirements in respect of Seminar on Current Trend prescribed for the said degree.

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ABSTRACT

Child safety wearable comes from the increasing need for safety for children .The major advantage of this wearable over other wearable is that it can be used in any cell phone and doesn't necessarily require a savvy individual to operate. Most of the wearable available today are focused on providing the location , activity, etc. of the child to the parents providing via Wi-Fi and Bluetooth which seems to be an unreliable source of communication. This device is to help parents locate their child with ease and also alerts the parent quickly when the child is in unfavorable conditions like fire, harmful gases. Therefore, this paper is to have an SMS text enabled communication medium between the child's wearable and the parent using GSM mobile communication. The parent can send a text with specific keywords such as "LOCATION" "TEMPERATURE" "UV" "SOS" "BUZZ", etc., the wearable device will reply back with a text containing the real time accurate location of the child which upon tapping will provide directions to the child's location on Google maps app and will also provide the surrounding temperature, UV radiation index so that the parents can keep track .It also alerts with SMS text to the parent when the child is in an environment where harmful gases like H2,CH4,CO,ALCOHOL,SMOKE. For the secondary safety measure the device alerts the people present in the surrounding of the child who could instantly react for the child's safety till the parents arrive or they could contact the parents and help locate them. In this scenario, a lost child can be located by the parent could send an SMS to the wearable device which would activate the SOS light feature on the wearable. Therefore alerting the people around the child that the child is in some distress and needs assistance as the SOS signal is universally known as the signal for help needed.

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Chapter 1

INTRODUCTION

1.1 Introduction

Child safety wearable comes from the increasing need for safety for children in current times as there could be scenarios of the child getting lost in the major crowded areas and child getting into harmful environment . This paper focuses on the key aspect that lost child can be helped by the people around the child and can play a significant role in the child's safety until reunited with the parents. Most of the wearable available today are focused on providing the location, activity, etc. of the child to the parents via Wi-Fi and Bluetooth[18]which seems to be unreliable source of communication. Therefore it is intended to use SMS as the mode of communication between the parent and child's wearable device, as this has fewer chances of failing compared to Wi-Fi and Bluetooth. This project will be running on Arduino Uno microcontroller board based on the ATmega328P, and the functions of sending and receiving SMS,calls and connecting to the internet which is provided by the Arduino GSM shield using the GSM network. Also, additional modules employed which will provide the current location of the child to the parents via SMS and warns the parent through SMS if any fire accident occurs or any combustible gas is around the child . The second measure added is SOS Light indicator that will be programmed with Arduino UNO board to display the SOS signal using Morse code. The different modules stay enclosed in a custom designed 3D printed case. Therefore alerting the people around the child that the child is in some distress and needs assistance as the SOS signal is universally known as the signal for help needed. Additionally, the wearable comes equipped with a distress alarm buzzer which sets to active by sending the SMS keyword "BUZZ" to the wearable. Hence the buzzer is loud and can be heard by the parent from very considerable distance. Also the parents via SMS can receive accurate coordinates of the child, which can help them locate the child with
pinpoint accuracy.

1.2 Motivation

The motivation for this wearable comes from the increasing need for safety for children in present times as there can be scenarios of the child getting lost in the major crowded areas.

This paper focusses on the key aspect that lost children can be helped by the people around the child and can play a significant role in the child's safety until reunited with the parents. Therefore, it is intended to use the SMS as the communication type between the parent and child's wearable device, as this has fewer chances of failing when compared to Wi-Fi and Bluetooth. The platform on which this project will be running on is the Arduino Uno microcontroller board based on the ATmega328P, and the functions of sending and receiving SMS, which is provided by the Arduino GSM Module using the GSM network. Also, additional modules employed which will provide the current location of the child to the parents via SMS. The second measure added is SOS Light indicator that will be programmed with Arduino UNO board to display the SOS signal whenever the parent wants. In the scenario, a lost child can be located by the parent could send a predefined keyword as an SMS to the wearable device which would reply by sending location to the parent mobile. Additionally, the wearable equipped with a distress alarm buzzer which sets to active by sending an SMS keyword "BUZZ" to the wearable. Hence the buzzer is louder and can be heard by the parent from very considerable distance. Also, the parents via SMS can receive coordinates of the child, which can help them locate the child with maximum accuracy. Some of the existing work done on these similar lines are for example the lowcost, lightweight Wristband Vital which senses and reports hazardous surroundings for people who need immediate assistance such as children and seniors. It is based on a multi-sensor Arduino microsystem and a low¬ power Bluetooth 4.1 module. The major drawback for the Vital band is that it uses Bluetooth as the mode of communication between child and the parent. Therefore, the wearable device proposed will be communicating with the parent via SMS through GSM which would ensure that there is a secure communication link. Also, customization of the wearable can be possible as per our needs by reprogramming the Arduino system.

1.3 Problem Statement

To track the daily activity of children and also help find the child using Wi-Fi and Bluetooth services present on the device.

Chapter 2

LITERATURE SURVEY

2.1 Literature survey

A. RFID based System for School Children Transportation Safety Enhancement(Akash moodibidri (2017))

In this paper author had presented a device to monitor pick-up and drop-off of kid to enhance the well-being during daily transportation from school and to school. In this system there are two main units, a bus unit, and a school unit. The bus unit is the system which is used to determine when a child is boarding or leaving the bus. The information from bus unit is then sent to the school system that identifies the students that haven't board or leave the bus. It then issues an alert message. In this paper author has a developed a web-based and database-driven application for controlling of the device. This application provides beneficial details about the children to caregiver's personnel.

B. Smart IoT Device for Child Safety and Tracking (Anand Jatti(2016))

It provides guardians with the real-time tracking of location, UV radiation index, surrounding temperature, and SOS light with a Distress alarm buzzer for their kids to make people near child toknow that child is in panic. It provides feature to locate their kid or alert bystanders so that they can act to comfort the child or rescue the child. In this device they have used ThingSpeak, Micro Electro Mechanical Systems (MEMS), NodeMCU, GPS, GSM and Various sensors. This device gives the result for the parent in two different ways. The first one is they get an alert message (SMS) for the registered phone number. The next one is they receive a graphical representation which shows the Latitude, Longitude, MEMS Sensor and Vibration sensor of the child's activities through "Thing Speak". The disadvantage of this device that to use this device there must be efficient flow of internet connection and it must be fullest. Then only it gives the outputs at the earliest otherwise it takes time for the result.

C. Child Safety Wearable Device(Zhigang Gao(2017))

This project focuses communication mode to be in SMS text form using GSM. The parent will send a keyword in form of SMS "SOS", "BUZZ", "LOCATION", "TEMPERATURE" etc., to

the devices. The device will reply back the real time accurate location of the child and will also provide the surrounding temperature, or any of the data asked by the parents. It helps parents to keep track if the temperature around their kid is not proper for their kid. The secondary idea implemented was distress alarm buzzer and a bright SOS Light on the device that can be activated by the guardians via sending the keywords in the SMS. Parents can text the keywords to ON the SOS signal brightly and can also send the keyword to sound an alarm which a people near child or bystander can instantly help the child's till the parents arrive. People around could also contact the parents and help them to reunite child with his or her parents. Hence this project provides parents a sense of protection for their kid in today's unsafe environment. The drawback of this system is that parent have to remember the keywords.

D. A Smart Security for Child Safety

Child tracking is mainly based on two units GPS watch and Android monitoring unit. This wearable device unit consist of a GPS receiver, Flexi Force Sensor, Temperature Sensor and MEMS accelerometer. This security Wearable Device will keep the child safe. The parent will get the continuous update about their child temperature and various other factors, so that they not afraid about their child well-being when they are not with their kid. This would create some fear in the persons mind who are involved in child trafficking and harassment. As a well-known proverb “Prevention is better than cure”, this application will act as a prevention for the childsafety

Chapter 3

SYSTEM ARCHITECTURE

3.1 System Model

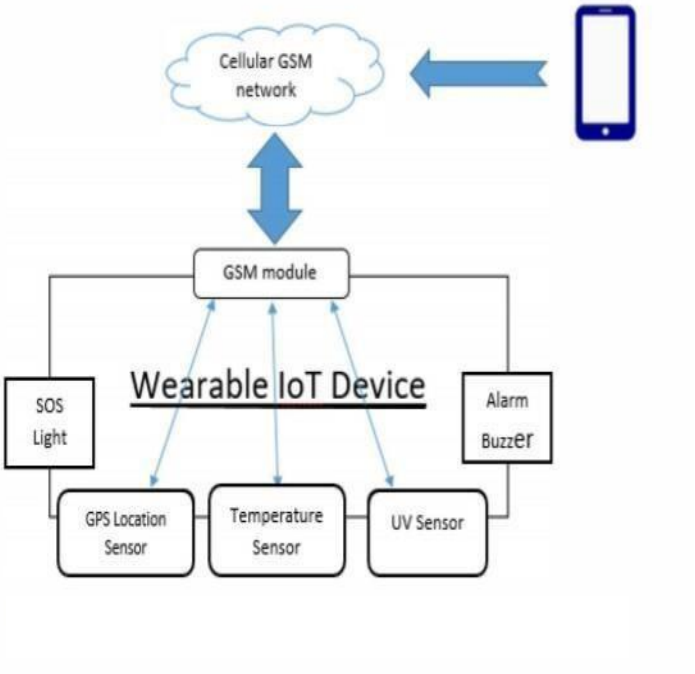

Figure 3.1: System Model

A. System Overview

An ATmega328p microcontroller controls the system architecture of the wearable device with an Arduino Uno bootloader. The Fig illustrates the architecture of the child safety wearable device, which depicts the various technologies and technological standards that are used. The Arduino Uno collects the data from the different modules interfaced to it, such as the GPS module upon being triggered by the Arduino Uno by receiving SMS from GSM module. The GSM module is used as an interface to send the data received by the Arduino Uno via SMS to a mobile. The GSM module functions as a trigger for the Arduino Uno to request data from its various modules connected to it. If an SMS text with specified keyword is sent to request the current location or GPS coordinates is sent to the GSM module via the user's phone, then the GSM module triggers the Arduino Uno to request the current GPS coordinates.

B. Wearable Device

The wearable device, for now, is not built on a system on chip model, rather has been proposed using larger components and can later build on the SOC platform once put into manufacture.The wearable device tasked with acquiring various data from the all the different modules connected to it. It comprises of Arduino Uno based on the ATmega328P microcontroller. The Arduino Uno receives data from different modules and analysis the data and customizes the data in a user understandable format. For the moment the design is not made compact, since the focus now has been to show that this concept of smart wearables would be highly impactful for the safety of the children. The wearable system runs on a battery or any external source. In order to minimize power consumption, the wearable device has been programmed to provide GPS and other information only upon request by SMS text via GSM.

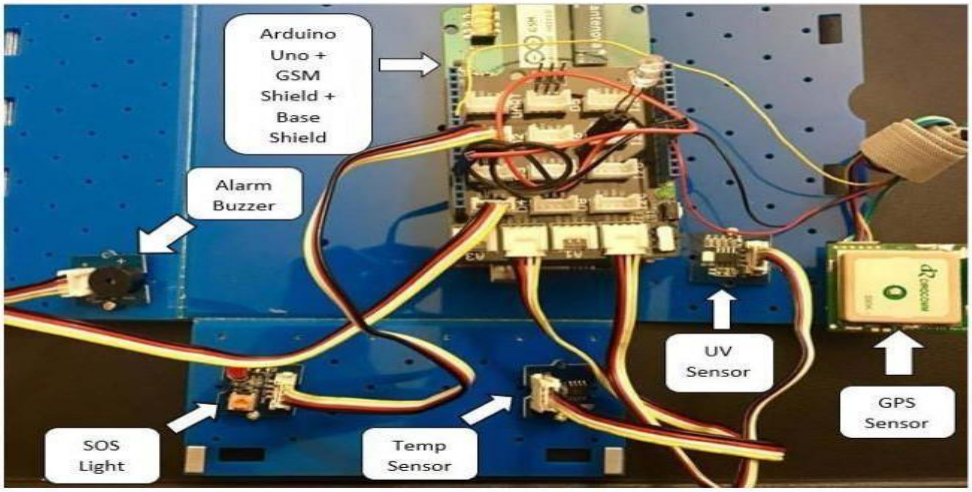

Figure 3.2: Proposed wearable IOT device

C. GPS location sensor

For determining the real time location of the child NEO6MV2 GPS module has been used which communicates with the Arduino Uno through a 9600-bps software serial interface.

The connections between the Arduino Uno and the GPS module established like the connections with GSM module. It has a low power consumption and small size, which is very compact. The GPS module output comprises of standard string information which is governed by the National Marine Electronics Association (NMEA) protocol. Once the SMS trigger text "LOCATION" is sent from the cell phone of the user, this text is received by the GSM which in turn triggers the Arduino Uno to execute the GPS code to fetch the current, accurate location of the GPS module. The location output received from the GPS module is in the following format:

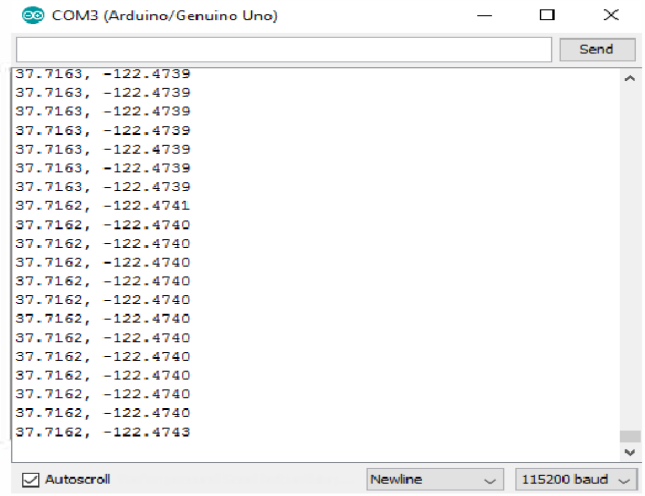

Figure 3.3:output received by GPS location sensor

The latitude and longitude coordinates received are stored in variables called "latitude" and "longitude," which are then called upon when the SMS text received on the GSM module matches with the keyword "LOCATION". Once the SMS trigger text "LOCATION" is sent from the smartphone of the user, this text is received by the Arduino GSM Shield which in turn triggers the Arduino Uno to execute the GPS code to fetch the current, accurate location of the GPSmodule.

D. UV Sensor

In order to measure the ultraviolet radiation intensity present around the surroundings of the child, a seed studio grove UV sensor was used. The UV sensor is built on the GUVA-SI2D sensor (spectral range of 200nm-400nm). The sensor works byoutputting electrical signal

which alters with UV intensity. It isa highly sensitive sensor. It is known that the absorption of UVrays in minor amounts can be progressive to the health of aperson as it helps in the production of Vitamin D The purpose of a UV sensor in a child wearable device can be to protect the child from harmful radiations of the sun. The UV sensor is connected to the AO port of the base shield. In the figure below shown is the output received from the UV sensor for the different intensities of sunlight.

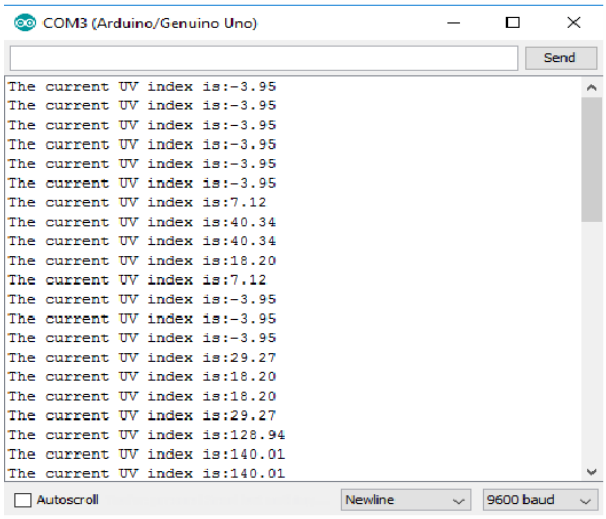

Figure 3.4: Output received by UV sensor

E. SOS light

The another theory that this paper focuses on is that bystanders are the first mode of help for a missing child. The purpose of the SOS light is to be able to alert the people nearby that the child might be in distress since the light will be flashing the universal SOS light symbol which may people nowadays know for to be a sign for help. This can be activated by the parent itself by sending an SMS text with the keyword “SOS” to the child’s wearable which will activate the SOS light flashing. The SOS light works on the principal of Morse code in which “S” stands for three short dots and the “O” stands for three long dashes. Since a very long time the SOS signal has been universally known for being the sign of distress and help. The SOS signal is referred to by all security personals, who if find the child to be missing can act and help locate the parents with surplus resources present at their disposal. The SOS light is connected to the pin of the Arduino.

F. Alarm

In the scenario, if a child is separated from his/her parents. The parent can locate the child by sound in a very loud alarm on the wearable. To achieve this, a piezoelectric buzzer is used, which is responsible for emitting a strong tone upon the output being set to HIGH. The buzzer module is activated upon sending an SMS text with the keyword "BUZZ" from a cell phone. Also, this buzzer works like the SOS led by alerting the people nearby with the distressed tone that the child might be lost and needs assistance. The buzzer is the child might be lost and needs assistance. The buzzer is connected to the digital pin of the Arduino.

G. Gateway

1) GSM Module: GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine-SIM900A, works on frequencies 900/1800 MHz The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet etc. through simple AT commands. It transfers the information over to the user via SMS. Arduino provides GSM libraries for GSM module as well which allows the GSM module to make/receive a call, send/receive SMS and act as a client/server. The GSM module receives 5V power supply directly from the 5V pin connection at the Arduino Uno 5V. The serial communication between the Arduino Uno and GSM module is performed between the serial pins 0,1. The Arduino has been programmed to receive SMS text messages from the parent's cellphone via GSM module. The GSM module will constantly be scanning the received text messages for the specific keywords such as "LOCATION", "TEMPERATURE", "SOS" and "BUZZ".

Chapter 4

EXPERIMENTS

4.1 Result analysis:

A.GPS Location Sensor

Upon testing the wearable device multiple times with repeated SMS texts. The GPS location sensor was able to respond back with precise latitude and longitude coordinates of the wearable device to the user's cellphone, which then the user would click on the received Google maps URL which would, in tum, open the google maps app and display the pinpoint location.

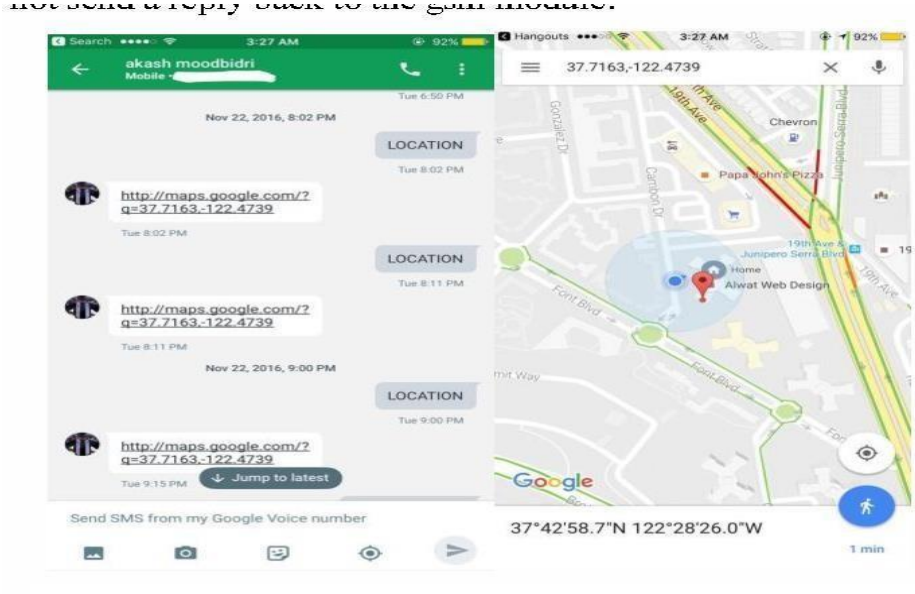

Fig 4.1. Left: Cellphone SMS app for LOCATION sensor and
Right: Google maps with latitude and longitude coordinates displayed.

B.Temperature and UV sensor:

Similar to the GPS location sensor, the Temperature, and UV sensors were tested multiple times under different temperatures and higher intensities of sunlight. Both the sensors performed exceptionally well to the test performed. The response time to receive a response back to the keywords "TEMPERATURE" and "UV" was under a minute.

Fig 4.2. SMS app screen for UV and Temperature sensor

C. SOS Light and Distress Alarm Buzzer:

The light and buzzer differ from the above sensors in the SMS trigger mechanism. Upon sending an SMS with either "SOS" or "BUZZ," this would trigger the light and buzzer to perform an output function instead of providing measurements back to the user's cellphone such as in the scenario of the other sensors.

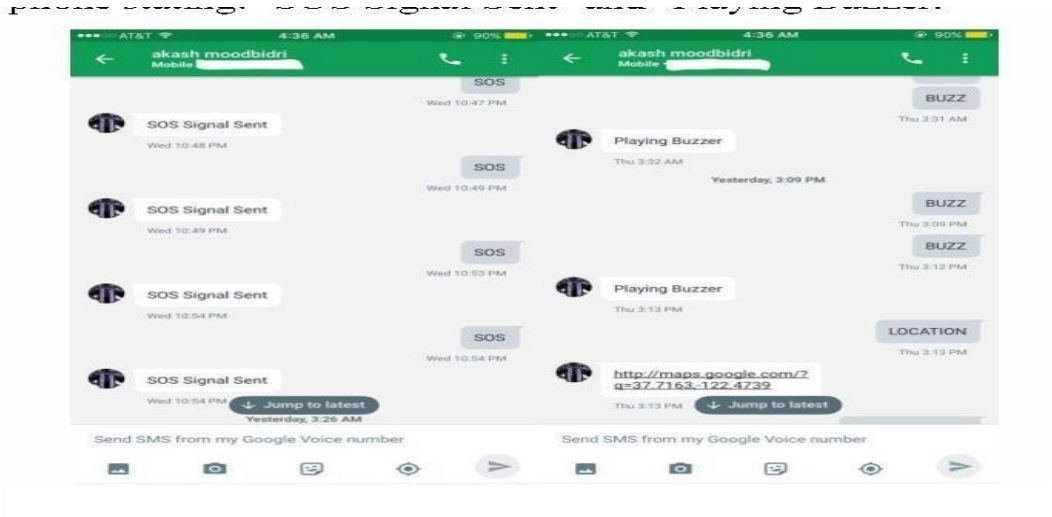

Fig 4.3. SMS app screen for Left: SOS Light and Right: Distress alarm buzzer.

4.1 Conclusion:

The child safety wearable device can act as a smart device. It provides parents with the real-time location, surrounding temperature, SOS light along with Distress alarm buzzer for their child's surroundings and the ability to locate their child or alert bystanders in acting to rescue or comfort the child. The smart child safety wearable can be enhanced much more in the future by using highly compact Arduino modules such as the Lily Pad Arduino which can be sewed into fabrics. Also, a more power efficient model will have to be created which will be capable of holding the battery for a longer time. This paper gives the result for the parent in two different ways.The first one is they get an alert message (SMS) for the registered phone number. The next one is they receive an graphical representation which shows the Latitude ,Longitude, MEMS Sensor and Vibration sensor of the child's activities through "Thing Speak". From these notification the parents can find their child in critical state. By this device we can avoid violence against children. This is one step to reduce rape, violence, theft etc. Firstly, various systems and devices available are defined. Basic child safety device comprises of a GPS, GSM, Arduino or any other Microcontroller, Panic button and the sensors to keep the track of child's movement, position, temperature etc. Design of the child wearable device is key factor for making the child wear the device happily. There are some important things to be considered like the limited range of devices, wearable or not, Battery life and the cost.

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