11th International Conference on Recent Development in Engineering Science, Humanities and Management
Nutan Maharashtra Institute of Engineering & Technology, Talegaon Dabhade, Pune ESHM-18
24th-25th March 2018 www.conferenceworld.in ISBN : 978-93-87793-14-9

# Child Safty and Health monitoring system

**Ms.Nimbalkar Manali[1], Mr.Dixit S.B.[2]**

[1]*PG Student from Department of Electronics and Telecommunication S.V.P.M COE, Malegaon,*

[2]*Associate Professor from Department of Electronics and Telecommunication S.V.P.M COE,Malegaon,*

**ABSTRACT**

*This paper discusses the concept of a smart wearable device for little children. The major advantage of this wearable over another wearable is that it can be used in any cellphone and doesn't necessarily require an expensive smartphone. Thepurpose of this device is to help parents locate their children with ease and also give the information about child health like child temperature; heart beat rate blood pressure, dehydration. At the moment there are many wearable's in the market which help track the daily activity of children and also help find the child using Wi-Fi and Bluetooth services present on the device. But Wi-Fi and Bluetooth appear to be an unreliable medium of communication between the parent and child. Therefore, the focus of this paper is to have an SMS text enabled communication medium between the child's wearable and the parent as theenvironment for GSM mobile communication is almost present everywhere. The parent can send a text with specific keywords such as "LOCATION" "TEMPERATURE" "SOS" "BUZZ",''SWT'',''HBT'' etc., the wearable device will reply back with a text containing the real time accurate location of the child and send location image by using the camera which is a capturing the image,which upon tapping will provide directions to the child's location on Google maps app and will also provide the surrounding temperature so that the parents can keep track if the temperature is not suitable for the child. and we always need to have a secondary measure at hand. The secondary measure used in this project is 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. The secondary measure implemented was using a bright SOS Light and distress alarm buzzer present on the wearable device which when activated by the parents via SMS text should display the SOS signal brightly and sound an alarm which a bystander can easily spot as a sign of distress. Hence this paper aims at providing parents with a sense of security for their child in today's time and also alerting about child health when they are out of station by using sensors*

***Keywords-loT, Children, Safety, Wearable***

## I. INTRODUCTION

The Internet of Things System (loT) [1] refers to the set of devices and systems that stay interconnected with real-world sensors and actuators to the Internet. loT includes many different systems like smart cars, wearable devices [2] and even human implanted devices, home automation systems [3] and lighting controls; smartphones which are increasingly being used to measure the world around them. Similarly, wireless sensor networks [4] that measure weather, flood defenses, tides and more. There are two key aspects to the loT: the devices

themselves and the server-side architecture that supports them [5]. The motivation for this wearable comes from the increasing need for safety and health monitoring for little children in current times as there could be scenarios of the child getting lost in the major crowded areas as well as there is need for any health problem take place when they are out of stations. 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 and health monitoring until reunited with the parents. Most of the wearable's available today are focused on providing the location, activity, etc. of the child to the parents via Wi-Fi [8] and Bluetooth [9]. But Wi- Fi and Bluetooth seem a very unreliable source to transfer information. 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. The platform on which this project will be running on is the Raspberry pi [10] single board computer based with wireless LAN and Bluetooth connectivity, and the functions of sending and receiving SMS, calls and connecting to the internet which is provided by the GSM shield using the GSM network [11]. Also, additional modules employed which will provide the current location and image of the child to the parents via SMS. The second measure added is SOS Light indicator that will be programmed with Raspberry pi board to display the SOS signal using Morse code. The different modules stay enclosed in a custom designed 3D printed case [12]. In the scenario, a lost child can be located by the parent could send an SMS to the wearable device which would activate the SOS lightfeature 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. Additionally, the wearable comes equipped with a distress alarm buzzer which sets to active by sending the SMSkeyword "BUZZ" to the wearable. Hence the buzzer is loud andcan be heard by the parent from very considerable distance. Also,the parents via SMS can receive accurate coordinates of thechild, which can them locate the child with pinpointaccuracy and camera capture the image of exact location of child and send to the parent viaSMS when parent sending the SMS" SNAPSHOT" to the wearable for location image. Additionally, the wearable comes equipped with a health monitoring unit which is a give the information about child body temperature, dehydrationlevel, heart beat rate of child and blood pressure Some of the existing work done on these similar linesare for example the low-cost, lightweight Wristband Vital [2]which senses and reports hazardous surroundings for peoplewho need immediate assistance such as children and seniors. Itis based on a multi-sensor Raspberry pi micro-system and a lowpowerBluetooth 4.1 module. The Vital band samples data frommultiple sensors and reports to a base station, such as theguardian's phone or the emergency services. It has an estimatedbattery life of 100 hours. The major drawback for the vital bandis that it uses Bluetooth as the mode of communication betweenchild and the parent. Since the distance between the two in somecases could be substantial and the Bluetooth just won't be ableto establish a close link between the two. Some more of thesimilar wearable devices are the Mimo, Sprouting, andleOIN iSwingband having their several drawbacks. Therefore, thewearable device proposed will be communicating with theparent via SMS which would ensure that there is a securecommunication link. Also, customization of the wearable ispossible as per our needs by reprogramming the Raspberry pisystem.

## II. SYSTEM DESIGN AND ARCHITECTURE

This section discusses the architecture and the designmethodologies chosen for the development of the Child Safety and health monitoring wearable device.

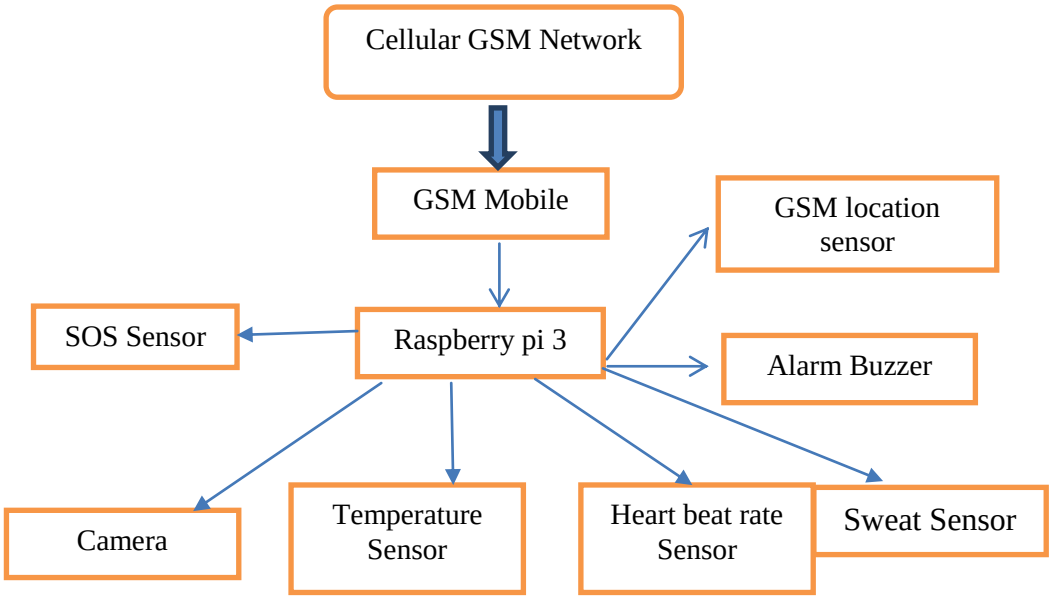


Fig 1. System overview of the wearable device.

**2.1.System Overview**

A raspberry Pi controls the systemarchitecture of the wearable with an allows for power (+3 V) and ground connectionsas well as providing access to TX, RX, and reset pins of theATMega328p. The Fig illustrates the architecture of the childsafety and health monitoring wearable device, which depicts the various technologiesand technological standards used. The system architecture of thewearable is based and controlled by an AT - mega328pmicrocontroller with an Raspberry Pi Board. The Raspberry pi-3 collects various types of data from the different modulesinterfaced to it, such as the GPS module upon being triggered bythe Raspberry pi GSM shield. The GSM shield is used as an interfaceto send the data received by the Raspberry pi via SMS or MMS to a smartphone over GSM/GPRS. The GSM shield functionsas a trigger for the Raspberry pi to request data from its variousmodules. If an SMS text with distinct characters is sent torequest the current location or GPS coordinates is sent to theRaspberry pi GSM shield via the user's smartphone, then the GSM shield triggers the Raspberry pi to request the current GPScoordinates. It alsosupports TCPIUDP and HTTP protocols through a GPRSconnection. Once the Raspberry pi has received at thecoordinate intonation, it will process this intonation andtransfer it over to the GSM shield, which then via SMS sendsthe coordinates to the user's smartphone. The user can just tapon the coordinates which will open up the default GPSapplication installed on the phone and will show the user thedistance between the child and the user.

**2.2.Wearable IotDevice**

The wearable device, for now, is not built on a SoC model,rather has been proposed using larger components and can laterbuild on the SoC platform once put into manufacture. Thewearable loT device tasked with acquiring various data fromthe all the different modules connected. It comprises of Raspberry pi based on the ATmega328P microcontroller. It receivesthe data from its various physically connected modules,anatomizes this data and refines the data in a more userunderstandable format to the different available user interfaces.The user, therefore, can conveniently view the informationon theircellphone. The physical characteristics of thewearable device are proposed to be as a wrist watch whichremains placed around the wrist of the child during times whenthe child is not being accompanied by an adult/parent. For themoment the design is not made compact, since the main focusnow has been to show that this concept of smart wearables wouldbe highly impactful for the safety of children. The wearablesystem runs on a battery with an output voltage of 5V. In orderto maximize power consumption, the wearable device has beenprogrammed to provide G P S and image information onlyupon request by SMS text via GSM shield.Fig 2. Proposed wearable loT Device.1) GPS Location SensorFor determining the real-time location of the child ParallaxPMB-648 GPS module has been used which communicates withthe Raspberry pi through a 4800 bps TTL-level interface. Once the SMS trigger text "LOCATION" is sent from the cell phone of the user, this text is received by the Raspberry pi boardGSM Shield which in turn triggers the Raspberry pi to execute the GPS code to fetch the current, accurate location of the GPS module. The location output received from the GPSmodule is in the n SMS text is received which contains none of the pre-programmed keywords, then the Raspberry pi GSM shield automatically deletes the text message and does not reply back the user the with any location details. Once the SMS trigger text "LOCATION" is sent from thesmartphone of the user, this text is received by the Raspberry pi GSM Shield which in turn triggers Raspberry pi to execute the GPS code to fetch the current, accurate location of the GPSmodule.

Hence the user can just directly click on this received Google maps hyperlink which will automatically redirect the user to the Google Maps app on the smartphone and show the pinpointlocation of the child. This SMS can be received directly on the default SMS app or via Android app on the user's smartphone. 2) Temperature Sensor In order to measure the temperature of the surroundings of the child, a seed studio grove temperature sensor was used. The sensor module is equipped with a thermistor for measuring the ambient temperature and the fluctuations with high accuracy. The observable temperature detectability for this sensor ranges from -40°C to -125°C and the precise accuracy for this device range from + 1.5°C to -1.5°C. The temperature is connected to the Raspberry pi and GSM shield using a Grove base shield upon receiving the proper SMSkeyword TEMPERATURE" by the user's smartphone.3) Heartbeat rate SensorIn order to measure theheart beat rate of child. a highly sensitive sensor.4) Sweat Sensor in order to detect the sweat of child body for detection of dehydration level5) SOS LightAnother theory that this paper focusses on is thatbystanders are the fast mode of help for a missing child. Thepurpose of the SOS light is to be able to alert the people nearbythat the child might be in distress since the light will be flashingthe universal SOS light symbol which many people nowadaysknow for to be a sign for help. This can be activated by the parentitself by sending an SMS text with the keyword "SOS" to thechild's wearable which will activate the SOS light flashing. TheSOS light works on the principal of Morse code in which "S"stands for three short dots and the "0" stands for three longdashes. Since a very long

time, the SOS signal has beenuniversally known for being the sign of distress and help. TheSOS signal is referred to by all security personals, who if findthe child to be missing can act and help locate the parents withsurplus resources present at their disposal. The SOS Light isconnected to the pin 13 of the base shield.6) Distress Alarm BuzzerIn the scenario, if a child is separated from his/her parents.The parent can locate their child by sounding a very loudalarm on the wearable. To achieve this, grove seed studiobuzzer was used, which has a piezoelectric module which isresponsible for emitting a strong tone upon the output beingset to HIGH. The grove buzzer module is activated uponsending an SMS text with the keyword "BUZZ" from a cellphone. Also, this buzzer works similar to the SOS led byalerting the people nearby with the distressed tone that thechild might be lost and is in need of assistance. 7) A camera is used for capturing cleared image of location

**2.3 GPS Location Sensor**

Upon testing the wearable device multiple times with repeatedSMS texts. The GPS location sensor was able to respond backwith precise latitude and longitude coordinates of the wearabledevice to the user's cellphone, which then the user would clickon the received Google maps URL which would, in tum, openthe google maps app and display the pinpoint location. In all thescenarios the GPS module was tested, it would respond back tothe user's cellphone within a minute. The GPS turned out to beso precise with the location that it performed even better than the GPS on an expensive smartphone. As shown in the imagebelow, the GPS module (red bubble) was able to show thecurrent location of the wearable with pinpoint accuracy and alsoshow exactly at which side of the building it is present. Whereasfor the smartphone (blue dot) is showing the wearable to bepresent on the street, which is marginally off from the exactlocation. This marginal miss match in the pin-point location ofthe wearable can tum out to be fatal in a real-life scenario, wherethe parent may be miss lead to the wrong location of the child.Therefore, the Parallax PMB-648 GPS module proves to besuccessful in providing the precise location with high accuracyand with a good response time. The only drawback that could bestated was, the GSM module could not interpret multiple validkeywords sent in a single message. For example, SMS stringsent: LOCATION, TEMPERATURE, BUZZ SOS; it wouldnot send a reply back to the gsm module.Fig 6. Left: Cellphone SMS app for LOCATION sensor andRight: Google maps with latitude and longitude coordinatesdisplayed.

**2.4. Temperature, Heart beat rate sensor**:

Similar to the GPS location sensor, the Temperature, and Heart beat ratesensors were tested multiple times under different temperaturesand higher intensities of sunlight. Both the sensors performedexceptionally well to the test performed. The response time toreceive a response back to the keywords "TEMPERATURE"and "HBT" was under a minute. Also, measured under different intensities of sunlight.

**2.5SOS Light and Distress Alarm Buzzer**:

The light and buzzer differ from the above sensors in the SMStrigger mechanism. Upon sending an SMS with either "SOS" or"BUZZ," this would trigger the light and buzzer to performoutput function instead of providing measurements back to theuser's cellphone such as in the scenario of the other sensors.Upon receiving the correct keywords, the SOS light and AlarmBuzzer would first perform the particular task of flashing theSOS light and sounding a distress alarm, which can take a littlelonger than their sensor counterparts. After completion of theirrespective functions, the response is sent back to the user' cell phone stating: "SOS Signal Sent" and "Playing Buzzer

## III. CONCLUSION

The child safety wearable device is capable of acting as asmart loT device. It provides parents with the real-timelocation, surrounding temperature, Heartbeat, dehydration level index andSOS light along with Distress alarm buzzer for their child'ssurroundings and the ability to locate their child or alertbystanders in acting to rescue or comfort the child. The smartchild safety and health monitoring wearable can be enhanced much more in the futureby using highly compact A Raspberry pi module. Also, a more powerefficient model will have to be created which will be capableof holding the battery for a longer time.

## REFERENCES

[1] B. Dorsemaine, 1. P. Gaulier, 1. P. Wary, N. Kheir and P. Urien, "Internet of Things: A Definition and Taxonomy," NextGeneration Mobile Applications, Services and Technologies,
2015 9th International Conference on, Cambridge, 2015, pp. 72-77.

[2] H. Moustafa, H. Kenn, K. Sayrafian, W. Scanlon and Y. Zhang, "Mobile wearable communications [Guest Editorial]," inIEEE Wireless Communications, vol. 22, no. 1, pp. lO-l1, February2015.

[3] S. Nasrin and P. 1. Radcliffe, "Novel protocol enables DIYhome automation," Telecommunication Networks andApplications Conference (ATNAC), 2014 Australasian, Southbank, VIC, 2014, pp. 212-216.

[4] F. A. Silva, "Industrial Wireless Sensor Networks: Applications, Protocols, and Standards [Book News]," in IEEEIndustrial Electronics Magazine, vol. 8, no. 4, pp. 67-68, Dec.2014.

[5] Jun Zheng; Simplot-Ryl, D.; Bisdikian, c.; Mouftah, H.T.,"The internet of things [Guest Editorial]," in CommunicationsMagazine, IEEE, vo1.49, no. ll, pp.30-31, November 2011 doi:
10.1109/MCOM.2011.6069706

[6] K. Braam, Tsung-Ching Huang, Chin-Hui Chen, E. Montgomery, S. Vo and R. Beausoleil, "Wristband Vital: Awearable multi-sensor microsystem for real-time assistance via
low-power Bluetooth link," Internet of Things (WF-IoT), 2015IEEE 2nd World Forwn on, Milan, 2015, pp. 87-9l. doi:10. l109/WF-IoT.2015.7389032

[7] "Digital parenting: The best wearables and new smart babymonitors. The latest smart baby monitors and connected tech foryour peace of mind,'Tech. Rep., 2015. [Online]. Available:
http://www.wareable.com/parenting/the-best -wearab lesbabies-smart-baby-monitors.

[8] "Wi-Fi and WiMAX - break through in wireless accesstechnologies," Wireless, Mobile and Multimedia Networks,2008. lET International Conference on, Beijing, 2008, pp. 141-145.

[9] P. Bhagwat, "Bluetooth: technology for short-range wireless apps," in IEEE Internet Computing, vol. 5, no. 3, pp. 96-103, May/Jun 200l.[lO] Y. A. Badamasi, "The working Principle of an Arduino,"Electronics, Computer and Computation (ICECCO), 2014 11thInternational Conference on, Abuja, 2014, pp. 1-4.[11] N. N. Prince, "Design and implementation ofmicrocontroller based short message service control system,"Internet Technology and Secured Transactions (ICITST), 20138th International Conference for, London, 2013, pp. 494-499.

[12] A. Anastasiou, C. Tsirmpas, A. Rompas, K. Giokas and D. Koutsouris, "3D printing: Basic concepts mathematics andtechnologies," Bioinformatics and Bioengineering (BIBE), 2013

IEEE 13th International Conference on, Chania, 2013, pp. 1-4.

[13] Akash Moodbidri San Francisco State University CA 94132 “Child Safety Wearable Device”