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IOT Based Smart Safety Wearable for Small Fry and Alzheimer's Patients

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Abstract: *This paper discusses the concept of a smart wearable device for little children/Alzheimer's. The major advantage of this wearable over other wearable is that it can be used in any cellphone and doesn't necessarily require an expensive smartphone and not a very tech savvy individual to operate. The purpose of this device is to help parents locate their children with ease. At the moment there are many wearables 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/Alzheimer's. Therefore, the focus of this paper is to have an SMS text enabled communication medium between the child's wearable and the parent as the environment for GSM mobile communication is almost present everywhere. The parent can send a specific keywords such as "LOCATION" "TEMPERA TURE" "UV" "SOS" "BUZZ", etc., the wearable device will reply back with a text containing the real time accurate location of the child /Alzheimer's 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 if the temperature or UV radiation is not suitable for the child/Alzheimer's. The prime motivation behind this paper is that we know how important technology is in our lives but it can sometimes can't be trusted, 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 microphone we can get a surrounding voice. Hence this paper aims at providing parents/ guardians with a sense of security for their child/Alzheimer's in today's time.*

Keywords: Internet of Things (IoT), Wearable Kit, Microphone, GPS, Moisture sensor, Microcontroller, GSM, Safety

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 for little children in current times as there could be scenarios of the child getting lost in the major crowded areas. This paper focusses 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 wearables 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

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platform on which this project will be running on is the Arduino [10] 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 [11]. 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 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 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. 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. Some of the existing work done on these similar lines are for example the low-cost, lightweight Wristband Vital [2] 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 micro-system and a lowpower Bluetooth 4.1 module. The Vital band samples data from multiple sensors and reports to a base station, such as the guardian's phone or the emergency services. It has an estimated battery life of 100 hours. The major drawback for the Vital band is that it uses Bluetooth as the mode of communication between child and the parent. Since the distance between the two in some cases could be substantial and the Bluetooth just won't be able to establish a close link between the two. Some more of the similar wearable devices are the Mimo, Sproutling, and iSwingband having their several drawbacks. Therefore, the wearable device proposed will be communicating with the parent via SMS which would ensure that there is a secure communication link. Also, customization of the wearable is possible as per our needs by reprogramming the Arduino system.

II. RELATED WORKS

A. Embedded IEEE Project Child Safety Wearable device: The concentration of this paper is to have an SMS content empowered correspondence medium between the children wearable and the parent as nature for GSM portable that correspondence is practically present all over the place. The parent can send a content with particular catchphrases, for example: area, temperature, uv, sos, buzz and wearable gadgets will answer back with a content containing the continuous exact area of the youngster which after will gives applications.

B. Child safety wearable device The child safety device is capable of acting as a capable IOT device it provides parents with the real time location, surrounding temperature, UV radiation index and SOS light along with distress alarm buzzer for their child’s surroundings and the ability to locate their child or alert by standers in acting to rescue or comfort the child. The smart child safety wearable can be enhanced much more in 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 for holding the battery holding for longer time.

C. Women safety device: Suraksha it describes that the device can be actuated by three ways namely, voice, switch and shock. The device when not in use locked so that the unnecessary signals are not sent. For unlocking it, a simple voice command is sufficient when the device is thrown with the force, using force sensor it will start functioning that is it will send the location to the police and distress message to the registered mobile number. The working of the device connected with the jewellery which sends a message to the person when the abnormal force is applied which is like a button, this records a voice message. This device is embedded with the jewellery. But accessing the button in danger and sending alert message through recording audio are the main drawback.

D. Women safety device: Safety and security in public transportation based on public perception in developing countries poses higher risk of safety and security since there happen to be more passengers in one car .the problem becomes worse in developing countries, because of the lack of suitable and integrated approaches. The aim of this research is to explore the perception of safety problems of those parties involved in the operation of public transportation. This perception is used as a base to develop and improvement agenda for the context of developing countries. The research employs a questionnaire survey to collect the perception data.

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III. MATERIALS AND METHODS

3.1 Methodology

This section discusses the architecture and the design methodologies chosen for the development of the Child Safety wearable device.

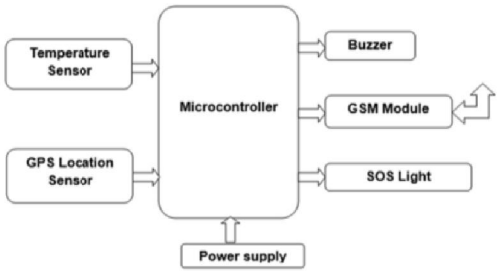

Fig 1. Existing Working Model

An A Tmega328p microcontroller controls the system architecture of the wearable with an Arduino Uno boot- loader. A 5 pin header allows for power (+3 V) and ground connections as well as providing access to TX, RX, and reset pins of the ATMega328p. The Fig illustrates the architecture of the child safety wearable device, which depicts the various technologies and technological standards used. The system architecture of the wearable is based and controlled by an AT - mega328p microcontroller with an Arduino Uno bootloader. The Arduino Uno collects various types of data from the different modules interfaced to it, such as the GPS module upon being triggered by the Arduino GSM shield. The GSM shield is used as an interface to send the data received by the Arduino Uno via SMS or MMS to a smartphone over GSMlGPRS. The GSM shield functions as a trigger for the Arduino Uno to request data from its various modules. If an SMS text with distinct characters is sent to request the current location or GPS coordinates is sent to the Arduino GSM shield via the user's smartphone, then the GSM shield triggers the Arduino Uno to request the current GPS coordinates. The GSM shield uses digital pins 2 and 3 for the software serial communication with the MIO. Pin2 is connected to the MlO's TX pin and pin 3 to its RX pin. The Ml 0 is a Quadband GSM/GPRS modem that works at GSM850Mhz, GSM900Mhz, DCS1800Mhz, and PCS1900Mhz. It also supports TCPIUDP and HTTP protocols through a GPRS connection. Once the Arduino Uno has received at the coordinate infonnation, it will process this infonnation and transfer it over to the GSM shield, which then via SMS sends 439 the coordinates to the user's smartphone. The user can just tap on the coordinates which will open up the default GPS application installed on the phone and will show the user the distance between the child and the user.

3.2 Internet of Things

Internet of Things (IoT) is the concept of machine-to-machine communication without any human intervention. This communication will take place through the internet. It is one of the fastest growing platforms used to connect wide embedded applications. The embedded models together with internet and cloud form the Internet of Things. In our Smart Grocery Management System the data from the ultrasonic sensor will reach the cloud platform through the internet. Then this data can be retrieved from the cloud and visualized. This setup is the so called Internet of Things.

3.3 Raspberry Pi 4 Module B

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It’s capable of doing everything you’d expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games. What’s more, the Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras. We want to see the Raspberry Pi being used by kids all over the world to learn to program and understand how computers work.A SD card inserted into the slot on the board acts as the hard drive for theRaspberry Pi. It is powered by USB and the video output can be hooked up to atraditional RCA TV set, a more modern monitor, or even a TV using the HDMIport. This gives you all of the basic abilities of a normal computer.

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It also has an extremely low power consumption of about 3 watts. To put this power consumption in perspective, you could run over 30 Raspberry Pi's in place of a standard light bulb!.

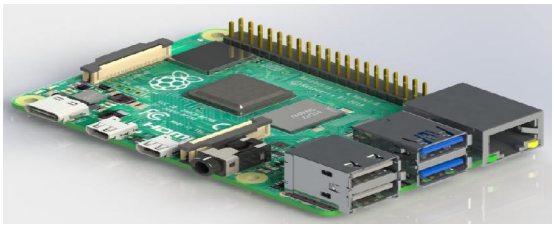

Fig 2: Raspberry Pi 4 Module B

3.4 GPS Location Sensor

GPS stands for Global Positioning System is a satellite based navigation system. It provides time and location based information to a GPS receiver, located anywhere on or near earth surface. In this project we are going to interface a GPS module with NodeMCU. A simple local web server is created using NodeMCU and the location details are updated in that server webpage. GPS works in all whether conditions provided 4 there is an unobstructed line of sight communication with 4 or more GPS satellites. The module will transmit data in multiple strings at 9600 Baud Rate. GPS module sends the Real time tracking position data in NMEA format. When we; use GPS module for tracking any location we only need coordinates and we can find this in $GPGGA string. Only $GPGGA (Global Positioning System Fix Data) string is mostly used in programs and other string are ignored. GPS module takes some time to capture location details once it is powered on. NodeMCU starts web server and waits for a client to get connected to the web server. Once client is connected to the web server, NodeMCU sends location details to connected client.

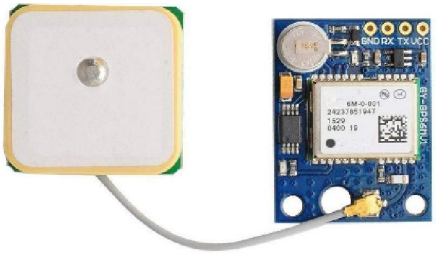

Fig 3: GPS Neo 6M Model

3.5 GSM Module

GSM stands for Global System for Mobile Communication. The idea of GSM was developed at Bell Laboratories in 1970. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. GSM makes use of narrowband Time Division Multiple Access (TDMA) technique for transmitting signals. A GSM digitizes and reduces the data then send it down through a channel with two different streams of client data each in its own particular time slot. The digital system has an ability to carry 64kbps to 120Mbps of data rates. There are various cell sizes in a GSM system such as macro, micro, pico and umbrella cells.

Fig 4: GSM module

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3.6 Moisture Sensor

"**smart**" diaper embedded with a moisture sensor that can alert a caregiver when a diaper is wet. This device allows me to configure at the moisture level in the diaper. At it reach saturtion point it will notify the diaper is wet. Every 10sec it will notified. when diaper is removed it will stop notifying.

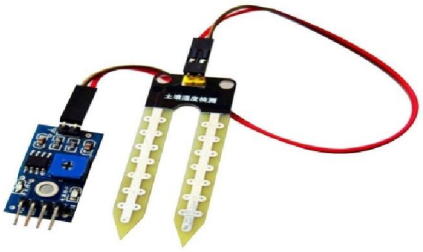

Fig 5: Moisture Sensor

3.7 Microphone

A microphone is an input device that was developed by Emile Berliner in 1877. It is used to convert sound waves into electric waves or input the audio into computers. It captures audio by converting sound waves into an electrical signal, which may be a digital or analog signal. This process can be implemented by a computer or other digital audio devices.

3.8 User interface

The result can be viewed with a help of user interfaces like Andriod Applications in Mobile Phones, Web pages in computers, Laptops, and Tablets etc.

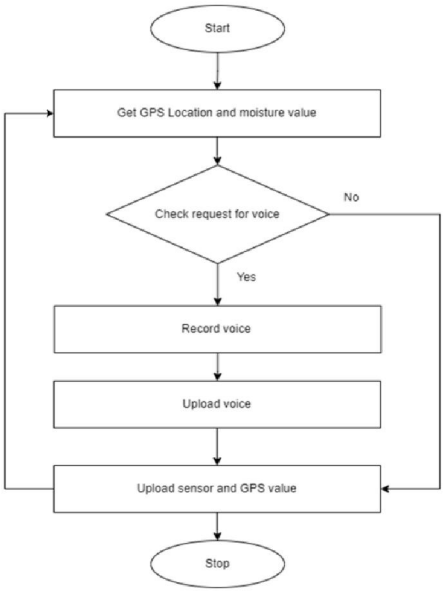

Fig. 6: Functional Flow Diagram.

The control of the Positioning System consists of different tracking stations that are located across the globe. These monitoring stations help in tracking signals from the GPS satellites that are continuously orbiting the earth. Space vehicles transmit microwave carrier signals. The users of Global Positioning Systems have GPS receivers that convert these satellite signals so that one can estimate the actual position, velocity and time.

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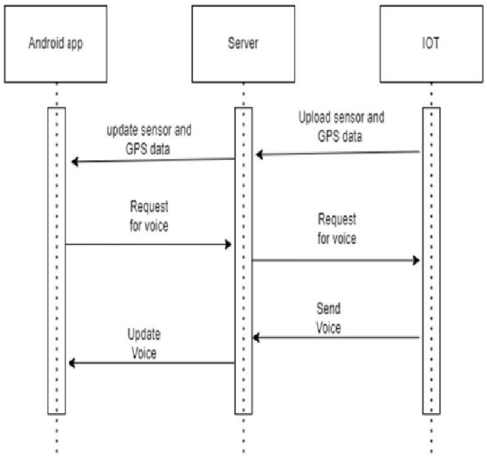

Fig .7: Sequence Diagram Of The Wearable Device Kit.

A GPS tracking system uses the Global Navigation Satellite System (GNSS) network. This network incorporates a range of satellites that use microwave signals that are transmitted to GPS devices to give information on location. The app we use in our Mobile get the required data from the server and can perform all the required operations like voice command, location tracking ,moisture detection.

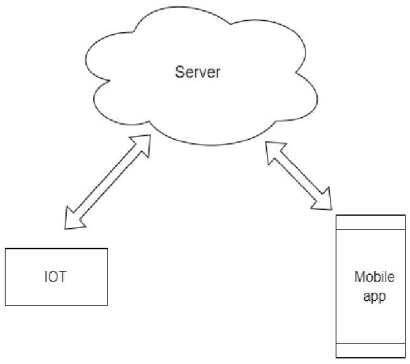

Fig. 8: Activity Diagram of the Wearable Device Kit.

IV. RESULTS AND DISCUSSION

Smart wearable device is embedded in any of the device like a watch, it will track the location , and also get a surrounding voice when parents does not identify by the location .

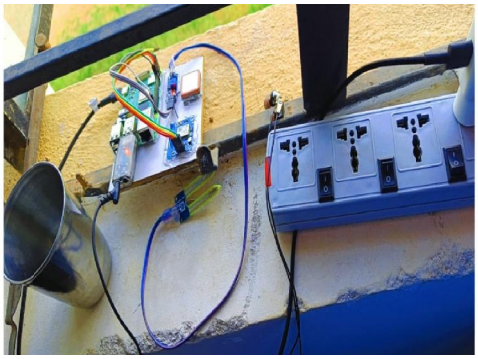

Fig. 9: Implemented Module

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In Android Application , A wearable device it send a live location of the childrens or Alzheimer's Patients through a GPS module ,When a parents or guardians requested a voice clicking on a download audio it will send a surrounding voice . Adding additional future is that through a andriod app get a notification of the diaper condition wherether it is dry or wet. When the diaper is wet every 10sec we will get a notification.

Fig.10: Android App.

V. CONCLUSION

The child safety wearable device is capable of acting as a smart loT device. It provides parents with the real-time location, surrounding voice, UV radiation index and 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 LilyPad 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.

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