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Smart Wearable Device Using Arduino GSM Shield

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ABSTRACT: To enhance the convenience of life, connecting most sensors with microcontrollers can be a good solution. Hence, in this research, the IOT base Smart Wearable Device by using AT - mega328p microcontroller with an Arduino Uno bootloader and GPS. There are many android applications for the safety of people but they're not as much as efficient. So in order to solve this issue of people safety, we developed a prototype which is easy to use and which is effective to provide one of the main advantages of this project is we did not require any expensive smart Phone and more knowledge to operate. It will work on any cellular device including small CDMA phones, tablets, personal device assistant (PDA) s. The prime motto of this project is one can track others location moments even when they're not around them. The person can know the location and other environmental conditions around the victim by just sending a text message using keywords such as Location, Temperature, UV radiation, Buzzer alarm, SOS emergency. With this, the parent can get alerts from the device and they can keep track, if the temperature conditions are suitable for their children or not. Even in dark and crowdie areas, the people can locate others by just sending the text as SOS emergency or Buzzer alarm.

KEYWORDS: IoT, people, GPS, Arduino, cellular devices, Temperature, UV,Location,Buzzer,SOS.

I. INTRODUCTION

The Internet of Things (IoT) [1] is defined as the network of physical objects-devices, vehicles, buildings and other items-embedded with electronics, software, sensors and network connectivity that enables these objects to collect and exchange data. It also represents a general concept for the ability of network devices to sense and collect data from around the world, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. Now a day's Smartphones have a predominant role around the globe. With this emerging wireless technology we can predict the climatic conditions, flood flows and earthquake arriving. IoT mostly uses wireless sensor technology to control smart cars, wearable devices [2], smart home automation [3], and auto traffic signaling system and health monitoring system etc.These devices themselves and the server-side architecture that supports them [4]. This paper mainly focuses on' 'safety and activities of people and lost children can be located easily". Most of the wearable devices available in the market today are embedded with Bluetooth and Wi-Fi [5] to track the location of people and their moments. But these Bluetooth and Wi-Fi are an unreliable medium for far communications; therefore, we used GPS enabled communication for a reliable medium between people. The total project will run on an Arduino [6] Uno microcontroller based on the ATmega328p and the text messaging process i.e. sending and receiving of messages and connecting to the internet will work with the help of an Arduino GSM shield using GSM network [7]. With this help of the same GPS, we can track the location of the person. And secondly, the device is equipped with distress alarm buzzer which is used to make a loud noise so we can notice the people even when they are in a huge crowd. And in this wearable device we'll fix a Morse code programmed SOS emergency light on Arduino UNO board hence this will activate when the person sends a text message to the others person who wears this smart wearable device using a keyword such as SOS Signal, then the SOS emergency light will glow brightly in dark areas, so thus it makes the

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person very easy to find his presence. By sending the text as "LOCATION" we can track the location including exact coordinates where the other person presents. Many of existing projects done with this same concept but works with Bluetooth [8] or Wi-Fi technology hence the working efficiency will have confined to a fixed length of 100 meters' maximum. This GPS used a smart wearable device is mostly useful for children and senior people and youngsters also.

II. RELATED WORK

In [9]The authors created a wearable IOT device for the security and shielding of women, girl children. it is accomplished by the examination of physiological signs in concurrence with body gestures. The signs are analyzed and body temperature is measured by galvanic skin resistance. This work deals with body temperature and stress and skin resistance and relationship between them. By applying the records, activities persons' position is analyzed. The device makes an analysis of skin resistance and body temperature to analyze the situation of the person. According to the authors, the device will work only at one person that too only to recognize the body temperature. The system intends to a wireless technique in the form of embedded device namely Raspberry Pi for women that will serve the purpose of alerts and way of communicating with secure channels and it captures the image using an R-pi camera. [10]. authors use a camera to observe everything that happens to a woman or child but this requires more functioning and doesn't give the accurate result and maximum transferring of video to mentioned person.A wearable device, a wristband/watch, and the second a Smartphone application. The wearable device is built using GPS, ZigBee and GSM modules. On triggering this system, the GPS data is acquired by the GPS module and is encoded into a valid Google maps link and sent through text messages to enlisted family, friends and the authorities. Then the data is sent using ZigBee wireless communication protocol to alert other wearable wristband owners with the coverage range [11]. The authors used ZigBee wireless technology where this ZigBee technology works within a range similar to Bluetooth technology. Not useful for far communication. In [12] the authors proposed an article for the safety of women and children which the device is provided with a shock mechanism to produce a non-lethal electric shock. Hence it won't give a sign of missing or any information or the situations around her. But with smart wearable device works with Arduino GPS which was implemented by us can give every information to the mobile owners who want to know the conditions around the person who went out with or without having the permission of their family people or co-workers.

III.PROPOSED METHODOLOGY AND DISCUSSION

A) System Overview:

An Arduino UNO boot-loader is controlled by the ATmega328p microcontroller. A five pin header allows for power (+3 volts) andground connections as well as it provides access to reset pins of the ATmega328pand access to RX, TX. Various data will be collected by Arduino Uno from different modules and interfaced to it. The total architecture of the wearable is based and controlled by an AT-mega328p microcontroller with an Arduino Uno bootloader. The interfacing of GPS in being triggered by Arduino GSM shield and is Controlled by Arduino Uno. The GSM shield works as a trigger for the Arduino Uno to access data from its various modules. The sending and receiving of data in a text format to a Smartphone done by the Arduino Uno and uses GSM shield as an interface. Whenever a person sends a text message to get the current location of another person, then the. Arduino GSM shield triggers Arduino Uno to get access the GPS coordinates or the exact location of the other person. The two digital pins 2 and 3 in GSM shield used for the Software serial communication with the M10.The first digital pin2 is connected with M10's TX and the digital pin 3 is connected to its RX pin. The Ml0 is a Quad-band GSM/GPRS modem that supports UDP\TCP and HTTP protocols through a GPRS connection. It works with GSM850Mhz, GSM900Mz, DCS1800Mz, and PCS1900Mz.when the Arduino Uno receive the coordinate information then it will process it and transfer it to the GSM shield, then it sends the coordinate information to the user cellular device immediately. now the user will receive the coordinate information directly on his mobile and then, by tapping the coordinate information it will redirect to default GPS application built into the Smartphone.

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B) Smart IoT wearable Device:

The physical outlook of the device looks like a wristband. So it can tie around the wrist to any person especially for kids when the parents are not accompanied with them. Even the device not made compactly but the main focus is for the safety of people who're not around them. And this wristband is mainly used for the people who want to keep an eye on their beloved old aged people and little kids. This wearable device consumes very low power and has a battery with an output voltage of 5Volts.This wearable will collect all the information that is given by the connected modules in it. It has fixed an Arduino Uno based on the ATmega 328p microcontroller. It receives the information that is physically connected with its modules and makes the information more conveniently to the user who operates the wearable.

1) GPS Location Sensor:

In order to determine the location, we use Parallax PMB-648 GPS system which interacts with Arduino Uno through a 4800 bps TTL-level interface. The reading of data by Arduino is done with the establishment of three wired connections between Arduino Uno and the GPS module. The NAVSTAR (American Satellite Timing and Ranging Global Positioning System) GPS system provides the all the location information from the various satellites to the GPS module. It consumes very low power and has a compact size of 32x32mm.and it has 20 parallel satellite tracking channels for fast acquisition and reacquisition. The National Marine Electronics Association (NMEA) protocol will govern the output that is received by the GPS module. A TinyGPS library was added to the Arduino IDE interface the PMB-648 GPS module with Arduino to provide precise latitude and longitude. The Black wire i.e. GND (Ground) wire on the GPS module is connected to the GND(Ground) pin on the Arduino through jumper cables. Similarly, the red wire i.e. Vin on the PMB-648 is connected to 5v power pin on the Arduino through jumper cables. The yellow Wire (TXD) connected to the pin 6 on Arduino Uno is connected to with Breadboard using jumper cables. The pin 6on the Arduino Uno is a digital pin which can also be used for PWM (Pulse Width Modulation) applications. When the user sends a text from his cellular device as "LOCATION" the Arduino GSM shield will receive the text and it triggers the Arduino Uno to execute to GPS source code to get access the current exact location of the GPS module. When the Arduino GSM shield receives the text as" LOCATION" then the latitude and Longitude information will have stored in variables as "flat" and" floon".

If in any case the text received from the Arduino GSM shield is not matched with the pre-programmed keywords, then it will automatically delete those text messages and it will not reply back to the user.

The output string that received from the GPS module will in the format:

1.2205 16-Time Stamp 7.168.9-speed in knots
2. A-validity- A-ok, V-invalid 8.218.2-True course
3.6135.81-current Latitude 9.220318-Date Stamp
4. N-North/East 10.002.3-Variation
5.1005.32-current Longitude 11.S-West/South
6. S-South/west 12. *69-Checksum

Then the final result for latitude and longitude are stored in the following URL from:
http://maps.google,com/?q=<lat>,<lng>
For example: if the reading is received as
62.7569, -102.4875
Then the text will send as http://maps.google,com/?q=62.7569,-102.4875

Hence the user will receive a text as in the above format in his default inbox. By a tap on the URL link that he received and it will direct to Google maps automatically. The user must have the Google maps his smartphone.it won't work in normal CDMA devices because of not having of Google map feature.

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2) Distress Alarm Buzzer:

A panic alarm is an electronic device designed to assist in alerting somebody in emergency situations where a threat to persons or property exists. In this aspect at any time if a person is separated from their family. The family members can know their presence by hearing a loud siren-like voice produced by Distress alarm buzzer on the wearable device. thus in this Wearable device, we fix a groove seeed studio buzzer to alert people around the victim who's lost from their family. The grove seeed studio buzzer is fixed with a piezoelectric module which can make a very loud sound. This Distress Alarm buzzer is activated when it receives the text keyword as "Alert" from the user who wants to track others by just listening to the sound. This distress Alarm buzzer is connected to D4 digital port of the base shield.

3)SOS Emergency Light:

Another very important feature that this device has is SOS Emergency Light because bystanders are the first mode of help for a missing child. The main purpose of this SOS Emergency Light is to alert people nearby that the person might be in distress since the light will be flashing and the universal SOS light symbol which many people nowadays know for to be a sign for help. The device can start flashing when the parent sends a text as "SOS" to the wearable device. This SOS Light will work based on the principle of Morse code. In SOS the "S" stands for three short dots and "O" stands for three long dashes. We've already known that this SOS is a universal distress help sign. This SOS Emergency Light is connected to 13 Pin of the Arduino GSM shield.

4)Temperature Sensor:

Basically, a temperature sensor is used to calculate the temperature in a certain area. so in order to calculate the temperature around a person in our wearable device, a seeed groove temperature sensor was used. it equipped with a thermistor to calculate the accurate temperature and fluctuations in temperature with high accuracy. The maximum and minimum temperature that this device can observe is -40o C to -125oC and the precise accuracy of this device range from +1.5oC to -1.5oC. The temperature sensor is connected to the Arduino Uno and GSM shield using a Grove base shield which has an eight digital ports ranging from D1 to D8, four analog ports ranging from AO to A3 and 4 I2C ports. Thus, the temperature sensor is connected to the A2 analog port of the base shield. The temperature value is stored in a string format like getTemp(a), here "a" is integer type. When the person sends a text as "TEMPERATURE" this getTemp(a) is called by GSM module.

5) UV Sensor:

as the UV radiation causes harm to the people this device comes with a UV rays' radiation alerting technique. In order to calculate the UV radiation around a person, this device is fixed with a seeed studio grove UV sensor. The UV Sensor is built on the GUVA-S12SD Sensor which is having a spectral range of 200nm-400nm.this UV sensor can identify a very accurate UV radiation by emitting its electrical signal around the person who wears this device.When a parent wants to know the UV radiation around his child which is not suitable for him then he can a send a text as "UV" to the wearable device to know the UV radiation rate. This UV sensor is connected to the A0 port of the base shield.

IV.EXPERIMENTAL RESULTS

C) SMS app Interface on Mobile:

SMS app interface is the overview of an environment on the mobile when we sending and receiving of text messages. The app interface shows the brief view of the working device.

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i). GPS Location Sensor:

after texting multiple times with repeated SMS texts. The GPS Location sensor was able to respond back with exact latitude and longitude coordinates of the wearable device to the user's cell phone, which then the user would click in the Google maps URL which would return, in turn, open on the Google maps app and display the pinpoint location. As shown in the figure below, the Red blinkindicates the current location of the wearable with an accurate and it shows it shows exactly at which side of the object it is present. Whereas the Blue blinkindicates the wearable to be present on the street, which is marginally off from the exact location. for all these accurate operations we use a parallax PMB-648 GPS module. Below figure depicts the working process of a GPS module.

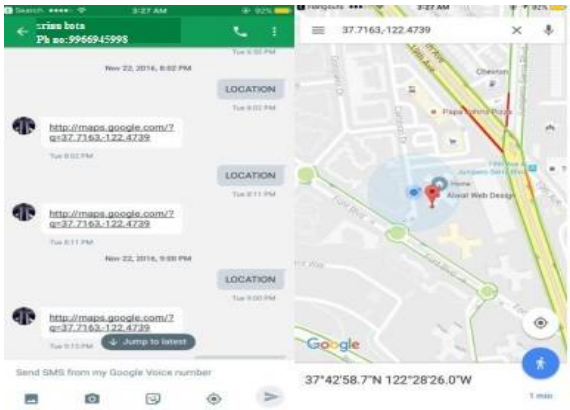

Fig 1: SMS app for Location sensor and Google maps with latitude and longitude coordinates displayed.

ii) Temperature, UVsensor and Distress Alarm and SOS Emergency light:

just similar to the GPS Location sensor, the temperature sensor, UV sensor, Distress Alarm buzzer and SOS emergency Light will work. The temperature and UV sensors will work on the base of sunlight and UV rays. For the accurate temperature we use a seeed groove temperature sensor used and for the accurate UV radiation, we used a seeed groove UV sensor. When the GSM module receives the text as either “TEMPERATURE” or “UV” the GSM Module response back to the users mobile with the recorded temperature or UV radiation. Similar to this the Distress Alarm Buzzer and SOS Emergency Light will work. The working mechanism of all these sensors shown below.

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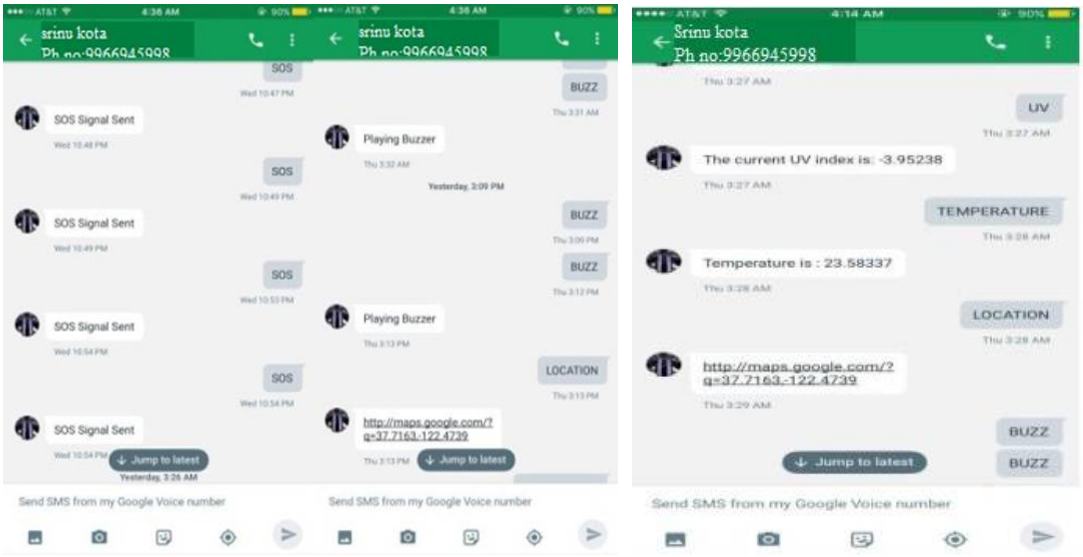

Fig:SMS app UI for Temperature
and UV sensorFig:SMS app UI for Distress Alarm & SOS Light

V. CONCLUSION

This Smart Wearable Device provides a real-time Accurate Location, Temperature, UV radiation information and Distress Alarm buzzer with SOS Emergency Light for the people surrounding and the ability to locate the person and alert the bystanders in acting to rescue the person. This Smart Wearable Device is fixed with most advanced sensors for the future use. And it consumes very low energy and works for a long time.

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