Pre-Fall Detection & Emergency Alert System for Kids & old Age with IoT-based Energy Efficient System

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Abstract— **As all we know we are living in the era of 4G technology where everyone using internet in their daily life. Now a days internet become our need , so as per our need most of the human beings are using Internet of Things based wearable devices for their different kind of application. In this paper basically we talk about the progress and demand of internet of things on current era with the application of pre fall detection. In this paper we proposed an system which is able to send alert when any person fall down similar it will also send an emergency alert whenever push button is pressed. This proposed device is working on 180mah small battery.**

Keywords— IoT, Pre Fall, NRF24L01, BEL, Atmel.

I. INTRODUCTION

Web of Things (loT) is enlargement of current web to give correspondence, affiliation, and internetworking between various contraptions or physical things generally called "Things". IoT term addresses a general thought for the limit of framework devices to distinguish and assemble data from our general environment, and thereafter share that data over the Internet where it might be taken care of and utilized for various intriguing purposes. The IoT is included adroit machines interfacing and talking with various machines, articles, conditions and establishments. By and by multi day's every individual are related with each other using heaps of correspondence way. Where most understood correspondence way is web so in another word we can say web which interface social orders [9]. The Internet of things can be described as interfacing the various sorts of articles like propelled cells, PC and Tablets to web, which gains very novel sort of correspondence among things and people and moreover between things [2]. With the introduction of IoTs, the inventive work of home robotization are getting the opportunity to be popular in the progressing days. An extensive parcel of the devices are controlled and watched for helps the person. Likewise extraordinary remote advances help in interfacing from remote spots to upgrade the knowledge of home condition. An impelled arrangement of IoT is being encircled when an individual need connecting with various things. IoTs advancement is used to come in with innovative idea and unfathomable improvement for astute homes to upgrade the desires for regular solaces of life.

II. LITERATURE REVIEW

Here we present the previous existing work in the field of internet of things & Pre fall detection based devices:

What the Internet of Things (IoT) needs to become a reality ,2013: In this paper author discusses the another period of processing innovation that many are calling the Internet of Things (IoT). Machine to machine, machine to system , machine to condition, the Internet of Everything, the Internet of Intelligent Things, insightful system call it what you need, yet it's going on, and its potential is tremendous. Author see the IoT as billions of shrewd, associated "things" (a kind of "all inclusive worldwide neural system" in the cloud) that will incorporate each part of our lives, and its establishment is the insight that inserted preparing gives. The IoT is contained savvy machines associating and speaking with different machines, articles, conditions and system s. Accordingly, enormous volumes of information are being created, and that information is being handled into valuable activities that can "order and control" things to make our lives a lot less demanding and more secure—and to decrease our effect on nature.

Research directions for the internet of things, 2014: In this paper author discusses the numerous specialized networks are vivaciously seeking after research themes that add to the Internet of Things (IoT). Today, as detecting, activation, correspondence, and control turn out to be perpetually advanced and universal, there is critical cover in these networks, in some cases from somewhat alternate points of view. More participation between networks is energized. To give a premise to examining open research issues in IoT, a dream for how IoT could change the world in the inaccessible future is first exhibited. At that point, eight key research subjects are counted and investigate issues inside those themes are talked about.

Internet of Things (IoT): A vision, architectural elements, and future directions,2013: In this paper author discusses the Ubiquitous detecting empowered by Wireless Sensor Network (WSN) innovations cuts crosswise over numerous zones of cutting edge living. This offers the capacity to quantify, deduce and comprehend ecological markers, from sensitive ecologies and common assets to urban conditions. This paper shows a cloud driven vision for overall usage of

Internet of Things. The key empowering advances and application spaces that are probably going to drive IoT investigate soon are talked about. A cloud execution utilizing Aneka, which depends on connection of private and open mists is displayed. We finish up our IoT vision by developing the requirement for intermingling of WSN, the Internet and circulated registering coordinated at mechanical research network.

The use of mobile devices with multi-tag technologies for an overall contextualized vineyard management, 2009: This paper depicts a Viticulture Service-Oriented System (VSOF) which pivots setting components or labels that are set in the field and which can be decoded by cell phones, for example, cell phones or PDAs. The labels are utilized to consequently relate a field area to the pertinent database tables or records and furthermore to get to relevant data or administrations. By indicating a cell phone a tag, the viticulturalist may download information, for example, climatic information or transfer data, for example, illness and bug rate basically, without giving directions or some other references, and without coming back to a focal office. This work is a piece of a push to actualize a vast scale disseminated agreeable system in the Douro Demarcated Region in Northeast Portugal, an area in which the exertion bodes well because of the amazingly factor geography and mesoclimates. The likelihood of trading contextualized data and getting to contextualized benefits in the field, utilizing understood gadgets, for example, mobile phones, may add to build the rate of selection of data innovation in viticulture, and add to increasingly effective and closer-to-the-crops rehearses.

Risk factors for falls among elderly persons living in the community, 1998: To study risk factors for falling, we conducted a one-year prospective investigation, using a sample of 336 persons at least 75 years of age who were living in the community. All subjects underwent detailed clinical evaluation, including standardized measures of mental status, strength, reflexes, balance, and gait; in addition, we inspected their homes for environmental hazards. Falls and their circumstances were identified during bimonthly telephone calls.

Challenges, issues and trends in fall detection systems, 2013: This work shows a broad writing audit of fall identification frameworks, including examinations among different sorts of studies. It means to fill in as a kind of perspective for the two clinicians and biomedical architects arranging or leading field examinations. Difficulties, issues and patterns in fall discovery have been distinguished after the inspecting work. The quantity of studies utilizing setting mindful systems is as yet expanding however there is another pattern towards the incorporation of fall recognition into cell phones just as the utilization of machine learning strategies in the discovery calculation. We have additionally recognized difficulties with respect to execution under genuine conditions, ease of use, and client acknowledgment just as issues identified with power utilization, constant activities, detecting restrictions, protection and record of genuine falls.

A survey on fall detection: principles and approaches, Neurocomputing , 2013: In this paper author discusses , Fall location is a noteworthy test in the general medicinal services area, particularly for the older, and solid reconnaissance is a need to moderate the impacts of falls. The innovation and items identified with fall location have dependably been in intense interest inside the security and the medicinal services ventures. A powerful fall discovery framework is required to give earnest help and to altogether lessen the therapeutic consideration costs related with falls. Here author give an extensive study of various frameworks for fall discovery and their fundamental calculations. Fall recognition approaches are partitioned into three fundamental classes: wearable gadget based, vibe gadget based and vision based. These methodologies are outlined and contrasted and one another and an end is inferred with a few exchanges on conceivable future work.

IoT-Based Fall Detection System with Energy Efficient Sensor Nodes, 2016: In this paper we examine vitality utilization of sensor hubs in an IoT-based fall discovery framework and present a plan of a redid sensor hub. What's more, we contrast the tweaked sensor hub and other sensor hubs, based on universally useful advancement sheets. The outcomes demonstrate that sensor hubs dependent on sensitive tweaked gadgets are more vitality proficient than the others dependent on broadly useful gadgets while thinking about indistinguishable determination of small scale controller and memory limit. Moreover, our modified sensor hub with vitality proficiency choices can work ceaselessly as long as 35 hours.

Energy efficient wearable sensor node for IoT-based fall detection systems, 2018: In this work, they center around vitality proficiency of a wearable sensor hub in an Internet-of-Things (IoT) based fall location framework. They actualizing the wearable gadget for IoT-based fall recognition frameworks as far as vitality proficiency and nature of administration. As per there results there wearable gadget can be utilized constantly for 76 h with a 1000 mAh li-particle battery.

As per the all previous work there is no any researcher who solve the most important and critical factors and that are:

Battery Life: Smartly utilize the power consumption & increase the battery life.

Form factor: This a serious problem as we know it's a wearable device but most of the design have the issue with its form factor

Cost: If we are talking about the IoT device so cost a big problem for any IoT device , so there is need of cost cutting which is not done by any previous researchers

These all are the research gap where we can focus and try to reduce those problems. As we know IoT is large area where lots of sectors are involve. If we are talking about the pre fall detection & alert device so there is lots of area where we can explore and improve those like Smart power Management system and increase the battery Life, Smartly utilize the component so the form factor will be small.

III. PROPOSED METHEDOLOGY

In this work we will design a system which is based on smart wearable concept using internet of things fundamental. Here we use ESP8266 Wi-Fi module for communication point of view. ESP8266 is working on HTTP protocol. For calculation

of angels and position we are using ADXL335. Our proposed design will work on sleep and wake up concept so for that we are using ATTINY 85 it's a 8 pin mcu with ultra low power consumption Our SMS API is Text local which is directly send by device itself. Here we are using followings equation and based on that we will decide the fall detection position:

$$\text{Angle: } \Theta = \arctan\left(\frac{\sqrt{y^2 + z^2}}{x}\right) * \frac{x}{180}$$

Hardware Components:
- Wi-Fi module (ESP8266)
- 3.3V Ultrasonic Sensor
- Red, Green LED
- ATTINY85

Here we are using Arduino as an IDE and we use ATTINY85 as a MCU apart from that we use ESp-01 which is provide the connectivity & logic part. So as per our design attiny85 is brain of our design and esp01 is heart here whenever anyone press alert push button mcu will activate esp01 and send message to concern person, similar we also heck the angel value whenever anyone fallen down immediately our system will send message to concern person apart from that we are also track down the data on think speak server. Our ESP8266-01 is always in deep sleep mode. Similar our MCU will trigger in every 8 sec and after every 8sec trigger our MCU is gone to sleep mode. Through this strategy we are able to save huge power. Here we are using very low capacity battery which is 180mah. This battery is very small in size. The design of PCB is done on EAGLE.

Schematic & PCB fabrication: Here we are using Eagle EDA for schematic & PCB designing. So at initial stage we design the schematic sketch and create the same design on breadboard and check the functionality once system functionality is up to the mark so after that we convert that schematic in to the PCB layout.
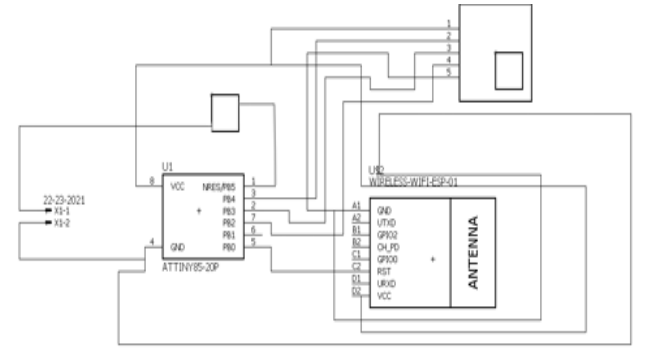
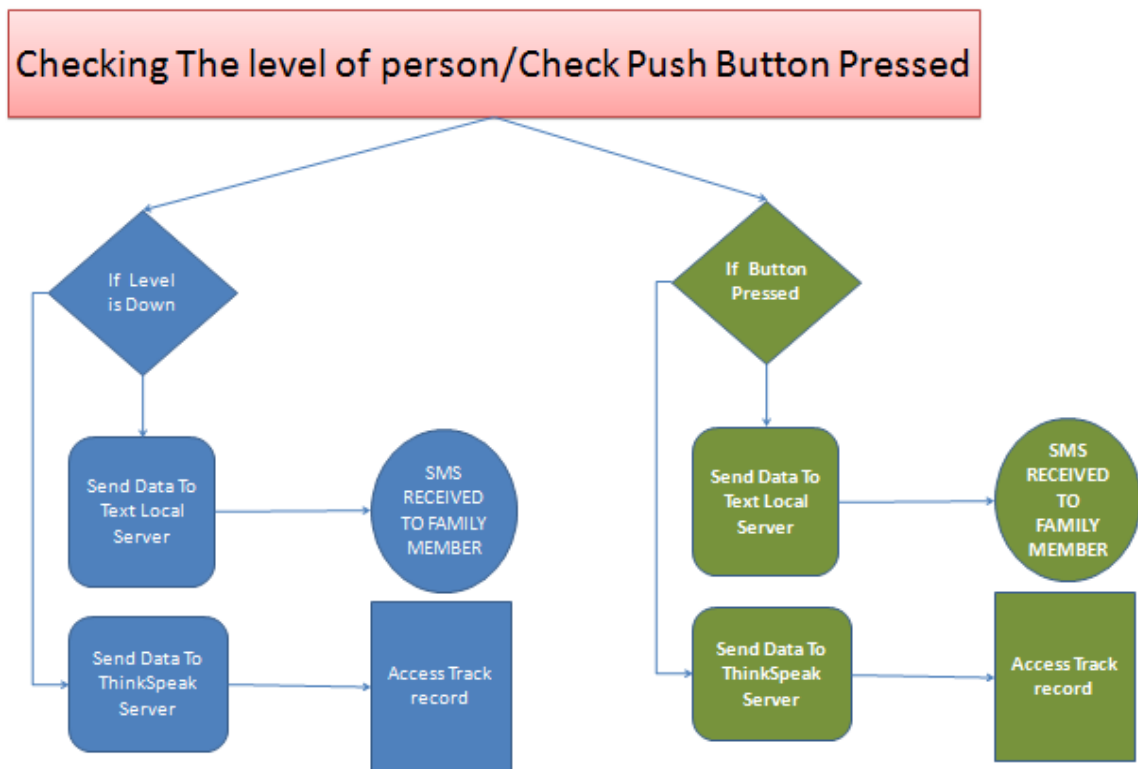*Schematic Design:*

Fig. 3.1 Schematic of Proposed Device

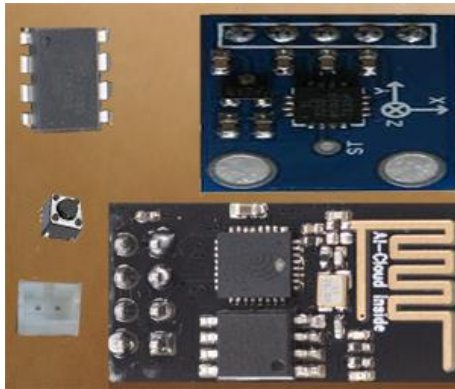Fig. 3.1 Data flow from Proposed Device

Fig. 3.2 Assembled PCB of Proposed Device

Simulation & Testing: Now after the development of PCB layout & assemble the all circuit we started real time testing. As per our testing we found whenever our device is fall down towards Y direction with minimum gap on x axis . Our device will start trigger the fall down alert. Similar if push button pressed it send message through cloud server.

IV. EXPERIMENTAL RESULT & ANALYSIS

In this work basically we are focusing on to design a device which is able to make justice with all parameters and provide a balance result. Here our main parameters are followings:

1. Cost

2. Battery Backup

3. Form Factor

According to our proposed approach we are using 180 mah battery and we are able to run the device up to 1000hr. Here we are using the concept of ultra-low power management system. In this approach we are able to manage the device form factor in small size with proper long lasting battery backup and best part we are able to achieve low cost design. Here is cost breakup of our proposed system:

Table 4.1

Component	Price (INR)
3V (180 mah battery)	80
ESP8266-01	110
ADXL335	150
PUSH Button	5
ATTINY85	60
TOTAL	405

Table 4.2 Comparative cost analysis:

Tuan[36]	Tuan[37]	Proposed
930	1000	405

we can see that our propose approach is able to reduce the cost with the factor of 40%.

Table 4.3 Comparative Power analysis per mill Second:

Tuan[36]	Tuan[37]	Proposed
0.0131uA	0.035 uA	55uA

Here we can see that our propose approach is perform very well in terms of power, as we are using smart battery power utilization .

Table 4.4 Comparative Battery Capacity analysis:

Tuan[36]	Tuan[37]	Proposed
76Hr	35Hr	1000Hr

Here we can see that our propose approach is able to improve the battery capacity with the factor of 40 times.

Table 4.5 Comparative Form Factor analysis:

Tuan[36]	Tuan[37]	Proposed
Small	Big	Very Small

According to our proposed approach we are able to make justice with all parameters. Now in terms of cloud server we are using think speak to send and store pre fall time with date, similar we are using bulk **SMS** service for sending pre fall notification to resister number.

V. CONCLUSION

As we know in this era there is need of smart device which is able to solve the real time issue in low cost. So here we propose a new system which is able to detect the fall & also send the alert when any one press emergency push button. Our proposed device is very low in cost we are able to achieve our device in 405 Inr only apart from that our battery will run up to 1000h which a big difference from previous existing approaches.

VI. ACKNOWLEDGEMENT

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