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Implementation of Machine Learning Algorithms in Iot Smart Shoe Helping Rehabilitation for Visually Challenged People

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Abstract

People who really are visually challenged will benefit from this study, which aims to help them complete their daily chores. Traveling outside can be difficult for those who are blind or have low vision, but this article explores a solution that uses Internet of Things (IOT) to construct sensor that can be worn on shoes. To warn the user of impending danger, ir sensor and a siren are employed. Ultrasonic, a sensor array, and an Arduino board make up this IoT-based Intelligent shoe solution for the blind. There is a lot of focus on the Internet of Things these days. physical equipment and other objects, including humans, being linked together Despite the fact that the market for this technology has grown significantly, it is still being developed at an accelerated pace. When people move from one place to another, the biggest problem occurs. It's impossible for someone carrying a stick to be aware of everything that might be lurking in their path. When it comes to walking on your own, this clever shoe design is a long-term solution for blind people. The smart sneaker will help the vision impaired go to their destination on their own thanks to safety measures. Incorporating sensors, microcontrollers, and buzzers into the shoe's design, it is built using Internet of Things (IoT) technology. You'll be alerted as soon as you step into the shoe if it detects an impediment in your path. by making a buzzing noise and then. Incorporating IoT and sensors, smart glasses are becoming a reality. Additionally, it aids in the discovery of potential problems by considering a wider variety of potential problems. The By exchanging data with one another, the smart shoe keeps the wearer safe from hitting any impediments in his path. A safe and self-contained way for them to arrive at their goal

Keywords: IoT, Arduino UNO, NodeMCU ESP8266, Ultrasonic Sensor, Pressure Sensor

1. Introduction

Physical items embedded with sensors, computers, and other technologies can communicate and share information between devices and systems through the internet through the Internet of Things (IoT). Connecting physical devices to the internet, and also processing and analyzing data, is the goal of the internet of things (IoT). Customers are likely to access the global communications network without a

keyboard or a display; many of their everyday devices and devices will be able to obtain orders from the net without any need for human participation. ' Devices such as this one acquire valuable data, which they then share with other gadgets. utilizing a range of currently available technologies. There are many applications for Internet of Things (IoT) technology presently, from irrigation systems to military applications to forests, all of which necessitate human contact. Devices may now connect with one another over the Internet, thanks to a combination of many technologies, including cloud computing. Hardware components include sensors and actuators. Interconnected devices make up the Internet of Things (IoT). computers, mechanical and digital machines,

products and people with distinct identification, responsibilities and the ability to transfer data without necessarily requiring or computer-to-computer contact It's [1]]. You can send SOS messages to the people on your contact list by pressing the power key twice.

The GPS position is sent every time the pushbutton is pressed. Family Locator [2][28] Life360 A machine learning algorithm can be designed to automate the system when the user is inside using the data collected by the ir sensors and uploaded to the cloud for the further analysis. [3] Manisha Mohan and NiladriBasu created SHE (Society Harnessing Equipment). The inside wear of 10 Bal, Rimpi Tripathi had sensors and a shock circuit board attached to it, however the outer wear did not. A polymer is used to insulate the underlying layer that comes into touch with the skin. The circuit has been installed. In the instance of eve-teasing or rape, women are attacked initially at the bosom. [4]. Smart Belt is a technology that uses a portable gadget that looks like a regular belt. It's made out of an Arduino board, a screamer, and pressure sensors. The device will automatically activate when the pressure sensor's threshold is crossed. The shrieking alarm system will be activated, with sirens crying for help.[5][29].

2. Related Works

The Global Positioning System (GPS) is a satellite-based navigation system. Regardless of the conditions, it will always be able to tell you wherever you are or what time it is. A total of four satellites may well be required to calculate X, Y, Z (latitude, meridian, and elevation), and also time. The GPS receiver processes the signals it receives into a precise location. [6]. The MinT platform powers its modules, and the API it provides makes it easy to build IoT applications and connect them to one another. It uses sensors to analyze the customer's walk and then communicates the results to a smartphone app [7]. The smart shoe's spectacles have sensors attached to them, and all of them are designed to detect objects. The wider field of view provided by these smart glasses will make it easier for even the tallest users to spot obstacles, resulting in greater efficiency. [8] [9]. An obstacle identification and real-time GPS assistance model was developed by Divija et al. in 2018. Vibrators are used to implement this system. When the ultrasonic sensor senses an obstruction, they will activate. The self-power production of some piezoelectric sensors is also utilized in order to alleviate power issues. The results of the experiments showed that at a distance of 150 cm from the shoes, this device has a very sluggish audio stream [10][30]. People with visual impairments typically depend on cane handles and other people for getting around, whether it's for asking for directions or just getting from point A to point B. This device, on the other hand, has a chipset, ultrasonic sensor, humidity sensor, Bluetooth module, and an LCD display screen. To provide the user with turn-by-turn directions, the shoe module's microcontroller is connected via Bluetooth to an app on their smartphone. Humidity is detected with a moisture sensor [11][31].

Sensor control is an integral part of the Internet of Things (IoT), and hence an embedded system is designed that can be tailored to match the needs of various sensors. [12,13] Even if you don't suffer from diabetes or heart disease, obesity can cause lower-limb musculoskeletal disorders including osteoarthritis in the knee and hip joints. [14] Diabetic foot problems are considered medical emergencies since they could lead to amputations if they don't get taken care of. According the NHS, who invests 10 percent of its annual budget on direct expenses, which is anticipated to rise to 17 percent by 2035, diabetics face budgetary constraints as well. [15,16] Detection of diabetic foot ulcers has become increasingly challenging, resulting in increased patient suffering and increased healthcare expenses. For diabetics, the current standard of care is to check their blood sugar levels every day with the help of a planned care provider. [17]. The intelligent analysis can be used to extract all of the most important human gait features from sensor data. As a consequence, the Smart Insole system keeps tabs on a wide range of activities while the subject is free to go about his or her daily routine. As according Wenyao et al., the mechanism is powered by slow motion, including such strolling. Indeed, the heel-striking event of striding is the human body's greatest source of energy and the most forceful motion[32][33].

The gait cycle has a power output of 67 W [18]. When walking, a person's normal gait consists of placing one foot forward to support their weight and putting the other foot forward. The normal gait is an effective gait pattern in terms of energy consumption and ambulatory speed that permits smooth walking for an extended period of time [19]. As more low-cost communication devices hit the market, developers have more options for choosing an appropriate communication design in terms of length and energy usage or even the data center, which might

include devices to devices and devices to a centralized network. [20] Additionally, the device is capable of detecting a wide range of living and non-living materials as well as humans and animals within the designated radius.[21] As long as the barrier is recognized within 60cm, the sideward vibrating motor [22] is activated [23][35]. The depth frames' resolution is reduced from 640 480 to 20 15 pixels as a result of the down sampling. User-facing pixels are given more weight in the down sampling process. Once the depth data is separated into discrete systems at different depth levels, the marching squares technique is used to locate obstacles. [23] Intelligent Whip Robot for Elderly and Disabled People was built by G. Prabhakar Reddy and K. Sathish Babu utilizing an ARM920T CPU and the AMBA bus architecture. To help the elderly and disabled, a robot cane has been designed that can move in any direction. An algorithm that analyzes a person's walking intention controls their movement accordingly. By utilizing sensors such as IR sensors, ultrasonic sensors, and microcontrollers that support the elderly and handicapped, it will be possible to avoid lower-limb issues. Due to the identical frequency of the sensors, the robot could be confused by the usage of so many sonar sensors, resulting in inaccurate readings [24]. The use of sensors such as sonar and internet systems to store data received are all currently the subject of research aimed at developing a GPS-enabled guide for the blind [25]. Gait analysis, fall detection, and sleep monitoring are just a few of the medical uses for inertial data. Today's society places a high value on medical management and patient maintenance performance. One of the most pressing concerns is ensuring that the patient receives enough care at a reasonable cost while also addressing the issue of nursing staff shortages. Recently developed IoT technology is upgrading and improving healthcare and biomedicine [27]. In contrast to all the above-mentioned gadgets, which create the desired environment on a broader scale, wearable devices can alter foot-ground interactions to locally render the simulated terrain to each foot. [28] shows an example of a common haptic shoe [31][34].

3. Methodologies

"LECHAL SHOES," which translates to "take me along," were marketed as "active haptic" footwear by the company behind them. There are approximately 40 billion blind people in the Usa, with 1.6 million of those individuals being minors. For the blind, there are many parts of their lives that they must rely on the help of others. When they walk the streets with a stick in their hand, they are unable to see all of the obstacles in their way. As a long-term solution, the Intelligent shoe design allows blind people to walk independently on public roads. A blind person's mobility will be much improved thanks to the smart shoe. The shoe incorporates a variety of sensors, micro - controllers, and buzzers as part of the Internet of Things (IoT) design. The shoe buzzes when the wearer walks before a barrier to inform them. An Arduino UNO is used to control the ultrasonic sensors on the front of the shoe. In order to avoid obstacles, the ultrasonic sensor can detect them, and the Arduino lets the sensors collect quite so much coverage of the user as feasible.

3.1. PROPOSED SYSTEM:

Ultimately, the user should be able to take care of himself or herself and be protected from anything that could be life-threatening. Using smart shoes, we offer a solution for visually challenged persons. The diagram of the intelligent shoe module's blocks is shown in the following image.

The hardware will be fixed from the perspective of the user. Sensors in the shoes identify barriers and buzzers signal turns in the path whenever the user places on the footwear and walks there. A buzzer is used to alert the user about an impending issue. Going somewhere without having to rely on people is unnecessary while wearing the smart shoe. The technology is intended to be reduced and user-friendly as a smart blind guide. It's intended to make life safer for the blind and visually impaired by alerting them to potential dangers in their path and allowing them to function more independently. Sensors and buzzers will be used to detect obstacles, and they will sound when an obstacle is discovered. An important part of our mission is to make it possible for persons who are blind or visually impaired to travel freely, independently, and safely wherever they want.

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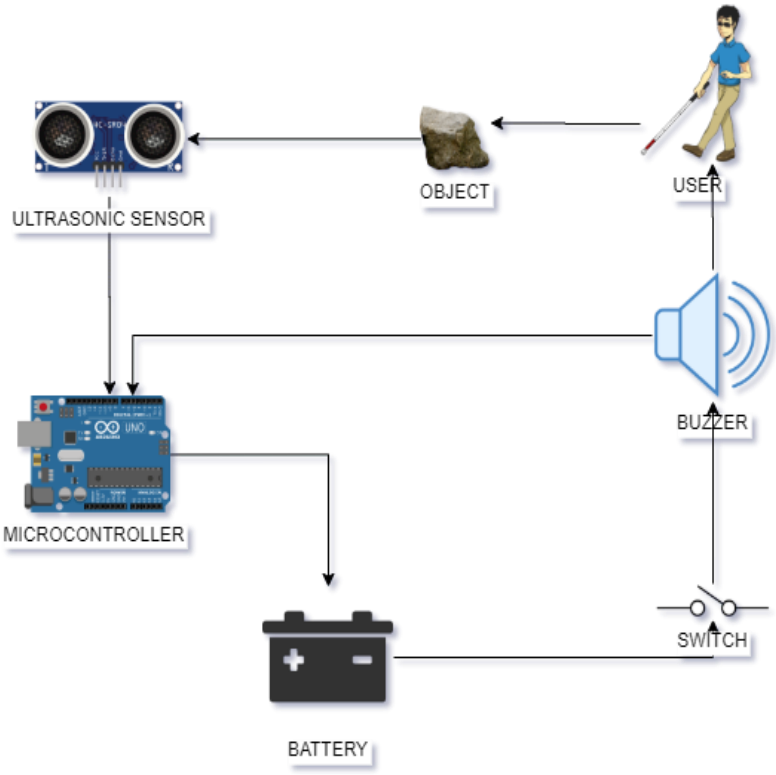

Fig.1 Block diagram of the ML Assisted smart shoe

4. Results:

The ultrasonic in the Thing Speak clouds produces the below-displayed distance vs. time graph at the conclusion of the experiment. The ultrasonic sensor measures the distance between items directly in front of the subject, and this graph shows that distance. When a signal is received, the buzzer goes off. The user gets warned when the space between the obstruction and the user is less than 100cm.The Things Speak Cloud is shaped by the Time VS Length curve created by the Smart shoe.

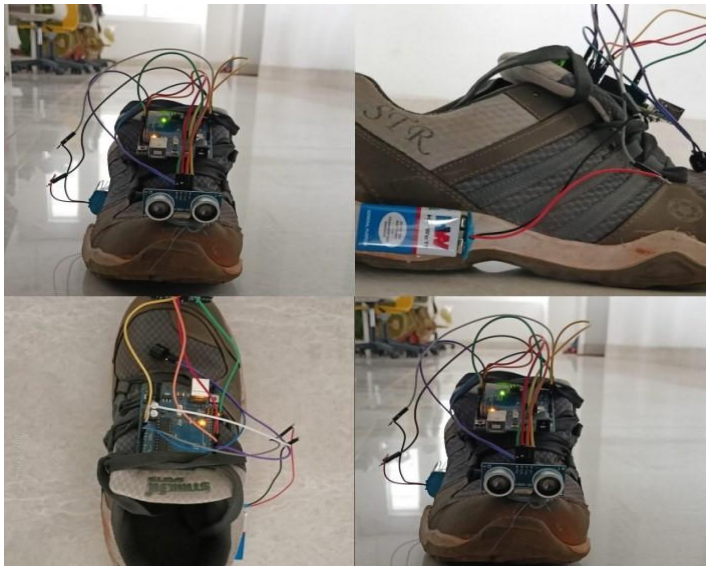

Figure 2. Smart Shoe Setup

4.1 Modules in the Project Design

❖ **Smart Shoe Module's Thing Speak Cloud**

• This think talk software can be used to run the proposed system. Inputs that are specific will yield distinct outputs. A machine learning model will most likely employ distance data as input. Having this information will be useful in the future when mapping the indoor environment.

❖ **The state of the system if there are no barriers in its way**

In the absence of a barrier, the buzzer stays quiet, signaling that the device is dormant and the client can go safely.

❖ **Along the event that there are hurdles in the way, the system's status will be updated.**

• A buzzer will sound if an obstruction is in front of user, alerting them to avoid the obstacle and proceed safely beyond it.

5. Conclusion

The smart shoe was developed as part of a proposed project. In order to overcome the shortcomings of the prior system, such as a lack of coverage, inefficient use of energy, and false alarms, we included this module. Arduino was born out of a need for such a setup. People with visual impairments can travel independently using this technology, which does not require any specialized training or knowledge of how to use it. The addition of new sensors or other parts will be straightforward thanks to the ease with which they may be integrated into the existing system.

References

1. A.Balleri, K. Woodbridge ; K. Chetty, “Frequency-agile non-coherent ultrasound radar for collection of micro-Doppler signatures,” 2017 IEEE Radar Conference (RADAR).
2. Kalpavi C.Y , Punith Kumar B.E Shiva Kumar H.K Shreyas R.S Varun B.C, “Women self defence watch,” project Reference no. : 39S_BE_0054, KSCST IISC Bangalore
3. Tan, Bo; Woodbridge, Karl; Chetty, Kevin "A real-time high resolution passive WiFi Doppler-radar and its applications", Radar Conference (Radar), 2014 International, On page(s): 1 - 6
4. Manisha Mohan, NiladriBasu Bal , Rimpi Tripathi, “SHE- Society Harnessing Equipment,” SRM University, Chennai. [Online]. Available: https://www.srmist.edu.in/content/worlds-first-anti-rapedevice-invented-young-student-researchers-srm-university-chennai
5. GC Harikiran, Karthik Menasinkai, SuhasShirol, “Smart security solution for women based on Internet Of Things(IOT),” DOI: 10.1109/ICEEOT 2016.7755365 Conference: International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT), 2016.
6. Lalit Prakash Vatsal, Prince Gupta and Sani Theo, “GPS- and GSM - Based Vehicle Tracking System,” January 21, 2019. [Online]. Available:
7. Jeon, S., Lee, C., Han, Y., Seo, D. and Jung, I., “MinT: Middleware for cooperative interactions of things,” 2016 IEEE International Conference on Consumer Electronics (ICCE), pp. 127-128, Jan. 2016.
8. M. Chandan, Srinivas.Malladi*, M. Nishitha, K. Sindhu Priya, Y. Sree Lekha, Automatic gas booking system using IoT, International Journal of Engineering & Technology, *7 (2.8) (2018) 235-238*
9. SaranyakumarChigurupati Ravi Teja Vallamsetti Yogesh MisraRagipati Karthik Intelligent vehicle pollution monitoring using IoT, International Journal of Engineering & Technology 7 (2.7) (2018) 376-378
10. ArneshSen, KaustavSen, Jayoti Das, on “Ultrasonic Blind Stick For Completely Blind People To Avoid Any Kind Of Obstacles” in 2018.
11. M. Divija, M. Rohitha, T. Meghana and H. Monisha, "Integrated Smart Shoe for Blind People," International Journal of Management,Technology and Engineering, vol. 8, pp. 748-752, 2018
12. S. H. Jang, Quality Measurement Method for Reliability Eva luation of Embedded Software, Master Thesis, Dongguk University, 2014.Paul A. Butterworth , Donna M. Urquhart , Karl B. Landorf , Anita E. Wluka d, Flavia M. Cicuttini d, Hylton B. Menz. Foot posture, range of motion and plantar pressure characteristics in obese and non-obese individuals.2014.
13. Hex, N.; Bartlett, C.; Wright, D.; Taylor, M.; Varley, D. Estimating the current and future costs of Type 1 and Type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs. Diabet. Med. 2012, 29, 855–862.

14. Lavery, L.A.; Higgins, K.R.; Lanctot, D.R.; Constantinides, G.P.; Zamorano, R.G.; Armstrong, D.G.;Athanasiou, K.A.; Agrawal, C.M. Home monitoring of foot skin temperatures to prevent ulceration. Diabet. Care 2004, 27, 2642–2647.
15. James Coates ,Andrew Chipperfield , and Geraldine Clough. Wearable Multimodal Skin Sensing for the Diabetic Foot.2016.
16. T. Starner, "Human-powered wearable computing," IBM systems journal, Vol. 35, No. 3&4, 1996, pp. 618-629.
17. K. Kong, "Smooth and Continuous Human Gait Phase Detection Based on Foot Pressure Patterns", IEEE International Conference on Robotics and Automation, pp. 3678-3683, 2008.
18. T. Nilpanapan, and T. Kerdcharoen "Social Data shoe for Gait Monitoring of Elderly People in Smart Home," IEEE Biomedical Engineering International Conference, pp. 1-5, Fabruary 2017.
19. International Journal of Mechanical Engineering and Technology (IJMET) Volume 8, Issue 8, August 2017, pp. 1588–1593, Article ID: IJMET_08_08_170
20. Pooja Sharma, Mrs. Shimi, Dr. S. Chatterjee DESIGN OF MICROCONTROLLER BASED VIRTUAL EYE FOR THE BLIND inInternationalJournal of Scientific Research Engineering & Technology(IJSRET), ISSN 2278 – 0882
21. Lorensen, W. E., and Cline, H. E. Marching Cubes: A high resolution 3D surface construction algorithm. In Proc. SIGGRAPH 1987, ACM Press (1987), 163–169.
22. G.Prabhakar Reddy, K . Satish Babu, "Intelligent Cane Robot for walking Assistance of elder and handicapped people" International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), ISSN 2278-6856, Volume 2, Issue 5, September – October 2013.
23. Yánez, D.V., Marcillo, D., Fernandes, H., Barroso, J., Pereira, A.: Blind Guide: anytime, anywhere. In: Proceedings of the 7th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion, pp. 346–352. ACM, December 2016
24. Buke, Ao, et al., "Healthcare algorithms by wearable inertial sensors: a survey.", China Communications 12.4 (2015): 1-12.
25. Natarajan, V. A., Kumar, M. S., Tamizhazhagan, V., & Chevdumoi, R. M. (2022). Prediction Of Soil Ph From Remote Sensing Data Using Gradient Boosted Regression Analysis. Journal of Pharmaceutical Negative Results, 29-36.
26. Kumar, M. Sunil, et al. "Deep Convolution Neural Network Based solution for Detecting Plant Diseases." Journal of Pharmaceutical Negative Results (2022): 464-471.
27. P. Sai Kiran, and M. S Kumar. "Resource aware virtual machine placement in IaaS cloud using bio-inspired firefly algorithm." Journal of Green Engineering 10 (2020): 9315-9327.
28. Balaji, K., P. Sai Kiran, and M. Sunil Kumar. "Power aware virtual machine placement in IaaS cloud using discrete firefly algorithm." Applied Nanoscience (2022): 1-9.
29. Kumar, M. Sunil, et al. "Applying The Modular Encryption Standard To Mobile Cloud Computing To Improve The Safety Of Health Data." Journal of Pharmaceutical Negative Results (2022): 1911-1917.
30. T. Pavan Kumar, and M. Sunil Kumar. "Efficient energy management for reducing cross layer attacks in cognitive radio networks." Journal of Green Engineering 11 (2021): 1412-1426.
31. Davanam, Ganesh, T. Pavan Kumar, and M. Sunil Kumar. "Novel Defense Framework for Cross-layer Attacks in Cognitive Radio Networks." International Conference on Intelligent and Smart Computing in Data Analytics. Springer, Singapore, 2021.
32. Walde, R.B., Prakash, O., Kumar, M.S., Sule, B., Nabilal, K.V. and Pawar, U.C., 2023. Ranking Based Security Scheme with Attack Detection and Improved Network Security. International Journal of Intelligent Systems and Applications in Engineering, 11(3s), pp.35-41.
33. Yadav, S.S., Maan, M.K., Kumar, M.S., Kumarnath, J., Pund, S.S. and Rathod, M., 2023. A Secure IoT Smart Network Model for the Contributory Broadcast Encryption for the Text Policy Management Scheme. International Journal of Intelligent Systems and Applications in Engineering, 11(3s), pp.42-48.
34. Kumar, A., Kumar, M. S., Vikhar, P. A., Ghodke, V., Waghulde, R. R., & Rathod, M. (2022). Improving the Software Privacy in the OFDM 5G Communication Integrated with License Key in the Hardware Communication Parameters. International Journal of Intelligent Systems and Applications in Engineering, 10(2s), 236-240.
35. Davanam, Ganesh, T. Pavan Kumar, and M. Sunil Kumar. "Efficient energy management for reducing cross layer attacks in cognitive radio networks." Journal of Green Engineering 11 (2021): 1412-1426.