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Ultrasonic Blind Stick with GPS and GSM Tracking

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Abstract: ***In this project we are proposing to create a model which will act as a boon for the visually impaired people in our society. This study is trying to work over a hypothetical idea of a walking stick that would alert the visually challenged people on encountering an obstacle, holes and water in their vicinity which would help in preventing any kind of accidental injury to them while walking. The project visualizes the idea of a revolutionary navigation tool for the visually impaired people. This ordinary looking blind stick is actually extra ordinary it has been provided with different kind of sensors to give the person an idea about the vicinity in which he or she is present and make the individual much more aware. The GPS sensor has been designed and programmed in such a manner that is it is able to give an idea about the best possible route depending upon the location it is able to access. The user has been provided with the phenomenal feature of choosing locations from the set of destinations that have been stored in the database of the system. In this stick ultrasonic sensor GPS and GSM tracker, ESP 8266, water sensor, infrared sensor and RF sensor, battery have been used. the comprehensive goal of the device is to provide a much more comfortable and Secure method for the visually impaired people to overcome hindrances in daily life.***
Keywords: GPS and GSM tracker, ESP8266, Relay, Sensor, Obstacle Detection, Wi-Fi module

I. INTRODUCTION

Blindness is a very common disability among the people throughout the world. They need help to walk outside in all other daily essential work we are proposing to make a system that tries to remove the difficulties caused due to blindness and make them self-dependent to do their daily chores. Blind people use a stick as a tool for directing them they move or work which can serve as a support system for them. The blind stick that we are proposing to make is integrated with ultrasonic sensors along with light and water sensing devices attached to it moreover it has also been provided with a buzzer which will sound differently upon detecting water and with the help of GPS the blind persons location can be detected. The ultrasonic stick for visually impaired people has been provided with powerful ultrasonic sensor along with photosensitive sensor and water sensing device attached with a buzzer which will sound differently upon detecting water and with the help of GPS the blind person's location can be detected and the stick is provided with RF sensor which will help in finding the lost stick. On pressing the RF based remote it sounds a buzzer on stick which helps to find stick. The blind stick that we are designing will surely be a boon for all the blind people in the world. The walking stick is very economical due to its low cost, fully automated, easy to maintain, cheap and very comfortable to use for the blind people. It consists of a circuit board that contains a ESP8266 microcontroller, different sensors and buzzer. The device should be able to work for a long time with minimal power utilization and it could be recharged so it operates with two rechargeable batteries and further can be recharged using USB cable or AC adaptor. This system proposes stick which uses ultrasonic sensor for detection in the microcontroller that controls the system without complexity.

II. LITERATURE SURVEY

[1]. In this paper electronics aid is given to the blind man that offers the artificial vision and object detection. Real time location is detected with the help of GPS connected to it. The ultrasonic sensor helps in detection of the Static and dynamic objects present nearer to the blind person. In the project twin feedback system is also used that helps a person in obtaining the sound of buzzer and voice assistant as well. The obstacle detection is done by IR sensor and passes the information with the IOT device connected to it. This also includes emergency button connected to the GSM that sends the SMS in case of emergency. [2]. The project contains voice assistant which produces a warning if obstacle comes in the range of ultrasonic sensor. The frequency of beep also gets changed when the person comes nearer to the obstacle. The basic concept is communication between the Arduino and the sensor. Instead of the RF sensor they have connected the Bluetooth based remote tracking system that helps the disabled person to find the remote. The range of sensor lies in between of the 2 cm to 400 cm which is the non-measurement function.

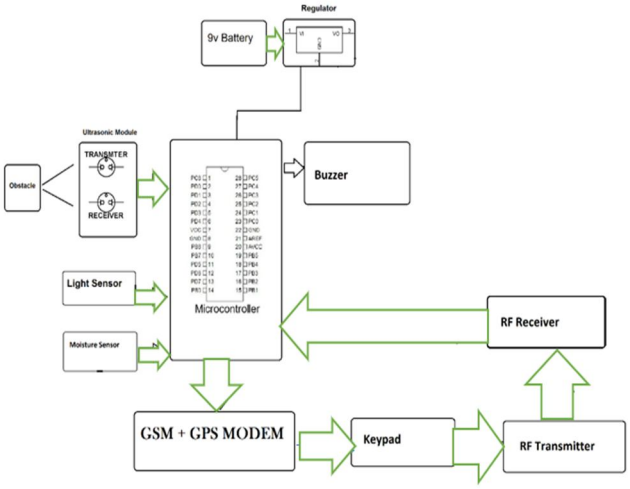
The IO Trigger is used to high the level of signal. 40 KHZ signal bounces back to the sensor, if obstacle is detected then it will share the information to the microcontroller which initiates the buzzer of different frequency according to distance between stick and obstacle. This can work only up-to 180 degrees wide angle. [3]. This paper presents design and implementation of an ultrasonic sensor-based walking stick for visually impaired person. An ultrasonic sensor module, HC-SR04 is used for obstacle detection in the path of the blind person and a buzzer is used to make the person alert. The proposed system is using pic microcontroller 16F877A. It uses ARM processor which contains more memory. This system cannot be used indoors since there will be no GPS detection. The proximity sensor and ultrasonic sensor unit are for the detection of obstacles. The GPS module determines the location of the obstacle with respect to the blind. It also uses a voice in navigation system to give direction to the blind man. This system has new innovation forward sensing circuit that makes it unique but due to this circuit complications occur in it. [4]. A functioning model is proposed in the plan, which is a Walking Stick with an in-built ultrasonic sensor and a microprocessor system. Ultrasonic waves are used to detect obstructions with the ultrasonic sensor. The sensor sends data to the microcontroller when it detects impediments. The data is then processed by the microcontroller, which determines whether the impediment is close enough. The circuit accomplishes nothing if the obstacle is not close enough. If an obstacle is approaching, the blind person receives an alert signal from the microcontroller. They have also integrated the e-SOS (Electronic Save Our Souls) system. When a blind person is having difficulty navigating, he presses the e-SOS distress call button on the stick to make a video call to a family member. The video is seen on an Android phone via an Android app. The Android application also informs the blind person's family member of his location. [5]. There is also a camera mounted at a specified height to capture video of the immediate area and feed it to users of the needed mobile application. The microphone button on the application page allows the user to send an audio guidance message to a blind person who is far away. After the Raspberry Pi and mobile application have established a connection, the video is streamed to the mobile application by refreshing the application page. The user of the application can view the video and assist the blind person as needed. The video streaming on the application is seen below. [6]. In this project, we'll use a variety of sensors, including an electromagnetic sensor, a moisture sensor, an ultrasonic sensor, and an Rf transmitter and receiver, to locate a missing stick in a small area. The ultrasonic sensor detects the object that comes before the stick and measures the distance between the object and the blind person. The moisture sensor detects the amount of water in the soil. Electromagnetic waves are detected using an electromagnetic sensor. If a cable or wire passes in front of a blind person, the electromagnetic sensor detects the waves from the cable and alerts the person to a potential serious accident. If a blind person carrying a blind stick goes misplaced in a large crowd, GPS is used to locate their location. The proposed system design for people who are blind is as follows: This approach is carried out with the use of a modern stick. [7] This technology creates a portable unit (stick) for blind persons to use in order to navigate in any environment. Because it can feel the path nature and detect obstructions in the blind person's path, a stick with a long cane construction with some changes to the hand cuff parameter is utilised. The purpose of the paper was to assist visually impaired people who use a stick to determine if there are any impediments in their path. The ultrasonic blind walking stick is far more advanced than a typical walking staff, as sensors allow for easier object identification. GPS provides the latitude and longitude coordinates that can be used to determine one's current location. One of the most advanced features is that if the blind forgets their stick, they can quickly identify it by pushing a wireless RF-based remote that is connected to their hand cuff and can be used to locate the missing stick by hitting the remote button. The device is capable of detecting obstacles as well as locating a misplaced stick. It also features a feature known as pulse detection. The system's microcontroller is the PICF877, which features a Serial Peripheral Interface, 8 channels of 10-bit Analog-to-Digital (A/D) converters, a 2-wire Inter-Integrated Circuit, and a universal asynchronous receiver transmitter (USART). The developed prototype model is capable of detecting obstacles in straight, right angle, and curved paths. For proper stick management, a minimum of 1m width is required. The cane construction in our proposal is compact, with all modules coupled by simple cables. The cane gives help to the blind, and the device is completely operated by spring mechanical suspension to detect obstructions. Special Issue 765 of the International Journal of Pure and Applied Mathematics on the ground, unbound surfaces, pit holes, and steps with changing slopes. Ultrasonic sensors with a wide beam angle provide information on a wide variety of obstacles. Infrared sensors have a non-linear response, which means that a large change in output voltage does not always imply a large change in range. When a visually impaired individual enters a firing area, the fire sensor in the system detects heat. Apart from that, people are directed to a clear path by taking into account various environmental elements such as rain, mist, and so on. People can boost their journey speed by more than 25%-40% with the use of this stick blind. [8]. We presented a solution for blind individuals in this research by incorporating an ultrasonic sensor into a blind stick. The instrument is used to detect impediments within a four-meter range, while the infrared instrument is used to detect nearer issues in front of blind individuals. The radio frequency transmitter and receiver help the user to find the exact location of the smart stick with the help of buzzer. The vibration motor which is placed in the smart stick gets activated and produces a vibration when any obstacle is detected.

This proposed method uses the Arduino UNO as controller. The branch is accomplished of sensing all difficulties in front of the user. The smart stick is user-friendly, has a quick response time, uses very little power, is lightweight, and is simple to grasp and fold. The smart stick, which is designed for the blind, uses ultrasonic and infrared sensors to detect the presence of impediments. Transmitter and receiver modules are included in an ultrasonic sensor. Ultrasonic waves are transmitted by the transmitter module to detect obstacles within 4 metres. The ultrasonic waves emitted by the barriers are received by the receiver module. The vibrator motor vibrates as a result of the signals sent by the receiver. The presence or absence of water, as well as changes in heat in the environment, can be detected using an infrared sensor. Sensors that detect infrared light. The blind persons donned a wrist band that is used to encourage the blind community to participate in inventions where a stick is present. Push button, encoder, and transmitter are all part of the wrist band. The encoder encodes signals and the transmitter broadcasts them when the wrist band's push button is pressed. The decoder, receiver, and buzzer are all located on the stick's handle. The signals are received and decoded by the receiver. The buzzer receives the decoded signals. The buzzer emits an alarming sound and assists the user in locating the stick. [9] This paper includes the user notification set up for the location detection. It uses sim808 module that is directly connected at 45 degrees to the backside of the stick. This technology also supports the GSM and GPRS quad band network which combines the GPS Navigation directly to the satellite and after getting the exact coordinates the location can be detected easily. In this module two-way communication is achieved by GSM modem and also contains SIM card which is used to send the exact text to the regular cell phone. The microprocessor used in this technology is Texas Instruments MSP430G2553 microcontroller. [10] The initial step in our suggested concept is to employ an ultrasonic sensor to detect barriers without having to touch them. The sensor sends this data/8 to the microcontroller when it detects impediments. The data is then processed by the microcontroller, which determines whether the impediment is close enough. If the obstacle is far away, the circuit does nothing, but if it is close, the microcontroller sends a signal to the buzzer to sound. If it senses water, the buzzer will play a different tone, alerting the blind person. Another feature is that it allows the blind person to detect whether the room is dark or light. One additional advanced feature has been included into the system to assist the blind person in finding their stick if they forget where they put it. A wireless RF-based remote is used to locate a misplaced stick. Pressing the remote button causes a buzzer to sound on the stick, assisting the blind person in locating their stick. This technology detects obstacles and locates the stick if it is misplaced by a visually impaired individual. Any obstacle in front of a blind person is detected using an ultrasonic sensor. It has a detection range of 2cm-450cm; thus, it will inform the blind person if there is an impediment within this range. A water sensor is used to detect whether or not there is any water in the path. The individual will be aware of it, and the buzzer will sound, giving the person an indication of where the stick is located. It can cover a distance of up to 3 metres and contains a rechargeable battery. This system can also be folded into a small package for easy transportation. However, this technology only detects impediments in one direction and is inaccurate in detecting them. The blind stick, which is equipped with an ultrasonic sensor, can detect light and water. Ultrasonic sensors are utilised in this system to identify obstructions using ultrasonic waves. The sensor detects obstacles and sends the information to the microcontroller, which processes the information and determines whether the obstacle is close enough to the person. The circuit accomplishes nothing if the barrier is not near to the microcontroller. It also detects water and informs the blind person with various sounds. Another feature is that it allows the blind person to detect whether the room is dark or light. A microphone was used to identify obstacles, which was signalled by a high-pitched BEEP. [10]. The range of ultrasonic sensor connected to it is 20-350 cm. For small obstacles two IR sensors are mounted which are aligned opposite to each other and having a range of 2 to 10 cm. A General message tap is also attached to which it can generate a text signal of “I am in trouble Please help me”. That stores the information of saved mobile number with that the information is shared. Vibrating sensor is connected along with the buzzer that is used to generate The Beep. In this electronic system microprocessor GSM 300/900 is used. That is responsible for signal transferring between the Ultrasonic and IR sensor and also gives the reliable distance between person and obstacle. [11]. This model is made up of several pieces that each serve a separate function. The Arduino serves as an interface to other sections of the model, allowing it to fulfil the project's needed tasks. The Ultrasonic sensor's goal is to detect any impediments that arise within a user-defined distance. The ultrasonic sound that reflects back after touching the obstacle is used to identify the barriers. Trigger and Echo are the two key activities involved, as mentioned previously, where trigger generates the wave and echo receives the wave and generates a signal to indicate an obstacle The water sensor, which is likewise connected to the Arduino, detects water in the path. Distinct tasks are identified by different sounds to communicate the variety to the blind individual, and the buzzer works as an output for different activities that are done in the model. The GPS receiver is used to determine the person's coordinates, and the GSM module is utilised to relay the coordinates via SMS. C and C++ are used as programming languages. Aside from USB, the board can also be powered by a battery or an AC to DC adapter. One detects an obstruction, while the other detects water. His access to that person's position is enabled by the GPS and GSM module. It is accessed by inserting a standard mobile SIM card.

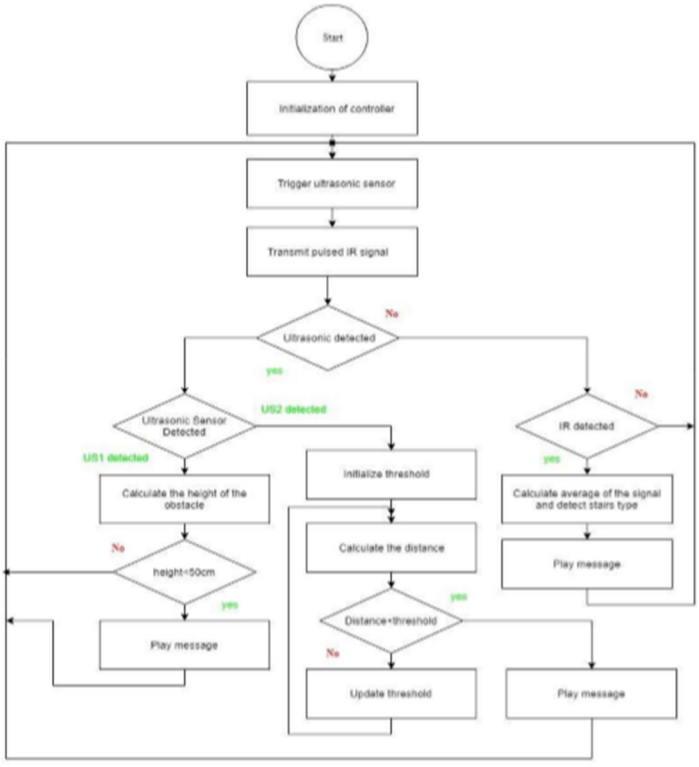
This approach aids the visually impaired person in avoiding obstacles before touching or sensing them, as the usual method of detecting barriers might be dangerous at times. It is extremely difficult for a visually impaired person to detect the presence of water in his surroundings, and water on the floor or in the vicinity can be extremely deadly in particular instances. The model also aids in the detection of water in one's route. His access to that person's live position is enabled via the GPS and GSM module. As a result, persons who are blind or visually challenged may find this model quite useful. [12]. Radio frequency identification is a daily based application that is used for communication purpose. it uses a specific device for transmitting and receiving information as a signal. it consists of automatic reader which can tag the object and also help in sustaining the distance of the object. It is different technology from bar code system because it is non -contact technology. The object which needs to be identified also contains the tag, which circulate the information as a Unique Identification. The data is read by the tag , then different suitable channels are formed through which the communication of data occurs and action is taken if any emergency alert occurs in the surrounding. [13]. The system specification is that, it is autonomous system. it contains two- 80 mm diameter and two-60 mm diameter wheels. The Servo Motor is used for the movement of wheels which are connected through the three 12 volts batteries Position sensor is used for positioning and Movement in right direction. Pulse width modulation technique is used for the signal controlling of Servo Motors. It also contains a mini camera that only sends the information to the microprocessor if required. Hence the memory does not get overwhelmed by the data. Echo technique is used for object detection in the surrounding. [14] The Arduino microprocessor is used along with the three ultrasonic sensors. Two ultrasonic sensors are used for obstacle detection and one is used for the pothole detection. For the water and mud detection water sensor is used. RF sensor is used to found the stick. The range on which it operates is 70 cm. its output contains the vibration motor which provides a haptic response. Piezo buzzer is also connected which sounds if obstacle comes in between. One ultrasonic sensor is connected 90 cm from ground and one at 15 cm from ground. [15] This project contains three different types of sensors, IR sensor, ultrasonic and light Sensor which are directly impaired with the Arduino UNO R3 through which buzzer and vibrators are also connected as the output device. The project also contains the voice-based command navigation which contains fire sensor and light sensor. The cost of project is very effective because the system is embedded on the Atmega 8 microcontroller through which all digital signals are processed. The path that projects offers is for the obstacles present in front, left and right of the Sensor. The grid of sensors for obstacle detection is paired with the three ultrasonic sensors. This project also contains the ultrasonic transmitting and receiving module and also contains the emergency switch that works as the feedback into the system. The arrangement is done in sequence of sensors, connected in dual channel as well. [16]. The system proposes a method of alerting the person by message and in this system contains a panic button as well which is connected through the GPS module and coordinates of the person is shared directly. As any unforeseen condition occurs the emergency button can be pressed, which is connected at the top of the Stick. The battery is connected with microcontroller in a casing through which other sensors are also connected and water sensor is connected at the bottom of the stick. In the project for voice command different frequency audio module is connected. The system also contains GSM Trigger which acts as the switch and converts the digital signal into the custom message. The system also uses ISD1820 for the message recording and have the tendency of recording 64 Second voice message. The system also contains rechargeable battery and can give 4 hour extra backup as well when it is required. [17]. The system is designed to work on the microprocessor AT 89S51. the main reason of selecting this microcontroller is that it can have 4kb flash memory as well, which can be reprogrammed if it is required. The oscillator connected to it is of 11.0592 MHZ, which is quite suitable for any kind of sensor. Two 22 pico-farad capacitors are also connected. The 3rx Pin is dedicated to give distance approximation. Two displays are connected through port 0, the dimension of display is 16*2 (LCD display), which is used for debugging the values and for demonstrating Purpose as well. Two transistors are also connected which are used for magnetizing of relay and for function activating of the buzzer and vibration motor along with the IR sensor photo detector circuit is also connected. [18]. The Stepper motor is used in the project for the self-direction of detector in forward direction. The bracelet contains acceleration Sensor that can sense the person feeling and getting up from any emergency condition. The time of passing the message through the bracelet is very quick, it hardly takes 10 seconds in sending voice command for the help. The location information is shared by the 4G network. The round help button is connected at Upper end of the stick. If person feels tired and requires some help from other family members, then person can press that specific button. Through the network band location is shared under the MCU control, the distance is measured in between any obstacle and person, As the Echo is found, the buzzer starts working and soon pin is pulled up, the microcontroller then counts time if it exceeds by 5 seconds, the buzzer is initiated. [19]. The system contains millimetre wave radar whose purpose is twofold and it is mounted with the radar board. the radar can discriminate in the human and obstacle detection. The radar system is operated on 122 GHz radar assembling system. The obstacle is detected by radar cane whereas the user is scanned. The feedback is provided in terms of the distance. The radar methodology is implemented along with the conjunction of white-cane, so that the system can be designed user-friendly.

The frequency of 120GHZ allows in obtaining the very small and lightweight stick. This functioning can only be done in a small range environment. As the target is detected mm-cane sends the feedback to the visually challenged person, depending upon the distance of human and Obstacle. [20]. The image classification method is used in the system. For the image discrimination neural network convolution system is used. The microcontroller is Atmega through which all the sensors are attached. HC-SR04 Ultrasonic module is also connected. The microprocessor used in it provides that 32 KB memory that is readable. The distance up to which the ultrasonic sensor can measure lies in between of 2 to 400 cm and the range accuracy obtained is of 3 mm. The APR9600 provides the capability of playback. Through this single chip the voice command can be recorded. AGC circuits are connected with the microphone Amplifier which can simplify the architecture. The voice signals are replicated with the help of APR9600.

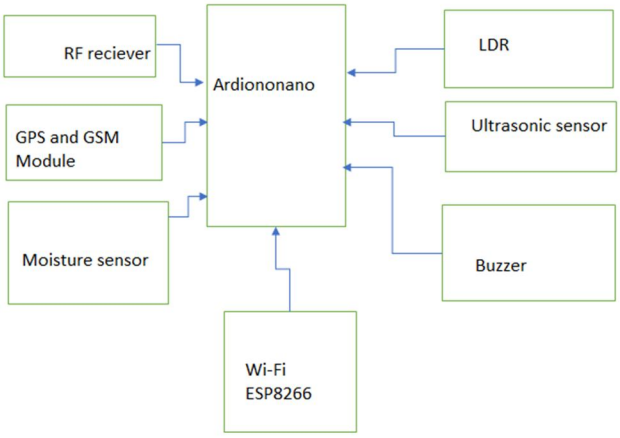
III. METHODOLOGY



Block Diagram



Flow Chart



Arduino Diagram

A. Application

1) It's a generic device that can help someone who is really in need
2) This smart innovative stick can be used in both outdoor & indoor application
3) This innovative stick is helpful to hearing impaired person also with use of a motor as a vibrator.
4) Detects obstacles and alerts the blind person through the vibration alert and able to find the exact location of the blind person whenever needed which will ensure additional safety

IV. WORKING

When the ultrasonic blind stick encounters different obstacles in the path of blind person then depending upon the nature of obstacles data is sent to the microcontroller in the form of signal using different type of sensors. The microcontroller then processes this data and convert this signal into a electrical form. This electrical signal will sound a buzzer if the obstacle is close enough to the blind person and alert him.

V. CIRCUIT COMPONENTS

A. LDR

Light dependent resistor is simply a resistor whose resistance depends on the intensity of light and thus called photoresistor. It is special resistor made up of semiconductor materials such as sulphide. These resistors are mainly used when there is a need to sense the absence and presence of the light.

B. Buzzer

A buzzer is a audio signalling device which makes a buzzing or beeping noise A buzzer in a circuit is a kind of speaker. It can beep and make tones based on the frequency and voltage and these are usually pitches that are higher in frequency, not buzzing or low tones.

C. Ultrasonic Sensor

An ultrasonic sensor is an electrical component that measures the distance to an object using ultrasonic sound waves. Ultrasonic sensor works on Doppler effect. It consists of a supersonic transmitter and a receiver. The transmitter transmits the signal in one direction. This transmitted signal is then reflected back by the obstacle and received by the receiver. So, the total taken by the signal to induce transmitted and to received back are used to calculate the gap between the supersonic device and also the obstacle.

D. Water Sensor

A water sensor in an electronic sensor that is designed to detect the presence of water in the path of blind people and provide an alert in time to avoid chances of slipping of blind person

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E. IR Sensor

It is a simple electronic instrument which emits and detects IR radiation in order to detect the small size of obstacle in its range. IR sensors use infrared radiation of wavelength between 0.75 to 1000µm. After detecting the size of obstacle IR sensor send this signal to the microcontroller. Then microcontroller send the voice signal for the small obstacle available. Buzzer also enable at the same time to inform the blind person about the obstacle.

F. ESP8266

Esp8266 is a low cost wi-fi microchip, integration wireless SOCs. It is design for space and power constraint mobile platform designers. It provides function as stand-alone application with the lowest cost and minimal space requirement. It is self and Wi-Fi networking solution; it can be used to host the application or to offloading all Wi-Fi networking function from another application processor. It is chip with a built in 1 MB memory, allowing the design of single chip devices capable of connecting via Wi-Fi. It has to increase the performance of the system in such applications.

G. GPS and GSM System

GPS is a satellite navigation system used to determine the ground position of an object when GSM modem receiver message microcontroller will process the message keyword saved in it. Then, it will get the location of stick from the GPS modem and transmit the location to GSM modem to sender. GPS will update the location of stick and automatically save the location in Microcontroller.

If microcontroller receives the codeword from GSM modem, the microcontroller will track the last location from EPROM and transmitted to the GSM modem which will send digital message that states the location for person to required number.

If emergency button is pressed, microcontroller access the location from GPS modem and transmit location to GSM modem which will send SMS message to all saved numbers.

H. Arduino IDE

Arduino IDE is the IDE (Integrated Development Environment) developed by the Arduino Company to work on Arduino boards. The open-source Arduino Software (IDE) enable a user to write code and upload it to any Arduino boards Arduino IDE is easy-to-use coding software or we can say that it is a text processor with coding-specific functions

I. Mc Programming Language: C

C is a high-level and general-purpose programming language that is ideal for developing firmware or portable applications. C language is really popularly on Microcontrollers and embedded systems. C programming language is used for developing system applications that forms a major portion of operating systems such as Windows, UNIX and Linux. It is portable, a code written in C can be ported to run on other machine architectures relatively easily

VI. RESULT

When the obstacle is appeared in the range of Ultrasonic sensor, the information is shared to the microcontroller connected to it. The ability of a stick is that it can detect the obstacle in a straight path, right angle path and curved path. 1 metre width is provided for proper management of a Stick.

The microprocessor then converts the digital signal into the ana-log signal with the help of A/D converter and sends the signal to the buzzer.

The buzzer sounds differently as the distance between stick and obstacle decreases, the intensity becomes high. All the location coordinates are shared with the help of Wi-Fi module and RF sensor is used to find the Lost stick, whose receiver end is connected to microcontroller port.

A. Application

1) Utilizing is transmission line
2) Utilized in distribution line
3) Utilized in towns

B. Future Scope

Future work includes installation of additional sensors like accelerometers, PIR motion detector and the cane can be replaced by robotic arm which guides user.

By using the active RFID tags will transmit the location information automatically to the PCB unit, when the stick is in its range. The RFID sensor does not have to read it explicitly

C. Advantages

1) Smart blind stick beeps if user is next to the obstacle and save the blind person man from any type of obstacles.
2) Ultrasonic sensor can find distance between the obstacle and the blind person
3) Bulit in speakers help navigate through voice command
4) Ultrasonic blind stick also helpful in sending location of the blind person which is effectively done by the application of GSM and GPS module VII.
5) It has a good accuracy
6) This innovative stick can runs on Windows, Macintosh, Unix , Linux operating systems

VII. CONCLUSION

All the studies which had been reviewed show that there are multiple technique used in the formation of Ultrasonic Blind Stick. All have their own power consumption devices and as well contains different microcontroller. The technology does not remain same as it is improving day by day. The Literature paper related to this topic were reviewed. That's why we have shortlisted different useful equipment, that has to be added. As the distinguish elements are chosen that's why hardware assembling process will not be that easy. The main aim of our project was to obtain lighter weight. Hence we have used ESP8266 microcontroller. The advanced feature of ESP8266 is that, it can add more pins if required to connect more sensors and will also provide the future scope for the connection of Accelerometer and PIR motion detector. This will also help to decide the designing scenario. We would also connect two ultrasonic sensors at different height that will help the visually challenged person and detecting the object of every size. GPS technology is used to access the coordinates of person which is shared through the Wi-Fi module to it. GSM technology is also used to transfer a text message in case of emergency to the saved mobile number.

VIII. ACKNOWLEDGMENT

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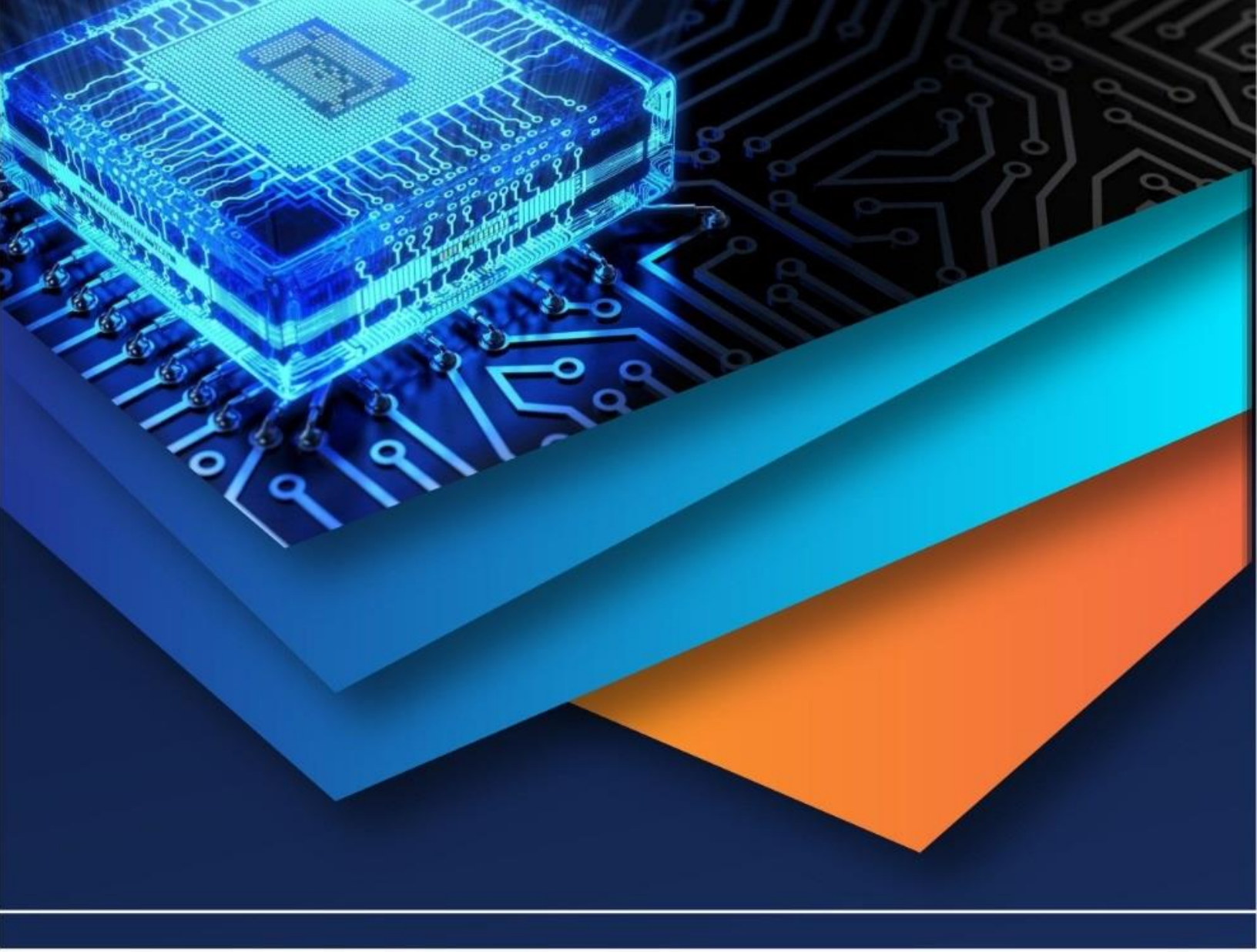

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