A ZigBee Based Security System for Supporting Children with Autism

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Abstract- ***Mention Human behavior monitoring system is a challenging task nowadays. Especially for children, it is difficult to analyze their behavior. There is no automatic smart technology used to find the lost child. An android application is developed to track the children. A ZigBee device is connected with the android user (Parent) and another device is paired with the child. Parent can track the child continuously; if the child is out of the Parent's range then a notification is sent to the Parent's device automatically. If the Parent cannot find the child, immediately the Parent can share the Child's device ID on the Social Networks. In - and - around people can also track the Child with the Device ID shared by the Parents if found in between. Once the Child is identified immediately location details are shared to the Parents so that the Child can be tracked and identified easily without mind boggling. If the child still could not be found, another option is to use the social site similar to face book, twitter, etc. created for this purpose. The parent posts the child device details along with the parent contact details. Many users who come across this information can use these details posted by the parent to track the child. If the user connects with the child's device, then the parent is alerted about the child details and the parent can easily find the child.***

Indexed Terms- ZigBee devices, Social networks, Monitoring system, Automatic smart technology separated by commas.

I. INTRODUCTION

Autism is one of five developmental disorders included under the umbrella of the Pervasive Developmental Disorders. [1.1].Autism affected children are described as living "in a world of their own". An android application is developed to interaction for the user with the devices connected. A ZigBee device is connected with the android user and another device is provided to the child. Both the devices are configured to provide constant connectivity. The child device keeps sending data to the parent's ZigBee which reads the data sent to it. When the parent's ZigBee reads a value indicating device disconnection, then an alert will be initiated to notify the parent of the disconnection. ZigBee is a wireless connectivity device which provides transmission of data to a longer distance as compared to Bluetooth. The ZigBee specification is proposed to be simpler and less expensive than Bluetooth and general wireless networking such as Wi-Fi. In this paper, ZigBee acts as an antenna that provides signal for connectivity with the child device which sends data. The received data from the child device is sent to the microcontroller board from the parent's ZigBee device. The controller board process the data received and displays the status of reading the data from the device. When the controller reads a data indicating that the device is out of range than an alert will be initiated- an audio alert will be played in the android device. A social website is also created where the parent can post the details of the lost child and the parent's contact information. Third persons using the website can track the child device. This helps the parent to easily find the child.

II. LITERATURE REVIEW

The system is developed from referring to many different ideas from which the concept of ZigBee is developed. The previous papers that were referred contain the concept of using Bluetooth neighbor discovery protocols. Bluetooth Low Energy (BLE) is

an emerging wireless technology developed by the Bluetooth Special Interest Group (SIG) for short-range communication [1]. Devices that use BLE for communication are normally powered by coin-cell batteries and it can be operated for months and even for years [2]. Although Bluetooth possessed many better qualities, it had a major disadvantage such that it cannot cover a larger area. Bluetooth consumes less energy, but do not cover a larger area as in ZigBee covers a larger area and consumes minimum energy. ZigBee could be the better option for it provides higher data rate and transmission range.

III. STUDIES ON ZIGBEE AND FINDINGS

Wireless Sensor Networks are being gradually introduced in different application scenarios. ZigBee is one of the most widely used transceiver standard in wireless sensor networks. ZigBee is a new Wireless sensor network technology based on the IEEE 802.15.4 standard. Its use in Wireless Sensor Networks (WSNs) has aroused a great interest in the research community and its deployment will be increasing in the near future [3]. ZigBee over IEEE 802.15.4, defines specifications for low data rate WPAN (LR-WPAN) to support low power monitoring and controlling devices. This paper presents a detailed study of ZigBee wireless standard, IEEE 802.15.4 specification, ZigBee device types, the protocol stack architecture and its applications [4].

ZigBee is an IEEE 802.15.4 based specification for a collection of high-level communication protocols used to build personal area networks with small, low-power digital radios, such as for medical device data collection, home automation etc. Hence, ZigBee is a low-power, high data rate, wireless ad hoc network. The ZigBee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or more general wireless networking such as Wi-Fi.

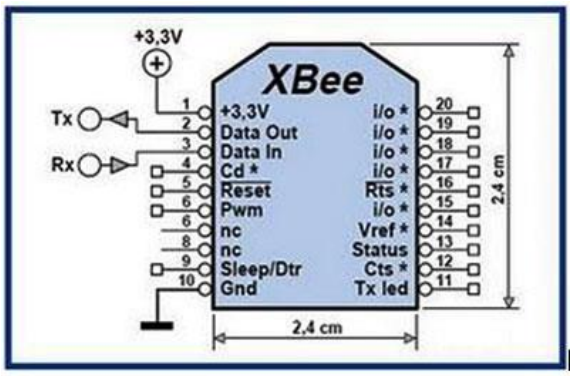

Fig.1 Circuit Diagram of ZIGBEE

Its low power consumption limits transmission distances to 10–100 meters' line-of-sight, depending on power output and environmental characteristics. ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones.

The aim is to provide a safety to the child and there are two approaches:

3.1 ZigBee Connectivity

3.2 How does a ZigBee communicate?

3.1 ZIGBEE CONNECTIVITY

An Android application will be developed which will be used to store the related information of the child with all physical data. A ZigBee device will be fitted with the Autistic child. This will send the communication to the parents' device. The parents can set the living space of the child as a threshold. As and when the child moves beyond the boundary of this threshold, without the notification of the parents, the ZigBee device attached with the child will communicate it to the Android device and the device will create an alarm or the ringtone in Order to make the parent a causing alarm. Under extreme conditions, if the child moves beyond the control of the parents, in such case, the information regarding the child such as the ZigBee device ID for the child to be identified and also the contact number details of the parent will be posted over the online social networking sites such as Facebook and Twitter. This will help the parents for early detection of the autistic child. ZigBee module contains an antenna part that helps the device to connect to all the nearby ZigBee devices. The child's ZigBee device Id is chosen from the connected ZigBee devices and the child is

tracked. The device covers a wider range of 100m and when the child crosses this range an alert would be sent to the Parent's android device through the android application. If the child comes back into the close proximity to the parent's device, then the alert would stop as the child and the parent's device connects. Connectivity of the devices ensures that the child is within the range of the parent. When the devices fail to connect, the parent is alerted to notify that the child may be out of range or lost. In this paper, ZigBee devices are configured to connect with the child and provide security measures against the child getting lost.

3.2 HOW DOES A ZIGBEE COMMUNICATE?

ZigBee system structure consists of three different types of devices such as ZigBee coordinator, Router and End device. Every ZigBee network must consist of at least one coordinator which acts as a root and bridge of the network. The coordinator is responsible for handling and storing the information while performing receiving and transmitting data operations.

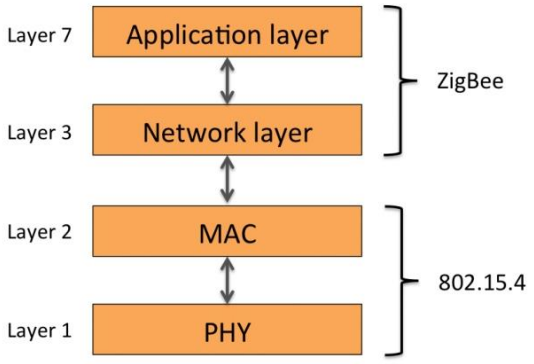

Fig: 2 ZIGBEE Protocol Layers

ZigBee routers act as intermediary devices that permit data to pass to and fro through them to other devices.

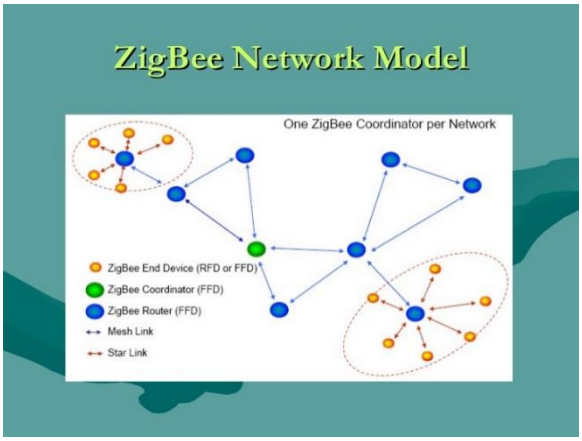

Fig 3: ZIGBEE Network Model

End devices have limited functionality to communicate with the parent nodes such that the battery power is saved. The number of routers, coordinators and end devices depends on the type of network such as star, tree and mesh networks

ZigBee protocol architecture consists of a stack of various layers where IEEE 802.15.4 is defined by physical and MAC layers while this protocol is completed by accumulating ZigBee's own network and application layers.

IV. SYSTEM DEISGN

The application is developed for monitoring the autistic child while moving outside home. ZigBee devices are connected to each other in the transmission network.

Fig 3: General Architecture of the System

One ZigBee is attached with the child and the other is attached with the parent. The child device is paired with the parent device as soon as it is switched on. When the parent and child devices are connected, the child's ZigBee begins to send a message that that informs the parent that the child is within the range of the parent. A ZigBee device covers a range of 100m

depending on the surrounding scenarios. If the child moves away from the parent and crosses the range, then another message indicating that the child's device is disconnected or that the child crossed the safe range of the parent. The PIC microcontroller receives the value sent from the ZigBee module and processes the value received. After processing the data received, the controller initiates the message to be displayed and the alert to be initiated on the android device. Another option for recovering the child is the social site on which the parent can post the child details along with the parent contact details. Any person who may come across this information can use the child's device ID and try to connect with the lost autistic child's ZigBee. If the third person connects with the child's ZigBee, then the parent will be informed about the child's whereabouts. This assists the parent to protect the child and easily recover the child, if lost.

V. SYSTEM IMPLEMENTATION

In this paper we are implementing the development of an android application is to interaction for the user with the devices connected. A ZigBee device is connected with the android user and another device is provided to the child. Both the devices are configured to provide constant connectivity. The child device keeps sending data to the parent's ZigBee which reads the data sent to it. When the parent's ZigBee reads a value indicating device disconnection, then an alert will be initiated to notify the parent. In this paper, we are also implementing another option for finding the child. If the parent still cannot find the child, they can use this option as last resort to find the child. A website is developed that would be similar to many social sites on which the child's details along with the child's device ID. Any person who may be using the website might come across this information and help find the child using their ZigBee and the application.

VI. RESULT

The goal is to develop a security measure to protect the autistic child while going out for any purpose. The effectiveness of this system is in keeping the child from getting lost and keeping the child within the parent's range. The aim of the paper is to continuously track the specially challenged (autistic) children. Parents cannot provide constant attention while going outside, this sometimes lead to the child getting lost. To overcome this problem, ZigBee device is used for connectivity with the child, and constantly monitor the location of the child. The paper aims to provide assistance to the parents of the autistic child by providing a tool that will help both the parent and the child. The main goal is to create a network transmission with the child that keeps the child in close proximity with the parent. The goal is to achieve a secure network for protecting the autistic child while travelling or outside the home premises. The result of this paper is an android application that helps the parent to monitor the autistic child while travelling and keep the child from missing through the assistance of ZigBee devices connectivity of the child and the parent. This helps the parent to travel outside home or even go to a shop, hospital or anywhere else with the child without getting worried.

VII. CONCLUSION

Autism is one of five developmental disorders included under the umbrella of the Pervasive Developmental Disorders. Autism is characterized by deficits in social interaction and communication, and unusual and repetitive behaviour. Autism affected children are described as living "in a world of their own". Many parents of the autistic child are struggling to travel places worrying that harm may come to the child, as the child may go far from the parent. To overcome this problem in this paper, we are developing an android application which helps to monitor the child through the use of ZigBee devices that would be attached with both child and the parent. At present, building a well-defined, manageable and well understood child monitoring application is the essential requirement to most of the parents of autistic children. Autistic child monitoring application is an effective approach to protect the child from getting lost, using ZigBee network devices. Even with the typical security measures for recovering the lost child such as the police complaints and applying posters on neighborhood areas, this protects the child from getting lost in the first place, if even lost by any reason, it also provides

the features to recover the lost child. It is feasible to develop the child monitoring application, as applications are commonly used worldwide as it has the advantage of constant availability and portability as it fits in the android device and provides interaction for the user with the devices. Moreover, it helps the parent to move outside home without getting worried. The application not only protects the child, but makes the parents life easier by taking over the monitoring process from the parent. Consequently, the target is on monitoring the child and keeping the child within the range of the parent within and outside home

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