Smart Stick for Blind People Using IOT (Internet of Things)

Harpreet Singh, V. B. Kirubanand

ABSTRACT: ***With the rapid increase in the domain of 10T (Internet of Things) day by day, whereas people acquire intelligence very quickly but at the same time people doesn't have time to help others and even helping others is thought to be a hectic task. In such a world where we don't have time for others, the people with disability are suffering the most. They are being alienated in the society. The most affected ones are the blind people. Blind people feel too much difficulty of navigation in their life. Blindness become a barrier in their life. As usual blind people used trained dogs and simple white stick for their navigation, but this method is not efficient to break the blindness barrier and also not so efficient to make blind people feel comfortable and live their life normally as normal people live. There are some existing methods available that offer help to the blind people in their navigation but that methods have some disadvantages. This paper analysed the existing solutions and proposes an entire new approach to solve such problems. Proposed approach not only overcomes the disadvantages of the existing approaches, but it is also reliable, cost efficient and easier for the blind people to use.***

Keywords: Blindness, YOLO algorithm, Obstacle detection, Navigation and smart system.

I. INTRODUCTION

According to the World Health Organization survey held on 11,october,2018 globally approximately 1.3 billion people live with some visual problem and approximately 36 million people are totally blind.

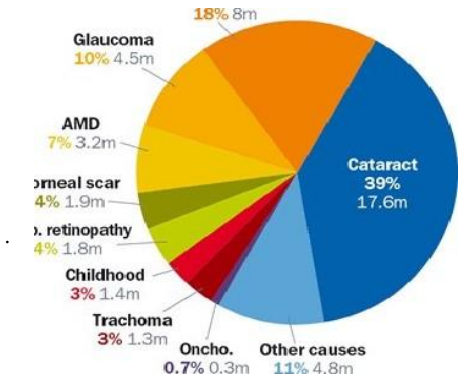

fig l. Cause of blindness.

A. IOT (Internet of Things)

Internet of Things (IOT) is a type of network in which various physical devices that contains electronics embedded in their architecture connected to the network and are able to communicate with each other and sense interactions amongst each other or with respect to the external environment.
Applications of 10T (Internet of Things):-

a. Smart Home
b. Wearable Things
c. Smart City
d. Smart Grid
e. Industrial Internet
f. Autonomous Car
g. Connected Health
h. Smart Retail
i. Smart Supply Chain
j. Smart Farming

B. Ultrasonic Sensor

Ultrasonic Sensor is very famous sensor to detect the obstacle. The sender which is attached to the sensor emits the ultrasonic wave which come back after collide by the obstacle and received by the receiver attached to the ultrasonic sensor. Ultrasonic Sensor calculate the distance of the object by calculating the time between the emission and receiving of ultrasonic waves by sender and receiver.
The distance can be calculated by formula given below:
Distance (D) 1/2 x (Twhere D is the distance, T is the time between the emitted and receiving ultrasonic wave and C is the sonic speed.(Final value is multiplied by the 1/2 because T is the time for go and return distance).

fig 2: Ultrasonic Sensor

C. GPS (Global Positioning System)

GPS (Global Positioning System) is a small electronic circuit that can be attached to the Arduino board to get the position and altitude as well as speed, date and time on UTC (Universal Time Coordinated).

Revised Version Manuscript Received on 25 March, 2019.
Harpreet Singh, Department of Computer Science, CHRIST [Deemed to be University], Bengaluru-560029
V. B. Kirubanand, Associate Professor, Department of Computer Science, CHRIST [Deemed to be University], Bengaluru-560029

GPS follows the NMEA (National Marine Electronic Association) protocol to transmit the data.

fig 3: GPS module

D. GSM (G1oba1 System for MobileCommunication)

As name suggests GSM stands for Global System for Mobile Communication, is a mobile communication modem. Arduino GSM field library enables the Arduino board to do various operation like place or receive the call, send or receive the call.

fig 4: GSM module

E. Regional Based Convolutional Neural Network [RCNN] Algorithm

According to the RCNN algorithm bench of boxes spread in the image and tried to find any object in that boxes or not. Selective search is used by the RCNN algorithm to remove the boxes. There are four regions that form the object: varying scales, colours, textures and enclosure. Selective search first finds these pattern on the image then proposes the selective region.

Steps shows how selective search happened:

Step l: It takes an image as an input.

fig 5: Input Image

Step 2: For the multiple regions on the input image it generates initial sub-segmentation for that.

fig 6: Initial Sub-segmentations of picture

Step 3: Now based upon the colour similarity, texture similarity, size similarity or shape compatibility similar regions are combined together to form a larger region.

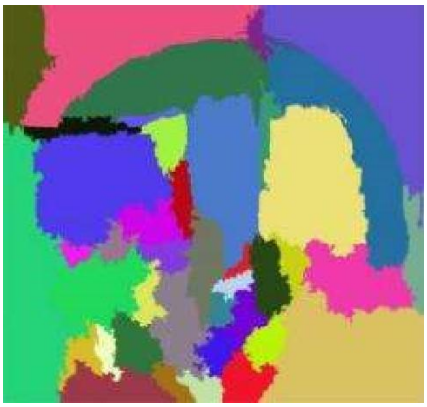

fig 7: larger regions image

Step 4: So finally these larger regions produce the location of the final object.

F. YOLO Algorithm

YOLO algorithm is one of the real time object detection algorithm. YOLO algorithm is more efficient from the RCNN algorithm. YOLO algorithm requires training data for analysis the object. The data should in terms of images.

YOLO algorithm divides the image into S X S grid and each grid assume as a one object.

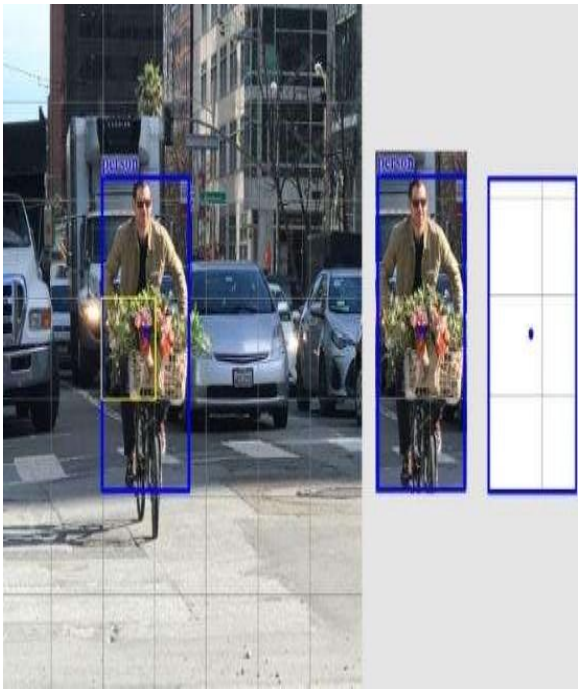

fig 8: multiple grid images

You Look Only Once (YOLO algorithm) uses 7x7 grids (S><S), 2 boundary boxes (B) and 20 classes (C).

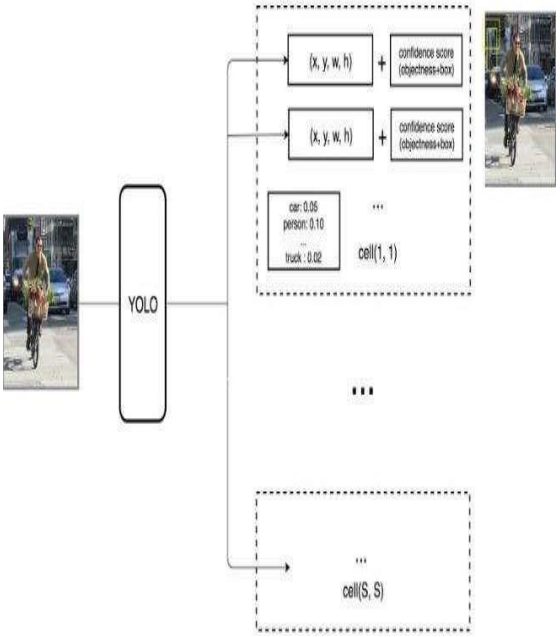

fig 9: working of YOLO algorithm

Every limit box contains 5 components: (x, y, w, h) and a case certainty score. The certainty score reflects how likely the container contains a protest (objectless) and how exact is the limit box. We standardize the bouncing box width w and stature h by the picture width and tallness. x and y are counterbalances to the relating cell. Henceforth, x, y, w and h are all somewhere in the range of 0 and l. Every cell has 20 contingent class probabilities. The contingent class likelihood is the likelihood that the recognized question has a place with a specific class (one likelihood for each classification for every cell). Along these lines, YOLO's expectation has a state of (S, S, Bx5 + C) - (7, 7, + 20) - (7, 7, 30).

CNN network is built by YOLO to predict a (7,7,30) tensor. It utilizes a CNN system to decrease the spatial measurement to with 1024 yield channels at every area. YOLO plays out a direct relapse utilizing two completely associated layers to make limit box expectations (the centre picture beneath). To make a last forecast, we keep those with high box certainty scores (more prominent than 0.25) as our last expectations (the correct picture).

The class certainty score for every forecast box is processed as:

class certainty score—box conference score x conditional class probability

Network Design:

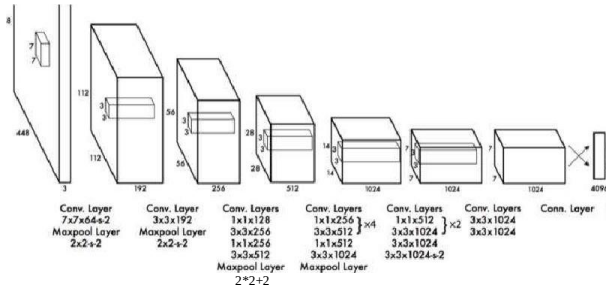

fig 10: Network Design

II. RELATED WORK

Many researchers come to improve the existing works of smart stick for blind people and many of them give the constructed projects. Some of the projects listed given below:

A. Mobility aid for blind people:

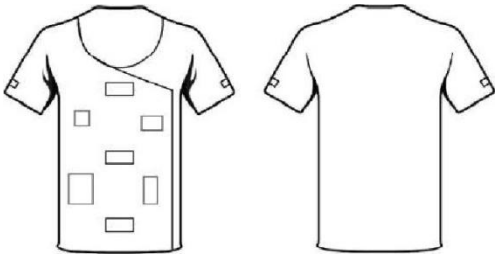

Fig 11: Smart Jacket Proposed

Smart Jacket using sensors project proposed in the year of 2015's to detect the obstacle in front of the blind people. The Proposed system uses jacket, ultrasonic sensor and microcontroller to detect the obstacles. According to the Proposed System Ultrasonic sensor detects the obstacle and inform to the user through that there is obstacle in front of in them. This Proposed System has some drawbacks. First the proposed system is applicable inside the campus only. Secondly, Speaker is used to inform the information of the obstacle to the user which is annoying because everyone can listen or disturb.

B. Blinder: An Invisible Eye for The Blind People.

fig 12: Blind Stick

The Proposed system proposed in the 2017's. The Author introduced the proposed system which includes ultrasonic sensor, gas detector sensor mounted on the stick which detects the obstacle in front of the blind people and it informs to the user by vibrating the band which is wear on the user's hand. Secondly, after every 20 MS the location of the user is updated on the clouds using GPS (Global Positioning System). Gas Sensor is used to detect the fire. One drawback in this proposed system is that it only detects the obstacle and inform to the user.

Working of proposed method:

One ultrasonic sensor is placed on the servo motor and servo motor is attached to the raspberry pi board. Servo motor rotates the ultrasonic senor 180 degree.

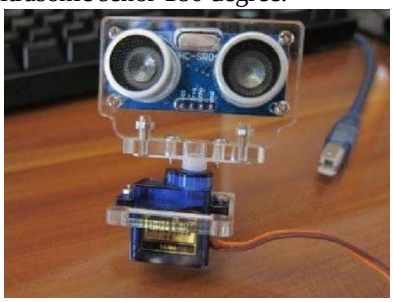

fig 13: servo motor with ultrasonic sensor

So all the objects which is in range of 180 degrees is detect by the ultrasonic sensor. To overcome the drawback of existing methods servo motor is used because according to the existing proposed system only those obstacle is detected which is in front of the ultrasonic sensor. See in fig 13.

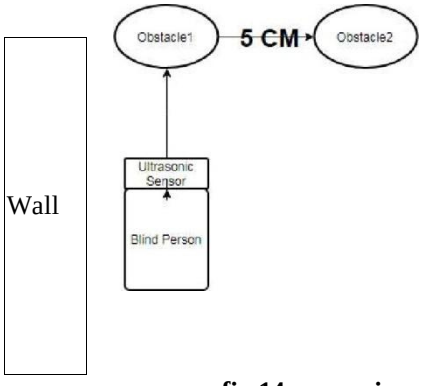

fig 14: scenario

From fig 13. there are two obstacles in front of the user and distance between these two obstacles are 5cm and blind person in front of the obstacle so according to the existing proposed system only obstacle is detected so blind person moves to right because on left side there is wall. After moving right if the obstacle2 is in front of the blind person then only it detects suppose blind person moves 2cm to its right side so according to the ultrasonic sensor no obstacle is detected but when blind person starts moving to its front, there is a possibility of clash of obstacle2 and the blind person. To overcome this drawback servo motor is used. In same scenario both the obstacles are detected and we can find the angle between them and compared with the threshold angle if the calculating angle is bigger than the threshold angle then user can pass through between the obstacles because the distance between the obstacles is more.

2. After obstacle is detected the camera which is attached to the raspberry pi board click the photo of obstacle and send to the YOLO algorithm which is used to detect the real time obstacle. The output of the YOLO algorithm sends to the Google Text-To-Speech API which converts text to voice and then final voice as a output send to the blind person and blind person can hear the voice using earphones which is connected to the raspberry pi B. The YOLO algorithm not only detect the obstacle but also tells whether the obstacle is dog, person, car or some other obstacle depending upon the training set. Example output of YOLO algorithm be like given below:

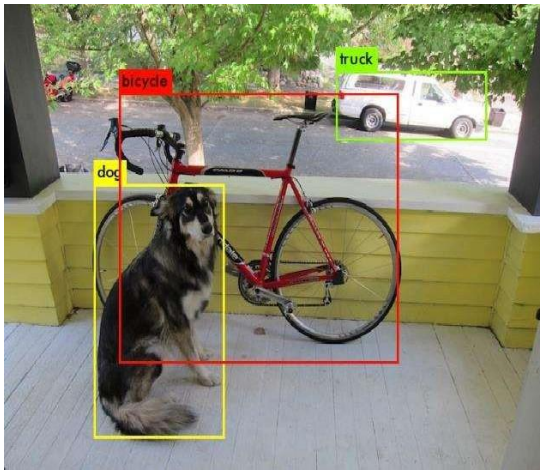

fig 15: object detected by YOLO algorithm

their near ones they can share using GPS (Global Positioning System) module just clicking one switch which is mounted on the stick. The location sends by phone message to their near ones and the destination phone number is taken from the GSM module where destination phone number saved in it.

III. BLOCK DIAGRAM

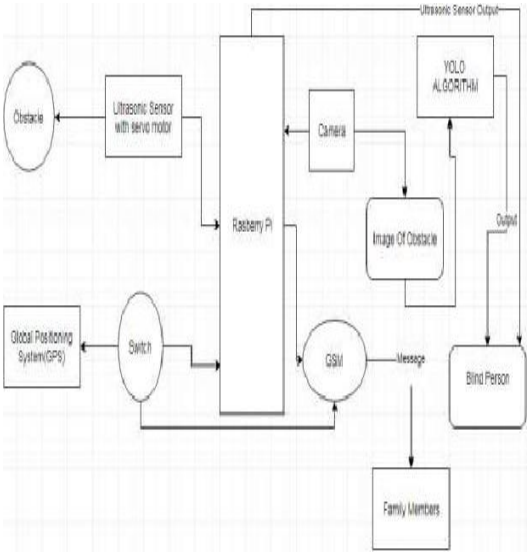

fig 16: block diagram

IV. CONCLUSION

This research work concludes that navigation of blind person using YOLO algorithm with object detectable sensors become more efficient than the existing methods. GPS tracking is also one other feature in smart stick and cost of the stick is also considered keeping in mind of various blind person. Future work is to make detection of obstacle more efficient and fast.

ACKNOWLEDGEMENT

The author honestly thanks to the research guider for their continued support and motivation.

REFERENCES

1. B S Sourab Ranganatha Chakarvarthi and SachithD'Souza, Design and implementation of Mobility Aid for bind people, International Conference on Power and Advanced Control Engineering (ICPACE), Pages: 290294, 2015.
2. Zeeshan Saquib, Vishakha Murari and Suhas N Bhargav, BlinDar: An invisible eye for the blind people, IEEE International Conference On Recent Trends in Electronics Information & Communication Technology, Pages: 71-75, 2017.
3. Radhika R, Payal G Pai, Rakshitha S, Rampur Srinath, Implementation of Smart Stick for Obstacle Detection and Navigation, International Journal of Latest Research in Engineering and Technology (IJLRET), Pages: 45-50, 2016.
4. Ayat Nada, Samia Mashelly, Mahmoud A. Fakhr and Ahmed F. Seddik, Effective Fast Response Smart Stick for Blind People, Pages: 1-7.
5. G. Gayathri, M.Vishnupriya, R.Nandhini, Ms.M.Banupriya, Smart Walking Stick For Visually Impaired, International Journal Of Engineering And Computer Science, Pages: 4057-4061, 2014.
6. [6] Ayat Nada, Samia Mashelly, Mahmoud A. Fakhr and Ahmed F. Seddik, Effective Fast Response Smart Stick for Blind People, Pages: 1-7.
7. G. Gayathri, M.Vishnupriya, R.Nandhini, Ms.M.Banupriya, Smart Walking Stick For Visually Impaired, International Journal Of Engineering And Computer Science, Pages: 4057-4061, 2014.
8. Mohd Helmy Abd Wahab, Amirul A. Talib,Herdawatie A.Kadir, Ayob Johari, A.Noraziah, Roslina M.Sidek and Ariffin A.Mutalib, Smart Cane: Assistive Cane For Visually Impaired People, Intemational Journal Of Computer Science, Pages: 21-27, July 2011.
9. Manikandan Shanmugam, John Victor, Mayank Gupta and K.Saravanakumar, Smart Stick For Blind People, International Journal Of Trend in Research and Development, Pages: 30-32, March 2, 2017.
10. Manikandan Shanmugam, John Victor, Mayank Gupta and K.Saravanakumar, Smart Stick For Blind People, International Journal Of Trend in Research and Development, Pages: 30-32, March 2, 2017.
11. Rohit Sheth, Surabhi Rajendkar, Shalaka Laddha Rahul Chaudari, Smart White Cane- An Elegant and Economic Walking Aid, American Journal of Engineering Research, Pages: 84-89, 2014

AUTHORS PROFILE

Harpreet Singh, PursuingMCA (4TH Semester) from CHRIST (Deemed to be University), BSc (Electronics), GGM Science College, Jammu 2015.

Dr. Kirubanand V B,PhD, Anna University 2013, MPhil, Periyar University,2007, PGDBA Annamalai University 2002,MCA, Bharathiar University 1996,BSc, Bharathiar University, 1993. Currently working as the Assosciate Professor in the Department of Computer Sciences, CHRIST (Deemed to be University).