Automated Hospital Management System implementing IOT and self-travelling robot using Image Processing and RFID Technology

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Abstract: ***This paper exhibits an astute Automated Hospital Ward Management System (AHWMS) in view of a robot for an emergency clinic ward. The need of a robotized framework including a helping robot and a linked data base (for real time updates) for performing exercises in the medical clinic framework is of extraordinary significance for specialists, attendants, patients and other social insurance collaborators because of requesting remaining task at hand and set number of work force. The point of this undertaking is to endeavor to effectively make and give a computerized versatile robot to enhance the viability of ward management, medication management and its distribution. This paper connects us with the database along with the help of remote system to accomplish previously mentioned errands along with assistance of controlling, image processing and handling. Confirmation of the framework should be possible with the assistance of recreation and physical demonstrating of a few units to demonstrate its utilization can enhance the adequacy of the present clinic ward the board framework.***

Index Terms: Image Processing, RFID Tag, Arduino, Python

I. INTRODUCTION

Introduction of portable robots that are known has mobile robots have shown an enormous growth in the field and have been developed at a very fast rate.

We know about two bots Care-o-bot [1] and Skillgent [2] which are currently being used for servicing. The use of these robots can be implemented in hospital ward where they can reduce the amount of labor. Even after implementing them we can't completely eradicate the humans as these robots are fixed for their own work and can't complete activiti9es performed by other counter parts. The parts used on the robots are designed for their specific use only. Not only this but the robot is denied communication access with hospital servers. In the field of health care, RFID technology assists in reducing the cost and also assists in facilitating autonomous living with the help of personal identification cards such as portable devices such as PDA. [3]

Currently people are pursuing research in maintaining a database which contains all information about the patient in one single space. It has been highlighted as one of the major works of the century. Configuring a way to store the health records has been considered as red priority in the field of scientific research al around the world and has been accepted by various communities., the idea is to integrate all different institutional data in one single database so that it can be used by anyone, hence assist people in pursuin g their research in the field of medicines. A software named HealthCare Record System(HIS) allows the computer to manage the clinical records without any problems or flaws. The computing has been very easy with the introduction of HIS. HIS also allows to access record services and also traction control. [4]

iWARD is a complex system that uses the concept of swarm robotics for checking popularity, attendance or even used for cleaning purposes. The same can be used for delivering items within the hospital boundaries. The software used to code the given module consists of basic programming languages such as C and C++. The robot also makes use of Open CV that is used for image processing applications. The operating system used for testing the software was Linux as it is an open source software and allows us to access feature that are denied to us by other operating systems such as windows. We decided to continuously monitor the Heart Rate, ECG, blood press and temperature of the body at all instants so that any deviation in the normal parameters may be reported instantaneously. The sensors are attached to the body that are working all along and are insulated to prevent humans from receiving any types of shock. The image processing of the system is carried out with the help of a 1 Dimension laser that is used to detect the surrounding of the patient or we can say that it detects the RGB values all around the proximity where the patient lies. All the processing done by the sensor and image processing are managed by the, machine hassle free. The machine was designed after consulting various health experts as well as doctors that declared the machine fit to serve in the hospital environment and the machine proved out to be a great, model that can embrace the future. Another implementation of the machine was the inclusion of 3-dimensional laser and changing the existing camera with a digital camera with high clarity and quality including Pan-Tilt-Zoom camera which I further used in detecting modules. This further assisted us in gathering more information about the patient and also the algorithm used for the same. The robotics involved will surely prove to be a great success as it will assist emerging scientists to include the same processing algorithms for various hospitals worldwide. [5-8]

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Another study stated reports of a robot which was stated sensible. It was known as ISHR. The main aim of the robot IHSR was to embrace human living conditions medically and assist them in creating a clean environment all around. The robot also consisted of the navigation system, which allowed to traverse autonomously and plot it's own idea on direction planning. The model also incorporated image processing which assisted the bot obstacle avoidance. The camera used was a CCD digital camera with attachments that allowed to conduct various conclusions such as degerming the upcoming barriers in the path. A total of 9 ultrasonic sensors are connected in the circuitry at the IHSR in order to increase the efficiency of obstacle free avoidance so that the robot can move without tumbling. The algorithm proposed to avoid obstacles was based on fuzzy logic that could create a collision free system which can be navigated easily. [9-11]

RFID converts radio waves so that it can be automatically understood by the human beings. It can also be identified by items from a few inches or feet depending on the range of the device.

RFID technology use computerized facts seize system which allows in growingmachine performance. aggregate of module and card reader is used for the detection of the specified identity possessed by the card owner..[12]

A Database which can be accessed remotely and updated on real time is known as Real-time Database. Google firebase uses JSON format for storing data i.e. the output will be visible in JSON format instead of a tabular output. [13]

IOT known a s Internet of things is the most widespread technology along with machine learning in todays world. Inclusion of IOT in life has made it easy for us to live as it allows to access anything remotely without moving that assist in competition of work without much effort. IoT allows us tio attach various sensors and see their real time application which can s=be seen in various devices used by us in our day to day lives.[14]

The MCU is assigned to be as one of the most learning software platform with respect to the combination of ESP8266 and Node MCU firmware.[15]

Robot car controlled by Wi-Fi makes work much more easier as we can make the robot move as we need by just a single movement on computer. In near future we can see such designs getting too common and being used extensively for household purposes[16]

II. METHODOLOGY

A microprocess Raspberry Pi is used, it is stated as small-sized computer which can be powered with the help of Broadcom BCM2835 system-on-a-chip (SoC). It has a RAM of 256MB in a package named POP above the SoC.

Image processing is the technique used for perfuming some mathematical functions and operations on an picture, photographs or video. The output that we get after picture processing is a set of parameters or some altered photograph, pix or films.

Idea revolves around making a robot that can be used instead of nurses in order to reduce error and labor in hospitals. The initial idea was to incorporate image processing in the robot that would assist in gaining knowledge about the disease of the patient. Each patient will be allowed different tag based on their diseases and the robot will detect the sign and provide the details on the screen displayed in the hospitals. Google Firebase has been used as a database which is secured by google. The real time database is used to store medicines for respective disease in the hospital. The image processing model will be able to detect images from far away location that assist in increasing the efficiency as well as the productivity of the robot. If given a database for people faces, the same concept can be incorporated in the paper by supplying medicines after matching the faces instead of the tag which surely can come into existence provided data is supplied by the hospital authorities. NodeMCU is an IOT platform which is open sourced. NodeMCU has an inbuilt chip ESP8266 which acts as a Wi-Fi module. It is cheaper as compared to Raspberry PI but can be used to upload and extract data online without any difficulties.

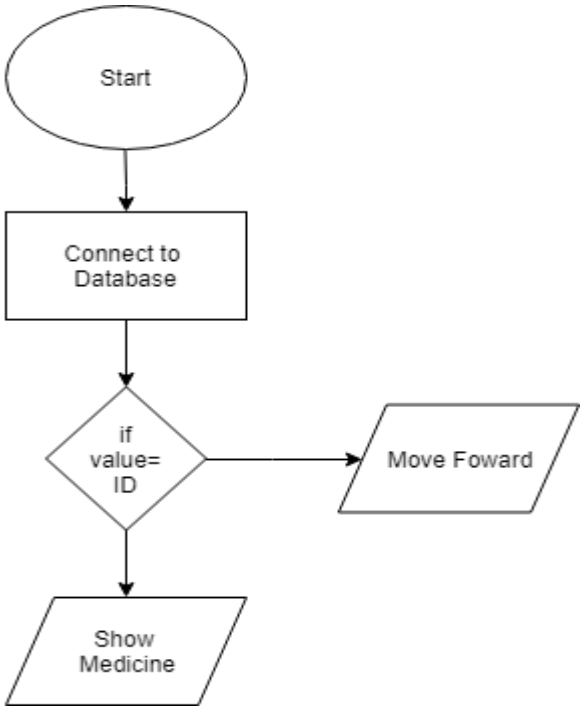

Figure 1 Raspberry Pi Model Flowchart

NodeMCU works on MQTT protocol for attaining cloud connectivity. MQTT is a machine to machine /"internet of things" protocol used for connectivity. The design is such that it is intensively lightweight put up/subscribe messaging shipping. it is useful for various purposes such as connections with remote places wherein a small code footprint is needed and/or network bandwidth is at a top class.

The RC522 is RFID Module which makes use of advanced modulation and demodulation concept. It is fully supplied in all forms of 13.56MHz passive non-contact conversation protocols. A RFID works on the principle of electromagnetic waves. Each RFID card is allotted a specific number which can be read or be altered if brought closer to the RFID tags. When an RFID tag is brought in proximity of the module,

electromagnetic waves are induced in between the tag and module due to which transmission of data occurs. The model presented includes a RFID module attached to the robot which moves in various direction and detect the presence of a RFID tag. As soon as it detects a card the process of data transfer behind. The robot is designed to read the tag and open the respective database for the same which will be displayed on the screen. The RFID Tag can also be used as an id card which will assist in locating the patient inside the hospital premises.

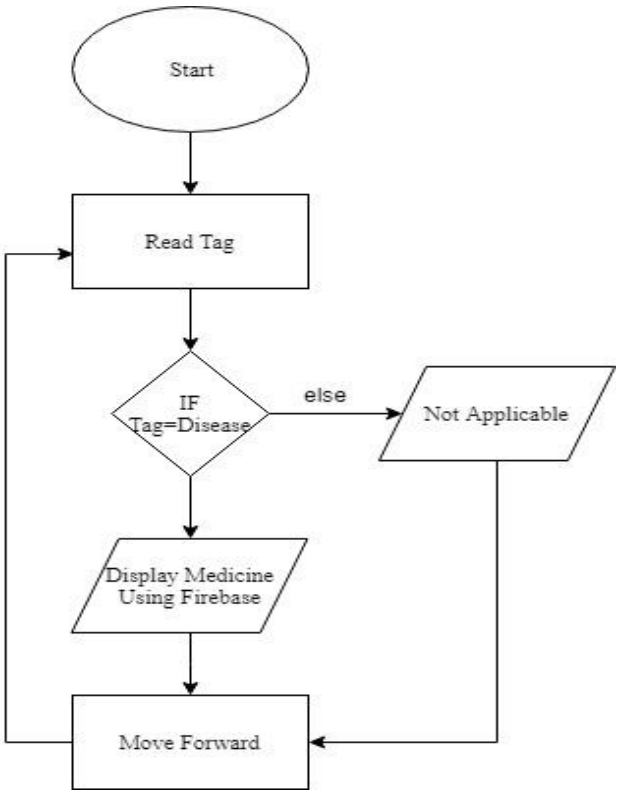

Figure 2 NodeMCU Model

The database is made in such a manner that it can store patient's history that can be used by the doctor for prescribing medicines in the future. The database will assist in learning about patient's allergy and prevent repetition of the allergic medicine in the future.

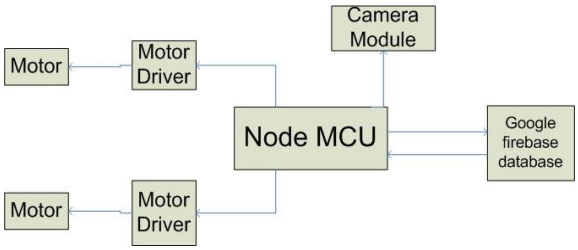

Figure 3 Block Diagram

The movement of the robot will be based on the H- bridge concept. Our motor driver works on the same concept. According to H bridge there are different situations divided for the movement of the car which assist us in setting the motion of the car as per our required destination. The movement is different in both the models.

The raspberry Pi model will be able to traverse various path as image detection is possible from long distances but in case of the second module i.e. NodeMCU model we need to move closer to the tag as the EM wave communication for the model used has low range connectivity. So in order to get better efficiency of the NodeMCU model we designed it in such a manner that it will follow a straight path without and deviations in the way so that it can read the cards without any difficulty. The same prototype can be interfaced with a line follower that will follow the line and follow that path as per the users need which can be manipulated as per the demand. Inclusion of such technology makes a better and efficient product to be used in the technological market.

III. SIMULATION

Figure 4 Number Plate Detection

The picture of the vehicle is captured the use of a excessive-resolution photographic digicam. A better preference is an Infrared (IR) digicam. The digicam may be rolled and pitched with admire to the license plates. character reputation is commonly very sensitive to the skew. The readable characters can come to be distorted due to the obliqueness of the camera. using a better digicam with greater definition and resolution will growth the fulfillment ratio of the system.

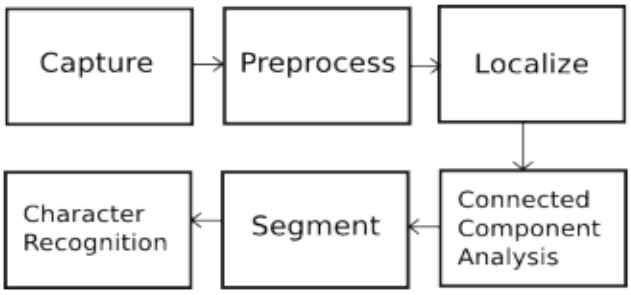

Figure 5 Image Processing Process

A set of algorithms are used to together on the photograph to embrace the quality of the same, the process used here is defined as preprocessing. It's miles a crucial and common place phase in any laptop imaginative and prescient gadget. For the prevailing gadget preprocessing entails techniques: Resize – The photograph duration from the camera is probably huge and may power the device sluggish. The size need to varied to convert it into a viable thing. Huge variety of channels inform us about the quantity coloration details which are available on the picture. The picture is to be converted into another format i.e. grayscale.

Rear or the front a part of the vehicle is captured into an picture. The image definitely consists of different parts of the car and the environment, which might be of no requirement to the system. The vicinity inside the image that interests us is the registration code and needs to be localized from the noise. Localization is basically a technique of binarizing the image. There are two motivations for this operation – 1. Highlighting characters and a pair of. Suppressing historical past. Localization is executed by means of an picture processing technique known as Thresholding. The pixels of the photo are truncated to 2 values relying upon the fee of the brink. Threshold requires pre-picture analysis for figuring out the perfect threshold fee. Adaptive thresholding method determines a local optimal threshold value for every picture pixel so that it will avoid the trouble originating from non-uniform illumination.

One can do away with undesired picture regions, a connected issue algorithm is first applied to the binarized plate candidate. related issue evaluation is achieved to become aware of the characters inside the image. simple concept is to traverse via the photo and discover the connected pixels. each of the related components (blobs) are labelled and extracted.

Segmentation is the procedure of cropping out the labelled blobs. these blobs are anticipated to be the specified portion of the license variety.

Finally, the chosen blobs are ship to a Optical character recognition (OCR) Engine, which returns the ASCII of the license quantity.

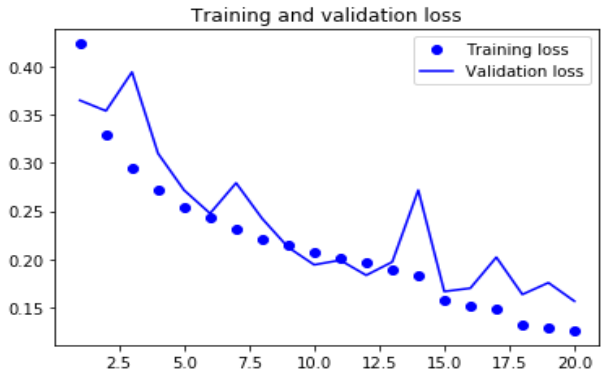

Figure 6 Graph I

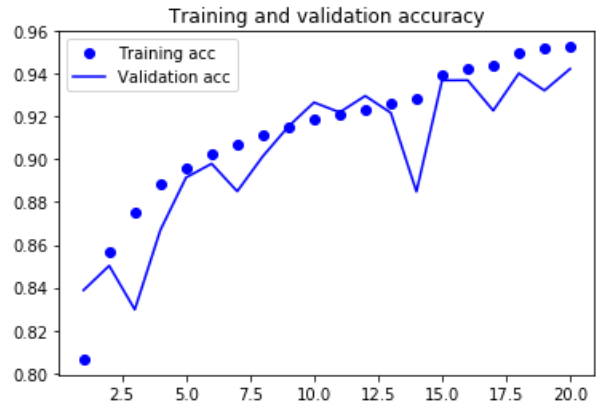

Figure 7 Graph II

Image Processing forms and important part of the paper. On the entirety, Image processing is used in the following elaborate ways:

- Determining the bed identification, with a unique number plate with a unique code assigned to every bed.
- Prediction Algorithms, especially logistic regression and Random Forests have been deployed to detect quantities of medicine needed for the future and categorical classification in terms of illness.
- The above graphs, [1 2] have proven to show the accuracy of our models.
- Fig. [1] shows the variation of loss for detecting an image plate. It is well established from the figure that the accuracy increases over time, which implies the accurate working of the model.
- Fig. [2] shows the categorical loss for illness classification which is decreasing over time.

IV. Experimental Results

Two different models have been used for the paper. These can be majorly classified into two different components on the basis of its core i.e.

- Microcontroller (NodeMCU)
- Microprocessor (Raspberry PI)

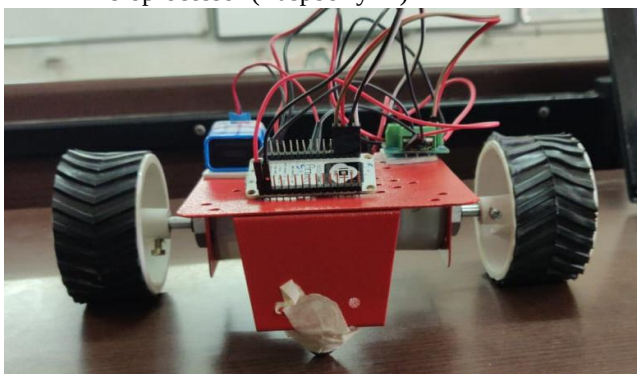

Figure 8 Hardware

Both the components have inbuilt Wi-Fi module which can be used to connect to a network without any difficulties.

The first model includes NodeMCU, RFID Tag, RFID Detector, DC Motors, Chassis and breadboard wires. NodeMCU is the microcontroller which is responsible for the working of the robot. RFID detector is interfaced with NodeMCU which detects the tag and feeds the value to the microcontroller which further opens the respective patient's database.

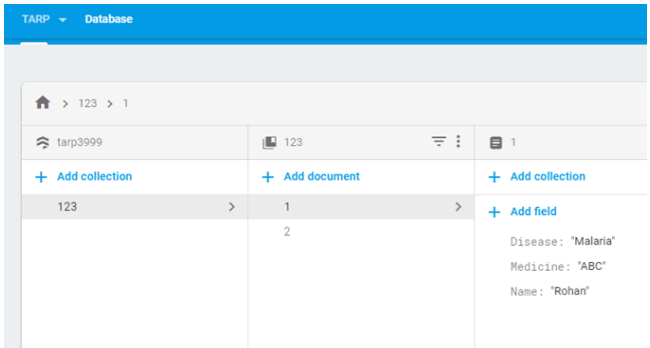

Figure 9 Google Firebase Display

The second model includes Raspberry Pi, Camera module, DC Motors, Chassis and breadboard. The camera module is interfaced with the microprocessor Raspberry Pi which detects the value written on the tag with the assistance of algorithms and libraries which are provided by OpenCv for implementing image processing, now the value is matched with the available database and if the value is matched, we open the corresponding database.
The database consists of different documents, each patient has a separate document which can be updated as per our will. The data is preserved and can be used as per our requirement.

V. CONCLUSION

Our automated health facility control machine stands apart from existing models and proves our approach as well as the effectiveness of the idea stated by us which is used in implementation as a dependable green approach for hospitals all across the world which majorly focuses on developing areas. The bot has reduced the time taken to reveal sufferers and additionally the nurse necessities of the hospital. As an end result now not simplest time is stored, but additionally it is greater monetary for the clinic management to characteristic to this manner. Human mistakes have been reduced due to the utility of picture Processing and RFID modules. the overall device is powerful in phrases of performance because of customizable additives and clean upgradeability because of the usage of numerous open platforms. Google Firebase presents a real time database containing the scientific statistics of all the sufferers. With the assist of IoT and on-line database we're capable of create this kind of rapid and efficient method of medical institution management which increases accuracy and reduces the time taken to deliver drug treatments to patients in a ward.

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