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Improving patients health-care using IoT

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Abstract - *The increasing development in the technologies related to Internet of things (IoT) is making possible the connection and communication of various smart devices together using the Internet and hence offering more data interoperability for application purpose. IoT has found its applications in various fields such as home automation, industries, city automation, pollution monitoring, traffic monitoring and many more. Among the never ending list of applications that are enabled by the Internet of Things (IoT), smart and automated health care is a highly important one as it can have a great impact and save and improve a lot of lives.*

Key Words: **Automated health care system, IOT(Internet of Things),Arduino Uno, UR(Ultrasonic) sensor, IR(Infrared), Proximity sensor, LED (Light Emitting Diode).**

1. INTRODUCTION

This paper aims to implement Smart Healthcare System using Ultrasonic sensor and IR proximity sensor in the hospitals and the existing healthcare systems. The two sensors are used for two different purposes and hence my system performs two different functions at once. The system uses Arduino Uno for the connection of the sensors and the overall implementation of the system. The data gathered by the two sensors is sent to the server immediately which will be handled by the admin and accordingly required action can be taken by the staff.

Input: The level of the IV fluid bottle which is calculated using the UR sensor which sends a sound wave and records the time taken through which the distance is calculated.

Processing: By knowing the time taken by the wave to come back, the distance can be calculated using the formula Distance = Speed * Time, the speed is fixed 334~340 m/s.

Output: The level of IV fluid, when to replace, will be automated instead of manually checking each patient's bed by which the manpower is reduced and also the wages will get reduced which will be profitable for the organization.

The device uses the ultrasonic sensor. It is a device which is used to measure the distance to a specific object by using the concept of sound waves. It measures the distance by emitting a sound wave at a fixed frequency and listening for the wave to bounce back after hitting the obstacle. It then records the elapsed time between the generation and the bouncing back of the sound waves and hence calculates the distance between the sensor and the object. The sensor has two openings in the front. One opening emits the ultrasonic waves like a tiny speaker and the other opening receives the waves like a microphone. It uses the following formula – (time x speed of sound)/2.

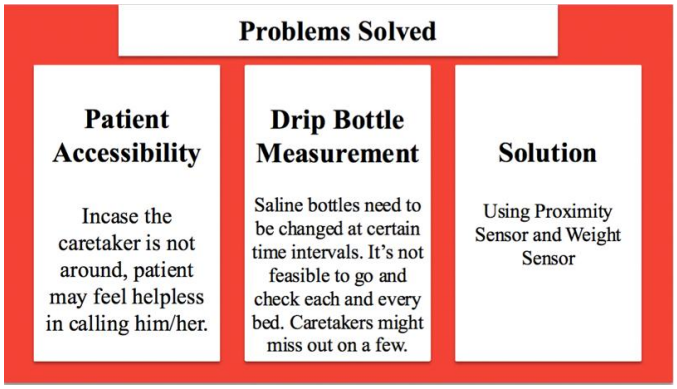

Fig -1: Problems that can be solved using my IoT device.

The device also uses the IR proximity sensor. An IR proximity sensor is used for the detection of the presence of close objects without any physical contact. It transmits an electromagnetic field or beam of infrared radiation and senses for the variations in the return signal. The object sensed by the sensor is called as the sensor's target. The maximum distance that can be detected by the sensor is called as nominal range. Most of these sensors are able to adjust the nominal range according to the application. They have high reliability and long lasting life due to the absence of physical contact and mechanical parts. An IR proximity sensor which is adjusted to a very short range can be used as a touch switch which is the case in this implementation.

The implemented model has dual functions. The UR sensor which is used to measure the distance between object can be adjusted in the glucose drip which is given to patients in the hospitals. Most of the time patients are left unattended and there is no glucose drip left for them. Hence the UR sensor will able to measure the distance of the glucose solution from the base of the bottle and will accordingly notify the main server the position of the glucose in the drip by which proper action can be taken whenever necessary.

The second function is carried out by the IR proximity sensor. The IR proximity sensor which senses the presence of an object can be used as a patient alarm system. The patient can simply put his hand over the sensor or can even

touch the sensor by which the sensor will gather the data and respond to the main server by which the staff will be notified of the patients' alarm and can take proper action.

2. LITERATURE REVIEW

[1] Automated Hospital Management System By Ogbobe Nkechi Agnes (Pg/M.Eng/08/49328) suggested that information and great quality data is required by each participate association, establishment or government organization to work adequately. Information gathered from different hotspots for instance phone, fax, verbal messages. This venture in this way goes for building up an enhanced healing facility data administration framework utilizing a capacity situated outline. The poor proficiency of the present manual administration framework in doctor's facilities today comes about because of the over the top period of time it takes to scan for and find tolerant organizers and the insufficient filling framework received. In this undertaking the Oracle database is the database server where the information is sent to and recovered from while Active Server Pages (.net programming dialect) is the customer which gives the UI plan and the structures utilized by the specialists, staff and attendants amid organization in the workplace, lab, wards, drug store, X-beam etc.

[2] "Study on information system of health care services management in hospital" This paper proposes HSMS (Hospital Services Management System) which goes for enhancing nature of administrations, distinguishing cost decrease regions, examinations and assess/rate heath mind administrations.The capacity to assess the administrations encourages doctor's facility accomplish higher Customer fulfilment scores and get a focused edge against those Hospital which scoreless or utilize HIS and don't have methods for advancing the nature of their administration.

[3] "A hospital resource and patient management system based on real-time data capture and intelligent decision making" Suggested that of the real difficulties existing healing facility administration frameworks confront is around operational productivity and hold up times between various procedures, divisions, and people. This paper features such constraints of existing frameworks and proposes a RFID (Radio Frequency ID) and remote sensor based, area and data administration system that encourages continuous following of clinic resources, staff, and patients as they travel through pre-set strategies as a component of day by day exercises of the hospital. The framework covers the visual reproduction and giving the capacity to examine the progressing tasks so they can be adjusted to accomplish expanded process productivity and administration levels.

[4] Studies indicated that addressing user expectation is a distinct element to ensure the successful adoption of the HMS (Farzandipour, Sadoughi and Meidani, 2010) showed that doctor's facility Management System (mechanized) is progressively turning into a developing device in social insurance field to proficiently empower conveyance of great wellbeing administrations. These frameworks have expansive mechanized information bases proposed fundamentally for correspondence and putting away wellbeing and regulatory data. HMS has distinctive segments and incorporates wide degree and level of frameworks from departmental (a framework constrained to a particular clinical or monetary space) to learning based frameworks that give indicative help and mediation to understanding consideration exercises. It is trusted that HMS usage is a hierarchical procedure directed toward data innovation inside client group. Client people group in medicinal services field comprises of a wide range of client gatherings (doctors, attendants, chairmen, supervisors, analysts, and so on.). Disregard of any of these gatherings suggest to missing related ability, aptitudes, learning, necessities and desires. Desire and necessity emerge from what clients see and find out about the framework and translate the ways the framework will work for them.

[5] Review on Hospital Management Syatem previous work proposed in health care has been an issue of growing importance for national government. Many national and regional health care plans have been developed in the past decades, in order to control the cost, quality and the availability of health care for all citizens. The application of electronic clinical information system (ECIS) has generated useful insight into the quality of data accuracy and health care provision in primary care settings. To further emphasize, there is a great need for improved education and protocols for consisting data entry in the and also subsequent follow up of patient clarification on the policy for duration and frequency treatment. The key advantage of shifting to computer-based patient record is the opportunity to strengthen the link between the hospital records and management information system so that resources uses and quality of care can be analysed using Hospital database which increase physician efficiency and reduce costs, as well as promote standardization of care.

3. PROPOSED APPROACH

The proposed automated healthcare system aims to implement the automation of healthcare resources and patient alarm system through the use of Ultrasonic sensor and Infrared Proximity Sensor.

The system uses the two sensors to gather the data and the response of the surroundings and then transmit the data to the main sever automatically for the automation of healthcare services. The system implemented uses Arduino Uno microcontroller for the connection of the sensors and the working of both the modules.

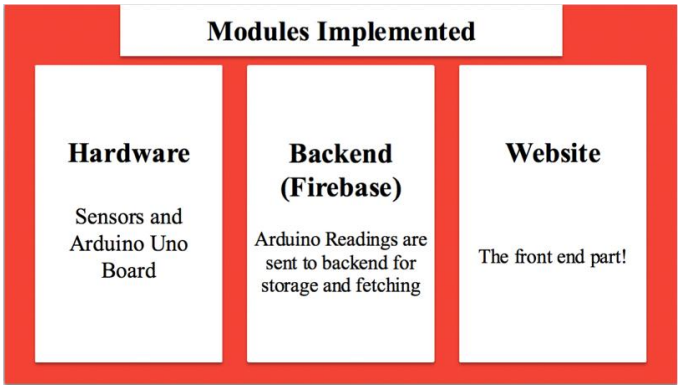

Fig -2: The modules implemented in the device

The components used in the system are-Arduino-Uno

- Ultrasonic Sensor
- IR proximity sensor
- Jump wires
- Ethernet Cable
- Main server(laptop)

The model is able to implement two functions at once. The information of the patients is stored in the Firebase database. The IR proximity sensor serves the function of patient alarm system. When the patient is in need of something and wants some immediate attention, he/she can just put his hand over the sensor. The proximity sensor will respond to the changes in the signal and will transmit this data to the server i.e. the laptop.

The laptop is connected to the Arduino Uno using the Ethernet Cable. I have used Arduino coding for the control of the sensors. I have implemented a website for the purpose of displaying the message to the admin or the staff. The website has been implemented using HTML and CSS. Python script has been used to connect the data transmitted by the sensor to the website. Same variables have been used to store the sensor data and the objects in the Python script. When the patient put his hand over the sensor, the sensor will send the data to the Python script which will result in changing of the colour of the patient card in the website to "Red" which means that the patient needs help and hence proper action can be taken. In the case when patient doesn't need any help the patient card will remain white in colour.

In the same way, the ultrasonic sensor measures the distance between itself and the object. This has been implemented in my healthcare system for the tracking of glucose drips. The sensor can be placed on the base of the glucose bottle which is given to the patient. The sensor will measure the level of the glucose accordingly.

When the glucose level is high the sensor will send this data and the colour of the border in the patient's card will be green. When the level is medium it will be yellow in colour. When the level will be low, the sensor will sense the signal and transmit it to the website where the border of the card will change to red and can notify the staff to change the glucose drip.

ADVANTAGES

1. Reduces Manpower.
2. Cost Effective because the "Night Shifts" of nurses in some critical wards.
3. No Human Errors because the system is fully automated.
4. Ease of the patient to call for assistance due to the proximity sensor.
5. The system will periodically send a UP signal to tell that its functioning
6. properly so that.

DISADVANTAGES

1. The proximity sensor can be faultily triggered because of any insect or dust particles which come near its radius of sensing.
2. At times when there is fluctuation in power supply the system might not function properly

4. CONCLUSION

This paper discussed and implemented the concept of automated healthcare system using the IR proximity sensors and Ultrasonic sensor which will help the hospital systems for efficient management of their resources and will help the patient to get good and comfortable treatment in the hospital. The proposed system can be used by the staff members and the patients easily and can be placed in the existing healthcare systems without much cost.
More and more smart Internet of Things solutions should be implemented in hospitals and in other fields so as to implement efficiency and productivity. I would try my best to expand my research in the future and add more functionalities to make it scalable and feasible for the hospitals to use it.

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BIOGRAPHIES

Garvit Khurana was born in New Delhi, India in 1998. He is currently pursuing his Bachelors of Technology(B.Tech) from Vellore Institute of Technology, Vellore.His research interests include data analytics, data mining and machine learning.