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Design Thinking On Automatic Multipurpose Health Monitoring Device For Lungs Using AI

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Abstract : Lung health monitoring programs allow employers to reduce harm to their workers by promoting early identification of potential health concerns, and establishing intervention methods when needed. In many jurisdictions, lung health monitoring includes Spirometry (otherwise known as pulmonary function testing), Chest X-rays, Questionnaires regarding a worker's health and occupational exposure history and physician interpretation. Health monitoring is collecting and using information about workers' health, related to the substances they use. The early detection of reduced lung function or increased breathing problems could prevent further damage to the lungs. The system uses the sensors and breathing balloon to monitor the condition of the patient. Then calculate their lung health automatically with the detected temperature, pulse rate and respiration rate using the ATMEGA 328 microcontroller. The human error in monitoring, time consumption and safety of patient are taken into consideration here. As a result, the lung health of the person exercising through this device will be monitored side by side and can be viewed through the website and user login by patient, his relative and doctor.

IndexTerms **– Health Monitoring, IOT, Artificial Intelligence.**

I. INTRODUCTION

Due to the population growth, present healthcare systems and resources are not adequate to satisfy the needs. Increasing the development of application software, communication protocols and devices for monitoring the health have a large influence on the healthcare industry. Approximately twenty billion devices would be connected to the internet by 2020 as per the analysis of Forbes and Gartner. The Internet of Things has a great scope on patient health monitoring and assisting professionals of the healthcare industry.

For patient assisting, the IoT is on its early stage on design and development to minimize the manual error and increasing the efficiency in a smart way. The Internet of Things is that the network of physical objects or "things" embedded with natural philosophy, software, sensors, and network property that permits these objects to collect and exchange info (Dinesh et al. 2015a). The IoT permits objects to be perceived and controlled remotely across existing network infrastructure creating opportunities for tons of direct integration between the physical world and computer-based systems and resulting in improved efficiency, accuracy and economic profit. Needless to mention that this packaging around the IoT is large. It looks like each day a replacement company announces some IoT enabled product. Connected health remains the sleeping big of IoT applications. The construct of a connected health-care system and good medical devices bears monumental potential, not only for firms conjointly for the well-being of individuals generally. Yet, connected health has not reached plenty. Healthcare and patient monitoring requires mobile technology to the efficient monitoring. The sensors are connected with the embedded system to collect the information from the patients. Applications can permit each patient and health care suppliers to possess access to reference materials, research laboratory tests and medical records victimization mobile devices (Raji et al. 2016). These applications empower patients and health suppliers proactively to deal with medical conditions, through close to period observation and treatment, regardless of the placement of the patient or health supplier.

II.RELATED WORK

Ehsan Abedini et al presented a new digital to digital encoding by improving None Return to Zero-Inverse (NRZ-I) digital to digital encoding. The proposed digital to digital encoding, which is called Modified NRZ-I (MNRZ-I), has great improvement in synchronization between transceiver. The results show that the propose method has considerably improvement in the direct current component, the number of invalid bits and bandwidth in comparison with other digital to digital encoding method.

Chanchal Raj et al present a low cost Health sensor platform for rural health monitoring with a well-structured and secure interface between medical experts and Remote centers for sharing of important medical parameters. In our proposed and implemented model we developed separate interface for medical experts and remote Centre's and introduced a new algorithm for implementation.

Norbahiah Misran et al present an IoT based health monitoring system using the MySignals development shield for Arduino Uno. Evaluating the performances and effectiveness of the sensors and wireless platform devices are also the aim of the project. MySignals enables multiple sensors such as temperature, ECG, oxygen saturation and pulse rate to gather the physical data.

Mrinmoy Barua et al studied a packet scheduling schemes for realtime transmission in WBAN with proper security and privacy. Real-time and non-real-time traffic are classified to minimize the waiting time of the eHealth application's data traffic. An efficient secure data transmission scheme in WBAN is proposed with data integrity.

Zhipeng Wang et al designed a human health monitoring system based on NB-IoT technology. Mainly completed the following work: 1) We designed a terminal device containing STM32 microprocessor to collect pulse, body temperature and geographical location. 2) Combined with the existing NB-IoT network, we built a Tomcat server in the cloud to store the uploaded information in the MySQL database. We designed the alarm service.

Ekanath et al present an IoT-based smart edge system for remote health monitoring, in which wearable vital sensors transmit data into two novel software engines, namely rapid active summarization for effective prognosis (RASPRO) and criticality measure index (CMI) alerts, both of which we have implemented in the IoT smart edge. RASPRO transforms voluminous sensor data into clinically meaningful summaries called personalized health motifs (PHMs).

Rao Naveed Bin Rais et al highlighted the requirements of patient monitoring systems, and then proposes and implements a four-tier architecture of IoTs by integrating WBASNs, fog computing and cloud services over IPv6. Furthermore, the proposed architecture is implemented in small scale as a testbed by using Arduino open-source prototyping platform.

MyeongHyun Kim et al proposed a lightweight anonymous user authentication and key establishment scheme for wearable devices. We demonstrate that their scheme cannot withstand user impersonation, session key disclosure and wearable device stolen attacks.

Anuja et al focused-on data aggregation method is to assemble and cluster data packets in a well-organized and cos-effective way so as to minimize power consumption, to intensify network life time, delay, traffic congestion etc. In wireless body area network data aggregation with high delay tolerance is of utmost importance.

Kavitha Kadarla et al presented a mechanism that assesses the default resource allocation strategy regarding its response time in simulated IoT healthcare workloads which will raise irregular requirements of the resources from the cloud to handle massive amounts of data.

Jitumani Sarma et al proposed a power management technique for prolong and continuous ECG monitoring based on critical data and energy level of battery. To reduce the power consumption, a light-weight power management controller is introduced based on the present status of ECG data and battery.

III. PERFORMANCE EVALUATION OF ERROR CONTROL SCHEME IN MULTIHOP WBAN BASED ON IEEE802.15.6

Kento Takabayash et al evaluated performance of an error control scheme in a multihop wireless body area network (WBAN) based on IEEE Std. 802.15.6, which is an international standard of WBAN. In the field of medical internet of things (m-IoT) systems, the WBAN is one of the most important key technologies.

Janardhan Rao et al present several metrics to evaluate activity predictors in the context of real-world applications. Third, we evaluate our approach using real sensor data collected from 24 smart home testbeds.

Maode Maetalproposed scheme enables a 6LoWPAN device to securely authenticate with the remote server with a session key established between them. The security proof by the protocol composition logic can prove the logic correctness of the proposed scheme.

IV. PROPOSED SYSTEM

For assisting lung disease patients, we proposed a smart healthcare system which senses the environmental conditions. Change in the environment may have a great impact on lung disease patients. Analysing the conditions includes temperature, humidity and pollution level giving the patient insight into how long the patient can stay in that environment. This is a cloud-based system through which the doctors and caretakers can ensure the health condition of the patient. If any critical condition emerges, the alert is given to the doctors and caretakers immediately (Mohanapriya et al. 2013). The symptoms for the patients affected with lung disease can be varied from person to person. The symptoms which have infrequent lung diseased attacks will be occurred in certain times such as when going with exercises. The major symptom which includes the shortness of breath i.e., it causes problem during breathing which can cause heart attack. The tightness is caused in chest when work in dine in high extent by the patients. It also a reason for the disturbances in sleeping. A trouble is caused during sleeping such as whisling type of sound is produced. Sometimes due to the low oxygen content environment where the patients can't breathe properly. In case of this predicament, whishing is caused which leads to breathing problem while exhaling. This symptom is common sign for lung disease. The coughing and wheezing which attacks the concern are worsened on the basis of the environmental conditions. The later stage will include the increased difficulty of breathing. It can be measured through a peak flow meter in which we can measure the working of lungs. The lung disease patients are provided with an inhaler in which it is loaded with medicine for the concern stage of disease. The medicine in the inhaler which is of powder type. When it is pressed, the inhaler will release a medicine which can be inhaled easily. The lung disease which may reach a worse condition, when the air is cold and dry, hence the exercise is induced as lung disease. Some factors which can include the working place irritations which are triggered by chemical forms of fumes, gases or dust. They are also caused by airborne gist such as pollen, waste of cockroach, mold spores and dried dribble shack by pets

Lung disease is a constant fiery malady that causes the aviation routes of the lungs to swell and restricted, bringing about shortness of breath, wheezing and hacking. It is a significantly becoming worldwide and financial issue. As per WHO, about 300 million individuals are all inclusive experiencing lung disease. In creating nations like India, it has been assessed that approximately 15-20 million individuals are lung diseased tic. Since there is no cure for lung disease, the casualty rate of lung disease is especially high, particularly in immature and creating nations. Lung disease is portrayed by intermittent scenes of wheezing, hacking, shortness of breath and chest snugness. Manifestations are typically more regrettable around evening time or at a young hour early in the day in light of cool air or exercise. Numerous natural variables assume a fundamental part being developed of lung disease in individuals, including presentation to air contamination, allergens, other compound aggravations. Low air quality and high ozone levels have likewise been related with advancement and expanded lung diseased seriousness. Family history is likewise a hazard factor for lung disease, with numerous qualities being embroiled. Very nearly 25 qualities have been related with lung disease. A large number of these qualities are identified with insusceptible framework or balancing irritation. Likewise, some hereditary variations may likewise cause lung diseased when they are joined with particular ecological exposures. There is no cure for lung diseases, just counteractive action.

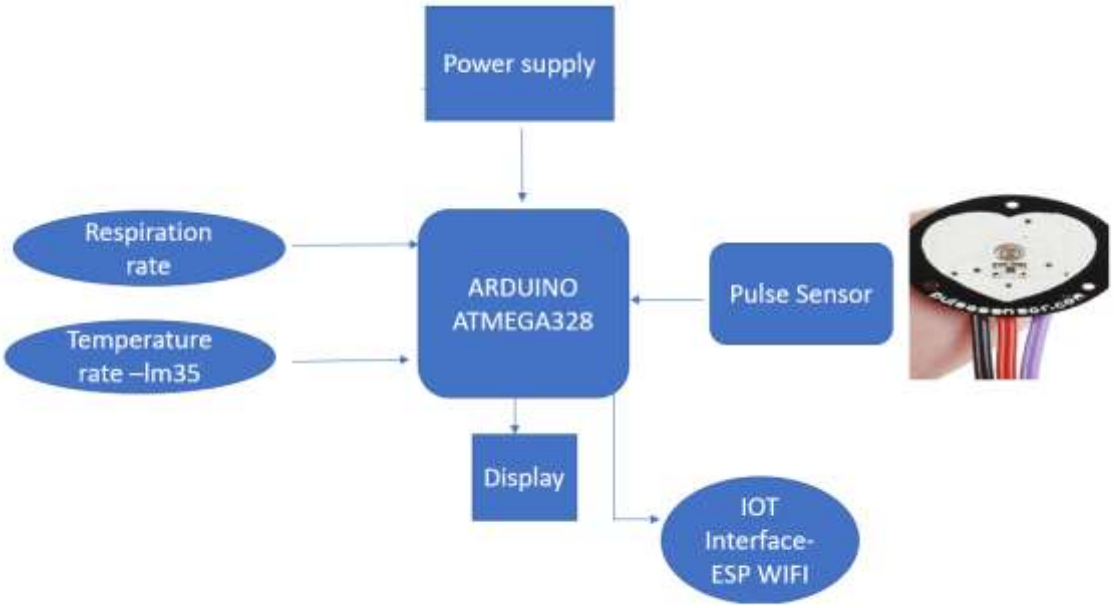

Figure: Proposed system

Automatically monitor lung health conditions and send alert: Pulse, respiration level, temperature with IOT. Preferable in hospitals and public sectors to maintain social distance as shown in Figure.

A particular, modified arrangement for proactively checking and overseeing indications must be made. This arrangement ought to incorporate diminishment of presentation to allergens, testing to survey the seriousness of side effects, and the utilization of solutions. The treatment design ought to be composed down and exhortation acclimations to treatment as indicated by changes in manifestations. The best treatment for lung disease is distinguishing triggers, for example, smoke, pets, or pharmaceuticals and dispensing with introduction to them. On the off chance that trigger shirking is deficient, at that point utilization of drug is prescribed. Pharmaceutical medications are chosen in light of (in addition to other things) seriousness of ailment and the recurrence of side effects. However, the adherence factor is variable- a large portion of the patients don't take their prescriptions routinely. Lung disease administration is trying as it requires understanding lung disease causes and triggers that are multi-calculated and individualistic in nature. Innovation is the best seek after conveying these new routes, for the most part through wearable associated gadgets, minimal effort sensors, customer-reviewed gadgets and so forth. Every one of these gadgets make them thing in like manner IoT (Internet of Things).

V.SOFTWARE AND HARDWARE SPECIFICATION

Arduino micro controller

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control objects in the physical world.

The project is based on microcontroller board designs, manufactured by several vendors, using various microcontrollers. These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits.

Contactless temperature sensor

Figure: Temperature sensor

The conventional temperature sensors need you to come in contact with the sensor. This is where our sensor stands out, MLX90614-DAA is a contactless temperature sensor, where the temperature can be sensed without actually coming in contact with the sensor.

This is an infrared thermometer designed for non-contact temperature sensing. An internal 17-bit ADC and a powerful DSP contribute to the MLX90614's high accuracy and resolution. It has a huge number of applications including body temperature measurement and movement detection. The sensor has a field of view of **90 degrees** and returns the average temperature value of all objects within this field of view.

MLX90614ESF-DAA non-contact infrared thermometer for use with Arduino, or any microcontroller that can communicate with it through its I2C interface.

Pulse oxidometer sensor

Figure: Pulse pulse oxidometer sensor

MAX30100 is an integrated pulse oximeter and heart-rate monitor sensor solution. It's an optical sensor that derives its readings from emitting two wavelengths of light from two LEDs – a red and an infrared one – then measuring the absorbance of pulsing blood through a photodetector. This particular LED colour combination is optimized for reading the data through the tip of one's finger. It is fully configurable through software registers and the digital output data is stored in a 16-deep FIFO within the device.It has an I2C digital interface to communicate with a host microcontroller.

VI.RESULT & DISCUSSION

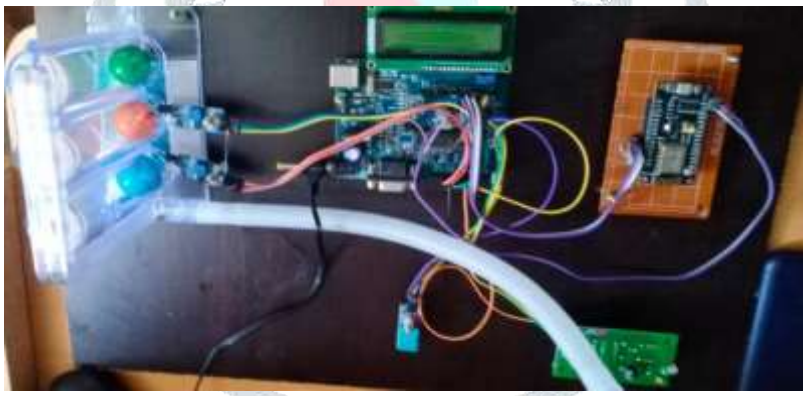

Figure : Overall hardware implementation

The above figure shows the hardware implementation of proposed system which includes Arduino controller, sensor and node MCU devices

VII.CONCLUSION

Internet of Things (IoT) which could be a network supported the physical systems within which it may be exhibited within the type of a typical embedded system including electronic devices like sensors. The connectivity of the network which may be enabled by these objects for exchanging and collecting data. Lung disease may be a lifetime chronic disease initiating to abnormal viscus functions and problem in breathing. Regarding 350 million individuals, that's similar to one in every twelve adults, suffer from respiratory disease worldwide. Self-monitoring is that the preliminary course of action to observe, treat and manage the chronic un-wellness. Self-monitoring together helps physicians and patients to possess management over real-time observance and to provide on-time treatment. Classical spirometer takes a glance at is presently the best because of diagnosing the severity of internal organ functions and their response to treatment, however, it needs superintendence. To help the people that are affected we had designed a tool to perform their regular activities. With the assistance of the sensors like temperature, heart rate and flow, the info has been collected so it's uploaded to the cloud for further analysis. The information uploaded within the cloud are going to be received by a concerned doctor or the caretaker of the patient.

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