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SMART BADGES FOR KIDS TO ALERT MEDICINE SCHEDULE

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***Abstract*— Worldwide kids are not able to concentrate on taking medicines on time because of their playfulness and busy on their studies. This paper introduce an Internet of Things based system to send alert to the kids to take medicine on time. The system displays the correct medicine and the quantity to be taken based on the prescription given by the doctor. It checks the child's health after taking the medicine every time. A message will be sent to the parent mobile after consuming the medicine.**

It includes the amount of medicine taken and the time of consumption. If any allergy or drastic changes appear in the body, the smart badge sends the message to the parent mobile immediately. The common illness that is taken for consideration is fever, flu, asthma, headache, and cough. Patient data is protected through Blockchain technology.

Keywords - Internet of Things Smart Badge, Medication Intake, Adherence Monitoring, Sensor; Wearable Device; RFID, Blockchain Technology

I. INTRODUCTION

During last decade there is a widespread research in the domain of healthcare services and the technology upgradation. In that, Internet of Medical Things (IoMT) is playing a vital role in the field of medicine. It is connecting medical devices, sensors, and healthcare professionals to provide prominence medical services in an isolated location. Internet of Things is providing patient safety, reduced healthcare costs, enhanced the accessibility of healthcare services, and better operational competence in the healthcare industry.

Many of the wearable health monitoring devices (smart watches, Jawbone Up wristband etc.,) are there to take care of the patients. Now a days this technology is converted from hospital-centric healthcare system into a patient-centric system. They can track patients' adherence to treatment plans or any need for immediate medical attention.

This paper introduces an Internet of Things based Smart Badge system to send alert to the kids to intake medicine on time. This smart badge is a wearable device that can be weared in our clothes. It displays the prescribed medicine to be taken and the quantity. This system also checks the child's health after taking the medicine every time. Parents will be worried whether the child has consumed the medicine or not. A message will be sent to the parent mobile after consuming the medicine. It includes the amount of medicine taken and the time of consumption. If allergy or drastic changes appear in the body, the smart badge sends the message to the parent mobile immediately. The common illness that we take into consideration is fever, flu, asthma, headache, and cough.

2. Smart Badge Health Monitoring System

2.1 Wearable Sensors

The proposed system smart badge is a wearable device that can be pinned in the clothes to monitor the patient's physiological parameters. Variety of sensors in the market today such as

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ECG sensors records the electrical signal from the heart to check for different heart conditions, Temperature sensors to sense the body temperature, Pulse monitors to measure the oxygen level (oxygen saturation) of the blood[4]. The cost of the sensors varies according to their size, flexibility and accuracy. The Raspberry Pi which is a cheap, flexible, entirely customizable and programmable small computer board brings the advantages of a PC to the domain of sensor network.

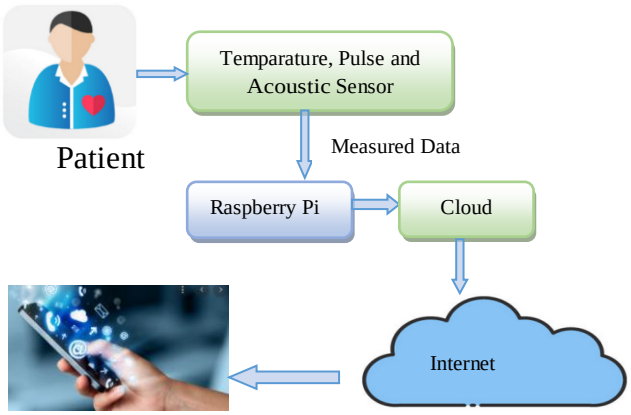

Fig.1 Architecture of the Smart Badge Medicine Schedule Alert System

The tool for assessing medicine intake is using acoustic sensors in the form of neck wearable. In general, acoustic-based approaches focus on collecting acoustic data resulting from swallowing or ingestion activity with a microphone placed by the throat and then harnessing specific data analytics methodology for classifying and analyzing the swallowing events[1]. The neckwear device contains microphones, a flex sensor, and an RFID reader. The microphones and the flex sensor is used to sense throat movement, the chewing sound and the medicine swallowing activity. RFID reader, aim for adding another element of medication adherence verification by monitoring pills equipped with ingestible biosensors when passing through the throat area.

In this proposed system child's parameters (Temperature and Pulse) are measured with different sensors as shown in the fig 1. These sensors collect the data i.e. biometric information is given to raspberry pi and then it is transferred to server. The proposed method monitors the patient's health parameters using sensors and Raspberry Pi. After connecting internet to the Raspberry Pi it acts as a server. Then the server automatically sends data to the parent mobile.

This system sends an alert to the kids to intake medicine on time. Every time the system will display the correct medicine and the quantity to be taken based on the prescription given by the doctor. It alerts the kid to take medicine between regular intervals. This system also checks with the child's health after taking the medicine every time. A message will be sent to the parent mobile after consuming the medicine. It includes the amount of medicine taken and the time of consumption. The heart beat sensor senses the number of beats per minute. If allergy or parameters goes abnormal, the smart badge sends the alert message to the parent mobile immediately.

2.2 AN ANALYSIS OF MEDICATION ADHERENCE MONITORING SYSTEMS

Medication non-adherence is a major problem. Many intrusions are mandatory to check the progress of medication adherence[7]. Many supportive tools are available to improve the adherence of medicine. These supportive systems are used for timely monitoring of the patients, and generate useful information about the behavior of the patients and send the data to the healthcare provider [6,9]. An large number of systems are developed that make use of monitoring and tracking techniques in various health-related projects, including medication adherence monitoring. Table 1: provides a

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taxonomy of the approaches reviewed in this paper

Table 1: Categorization of the Technology-Based Approaches for Medication Adherence Monitoring

Reference	Main Technology	Secondary Technology	Monitored Activities and/or Subjects
Hayes et al., 2006 [10]	Smart pillbox	Smart pill bottle	Lid opening
Aldeer et al., 2018 [11]	Smart pillbox	-	Lid opening and closure, bottle picking and flipping/shaking, bottle weight
Lee and Dey, 2015 [12]	Wearable sensors	-	
Kalantzian et al., 2016 [13]	Wearable sensors	Smart pill bottle	Lid opening and closure, box manipulation Pill bottle pick up and pill swallowing
Wu et al., 2015 [14]		Ingestible biosensors	
Putthaprasart et al., 2012 [15]	Wearable sensors	-	Drinking water, picking pills by one hand, holding pills using both hands, hand(s) to mouth motion
Kalantzian et al., 2015 [16]	Wearable sensors	-	pill bottle opening, pill removal, pill pouring into the secondary hands, water bottle handling
Hezarjaribi et al., 2016 [17]	Wearable sensors	-	Hand-to-mouth motion
Wang et al., 2014 [18]	Wearable sensors	-	Taking a pill, drinking water and wiping mouth
Chen et al., 2014 [19]	Wearable sensors	-	Cap twisting and hand-to-mouth actions
Serdaroglu et al., 2015 [20]	Wearable sensors	-	open-pill-box, put-glass-back, put-pill-in-mouth, drink water
Mondol et al., 2016 [21]	Wearable sensors	-	
Abdullah and Lim, 2017 [22]	Wearable sensors	-	User's response in the form of voice commands
Hafezi et al., 2015 [23]	Ingestible biosensors	-	Hands movement Medication ingestion
Chai et al., 2016 [8]	Ingestible biosensors	-	Medication ingestion Pill bottle pick up
Agarawala et al., 2004 [24]	RFID	-	Pill removal
Becker et al., 2009 [25]	RFID RFID NFC	-	Pill bottle removal
McCall et al., 2010 [26]	Computer vision	-	Pill removal
Morak et al., 2012 [27]	Computer vision	-	Pill bottle opening, hand over mouth motion,
Batz et al., 2005 [28]	Computer vision	-	bottle closing Pill bottle opening, pill picking,
Valin et al., 2006 [29]	Computer vision	-	pill swallowing, bottle closing Pill bottle picking,
Dauphin and Khanfir, 2011 [30]	Computer vision	-	drinking a glass of water, putting glass back
Huynh et al., 2009 [31]	Computer vision	-	Tracking the face, the mouth, the hands, a glass
Bilodeau and Ammouri, 2011 [32]	Computer vision RFID	-	of water, and the medication bottle Occlusion of
Sohn et al., 2015 [33]	RFID Computer vision	-	hands, occlusion of a hand and the face,
Tucker et al., 2015 [34]	Computer vision Smart	-	medication bottle recognition Bottle weight
Li et al., 2014 [35]	pillbox Smart pillbox	Sensor networks	Patient gait
Hasanuzzaman et al., 2013 [36]		Computer vision	Pill removal, hand motion
Suzuki and Nakauchi, 2011 [37]		Sensor networks	Pill bottle removal, tracking hands and
Moshnyaga et al., 2016 [38]		Smart pillbox	medication bottle
Abbey et al., 2012 [39]		Mobile application	Pill bottle removal, user behavior prediction
Boonnuddar and Wuttidittachotti, 2017 [40]		Mobile application	Pillbox opening and closing, hand-to-mouth motion Pill removal Bottle weight

3. SECURITY OF INFORMATION

A database is a collection of information that is stored electronically on a computer system. Information, or data, in databases is typically structured in table format to allow for easier searching and filtering for specific information. A blockchain collects information together in groups, also known as blocks that hold sets of information. Blocks have certain storage capacities and, when filled, are chained onto the previously filled block, forming a chain of data known as the "Blockchain." All new information that follows that freshly added block is compiled into a newly formed block that will then also be added to the chain once filled.

It inherently makes an irreversible timeline of data when implemented in a decentralized nature. When a block is filled it is set in stone and becomes a part of this timeline. The block maintains an exact timestamp when it is added to the chain. Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets.

Blockchain technology is used to secure patient's personal data[5] and can deliver decentralized attack detection model to mitigate the single point of failure. In the above scenarios, data and information collected from smart devices are sent to edge gateways, services, or cloud. Due to high security and privacy concerns in the health domain, it is important to understand that these edge gateways and cloud-IoT platforms will be owned only by authorized entities, or other highly trusted entities through some private cloud.

4. CONCLUSION

This system helps the kids to alert them to take medicines during their schooling. Parents will not be able to remain their kids when they are in school. This system sends alert to kids and also it send the message to parents once the medicine is consumed by the kid.

5. FUTURE ENHANCEMENT

This project is scalable in terms of sensor to maximize the advantage of Internet of Things, such as heart rate monitor, height measuring, blood pressure gauge and more. Besides, huge data gathered by sensors can be logged and further analyses to deepen the understanding of patient. More sophisticated medical formula can be included to cater not only children but another category of patient as well.

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