Anamnesis: Technology for the Forgetful

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***Abstract*—Dementia describes a set of symptoms that may include memory loss and difficulties with thinking, problem-solving or language. This paper proposes a technique used to monitor the symptoms of Dementia. To tackle this condition, we have designed a device to track the patterns and frequency of memory loss in the affected people. The device will thus give a report on the memory condition of the patient, in turn helping the doctor to treat the person appropriately.**

Keywords—Dementia, alzheimer's, IOT(Internet Of Things), sensors

I. INTRODUCTION

Dementia is caused by the damage to brain cells that lead to malfunctioning of thinking ability, remembering, reasoning and behavioral abilities. This loss of cognitive functioning interferes with a person's daily routine to a great extent.

There are distinct and numerous reasons that cause dementia. Some of which are- building up of excess fluid in the brain ventricles which results in extra pressure on the brain, protein deposits in nerve cells that interrupt chemical messages to the brain, thyroid disorders and vitamin deficiencies, death or breaking down of neurons, and lack of blood flow to the brain. [1] This disease is also genetic in a few victims. The most common type of dementia is Alzheimer's. Different target regions of the brain result in different symptoms of dementia.

At least two of the following core mental functions must be significantly impaired to be considered dementia[2]:

- Memory
- Communication and language
- Ability to focus and pay attention
- Improper sleeping schedule
- Reasoning and judgment
- Visual perception

A key component of diagnosis is self-reporting about symptoms as well as interacting with family members about the person under consideration. Added to this are a series of neuropsychological tests prescribed by the doctor. Blood tests eliminate memory loss due to thyroid disorders and vitamin deficiencies.

Brain imaging tests are conducted to detect other causes of change or deterioration of perception and comprehension due to reasons other than Alzheimer's.

Following are the brain imaging tests conducted -

1. Magnetic Resonance Imaging (MRI) – it detects the extent of brain shrinkage.
2. Computerized Tomography (CT) – it detects tumors.
3. Positron Emission Tomography (PET) – it identifies areas of the brain where nutrients are poorly metabolized.
4. Communication happens in the brain cells via electrical impulses. An Electroencephalogram (EEG) test helps to detect problems associated with Alzheimer's by analyzing the pattern of the waves recorded by the test.

Our device focuses on monitoring the patient and acts as a substitute nurse. The idea is to automate the process of collecting information about the patient's symptoms of dementia, mainly memory and sleep patterns.

The patient is assigned certain tasks and the performance of these tasks is monitored through our device. The data is recorded and further analyzed to generate a report. This report is finally used by the doctor for further treatment.

II. RELATED WORK

There is a need for tools that can more closely monitor treatment response in dementia across care settings and the authors have explored wearable sensors [3]. Reference [4] gives an approach to monitor patients with Dementia via GPS. They track the patients if the patient leaves their respective house or shelter. This paper does not focus on the monitoring of daily routine tasks. The authors in [5] came up with a mechanism to detect whether the patient has dementia or not, using classification techniques. Another study utilized a suite of apps administered via a tablet device as a non-pharmacologist intervention for agitation in dementia [6]. In reference [7], the system can automatically remind caregivers whenever an elderly person approaches a dangerous area or strays too far. A study that aimed to characterize normal and adventitious respiratory sounds in older people with and without dementia is conducted [8]. Reference [9] proposes a new computer avatar with spoken dialog functionality that produces spoken queries based on the mini-mental state examination, the Wechsler memory scale-revised, and other related neuropsychological questions.

III. WORKING AND BLOCK DIAGRAM

Our device monitors the patient's daily activities through the tasks assigned. These tasks are governed by sensors connected to the micro controller.

The data collected through the device is stored on the cloud

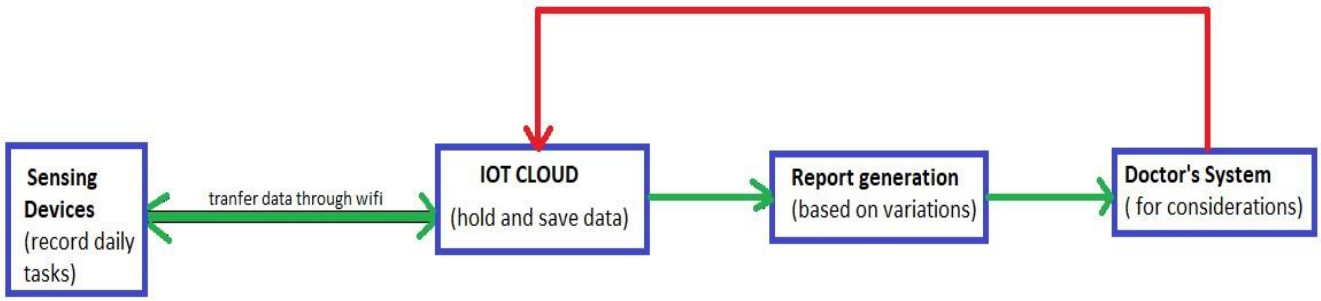


Fig 1. Block diagram of the device anamnesis

and a report is generated, and further reached to the doctor. This is summarized in the block diagram of the device as shown in Fig. 1.

A. *Hardware Implementation*

The following are the tasks and the respective sensors used –

Medication: The patient is asked to take tablets at a specified time. An IR sensor and a weight sensor is used to monitor this activity. If the patient fails to take the tablets, it will be recorded. Since the patient cannot skip taking tablets, after a brief delay, a buzzer goes on. The buzzer goes off only after he takes the tablets. There is a possibility that the patient may repeat the medication. As a countermeasure, there is a light indicator is used as a reminder that the medication is taken already. The symptom targeted here is the patient's memory loss. This task also ensures that the patient does not miss his daily dose.

Date Verification: The patient is supposed to enter the current day's date through a keypad. The LCD display displays the date if it's correct, else take note and prints the right date. Through this task the patient's ability to pay attention to his or her environment is verified. This task also checks the ability of the patient to keep a track of time.

Sleep Schedule: The sleep patterns of the patient are observed by a pressure sensor. The pressure sensor is embedded in the pillow. The duration of sleep and the time at which he sleeps is recorded. One of the symptoms of dementia is irregular sleep patterns, i.e. – falling asleep unexpectedly during the day or not sleeping at all in the night. This is monitored through the pressure sensor.

Gardening: The patient has to water a plant at a particular time of the day. A water sensor is used to monitor this activity. This task thoroughly examines the current memory status of the patient by checking up to what extent the patient is forgetful.

The micro controller sends the recorded values – current date, time when the medicine was taken, duration of sleep, gardening time, and date verified flag value to the Wi-Fi module (node MCU).

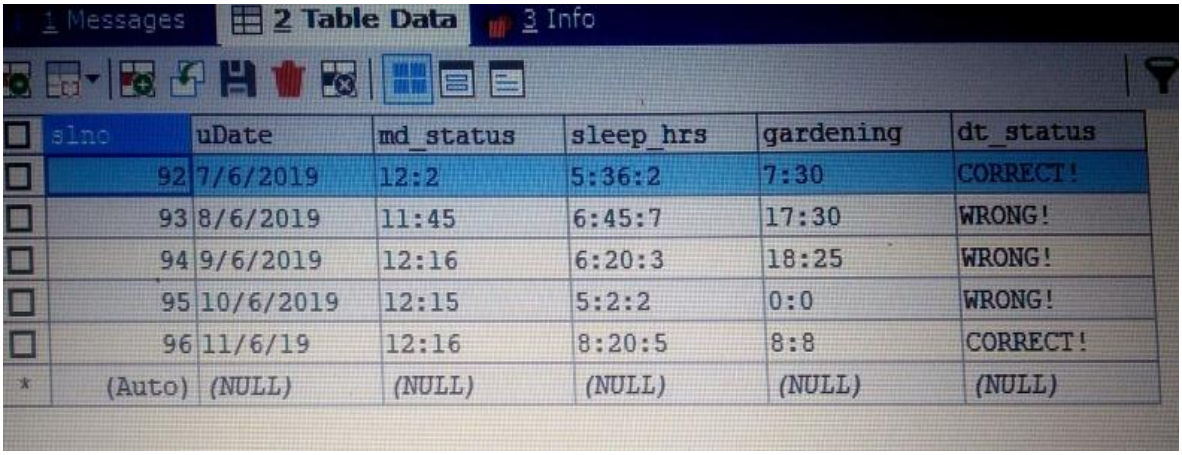
B. *Software Implementation*

The functioning of the sensors, performance, logic, and peripheral interfacing are controlled through the programming of the micro-controller using embedded C and C++. Values recorded by the micro controller are sent to the Wi-Fi module, which is further updated to the database using My SQL. The recorded database is transferred via internet to the IoT cloud. The cloud holds and saves the data. The same updated database is viewed by the doctor using internet, and further treatment is provided.

IV. RESULTS AND CONCLUSION

We can see the spread of dementia is on the rise. Detection and tracking of dementia has to be made more effective and easy. Keeping the above aspects in mind, our device helps attaining precise schedules and keeps a track of daily routine activities of the patient through the data recorded. This helps in the detection of dementia and the track record gives the state of progress in the patient. The stage of dementia can be approximately known from the data because each stage has a specified frequency of memory loss.

This report, as shown in fig.2 delivers the deviations in the memory and sleep patterns of the patient. The graphical representation of the deviations is demonstrated in Fig. 3,4,5 and 6. The doctor considers these reports and makes required modifications in the medication.


1 Messages | 2 Table Data | 3 Info

slno	uDate	md_status	sleep_hrs	gardening	dt_status
92	7/6/2019	12:2	5:36:2	7:30	CORRECT!
93	8/6/2019	11:45	6:45:7	17:30	WRONG!
94	9/6/2019	12:16	6:20:3	18:25	WRONG!
95	10/6/2019	12:15	5:2:2	0:0	WRONG!
96	11/6/19	12:16	8:20:5	8:8	CORRECT!
*	(Auto)	(NULL)	(NULL)	(NULL)	(NULL)	(NULL)

Fig 2. Report consisting of patient's performance of task

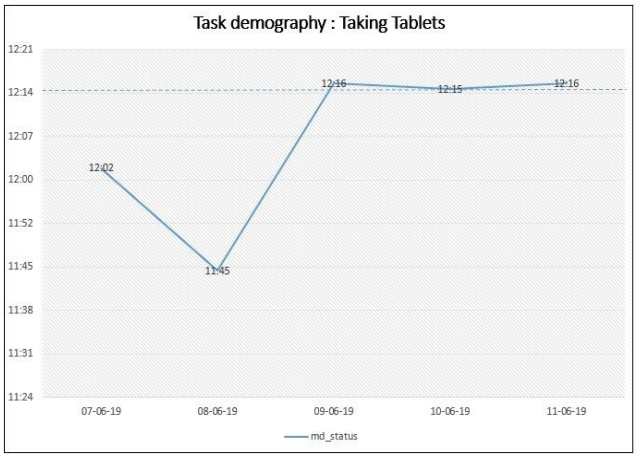


Fig 3. Statistics of the patient taking his tablets

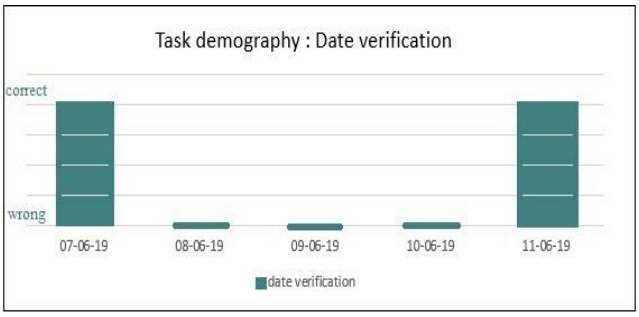


Fig 4. Statistics of the patient keeping track of the current date

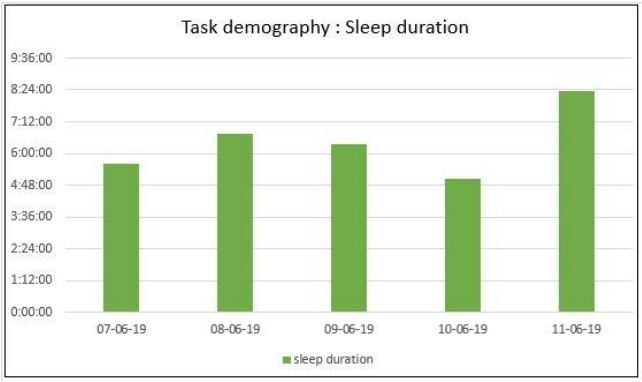


Fig 5. Graphical representation of the patient's sleeping patterns

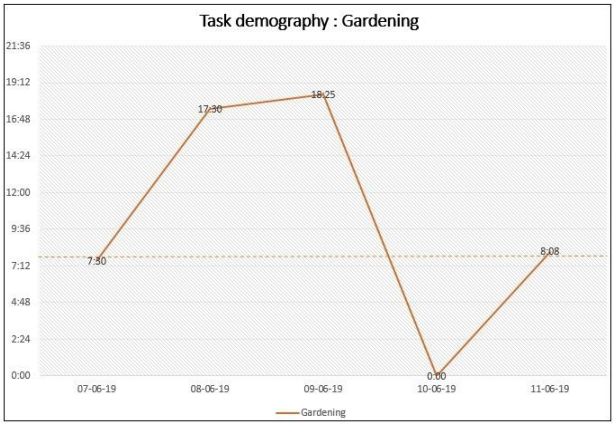


Fig 6. Statistics of the patient's memory of a given task(gardening)

The device makes it more convenient and affordable as the need to assign a nurse or family member to monitor the patient is no longer required. Since the database recorded by this device is real and authentic, it can serve as a base for research on Dementia/Alzheimer's. The proposed device can also help patients who have suffered from a stroke or head injury, as such conditions induce memory loss.

The device targets the major symptoms - memory loss and irregular sleep patterns. It can be made more advanced by monitoring other symptoms such as deterioration in logical reasoning and judgement. The scope of software in this application can be enhanced by using Machine Learning for automatic interpretation of the data instead of the doctor.

V. REFERENCES

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