Smart medicine pill box using IOT especially for TB patients

KEY POINT: TB treatment is min. 6 months to maximum 24 months long .A solution is needed by which Patients can be tracked on their daily doses, pill habits, missing dosages, therapy duration etc.

ROBLEM STATEMENT:

Tuberculosis is one of the top 10 causes of death globally and resulted in 1.8 million deaths in 2016 alone. 95% of TB deaths occur in low-and middle-income countries like India, African countries, china etc. Tuberculosis is a serious form of infection that affects lungs and at times other parts of the body like bones, joints and kidneys. It is caused by bacteria Mycobacterium tuberculosis. A previous study showed that TB killed 60,000 children below 15 in India, the highest in the world, in 2015. It is estimated that about 40% of the Indian population is infected with TB bacteria which is roughly 50 crores of population, the vast majority of whom have latent TB rather than TB disease (data source). Tuberculosis is an infectious disease. The classic symptoms of active TB are, chronic cough with blood containing sputum, fever, night sweats, and weight loss. TB spreads through sputum from one infected person to normal individual while coughing, singing, speaking. Apparently, there are 3 different stages of TB based on drug resistance called Rif-DR TB, MDR, XDR.

Initiatives Taken so far: Indian govt. has taken several initiatives starting from 14000 DOTs centres creation, launching aspirational project END-TB campaign by 2025, engaging different stakeholders like HCPs, Pvt. Doctors, NGOs in different TB projects etc. But still TB needs much more attention as far as patient awareness, patient adherence is concerned.

Major Challenges: India is a hub of TB and different factors play pivotal role for a person become TB patient or a primary TB patient become DR-TB patient, starting from - lack of awareness, lack of knowledge at doctors as well as at patient level, poor economic conditions etc. But among all most prominent reason for a primary TB patient become drug resistant TB patient is “Poor patient adherence to therapy”. TB treatment is min. 6 months to maximum 24 months long, based on type of TB. But in many cases after 2-3 months when patients are in recovery phase, patient stops taking the medicines, assuming he/she got cured already. Because of this, after few months or year patient develop resistance to primary drug and become DR-TB patient.

Need of the hour: Transition from primary TB patients to DR-TB patient must be controlled and monitored, and for that we need to improve ‘patient adherence’ through continuous monitoring of patients**.** A solution is needed by which Patients can be tracked on their daily doses, pill habits, missing dosages, therapy duration etc.

Solution:

A prototype is developed to assure the safety of the patients and also prevents wrong dosages. It reduces the effort in remembering medicine and patients will get the schedule of the medicine containing medicine name, timings and so on. Two prominent persons one is care taker and other is patient.

An IOT enabled pill box provided with a set of compartments. It is designed in such a way that normal users can use it easily for their medication purpose. The control system of pill box comprises of sensors for monitoring and reporting the state of the environment and its associated control software, which regularly checks whether the medicine is taken or not. Whenever the medicine is loaded into the pill box it will be updated and the data will be stored in the database. Pill Box contains Arduino Uno R3 which is an open-source electronics platform. Arduino boards are able to read inputs and turn it into an output, for example turning LED on etc. User can control the board by sending a set of instructions to the microcontroller on the board. The user should register for this device using the device ID before using this device. No two users can register for the same device. The user should maintain a username and password authentication using the device ID.

Hence the medicine loaded into the device, simultaneously user should upload the medication details using the mobile application. It consists of medicine name, medicine quantity, etc. By using this information device will alert and send notifications on time. User can save the following medical information.

1. Medicine Name

2. Total quantity of medicines.

3. Reminder time.

4. Image of the medicine.

5. Username.

6. Number of medicine that has to be taken.

7. Compartment Number in which the medicines are kept.

8. Reminder Days.

- Every day
- Specific days of the week
- Days Interval

The Entered details will be stored in the cloud using Esp-8266 and reminders will be set. The details about each of the above activities will be stored in the local database. Whenever net connection is available the details will be pushed to cloud database.

Stock Alert

User has the option for setting a stock alert when the quantity reaches a particular predefined minimum level. A notification message will be sent to the mobile application. After receiving the notification caretaker can refill the medicine. The user will get the medicine type, quantity of medicine left in the stock as the stock alert.

Report

This module is used for bringing forth a report based on Patient's performance. The report indicates whether the Patient is taking the medicine on time or not. The user can get a the report consists of medication time, type of medicine taken, whether the medicine was missed at any time and so on.

Role of care-taker:

The caretaker is responsible for filling up the medicines into the pillbox. Whenever the caretaker gets a stock alert message, he can occupy the box with medicines. There are many compartments in the box; different types of medicines can be filled in different compartments.

The system provides alerts when it's time to take medication. These details are regularly updated automatically from the cloud. When there is a change in the dosage of medicine caretaker can update it through the mobile application. If the medicines were taken or not, alert messages will be transmitted to the caretaker and also the details will be stored in the database.

Hardware devices:

Arduino Uno R3

SRAM

ESP8266 Wi-Fi wireless Transceiver

Ultrasonic Sensor

LCD Display

Software platforms:

Arduino Software (IDE)

Android studio

Cloud server

BLOCK DIAGRAM