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Intelligent Pillbox : Automatic and Programmable Assistive Technology Device

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ABSTRACT

Assistive Technology (AT) maintains and improves the individual's functioning and independence, thereby promoting their well-being. But today only 1 fom each 10 people in need have access to AT due to high costs and a lack of awareness, availability, personal training, policy and functioning. By 2050, more than 2 billion people will need at least 1 assistive product with many elderly needing 2 or more. Elderly make important contributions to the society. Though some people aged well, other become fail, with a high risk of disease. In this paper, we propose a frst approach related the design of AT device. This uses open source technologies and gives a new choice in taking medication dosages. "The Intelligent PillBox" allows the organization of several medication schedules that health disorders presented in elderly need basically. Arduino Mega 2560 was taken as the principal controller. This prototype contains; a programmable alarm system with an automatic opening and closing system, an interactive user interface and a notification system through GSM network. The development of this device is focused in the support of elderly people and other vulnerable groups that may need for an assisted care.

Keywords: Assistive Technology, Elderly, Intelligent PillBox Design, Internet of Things, Ambient Assisted Living, Medication Schedule

I. INTRODUCTION

The pill dispensers in the other words electronic pill organizers are developed to alert people about the intermediation. It is an easy way to use tablet dispenser which can assist in the management of medication and allows the correct dose to be available at the correct time of day or night. Their purpose is to help people who may suffer from impaired ability to adhere to their prescribed medication regime. They are commonly used in medicine and some people can use individually as well such as elderly, chronically ills. These devices are evolved to care public health, the cost of medicine industry and waste of drugs. The advanced models of these dispensers can be available in the medicinal industry. As the people getting busier these days, they tend to forget to take their medicines at prescribed schedule.

According to the national council report, In the United States and around the world, there is compelling evidence that patients are not taking their medicines as prescribed, resulting in significant consequences.‖ A large percentage of patients fail to comply with their prescribed medication schedules .This can result in unnecessary disease progression, complications, lower quality of life, and even mortality. This growing trend of medicine non adherence has many causes. —The most commonly cited reasons for noncompliance include, not being convinced of the need for treatment, fear of adverse

effects, difficulty in managing more than 1 dose a day, or multiple drug regimens‖ .Paper identified that —24% of respondents ascribed non adherence to forgetfulness. 20% did not take medications due to perceived side effects‖. Additionally, it is projected that the population growth of retirement-age Americans will cause the current healthcare system to become overloaded and inevitably fail in as little as ten years. Although forgetfulness is not the only factor contributing to the medication non adherence issue, it is the biggest factor, and hence, there is a real need to develop an automatic medication self management device. In addition, if the device can provide near real time medication remote monitoring to alert health care providers of non adherence events, it would also help reduce medication non adherence caused by the other factors.

II. LITERATURE REVIEW

n. In this section, a combination between electronic and mechanical pill boxes or dispensers is presented. It's been included certain traditional pills organizers, which represents a first step in these developments and allowed us to obtain ideas about design useful patterns in development of this solution. In this box presented a pill dispenser which has different prescribed administration schedules. It includes a plurality of pill storage compartments, each of them capable of holding more than one pill. This device has a pill detector and generates a signal to alert patients to take the prescribed medicine. There are twelve storage compartments, arranged in a ring about a vertically rotating wheel. However, this solution has a limitation due to this pill dispenser can only hold doses for 24hours. A current design presented in Cheyenne, shows a device that allows the storing and dispensing of pills and various supplements (i.e., food, drug, supplements, liquids, powders or pills).

This device Works such as an alarm clock and may work with blister packed pills or alternatively uses an encapsulated compartment to hold and dispense loose pills. Also, it can be connected by wireless to external environments (cell phones, computers). However, this device does not allow the management of several dosages and different kind of pills. Another solution is the e-pill. It has in its stock various alternatives to organize and dispense pills, can be mentioned especially two: i) A device dedicated to dispense pills composed by 2 medication trays, and 3 day-dosage discs. It has a circumference shape and it has turning compartments for each dosage time. The dosages are dispensed when an alarm is activated, this device does not use referential diseases, just use dosages per days, and is also not programmable for any schedule; ii) it is a reminder medication product focused on patients, caregivers or medical health professionals. This device locks automatically and includes 2 keys. For patients trying to get medications before it is time there is tamper resistant. This device considers supply pills in one week, four times per day. Also it has alarm and text message reminders disadvantages perceived are to close device by interaction of keeper and is not independent. As far as we know, more than it has been described before, there are many solutions which offers advantages as dispensing or alerting system however they do not provide an automatic reminder system, different alert forms or a study in lot field, besides devices are economically difficult to access. In this work, it is proposed a solution that solves these problems.

Doan B. Hoang, Lingfeng Chen"Mobile Cloud for Assistive Healthcare (MoCAsH)" 2010 IEEE Asia-Pacific Services Computing Conference.

This paper proposes a Mobile Cloud for Assistive Healthcare infrastructure. The infrastructure addresses the limitations of our earlier Active Grid infrastructure, deploys Cloud computing features such as user easy access, elasticity of resources demands, scalability of infrastructure, and metered usage and accounting of resources. The new infrastructure also addresses a number of issues with current Cloud architecture including some security and privacy

issues, data protection and ownership. P2P paradigm is deployed to federate clouds that may belong to different administrators to address security, data protection and ownership. Part of the infrastructure has been implemented or migrated from the Active Grid. The first version of the mobile platform was implemented with J2ME on Nokia phones; the platform is being migrated to an Android platform. Part of the intelligent Mobile Cloud Middleware was implemented within an active database. In the next version, part of the middleware will reside in the mobile platform to handle local issues efficiently in terms of speedy response and energy minimization. Part of the component will reside in the Cloud Middleware component to provide rich context analysis, recognition and decision support. A collaborative workflow editor has been developed over the existing Grid, it will be deployed in the newly Cloud infrastructure.

Brianna Abbey⋆, Anahita Alipour†, Logan Gilmour†, Christopher Camp‡, Crys Hofer‡, Robert Lederer‡, Greig Rasmussen‡, Lili Liu§, Ioanis Nikolaidis†, Eleni Stroulia†, Cheryl Sadowski "A Remotely Programmable Smart Pillbox for Enhancing Medication Adherence" 2012 IEEE.

In this paper we have introduced a new medication adherence device in the form of a dosage-based pillbox with

removable and transportable columns. As we are producing the first fully functional unit, we are also considering three extensions: (a) equipping each removable column with wireless capabilities to enable it to autonomously communicate with a mobile phone (or via access points and/or the cellular network directly) to enable the continuous monitoring and update even if the column is detached from the unit, (b) adding Braille numbers beside each chamber to enhance usability by users with sight problems, and (c) enhancing the ability to infer that the medication was consumed by using photo/video evidence triggered when a chamber is opened.

Medication adherence is an important challenge for many patients with chronic conditions, most of them elderly. Technology has an important role to play in this area potentially, with electronic devices equipped with reminder capability and medication intake recording. In this paper, we present a remotely programmable pillbox. This pillbox is equipped with a web application which gives the health professional or caregiver a tool to check and program the pillbox. Also, a mobile application is implemented to establish a connection with the web-application to show pills' daily schedule and pill taking notifications.

Shuai Zhang, Sally I. McClean, Chris D. Nugent, Mark P. Donnelly, Leo Galway, Bryan W. Scotney, and Ian Cleland"A Predictive Model for Assistive Technology Adoption for People with Dementia"

The acceptance of assistive technologies is crucial for healthcare professionals in the provision of such technologies to PwD. In this paper, we characterized PwD features that are relevant to assistive technology adoption. Based on these features, an optimal predictive model was developed through the investigation of a range of classification algorithms, different feature sets, and data resampling to handle class imbalance. The models were evaluated using the multiple criteria of model predictive performance, prediction robustness, bias toward two types of errors, and usability by healthcare professionals. Overall, the model trained using the kNN classification algorithm on data collected from seven features best addressed the four criteria for model evaluation. This predictive model can maximize the opportunity of using assistive technology in order to allow people to stay in their home for longer, thus minimizing the risk of negative impacts on mood and the quality of life for PwD, and financial implications for inappropriate deployment to nonsuitable technology adopters. A limitation to our work is the amount of data available. It was both expensive and time-consuming to collect such data from the PwD using the technology. Questionnaires about the PwD and their user experience were

particularly time consuming to administer; caregivers could face additional work checking if the PwD was handling the device well; trials required weeks to complete in order to allow the users to become familiar with the device before deciding whether to adopt it or not. Consequently such trials may be intimidating for the PwD. Nevertheless, a collaborative project is currently underway, which will allow our current approach to be extended to a larger sample size. This collaboration is based around the Cache County Study on Memory in Aging, a large database containing genetic and environmental factors associated with risk for Alzheimer's disease and other forms of dementia. Another interesting future direction is to embed the cost of the two types of error into the classification model in order to minimize the total cost of misclassification.

Huai-Kuei Wu, Chi-Ming Wong2, Pang-Hsing Liu1, Sheng-Po Peng1, Xun-Cong Wang1, Chih-Hi Lin1 and Kuan-Hui Tu1"Smart Pill Box with Remind and Consumption" Confirmation Functions" 2015 IEEE 4th Global Conference on Consumer Electronics (GCCE)

To improve medication safety among the elderly, this paper proposed a smart pill box with remind and confirm functions. The proposed pill box can reduce family member's responsibility towards ensuring the correct and timely consumption of medicines. Because the proposed pill box is based on the medicine bag concept and the matrix bar code printed on the medicine bag simplifies the operational procedure. The remind and confirm functions work well even if internet service is not available, thus reducing implementation costs. Population aging is a global issue that affects many developing countries such as Taiwan. The natural decline in physical function with aging leads to an increase in incidences of various chronic diseases in elderly individuals; most patients with chronic diseases need to take medications over a prolonged period of time in order to stabilize their conditions. Ensuring that the patients consume the right medication at the appropriate time becomes crucial. This paper proposes a smart pill box equipped with a camera and based on the medicine bag concept. The matrix bar code printed on the medicine bags is used to interact with the pill box in order to perform pill remind and confirm functions.

P. Jayashree, S. Shrinidhi, V. Aishwarya, A. Sravanthi "Smart Assistive technologies for aging society: Requirements, Response and Reality" 2016 IEEE Eighth International Conference on Advanced Computing (ICoAC)

Through the use of smart devices and systems, disabled people are well supported to perform routine tasks that are felt difficult otherwise. The feel at home enhanced living style though reduces the burden of care takers and support staff, has some hitches in peoples' adaptability to numerous devices and acceptability to a larger extent. A well connected home is to supplement the lifestyle of the user, delivering an anytime, anywhere, borderless quality lifestyle. In such an environment, all devices work together irrespective of the application (entertainment, home control or energy management). But, this demands security and robustness of the devices and technology. Personal assistive devices are emerging technologies that are indeed developed for the betterment of human life. Through the use of smart devices and systems, disabled people are well supported to perform routine tasks that are felt difficult otherwise. The feel at home enhanced living style though reduces the burden of care takers and support staff, has some hitches in peoples' adaptability to numerous devices and acceptability to a larger extent. A well connected home is to supplement the lifestyle of the user, delivering an anytime, anywhere, borderless quality lifestyle. In such an environment, all devices work together irrespective of the application (entertainment, home control or energy management). But, this demands security and robustness of the devices and technology. Personal

assistive devices are emerging technologies that are indeed developed for the betterment of human life.

III. PROPOSED WORK

Device Contribution

Improving lifestyle not only in elderly sick people also in general sick people is a main goal of this development; our device involves reliability and usability with a friendly technology. In the case of elderly people as in Marceline. It is well known with the years, the gradual degradation of faculties can affect the ability to cope with machine technology that is nowadays common in public spaces, like telephone cards and ticket machines (which requires physical and mental agility) or automatic tellers (where codes are needed to be memorized and alternatives must be selected rapidly). It is important to understand that these devices could become more an obstacle than an aid. This conclusion obtained through a study using two generations of men and women (aged 55-74 and 75+ years, respectively), giving us a way to focus our priorities in development of a pillbox, considering parameters to interact correctly with elderly users mainly. Achieving an appropriate reminder system combined with a new type of programming dosages inside a device may be a possible solution to currently interface that nowadays are everywhere to interact in a better way with a keeper or doctor who are tied most of the time to keep track from their patients, who can use easily technology interfaces. Give them partially release from that responsibility and focus only in load dosage in device. While the interaction between patient and object won't be deep, is necessary to give a solution which doesn't complicate prospective interaction patient pillbox, even though interact between them through technology is an important contribution which this work looks for.

As following fig. shows, a block diagram which summarizes the contribution of this paper. Here, it is an interaction between keeper and doctor (1) with the pillbox (4) through an interface (3) and a microcontroller. The device (4) sends notifications (5) to patient (6) and keeper (1). When a patient (6) takes the pill, there is an interaction between the pillbox (4) and a sensor (7). Finally, about that interactions are send.

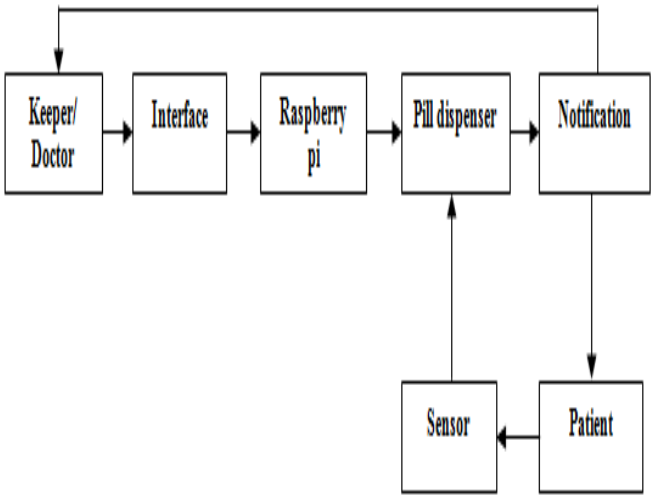

Fig.1: Pillbox Block Diagram

Intelligent pillbox composition

The system is composed by different modules that are controlled by Raspberry Pi Mega. Below fig. shows the Pillbox's block diagram. There are different types of communication of each module. It could be one way or two ways. Therefore the Raspberry sends commands to the modules but also receives data from them. Web page contains the connecting information between the Raspberry pi with the help of WiFi. Keypad plays the general role for changing the information of the requirement. Below figure shows the composition of pillbox.

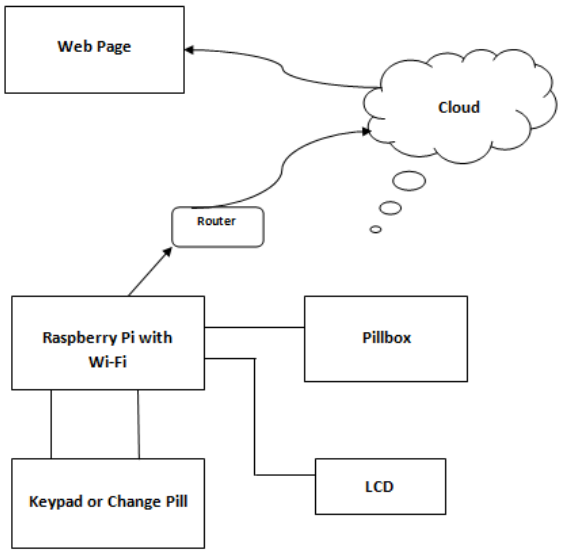

Fig.2: Intelligent Pillbox Composition

LCD

There is a vast array of LCD displays available. Fortunately, a majority of them comply with the HD44780U standard. This standard refers to the LCD controller chip that accepts data from the Micro Converter and communicates with the LCD screen. HD44780 standard LCD screens are available in numerous formats, the most popular of which are the 16 into 2 and 20 into 2 formats. The various commands to control the basic functions of the LCD are outlined in this application note. INTERFACING AN HD44780 LCD The data bus that connects the HD44780 to the Micro Converter can be eight bits or four bits wide; this document discusses the 8-bit data bus. In addition to the data bus, three control lines are needed, requiring a total of 11 pins to interface the LCD to the Micro Converter. The eight data lines that form the data bus are referred to as DB0 to DB7. The three control lines are referred to as EN, RS, and RW: EN is the enable line. This line is used to indicate the start of a transmission of a data byte to the LCD controller. To indicate the start of transmission, this line is brought high. When transmission is complete, the EN line is brought low.

RS is the register select line. This line indicates to the LCD controller whether the data byte is to be treated as a command or as text data to be displayed on the screen. If the RS line is high, the data byte is treated as text to be displayed. If the RS line is low, the data byte is treated as a command. RW is the read/write line. When this line is low, the information on the data bus is written to the LCD controller. If this line is high, the LCD controller can be read to check the status of the LCD. As shown in Figure 1, the eight data lines are connected to Port 0 of the Micro Converter; external pull-ups are required on Port 0. The three control lines are connected to three Ports. And pill box contain the stock of pills for the providing patient.

Raspberry Pi

Didn't think the Raspberry Pi could get any better? You're in for a big surprise! The Raspberry Pi 2 Model B is out and it's amazing! With an upgraded ARMv7 multi core processor, and a full Gigabyte of RAM, this pocket computer has moved from being a 'toy computer' to a real desktop PC. The big upgrade is a move from the BCM2835 (single core ARMv6) to BCM2836 (quad core ARMv7). The upgrade in processor types means you will see ~2x performance increase just on processor-upgrade only. For software that can take advantage of multiple-core processors, you can expect 4x performance on average and for really multi-thread-friendly code, up to 7.5x increase in speed!

That's not even taking into account the 1 Gig of RAM, which will greatly improve games and web browser performance! Best of all, the Pi 2 keeps the same shape, connectors and mounting holes as the Raspberry Pi B+. That means that all of your HATs and other plug-in daughter boards will work just fine. 99% of cases and accessories will be fully compatible with both versions.

IV. IMPLEMENTATION

The user of the web application may be a health professional, an informal caregiver or possibly the patient. Each person with the authority to record the

medication regimen of the patient has his/her own username and password for accessing the application. Associated with each username are metadata that specify the role of the given user and the type of access permitted to the user. For example, if the user is a health professional, he should first select the patient then visit the patient's medicine schedule. If the user is not a health professional, only the information about one specific patient is provided to the user. The user can enter the prescribed medicines and times into a calendar-like interface, and attach special instructions about how each pill looks, how it should to be taken, and what are the possible side effects to look out. As can be seen in the calendar of, each day is associated with four medication-taking events (which seems to satisfy the majority of patients who usually take medications in the morning, noon, afternoon and evening). The schedule, once completed, is recorded in the online common data source so that the pillbox and the mobile application can share the same information. Each cell in the medication schedule corresponds to a prescribed medication-taking event and it can be in one of five possible different states:

1. **Empty:** showing that the chamber is empty and the corresponding day time does not have any scheduled medications; The daily view (left), the details view (centre), and the information view (right).
2. **Not Taken:** showing that the chamber has medications inside and the time when they need to be taken is in the future;
3. **Take Now:** representing that it is time to take this chamber's pills;
4. **Taken:** indicating that the medications that used to be inside this chamber have been taken on time, and,
5. **Missed:** indicating that (part of) the medications inside this chamber were not taken.

The mobile application can be used by the patient and also by informal caregivers, i.e., family members, who can communicate with the patient and could motivate the patient to take the medication. This application shows the schedule's daily view, status of each dosage, and the details about the medication associated with each dosage. When it is time to take a chamber's pills, the mobile application alarms continuously until the patient takes the pills or selects the postpone option. In the case of postponement, the application restarts the alarm after 5 minutes, unless the time window for consuming the corresponding dosage is over. The mobile application full's the need for having a social component in our design, paying attention to the fact that adherence increases when friends and family are involved in the patient's medication regimen. In the pillbox, at the scheduled time, the appropriate pill chamber begins to glow (illuminated by LED) and, at the same time, a notification pops up on the mobile device and a voice alarm is generated. The patient notices the lit chamber, opens the corresponding container, and takes all pills in it. The patient may also choose to look up the associated pill information on the mobile application. The light produced by the LED is also sensed by an embedded light sensor (each chamber has one light sensor). The light sensor is a programmable light–to–frequency IC that outputs a square wave signal with the frequency directly proportional to the incident light intensity. The sensor is very sensitive and supports a wide range of frequencies. A raspberry pi platform analyzes the frequency returned by the sensor and sends a message via Wi-Fi, thus uploading the new state of the pillbox to the online data source.

1. Cloud

Cloud is a network or internet which is present at remote location. It provides services over network on public networks or on private networks. There are different applications running on the cloud such as e-mail, customer relationship management. Cloud computing manipulates, configures and access the application online. Cloud has unlimited storage capacity.

Cloud computing allows simple and easy user access, handles users' dynamic and elastic demands

effectively, and provides convenient metered usage for its resources and hence it is increasingly being adopted by individual users as well as enterprise users. It may just be the right technology for healthcare infrastructure. However, several serious issues concerning security, data protection and ownership, quality of services, and mobility need to be resolved before Cloud computing can be widely adopted. To address these concerns, proposes a new solution that includes a cloud platform designed to deal with those issues that are relevant for an assistive healthcare infrastructure. Within this assistive health infrastructure, the cloud platform offers a high level abstraction and its services can be accessed easily with simple web interface to the users. The new solution includes mechanisms for early detection of networks and network auto-switch function to ensure a ubiquitous computing, which can guarantee a wireless consistent connectivity with back-end processing centre for a high QoS (quality of service). To address the power limitation issue, the new solution includes mechanisms for controlling the energy consumption while maintaining the quality of care. Possible approaches include auto-switch network and algorithm to efficiently control monitoring interval. The new solution will emphasize on data contexts and context-sensitive applications to deal with deviations in physiological state variations. More importantly, MoCAsH adopts a federated Cloud model to address aspects of data ownership, protection and privacy.

2. Web Page

"A **web page** (also written as webpage) is a document that is suitable for the world wide web and web browsers. A web browser displays a web page on a monitor or mobile device. The browser uses the Hypertext Transfer Protocol (HTTP) to make such request."

The web page usually means what is visible, but the term also refer to a computer file, usually return in HTML or a comparable markup language. Web browser coordinate various web resources elements for the return web page,such as style sheet, scripts and images, to present the web page. Typical web page provide hypertext that include the navigation bar or a side bar menu linking to other web pages via hyperlinks, often referred to as links.

On a network, a web browser can retrieve a web page from a remote web server. The web server may restrict access to a private network such as corporate intranet. The web browser uses the hypertext transfer protocol (HTTP) to make such request.

A static web page is delivered exactly as stored, as web content in the web server's file system. In contrast dynamic web page is generated by a web application, usually driven by server side software. Dynamic web page helps the browser (the client) to enhance the web page through user input to the server.

3. Router

A router is a networking device that forwards data packets between computer networks. Router performs the traffic directing functions on the internet. A data packet is typically forwarded from one router to another router through the network that constitute an internetwork untilled it reaches its destination node.

A router is connected to two or more data lines from different networks. When a data packet comes in on one of the lines, the router reads the network address information in the packet to determine the ultimate destination.

Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey.

The most familiar type of routers are home and small office routers that simply forward IP packets between the home computers and the internate. An example of the router would be the owner's cable or DSL router, which connects to the internet through an internet service provider (ISP).more sophisticated routers, such as interprice routers, connect large business or ISP networks up to powerful core routers that forward

data at high speed along the optical fiber lines of the internet backbone. Through routers are typically dedicated hardware devices, software based routers also exist.

4. WI-FI

Due to the advancement of wireless technology, there are several different of connections are introduced such as WIFI, and each of the connection has their own unique specifications and applications. Among the four popular wireless connections, WIFI is being chosen with its suitable capability. The capabilities of WIFI are more than enough to be implemented in the design. Also, most of the current laptop/notebook or Smartphone come with built-in WIFI adapter. It will indirectly reduce the cost of this system.

In this project, we propose a system, which is very different than the existing system. We are going to implement it with the help of Wi-Fi (Wireless Federation). The main advantage of this system is that it can be implemented with a wider range. It allows communicating with a brief and small set up without wired connection. This system can be extended for a proper Surveillances of home (Humidity control, security and remote sensing) system.

5. Raspberry Pi With Wifi

Raspberry Pi is a Linux powered computer and definitely is a natural choice for IoT applications. The reason for raspberry pi being a preferred IoT device is because it runs a complete Linux Kernel and has direct interfaces such as Ethernet for wired internet as well as USB ports to connect to wifi. The operating system of raspberry Pi supports modern programming languages like python which makes IoT application development easier. Moreover, raspberry pi also has GPIOs so it can directly connect with devices, sensors and many real world devices. The Raspberry Pi is having a 40-Pin GPIO header, 4 x USB ports, 1x LAN port, 1x CSI and 1x Touch Screen interface, 1xhdmi port, 1x integrated audio and video output port. The board runs on single +5v power supply for which there is a micro USB female connector provided.

Didn't think the Raspberry Pi could get any better? You're in for a big surprise! The Raspberry Pi 2 Model B is out and it's amazing! With an upgraded ARMv7 multi core processor, and a full Gigabyte of RAM, this pocket computer has moved from being a 'toy computer' to a real desktop PC. The big upgrade is a move from the BCM2835 (single core ARMv6) to BCM2836 (quad core ARMv7). The upgrade in processor types means you will see ~2x performance increase just on processor-upgrade only for or software that can take advantage of multiple-core processors, you can expect 4x performance on average and for really multi-thread-friendly code, up to 7.5x increase in speed! That's not even taking into account the 1 Gig of RAM, which will greatly improve games and web browser performance! Best of all, the Pi 2 keeps the same shape, connectors and mounting holes as the Raspberry Pi B+. That means that all of your HATs and other plug-in daughter boards will work just fine. 99% of cases and accessories will be fully compatible with both versions.

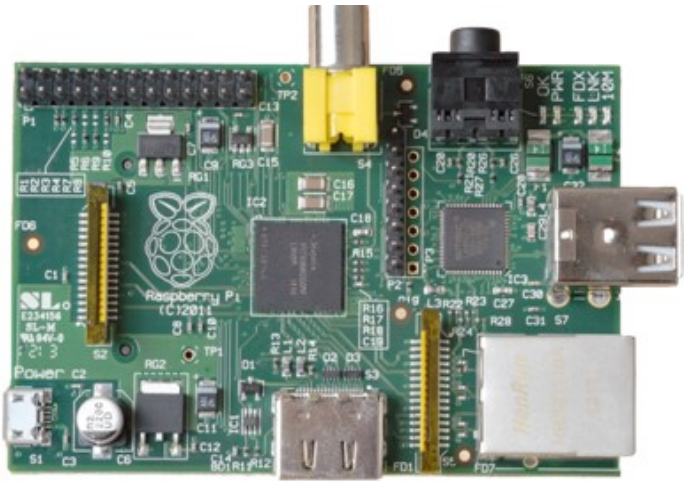

Fig.3 Raspberry pi board

Raspberry Pi is using the Advanced Reduced Instruction Set Computing Machine (ARM) technology. ARM technology is used on the board

which reduces cost, heat and power consumption. It is energy effective multi core CPU implemented as System-On-Chip (SoC) weighing 50gm and operates on 5V, 700mA power rating. This board is available in three models named A, B, B+. The B+ Raspberry Pi board is the latest version among them, and it runs on ARM11 processor with 512MB RAM operating at 700 MHz frequency. It has SD card slot, which is used for booting the operating systems like Raspbian, Pidora, Raspbm. It has four USB2.0 ports to connect to the peripherals like mouse, keyboard and Wi-Fi adapter etc, making it as a full sized portable pocket computer. It also has an Ethernet port to connect to the network. GPIO ports are used to interface and control the LED's, switches, sensors and other devices. With the help of HDMI port, all kinds of monitors like LCD screens, projectors, TVs can be connected. In this board, some additional features like camera connector is available to interface camera and an audio jack. With all these features, Raspberry Pi is not just limited to single use, it can be used in many applications.

6. Keypad

Keypad is used for the user or nurse to enter the information of time when the smart box would send "reminder" (displaying numbers and playing synthesized voice). A 3x4 12 button keypad is used for the device. It is also used for the user to enter a number to command a specific pill box to open on a specific day. The keypad is also used for stopping the music and led display when the user has taken the pill. A function for scanning the keypad by corresponding button that is pushed. Firstly, set high 4 bits input port and low-4 bits to output. Calculate the value of the high-4 bits, then inversely do the same task and get the whole value of port. Then using this value we get to look up the button table to find out which button we pushed. The state machine will execute every 25 milliseconds. In state detect, we will judge which kind of button is pushed and do different things corresponding to the button, such as run flag setting, input string updating and changing to next parameter input. And it also used for the changed the pill depend on the requirement. In computing, a computer keyboard is a typewriter-style device which uses an arrangement of buttons or keys to act as a mechanical lever or electronic switch. interaction via teleprinter-style keyboards became the main input device for computers.

7. LCD

There is a vast array of LCD displays available. Fortunately, a majority of them comply with the HD44780U standard. This standard refers to the LCD controller chip that accepts data from the Micro Converter and communicates with the LCD screen. HD44780 standard LCD screens are available in numerous formats, the most popular of which are the 16 into 2 and 20 into 2 formats. The various commands to control the basic functions of the LCD are outlined in this application note.

V. CONCLUSION

It is impossible for the huge population of elders to follow the traditional health care. This IoT based system not only provides an accurate diagnosis of the users condition, but rather a solution that detects and prevents health episodes by carefully following, capturing, and describing the health trends recorded from physiological and contextual sensors. This system is useful for doctors who are overwhelmed with patient load and also beneficial for rural patients who have less access to health care facilities. The proposed system is suitable for all kinds of patients. It efficiently controls the time of patients to take medicine. It also reduces the ratio that patient misses and delays taking medicine. In addition, the box also has a cold storage for few precise medicine. If the tablets are empty in the box it sends an alert message to refill it.

The goal of the paper was to design automated pill box reminder system using Raspberry pi. So, as to help people to easily Operate the pill box. This project is based on the Raspberry pi, and the language used for communication of kit is Python. These platforms are Free Open Source Software. So the overall implementation cost is low and can be easily configured. We are implementing smart ideas interfacing it with the kit and making easy use or interface with the pill box.

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