
Agile Based Methodology for Embedded Systems

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Abstract—The use of embedded system in the everyday life has increased. The growth of internet of things approach had lead to increase in the data explosion and network traffic. Most of the developers follow a general methodology for development of embedded system projects which leads to increase in cost and time of product. This paper proposes a methodology for development of embedded systems which follow the Agile principles. The paper tries to identify the certain problems that may occur during development and specifies the solutions.

Keywords—Agile principles, Test Driven Development, IOT embedded system.

I. INTRODUCTION

The growth of embedded system in real world life has increased exponentially.[1]Most of the organizations have considered Internet of Things as the major opportunity to gain the market. Since the internet of things may include any number of hardware like sensors, processor, rectifiers and it may also include the software to drive the required hardware. In traditional software development the organizations will iterative development, exploratory development. Thus there is very less chance that the software may fail during release or after the release. This type of software will satisfy all the requirements of the customer and brings down the required cost of the development but this may not happen during the case of development of embedded systems. Since the embedded system includes both the hardware and software, most of the time the Engineer who is responsible for development of hardware may also develop the required software for it. So there exists case such that the engineer may not follow any approach for the development. This lead to improper developments of system and lead to increase in the cost of the systems paper submission is available from the conference website.

Agile methodology provides certain principles which must be considered for agile based system development which includes respecting customer requirements, individuals and interactions, accepting the changes etc

This paper is divided into various sections. Section II prerequisites needed prior the development, Section III provides the methodology that needed to be

followed for Development of embedded systems, Section IV Provides Conclusion.

II. PREREQUISITES

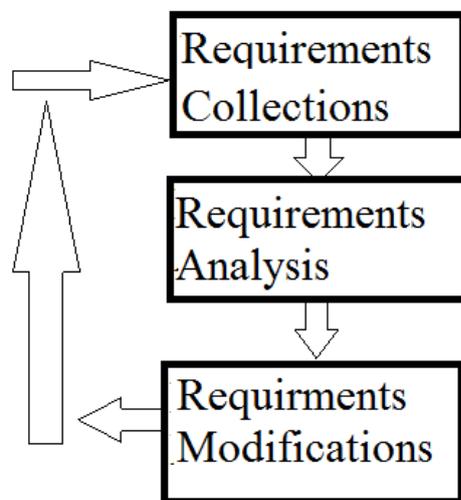
The following are the prerequisites 1) there shall be two separate engineers for hardware and software development. Both the engineers will work together during the product development.

2) Software developer is employing “Test Driven Development” for developing the software. 3) The customer/client of the product will always be present with the development team else there will be manager who has depth of knowledge of the product and he may answers the queries during the development

III. PROPOSED METHODOLOGY

Any Software development team will undergo certain lifecycles prior to completion of the software. It includes Requirements analysis, Delivering Initial working model, Continuous analyses and changes in the Design, Iterative Build Releases, and Deploying Final Build.

Requirements Analysis: Analysis of the hardware and software requirements that are needed for the system development. In any product development the clients may be a specific customer or a general public. In case of a specific customer the client may not be able to provide full detailed requirements at a time, he may also not able to provide requirements at a time but he may provide a scenarios at a time during initial product developments, as the product developments continues he may start understanding how the product is developed and he will start specifying the requirements more specifically and detailed. During the coarse of development he may change the requirements N times but with the help of Agile Methodology the developer will be happy to accept the changing software requirements .



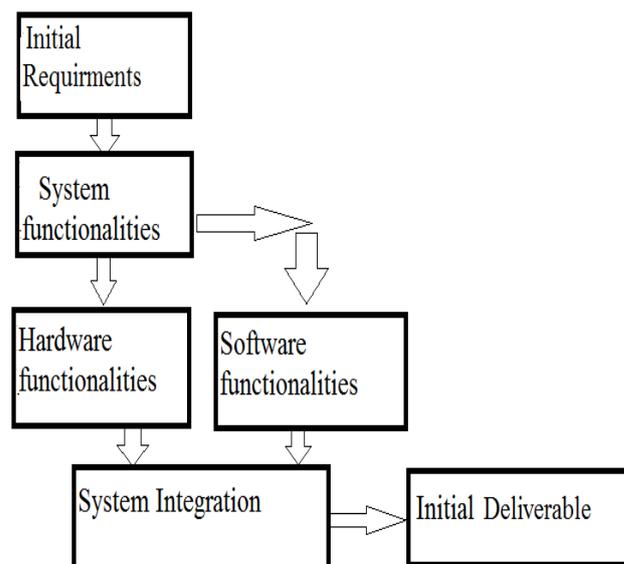
It may also be noted that the requirements may also come from general public. Generally industries will try to find out trends in the market and they will start developing the products for the market. Here the requirements providers be may be a market researcher.

Our paper provides a simple flow chart which deals with how to handle requirements stage .It includes requirements collection for the customer, once the requirements are present with the developer. They will divide the requirements into hardware and software requirements . they will start analysing what all are the requirements. during the analysing they may feel that some requirements may need more clarification so they will keep some requirements aside , they may also feel that some of the requirements may not be implemented with the given hardware and software combinations so they may keep aside the requirements or they may perform some modifications so that requirements must be implemented .

The developers will present the modified and untouched requirements in front of customer after some intervals of time , At this stage the developer will clarify doubts about the requirements and he may also specify the modified requirements . It depends upon the client and the product to accept the modified requirements from developers . Alternatively the client can understand the problems in the requirements and can propose his own new set of specific requirements . The process continues once again

Thus this stage ensures that the developers get the fully understood, detailed and implement able requirements.

Delivering Initial working model: [2]Agile methodology specifies that Deliver a working software as soon as possible to the client so that clients can understand how the product can be implemented and wether the developers really understood the requirements that the clients had specified. It also provides an opportunity to clients to specify any major changes in the product. Thus reducing the risks of product failure at the end



Since getting the initial requirements from the customer, The requirements are split into Stories. The developers will represent each story as the functionalities. The Developers will pick up the stories that are utmost important to the customer. Those stories represent the core functionalities of the product. These important stories may also be specified by client. The client may specify the priority of a story this helps developer to choose the functionalities that are important for customers.

Once knowing important requirements the requirements are split into hardware and software requirements, the hardware engineer starts working on initial deliverable hardware component. He must assemble the hardware such that it must be able to accommodate more number devices on it and must also be designed such that it is capable of undergoing changes at any point in time.

The hardware engineer must work with software engineer to discuss each functionalities, device capabilities, Required modules, etc.

The hardware engineer must also ensure that he has kept the design very flexible by providing more open slots, extra space to hold additional sensors. In IoT while developing the hardware if an engineer uses

an Arduino board then the board provides capabilities to accommodate shields sensors on it, thus helping in keeping the design more flexible and simple.

The Hardware engineer must ensure that he had assembled the hardware which is capable to undergo a major change at any particular interval of time. Thus helping in keeping the design flexible for software engineer and clients.

As the engineers develop the initial required hardware the software engineers identifies the required suitable programming language, The Operating system that is needed to be hosted on device , the required device drivers for device detection and working etc.

The software engineer must follow the same methodology followed by hardware engineer keeping the design of software simple and flexible.

[3]Agile specifies the Pair programming as concept where the programmers need to work in the pairs in which one is driver and other is navigator. our paper recommends that a programmer can pair with a software engineer for more efficient programming and also he may pair with a hardware engineer to get more detailed understanding about a hardware engineer

Once both the engineers completes there initial components the need to integrate as one product and deliver it customer.

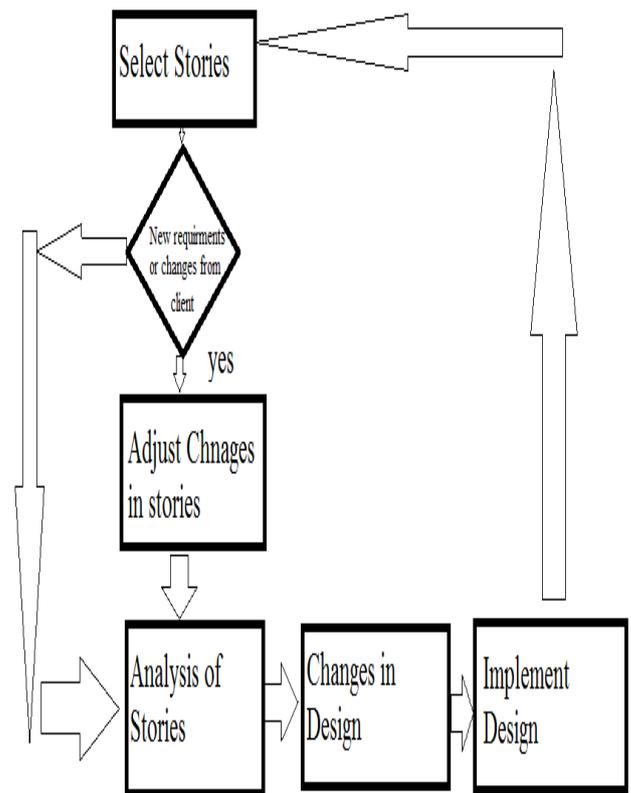
Continuous analyses and changes in the Design:

Agile Methodology is known for continuous changes in design of product during development.

The Developer at this time has the clear idea of what actually the product is and how the development should be done. As all requirements would be treated as stories. The developer will selects new stories after completion of initial build release. The customer had specified about priorities in the stories so that developers can easily pick up the stories.

[4]The developer may also verify with customers that any changes in the requirements are needed. If yes then the developer needs to make appropriate changes in the stories and he need to change the design of the product.

In the agile development the design of the product changes continuously over the period of time , thus there is no fixed design for and product in agile development.



Once the new requirements arrive the hardware engineer must ensure that he has necessary hardware to satisfy that requirements .he may also need to make changes in the existing product.

Iterative Build Releases:

Once the Design is ready the developers will start working on the design. They may schedule how much amount of work needed to be completed for each stories .Agile specifies that “Release Early , Release Often”, where the developer needs to release the working product at a particular interval of time

Our paper specifies that for every two weeks there will be a iterative release of product. It includes considering the changed design after getting the requirements from customer and selected stories from overall requirements .

[5]During iteration the developers will cooperatively work together to complete the specified requirements. They conduct stand-up meetings to ensure that iteration of the product development is going smoothly. Any problems during the developments are discussed during the stand up meetings and pair programming.

Once completion of a build the team may demonstrate the working software to the client. The feedback from the client is taken and any changes required for the product are implemented in next iteration.

Thus this iteration build releases ensures that product will be developed as schedule , customer will periodically get new features of the product , he may specify any feedback to development team .this will also be helpful to develop a hassle free , fully integrated product.

Deploying Final Build and Continuous Support:

Developers may arrive at the stage where they have successfully deployed most of the stories, required functionality of the product and need to deploy the final build.

At this stage the development team needs to complete the remaining small functionalities and fixing the last moment bugs. Since the product is integrated at every build release so the deployment of the final build may not take much amount of time .

The customer may still has time to specify any new requirements to the development team. The flexible design of the product helps to make last moment changes in the product.

Finally once the final build is deployed, the organization must continuously provide support to product because due to following reasons 1.the hardware may fail at any time 2.The customer requirements may still also change once final build is provided.

This paper specifies that document the development process which includes only important features of the products, major functionality implementation details. Etc this will help the support team which provides support to the product even after the final release to provide support to product.

IV. CONCLUSION

Agile methodology has been widely used in most of the leading software industries .Most of the companies have got very high success in software development.

This paper concludes that with the adaptation of agile principles and methodology in development of embedded systems we can see an enormous amount of growth by saving cost and time required for product development.

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